PART 3

Florida Power & Light Company
Turkey Point Plant, Units 6 & 7
COL Application

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CHAPTER 1 INTRODUCTION

1.1 THE PROPOSED PROJECT

This section introduces the applicant and owner and provides a brief description of the proposed project, including descriptions of the site location, the selected reactor type and other plant design features, pre-application public participation activities, and major project activity dates.

Pursuant to the Atomic Energy Act of 1954, as amended, and Title 10 of the CFR, the NRC is responsible for licensing the construction and operation of domestic nuclear power plants. In accordance with the provisions of 10 CFR Part 52, Subparts B (Standard Design Certifications) and C (Combined Licenses), and supporting guidance, Florida Power & Light Company (FPL) has developed a COL Application for submittal to the NRC for construction and operation of two new nuclear generating units, Units 6 & 7, at the existing Turkey Point plant property in Miami-Dade County, Florida. The COL Application includes an Environmental Report (ER), in accordance with the provisions of 10 CFR Part 51 and the National Environmental Policy Act of 1969 (NEPA), as amended. The ER provides an analysis of the reasonably foreseeable impacts to the environment from site preparation, construction, operation, and decommissioning of Units 6 & 7.

This ER follows the content and organization of the NRC's *Standard Review Plans for Environmental Reviews for Nuclear Power Plants*, also known as NUREG-1555, Revision 0 (October 1999). Available draft revisions to this guidance have been considered, as practicable. Pursuant to 10 CFR Part 51, the NRC is required to perform a review of the environmental impacts of the construction and operation of Units 6 & 7; this ER supports that review. 10 CFR Part 51 requires that environmental impacts from the proposed project be evaluated and described in a concise, clear, and analytical manner. This report describes the project and potential alternatives and the methods and sources used in the environmental impact analysis.

Environmental issues identified in this ER are evaluated using a three-tier standard of significance as defined in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, Footnote 3, as follows:

SMALL — Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.

MODERATE — Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.

LARGE — Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

1.1.1 PURPOSE AND NEED

FPL's purpose is to provide additional baseload generation to maintain system reliability, increase fuel diversity, and allow progress toward meaningful CO_2 emissions reductions. The need for Units 6 & 7 has been determined by the state of Florida as described in Chapter 8. The proposed action is for the NRC to authorize FPL to construct and operate two PWRs at the Turkey Point plant property.

1.1.2 PROJECT DESCRIPTION

This subsection provides a brief summary of project information. Subsequent sections, particularly Chapter 3, give additional details of the proposed project.

1.1.2.1 The Applicant and Owners

FPL is the owner of the Turkey Point plant property and the existing power plants. FPL would own proposed Units 6 & 7. FPL is the operator of the existing power plants and would be the operator of Units 6 & 7. The new units would be operated as baseload plants to supply the needs of the FPL service territory. Additional information about FPL is provided in Part 1 of this COL Application.

1.1.2.2 Site Location

The Turkey Point plant property comprises approximately 9400 acres in unincorporated southeast Miami-Dade County, Florida, east of Florida City and the City of Homestead and bordered by Biscayne Bay to the east. Currently located on the Turkey Point plant property are five FPL power plants: two natural gas/oil steam electric generating units (Units 1 & 2), two pressurized water reactor nuclear units (Units 3 & 4), and one natural gas combined-cycle steam electric generating unit (Unit 5). Figure 2.1-4 shows the location of the Turkey Point plant property and regional features of the area. The new units would be constructed on an approximately 218-acre area (the Units 6 & 7 plant area) south of Units 3 & 4. Figure 2.1-3 shows the location of Units 6 & 7 on the Turkey Point plant property. Additional information regarding the Turkey Point plant property and the Units 6 & 7 plant area is provided in Section 2.1.

1.1.2.3 Reactor Information

FPL proposes to build and operate two AP1000 units, a nuclear plant design certified under 10 CFR 52, Subpart B. The total gross thermal MW output per unit is 3415 MWt with a nominal net electrical output of at least 1000 MWe. Additional details on the AP1000 design are provided in Section 3.2.

1.1.2.4 Cooling System Information

During normal operation of Units 6 & 7, waste heat would be dissipated by mechanical draft cooling towers. Two sources of makeup water are planned to replace cooling tower blowdown for Units 6 & 7. The primary source would be water reclaimed for reuse after processing by the Miami-Dade Water and Sewer Department, conveyed via pipelines to the Turkey Point plant property. An onsite FPL reclaimed water treatment facility would further treat the reclaimed water for use in the cooling system. When reclaimed water cannot supply the quantity and/or quality of water needed for the circulating water system, a second source for makeup water would consist of radial collector wells that would withdraw saltwater from under Biscayne Bay. Each radial collector well would consist of a central reinforced concrete caisson extending below the ground level with laterals projecting horizontally from the caisson. The well caissons would be located on the Turkey Point peninsula, east of the existing units.

Blowdown would control the accumulation of dissolved solids in the cooling system. Blowdown water would be discharged through the use of deep injection wells to the Boulder Zone, a cavernous, high-permeability South Florida geologic horizon located at depths of approximately 2800–3500 feet in the lower Floridan aquifer.

Descriptions of the cooling system, makeup water sources, and the anticipated modes of cooling system operation and discharge are provided in Sections 3.3 and 3.4.

1.1.2.5 Transmission System Information

Eight 230 kV transmission lines currently connect the existing Turkey Point units to the transmission system by way of two corridors, one proceeding to the north and one to the west. Two new 500 kV circuits and three new 230 kV circuits would be built to connect Units 6 & 7 to the electric grid. Plans are for the new transmission lines to proceed from the a new onsite substation (Clear Sky), with the 500 kV circuits connecting to the existing Levee substation and the 230 kV circuits connecting to the existing Turkey Point, Davis, Miami, and Pennsuco substations. Final transmission routes are selected through the state of Florida's Power Plant Siting Act (PPSA) process. To the extent practicable, new transmission lines would be routed in existing rights-of-way owned by FPL, in many places adjacent to existing transmission lines. Additional information on proposed transmission corridors serving Units 6 & 7 is provided in Sections 2.2 and 3.7. The proposed configuration of the transmission system for Units 6 & 7 is shown in Figure 2.2-5.

1.1.2.6 Public Involvement

FPL has an active community and public outreach program. The outreach principles include:

- Open, honest, and accessible communication with the general public and all key stakeholders
- Keeping state and local agencies and business organizations informed regarding the progression of the proposed project by meeting and briefing public officials from the affected area
- Using media opportunities to explain the project planning and licensing processes
- Actively soliciting input on proposed plans for the project, including any offsite facility and transmission and pipeline corridor location selection, and answering questions and inquiries that come to FPL. Special efforts are made in the ER preparation process to solicit and incorporate inputs on matters of environmental justice

These activities would continue as the regulatory review processes progress at the local, regional, state, and federal levels.

1.1.2.7 Schedule for Major Activities

No site preparation activities would occur until the site is certified under the PPSA and the required U.S. Army Corps of Engineers permits are obtained. The project schedule assumes a 69-month duration for preconstruction activities. Unit 6 construction would have an approximate 66-month duration for construction activities (48-month standard plant construction plus activities under NRC authority [e.g. slurry wall]) and an approximate 6-month duration for fuel load and startup. Unit 7 construction is planned to begin approximately 12 months after Unit 6 construction initiation and would follow an identical construction and fuel load/startup duration. Units 6 & 7 would initiate electric generation output in or about 2022 and 2023, respectively. A description of the construction schedule and milestone activities is included in Section 3.9.

1.2 STATUS OF REVIEWS, APPROVALS, AND CONSULTATIONS

In this section, the federal, state, regional, and local environmental protection licenses, permits, reviews, approvals, and consultations, collectively called authorizations, that are applicable to the proposed action to construct and operate Units 6 & 7 are identified. The information listed below is included in Table 1.2-1 for each authorization:

- Jurisdictional agency
- Authority, law, or regulation that dictates the requirement
- Description of the requirement
- License or permit number as applicable
- Date of application or date issued
- Description of the activities covered

FPL is in the process of initiating actions to obtain the necessary authorizations. Appendix A contains copies of consultation letters and responses received to date. The bulleted items below describe some of the principal required authorizations.

- *Endangered Species Act of 1973* (16 U.S.C. 1531-1544, as amended) — The *Endangered Species Act of 1973* requires federal agencies to ensure that agency action is not likely to jeopardize any species that is listed or proposed for listing as endangered or threatened. Depending on the action involved, the Act requires consultation with the U.S. Fish and Wildlife Service (USFWS) about effects on non-marine species, the National Marine Fisheries Service (NMFS) for marine species, or both. Because of the proximity of the Turkey Point site to the Atlantic Ocean, consultation with the USFWS and the NMFS is required.

- *National Historic Preservation Act of 1966* (16 U.S.C. 470) — The *National Historic Preservation Act of 1966* requires that federal agencies that have the authority to license an initiative consider (before the license is issued) the effects of the initiative on historic properties or properties eligible for protection under the National Historic Preservation Act.

- *Federal Coastal Zone Management Act of 1972* (16 U.S.C. 1451-1456) — The *Federal Coastal Zone Management Act* imposes requirements on applicants for a federal license to conduct an activity that could affect a coastal zone. The Act requires the applicant to certify to the licensing agency that the proposed activity would be consistent with the state's federally approved coastal zone management program. FPL would certify to the NRC that the proposed project is consistent with the federally approved state of Florida Coastal Zone Management Plan.

- *Federal Water Pollution Control Act of 1972, as amended by the Clean Water Act of 1976* (33 U.S.C. 1251, et seq.)*, also known as the "Clean Water Act"* —The *Clean Water Act, Section 401*, requires any federal license applicant, who plans to conduct activities that might result in a discharge into navigable waters, to provide the licensing agency a certification from the state that the discharge would comply with applicable Clean Water Act requirements; the *Clean Water Act,Section 404*, requires applicants proposing the discharge of dredge or fill materials into "waters of the United States" to obtain a permit for this activity from the U.S. Army Corps of Engineers.

- *Rivers and Harbors Act of 1899* (33 U.S.C.401 et. seq.) The *Rivers and Harbors Act, Section 10,* prohibits the creation of any obstruction, and prohibits the excavation or filling, within navigable waters of the United States without prior authorization from the U.S. Army Corps of Engineers.

- The Florida Power Plant Siting Act, Sections 403.501-403.518, Florida Statutes, mandates a site certification process for obtaining a single site-related license that will include state, regional, and local requirements for construction and operation of a power plant and associated facilities of the type and magnitude being proposed by FPL.

Preconstruction activities, according to NRC requirements, are those that may be initiated before a COL or LWA is issued. Pursuant to 10 CFR 50.10(c), "No person may begin the construction of a production or utilization facility on a site on which the facility is to be operated until that person has been issued either a construction permit under this part, a combined license under part 52 of this chapter, an Early Site Permit authorizing the activities under paragraph (d) of this section, or a LWA under paragraph (d) of this section." NRC regulations at 10 CFR 50.10(a) define activities which are (and are not) considered to be construction. Activities not defined as construction may be initiated without prior NRC authorization. However, according to Florida PPSA requirements, no preconstruction or construction activity may occur before site certification is issued.

A COL applicant may begin certain preconstruction activities without prior NRC authorization before receipt of a COL or LWA, such as:

- Preconstruction plans and exploration activities such as soil boring/sampling, installation of monitoring wells, or installation of additional geophysical borings as defined in 10 CFR 50.10(a)(2) and the removal and/or relocation of existing facilities in the new plant footprint

- Site preparation activities such as installation of temporary facilities, construction support facilities, service facilities, utilities, docking and unloading facilities, excavations for facility structures and foundations, and construction of structures, systems, or components (SSCs) that do not constitute construction as defined by 10 CFR 50.10(a)(1).

On December 24, 2007, the Miami-Dade County, Florida, Board of County Commissioners approved Resolution Z-56-07 (Miami 2007), approving, with conditions, FPL's request for unusual use of the proposed plant site to allow construction and operation of Units 6 & 7 and ancillary structures and equipment.

Section 1.2 References

(Miami 2007) Resolution No. Z-56-07, Miami Dade County Clerk of the Board, http://www.miamidade.gov/COB/library/Zoning_Resolutions/Z-56-07.pdf, Accessed February 24, 2009.

Table 1.2-1 (Sheet 1 of 7)
Authorizations for Turkey Point Units 6 & 7

Jurisdictional Agency	Authority, Law, or Regulation	Description of Requirement	License/Permit and/or Applicability[(a)]	Date of Application or Date Issued	Activity Covered
FEDERAL AUTHORIZATIONS					
NRC	10 CFR Part 30	By-product license	(3)	Application submitted 06/30/2009	Possession of by-product material.
NRC	10 CFR Part 40	Source material license	(3)	Application submitted 06/30/2009	Possession of source material.
NRC	10 CFR Part 50	Licensing of nuclear power plant	(3)	Application submitted 06/30/2009	Approval for construction and/or operation of nuclear power plant.
NRC	10 CFR Part 51, 10 CFR Part 52	NRC approval of an environmental report	(2)	Application submitted 06/30/2009	Evaluation of environmental impacts from construction and operation of a nuclear power plant.
NRC	10 CFR Part 52	COL	(3)	Application submitted 06/30/2009	Safety review of the nuclear power plant site.
NRC	10 CFR Part 61	Licensing requirements for land disposal of radioactive wastes	(2)	Application submitted 06/30/2009	Land disposal of radioactive waste that contains by-product source and special nuclear material.
NRC	10 CFR Part 70	Special nuclear material license	(3)	Application submitted 06/30/2009	Possession of special nuclear material.
NRC	10 CFR Part 71	Packaging and transportation of radioactive material	(3)	Application submitted 06/30/2009	Packaging and transportation of licensed radioactive material.
DOE	Nuclear Waste Policy Act (42 U.S.C 10101 et seq.) and 10 CFR Part 961	Spent fuel contract	No. DE-CR01-09RW9012 (Unit 6) No. DE-CR01-09RW09013 (Unit 7) (3)	11/14/2008 11/14/2008	Disposal of spent nuclear fuel.
USACE	Clean Water Act of 1976 /33 U.S.C section 1344	Section 404 Permit	(1)	06/30/2009, modified 05/07/2010	Discharge of dredge and fill materials into waters of the United States.

Table 1.2-1 (Sheet 2 of 7) Authorizations for Turkey Point Units 6 & 7

Jurisdictional Agency	Authority, Law, or Regulation	Description of Requirement	License/Permit and/or Applicability[(a)]	Date of Application or Date Issued	Activity Covered
USACE	Rivers and Harbors Act of 1899/ 33 U.S.C. section 401 *et. seq*.	Section 10 — Rivers and Harbors Act Permit	(1)	Application submitted 06/30/ 2009	Excavation or filling within navigable waters of the United States.
USACE	Secretary of the Army	Modified water deliveries to Everglades National Park	DACW-17-3-08-0006 Amendment No.1 Amendment No. 2 Amendment No. 3 (each Amendment extended the license agreement for an additional year, currently expires 6/20/2012)	06/20/2008 06/20/2009 06/20/2010 06/20/2011	Use of Government owned lands for the purpose of onsite investigations in support of a Phase 1 ESA, Wetland delineation, preparation of legal description and soil borings
Federal Aviation Agency	14 C.F.R. Part 77 - Safe, Efficient Use, and Preservation of Navigable Airspace	FAA Obstruction Permit for Unit 6 Containment Building	2009-ASO-4094-OE	01/31/2011	FAA Obstruction Permit for Unit 6 Containment Building
Federal Aviation Agency	14 C.F.R. Part 77 - Safe, Efficient Use, and Preservation of Navigable Airspace	FAA Obstruction Permit for Unit 7 Containment Building	2009-ASO-4093-OE	01/31/2011	FAA Obstruction Permit for Unit 7 Containment Building
Department of the Interior	RE-DO-53	Temporary Construction Easement	EVER SUP 08-38	07/28/2008	Provide access to delineate wetland boundaries within the proposed utility line ROW relocation in Everglades National Park
Department of the Interior	RE-DO-53	Temporary Construction Easement	EVER SUP 08-39	07/28/2008	Provide access to conduct visual and pedestrian surveys for Phase I environmental assessment within the proposed utility line ROW relocation in Everglades National Park
USFWS	16 U.S.C 1539(a)(1)(A); 50 CFR Parts 13, 17	Endangered species permit to take American crocodile during monitoring	TE092945-2 (1)	01/29/2010	Provides authorization to take (capture, examine, weigh, sex, collect tissue samples, mark, radio-tag, radio-track, relocate, release) endangered American crocodile individuals during population monitoring.

Table 1.2-1 (Sheet 3 of 7)
Authorizations for Turkey Point Units 6 & 7

Jurisdictional Agency	Authority, Law, or Regulation	Description of Requirement	License/Permit and/or Applicability(a)	Date of Application or Date Issued	Activity Covered
USFWS	16 U.S.C 703-712	Special purpose salvage permit, migratory birds	MB697722-0 Amendment (1)	04/01/2009	Provides authorization to: salvage dead migratory birds, abandoned nests, and addled eggs after nesting season; dead bald or golden eagles; and possess live migratory birds for transport to permitted rehabilitator.
USFWS	16 USC 703-7121 50 CFR Part 13: 50 CFR 21.41	Federal Fish and Wildlife Permit	MB135540-0 (1)	04/01/2011	Emergency relocation of active migratory bird nests when birds, nests, or eggs pose a direct threat to human health and safety or when the safety of the bird is at risk if the nest and/or birds are not removed.
STATE OF FLORIDA AUTHORIZATIONS					
FDEP, Siting Board	F.S. § 403.501-.518	Power plant site certification*	(2)	06/30/2009, Amendment submittal 05/07/2010	Construction and operation of a power plant with more than 75 MW of steam generated power and associated facilities.
*Pursuant to the Florida Electrical Power Plant Siting Act (PPSA) all state, regional and local permits, except for certain local land use and zoning approvals and certain state issued licenses required under federally delegated or approved permit programs, are covered under a single “Certification”. Because the Certification is the sole license of the state and any agency required for construction and operation of the proposed electrical power plant, it is not necessary to apply for permits individually.					
FDEP, USEPA Region IV review	F.A.C. 62-621	NPDES storm water operations permit for industrial activities	(3)	06/30/2009	Operation of an industrial facility.
FDEP	Chapter 403 F.S.	Exploratory well construction permit	0293962-001-UC (1)	05/05/2010	Allows for the construction of the exploratory well and dual-zone monitor well.
FDEP	Chapter 403 F.S.	UIC well construction permit	(1)	Application date to be determined. A decision to move forward and submit the permit application will be made after the exploratory well is completed.	Allows for the conversion of the exploratory well to an injection well and perform operational testing for up to 2 years.

Table 1.2-1 (Sheet 4 of 7)
Authorizations for Turkey Point Units 6 & 7

Jurisdictional Agency	Authority, Law, or Regulation	Description of Requirement	License/Permit and/or Applicability[(a)]	Date of Application or Date Issued	Activity Covered
FDEP	Chapter 403 F.S.	Class I well operation permit	(3)	Application date to be determined. A decision to move forward and submit the permit application will be made after the exploratory well is completed.	Allows for the operation of the injection wells. This permit must be renewed every 5 years.
FDEP, USEPA Region IV review	F.A.C. 62-212	Prevention of significant deterioration construction permit	PSD-FL-409 (1)	05/28/2010	Construction and operation of facilities that generate air emissions.
FDEP, USEPA Region IV review	403.0885 F.S.	Modification of Industrial Wastewater Treatment Facility (IWW) permit	FL0001562 (2)	06/30/2009	Construction of Units 6 & 7 within the industrial wastewater facility.
FDEP/USEPA	F.A.C 62-25, 62-40	NPDES construction storm water permit	(1)	To be submitted 2 days prior to beginning construction	Construction of any facility that disturbs 1 acre or more.
Florida Fish and Wildlife Conservation Commission	F.A.C. 68A-9.002; 68A-25.002; 68A-27.003	Special purpose live-capture permit	WX06467A (1)	12/24/2008	Provides authorization for live-capture, insertion of data loggers in nests, and collection of samples, on FPL properties of American crocodiles for mark/recapture and scientific data collection; also provides for live-capture, relocation, and release of American alligators and Eastern indigo snakes and other endangered or threatened species or species of special concern.
FDEP	403.087, F.S. and F.A.C. 62-4, 62-520, 62-522, 62-528 62-550, 62-600, 62-601	Operation of Class V, Group 3 domestic wastewater injection (gravity flow) well	0127512-002-UO (3)	Renewal application date: 10/27/2010	Operation of IW-1.
FDEP	403, F.S. and F.A.C. 62-600, 62-601, 62-602, 62-620, 62-640, 62-699	Operation of domestic wastewater treatment facility (WWTF)	FLA013612- 003-DW3P (3)	09/28/2010	Operation of Turkey Point Power Plant WWTF.
FDEP	F.A.C 62-213	Title V Operations Permit	0250003-010-AV (3)	01/01/2009	Operation of facilities that generate air emissions.
FDEP, South Florida Water Management District	F.A.C. 40B-3	Well Construction Permit	13-59-3795 to 13-59-3814 (2)	01/14/2008	Construct, repair, modify, or abandon a well.

Table 1.2-1 (Sheet 5 of 7)
Authorizations for Turkey Point Units 6 & 7

Jurisdictional Agency	Authority, Law, or Regulation	Description of Requirement	License/Permit and/or Applicability[(a)]	Date of Application or Date Issued	Activity Covered
South Florida Water Management District	F.A.C. 40E-3	Well Abandonment Permit	#SF092308E, #SF092308F, #SF092308G, #SF092308H (2)	05/05/2009 Cancelled	Well abandonment permits.
State of Florida	F.A.C. 40E-3	Well Abandonment Permit	13-59-2241 through 13-59-2259 (2)	02/19/2008	Application to construct, repair, modify, or abandon well.
FWCC	F.A.C. 68A-9.002, 68A-9.025, 68A-27	Carcass Salvage Permit	WS06468a (1)	02/02/2011	Salvage, mount, and display wildlife carcasses upon encounter for educational or scientific purposes.
FWCC	F.A.C 68A-9.002, 68A-27.005	Removal of nests and ospreys	LSNR-1100026 (1)	02/02/2011	Removal and replacement of inactive nests of ospreys and other migratory birds.
FWCC	F.A.C 68A-9.002, 68A-9.025, 68A-27	Carcass Salvage Permit	LSSC-11-00021 (1)	02/02/2011	Salvage, mount, and display wildlife carcasses upon encounter for educational and scientific purposes.
OTHER STATE AUTHORIZATIONS					
Utah Department of Environmental Quality Division of Radiation Control	R313-26 of the Utah Radiation Control Rules	Revision of existing general site access permit	(3)	Annual authorization	Transport of radioactive materials into the state of Utah.
Tennessee Department of Environment and Conservation Division of Radiological Health	TDEC Rule 1200-2-10.32	Revision of existing Tennessee radioactive waste license-for-delivery	(3)	Annual authorization	Transport of radioactive waste into the state of Tennessee.

Table 1.2-1 (Sheet 6 of 7)
Authorizations for Turkey Point Units 6 & 7

Jurisdictional Agency	Authority, Law, or Regulation	Description of Requirement	License/Permit and/or Applicability[(a)]	Date of Application or Date Issued	Activity Covered
LOCAL AUTHORIZATIONS					
Miami-Dade County	Chapter 163 F.S.; Miami-Dade County Comprehensive Plan and adopted regulations	Land use and zoning approval (unusual use approval)	Miami-Dade County Board of County Commissioners Resolution Z-56-07 (1)	12/24/2007	Unusual use (zoning approval) to permit a nuclear power plant (atomic reactors) and ancillary structures and equipment.
Miami-Dade County	Chapter 163 F.S.; Miami-Dade County Comprehensive Development Master Plan (CDMP) and adopted regulations	CDMP text amendment	(1)	Application submitted 10/31/ 2008; withdrawn 03/05/2010	Excavation for fill source.
Miami-Dade County	Chapter 163 F.S.; Miami-Dade County Comprehensive Development Master Plan (CDMP) and adopted regulations	CDMP text amendment	(1)	04/30/2009	Temporary Access roads.
Miami-Dade County	Miami-Dade County Ordinances	IW6 permit (industrial well field) for site investigation	Permit Numbers: 13-59-2241 through 13-59-2259 (1)	02/19/2008	Land use — nonresidential, within major well field protection areas not served by sanitary sewers.
Miami-Dade County Health Department	Chapter 373 F.S.	Water well construction permits	13-59-2241 to 13-59-2259 13-59-3795 to 13-59-3814 (1)	02/19/2008 1/14/2008	Well installation for hydologic investigation.
Miami-Dade County	Miami-Dade County Code Chapter 24	Domestic wastewater annual operating permit	DWO-000010-2010-2011 (2)	04/15/2011	Stabilization treatment facility.
Miami-Dade County	Miami-Dade County Code Chapter 24	Operation of pollution control facility Permit	IW5-006229-2010-2011 (2)	05/01/2011	Operation of fleet vehicle maintenance facility that generates waste oil, coolant, and used batteries with a solvent wash tank and served by septic tank.

Table 1.2-1 (Sheet 7 of 7)
Authorizations for Turkey Point Units 6 & 7

Jurisdictional Agency	Authority, Law, or Regulation	Description of Requirement	License/Permit and/or Applicability[(a)]	Date of Application or Date Issued	Activity Covered
Miami-Dade County	Miami-Dade County Ordinances, Chapter 14	Burn Permit	8842, ODS 07200-00000-00017 (2)	03/04/2011	Onsite combustion of construction debris. Annual permit issued.
Miami-Dade County	Miami-Dade County Ordinances, Section 24-35	IW5 Permit (or waiver)	IW-000016-2009/ 2010	Renewal application date: 04/21/2011	Hazardous materials or hazardous waste-large user or generator. Hazardous waste permit issued 10/01/2008.
Miami-Dade County	Miami-Dade County Code Chapter 24	Stratospheric Ozone Protection Annual Operations Permit	APCF-001747-2010-2011 (1)	07/01/2011	Use of refrigerants R-12, R-22, R-502 for Robinair Recovery Units, Models 25200, 25200A, 25200B.
Miami-Dade County	Miami-Dade County Code Chapter 24	Industrial Waste Annual Operations Permit	IW-000003-2010-2011 (2)	Renewal application date: 04/21/2011	Onsite disposal of Class III industrial solid waste consisting of earth and earth-like products, concrete, rock, bricks, and land clearing debris.
Miami-Dade County	Miami-Dade County Ordinance 89-104	Marine Facilities Annual Operations Permit	MOP-000072-2010/2011 (2)	10/01/2010	Operation of 1 wet slip, 1 dry slip, 2 commercial vessels.
Miami-Dade County	Miami-Dade County Ordinances, Chapter 8	TP 6 & 7 Site Investigation-Construction trailers	2008-026502	01/29/2008	Construction Trailers
Miami-Dade County	Miami-Dade County Ordinances, Chapter 8	TP 6 & 7 Exploratory Well-Electrical permits	2011-028574 2011-031469	03/28/2011 04/13/2011	Exploratory well electrical permit
State of Florida; Miami-Dade County	Miami-Dade County Ordinances, Chapter 8; F.A.C. 64E-6	TP 6 & 7 Exploratory Well-Construction Trailer permits	2011-031471 2011-031529 2011-031532 13-SC-1307746 2011-031470 2011-031530 2011-031531 13-SC-1307751	04/13/2011 04/13/2011 04/13/2011 03/18/2011 04/13/2011 04/13/2011 04/13/2011 03/18/2011	Exploratory well construction trailer permit
State of Florida	F.A.C. 40D-3	TP 6 & 7 Exploratory Well-Pad monitor well permits	13-59-6664-71	04/14/2011	Exploratory well pad monitor well permits
Miami-Dade County	Miami-Dade County Ordinances, Chapter 33	Unusual Use Resolution	Resolution Z-56-07	12/24/2007	Unusual use resolution
South Florida Water Management District (SFWMD)	Chapter 373 F.S.	Water well construction permits	SF092308A-SF092308D SF123008A-SF123008E	9/23/2008 12/23/2008	Pump test for test wells.

(a) Applicability of the license or permit to the project activity type, i.e., 1 = activities not requiring a COL, 2 = construction activities requiring a COL, 3 = plant operation activities

APPENDIX A

CONSULTATION LETTERS AND RESPONSES

U.S. FISH AND WILDLIFE SERVICE

Florida Power & Light Company, P.O. Box 14000, Juno Beach, FL 33408-0420
Environmental Services Department

FPL

FLFW-08-0287

December 21, 2008

Mr. John Wrublik
U.S. Fish and Wildlife Service
South Florida Field Office
1339 20[th] Street
Vero Beach, FL 32960

SUBJECT: Request for Information on Federal Listed Species in Miami-Dade County, Florida

Dear Mr. Wrublik:

Florida Power & Light Company (FPL) is preparing permit and license applications to the U.S. Nuclear Regulatory Commission (NRC), the Florida Department of Environmental Protection (FDEP) and the United States Army Corps of Engineers (USACE) to allow construction and operation of two new nuclear units and associated project features at our existing Turkey Point property in Miami-Dade County, Florida (the "proposed action"). As part of the permitting and licensing process, FPL is required to assess impacts of the proposed action, including those on Federal listed species in accordance with the Endangered Species Act . Consistent with 10 CFR Part 51, FPL requests that the U.S. Fish and Wildlife Service ("Service") provide it with information in your possession showing known occurrences of federal listed (or proposed for listing) species that could potentially be affected by the proposed action. FPL will include a copy of this request and your response in both the State of Florida Site Certification Application and the NRC Combined Operating License Application Environmental Report. Information about the property and the proposed action follows.

The Turkey Point property is located in Miami-Dade County Florida, adjacent to Biscayne Bay and Card Sound, about 25 miles south of Miami (Figure 1). The total, non-contiguous property area is approximately 11,000 acres. The developed portion of the property includes a natural gas fueled generating unit; two oil/gas-fired generating units, and two nuclear-powered generating units. The proposed action would further develop approximately 300 acres of the property west and south of these existing units, primarily within an existing cooling canal system. In addition, FPL will construct (1) pipelines to convey dual cooling water supplies (reclaimed and saline) to new cooling towers, (2) power transmission lines to connect the new units with the regional electric grid, and (3) a reclaimed water treatment facility to condition the reclaimed water for cooling water uses. In addition, because fill material is necessary for the unit foundations, FPL is proposing to place fill sourced from a commercial mine and/or from a nearby FPL-owned property approximately 4 miles northwest of the proposed site. These areas are shown in Figures 2 and 3. Figures 2A and 2B include the project features in the vicinity of the proposed plant area. Figure 3 also provides an expanded view of the area showing the proposed transmission corridor.

Thank you for your attention to this request; I will follow-up with you to confirm receipt and to address any information needs or questions you may have. Should you need to talk to me earlier, please reach me by telephone at 561-691-7518.

Sincerely,

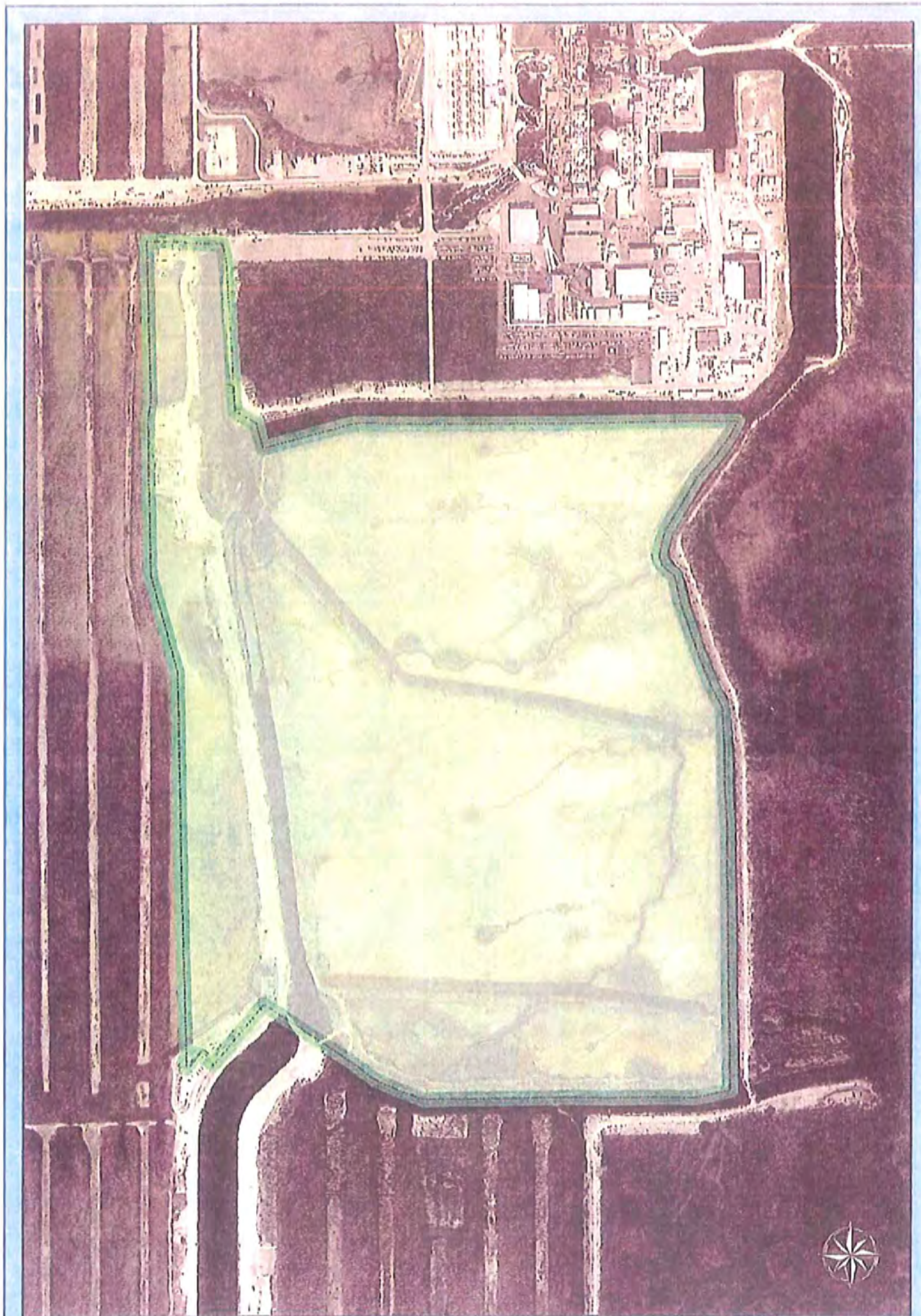
Barbara Linkiewicz

Director, Environmental Licensing

cc: Patrick Pitts, USFWS

bcc: Florette Braun
Antonio Fernandez
Greg Hall
Bill Maher
Rick Orthen
Matt Raffenberg
Marister Ruiz
Steve Scroggs
Mike Tammaro

Figure 1



Turkey Point Units 6 and 7 Site

Miles
0 0.03 0.06 0.12 0.18 0.24

0 0.05 0.1 0.2 0.3
Kilometers

GIS Map Code: US-TURK-000082-R000C

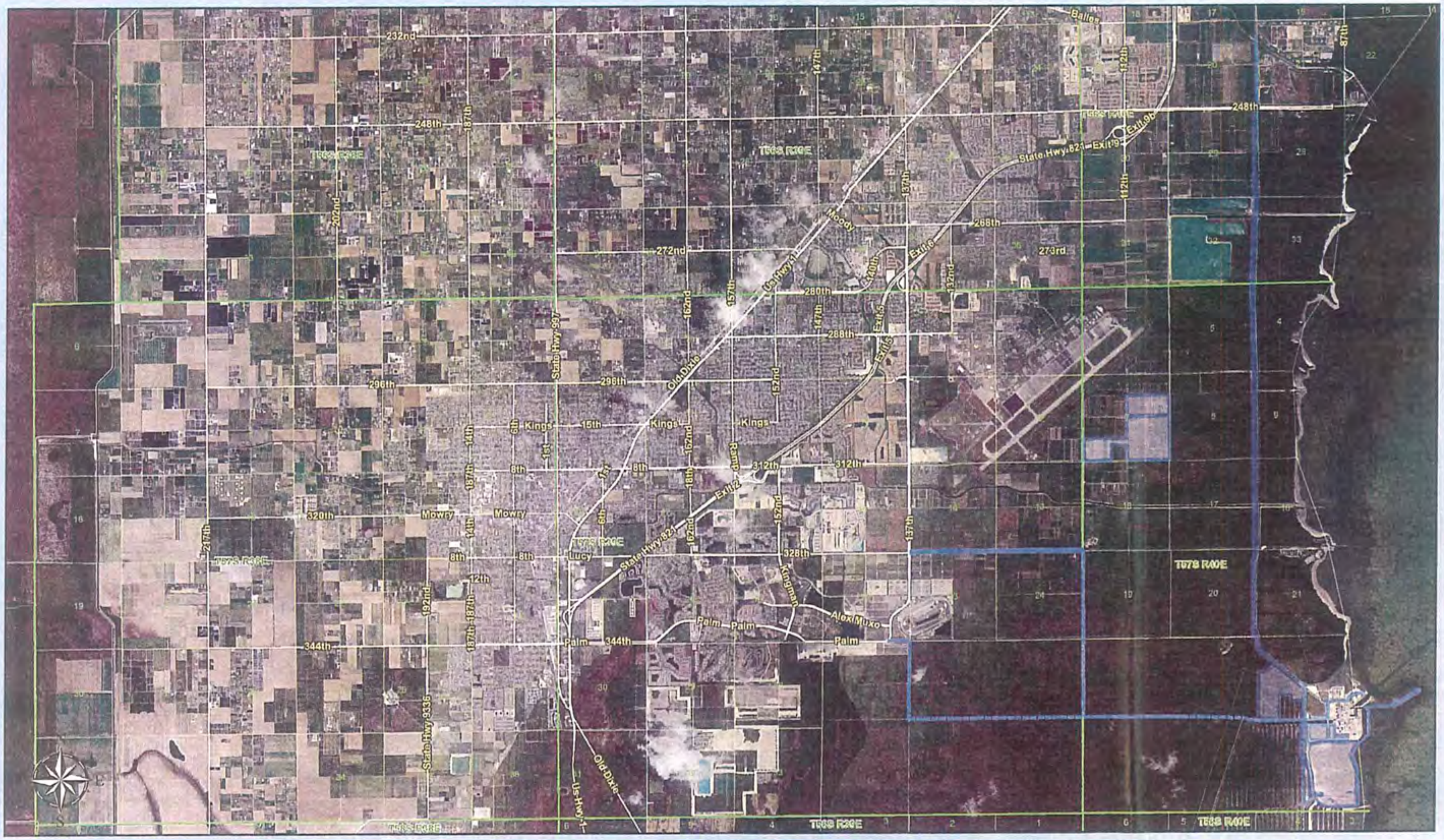


Figure 2A: Turkey Point Units 6 & 7 Potential Project Features (without transmission)

0 0.5 1 2 Miles

GIS Map Code: US-TURK-000159-R000F

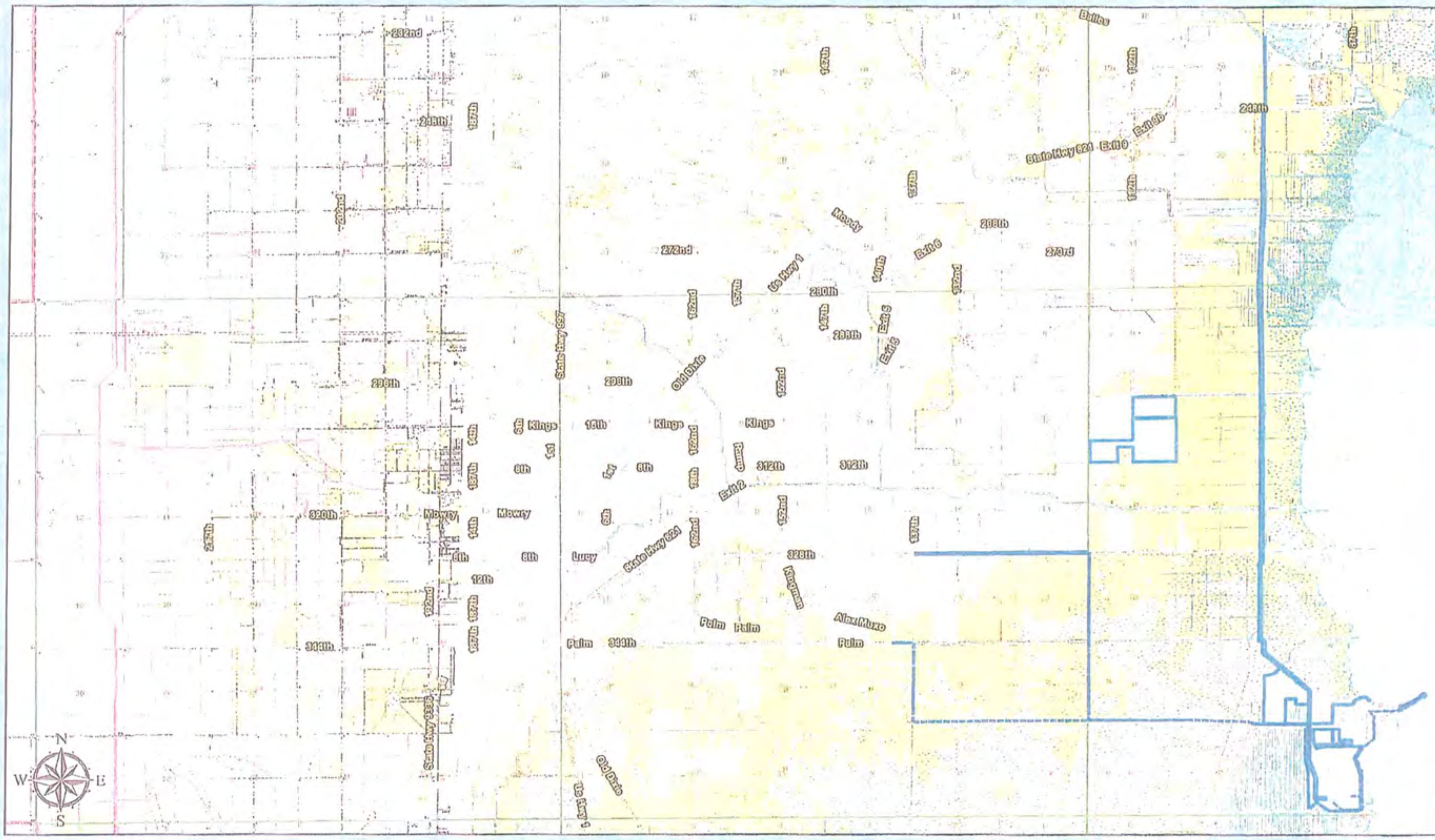
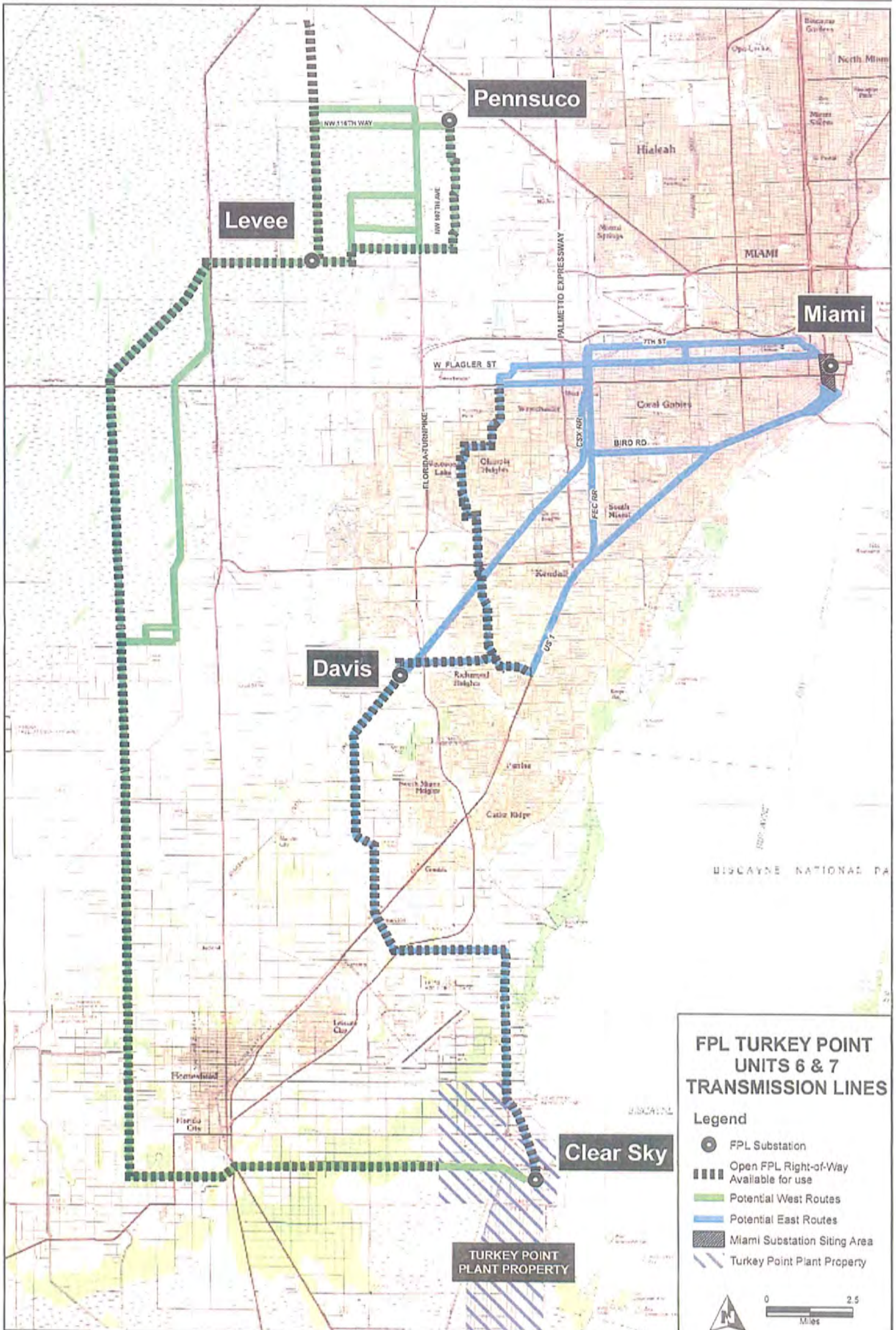


Figure 2B: Turkey Point Units 6 & 7 Potential Project Features (without transmission)

0 0.5 1 2 Miles

GIS Map Code: US-TURK-000181-R000D

FIGURE 3.
POTENTIAL TRANSMISSION ROUTES BEING STUDIED



From: John_Wrublik@fws.gov [mailto:John_Wrublik@fws.gov]
Sent: Wednesday, January 14, 2009 10:13 AM
To: Linkiewicz, Barbara P
Subject: Two New Nuclear-Powered Generating Units at Turkey Point

January 14, 2009

Barbara Linkiewicz
Florida Power and Light Company
Post Office Box 14000
Juno Beach, Florida 33408-0420

Service Federal Activity Code:	41420-2009-FA-0180
Service Consultation Code:	41420-2009-TA-0098
Date Received:	December 23, 2008
Project:	Two New Nuclear-Powered Generating Units at Turkey Point
County:	Miami-Dade

Dear Ms. Linkiewicz:

The Fish and Wildlife Service (Service) has received your letter dated December 23, 2008, for the project referenced above. We offer the following comments.

PROJECT DESCRIPTION

The proposed action would construct two new nuclear-powered electrical generating units at the Turkey Point Power Facility on 300 acres of undeveloped land located west and south of the existing units. The project will also include the construction of cooling pipes, cooling towers, and power transmission lines, and reclaimed water treatment facility. The project is located in Miami-Dade County, Florida.

THREATENED AND ENDANGERED SPECIES

American crocodile

The project is located within the geographic range of the threatened American crocodile (*Crocodylus acutus*). The American crocodile is known to occur and nest at the Turkey Point Power Plant within the cooling canal system.

No other records of federally listed species were not identified on your project site. The Service has not conducted a site inspection to verify species occurrence or validate the GIS results. However, we assume listed species occur in suitable ecological communities and recommend site surveys to determine the presence or absence of listed species. Ecological communities suitable for listed species can be found in the species accounts in the *South Florida Multi-Species Recovery Plan*. This document is available on the web at: http://www.fws.gov/verobeach/index.cfm?Method=programs&NavProgramCategoryID=3&programID=107&ProgramCategoryID=3. We have also provided for your consideration two computer links: (1) http://www.fws.gov/verobeach/index.cfm?Method=programs&NavProgramCategoryID=3&programID=37&ProgramCategoryID=3, and (2) http://migratorybirds.fws.gov/. The first link provides links to lists of species protected under the Endangered Species Act of 1973 (as amended, 87 Stat. 884; 16 U.S.C. 1531 *et seq.*) for each county in south Florida. The County lists do not include State-listed species. Please contact the Florida Fish and Wildlife Conservation Commission to identify potential State-listed species occurring in the vicinity of your project. The second link provides information on species the Service is required to protect and conserve under other authorities, such as the Fish and Wildlife Coordination Act of 1958, as amended (48 Stat. 401; 16 U.S.C. 661 *et seq.*) and the Migratory Bird Treaty Act (40 Stat. 755; 16 U.S.C. 701 *et seq.*). A variety of habitats in south Florida occasionally provide resting, feeding, and nesting sites for a variety of migratory bird species. As a public trust resource, migratory birds must be taken into consideration during project planning and design.

Thank you for the opportunity to comment. If you have any questions, please contact me at 772-562-3909, extension 282.

Sincerely yours,

John M. Wrublik
U.S. Fish and Wildlife Service
Vero Beach Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960
Phone: 772-562-3909, x-282
Fax: 772-562-4288

NATIONAL MARINE FISHERIES SERVICE

Florida Power & Light Company, P.O. Box 14000, Juno Beach, FL 33408-0420
Environmental Services Department

FPL

FLNA-08-0288

December 21, 2008

Mr. Bob Hoffman
NOAA Fisheries Services
Southeast Regional Office
263 13th Ave. South
St. Petersburg, FL 33701

SUBJECT: Request for Information on Federal Listed Species in Miami-Dade County, Florida

Dear Mr. Hoffman:

Florida Power & Light Company (FPL) is preparing permit and license applications to the U.S. Nuclear Regulatory Commission (NRC), the Florida Department of Environmental Protection (FDEP) and the United States Army Corps of Engineers (USACE) to allow construction and operation of two new nuclear units and associated project features at our existing Turkey Point property in Miami-Dade County, Florida (the "proposed action"). As part of the permitting and licensing process, FPL is required to assess impacts of the proposed action, including those on Federal listed species in accordance with the Endangered Species Act. Consistent with 10 CFR Part 51, FPL requests that the U.S. Fish and Wildlife Service ("Service") provide it with information in your possession showing known occurrences of federal listed (or proposed for listing) species that could potentially be affected by the proposed action. FPL will include a copy of this request and your response in both the State of Florida Site Certification Application and the NRC Combined Operating License Application Environmental Report. Information about the property and the proposed action follows.

The Turkey Point property is located in Miami-Dade County Florida, adjacent to Biscayne Bay and Card Sound, about 25 miles south of Miami (Figure 1). The total, non-contiguous property area is approximately 11,000 acres. The developed portion of the property includes a natural gas fueled generating unit; two oil/gas-fired generating units, and two nuclear-powered generating units. The proposed action would further develop approximately 300 acres of the property west and south of these existing units, primarily within an existing cooling canal system. In addition, FPL will construct (1) pipelines to convey dual cooling water supplies (reclaimed and saline) to new cooling towers, (2) power transmission lines to connect the new units with the regional electric grid, and (3) a reclaimed water treatment facility to condition the reclaimed water for cooling water uses. In addition, because fill material is necessary for the unit foundations, FPL is proposing to place fill sourced from a commercial mine and/or from a nearby FPL-owned property approximately 4 miles northwest of the proposed site. These areas are shown in Figures 2 and 3. Figures 2A and 2B include the project features in the vicinity of the proposed plant area. Figure 3 also provides an expanded view of the area showing the proposed transmission corridor.

Thank you for your attention to this request; I will follow-up with you to confirm receipt and to address any information needs or questions you may have. Should you need to talk to me earlier, please reach me by telephone at 561-691-7518.

Sincerely,

Barbara P Linkiewicz

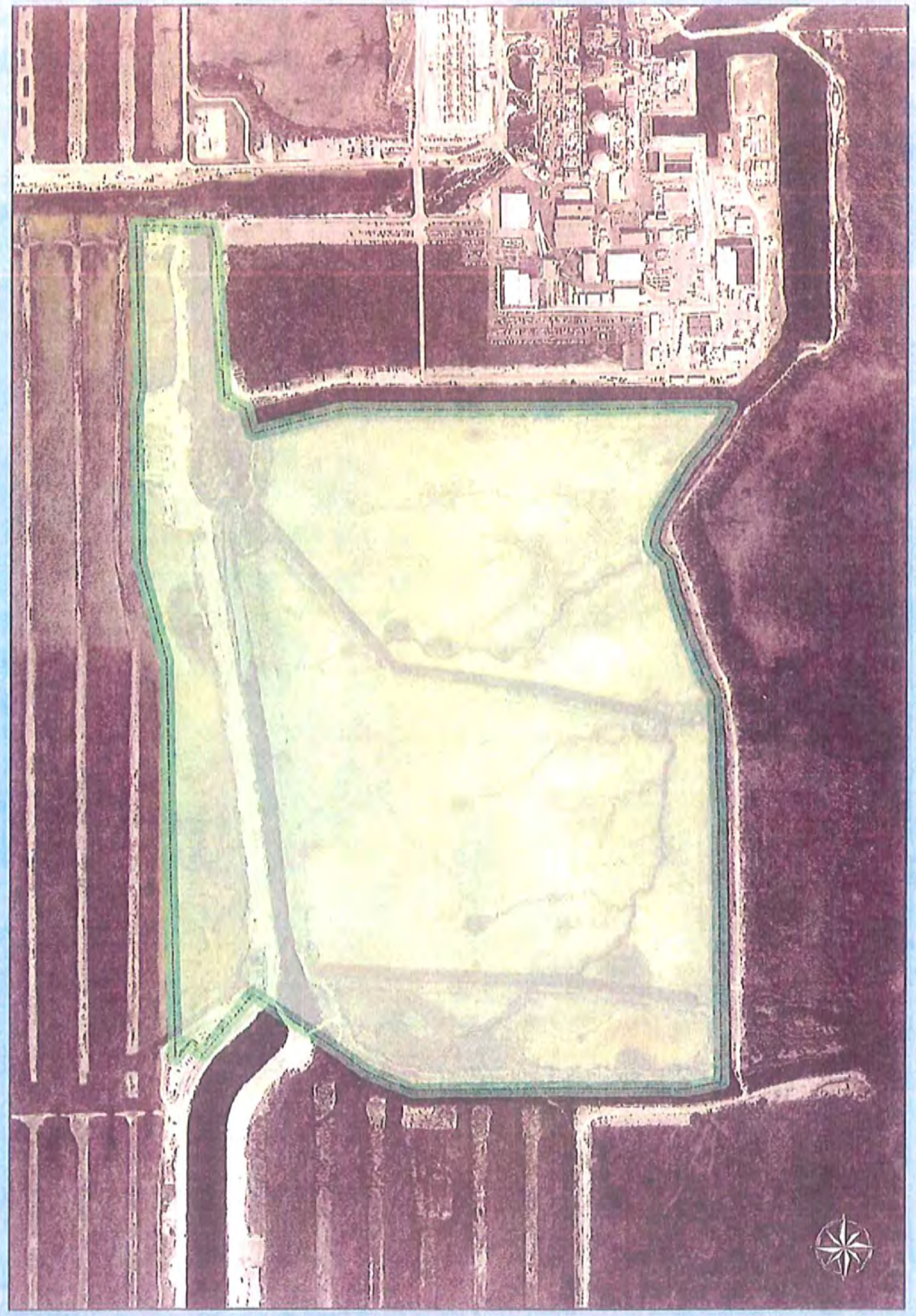
Barbara Linkiewicz

Director, Environmental Licensing

cc: Jocelyn Karazsia, NOAA Fisheries Services

bcc: Florette Braun
Antonio Fernandez
Greg Hall
Bill Maher
Rick Orthen
Matt Raffenberg
Marister Ruiz
Steve Scroggs
Mike Tammaro

Figure 1



Turkey Point Units 6 and 7 Site

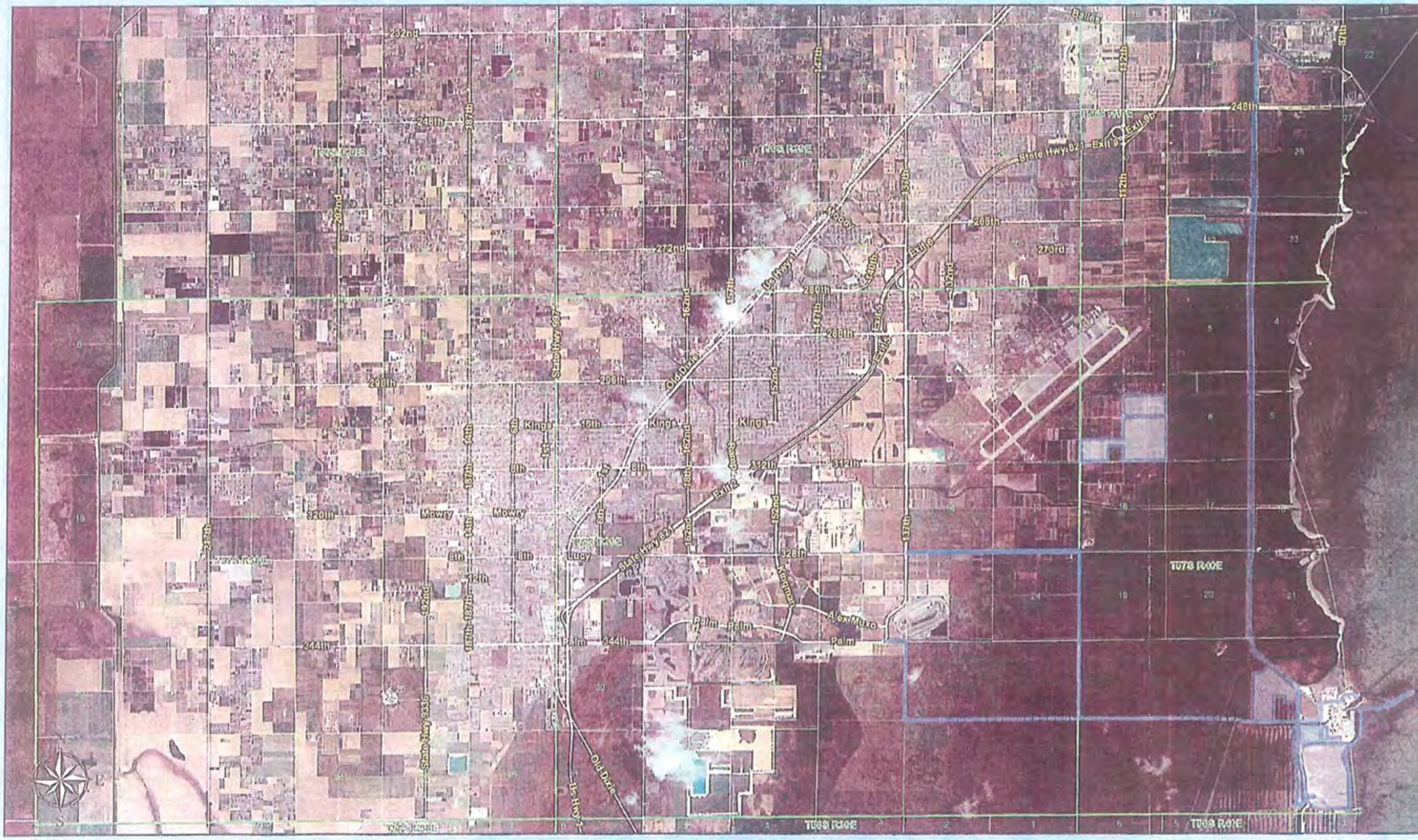


Figure 2A: Turkey Point Units 6 & 7 Potential Project Features (without transmission)

0 0.5 1 2 Miles

GIS Map Code: US-TURK-000159-R000F

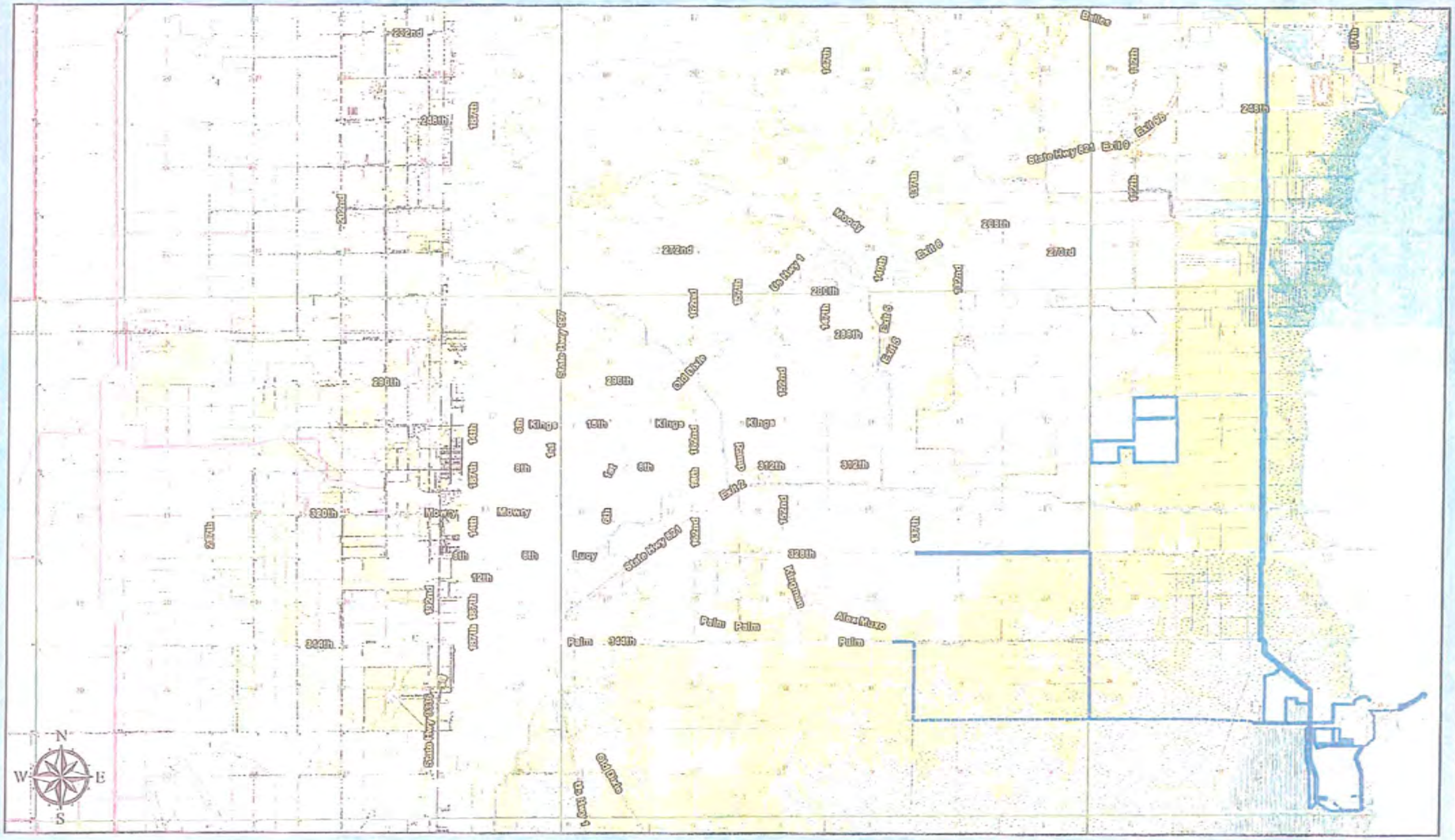
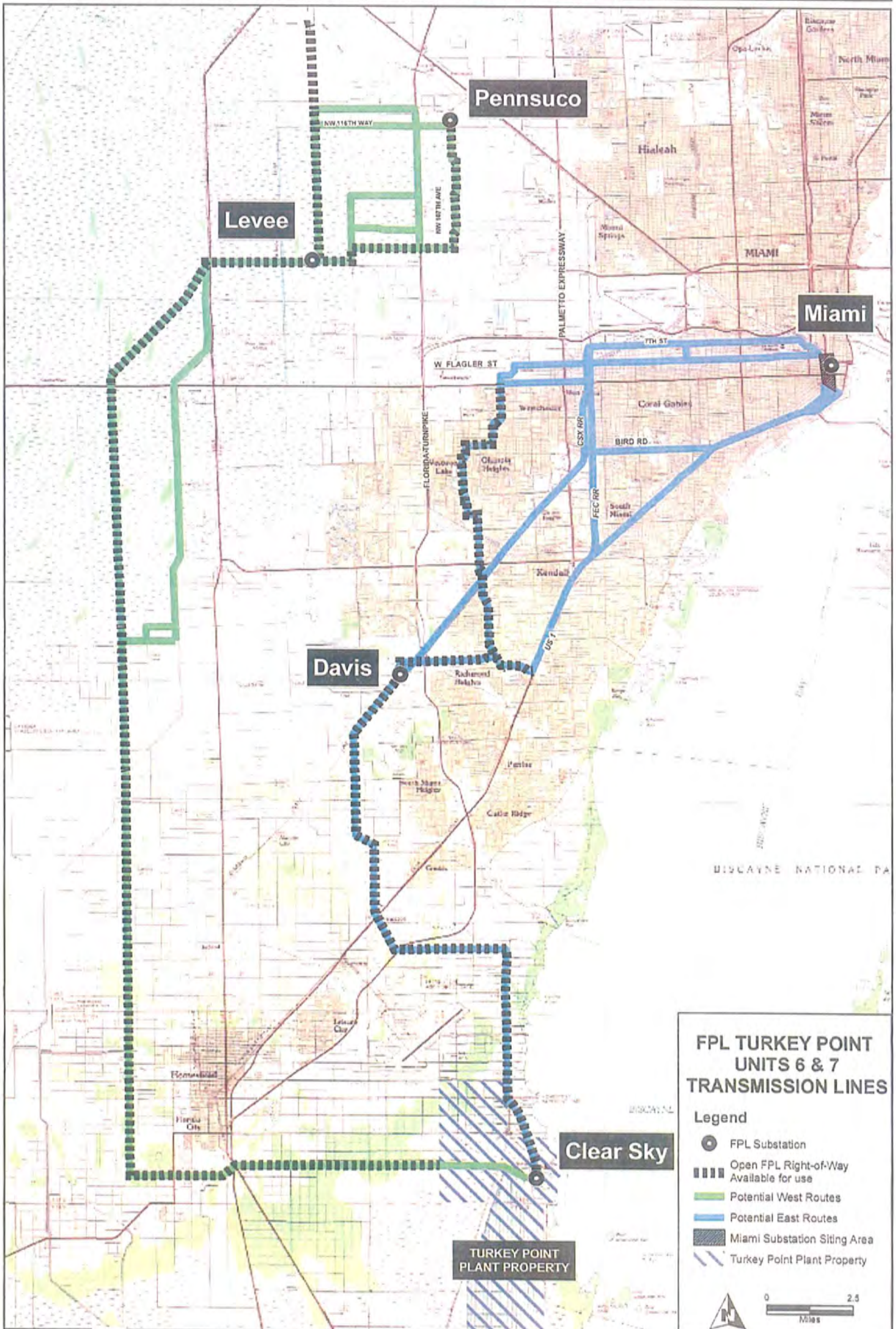


Figure 2B: Turkey Point Units 6 & 7 Potential Project Features (without transmission)

0 0.5 1 2 Miles

GIS Map Code: US-TURK-000161-R0000

FIGURE 3.
POTENTIAL TRANSMISSION ROUTES BEING STUDIED



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, FL 33701
(727) 824-5312, Fax 824-5309
http://sero.nmfs.noaa.gov

JAN 0 9 2009

Dear Colleague:

Pursuant to section 7(a)(2) of the Endangered Species Act (ESA), the Protected Resources Division of NOAA's National Marine Fisheries Service (NMFS) has reviewed your letter dated December 21, 2008, requesting information on federal listed species in Miami-Dade County, Florida.

____ **There are no ESA-listed species** or designated critical habitat under our purview in the action area.

___ **We cannot determine** impacts to threatened or endangered species, or designated critical habitat, under NOAA Fisheries purview because the letter lacks sufficient information to evaluate the project.
Enclosed are guidelines to conduct a proper biological evaluation.

___ **Please provide a letter** from the lead federal action agency designating you to conduct ESA section 7 consultation with this office.

__X__ **Enclosed is a list** of federally-protected species under the jurisdiction of NMFS for the state of Florida. Biological information on federally-protected species and candidate species can be found at the following website addresses: http://www.nmfs.noaa.gov/prot_res/prot_res.html; http://www.cccturtle.org; http://noflorida.fws.gov/SeaTurtles/seaturtle-info.htm); http://endangered.fws.gov/wildlife.html#Species; http://www.cmc-ocean.org/main.php3; http://floridaconservation.org/psm/turtles/turtle.htm; http://obis.env.duke.edu/data/sp_profiles.php; www.mote.org/~colins/Sawfish/SawfishHomePage.html; www.floridasawfish.com; www.flmnh.ufl.edu/fish/sharks/InNews/sawprop.htm; Gulf sturgeon critical habitat rule and maps (http://alabama.fws.gov/gs/)

___ **It is NMFS' opinion that the project will have no effect** on listed species or critical habitat protected by the ESA under NOAA Fisheries purview. No further consultation with NOAA Fisheries pursuant to section 7(a)(2) of the ESA is required unless the project description changes.

Consultation with NMFS' Habitat Conservation Division (HCD), pursuant to the Magnuson-Stevens Fishery Conservation and Management Acts requirements for essential fish habitat consultation, may be required. Please contact HCD at (727) 824-5317. If you have any ESA questions, please contact our ESA section 7 Coordinator, Eric Hawk, at (727) 824-5312 or by e-mail at eric.hawk@noaa.gov

Sincerely,

Teletha Mincey

Teletha Mincey
Administrative Support Assistant
Protected Resources Division

Enclosure

File: 1514-22.B

Florida-Atlantic

Species Proposed for Listing
None

Proposed Critical Habitat
None

Candidate Species[2]	Scientific Name
None	

Species of Concern[3]	Scientific Name
Fish	
Atlantic sturgeon	*Acipenser oxyrhynchus oxyrhynchus*
dusky shark	*Carcharhinus obscurus*
key silverside	*Menidia conchorum*
largetooth sawfish	*Pristis pristis*
mangrove rivulus	*Rivulus marmoratus*
Nassau grouper	*Epinephelus striatus*
night shark	*Carcharinus signatus*
opossum pipefish	*Microphis brachyurus lineatus*
saltmarsh topminnow	*Fundulus jenkinsi*
sand tiger shark	*Carcharias taurus*
speckled hind	*Epinephelus drummondhayi*
striped croaker	*Bairdiella sanctaeluciae*
Warsaw grouper	*Epinephelus nigritus*
Invertebrates	
ivory bush coral	*Oculina varicosa*

[2] The Candidate Species List has been renamed the Species of Concern List. The term candidate species" is limited to species that are the subject of a petition to list and for which NOAA Fisheries Service has determined that listing may be warranted (69 FR 19975)
[3] Species of Concern are not protected under the Endangered Species Act, but concerns about their status indicate that they may warrant listing in the future. Federal agencies and the public are encouraged to consider these species during project planning so that future listings may be avoided

Endangered and Threatened Species and Critical Habitats
under the Jurisdiction of the NOAA Fisheries Service

Florida-Atlantic

Listed Species	Scientific Name	Status	Date Listed
Marine Mammals			
blue whale	*Balaenoptera musculus*	Endangered	12/02/70
finback whale	*Balaenoptera physalus*	Endangered	12/02/70
humpback whale	*Megaptera novaeangliae*	Endangered	12/02/70
North Atlantic right whale	*Eubalaena glacialis*	Endangered	12/02/70
sei whale	*Balaenoptera borealis*	Endangered	12/02/70
sperm whale	*Physeter macrocephalus*	Endangered	12/02/70
Turtles			
green sea turtle	*Chelonia mydas*	Threatened[1]	07/28/78
hawksbill sea turtle	*Eretmochelys imbricata*	Endangered	06/02/70
Kemp's ridley sea turtle	*Lepidochelys kempii*	Endangered	12/02/70
leatherback sea turtle	*Dermochelys coriacea*	Endangered	06/02/70
loggerhead sea turtle	*Caretta caretta*	Threatened	07/28/78
Fish			
shortnose sturgeon	*Acipenser brevirostrum*	Endangered	03/11/67
smalltooth sawfish	*Pristis pectinata*	Endangered	04/01/03
Invertebrates			
elkhorn coral	*Acropora palmata*	Threatened	5/9/06
staghorn coral	*Acropora cervicornis*	Threatened	5/9/06
Seagrasses			
Johnson's seagrass	*Halophila johnsonii*	Threatened	09/14/98

Designated Critical Habitat
Right whale: Between 31°15'N (approximately the mouth of the Altamaha River, Georgia) and 30°15'N (approximately Jacksonville, Florida) from the coast out to 15 nautical miles offshore; the coastal waters between 30°15'N and 28°00'N (approximately Sebastian Inlet, Florida) from the coast out to 5 nautical miles

Johnson's seagrass: A final rule designating Johnson's seagrass critical habitat was published on April 5, 2000 (65 FR 17786) and 10 geographic areas (units) within the range of the species were identified along the east coast of Florida

[1] Green turtles are listed as threatened, except for breeding populations of green turtles in Florida and on the Pacific Coast of Mexico which are listed as endangered

SECTION 2.1: STATION LOCATION

SECTION 2.1 LIST OF FIGURES

2.1 STATION LOCATION

FPL proposes to construct and operate two Westinghouse AP1000 units at the existing approximately 9400-acre Turkey Point plant property in southeast Miami-Dade County, Florida. The two AP1000 reactors would be referred to as Units 6 & 7. This section describes the general location of the Turkey Point plant property and the Units 6 & 7 plant area.

Units 6 & 7 and supporting infrastructure would be located in the approximately 218-acre plant area delineated in Figure 2.1-1. The center point of the Unit 6 containment building would be approximately 215 feet west and 3625 feet south of the center point of the Unit 4 containment building. The center point of Unit 7 would be approximately 850 feet west of the center point of Unit 6. Unit 5 is located northwest of Units 1 through 4 and is independently cooled through the use of cooling towers. Units 1 through 4 use the cooling canals of the industrial wastewater facility for heat removal and are located at the northern boundary of the industrial wastewater facility. Units 6 & 7 would be located within the northeast corner of the industrial wastewater facility on an area surrounded by canals, referred to as the Units 6 & 7 plant area, just south of Units 1 through 5. The Units 6 & 7 containment buildings would be located at the following coordinates:

Coordinate System

Geographic, Decimal Degrees, North American Data 1983 (NAD83)		
Unit 6	25.424186 N	–80.331961 W
Unit 7	25.424186 N	–80.334536 W
Universal Transverse Mercator Zone 17, Meters, NAD83		
Unit 6	2812086.79 N	567179.31 E
Unit 7	2812086.79 N	566920.31 E
Florida State Plane East, U.S. Feet, NAD83		
Unit 6	396968 N	876646 E
Unit 7	396968 N	875796 E

The Turkey Point plant property is on the southeastern coast of Florida, bordering Biscayne Bay and Card Sound, in unincorporated southeast Miami-Dade County. It is located in all or portions of Sections 27, 28, 29, 30, 31, 32, 33, and 34 of Township 57S, Range 40E and Sections 4, 5, 7, 8, 9,16, 17, 18, 19, 20, 21, 28, 29, and 30 of Township 58S Range 40E. The Units 6 & 7 plant area would be located in portions of Sections 33 and 34 of Township 57S, Range 40E. The only existing access to the plant property is from SW 344th Street/Palm Drive as shown on Figure 2.1-1.

The Turkey Point plant property is approximately 25 miles south of Miami, 8 miles east of Florida City, and 4.5 miles east of the southeastern municipal limits of Homestead. The property is approximately 2 miles south of the Biscayne National Park Visitors Center and is within 3 miles of the South Florida Water Management District conservation area (Model Lands Basin). A portion of the Biscayne Bay Aquatic Preserve runs along the coastal boundary of the Turkey Point plant property. The Homestead Bayfront Park lies approximately 1.5 miles north of Units 6 & 7, and 1.5 miles east of the L-31E canal. In addition, the plant property is adjacent to the 13,000-acre Everglades Mitigation Bank, owned by FPL. The exclusion area boundary for Units 3 & 4 is irregularly shaped, with a distance from the center of the existing Units 3 & 4 containment buildings of 4164 feet to the northern property line, 5582 feet to the southern property line, and a minimum distance of 1800 feet. The exclusion area boundary for Units 6 & 7 would be irregularly shaped, with a minimum distance from the center point of the Units 6 & 7 containment buildings of 1927 feet in the east to northeast direction.

Within Miami-Dade County, Homestead is the closest major population center to Units 6 & 7, with 55,036 residents during the 2005-2009 census range (USCB 2010). The distance to the center of the city of Miami (the nearest major city) is approximately 25 miles. The Homestead/Miami Speedway is located approximately 5 miles northwest of the Turkey Point plant property. Homestead Air Reserve Base, with both civilian and military operations, is approximately 4.5 miles northwest of the plant area. Miami International Airport is approximately 25 miles north of the plant property. There are no rail systems within 5 miles of the Turkey Point plant property (Figure 2.1-3). The Port of Miami is approximately 26 miles from the plant area. Key Largo is approximately 23 miles from the plant area. Figures 2.1-2, 2.1-3, and 2.1-4 provide, respectively, an oblique aerial photograph of the Turkey Point plant property, a map of the vicinity within 6 miles of Units 6 & 7, and a map of the region within 50 miles of Units 6 & 7.

Section 2.1 References

USCB 2010. Table DP05 *Demographic and Housing Estimates 2005-2009*, 2005-2009 American Community Survey 5-Year Estimates. Available at www.census.gov, accessed March 27, 2012.

Figure 2.1-1 Turkey Point Site

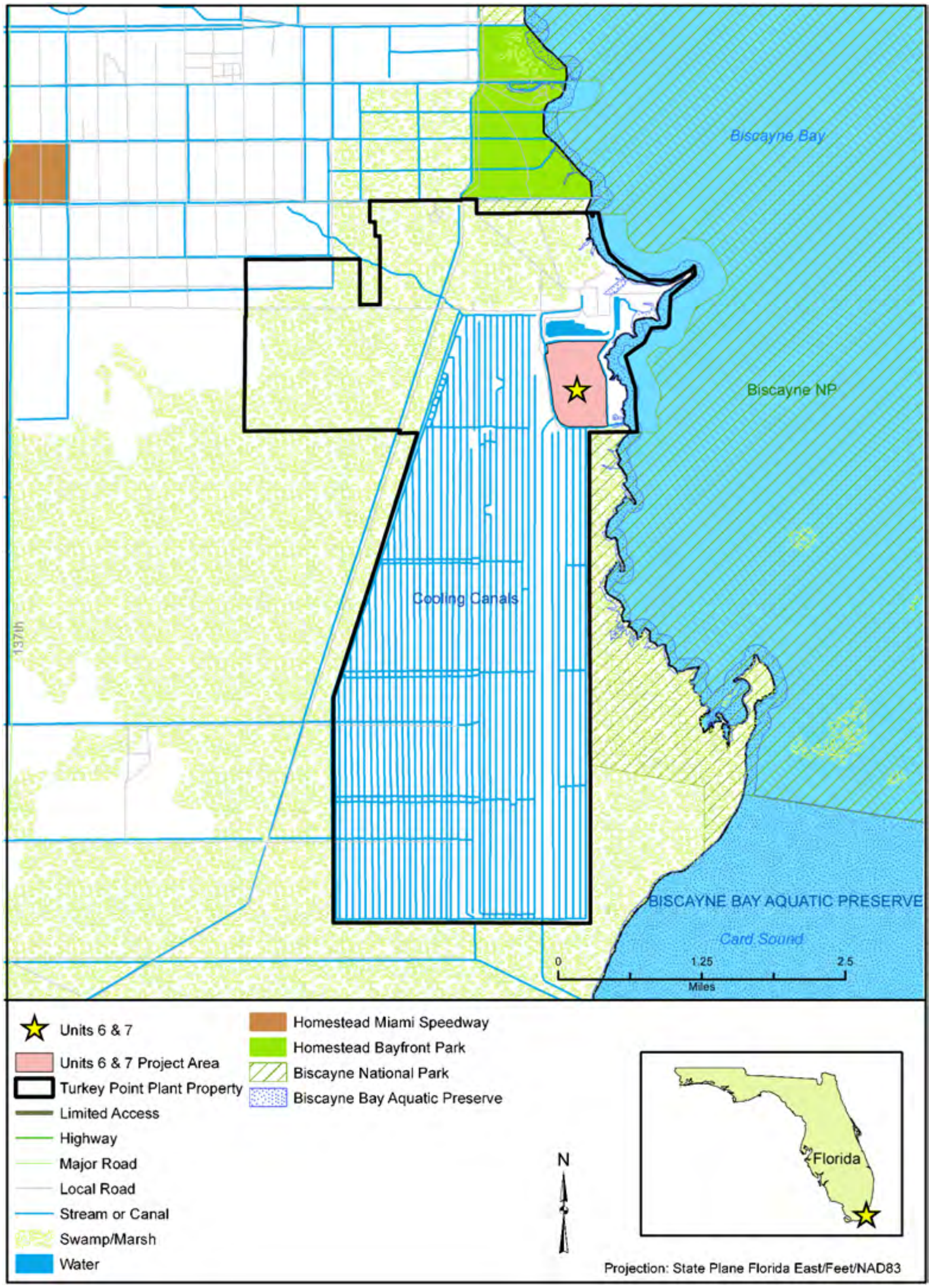


Figure 2.1-2 Oblique Aerial Photograph of Turkey Point Plant Property

Looking west, Units 6 & 7 plant area shown to left, Units 1–5 shown to right

Figure 2.1-3 6-Mile Vicinity

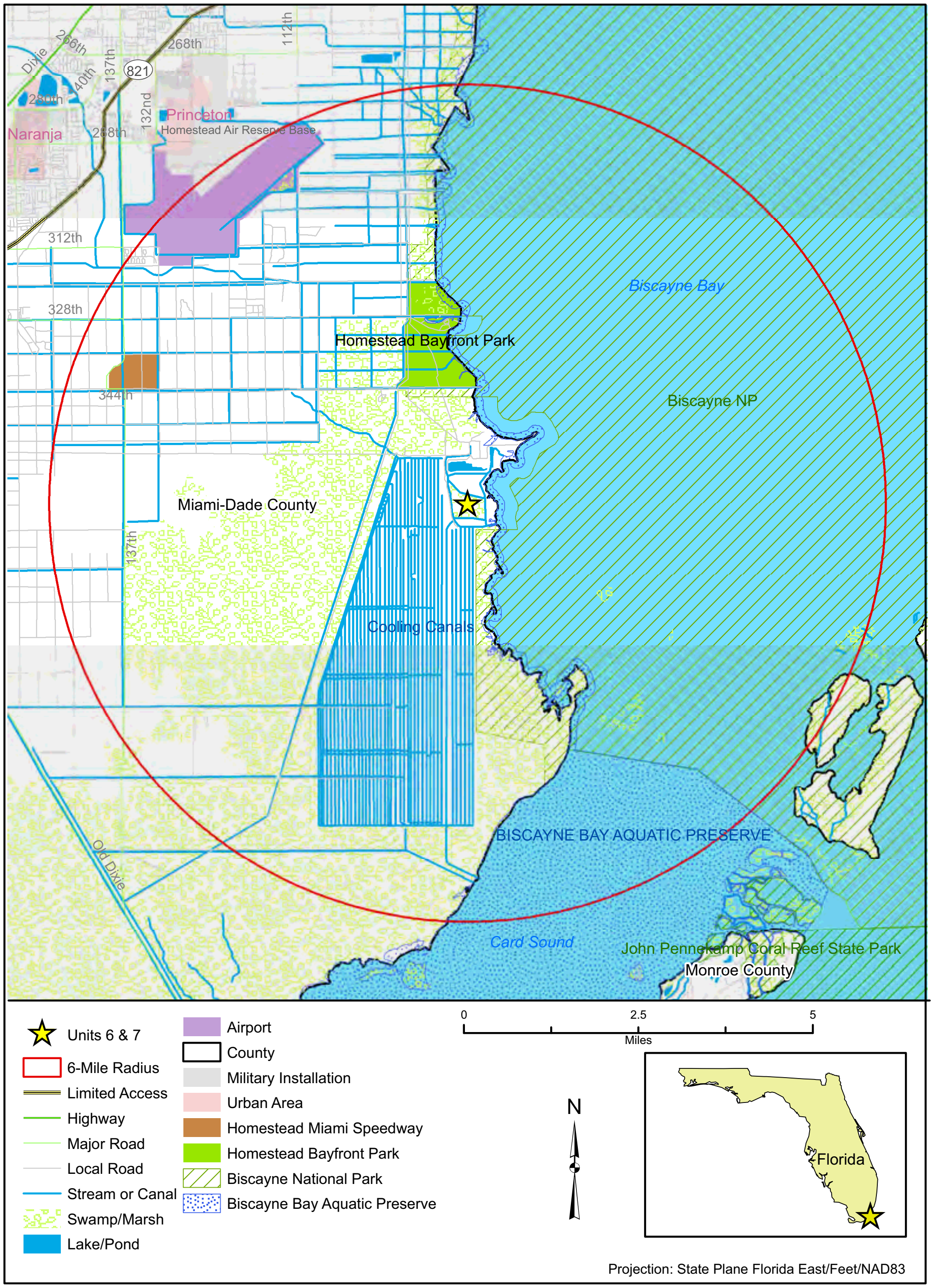
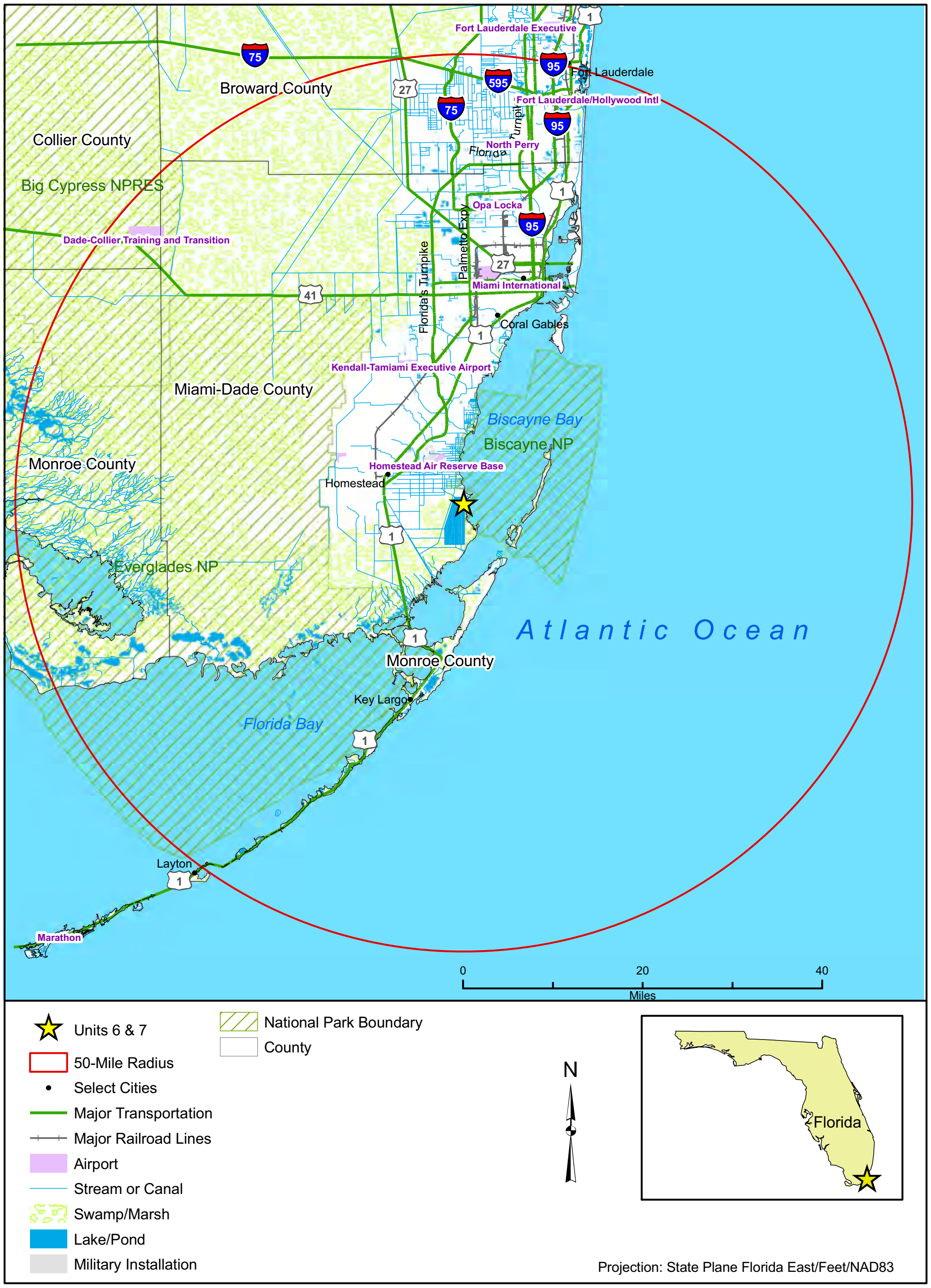


Figure 2.1-4 50-Mile Region



SECTION 2.2: LAND

SECTION 2.2 LIST OF TABLES

SECTION 2.2 LIST OF FIGURES

2.2 LAND

This section describes the land characteristics of the Units 6 & 7 plant area, the Turkey Point plant property, and vicinity; transmission corridors and offsite areas; and the region. Land use impacts are presented in Sections 4.1 and 5.1.

2.2.1 THE SITE AND VICINITY

2.2.1.1 The Site

2.2.1.1.1 Turkey Point Plant Property

Units 6 & 7 would be collocated with two natural gas/oil steam electric generating units (Units 1 & 2), two pressurized water reactor nuclear units (Units 3 & 4), and one natural gas combined-cycle steam electric generating unit (Unit 5) on the approximately 9400-acre Turkey Point plant property located in unincorporated Miami-Dade County, Florida. The location of the Turkey Point plant property in relation to Biscayne Bay, Card Sound, and the Atlantic Ocean is shown in Figures 2.1-3 and 2.1-4. Figure 2.2-4 shows the 50-mile region. Figure 2.2-1 shows the location of the Turkey Point plant property boundary.

FPL is the owner of Units 1 through 5 and would be the owner of Units 6 & 7. All five existing units lie in the developed area of the Turkey Point plant property. Units 6 & 7 would be located in a previously undeveloped area of the plant property, south of Units 3 & 4. FPL directs land management activities for the Turkey Point plant property and is the NRC-licensed operator for Units 3 & 4. FPL would be the NRC-licensed operator for Units 6 & 7.

The Units 6 & 7 power blocks and associated infrastructure including mechanical draft cooling towers, makeup water reservoir, deep injection wells, substation, etc. would be located on an approximately 218-acre portion of the Turkey Point plant property, called the Units 6 & 7 plant area. The Units 6 & 7 plant area is south of Units 3 & 4 and is completely encircled by cooling canals of the industrial wastewater facility (Figure 2.2-1). Units 3 & 4 are south of Units 1 & 2. Unit 5 is located northwest of Units 1 & 2. The South Florida Water Management District Canal L-31E lies west of the Turkey Point plant property.

FPL owns all (Note: SFMWD L-31E Canal and certain roads within the property boundary are not owned by FPL) of the property within the Turkey Point plant property boundary, including the entire exclusion area, subject to certain encumbrances on portions of property within the exclusion area, specifically, certain canal, drainage, reclamation, oil, gas and mineral rights reservations held by the Trustees of the Internal Improvement Fund of the State of Florida and a canal reservation held by Miami-Dade County. Also, a small parcel of submerged land in the southeast and south-southeast portions of the exclusion area is located in the Biscayne Bay waterway. With the exception of the described submerged land, the site boundary entirely encompasses the designated exclusion area for Units 6 & 7. Because of the location of the submerged land, this portion of the exclusion cannot be reasonably accessed except through FPL property.

Units 1–4 use the cooling canals of the industrial wastewater facility, located south and southwest of the existing units, to cool heated noncontact water (water used for cooling that does not come into direct contact with any raw material, product, by-product, or waste) and to recirculate water for reuse. Unit 5 uses cooling towers for system cooling and releases blowdown water to the industrial wastewater facility. The industrial wastewater facility is an integral part of the existing units design and is not a water of the United States or the state. The industrial wastewater facility occupies an area of approximately 5900 acres, and contains 39 canals (32 discharge and 7 return). The canals are shallow, generally 1 to 3 feet deep, with the exception of the grand canal (main return canal), north discharge canal, south collector canal, and the east return canal, all of which extend to a depth of elevation (North American Vertical Datum [NAVD] 88) –18 feet. The canals undergo routine maintenance including removal of aquatic vegetation to minimize flow restriction and maintenance of the berms.

The Turkey Point plant property is located on the shore of Biscayne Bay, in an unincorporated area of Miami-Dade County, Florida, approximately 8 miles east of Florida City, 4.5 miles southeast of the municipal limits of Homestead, and 25 miles south of Miami. Most of Miami-Dade County is within 50 miles of the Units 6 & 7 plant area, as well as portions of Monroe County, Broward County, and Collier County (Figure 2.1-4).

The plant property, including the approximately 2- by 5-mile closed loop industrial wastewater facility, is located in portions of Sections 27–34 of Township 57S, Range 40E, and all of Sections 4, 9, 16-17, 20-21 and portions of Sections 5, 7-8, 18-19, and 28–30 of Township 58S, Range 40E. Units 6 & 7 would be located in portions of Sections 33 and 34 of Township 57S, Range 40E. The centerpoint of the Unit 6 reactor would be located at 25.424186 N latitude and -80.331961 W longitude (see Figure 2.1-1), using a geographic reference system of decimal degrees, North American Datum 1983 (NAD83); the centerpoint of the Unit 7 reactor would be located at 25.424186 N latitude and -80.334536 W longitude (Figure 2.1-1).

The only existing public access to the plant property is via SW 344th Street/Palm Drive. Palm Drive is a two-lane road for approximately one-half of its length from the plant to Florida City. Palm Drive intersects U.S. Highway 1 in Florida City, approximately 9 miles from the plant. Both Palm Drive and U.S. Highway 1 are four-lane roads in the area of intersection. Palm Drive narrows to two lanes at SW 137th Avenue/Speedway Boulevard.

The plant property is on the shore of Biscayne Bay with several miles of the shoreline north and east of the property that includes the Biscayne Bay Aquatic Preserve and the Biscayne National Park. The Biscayne National Park headquarters is located approximately 2.3 miles north of

Units 6 & 7, adjacent to the Metropolitan Miami-Dade County Homestead Bayfront Park. The Everglades National Park is approximately 10 miles southwest of the plant property. Mangrove Point forms the dividing line between Biscayne Bay and Card Sound. The northern half of Mangrove Point is part of Biscayne National Park, and the southern half is state-owned. Land south and west of the Turkey Point plant property is the FPL-owned Everglades Mitigation Bank (EMB), comprised of approximately 13,000 acres of relatively undisturbed freshwater and estuarine wetlands. A mitigation bank is a wetland area that is created, restored, or enhanced for the purpose of providing compensatory mitigation of wetland losses elsewhere.

The plant property is located adjacent to Biscayne Bay and the Intracoastal Waterway, a 3000-mile waterway along the Atlantic and Gulf coasts of the United States. Some lengths of the coastline consist of natural inlets, saltwater rivers, bays, and sounds; others are man-made canals. Barge access is provided by an existing channel across Biscayne Bay for the delivery of heavy equipment and fuel oil.

A natural gas pipeline serving Units 1, 2, and 5, owned and operated by Florida Gas Transmission Company, LLC, terminates at Unit 5.

Figure 2.2-2 and Table 2.2-1 identify the current Florida Land Use, Cover, and Forms Classification System (FLUCCS) land use/land cover within the 9400-acre Turkey Point plant property. The classification data was generated as part of the Land Cover/Land Use 2004-05 Mapping Update Project by the South Florida Water Management District (SFWMD). Data used in this figure and table show the Level 3 FLUCCS classification coding.

2.2.1.1.2 Units 6 & 7 Plant Area

The Units 6 & 7 plant area is an approximately 218-acre island that is a sparsely vegetated, hypersaline mudflat, partially buffered from tidal influence by cooling canals that encircle the plant area (Figure 2.4-2). The industrial wastewater facility isolates the plant area from normal access. A bridge located southeast of the Land Utilization building provides access to the Units 6 & 7 plant area. The cooling canals encircling the plant area are deep, primary return, water canals leading to the Units 1-4 cooling water intakes.

The Units 6 & 7 plant area is located outside of the 100-year floodplain, with an existing elevation of -2.4 to 0.8 feet (NAVD 88) and is generally flat. The eastern margins of the plant area slope gently to the return canal on the east perimeter, which is separated from Biscayne Bay by a 15 foot-high berm. The perimeter berms, along the west and north margins of the plant area, range in height from approximately 3 to 15 feet above natural ground surface. A berm is not present between the plant area and the eastern return canal, permitting inundation and sheetflow across the plant area when water levels rise in the cooling canals of the industrial wastewater facility. There are two remnant canals that cross the plant area from east to west; these remnant canals would be eliminated during construction of Units 6 & 7.

An ecological assessment of the Units 6 & 7 plant area and other areas on the Turkey Point plant property was conducted in 2008 to characterize the areas, including habitat description and surveys for threatened, endangered, and candidate species and species of special concern (state). The results of the characterization are described below in general terms, with a more complete ecological description provided in Section 2.4. Wetlands are the primary habitat types and non-wetland habitats make up the remainder.

Wetland habitats within the Units 6 & 7 plant area and adjacent laydown area include mudflats (188 acres), remnant and active canals (25 acres), dwarf mangrove (17 acres), open water (12 acres), mangrove heads (12 acres), and wetland spoil areas (10 acres) (Figure 2.4-2). Encircled by canals, the sparsely vegetated mudflats are inundated by water 3 to 4 months out of the year and a few hardy plant species, including saltwort, sea oxeye daisies, wood glasswort, and dwarf glasswort that can tolerate these conditions persist. Dwarf mangrove habitats contain the three locally abundant mangrove species, predominantly red mangrove with a few white and black mangrove, but the trees are stunted by high salinities and fluctuating water levels. The mangroves are located within the open water area on the western edge of the adjacent laydown area. The open water area joins the upper end of the cooling canals of the industrial wastewater facility. Harsh conditions in the open water area limit submerged aquatic vegetation to scattered patches of two seagrass species, widgeon grass and shoal grass. Mangrove heads, remnants of the original tidal creeks, contain primarily red mangrove, but white mangrove and black mangrove are also present. The connection between these creeks and Biscayne Bay were severed during construction of the cooling canals. Wetland spoil areas adjacent to the remnant canals are typically occupied by Australian pine, buttonwood, and mangrove.

Non-wetland areas within the Units 6 & 7 plant area and the adjacent laydown area to the west include approximately 20 acres of fill area/roadway habitat and approximately 8 acres of upland spoil piles (Figure 2.4-2). The former are limerock aggregate uplands filled for construction of access roads, parking areas, and research facilities. These areas are dominated by maintained grasses with wetland edges containing Brazilian pepper, buttonwood, and assorted herbaceous plants. Upland spoil piles were formed with spoil from the canal dredging operation. The vegetation in these areas is dominated by exotic species such as Brazilian pepper and Australian pine, as well as poisonwood, buttonwood, wild sage, ground orchid, and sea grape.

Figure 2.2-1 shows the location of the Turkey Point plant property boundary. Figure 2.2-3 shows the location of the exclusion area boundary (EAB) for Units 6 & 7 in relationship to the existing EAB for Units 3 & 4 (2009 acres) and the combined EAB (2070 acres) for all units. Table 2.7-12 identifies the distance to the EAB from the Units 6 & 7 power block area in each of the 16 major compass directions. These distances were calculated to model potential dispersion effects from plant operations to offsite areas (Section 2.7). The minimum distance to the EAB is 1427 feet in the northeast direction.

There are no public roads, railroads or waterways within the EAB. There are no domestic residences within the plant property boundary, nor are there any residences within two miles of Units 6 & 7.

2.2.1.1.3 Other Areas

Additional facilities associated with Units 6 & 7 would be located outside of the Units 6 & 7 plant area but on the Turkey Point plant property including the FPL reclaimed water treatment facility and reclaimed water pipelines, radial collector wells and pipelines, nuclear administration and training buildings, parking areas, laydown areas, expanded equipment barge unloading area, security buildings, access and heavy haul roads, spoils areas, transmission infrastructure, and potable water supply pipelines. The locations of these facilities are presented in Figure 3.9-1.

- An FPL reclaimed water treatment facility would be constructed on approximately 44 acres of sawgrass marsh, dwarf mangroves, mixed wetland hardwoods and roads/highways located at the northwest corner of the plant property between SW 344th Street/Palm Drive and the test canal system. The reclaimed water pipelines from the FPL reclaimed water treatment facility to Units 6 & 7 would be routed south along the eastern side of the cooling canals to the makeup water reservoir, traversing a dwarf mangrove stand and the laydown area on the western side of the Units 6 & 7 plant area.

- Four radial collector well caissons would be installed on the Turkey Point peninsula, east of the existing units, with laterals drilled horizontally in the subsurface beneath the floor of Biscayne Bay. The radial collector well water supply pipelines would be routed west from the caissons and south to the Units 6 & 7 cooling towers along the eastern side of the plant area.

- An approximate 32-acre area for location of a nuclear administration building, training building, and a parking area would be located on two adjacent parcels of land immediately north of the Units 6 & 7 plant area. These parcels of land are comprised of a variety of land cover types, the majority land cover being mangrove swamps. Two smaller laydown areas, totaling approximately one acre, would be located on paved areas within the existing facilities area of the plant property.

- The existing barge turning basin located at Turkey Point connects Biscayne Bay to the Turkey Point plant property and would be used for Units 6 & 7 plant module and component delivery, the transport of which is planned to be accomplished by barge. The barge turning basin is a dead-end canal approximately 300 feet wide, 1200 feet long, and 18 feet deep. The turning basin, constructed in 1979 for transport of major equipment to the existing units, was designed to allow for the maneuvering of major equipment barges within the basin and not in the bay or the bay channel. The turning basin is currently used for fuel deliveries for Units 1 & 2. Water depths in the entrance channel to the turning basin are between 8 and 12 feet. The near shore shallow areas outside of the channel are generally less than 5 feet deep. The only flushing that occurs in the basin is from slight tidal action and rare westerly winds.

Fuel oil is delivered to the existing units by barge and tug from a fuel oil terminal at the Port of Miami on Dodge Island. The barge route is via the Intracoastal Waterway through Biscayne Bay using the existing barge channel. The barge channel is approximately 3.4 miles long and 90 feet wide with a depth of –11 feet NAVD (–9.37 feet mean low water) or more for the majority of its length. The fuel deliveries are currently made to the fuel oil unloading area near the head of the turning basin (southwest of the equipment barge unloading area; Figure 3.9-1) and would continue during the period of Units 6 & 7 module and component delivery; current fuel oil deliveries are typically 5–7 deliveries per week.

For each new unit, there would be approximately 80 round-trip barge deliveries of modules over an approximate six-year duration. The existing equipment barge unloading area, located on the north side of the turning basin (Figure 3.9-1 [Sheet 1]), would be extended landward to approximately 90 feet by 150 feet (0.31 acres) and 9 feet deep, with a total disturbed area, including concrete apron, of 130 feet by 250 feet (0.75 acres) to facilitate heavy equipment and component unloading for construction of Units 6 & 7.

- The existing heavy haul road, originating at the equipment barge unloading area, would be improved and terminate at three locations at the Units 6 & 7 plant area, to facilitate unloading plant modules and components. The road from the equipment barge unloading area to the Units 6 & 7 plant area would be approximately 2 miles long and 24 feet wide. The road would start at the equipment barge unloading area and extend generally west between and around Unit 5 and Units 1 & 2. The road would then extend generally south and cross over two new heavy haul bridges, one at the main cooling discharge canal and the other at the main cooling return canal. The heavy haul road would then terminate at three locations of the plant area.

- A new entrance to the Turkey Point plant property would be constructed for access to Units 6 & 7, beginning with onsite construction activities. The new entrance would be SW 359th Street. The existing SW 359th Street and the existing service road at the northern end of the cooling canals/industrial wastewater facility would be joined by a new road segment, and improved to four lanes, two eastbound and two westbound, and a bridge constructed over the L-31E canal to handle the traffic to and from Units 6 & 7. The SW 359th Street improvements would extend offsite from the Turkey Point plant property westward to connect to SW 117th Avenue and SW 137th Avenue/Tallahassee Road that would also be improved.

- Spoils areas would be established on the Turkey Point plant property south of the Units 6 & 7 plant area to allow dewatering of materials during construction of Units 6 & 7 from activities such as clearing, grubbing, and excavation. Three separate spoils areas, denoted as "A," "B," and "C" would be established at the southern end of the industrial wastewater facility. Spoils areas "A" and "C" would be located on the western and eastern side of the main return canal, respectively, and each pile would be 4.6 to 5 miles long. Spoils area "B" would be established at the southern end of the industrial wastewater facility and would be approximately 1.8 miles in length. The total area for spoils area "A," "B," and "C" would be approximately 77 acres, 18 acres, and 116 acres, respectively, resulting in a total spoils capacity of approximately 2 million cubic yards. The estimated height of the spoils pile will be determined after the spoils storage area has been surveyed and final dirt road width for the berms has been established. It is anticipated that the final spoils elevation will be approximately 16–20 feet NAVD 88.

- Existing transmission infrastructure on the Turkey Point plant property would be expanded to include: construction of the new 500/230 kV Clear Sky substation; construction of a single-circuit 230 kV transmission line between Clear Sky substation and the existing Turkey Point substation and six 230 kV underground connections with the new Units 6 & 7 transformers; and construction of the onsite portions of the new transmission lines from Clear Sky substation to the Levee and Pennsuco substations in the proposed West Corridor and from Clear Sky substation to the existing Davis substation, and then on to the Miami substation in the proposed East Corridor. Improvements at the Turkey Point substation would include a 0.9-acre expansion of the substation site to accommodate a new bay with two new 230 kV line terminals and enlargement of the existing relay vault building.

- Potable water pipelines, approximately 10 miles long, would be constructed to supply potable water for Units 6 & 7. The new water pipelines would deliver potable water from the Miami-Dade County Water and Sewer Department potable water source facility to the Units 6 & 7 plant area. Routing for the pipelines is identified in Figure 3.9-1. The pipelines would enter the Turkey Point plant property at the intersection of SW 117th Avenue and SW 359th Street, following the new four-lane SW 359th Street to a position on the plant property and then south to Units 6 & 7.

Other supporting infrastructure for Units 6 & 7, including an FPL-owned fill source, transmission lines and expanded substations, portions of the reclaimed water and potable water pipelines, and access roads, would be located offsite of the Turkey Point plant property and are discussed in Subsection 2.2.2.

2.2.1.1.4 Land Use

Laws adopted during 1984-1986 established Florida’s growth management system, including adoption of a state comprehensive plan. The laws also required regional planning councils to prepare and adopt comprehensive regional policy plans consistent with the state comprehensive plan. Miami-Dade, Broward, and Monroe Counties are included in the South Florida Regional Planning Council, which works with the regional community to identify issues and opportunities that are regional in scope and create implementing strategies to achieve the desired future. The *Strategic Regional Policy Plan for South Florida (*SFRPC 2004) is the policy document that guides all of the Council's activities.

The Local Government Comprehensive Planning and Land Development Regulation Act (Chapter 163, Part II, Florida Statutes), also known as Florida’s Growth Management Act, requires all of Florida’s 67 counties and 410 municipalities to adopt local government comprehensive plans that guide future growth and development. The comprehensive plans contain chapters or “elements” that address future land use, housing, transportation, infrastructure, coastal management, conservation, recreation and open space, intergovernmental coordination, and capital improvements. A key component of the Act is its “concurrency” provision that requires facilities and services to be available concurrent with the impacts of development. The Act mandates that specific level of service standards for traffic, mass transit, parks, water, sewer, solid waste, and drainage be included in local comprehensive plans and that no development orders be issued when the adopted levels of service would not be met. The Act also requires consistency between the local plan, the applicable regional plan, and the state comprehensive plan, and all development regulations and orders must be consistent with the adopted local comprehensive plan.

Florida’s Growth Management Act authorizes the Florida Department of Community Affairs, Division of Community Planning, to review comprehensive plans and plan amendments for compliance with the Act. Other review agencies, including the regional planning councils, water management districts, the Departments of State, Transportation, Environmental Protection, and Agriculture and Consumer Services, and the Florida Fish and Wildlife Conservation Commission, also review comprehensive plans and amendments and issue recommended objections. Local governments may amend their comprehensive plans twice per year.

Effective comprehensive planning has been a central focus of the Miami-Dade County government from its formation. The power to “prepare and enforce comprehensive plans for the development of the county” was one of 24 specified in the County Charter and a Department of Planning is one of the four departments required by it. Miami-Dade County developed its first land use plan in 1965 and has since enacted a series of increasingly more refined growth management plans and procedures.

The Miami-Dade County Comprehensive Development Master Plan (CDMP; MDC 2009) is adopted by ordinance by the Board of County Commissioners. This ordinance is codified at Chapter 12-114, Code of Miami-Dade County, Florida. The CDMP for Miami-Dade County, which is usually revised twice yearly, necessarily addresses both incorporated and unincorporated areas due to the many area-wide responsibilities of County government. Each of the 34 municipalities in Miami-Dade County is also required by Florida's Growth Management Act to adopt its own comprehensive plan for the area within its jurisdiction. The County CDMP emphasizes the regulation of land development in the unincorporated areas and the County's jurisdictional responsibilities in municipal areas.

The Miami-Dade County CDMP is organized into eleven Plan Elements preceded by a statement of legislative intent: Land Use; Housing; Conservation; Aquifer Recharge and Drainage; Water, Sewer, and Solid Waste; Recreation and Open Space; Coastal Management; Intergovernmental Coordination; Capital Improvements; Educational; and Economic.

Miami-Dade County has more than 2000 square miles of land, of which almost 500 square miles have been developed for urban uses. The county-wide land use plan broadly defines land use categories, with the smallest distinguishable area of the land use map set at 5 acres. The land use portion of the CDMP includes a map for 2015-2025, which visually shows recommended future land uses by major categories, each of which is interpreted locally through zoning designations.

The Miami-Dade County CDMP has designated the location of Turkey Point, including the location of Units 6 & 7, as Environmental Protection Subarea F (Coastal Wetlands and Hammocks). These areas are low-lying, flood-prone, and characterized predominantly by coastal wetland communities. Accordingly, land use or site alteration proposals would be carefully evaluated case by case by federal, state, regional, and county agencies. In addition, necessary electrical generation and transmission facilities are permitted in this area. The approval of any new use, and the replacement or expansion of any existing use, would be conditioned upon its demonstrated consistency with the CDMP's adopted goals, objectives, and policies, and conformity with prevailing environmental regulations (MDC 2009).

All of Miami-Dade County is zoned, including the unincorporated portion of the county. According to the Miami-Dade County CDMP map, Units 1–5 have a future land use category which allows a full range of institutions, communications, and utilities. The Units 6 & 7 plant area is zoned as Interim District (GU). Nuclear reactors are a permitted use in this district with the approval of an Unusual Use by Miami-Dade County, as described below (MDC 2009).

After consultations with Miami-Dade County and its various agencies concerning application number Z07-207, the county's Developmental Impact Committee Executive Council issued its recommendation by concluding that the construction of two new nuclear reactors, with mitigation measures imposed through conditions of approval, would be consistent with the CDMP. The county issued its decision in 2007 to approve the Unusual Use to permit two new nuclear power stations and the associated facilities as well as the excavation and filling of the Units 6 & 7 plant area. The approval was issued by the Miami-Dade County Board of County Commissioners as Resolution Z-56-07, with identified conditions of approval.

The NRC Office of Nuclear Reactor Regulation has issued guidance to its staff regarding compliance with the federal Coastal Zone Management Act. This guidance acknowledges that Florida has an approved Coastal Zone Management Program. Units 6 & 7 would be located within the Florida coastal zone.

2.2.1.2 The Vicinity

For the purposes of this environmental report, the vicinity is defined as the area within a 6-mile radius of the centerpoint between Units 6 & 7 (Figure 2.1-3).

The Turkey Point plant property and its immediate environs are located on the Floridan plateau, a partly submerged peninsula of the continental shelf. The topography of the area is flat and rises very gently from sea level to an approximate elevation of 10 feet (NAVD 88) at a point some 8 to 10 miles west of the plant property.

Biscayne Bay is immediately adjacent to the Turkey Point plant property (Figure 2.1-3) and the Units 6 & 7 plant area. To the east, 5 to 8 miles across Biscayne Bay, is a chain of offshore islands, comprising the northern part of the Florida Keys running in a northeast-southwest direction between the bay and the Atlantic Ocean, the largest of which, near the plant property, is Elliott Key. Figure 2.2-4 and Table 2.2-2 identify land use classifications in the vicinity of Turkey Point. The closest incorporated communities are Homestead and Florida City. Florida City is 8 miles west of the plant property and the municipal limits of Homestead are 4.5 miles west of the plant property. The nearest full-time residence is approximately 2.7 miles from the Units 6 & 7 plant area.

Land in the area surrounding the Turkey Point plant property is almost exclusively undeveloped. The FPL-owned EMB is adjacent to most of the western and southern boundaries of the plant property. The South Florida Water Management District Canal L-31E is also located to the west of the plant property. The eastern portions of the Turkey Point plant property are adjacent to the open waters of the Biscayne Bay Aquatic Preserve and Biscayne National Park. The southernmost eastern portion of the plant property is bounded by state-owned land located on Card Sound. Undeveloped land owned by Miami-Dade County is located to the north of the plant property and is part of Biscayne National Park.

There is one state-managed aquatic preserve, a wetlands habitat preserve, two national parks, and a national wildlife refuge in the vicinity of Units 6 & 7. Biscayne Bay Aquatic Preserve is a shallow, subtropical lagoon consisting of three separate areas of Biscayne Bay, located northeast, east, and southeast of the Turkey Point plant property (Figure 2.1-3). The northern part of the Preserve begins just south of Cape Florida on the east and south of Chicken Key on the west. The southern portion is in Card Sound. The Preserve is approximately 69,000 acres of submerged state land that has been designated as an Outstanding Florida Water, Class III. The Florida Department of Environmental Protection (FDEP), Office of Coastal and Aquatic Managed Areas manages the Preserve. The Preserve offers recreational and commercial on- and in-water activities, such as boating, water sports, and fishing.

The Model Lands Basin was a Save Our Rivers (SOR) land acquired for conservation by the South Florida Water Management District. The Model Lands are fragmented, with state, local, and private ownership west of the Turkey Point plant property and east of U.S. Highway 1. With the exception of a small segment of Canal L-31E, the closest Model Lands properties are approximately 3 miles from the plant property. The Model Lands Basin is comprised largely of fresh and salt-water wetlands that form a contiguous habitat corridor with the Everglades National Park, the Southern Glades SOR project located further to the southwest, the Biscayne National Park, and other designated lands in Miami-Dade County.

Biscayne National Park is immediately north and east (Figure 2.1-3). The park headquarters building is approximately 2.3 miles north of the Units 6 & 7 plant area. The Biscayne National Park was first established in 1968 as a National Monument and was expanded in 1980 to approximately 173,000 acres of water, coastal lands, and 42 keys. The park fulfills a multi-purpose mission by managing natural and historic resources, advocating responsible stewardship, and enabling visitors to experience scenic vistas and compatible recreational activities. Boating is the most prevalent activity in the park, and recreational and commercial fishing are allowed. Other recreational activities include snorkeling, diving, camping, picnicking, and hiking.

Everglades National Park is approximately 10 miles southwest of the plant property. Everglades National Park consists of 1,509,000 acres, including most of Florida Bay. The Ernest Coe Visitors Center in the park is located approximately 16 miles southwest of Units 6 & 7. The Crocodile Lake National Wildlife Refuge is approximately 10 miles south of the plant property. The Big Cypress National Preserve is approximately 35 miles northwest of the plant property.

Homestead Bayfront Park is located adjacent to Biscayne National Park, within about 1.5 miles of the Units 6 & 7 plant area (Figure 2.1-3). Homestead Bayfront Park is a large recreational park south of the North Canal on Biscayne Bay which also includes a marina.

The Homestead Air Reserve Base is approximately 4.5 miles northwest of the Units 6 & 7 plant area (Figure 2.1-3). The base encompasses 2938 acres. The U.S. Air Force determined that it would make available 717 acres at the base to Miami-Dade County for future mixed economic uses that could include commercial development as well as residential or recreational uses. However, the U.S. Air Force rejected a proposal for a civilian commercial airport at the base.

The Homestead Miami Speedway is approximately 5 miles northwest of the Units 6 & 7 plant area. The speedway can seat 65,000 people in the grandstands, but has greater overall seating capacity and hosts various motor racing events throughout the year.

Land south and west of the plant property is the FPL-owned Everglades Mitigation Bank (EMB). The EMB comprises approximately 13,000 acres of relatively undisturbed freshwater and estuarine wetlands.

The predominant existing land uses in the immediate area surrounding the Turkey Point plant property are undeveloped land and protected areas (Figure 2.1-3). Land use adjacent to the Units 6 & 7 plant area comprises undeveloped land, Units 1 through 5, a gas pipeline, a potable water pipeline, and electric transmission infrastructure. The industrial wastewater facility is located to the immediate west and south of the Units 6 & 7 plant area.

Current land use within 6 miles of Units 6 & 7 is described in Table 2.2-2. Most of the area south and southwest consists primarily of marshland and glades and contains no resident human population (Figures 2.1-3 and 2.2-4). The area west to northwest within 6 miles of Units 6 & 7 consists primarily of agricultural land (Figure 2.2-4).

The agricultural lands are located to the west, northwest, and north of the plant property within Miami-Dade County. An assessment of soil types in the area of the plant property indicated that no prime farmland, as defined in the Farmland Protection Act (7 U.S.C. Section 4201(b)), occurs on the Turkey Point plant property in the vicinity. In addition, there is no indication of unique farmland in the 6-mile vicinity. Further discussion of agriculture in the four-county region surrounding the Turkey Point plant property is provided in Section 2.3.

The closest population center of 25,000 residents or more, as defined in 10 CFR 100.3, is Homestead (Figure 2.1-4). Homestead had a 2005-2009 census range population of 55,036 (USCB 2010). Homestead's political boundary is approximately 5 miles from Units 6 & 7 at its closest point. However, no resident population exists at this distance from Units 6 & 7. The nearest populated area of Homestead lies approximately 7 miles west of the Turkey Point plant property.

There are no hospitals located within 6 miles of Units 6 & 7. Homestead Hospital is the primary health care provider in the southeast portion of Miami-Dade County and is located approximately 9.6 miles northwest of Units 6 & 7. There are no existing public schools within 5 miles of Units 6 & 7. The closest public school is the Keys Gate Charter School, located approximately 6 miles west of the Units 6 & 7 plant area. There are no prisons within 6 miles of Units 6 & 7.

The Units 6 & 7 plant area is 10 miles east of the nearest rail line, which is owned by CSX (National Atlas 2008a), and is also located adjacent to a navigable waterway—Biscayne Bay. There is a U.S. Naval Reservation 7 miles southwest of the plant area (National Atlas 2008b).

There are two industrial facilities located within 6 miles of the Units 6 & 7 plant area, the RMC Florida Group Ltd. which mines limestone, and the Homestead Air Reserve Base.

Most of Miami-Dade County is underlain by Miami limestone. An area of past, present, or future mineral extraction is located within 4 miles of the Units 6 & 7 plant area (MDC 2009). There is an active limestone mine 6 miles west of the plant area (the RMC Florida Group Ltd. facility identified above) as well as an abandoned quarry 6 miles north of the plant area (MSHA 2008).

2.2.2 TRANSMISSION CORRIDORS AND OFFSITE AREAS

The existing transmission corridors are described in Subsection 2.2.2.1. Proposed transmission lines would be constructed in these corridors and are described in Subsection 2.2.2.2. Other offsite areas required to construct or operate the new units are identified in Subsections 2.2.2.3 through 2.2.2.6. Florida Land Use, Cover, and Forms Classification System (FLUCCS) land use/land cover data (level 3) was used to analyze potential impacts within the transmission corridors.

2.2.2.1 Existing Circuits

Existing transmission lines are identified in Figure 2.2-5. There are two 230 kV substations on the Turkey Point plant property—the 1-acre McGregor substation and the approximately 6-acre Turkey Point substation. The McGregor substation is approximately 0.25 miles west of the Turkey Point substation and is connected via one 230 kV circuit.

Seven 230 kV transmission circuits depart from Turkey Point substation and proceed northward to the Davis substation near the town of Three Lakes. These lines are within the Turkey Point-Davis transmission corridor. This corridor is typically 330 feet wide, 19 miles long, and typically contains four sets of transmission line structures. Three of the structure sets carry two outgoing 230 kV circuits each, and the fourth carries a single 230 kV circuit. The first 6 miles of the existing corridor pass through and alongside Biscayne National Park.

Currently, a single transmission circuit is located in the Turkey Point-Levee corridor. This corridor proceeds west, continues for approximately 7 miles, and turns north toward the Levee substation for approximately 16 miles. This corridor is nominally 330 feet wide.

In total, the corridors carrying the eight 230 kV transmission circuits from the Turkey Point plant property extend a distance of approximately 27 miles, and occupy approximately 1111 acres of land. They are contained in Miami-Dade County.

2.2.2.2 Proposed Circuits

Units 6 & 7 would require new transmission facilities to provide reliable interconnection and integration of approximately 2200 MW of new electricity generation into the FPL transmission system. Existing linear features would generally be followed where available, within two proposed corridors, a West Preferred or Secondary Corridor and an East Preferred Corridor, from the Units 6 & 7 plant area to existing substations (Figure 2.2-5). As depicted in Figure 2.2-5, the first leg of the Western Preferred or Secondary Corridor is the transmission corridor between Clear Sky substation and the initial junction at the Western Preferred or Secondary Corridor split. The second leg is defined as either the Western Preferred or Secondary Corridor option. The third leg is defined as the corridor between the Western Preferred or Secondary Corridor junction and the Levee substation.

Units 6 & 7 would be connected to a new 500/230kV substation known as Clear Sky substation, which would be constructed in the Units 6 & 7 plant area. The connection would be to the 230kV section of the substation via underground transmission facilities. The Clear Sky substation would have two 500 kV transmission lines, approximately 43 miles long, connecting it to the existing Levee 500kV substation in a proposed transmission West Preferred Corridor. A second new 230kV line, approximately 52 miles long, would be constructed in the same West Preferred Corridor between Clear Sky substation and a new 230kV bay position at the existing Pennsuco substation; the line would share the same right-of-way with the two new 500kV lines between Clear Sky and Levee substations.

In addition to the proposed new transmission lines in the West Preferred Corridor, a new 230 kV line, approximately 19 miles long, would be constructed to connect the Clear Sky substation to a new 230 kV bay position at the existing Davis substation in a proposed transmission East Preferred Corridor. In addition, a new 230 kV line, approximately 18 miles long, would be constructed (in a largely collocated existing right-of-way or other linear/transportation corridors) to connect the Davis substation to a new 230 kV bay position at Miami substation.

As described in Chapter 1, routing of the new 500 kV and 230 kV transmission lines requires certification through the Florida Power Plant Siting Act (PPSA) site certification application process. In addition, installation of these lines would require easement acquisition. Various approvals and agency notifications would be required for each of the required transmission lines and would be acquired as part of the PPSA process. Table 2.2-3 summarizes the major land uses along each corridor/option.

<u>West Preferred or Secondary Transmission Corridor</u>

The proposed transmission West Corridor includes two options, a West Preferred Corridor option and a West Secondary Corridor option. The proposed West Corridor, with either option, would include two 500 kV single-circuit transmission lines connecting the new Clear Sky substation to the existing Levee substation and one 230 kV single-circuit transmission line connecting the Clear Sky substation to the existing Pennsuco substation.

From the Clear Sky substation, the two 500 kV and single 230 kV transmission lines would extend west and north to the Levee substation located in an area of unincorporated Miami-Dade County east of Krome Avenue (SR 997) and north of U.S. Highway 41 (Tamiami Trail). FPL currently has available right-of-way, either in fee or easement, for a significant portion of this distance. The total length of the line to Levee substation would be approximately 43 miles, of which approximately 13 miles would be a proposed relocation (preferred corridor option) of an existing right-of-way (secondary corridor option) partially located within Everglades National Park. The existing Levee substation would be expanded to accommodate the two new 500 kV lines.

The West Preferred corridor between Clear Sky and Levee substation (preferred option), which runs along the eastern boundary of Everglades National Park, has a current land use distribution described in Table 2.2-3. The West Secondary corridor between Clear Sky and Levee substation (secondary option), which runs through Everglades National Park, has a current land use distribution described in Table 2.2-3.

The single 230 kV transmission line (maximum current rating of 2990 amps) would extend from the Clear Sky substation to the Levee substation using the same transmission corridor, but would not connect to but bypass the Levee substation and follow largely an existing 230 kV transmission easement for approximately 8 miles to connect to the existing Pennsuco substation. The Pennsuco substation would be expanded to accommodate the single 230 kV line.

Current land use for the transmission corridor between Levee and Pennsuco substations is shown in Table 2.2-3.

All three transmission lines would be constructed within a single right-of-way of approximately 330 feet in width within either of the proposed West Corridors to the Levee substation. From Levee to Pennsuco, the single 230 kV line would be constructed largely in an existing right-of-way.

Two access-only corridors would be constructed as part of the West Preferred/Secondary Corridor alignments. These corridors would be used to access the transmission corridor and eventual right-of-way. No transmission structures would be built in these access corridors, although access roads or road improvements may be required. The two access corridors are:

- Tamiami Trail Corridor
- Krome Avenue Corridor

Current land use in the transmission line access corridors (Table 2.2-4) at Tamiami Trail is 2.74 acres of streams and waterways/canals, 3.06 acres of freshwater marshes, and 4.70 acres of roads and highways (Table 2.2-4).

Current land use for the transmission line access corridor at Krome Avenue is 85.33 acres of streams and waterways/canals, 56.81 acres of exotic wetland hardwoods, 143.40 acres of freshwater marshes, and 79.17 acres of roads and highways (Table 2.2-4).

East Preferred Transmission Corridor

The proposed East Preferred Corridor would include a single-circuit 230 kV transmission line. This line would provide connection from the Clear Sky substation to the existing Davis substation (maximum current rating of 2990 amps) and then connection from the Davis substation to the existing Miami substation (maximum current rating of 2300 amps), both substations located in Miami-Dade County. The Davis substation is located at the intersection of SW 136th Street and SW 127th Avenue. The Miami substation, located within the city limits of Miami, is at the intersection of SW 2nd Avenue and SW 3rd Street along the Miami River. There would be improvements made to both substations to accommodate the new 230 kV line.

The Clear Sky-Davis portion of the East Preferred Corridor would use an existing, 19-mile-long, multicircuit FPL transmission line right-of-way. This right-of-way has the ability to accommodate the proposed single-circuit 230 kV line without the need for additional right-of-way. However, for a portion of the Davis to Miami corridor, new rights-of-way would be required, but much of the proposed corridor includes existing transportation rights-of-way (e.g., U.S. Route 1, Metrorail). The Davis-Miami portion of the East Preferred Corridor is approximately 18 miles long.

Current land use for the transmission corridor between Clear Sky and Davis substations is shown in Table 2.2-3.

Current land use for the transmission corridor between the Davis and Miami substations is also shown in Table 2.2-3.

Also included as part of the East Preferred Corridor is another single-circuit 230 kV transmission line that would connect the Clear Sky substation to the Turkey Point substation on the plant property (maximum current rating of 2990 amps) that are approximately 0.4 miles apart. Improvements would be made to the Turkey Point substation to accommodate the new 230 kV line from Clear Sky substation.

In some portions of the proposed Davis-Miami transmission line section, it would be collocated with other transmission lines on the existing right-of-way. In some of the locations, to accommodate both power lines on one pole, teh transmission line would be constructed using double-circuit concrete poles directly embedded in the ground. An additional, short portion of the

Davis-Miami line section, located at the crossing of the Miami River adjacent to the existing Miami substation, would be constructed as an underground extruded dielectric cable system using cross-linked polyethylene (XLPE) insulating cables.

In some cases along the proposed transmission line routes, the new lines may also be designed to provide for other attachments such as electric distribution lines, communication facilities, or other utility equipment. The typical span lengths between structures along the three proposed transmission lines would range from approximately 200 to 750 feet, depending on site-specific right-of-way widths and other design considerations.

Transmission Substations

In addition to the new and modified transmission lines discussed above, the interconnection and integration of new Units 6 & 7 generating capacity would include one new substation and upgrades and expansions of the following existing substations (Figure 2.2-5): Turkey Point, Miami, Levee, Davis, and Pennsuco. Improvements at the Turkey Point, Levee, and Davis substations would require site expansions on existing FPL property in previously disturbed areas. Work at the Pennsuco substation would require acquisition of additional property for expansion on a previously disturbed area. Acreages and current land use for the areas of substation expansion are identified in Table 2.2-5.

The Clear Sky substation would be a new 500/230 kV switchyard constructed in the Units 6 & 7 plant area utilizing 230 kV underground facilities to connect Units 6 & 7 transformers for a total of six 230 kV underground connections. The two new 500 kV transmission lines to the Levee substation would be connected to the 500 kV section of the Clear Sky substation and three new 230 kV transmission lines, one each to the Davis, Pennsuco, and Turkey Point substations, would be connected to the 230 kV section of the Clear Sky substation.

The Turkey Point substation would be expanded by 0.9 acre to accommodate a new bay with two new 230 kV line terminals and enlargement of the existing relay vault building. The new bay would be rated at 3000 amps and include new pulloff towers, breakers, line switch, disconnect switches and all associated bus work, cable trench, foundations, conduits, and grounding. Current land use of the approximately 0.9 acre area of expansion for the Turkey Point substation is 100 percent electric power facilities.

The existing Levee substation, located at NW 41St Street and NW 147th Avenue, would be expanded by 2.3 acres to accommodate a new bay with two 500 kV line terminals. The interconnection work at the Levee substation would include filling, grading, and rocking an expansion area of approximately 130 x 850 feet to the north of the existing 500 kV yard for construction of a new bay and associated equipment. In addition, a new stormwater retention system would be constructed. Current land use of the 2.3 acres area of expansion for the Levee substation is approximately 1.81 acres of exotic wetland hardwoods and 0.52 acres of electric power facilities.

The existing Pennsuco substation, located at 10800 NW 107th Avenue, would be expanded by 0.65 acres to accommodate addition of a stormwater retention system and installation of new equipment including a new 230 kV line terminal; new breakers and conversion/reconfiguration of existing buses, relocation of distribution transformers, and installation of a new pulloff structure and disconnect switches. Current land use of the 2.42 acres area of expansion for the Pennsuco substation is 100 percent rock quarries.

The existing Davis substation, located at 12701 SW 136th Street, would be expanded by 1.12 acres to accommodate addition of two new 230 kV line terminals and installation of a switchable inductor to control power flow for the line connecting to the Miami substation. Current land use of the approximately 1.12 acres area of expansion for the Davis substation is 100 percent tree nurseries.

The Miami substation, located at 122 SW 3rd Street, would be modified to expand the 230 kV section to a double bus configuration, add a new 230 kV line terminal for connection of the line from the Davis substation, and replace the autotransformer to match the long-term emergency rating of the Miami substation autotransformer all within the existing fence line.

2.2.2.3 Makeup and Potable Water Systems

Makeup water for the Units 6 & 7 cooling system would consist of both reclaimed water and saltwater. As described in Sections 3.4 and 3.9, reclaimed water pipelines would require approximately 9 miles of pipeline corridor between the FPL reclaimed water treatment facility on the plant property and the Miami-Dade Water and Sewer Department South District Wastewater Treatment Plant to the north (Figure 2.2-5). For about 6.5 miles of their length, the pipelines would be collocated with the existing Clear Sky-to-Davis transmission line right-of-way and adjacent road and canal rights-of-way, although most of the route is classified as wetland, agricultural, or electrical power transmission lines land use types. The remaining 2.5 miles would be located along new pipeline corridor. The reclaimed water pipelines from the FPL reclaimed water treatment facility would be routed south along the eastern side of the cooling canals to the makeup water reservoir, traversing a dwarf mangrove stand and the laydown area on the western side of the Units 6 & 7 plant area (Figure 3.9-1).

Current land use within the reclaimed water pipeline corridor is described in Table 2.2-6 and consists mainly of tree nurseries, streams and waterways/canals, mangrove swamps, mixed wetland hardwoods, roads and highways, sewage treatment, and solid waste disposal.

Saltwater would be supplied by four radial collector wells drawing water from below Biscayne Bay. The wells would be located on the Turkey Point peninsula, east of the existing units. Each radial collector well would consist of a central reinforced concrete caisson extending below the ground level with horizontal laterals projecting up to a distance of 900 feet from the caisson in the subsurface beneath the floor of Biscayne Bay. The radial collector well locations are shown on Figure 3.1-3. The radial collector well pipelines would be routed west from the caissons and south to the Units 6 & 7 cooling towers along the eastern side of the plant area (Figure 3.9-1).

Potable water pipelines, approximately 10 miles long, would be constructed to supply potable water for Units 6 & 7. The new water pipelines would deliver potable water from the Miami-Dade County Water and Sewer Department potable water source facility to the Units 6 & 7 plant area. Routing for the pipelines is identified in Figure 3.9-1. Approximately 2.5 miles of the pipeline corridor (origination at SW 288th Street and SW 137th Avenue/Tallahassee Road to SW 328th Street/N. Canal Drive) would require new land disturbance. The major land categories disturbed would be mainly row crops, tree nurseries, streams and waterways/canals, mixed wetland hardwoods, exotic wetland hardwoods, freshwater marshes, and roads and highways. The remaining pipeline route would be along roadways that would be improved.

2.2.2.4 Fill Material

An estimated 10.7 million cubic yards of fill (Category I - safety-related; and Category II - general area) would be required to raise the elevation of the Units 6 & 7 plant area to a final elevation of 19 to 26 feet above sea level. As described in Section 3.9, fill material would be obtained from a combination of an FPL-owned fill source, other regional sources, or reused material.

The FPL-owned fill source is located approximately 4 miles northwest of the Turkey Point plant property (Figure 3.9-1). The fill source land, which is approximately 300 acres, is located northwest of the intersection of SW 107th Avenue and SW 312th Street. The land is predominantly tree nurseries and mixed wetland hardwood. The land surface elevation in this area is approximately 3-4 feet NGVD. The land is nearly flat, with a slope of 1-2 feet per mile to the east. Water levels in this area range from approximately 2 feet in the wet season to 1 foot in the dry season. The upper 4-5 feet of soil is a mixture of marl, peat, and fills. Rock (Miami oolite) is generally encountered 4-5 feet below land surface (bls). The Fort Thompson Formation and Key Largo Limestone (interbedded) are found between 9 and 74 feet bls. Surface drainage in the area is currently through swales and roadside ditches to Military or Mowry Canals and then east toward Biscayne Bay.

The aggregate mining operation at this location to obtain fill material for construction of Units 6 & 7 would create a lake in the deep cut areas. There would be a shallow (maximum 3-4 feet deep) littoral zone around the shoreline with 4:1 slopes. The final depth of the lake in the deep cut areas would be based on Miami-Dade County Department of Environmental Resources criteria for rock mining, which require a 10 foot vertical buffer between the bottom of the mine and the 250 mg/L chloride level in the aquifer.

2.2.2.5 Emergency Operations Facility

The existing emergency operations facility for Units 3 & 4 would also be used for Units 6 & 7. This facility is located offsite in Miami-Dade County at the intersection of West Flagler Street and SW 92nd Avenue. The facility is not further considered in this environmental report.

2.2.2.6 Roads and Highways

The roads and highways in the area surrounding the Turkey Point plant property and providing potential access to the property and the Units 6 & 7 plant area include U.S. and interstate highways, multilane divided state highways, and local streets. The major federal highways in Miami-Dade County are U.S. Highway 1, which bisects the county from north to south and continues south to the Florida Keys, and Interstates 75 and 95, which also have a north-south direction but terminate in Miami.

Two of the major state highways in Miami-Dade County are Florida's Turnpike and SR 997. Florida's Turnpike is a multilane, divided toll road that traverses much of Florida, linking Interstate 75 in the interior south of Ocala to Miami. The Homestead extension of Florida's Turnpike terminates at U.S. Highway 1 north of Florida City. SR 997 connects U.S. Highway 1 in Homestead with U.S. Highway 27, which fringes the western edge of metropolitan Miami and terminates in Homestead, becoming Krome Avenue. Krome Avenue continues south and terminates at U.S. Highway 1, south of Florida City.

The existing access road for the Turkey Point plant property is SW 344th Street/Palm Drive. SW 344th Street/Palm Drive intersects with U.S. Highway 1 and SR 997. It is a four-lane road that narrows at its intersection with SW 137th Avenue/Tallahassee Road to two lanes as it leads to the Turkey Point plant property. Access to the plant property and the Units 6 & 7 plant area from U.S. Highway 1 could also be made using SW 328th Street/N. Canal Drive, which parallels SW 344th Street/Palm Drive to the north. This road is linked to SW 344th Street/Palm Drive by cross streets such as the four-lane SW 137th Avenue/Tallahassee Road and the two-lane SW 117th Avenue. Access to the site from Florida's Turnpike could be made via the exit at SW 312th Street/Campbell Drive or via the Turnpike terminus at U.S. Highway 1. SW 312th Street/Campbell Drive is a four-lane road that parallels SW 344th Street/Palm Drive to the north. A connecting road is SW 137th Avenue/Tallahassee Road. The functional class for each of these roads is presented in Tables 2.5-14.

Road improvements are planned to allow access to the Turkey Point plant property for construction and operations. As described in Section 3.9, the improvements include the widening of three existing roadways and the development of existing unpaved roads to four paved roadways.

Acreages and current land use for the areas of road improvements are identified in Table 2.2-7.

2.2.3 THE REGION

The region is defined as the area within a 50-mile radius of the centerpoint between Units 6 & 7, but excluding the plant property and vicinity described in Subsection 2.2.1. All or parts of four counties are located within 50 miles: Broward, Collier, Miami-Dade, and Monroe. Figure 2.2-6 shows the 50-mile radius bounded by the four counties. Major land use classifications and waterways in the region are shown on Figure 2.2-6. Major highways and rail lines are shown on Figure 2.2-5.

In determining what regional land use information would be relevant to Subsection 2.2.3, the construction and operational impacts of the new units on regional land use were evaluated. Land use impacts identified were limited to the Turkey Point plant property, 6-mile vicinity, and those counties in the region that would receive the bulk of new residents and taxes. There are county land use plans for the four counties within the region (Broward 2009, Collier 2007, MDC 2009, and Monroe 2009). The plan that is most directly relevant to new Units 6 & 7 is the Miami-Dade CDMP, which is addressed in Subsection 2.2.1.1.

As summarized in Table 2.2-8, the regional land use area encompasses approximately 2,634,939 acres of FLUCCS land use data (FLUCCS data does not extend all the way out into the Atlantic Ocean, Gulf of Mexico, Biscayne Bay, Card Sound, or Florida Bay).

Within the region there are many federal, state, county, and city public lands that offer both recreational and educational services. Parks include Everglades National Park, Crocodile Lake National Wildlife Refuge, Biscayne National Park, Biscayne Bay Aquatic Preserve, and Homestead Bayfront Park among others.

There are two nearby major roadways. U.S. Highway 1, the closest major roadway to the plant property, intersects Palm Drive in Florida City. The southernmost access to Florida’s Turnpike is from U.S. Highway 1, approximately 0.25 miles north of the U.S. Highway 1 intersection with Palm Drive. Other access/entrances to both U.S. Highway 1 and Florida’s Turnpike are provided from various local roads that can be accessed from Palm Drive. Road access to the plant property is provided by SW 344th Street/Palm Drive, which extends from the Turkey Point plant entrance through the intersection with U.S. Highway 1.

Two Indian reservations are located within the region (Figure 2.5-25). The Miccosukee Indian Reservation is located 50 miles from the plant area. The Seminole Indians have a reservation north of Hollywood named Seminole Paradise.

In accordance with NUREG 1555, principal agricultural products, crop areas, and average annual yields are addressed below by county, along with other county-specific information. The most recent data available is from 2007. Table 2.2-9 presents information for farms and harvested lands in the region for the period 1997 to 2007.

2.2.3.1 Broward County

Broward County is bounded on the north by Palm Beach County, on the northwest by Hendry County, on the west by Collier County, on the east by the Atlantic Ocean, and on the south by Miami-Dade County. Primary access routes in Broward County include Interstates 95, 75, and 595, Florida's Turnpike, and SR 869 (Sawgrass Expressway).

Broward County consists of 1197 square miles, of which 787 square miles is conservation area and 410 square miles is developable area (Broward Aug 2003). Elevations range from sea level to 25 feet above sea level, with most of the county below 10 feet elevation.

As shown in Table 2.2-9, there were 547 farms totaling approximately 8737 acres in Broward County in 2007 (NASS 2007). The 2007 numbers reflect an increase from 347 farms in 1997 but a decrease in the total acreage of farms from 30,897 acres in 1997 (AgCensus 2004a).

In 2007, approximately 29 percent (2577 acres) of the 8737 acres of total farmland in Broward County was used as harvested cropland and 47 percent (4141 acres) as pastureland (NASS 2007). The chief agricultural products of Broward County are cattle, orchard crops, vegetables, poultry, hogs and pigs, and hay. In 2007, the yields of agricultural products for Broward County were:

- 1253 head of cattle and calves
- 347 acres of land in orchards
- 768 acres of vegetables for harvest
- 938 head of poultry (layers)
- 8 head of hogs and pigs
- 272 tons of hay

2.2.3.2 Collier County

Collier County is on the Gulf coast of Florida between the cities of Bonita Springs and the mainland component of Monroe County. Collier County is bordered on the north by Lee and Hendry counties, on the west by the Gulf of Mexico, on the south by Monroe County, and east by

Miami-Dade and Broward Counties. The county seat of Collier County is located in East Naples, and is accessible by major roadways including Interstate 75 and U.S. Route 41.

The total area of Collier County is 2025 square miles (USCB 2009a). The elevation across the county ranges between sea level and 40 feet above sea level (Collier Apr 2005).

As shown in Table 2.2-9, the number of farms in Collier County increased from 235 in 1997 to 322 farms in 2007. However, farm acreage decreased from 277,279 acres in 1997 to 109,934 acres in 2007 (AgCensus 2004b, NASS 2007).

In 2007, 32 percent (35,288 acres) of the 109,934 acres of total farmland in the county were devoted to harvested cropland and 58 percent (63,612 acres) to pastureland (NASS 2007). Cattle and calves, poultry, orchards crops, vegetables, hogs and pigs, and hay are the chief agricultural products. In 2007, the yields of the primary agricultural products in Collier County were:

- 10,458 head of cattle and calves
- 21,622 acres of land in orchards
- 12,982 acres of vegetables for harvest
- 849 head of poultry (layers)
- 358 head of hogs and pigs
- 150 head of sheep and lambs
- 566 tons of hay

2.2.3.3 Miami-Dade County

Miami-Dade County is on the Atlantic Ocean coastline and is bounded on the north by Broward County, on the east and the south by Biscayne Bay, on the west by Collier County, and on the west and south by Monroe County. The county seat is the City of Miami, the county's largest municipality. Miami-Dade County is accessible by major roadways including Interstates 395, 75, 95 and 195, and U.S. Routes 1, 27, 41, and 441.

The total land area of Miami-Dade County is 1946 square miles (USCB 2009b). The elevation across the county ranges from 8 feet to 15 feet above sea level (MDC 2009).

In 2007, the county had 2498 farms covering 67,050 acres, representing an increase in the number of farms from 1576, but a decrease in total acreage from 85,093 in 1997 (AgCensus 2004c, NASS 2007).

Of the 67,050 acres of total farmland in the county in 2007, 73 percent (49,065 acres) were devoted to harvested cropland and 14 percent (9108 acres) to pastureland (NASS 2007). Cattle and calves, poultry, orchards crops, vegetables, hogs and pigs, sheep and lambs, sweet potatoes (most of the reported Florida crop), and hay are the chief agricultural products. In 2007, the yields of the primary agricultural products in Miami-Dade County were:

- 3385 head of cattle and calves
- 11,365 acres of land in orchards
- 33,451 acres of vegetables for harvest
- 7755 head of poultry (layers)
- 135 head of hogs and pigs
- 972 head of sheep and lambs
- 541 tons of hay (for the year 2002; 2007 data not reported)
- 2825 acres of sweet potatoes

2.2.3.4 Monroe County

Monroe County is the southernmost county in Florida and consists of both mainland and island components. The county is located at the intersection of the Gulf of Mexico and the Atlantic Ocean and includes a large tract of land along the southwestern most part of mainland Florida, a small strip of land between Florida City and the U.S. Highway 1 causeway to Key Largo and all of the island chain known as the Florida Keys. Virtually all the Monroe County population (more than 99.9 percent) lives in the Florida Keys. Monroe County is bounded on the north by Collier County and Miami-Dade County, on the east by Miami-Dade County, on the east and south by the Atlantic Ocean, on the south and west by the Gulf of Mexico and on the north, south and west by the Florida bay. The county seat of Monroe County is in Key West, and is accessible by major roadway U.S. Highway 1.

Two-thirds of the large Monroe County mainland area south of Collier County (mainland Monroe) is protected by virtue of being part of the Everglades National Park, and the remainder by the Big Cypress National Preserve in the northeastern interior. The area is virtually uninhabited. The total land area of Monroe County is 997 square miles (USCB 2009c). Most of the Monroe County land area makes up the southwestern corner of the state of Florida. Two-thirds of Monroe County mainland is part of the Everglades National Park, while the remainder is part of the Big Cypress National Preserve and the islands of the Florida Keys.

In 2007, the county had 23 farms covering 187 acres, an increase from 18 farms in 2002, and an increase in acreage from 102 in 2002 (NASS 2007).

Cropland is the predominant use comprising 83 percent (156 acres) of the 187 acres of farmland in the county. Pastureland comprises 6 percent (12 acres) of farmland use in the county. In 2007, the yields of the primary agricultural products in Monroe County were not disclosed.

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Table 2.2-1
Major Land Use Acreages Within the Turkey Point Plant Property

Level 3	FLUCCS Land Use Category	Acres	% of Total
140	Commercial And Services	13.77	0.15
422	Brazilian Pepper	26.29	0.28
437	Australian Pines	2.35	0.02
510	Streams And Waterways/Canals	256.57	2.71
511	Ditches	9.34	0.10
512	Channelized River, Stream, Waterway/Canals	40.48	0.43
530	Reservoirs	12.54	0.13
531	Reservoirs Larger Than 500 Acres (202 Hectares)	12.83	0.14
534	Reservoirs Less Than 10 Acres (4 Hectares) Which Are Dominant Features	13.59	0.14
541	Embayments Opening Directly Into The Gulf Of Mexico Or The Atlantic Ocean	166.06	1.76
542	Embayments Not Opening Directly Into The Gulf of Mexico Or The Atlantic Ocean	<0.01	<0.01
543	Enclosed Saltwater Ponds Within A Salt Marsh	0.78	0.01
612	Mangrove Swamps	310.94	3.29
612-A	Mangrove Heads	12.20	0.13
612-B	Dwarf Mangroves	113.29	1.20
612-B/6411	Dwarf Mangroves/Sawgrass	42.87	0.45
617	Mixed Wetland Hardwoods	324.61	3.43
617-P	Mixed Wetland Hardwoods Planted	0.48	0.01
619	Exotic Wetland Hardwoods	12.81	0.14
619-AP	Exotic Wetland Hardwoods-Australian Pines	0.58	0.01
641	Freshwater Marshes	1490.53	15.76
6411	Sawgrass Marsh	14.03	0.15
642	Saltwater Marshes	12.28	0.13
643	Wet Prairies	6.29	0.07
650	Non-Vegetated Wetlands	216.35	2.29
651	Tidal Flats	149.26	1.58
740	Disturbed Land	27.74	0.29
743	Spoil Areas	61.98	0.66
743-WET	Wetland Spoils Areas	9.12	0.10
744	Fill Areas <Highways-Railways>	393.96	4.16
814	Roads And Highways	23.12	0.24
831	Electric Power Facilities	5682.84	60.07
832	Electrical Power Transmission Lines	0.08	<0.01
	Total(a)	**9459.94**	**100.00**

(a) Due to rounding, table values may not exactly sum to the total acres and percentages.

Table 2.2-2 (Sheet 1 of 2)
Major Land Use Acreages within the 6-Mile Vicinity

Level 3	FLUCCS Land Use Category	Acres	% of Total
110	Residential, Low Density <Less Than Two Dwelling Units Per Acre>	1.73	<0.01
133	Multiple Dwelling Units, Low Rise <Two Stories Or Less>	45.92	0.07
140	Commercial And Services	13.88	0.02
155	Other Light Industrial	6.40	0.01
170	Institutional	8.45	0.01
173	Military	110.56	0.18
183	Race Tracks	513.45	0.82
185	Parks And Zoos	36.04	0.06
187	Stadiums <Those Facilities Not Associated With High Schools, Colleges Or Universities>	3.68	0.01
190	Open Land	7.76	0.01
214	Row Crops	616.75	0.98
215	Field Crops	176.18	0.28
221	Citrus Groves	13.90	0.02
222	Fruit Orchards	39.17	0.06
241	Tree Nurseries	1,961.41	3.12
243	Ornamentals	39.47	0.06
261	Fallow Crop Land	10.58	0.02
320	Shrub And Brushland	1,100.42	1.75
420	Upland Hardwood Forests	24.63	0.04
422	Brazilian Pepper	2,181.43	3.47
434	Hardwood - Coniferous Mixed	26.95	0.04
437	Australian Pines	15.85	0.03
510	Streams And Waterways/Canals	301.87	0.48
511	Ditches	19.42	0.03
512	Channelized River, Stream, Waterway	298.38	0.47
520	Lakes	29.73	0.05
530	Reservoirs	85.62	0.14
531	Reservoirs Larger Than 500 Acres (202 Hectares)	12.83	0.02
534	Reservoirs Less Than 10 Acres (4 Hectares) Which Are Dominant Features	13.59	0.02
542	Embayments Not Opening Directly Into The Gulf Of Mexico Or The Atlantic Ocean	24,412.85	38.79
543	Enclosed Saltwater Ponds Within A Salt Marsh	870.59	1.38
611	Bay Swamps	115.66	0.18
612	Mangrove Swamps	3343.7	5.31
612/618	Mangrove Swamps/Exotic Wetland Hardwoods	1.85	<0.01
612/618	Mangrove Swamps/Willow and Elderberry	<0.01	<0.01
612/619	Mangrove Swamps/Exotic Wetland Hardwoods	3.12	<0.01
612-A	Mangrove Heads	12.20	0.02
612-B	Dwarf Mangroves	113.29	0.18
612-B/6411	Dwarf Mangroves/Sawgrass	42.87	0.07
617	Mixed Wetland Hardwoods	4,022.29	6.39
617/641	Mixed Wetland Hardwoods / Freshwater Marshes	16.93	0.03

Table 2.2-2 (Sheet 2 of 2)
Major Land Use Acreages within the 6-Mile Vicinity

Level 3	FLUCCS Land Use Category	Acres	% of Total
617-P	Mixed Wetland Hardwoods Planted	0.48	<0.01
619	Exotic Wetland Hardwoods	45.08	0.07
619/631	Exotic Wetland Hardwoods/Wetland Scrub	30.71	0.05
619-AP	Exotic Wetland Hardwoods-Australian Pine	0.58	<0.01
625	Hydric Pine Flatwoods	83.61	0.13
630	Wetland Forested Mixed	552.64	0.88
631	Wetland Shrub	4.42	0.01
641	Freshwater Marshes	11,246.07	17.87
6411	Sawgrass Marsh	14.03	0.02
642	Saltwater Marshes	35.20	0.06
643	Wet Prairies	1,129.69	1.79
650	Non-Vegetated Wetlands	393.92	0.63
651	Tidal Flats	1,128.20	1.79
740	Disturbed Land	120.85	0.19
743	Spoil Areas	61.98	0.10
743-WET	Wetland Spoils Areas	9.12	0.01
744	Fill Areas <Highways-Railways>	516.92	0.82
811	Airports	1,067.36	1.70
814	Roads And Highways	103.49	0.16
831	Electric Power Facilities	5,725.28	9.10
832	Electrical Power Transmission Lines	0.08	<0.01
	Total[a]	**62,941.15**	**100.00**

(a) Due to rounding, table values may not exactly sum to the total acres and percentages.

Table 2.2-3 (Sheet 1 of 5)
Major Land Use Acreages Along the Proposed Transmission Corridors

Transmission Line Route	Level 3	FLUCCS Land Use Category	Acres	% of Total
Clear Sky to Davis	111	Fixed Single Family Units	1.10	0.17
	121	Fixed Single Family Units	3.07	0.48
	131	Fixed Single Family Units <Six Or More Dwelling Units Per Acre>	1.67	0.26
	132	Mobile Home Units <Six Or More Dwelling Units Per Acre>	0.21	0.03
	133	Multiple Dwelling Units, Low Rise <Two Stories Or Less>	0.59	0.09
	139	High Density Under Construction	0.16	0.02
	140	Commercial And Services	0.38	0.06
	155	Other Light Industrial	0.14	0.02
	170	Institutional	1.28	0.20
	180	Recreational	0.33	0.05
	185	Parks And Zoos	0.48	0.08
	214	Row Crops	1.87	0.29
	215	Field Crops	0.30	0.05
	221	Citrus Groves	22.52	3.55
	222	Fruit Orchards	6.95	1.09
	241	Tree Nurseries	308.58	48.60
	242	Sod Farms	3.48	0.55
	243	Ornamentals	74.49	11.73
	251	Horse Farms	0.12	0.02
	310	Herbaceous (Dry Prairie)	60.89	9.59
	320	Shrub And Brushland	14.87	2.34
	330	Mixed Rangeland	0.31	0.05
	411	Pine Flatwoods	0.03	0.01
	420	Upland Hardwood Forests	0.36	0.06
	422	Brazilian Pepper	0.75	0.12
	510	Streams And Waterways/Canals	13.79	2.17
	511	Ditches	0.31	0.05
	530	Reservoirs	3.60	0.57
	612	Mangrove Swamps	64.28	10.12
	612/618	Mangrove Swamps/Willow and Elderberry	<0.01	<0.01
	612-B	Dwarf Mangroves	4.84	0.76
	619	Exotic Wetland Hardwoods	2.06	0.32
	641	Freshwater Marshes	0.50	0.08
	740	Disturbed Land	0.02	<0.01
	744	Fill Areas <Highways-Railways>	1.62	0.25
	814	Roads And Highways	9.57	1.51
	831	Electric Power Facilities	29.37	4.63
		Total[a]	**634.87**	**100.00**

Table 2.2-3 (Sheet 2 of 5)
Major Land Use Acreages Along the Proposed Transmission Corridors

Transmission Line Route	Level 3	FLUCCS Land Use Category	Acres	% of Total
Davis to Miami	111	Fixed Single Family Units	0.84	0.08
	119	Low Density Under Construction	0.25	0.02
	121	Fixed Single Family Units	61.08	6.11
	131	Fixed Single Family Units <Six Or More Dwelling Units Per Acre>	0.50	0.05
	133	Multiple Dwelling Units, Low Rise <Two Stories Or Less>	63.68	6.37
	134	Multiple Dwelling Units, High Rise <Three Stories Or More>	33.74	3.37
	140	Commercial And Services	224.39	22.44
Davis to Miami	141	Retail Sales And Services	79.35	7.94
	155	Other Light Industrial	1.92	0.19
	170	Institutional	16.41	1.64
	171	Educational Facilities	0.48	0.05
	180	Recreational	0.39	0.04
	243	Ornamentals	13.63	1.36
	310	Herbaceous (Dry Prairie)	11.35	1.13
	320	Shrub And Brushland	7.86	0.79
	420	Upland Hardwood Forests	2.10	0.21
	510	Streams And Waterways/Canals	15.42	1.54
	530	Reservoirs	1.23	0.12
	810	Transportation	195.85	19.58
	812	Railroads	21.82	2.18
	814	Roads And Highways	187.32	18.73
	831	Electric Power Facilities	4.90	0.49
	832	Electrical Power Transmission Lines	55.49	5.55
		Total[a]	**1,000.02**	**100.00**

Table 2.2-3 (Sheet 3 of 5)
Major Land Use Acreages Along the Proposed Transmission Corridors

Transmission Line Route	Level 3	FLUCCS Land Use Category	Acres	% of Total
Clear Sky to Levee 1st Leg	120	Residential, Medium Density <Two-Five Dwelling Units Per Acre>	0.37	0.03
	121	Fixed Single Family Units	2.39	0.17
	129	Medium Density Under Construction	0.46	0.03
	211	Improved Pastures	37.36	2.71
	214	Row Crops	61.32	4.45
	215	Field Crops	157.05	11.39
	220	Tree Crops	40.37	2.93
	221	Citrus Groves	123.67	8.97
	222	Fruit Orchards	94.99	6.89
	223	Other Groves	63.53	4.61
	240	Nurseries And Vineyards	10.42	0.76
	241	Tree Nurseries	122.25	8.87
	243	Ornamentals	21.59	1.57
	310	Herbaceous (Dry Prairie)	1.22	0.09
	320	Shrub And Brushland	18.68	1.35
	420	Upland Hardwood Forests	3.69	0.27
	422	Brazilian Pepper	1.51	0.11
	436	Upland Scrub, Pine And Hardwoods	0.35	0.03
	437	Australian Pines	0.84	0.06
	510	Streams And Waterways/Canals	219.01	15.88
	511	Ditches	0.92	0.07
	511/641	Ditches/Freshwater Marshes	2.99	0.22
	531	Reservoirs Larger Than 500 Acres (202 Hectares)	0.85	0.06
	534	Reservoirs Less Than 10 Acres (4 Hectares) Which Are Dominant Features	11.61	0.84
	612	Mangrove Swamps	0.11	0.01
	612-B	Dwarf Mangroves	73.16	5.31
Clear Sky to Levee 1st Leg	617	Mixed Wetland Hardwoods	57.46	4.17
	617/641	Mixed Wetland Hardwoods/Freshwater Marshes	8.09	0.59
	617/643	Mixed Wetland Hardwoods/Wet Prairies	<0.01	<0.01
	619	Exotic Wetland Hardwoods	57.07	4.14
	619-AP	Exotic Wetland Hardwoods-Australian Pine	0.50	0.04
	641	Freshwater Marshes	75.60	5.48
	641/643	Freshwater Marshes/Wet Prairies	2.62	0.19
	6411	Sawgrass Marsh	11.47	0.83
	643	Wet Prairies	11.43	0.83
	650	Non-Vegetated Wetlands	0.43	0.03
	740	Disturbed Land	9.72	0.71
	743	Spoil Areas	53.69	3.89
	744	Fill Areas <Highways-Railways>	4.70	0.34
	814	Roads And Highways	12.27	0.89
	831	Electric Power Facilities	3.09	0.22
		Total[(a)]	**1,378.86**	**100.00**

Table 2.2-3 (Sheet 4 of 5)
Major Land Use Acreages Along the Proposed Transmission Corridors

Transmission Line Route	Level 3	FLUCCS Land Use Category	Acres	% of Total
Clear Sky to Levee 2nd Leg (Preferred Option)	163	Rock Quarries	5.24	0.37
	211	Improved Pastures	1.34	0.09
	214	Row Crops	50.29	3.56
	215	Field Crops	63.03	4.46
	222	Fruit Orchards	1.03	0.07
	251	Horse Farms	0.68	0.05
	310	Herbaceous (Dry Prairie)	41.83	2.96
	320	Shrub And Brushland	27.58	1.95
	422	Brazilian Pepper	61.67	4.36
	510	Streams And Waterways/Canals	166.98	11.82
	530	Reservoirs	0.08	0.01
	617	Mixed Wetland Hardwoods	31.96	2.26
	617/641	Mixed Wetland Hardwoods/Freshwater Marshes	408.00	28.88
	618	Willow And Elderberry	1.61	0.11
	619/641	Exotic Wetland Hardwoods/Freshwater Marshes	19.07	1.35
	641	Freshwater Marshes	254.04	17.98
	643	Wet Prairies	41.62	2.95
	814	Roads And Highways	162.29	11.49
		Total[(a)]	**1,412.94**	**100.00**
Clear Sky to Levee 3rd Leg	617	Mixed Wetland Hardwoods	33.19	13.16
	619	Exotic Wetland Hardwoods	92.93	36.83
	641	Freshwater Marshes	76.39	30.28
	643	Wet Prairies	26.58	10.53
	740	Disturbed Land	1.75	0.69
	814	Roads And Highways	0.03	0.01
	831	Electric Power Facilities	17.44	6.91
	832	Electrical Power Transmission Lines	3.98	1.58
		Total[(a)]	**252.28**	**100.00**

Table 2.2-3 (Sheet 5 of 5)
Major Land Use Acreages Along the Proposed Transmission Corridors

Transmission Line Route	Level 3	FLUCCS Land Use Category	Acres	% of Total
Levee to Pennsuco	131	Fixed Single Family Units <Six Or More Dwelling Units Per Acre>	3.73	1.19
	133	Multiple Dwelling Units, Low Rise <Two Stories Or Less>	5.09	1.63
	140	Commercial And Services	9.14	2.93
	141	Retail Sales And Services	0.66	0.21
	149	Commercial And Services Under Construction	0.49	0.16
	163	Rock Quarries	44.64	14.30
	166	Holding Ponds	0.59	0.19
	182	Golf Courses	2.11	0.68
	190	Open Land	20.48	6.56
	510	Streams And Waterways/Canals	0.71	0.23
	511	Ditches	0.53	0.17
	534	Reservoirs Less Than 10 Acres (4 Hectares) Which Are Dominant Features	0.53	0.17
	619	Exotic Wetland Hardwoods	26.08	8.35
	619/641	Exotic Wetland Hardwoods/Freshwater Marshes	19.23	6.16
	631/641	Wetland Scrub/Freshwater Marshes	5.04	1.61
	641	Freshwater Marshes	111.95	35.85
	641/643	Freshwater Marshes/Wet Prairies	1.05	0.34
	643	Wet Prairies	6.06	1.94
	740	Disturbed Land	19.42	6.22
	814	Roads And Highways	10.96	3.51
	831	Electric Power Facilities	2.40	0.77
	832	Electrical Power Transmission Lines	21.40	6.85
		Total[(a)]	**312.28**	**100.00**
Clear Sky to Levee 2nd Leg (Secondary Corridor)	510	Streams And Waterways/Canals	0.99	0.20
	617	Mixed Wetland Hardwoods	8.79	1.76
	617/641	Mixed Wetland Hardwood/Freshwater Marshes	302.37	60.61
	619	Exotic Wetland Hardwoods	8.16	1.64
	641	Freshwater Marshes	177.66	35.61
	814	Roads and Highways	0.92	0.18
		Total[(a)]	**498.88**	**100.00**

(a) Due to rounding, table values may not exactly sum to the total acres and percentages.

Table 2.2-4
Major Land Use Acreages Along Transmission Line Access Corridors

Level 3	FLUCCS Land Use Category	Acres	% of Total
Tamiami Trail			
510	Streams And Waterways/Canals	2.74	26.08
641	Freshwater Marshes	3.06	29.16
814	Roads And Highways	4.70	44.76
	Total[(a)]	**10.50**	**100.00**
Krome Avenue			
510	Streams And Waterways/Canals	85.33	23.40
619	Exotic Wetland Hardwoods	56.81	15.58
641	Freshwater Marshes	143.40	39.32
814	Roads And Highways	79.17	21.71
	Total[(a)]	**364.71**	**100.00**

(a) Due to rounding, table values may not exactly sum to the total acres and percentages.

Table 2.2-5
Major Land Use Acreages in the Areas of the Access Road Improvements

Substation	Level 3	FLUCCS Land Use Category	Acres	% of Total
Davis	241	Tree Nurseries	1.12	100.00
		Total	1.12	100.00
Levee	619	Exotic Wetland Hardwoods	1.81	77.68
	831	Electric Power Facilities	0.52	22.32
		Total	2.33	100.00
Pennsuco	163	Rock Quarries	2.42	100.00
		Total	2.42	100.00
Turkey Point	831	Electric Power Facilities	0.88	100.00
		Total	0.88	100.00

Table 2.2-6 (Sheet 1 of 2)
Major Land Use Acreages Along the Reclaimed Water Pipeline to the FPL Reclaimed Water Treatment Facility and Potable Water Pipeline

Level 3	FLUCCS Land Use Category	Acres	% of Total
Reclaimed Water Pipeline			
166	Holding Ponds	42.75	2.28
184	Marinas And Fish Camps	8.61	0.46
215	Field Crops	71.55	3.81
241	Tree Nurseries	421.76	22.48
242	Sod Farms	1.18	0.06
243	Ornamentals	2.15	0.11
310	Herbaceous (Dry Prairie)	26.35	1.40
320	Shrub And Brushland	43.13	2.30
330	Mixed Rangeland	29.80	1.59
422	Brazilian Pepper	2.06	0.11
510	Streams And Waterways/Canals	59.04	3.15
511	Ditches	1.44	0.08
530	Reservoirs	13.69	0.73
534	Reservoirs Less Than 10 Acres (4 Hectares) Which Are Dominant Features	0.72	0.04
612	Mangrove Swamps	276.15	14.72
612/619	Mangrove Swamps/Exotic Wetland Hardwoods	4.47	0.24
612-B	Dwarf Mangroves	0.05	<0.01
617	Mixed Wetland Hardwoods	91.63	4.88
619	Exotic Wetland Hardwoods	3.02	0.16
630	Wetland Forested Mixed	2.52	0.13
631	Wetland Shrub	35.03	1.87
641	Freshwater Marshes	32.72	1.74
642	Saltwater Marshes	2.21	0.12
740	Disturbed Land	31.07	1.66
744	Fill Areas <Highways-Railways>	0.20	0.01
814	Roads And Highways	49.54	2.64
831	Electric Power Facilities	24.57	1.31
834	Sewage Treatment	234.47	12.50
835	Solid Waste Disposal	363.99	19.40
	Total	**1,875.86**	**100.00**
Potable Water Pipeline			
110	Residential, Low Density <Less Than Two Dwelling Units Per Acre>	1.19	0.37
131	Fixed Single Family Units <Six Or More Dwelling Units Per Acre>	3.51	1.07
133	Multiple Dwelling Units, Low Rise <Two Stories Or Less>	3.45	1.06
134	Multiple Dwelling Units, High Rise <Three Stories Or More>	4.76	1.46
139	High Density Under Construction	3.68	1.13
140	Commercial And Services	1.33	0.41
149	Commercial And Services Under Construction	1.75	0.53
214	Row Crops	20.94	6.40
215	Field Crops	6.98	2.14
221	Citrus Groves	3.44	1.05

Table 2.2-6 (Sheet 2 of 2)
Major Land Use Acreages Along the Reclaimed Water Pipeline to the FPL Reclaimed Water Treatment Facility and Potable Water Pipeline

Level 3	FLUCCS Land Use Category	Acres	% of Total
222	Fruit Orchards	3.38	1.04
241	Tree Nurseries	35.18	10.76
320	Shrub And Brushland	1.63	0.50
422	Brazilian Pepper	6.93	2.12
437	Australian Pine	0.38	0.12
437	Australian Pines	0.38	0.12
510	Streams And Waterways/Canals	20.25	6.19
511	Ditches	2.17	0.66
530	Reservoirs	0.42	0.13
534	Reservoirs Less Than 10 Acres (4 Hectares) Which Are Dominant Features	1.91	0.59
612-B	Dwarf Mangroves	8.79	2.69
617	Mixed Wetland Hardwoods	23.04	7.05
617/641	Mixed Wetland Hardwoods/Freshwater Marshes	8.42	2.58
617-P	Mixed Wetland Hardwoods Planted	0.47	0.14
619	Exotic Wetland Hardwoods	24.51	7.50
619-AP	Exotic Wetland Hardwoods-Australian Pine	0.07	0.02
641	Freshwater Marshes	92.69	28.35
6411	Sawgrass Marsh	1.96	0.60
740	Disturbed Land	3.35	1.02
743	Spoil Areas	0.50	0.15
744	Fill Areas <Highways-Railways>	0.20	0.06
814	Roads And Highways	39.18	11.98
831	Electric Power Facilities	0.03	0.01
	Total[(a)]	**326.90**	**100.00**

(a) Due to rounding, table values may not exactly sum to the total acres and percentages.

Table 2.2-7 (Sheet 1 of 2)
Major Land Use Acreages in Areas of the Access Road Improvement

	Level 3	FLUCCS Land Use Category	Acres	% of Total
SW 117th Ave. North	241	Tree Nurseries	0.04	0.43
	510	Streams And Waterways/Canals	<0.01	<0.01
	511	Ditches	1.57	18.01
	619	Exotic Wetland Hardwoods	0.19	2.16
	814	Roads And Highways	6.91	79.40
		Total	**8.70**	**100.00**
SW 117th Ave. South	510	Streams And Waterways/Canals	<0.01	0.05
	617	Mixed Wetland Hardwoods	1.94	25.30
	617/641	Mixed Wetland Hardwoods/Freshwater Marshes	1.95	25.34
	641	Freshwater Marshes	2.62	34.18
	814	Roads And Highways	1.16	15.13
		Total[a]	**7.68**	**100.00**
SW 137th Ave.	183	Race Tracks	0.63	8.54
	510	Streams And Waterways/Canals	1.66	22.55
	617	Mixed Wetland Hardwoods	0.75	10.17
	617/641	Mixed Wetland Hardwoods/Freshwater Marshes	2.78	37.73
	814	Roads And Highways	1.55	21.01
		Total[a]	**7.38**	**100.00**
SW 328th St.	110	Residential, Low Density <Less Than Two Dwelling Units Per Acre>	0.53	2.18
	214	Row Crops	2.95	12.04
	222	Fruit Orchards	1.59	6.50
	241	Tree Nurseries	2.73	11.14
	510	Streams And Waterways/Canals	0.67	2.72
	511	Ditches	1.40	5.73
	619	Exotic Wetland Hardwoods	4.01	16.38
	814	Roads And Highways	10.60	43.31
		Total[a]	**24.49**	**100.00**
SW 344th St.	183	Race Tracks	0.64	38.74
	814	Roads And Highways	1.02	61.26
		Total[a]	**1.66**	**100.00**
SW 359th Ave. East	437	Australian Pine	0.76	1.62
	510	Streams And Waterways/Canals	1.54	3.28
	511	Ditches	0.32	0.68
	534	Reservoirs Less Than 10 Acres (4 Hectares) Which Are Dominant Features	0.06	0.13
	612	Mangrove Swamps	0.02	0.05
	612-B	Dwarf Mangroves	6.26	13.37
	617	Mixed Wetland Hardwoods	0.70	1.50
	617-P	Mixed Wetland Hardwoods Planted	0.01	0.01
	619-AP	Exotic Wetland Hardwoods-Australian Pine	<0.01	0.01
	641	Freshwater Marshes	23.97	51.21
	6411	Sawgrass Marsh	0.60	1.27
	740	Disturbed Land	6.57	14.05
	743	Spoil Areas	0.01	0.01

Table 2.2-7 (Sheet 2 of 2)
Major Land Use Acreages in Areas of the Access Road Improvement

SW 359th Ave. East	744	Fill Areas <Highways-Railways>	0.36	0.77
	814	Roads And Highways	4.31	9.20
	831	Electric Power Facilities	1.33	2.85
		Total[(a)]	**46.81**	**100.00**
SW 359th Ave. West	510	Streams And Waterways/Canals	0.07	0.22
	617	Mixed Wetland Hardwoods	5.71	18.44
	617/641	Mixed Wetland Hardwoods/Freshwater Marshes	0.76	2.45
	641	Freshwater Marshes	21.35	68.92
	814	Roads And Highways	3.09	9.98
		Total[(a)]	**30.98**	**100.00**

(a) Due to rounding, table values jay not exactly sum to the total acres and percentages.

**Table 2.2-8 (Sheet 1 of 4)
Major Land Use Acreages Within the 50-Mile Region**

Level 3	FLUCCS Land Use Category	Acres	% of Total
110	Residential, Low Density <Less Than Two Dwelling Units Per Acre>	1.73	<0.01
111	Fixed Single Family Units <Less Than Two Dwelling Units Per Acre>	25,112.89	0.95
112	Mobile Home Units <Less Than Two Dwelling Units Per Acre>	72.21	<0.01
113	Residential, Mixed Units <Fixed And Mobile Home Units> <Less Than Two Dwelling Units Per Acre>	22.78	<0.01
118	Rural Residential	14,208.21	0.54
119	Residential, Low Density Under Construction <Less Than Two Dwelling Units Per Acre>	692.72	0.03
120	Residential, Medium Density <Two-Five Dwelling Units Per Acre>	0.37	<0.01
121	Fixed Single Family Units <Two-Five Dwelling Units Per Acre>	130,383.55	4.95
122	Mobile Home Units <Two-Five Dwelling Units Per Acre>	56.77	<0.01
129	Residential, Medium Density Under Construction <Two-Five Dwelling Units Per Acre>	2,772.41	0.11
131	Fixed Single Family Units <Six Or More Dwelling Units Per Acre>	17,490.42	0.66
132	Mobile Home Units <Six Or More Dwelling Units Per Acre>	4,220.80	0.16
133	Multiple Dwelling Units, Low Rise <Two Stories Or Less>	30,535.69	1.16
134	Multiple Dwelling Units, High Rise <Three Stories Or More>	7,238.34	0.27
135	Residential, Mixed Units <Fixed And Mobile Home Units> <Six Or More Dwelling Units Per Acre>	15.30	<0.01
139	Residential, High Density Under Construction <Six Or More Dwelling Units Per Acre>	1,852.51	0.07
140	Commercial And Services	33,873.53	1.29
141	Retail Sales And Services	7,060.66	0.27
142	Wholesale Sales And Services <Excluding Warehouses Associated With Industrial Use>	266.42	0.01
146	Oil And Gas Storage <Except Those Areas Associated With Industrial Use Or Manufacturing>	260.02	0.01
148	Cemeteries	1,092.24	0.04
149	Commercial And Services Under Construction	1,956.17	0.07
150	Industrial	390.41	0.01
154	Oil And Gas Processing	11.45	<0.01
155	Other Light Industrial	10,117.10	0.38
156	Other Heavy Industrial	417.60	0.02
160	Extractive	3.67	<0.01
163	Rock Quarries	4,030.03	0.15
165	Reclaimed Land	781.57	0.03
166	Holding Ponds	9,433.14	0.36
170	Institutional	5,689.47	0.22
171	Educational Facilities	9,649.10	0.37
172	Religious	19.42	<0.01
173	Military	1,623.50	0.06
176	Correctional	955.31	0.04
180	Recreational	723.35	0.03
181	Swimming Beach	634.95	0.02

Table 2.2-8 (Sheet 2 of 4)
Major Land Use Acreages Within the 50-Mile Region

Level 3	FLUCCS Land Use Category	Acres	% of Total
182	Golf Courses	8,925.01	0.34
183	Race Tracks	1,279.08	0.05
184	Marinas And Fish Camps	460.88	0.02
185	Parks And Zoos	7,711.71	0.29
187	Stadiums <Those Facilities Not Associated With High Schools, Colleges Or Universities>	495.02	0.02
190	Open Land	9,834.10	0.37
192	Inactive Land With Street Pattern But Without Structures	1,068.54	0.04
211	Improved Pastures	4,225.05	0.16
212	Unimproved Pastures	755.68	0.03
213	Woodland Pastures	17.42	<0.01
214	Row Crops	13,240.92	0.50
215	Field Crops	25,767.33	0.98
216	Mixed Crops	93.14	<0.01
220	Tree Crops	40.37	<0.01
221	Citrus Groves	6,026.74	0.23
222	Fruit Orchards	6,418.22	0.24
223	Other Groves	153.79	0.01
231	Cattle Feeding Operations	73.40	<0.01
240	Nurseries And Vineyards	10.42	<0.01
241	Tree Nurseries	11,277.64	0.43
242	Sod Farms	370.98	0.01
243	Ornamentals	11,792.88	0.45
250	Specialty Farms	276.71	0.01
251	Horse Farms	495.41	0.02
254	Aquaculture	25.46	<0.01
261	Fallow Crop Land	2,224.42	0.08
310	Herbaceous (Dry Prairie)	7,115.27	0.27
320	Shrub And Brushland	10,957.11	0.42
321	Palmetto Prairies	1.91	<0.01
322	Coastal Scrub	254.81	0.01
323	Abandoned Groves	102.98	<0.01
330	Mixed Rangeland	2,937.05	0.11
411	Pine Flatwoods	6,146.17	0.23
420	Upland Hardwood Forests	8,618.77	0.33
422	Brazilian Pepper	4,519.97	0.17
424	Melaleuca	2,257.98	0.09
427	Live Oak	5.62	<0.01
428	Cabbage Palm	36.15	<0.01
434	Hardwood - Coniferous Mixed	1,160.41	0.04
436	Upland Scrub, Pine And Hardwoods	0.35	<0.01
437	Australian Pines	971.99	0.04
441	Coniferous Plantations	11.54	<0.01
510	Streams And Waterways/Canals	617.61	0.02
511	Ditches	14,602.53	0.55
511/641	Ditches/Freshwater Marshes	2.99	<0.01

Table 2.2-8 (Sheet 3 of 4)
Major Land Use Acreages Within the 50-Mile Region

Level 3	FLUCCS Land Use Category	Acres	% of Total
512	Channelized River, Stream, Waterway	11,552.62	0.44
520	Lakes	960.47	0.04
530	Reservoirs	22,022.67	0.84
531	Reservoirs Larger Than 500 Acres (202 Hectares)	12.83	<0.01
534	Reservoirs Less Than 10 Acres (4 Hectares) Which Are Dominant Features	14.84	<0.01
541	Embayments Opening Directly Into The Gulf Of Mexico Or The Atlantic Ocean	431,309.56	16.37
542	Embayments Not Opening Directly Into The Gulf Of Mexico Or The Atlantic Ocean	16,182.61	0.61
543	Enclosed Saltwater Ponds Within A Salt Marsh	6,601.01	0.25
571	Atlantic Ocean	186,688.30	7.09
611	Bay Swamps	2,510.05	0.10
612	Mangrove Swamps	266,911.62	10.13
612/618	Mangrove Swamps/Exotic Wetland Hardwoods	1.85	<0.01
612/619	Mangrove Swamps/Exotic Wetland Hardwoods	4.47	<0.01
612-A	Mangrove Heads	12.20	<0.01
612-B	Dwarf Mangroves	113.29	<0.01
612-B/6411	Dwarf Mangroves/Sawgrass	42.87	<0.01
617	Mixed Wetland Hardwoods	107,695.45	4.09
617/641	Mixed Wetland Hardwoods/Freshwater Marshes	732.37	0.03
617/643	Mixed Wetland Hardwoods/Wet Prairies	<0.01	<0.01
617-P	Mixed Wetland Hardwoods Planted	0.48	<0.01
618	Willow And Elderberry	1.61	<0.01
619	Exotic Wetland Hardwoods	14,242.97	0.54
619/631	Exotic Wetland Hardwoods/Wetland Scrub	30.71	<0.01
619/641	Exotic Wetland Hardwoods/Freshwater Marshes	38.30	<0.01
619-AP	Exotic Wetland Hardwoods-Australian Pine	0.58	<0.01
621	Cypress	27,254.84	1.03
624	Cypress - Pine - Cabbage Palm	2,427.97	0.09
625	Hydric Pine Flatwoods	11,471.81	0.44
630	Wetland Forested Mixed	650.78	0.02
631	Wetland Shrub	39.45	<0.01
631/641	Wetland Scrub/Freshwater Marshes	5.04	<0.01
641/643	Freshwater Marshes/Wet Prairies	3.67	<0.01
641	Freshwater Marshes	890,026.17	33.78
6411	Sawgrass Marsh	14.03	<0.01
642	Saltwater Marshes	33,359.60	1.27
643	Wet Prairies	29,122.50	1.11
644	Emergent Aquatic Vegetation	7,019.07	0.27
650	Non-Vegetated Wetlands	1,663.59	0.06
651	Tidal Flats	21,533.42	0.82
720	Sand Other Than Beaches	10.62	<0.01
740	Disturbed Land	378.98	0.01
743	Spoils Areas	300.08	0.01
743-WET	Wetland Spoils Areas	9.12	<0.01

Table 2.2-8 (Sheet 4 of 4)
Major Land Use Acreages Within the 50-Mile Region

Level 3	FLUCCS Land Use Category	Acres	% of Total
744	Fill Areas <Highways-Railways>	2,330.92	0.09
810	Transportation	497.98	0.02
811	Airports	9,123.75	0.35
812	Railroads	801.50	0.03
814	Roads And Highways	18,743.52	0.71
815	Port Facilities	1,195.54	0.05
820	Communications	367.23	0.01
830	Utilities	39.47	<0.01
831	Electric Power Facilities	6,232.23	0.24
832	Electrical Power Transmission Lines	2,805.60	0.11
833	Water Supply Plants	155.02	0.01
834	Sewage Treatment	905.28	0.03
835	Solid Waste Disposal	1,720.74	0.07
	Total[(a)]	**2,634,940.55**	**100.00**

(a) Due to rounding, table values may not exactly sum to the total acres and percentages.

Table 2.2-9
Farms and Harvested Land in Broward, Collier, Miami-Dade, and Monroe Counties

Item	Broward County			Collier County		
	1997	2002	2007	1997	2002	2007
Approximate land area (square miles)	1,197	1,197	1,197	2,025	2,025	2,025
Land in farms (acres)	30,897	23,741	8,737	277,279	180,852	109,934
Number of farms	347	494	547	235	273	322
Average size farm (acres)	89	48	16	1,180	662	341
Harvested land (acres)	3,737	4,385	2,577	55,213	NA[a]	35,288

Item	Miami-Dade County			Monroe County		
	1997	2002	2007	1997	2002	2007
Approximate land area (square miles)	1,946	1,946	1,946	997	997	997
Land in farms (acres)	85,093	90,373	67,050	NA[a]	102	187
Number of farms	1,576	2,244	2,498	NA[a]	18	23
Average size farm (acres)	54	40	27	NA[a]	6	8
Harvested land (acres)	62,693	55,142	49,065	NA[a]	NA[a]	NA[a]

(a) Information not available (NA) in source references, or information considered to be inaccurate.
References: AgCensus 2004a, b, c, d; Broward Aug 2003; NASS 2002a, b, c, d; NASS 2007; USCB 2009a, b, c.

Figure 2.2-1 Turkey Point Units 6 & 7

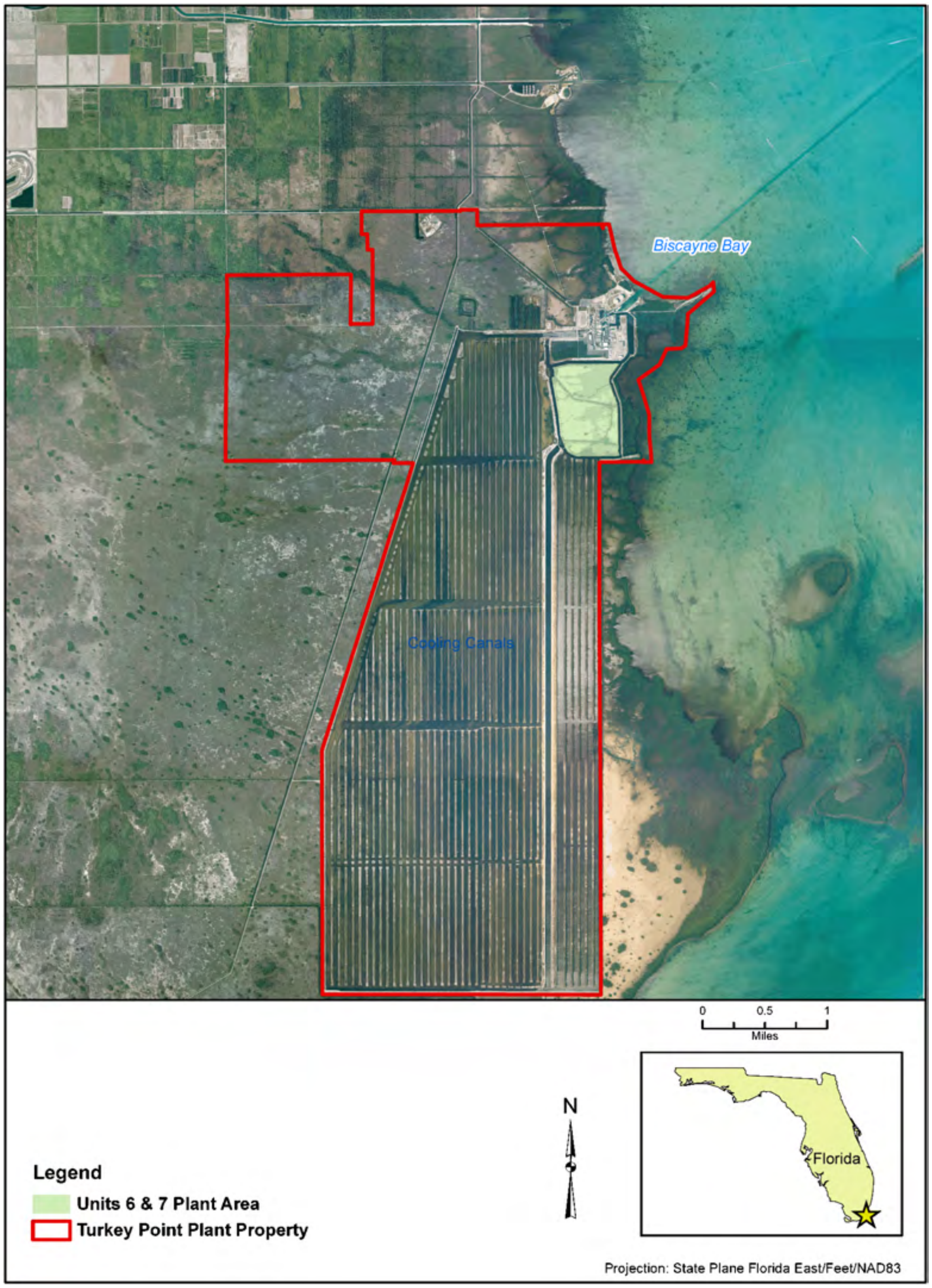

Figure 2.2-2 Land Use

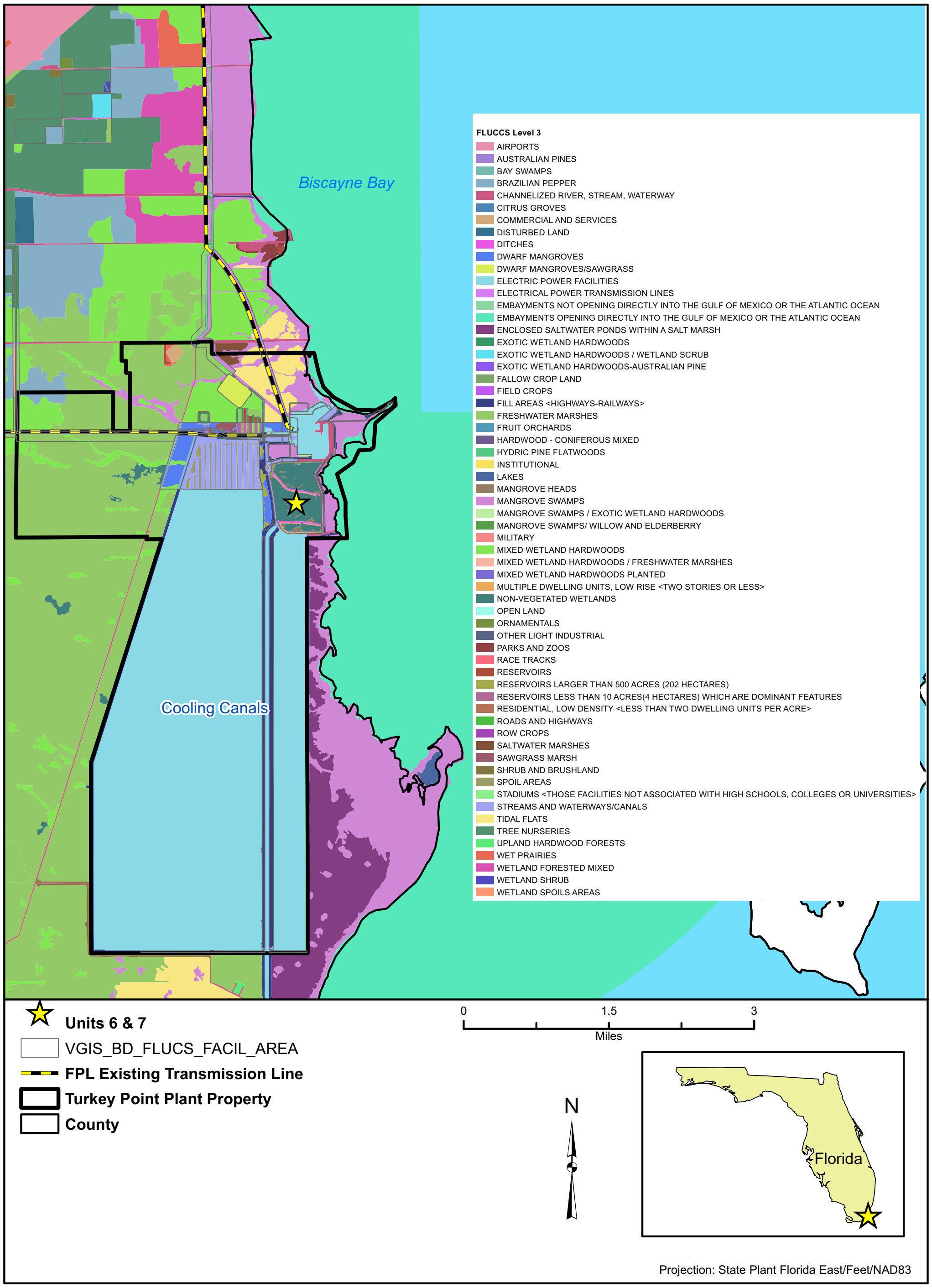

Figure 2.2-3 Turkey Point Exclusion Area Boundary

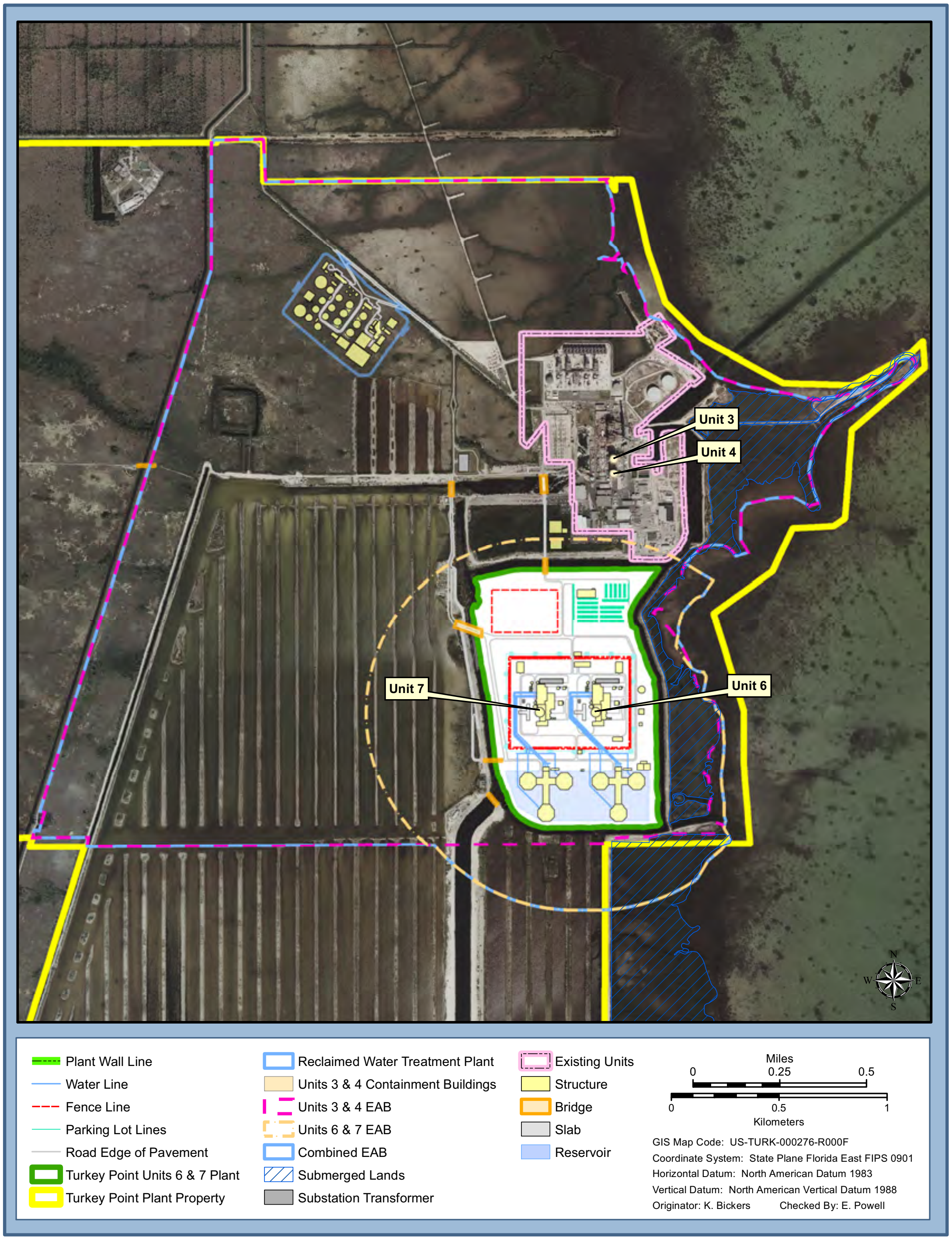

Figure 2.2-4 6-Mile Land Use (Sheet 1 of 5)

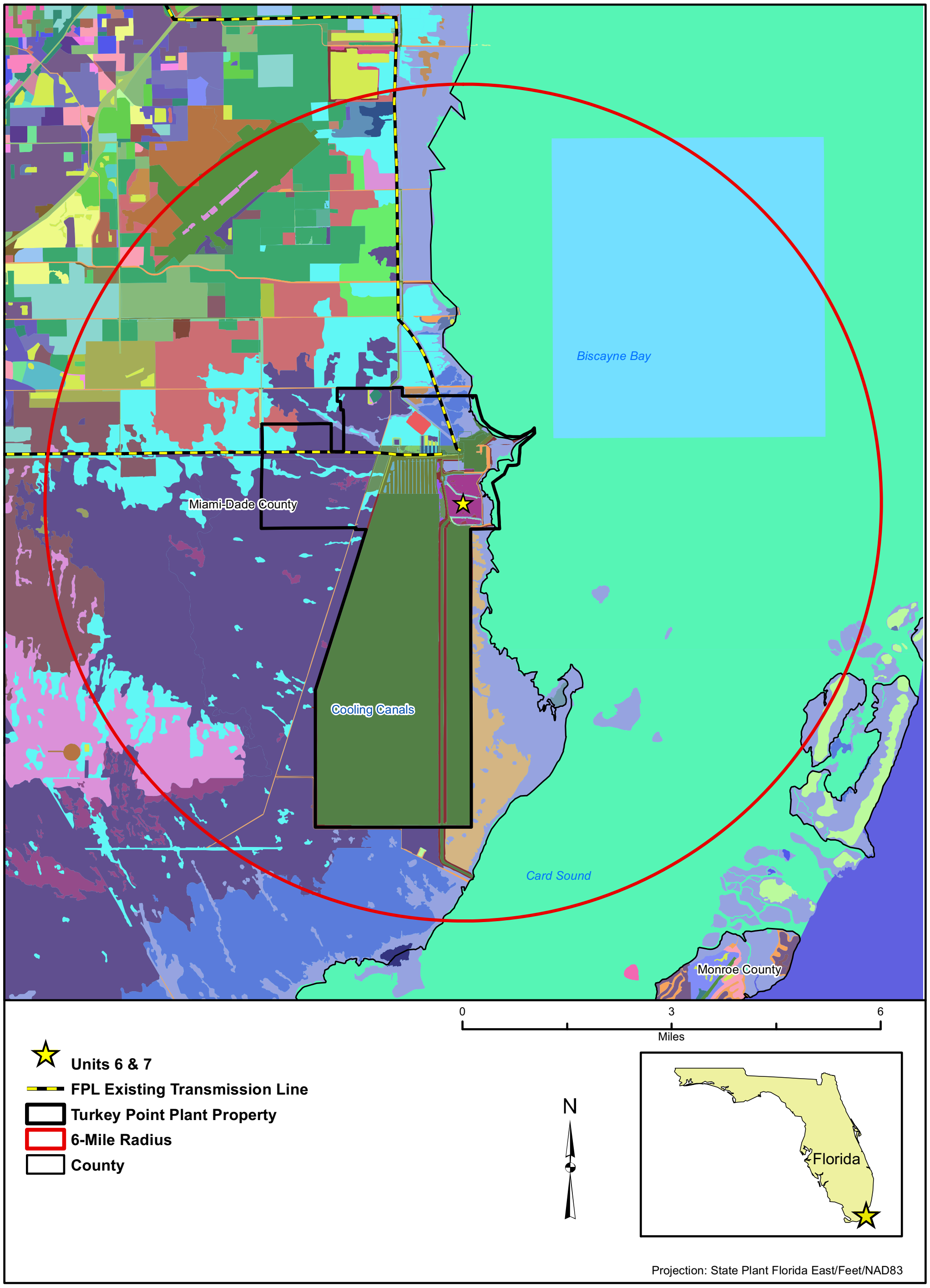

Figure 2.2-4 6-Mile Land Use (Sheet 2 of 5)

Legend

- ABANDONED GROVES
- AIRPORTS
- AQUACULTURE
- ATLANTIC OCEAN
- AUSTRALIAN PINES
- BAY SWAMPS
- BRAZILIAN PEPPER
- CABBAGE PALM
- CATTLE FEEDING OPERATIONS
- CEMETERIES
- CHANNELIZED RIVER, STREAM, WATERWAY
- CITRUS GROVES
- COASTAL SCRUB
- COMMERCIAL AND SERVICES
- COMMERCIAL AND SERVICES UNDER CONSTRUCTION
- COMMUNICATIONS
- CONIFEROUS PLANTATIONS
- CORRECTIONAL
- CYPRESS
- CYPRESS - PINE - CABBAGE PALM
- DISTURBED LAND
- DITCHES
- DITCHES / FRESHWATER MARSHES
- DWARF MANGROVES
- DWARF MANGROVES/SAWGRASS
- EDUCATIONAL FACILITIES
- ELECTRIC POWER FACILITIES
- ELECTRICAL POWER TRANSMISSION LINES
- EMBAYMENTS NOT OPENING DIRECTLY INTO THE GULF OF MEXICO OR THE ATLANTIC OCEAN
- EMBAYMENTS OPENING DIRECTLY INTO THE GULF OF MEXICO OR THE ATLANTIC OCEAN
- EMERGENT AQUATIC VEGETATION
- ENCLOSED SALTWATER PONDS WITHIN A SALT MARSH
- EXOTIC WETLAND HARDWOODS
- EXOTIC WETLAND HARDWOODS / FRESHWATER MARSHES
- EXOTIC WETLAND HARDWOODS / WETLAND SCRUB
- EXOTIC WETLAND HARDWOODS-AUSTRALIAN PINE
- EXTRACTIVE

Figure 2.2-4 6-Mile Land Use (Sheet 3 of 5)

Figure 2.2-4 6-Mile Land Use (Sheet 4 of 5)

Figure 2.2-4 6-Mile Land Use (Sheet 5 of 5)

Legend

- ROADS AND HIGHWAYS
- ROCK QUARRIES
- ROW CROPS
- RURAL RESIDENTIAL
- SALTWATER MARSHES
- SAND OTHER THAN BEACHES
- SAWGRASS MARSH
- SEWAGE TREATMENT
- SHRUB AND BRUSHLAND
- SOD FARMS
- SOLID WASTE DISPOSAL
- SPECIALTY FARMS
- SPOIL AREAS
- STADIUMS <THOSE FACILITIES NOT ASSOCIATED WITH HIGH SCHOOLS, COLLEGES OR UNIVERSITIES>
- STREAMS AND WATERWAYS/CANALS
- SWIMMING BEACH
- TIDAL FLATS
- TRANSPORTATION
- TREE CROPS
- TREE NURSERIES
- UNIMPROVED PASTURES
- UPLAND HARDWOOD FORESTS
- UPLAND SCRUB, PINE AND HARDWOODS
- UTILITIES
- WATER SUPPLY PLANTS
- WET PRAIRIES
- WETLAND FORESTED MIXED
- WETLAND SCRUB
- WETLAND SCRUB / FRESHWATER MARSHES
- WETLAND SPOIL AREAS
- WHOLESALE SALES AND SERVICES <EXCLUDING WAREHOUSES ASSOCIATED WITH INDUSTRIAL USE>
- WILLOW AND ELDERBERRY
- WOODLAND PASTURES

Figure 2.2-5 Transmission System and Reclaimed Water Pipelines Route

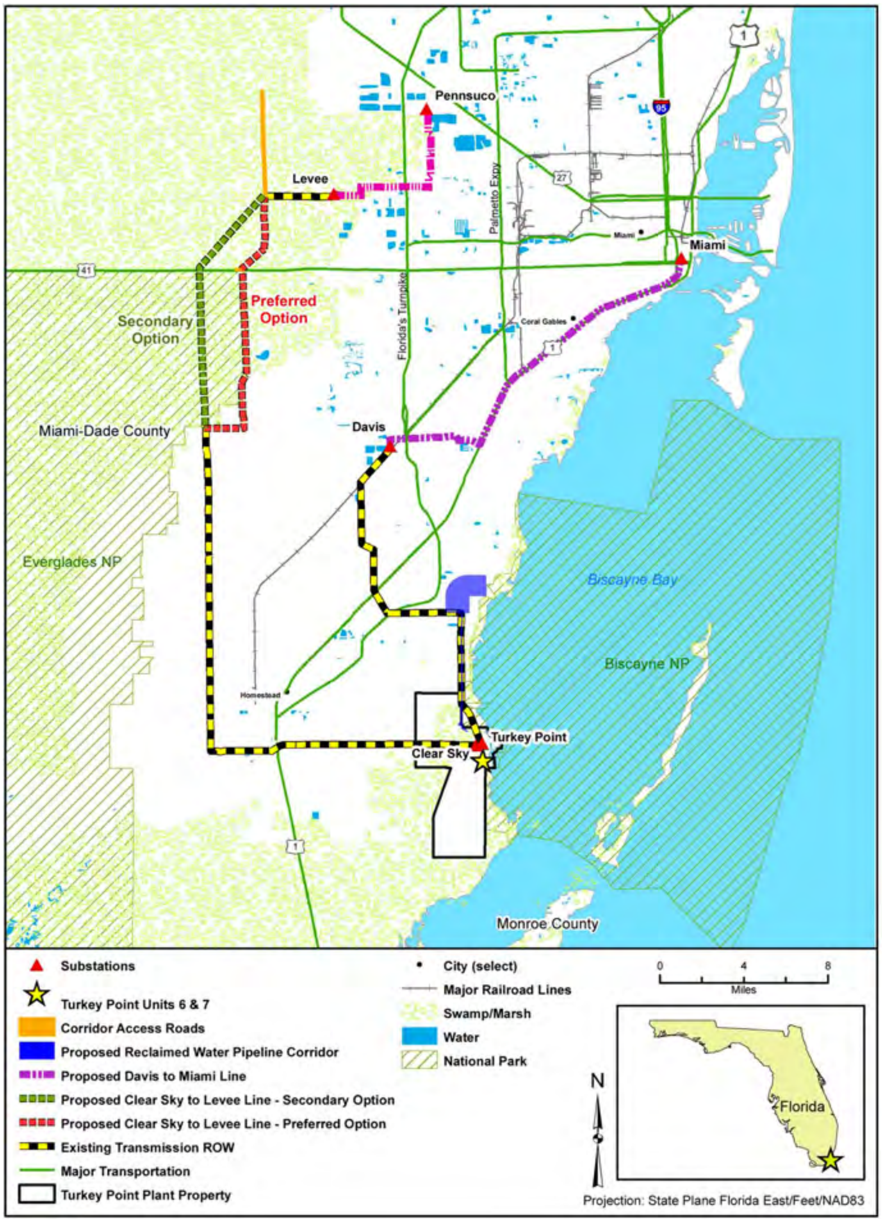

Figure 2.2-6 50-Mile Land Use (Sheet 1 of 5)

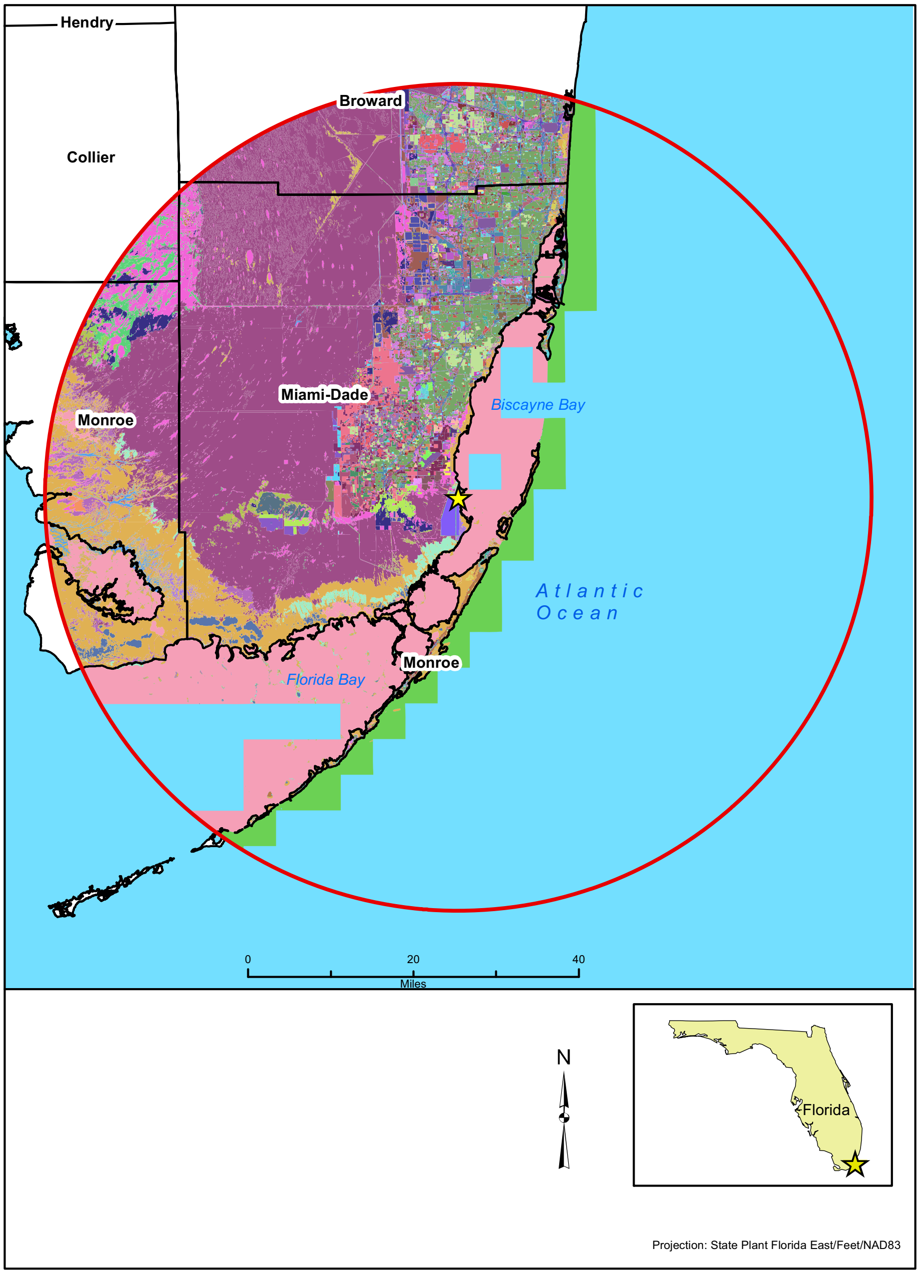

Figure 2.2-6 50-Mile Land Use (Sheet 2 of 5)

Legend

ABANDONED GROVES
AIRPORTS
AQUACULTURE
ATLANTIC OCEAN
AUSTRALIAN PINES
BAY SWAMPS
BRAZILIAN PEPPER
CABBAGE PALM
CATTLE FEEDING OPERATIONS
CEMETERIES
CHANNELIZED RIVER, STREAM, WATERWAY
CITRUS GROVES
COASTAL SCRUB
COMMERCIAL AND SERVICES
COMMERCIAL AND SERVICES UNDER CONSTRUCTION
COMMUNICATIONS
CONIFEROUS PLANTATIONS
CORRECTIONAL
CYPRESS
CYPRESS - PINE - CABBAGE PALM
DISTURBED LAND
DITCHES
DITCHES / FRESHWATER MARSHES
DWARF MANGROVES
DWARF MANGROVES/SAWGRASS
EDUCATIONAL FACILITIES
ELECTRIC POWER FACILITIES
ELECTRICAL POWER TRANSMISSION LINES
EMBAYMENTS NOT OPENING DIRECTLY INTO THE GULF OF MEXICO OR THE ATLANTIC OCEAN
EMBAYMENTS OPENING DIRECTLY INTO THE GULF OF MEXICO OR THE ATLANTIC OCEAN
EMERGENT AQUATIC VEGETATION
ENCLOSED SALTWATER PONDS WITHIN A SALT MARSH
EXOTIC WETLAND HARDWOODS
EXOTIC WETLAND HARDWOODS / FRESHWATER MARSHES
EXOTIC WETLAND HARDWOODS / WETLAND SCRUB
EXOTIC WETLAND HARDWOODS-AUSTRALIAN PINE
EXTRACTIVE

Figure 2.2-6 50-Mile Land Use (Sheet 3 of 5)

Legend

FALLOW CROP LAND
FIELD CROPS
FILL AREAS <HIGHWAYS-RAILWAYS>
FIXED SINGLE FAMILY UNITS
FIXED SINGLE FAMILY UNITS <LESS THAN TWO DWELLING UNITS PER ACRE>
FIXED SINGLE FAMILY UNITS <SIX OR MORE DWELLING UNITS PER ACRE>
FIXED SINGLE FAMILY UNITS <TWO-FIVE DWELLING UNITS PER ACRE>
FRESHWATER MARSHES
FRESHWATER MARSHES / WET PRAIRIES
FRUIT ORCHARDS
GOLF COURSES
HARDWOOD - CONIFEROUS MIXED
HERBACEOUS (DRY PRAIRIE)
HIGH DENSITY UNDER CONSTRUCTION
HOLDING PONDS
HORSE FARMS
HYDRIC PINE FLATWOODS
IMPROVED PASTURES
INACTIVE LAND WITH STREET PATTERN BUT WITHOUT STRUCTURES
INDUSTRIAL
INSTITUTIONAL
LAKES
LIVE OAK
LOW DENSITY UNDER CONSTRUCTION
MANGROVE HEADS
MANGROVE SWAMPS
MANGROVE SWAMPS / EXOTIC WETLAND HARDWOODS
MANGROVE SWAMPS / WILLOW AND ELDERBERRY
MARINAS AND FISH CAMPS
MEDIUM DENSITY UNDER CONSTRUCTION
MELALEUCA
MILITARY
MIXED CROP
MIXED RANGELAND
MIXED WETLAND HARDWOODS
MIXED WETLAND HARDWOODS / FRESHWATER MARSHES
MIXED WETLAND HARDWOODS PLANTED

Figure 2.2-6 50-Mile Land Use (Sheet 4 of 5)

Figure 2.2-6 50-Mile Land Use (Sheet 5 of 5)

Legend

ROADS AND HIGHWAYS
ROCK QUARRIES
ROW CROPS
RURAL RESIDENTIAL
SALTWATER MARSHES
SAND OTHER THAN BEACHES
SAWGRASS MARSH
SEWAGE TREATMENT
SHRUB AND BRUSHLAND
SOD FARMS
SOLID WASTE DISPOSAL
SPECIALTY FARMS
SPOIL AREAS
STADIUMS <THOSE FACILITIES NOT ASSOCIATED WITH HIGH SCHOOLS, COLLEGES OR UNIVERSITIES>
STREAMS AND WATERWAYS/CANALS
SWIMMING BEACH
TIDAL FLATS
TRANSPORTATION
TREE CROPS
TREE NURSERIES
UNIMPROVED PASTURES
UPLAND HARDWOOD FORESTS
UPLAND SCRUB, PINE AND HARDWOODS
UTILITIES
WATER SUPPLY PLANTS
WET PRAIRIES
WETLAND FORESTED MIXED
WETLAND SCRUB
WETLAND SCRUB / FRESHWATER MARSHES
WETLAND SPOIL AREAS
WHOLESALE SALES AND SERVICES <EXCLUDING WAREHOUSES ASSOCIATED WITH INDUSTRIAL USE>
WILLOW AND ELDERBERRY
WOODLAND PASTURES

SECTION 2.3: WATER
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SECTION 2.3 LIST OF FIGURES (CONT.)

SECTION 2.3 LIST OF FIGURES (CONT.)

SECTION 2.3 LIST OF FIGURES (CONT.)

SECTION 2.3 LIST OF FIGURES (CONT.)

2.3 WATER

This section provides site-specific and regional descriptions of the hydrology, water use, and water quality conditions that could affect or be affected by the construction and operation of Units 6 & 7. The potential impacts of plant construction and operation on surface water and groundwater are described in Chapters 4 and 5, respectively.

Units 6 & 7 would be collocated with two natural gas/oil steam electric generating units (Units 1 & 2), two pressurized water reactor nuclear units (Units 3 & 4), and one natural gas combined-cycle steam electric generating unit (Unit 5) on the approximately 9400-acre Turkey Point property. The Turkey Point plant property is located in southeast Florida on the west bank of Biscayne Bay in Miami-Dade County, approximately 25 miles south of Miami, Florida, as shown on Figure 2.3-1. Major hydrologic features near the plant property are also identified in the figure. Areas surrounding the plant property are shown on Figure 2.3-2.

The 218-acre Units 6 & 7 plant area would be built up to higher elevations above the adjacent grade with finished grade elevations varying from 19 feet to 25.5 feet in North American Vertical Datum of 1988 (NAVD 88). The plant area would be surrounded by a retaining wall structure with the top of wall elevation varying from 20 feet to 21.5 feet NAVD 88. The Units 6 & 7 plant area is south of Units 3 & 4 and completely encircled by the cooling canals of the industrial wastewater facility (Figure 2.3-3, Figure 2.3-4) that are used by Units 1 through 4. Unit 5 uses mechanical draft cooling towers where the cooling tower makeup water is supplied from the Upper Floridan aquifer and the blowdown is routed to the industrial wastewater facility. The Units 6 & 7 plant area is sparsely vegetated consisting of mudflats, open water, dwarf mangroves, man-made remnant canals, wetland spoil areas, and mangrove heads and is isolated by the surrounding industrial wastewater facility. The existing grade elevation within the Units 6 & 7 plant area varies from approximately –2.4 feet to 0.8 feet NAVD 88.

2.3.1 HYDROLOGY

This subsection describes surface water and groundwater hydrology that could affect or be affected by the construction and operation of Units 6 & 7. The site-specific and regional data on the physical and hydrologic characteristics are also summarized to provide the basis for an evaluation of impacts on water bodies, aquifers, aquatic ecosystems, and social and economic structures of the area.

2.3.1.1 Surface Water Resources

The Units 6 & 7 plant area is located on the shore of Biscayne Bay within the Everglades drainage basin of the south Florida watershed subregion, as shown on Figure 2.3-5 (Marella 1999). As described in Section 2.6, the Turkey Point plant property is located in the Southern Slope subprovince of the Southern Zone subregion of the Florida Platform within the Atlantic

Coastal Plain physiographic province (Figure 2.6-1). The physiographic features in the Southern Zone subregion that govern surface water flows southward from Lake Okeechobee include the Immokalee Rise, Big Cypress Spur, Atlantic Coastal Ridge, and the Everglades physiographic sub-provinces (Figure 2.6-1). Higher topographic relief of the Immokalee Rise and Big Cypress Spur in the west and the Atlantic Coastal Ridge in the east of the Everglades historically guided the stormwater runoff and freshwater flows from Lake Okeechobee to drain south and southeast into the Everglades. However, flood control structures and an elaborate drainage canal system constructed in the past century has since modified the natural drainage basin, its freshwater discharge, and its interaction with the coastal bays of the Atlantic Ocean and Gulf of Mexico. The interaction of surface water and groundwater within the area further complicates the hydrology of the area (McPherson and Halley 1997, Godfrey 2006, Wolfert-Lohmann et al. 2007).

The Units 6 & 7 plant area is located in the low-lying areas of the Southern Slope physiographic subprovince on the western shore of Biscayne Bay (Figure 2.6-1). There are no lakes, major rivers, or dams located near the plant area, as shown on Figures 2.3-1 through 2.3-3. However, a network of drainage canals, which includes canals from the Everglades National Park-South Dade Conveyance System (ENP-SDCS) and local project (drainage) canals, provides freshwater supply to the Everglades National Park and controlled drainage from southeast Florida to the Biscayne Bay. Consequently, the hydrology near the Units 6 & 7 plant area is mainly governed by the dynamics of Biscayne Bay. In addition to Biscayne Bay, other major hydrologic features near the Units 6 & 7 plant area include the Everglades and the drainage canal system of southeast Florida, and the cooling canals of the industrial wastewater facility (see Figure 2.3-1 and Figure 2.3-3). Each of these hydrologic features is described below.

The Westinghouse AP1000 certified plant design has been selected for Units 6 & 7. The AP1000 design employs a passive containment that does not require offsite water sources to perform its safety-related functions. Units 6 & 7 would use mechanical draft towers for nonsafety-related circulating water system cooling. Makeup water for the circulating water system cooling towers would be from two independent water sources, each capable of supplying the required makeup water demand, as described in Section 3.4. The makeup water sources for the circulating water system would be reclaimed water from Miami-Dade Water and Sewer Department (MDWASD) water treatment facilities and saltwater from radial collector wells with horizontal laterals installed beneath the floor of Biscayne Bay. Therefore, there would be no direct withdrawals or discharges to surface waters associated with the operation of Units 6 & 7. It is noted however, that the majority of water recharging the radial collector wells would originate from Biscayne Bay. Cooling tower blowdown discharge and other applicable plant discharge effluents from Units 6 & 7 would be collected in a common blowdown sump and discharged into deep injection wells, as described in Section 3.4. None of the surface water bodies would be used as an effluent discharge point or heat sink for Units 6 & 7.

Units 6 & 7 transmission lines would use existing and new corridors. New corridors would be established to supplement existing corridors where necessary. The transmission corridors are described in Section 3.7.

2.3.1.1.1 The Everglades

The Everglades is the largest wetland in the continental United States and was part of the larger, natural Kissimmee-Okeechobee-Everglades watershed that once extended south from Lake Okeechobee to the southernmost extremity of peninsular Florida (McPherson and Halley 1997). Elevations within the Everglades, which was formed on limestone bedrock, are lower than the elevations in the Immokalee Rise or Atlantic Coastal Ridge physiographic subprovinces and slope towards the south with an average gradient less than 2 inches per mile (McPherson and Halley 1997, Galloway et al. 1999). The freshwater flow from Lake Okeechobee and the flat terrain of the basin supported the accumulation of layers of peat and mud that formed the historical Everglades wetlands over an area of approximately 4500 square miles (McPherson and Halley 1997, Galloway et al. 1999). Historically, overflows from Lake Okeechobee slowly moved through the Everglades as sheet flows. The overflow also provided the freshwater supply that sustained the ecosystem functions within the wetlands that were dominated by sawgrass and tree islands, the small, forested islands that are a prominent feature of the Everglades (McPherson and Halley 1997, Godfrey 2006). From the Everglades, water drained south to the Gulf of Mexico through a series of open-water sloughs. Hydrological features and direction of historical surface water flows are shown on Figure 2.3-6.

The Atlantic Coastal Ridge that separates the Everglades from the Atlantic coastline has a maximum elevation of approximately 20 feet above MSL datum (Galloway et al. 1999), which is equivalent to the National Geodetic Vertical Datum of 1929 (NGVD 29). At the National Oceanic and Atmospheric Administration (NOAA) tide gage station at Virginia Key, Florida, the NGVD 29 is located approximately 1.6 feet below the NAVD 88. This datum relationship is also considered applicable to the Units 6 & 7 plant area. Applying the datum conversion, the maximum elevation of the Atlantic Coastal Ridge is approximately 18.4 feet NAVD 88. The NAVD 88 is used as the reference vertical datum in this subsection. A conversion to NAVD 88 is provided when a reference to other vertical datums are made. Historically, nearly all of southeast Florida, except for the Atlantic Coastal Ridge, was flooded annually (Galloway et al. 1999). The floodwater discharged to Biscayne Bay through the undeveloped Miami, New, and Hillsborough Rivers and other sloughs that formed the transverse glades in the Atlantic Coastal Ridge.

Since the late nineteenth century, the south Florida watershed subregion has been affected by anthropogenic alterations (Ishman 1997, Godfrey 2006). Land reclamation for agriculture, construction of flood control levees and drainage canals, and urbanization has irreversibly modified the hydrology of the region. One of the major impacts of the hydrologic modification is the reduction of freshwater flow to the Everglades, which resulted in a degradation of the south

Florida ecosystem. Canals were first dug through the Everglades to drain water from the area south of Lake Okeechobee, thus enabling agriculture to develop during the late nineteenth century (McPherson and Halley 1997, Renken et al. 2005, Godfrey 2006). By the late 1920s, major canals were constructed and rivers in the transverse glades were modified to connect Lake Okeechobee with the Gulf of Mexico and Atlantic Ocean (Figure 2.3-7). In the west, the Caloosahatchee Canal connected Lake Okeechobee with the Gulf of Mexico. St. Lucie Canal in the east connected Lake Okeechobee with the St. Lucie River and estuary. In the southeast, the West Palm Beach, Hillsborough, North New River, South New River, and Miami (River) Canals connected Lake Okeechobee with the Biscayne Bay and the Atlantic Ocean (McPherson and Halley 1997, Renken et al. 2005, Godfrey 2006). Government-initiated flood control measures including levee construction and drainage channel modification began in the 1930s (Godfrey 2006).

The consequences of the Everglades watershed alterations were the destruction of plants and wildlife, soil subsidence, saltwater intrusion, and fires in the peat layers during periods of drought (Godfrey 2006). To counter the deteriorating environmental conditions, the U.S. Congress authorized the Central and Southern Florida Flood Control Project (C&SF project) in 1948 with a mandate to provide flood protection, water supply, prevention of saltwater intrusion, and protection of fish and wildlife resources (McPherson and Halley 1997, Godfrey 2006). The state of Florida formed the Central and Southern Florida Flood Control District in 1949, which later became the South Florida Water Management District (SFWMD), to work with the C&SF project. The C&SF project adopted a water-management plan for Lake Okeechobee and three water conservation areas (WCAs) to provide flood protection and water supply through a complex series of canals, levees, pumps, and control structures (McPherson and Halley 1997, Renken et al. 2005, Godfrey 2006). An area of approximately 800,000 acres was identified in the northern Everglades, on the basis of soil thickness and geologic formations, as potential agricultural land and referred to as the Everglades Agricultural Area (EAA), which was subsequently drained and farmed. The WCAs, which are approximately 900,000 acres of land enclosed by levees and canals, were constructed in the central Everglades (McPherson and Halley 1997). The locations of the EAA and the WCAs are shown on Figure 2.3-7.

The construction of the flood control canals, levees, and structures by the C&SF project causes a large portion of runoff that originally flowed from the Kissimmee River and Lake Okeechobee into the Everglades to be diverted directly to the Gulf of Mexico by the Caloosahatchee Canal and to the Atlantic Ocean by the St. Lucie Canal. The remaining outflow from the lake discharges to the canals that pass through the EAA (McPherson and Halley 1997). Before flood control, agriculture, and urbanization development, which began in the late nineteenth century, the natural water level in the lake overflowed its southern bank at elevations 20 to 21 feet NGVD 29 (18.4 to 19.4 feet NAVD 88). Currently, the lake water level is artificially maintained at approximately 13 to 16 feet NGVD 29 (11.4 to 14.4 feet NAVD 88) (Galloway et al. 1999). Surface water flows from the EAA into the WCAs are maintained by pumping, resulting in alterations in the timing and spatial distribution of flows, as well as a reduction in the volume of water discharged. As a result, water levels in the Everglades at present are generally shallower and have shorter hydroperiods than water levels prior to late nineteenth century development (McPherson and Halley 1997, Galloway et al. 1999). By 1930, the network of mostly uncontrolled canals drained large quantities of freshwater from the Everglades into the Atlantic Ocean, lowering the water levels in the Everglades as much as 6 feet compared to the predevelopment period (Renken et al. 2005). In the southern part of the Everglades, levees impede water flows and cause ponding, which became evident during the mid-1960s in WCA-3 with extensive flooding of tree islands. During periods of drought, water is released from Lake Okeechobee to the EAA and the WCAs. Most of the flows, however, never reach the interior marshes as the flows are confined to canals and nearby marshes (Wolfert-Lohmann et al. 2007). Post-development drainage patterns in the Everglades are shown on Figure 2.3-7.

By 2000, approximately 50 percent of the historic Everglades basin in Florida remained undeveloped (Renken et al. 2005). The rest of the area has been altered for agriculture or urban growth (Godfrey 2006). Most of the remaining portions of the Everglades at present are protected by public parks including Everglades National Park, Big Cypress National Preserve, Loxahatchee National Wildlife Refuge, the WCAs, the Fakahatchee Strand State Preserve, and other state lands (McPherson and Halley 1997). Everglades National Park was established in 1947 on marshland south of the WCAs and now covers approximately 1.4 million acres (McPherson and Halley 1997). Everglades National Park is approximately 15 miles west of the Units 6 & 7 plant area and is adjacent to the southeast Florida drainage canal system.

In 2000, the Federal Water Resources Development Act authorized a Comprehensive Everglades Restoration Plan (CERP) to guide the restoration, protection, and preservation of the water resources of central and southern Florida, including the Everglades (CERP 2008a). The plan covers 16 counties over an area of 18,000 square-miles and focuses on updating the C&SF project. The CERP includes more than 60 elements that would require more than 30 years to construct (CERP 2008a). The CERP projects would improve south Florida's ecosystem by restoring water flows that have changed over the past century. CERP projects would capture and store freshwater flows in surface and subsurface reservoirs, which are currently released to the Atlantic Ocean and Gulf of Mexico. The freshwater would be directed to the wetlands, lakes, rivers, and estuaries of south Florida while also ensuring future urban and agricultural water supplies (CERP 2008a). The reservoir storage areas would mainly be located within the EAA and WCAs.

2.3.1.1.2 Everglades National Park-South Dade Conveyance System

The development of reclaimed land from the Everglades for agriculture, urbanization, and flood control needs resulted in a gradual construction of canals and levees in the south Florida region before the implementation of the C&SF project. The systematic and elaborate construction of drainage canals in southern Dade County was initiated in the 1960s. The federal Flood Control Act of 1962 authorized the C&SF project for southern Dade County. The C&SF project implemented a system of canals and structures to provide drainage for urban development, prevent over-drainage of agricultural lands, and prevent contamination of groundwater by saltwater intrusion (USACE 2007). The conveyance system relies on gravity drainage through a primary network of 12 canals with outlets to serve a system of secondary canals (USACE 2007). The stages of development of the canals during the 1950s and 1960s are shown on Figure 2.3-8.

The canal system was modified in the 1970s to meet the hydrologic needs of the Everglades National Park, as authorized by the updated Flood Control Act of 1968, by implementing the ENP-SDCS (USACE 2007). ENP-SDCS interconnected several drainage basins of the C&SF drainage project (Cooper and Lane 1987). Gated control structures were first installed at the eastern (coastal) end of the primary canals to release excess stormwater runoff to the coastal water bodies during the wet season and to manage saltwater intrusion during the dry seasons. Secondary controls on the inland reaches of canals were then installed to regulate flow eastward, control inland and agricultural flooding, and maintain higher water levels in the surficial aquifer system where appropriate (Renken et al. 2005). The surface water canal system was fully developed in the 1980s when the ENP-SDCS was completed. The progression of canal development during the 1970s through 1990 is shown on Figure 2.3-9. The conveyance system met its objectives by providing agricultural water supply, controlling inland flooding, and mitigating saltwater intrusion (Renken et al. 2005).

The ENP-SDCS was mandated to supply 55,000 acre-feet of water per year to the Everglades National Park. It made use of the existing canals from the C&SF project (Cooper and Lane 1987). The existing north-south directed borrow canals, L-30 and L-31N/L-31W, were enlarged to convey water from the Miami Canal (C-6) to the Everglades. The west-east running canals provide drainage from the South Dade development corridor to Biscayne Bay by control structures at the mouth of the canals (Renken et al. 2005). The locations of present day ENP-SDCS and C&SF project drainage canals are shown on Figure 2.3-10. The western borrow canal of the Levee L31-E (L-31E Canal) runs parallel to the Biscayne Bay coastline in southern Miami-Dade County, separating the coastal wetlands along the bay from the mainland. Starting north of Black Creek Canal (C-1) and extending to Card Sound Road in the south, the L-31E Canal has a levee crest elevation of approximately 7 feet NAVD 88 (SFWMD 2006a). Near the Turkey Point plant property, the levee and canal are located immediately west of the Turkey Point interceptor ditch and the industrial wastewater facility.

Based on the hydrology of the area, the U.S. Army Corps of Engineers (USACE) delineated water management subbasins in southern Dade County (Cooper and Lane 1987). At present, the water management area includes 17 subbasins that contribute flow to Biscayne Bay and the Everglades, as shown on Figure 2.3-10. Surface water flows from the drainage subbasins to

Biscayne Bay or the Everglades are controlled by numerous flow control structures. Flow control structures also control flow between the subbasin areas. The names of subbasins are based on the major canal in the subbasin. A summary of the subbasins (with names corresponding to the primary canal servicing each of the areas), drainage areas, and the control structures at basin outlets that regulate flow to Biscayne Bay is provided in Table 2.3-1 (Cooper and Lane 1987). The locations of the major control structures are shown on Figure 2.3-10.

Detailed flow and water level monitoring and measurements are performed as part of the operation of the structures in the ENP-SDCS. A search in the SFWMD database (DBHYDRO) for flow and water level monitoring data within the subbasins listed in Table 2.3-1 returned approximately 700 records (SFWMD 2009). The DBHYDRO database includes data from stations maintained by various agencies including USGS, SFWMD, and Everglades National Park. Monthly mean flow rates and water levels at four stations near the Units 6 & 7 plant area, S-197, S-20, S-21A, and S-21, were obtained from the SFWMD database. Details of the station locations and available data records are presented in Table 2.3-2. Monthly mean flow rates and water levels at the selected locations are presented in Tables 2.3-3 through 2.3-10. The location of these structures is shown on Figure 2.3-10.

2.3.1.1.3 Biscayne Bay

Biscayne Bay is a shallow coastal lagoon located on the lower southeast coast of Florida (Langevin 2001). The bay is approximately 38 miles long, approximately 11 miles wide on average, and has an area of approximately 428 square miles (USGS 2004 and Wingard 2004). Biscayne Bay began forming between 5000 and 3000 years ago as sea level rose and filled a limestone depression (Wolfert-Lohmann et al. 2007). The eastern boundary of Biscayne Bay is composed of barrier islands that also form part of the Florida Keys and separates the bay from the Atlantic Ocean (NOAA 2000). Coral reefs east of the barrier islands make up the northern extent of the Florida reef tract (USGS 2004). Several canals on the western shore discharge surface water into the bay, as described in Subsection 2.3.1.1.2. The Biscayne Bay subbasin is hydrologically connected with the Everglades, as shown in Figure 2.3-5. Biscayne Bay is connected to the Atlantic Ocean by a wide and shallow opening of coral shoal near the middle of the bay that is known as the safety valve, and by several channels and cuts (Cantillo et al. 2000). Because Biscayne Bay, unlike most estuaries, is not a drowned river valley, sediment inflow to the bay from rivers/canals is insignificant.

Part of Biscayne Bay is within the designated boundary of Biscayne National Park. With an area of 172,000 acres, Biscayne National Park is the largest marine park in the U.S. National Park system. More than 95 percent of Biscayne National Park is located in the marine environment (USGS 2006). The park contains a narrow fringe of mangrove forest along the mainland. Similar mangrove zones are present along the southern expanse of Biscayne Bay and in the northernmost islands of the Florida Keys including Elliott Key (BNP 2008b).

For basin-wide planning purposes, Biscayne Bay is divided into three subregions: North Bay, Central Bay, and South Bay (Cantillo et al. 2000). North Bay extends from approximately 5 miles north of the Miami-Dade/Broward County boundary to the highly urbanized shoreline near Miami, Florida; Central Bay extends from the shoreline near Miami, Florida to the Featherbed Banks east of Black Creek Canal; and South Bay extends from the Featherbed Banks east of Black Creek Canal to Barnes Sound (Figure 2.3-10). The Turkey Point plant property is located on South Bay, which is generally undeveloped and fringed by mangrove wetlands. The South Bay (also identified as the Lower Biscayne Bay) is approximately 100 square miles in area.

The average depth of Biscayne Bay is approximately 6 feet with a maximum depth of approximately 13 feet (Caccia and Boyer 2005). The volume of the bay at mean low water is approximately 1.5E10 cubic feet. The mean low water datum is located at approximately elevation -1.9 feet NAVD 88 at the NOAA Virginia Key, Florida station (NOAA 2008a).

Tides in Biscayne Bay are semidiurnal. NOAA maintains tidal stations in Biscayne Bay and surrounding areas (NOAA 2008b). A list of selected stations near Units 6 & 7 and their estimated tidal ranges are presented in Table 2.3-11. The stations with more than 10 years of record that remain in operation include Virginia Key, Florida (NOAA station 8723214), Vaca Key, Florida (8723970), and Key West, Florida (8724580) (NOAA 2008c, NOAA 2008d, and NOAA 2008e). The Virginia Key, Florida station is located approximately 25 miles north-northeast of the Units 6 & 7 plant area. The Vaca Key, Florida and Key West, Florida stations are located approximately 70 miles and 110 miles southwest of the plant area, respectively. Historical high and low water levels at these stations are presented in Table 2.3-12. Other stations, as listed in Table 2.3-11, are located within Biscayne Bay and Card Sound with only short periods of tidal data and are no longer active. The locations of the tidal stations are shown on Figure 2.3-12.

In Biscayne Bay, the great diurnal tide range, which is the difference between the mean higher high and mean lower low tide levels, is higher near the entrance of the bay, as shown in Table 2.3-11 and Figure 2.3-12. At the Cutler, Biscayne Bay, Florida station, the great diurnal range is 2.13 feet. Near the Units 6 & 7 plant area, the range is 1.78 feet, and in southern Biscayne Bay at Card Sound Bridge station, the range is reduced to 0.63 feet. The 100-year return period low water level in Biscayne Bay near the Units 6 & 7 plant area is estimated to be approximately –3.8 feet NAVD 88.

Monthly mean salinities vary widely over Biscayne Bay, ranging from a low of approximately 6 parts per thousand (ppt) to a high of 42 ppt, depending on the amount of rainfall and surface drainage reaching the coastal zone (Caccia and Boyer 2005). The bay is shallow and well mixed with only a weak salinity-based density gradient generated by the freshwater discharge from the canals on the western side. Salinity in the bay is affected by the pronounced wet-dry seasonal dynamics and is highest in June when rainfall is low and evaporation is high (BNP 2008b, Caccia and Boyer 2005). Natural water temperatures range from 59°F to 92°F at the surface, with little or no thermal stratification.

Studies of Biscayne Bay show the principal circulation forces to be tidal. Hurricane storm events with persistent wind for long periods may also cause relatively large water movements. Measurements of tidal flow past discrete points such as Cutter Bank (east of the industrial wastewater facility) average approximately 50,000 acre-feet per day, or a continuous flow of 60,000 acre-feet per half tidal cycle. Tidal exchange between Biscayne Bay and the Atlantic Ocean is estimated to be less than 10,000 acre-feet per day. Apart from the wide and shallow opening of coral shoal near the middle of the bay, the major creeks and sloughs that control the tidal circulation within Biscayne Bay and interact with the Atlantic Ocean flows include Angelfish Creek, Broad Creek, and Caesar Creek in the South Bay and Virginia Key Channel in the North Bay. Measured data indicate a net southward tidal current magnitude of approximately 0.018 meter per second (0.06 foot per second) (Wang et al. 2003). The 10-year annual mean and seasonal freshwater inflow to the bay from major canals over a period from 1994 to 2003 are presented in Table 2.3-13 (Caccia and Boyer 2005).

Bathymetry variation within Biscayne Bay is shown on Figure 2.3-13. Long- and short-term shoreline change rates for the bay are not available. The average long-term rate of shoreline change for east Florida along the Atlantic coast shoreline is 0.2 ± 0.6 meter per year (0.66 ± 2.0 feet per year) (Morton and Miller 2005). This long-term shoreline rate of change is relatively small compared to shoreline changes for the other parts of the southeast Atlantic coast (Morton and Miller 2005). Shoreline changes within Biscayne Bay would be smaller than the rates for the Atlantic coast shoreline because the bay is protected from tide and wave actions by the barrier islands. The long-term trends in sea level rise at Miami Beach, Vaca Key, and Key West, Florida are approximately 2.39 ± 0.43 millimeters/year (0.09 ± 0.017 inch per year), 2.78 ± 0.6 millimeters/year (0.11 ± 0.024 inch per year), and 2.24 ± 0.16 millimeters per year (0.09 ± 0.006 inch per year), respectively (NOAA 2008f). Because Units 6 & 7 would not use surface water from or discharge process water into Biscayne Bay, detailed sediment transport properties for the bay are not provided.

The South Bay also includes Card Sound and Barnes Sound south of Biscayne Bay. Card Sound is part of the Biscayne Bay Aquatic Preserve of the Upper Florida Keys. Freshwater input to Card Sound is primarily surficial sheet flow with additional flow from groundwater upwelling (Ishman 1997). Circulation within Card Sound and Barnes Sound is restricted because of the enclosed configuration of the sounds by barrier islands that increases residence times of its waters (Ishman 1997).

The waters of Biscayne Bay support a rich and diverse ecosystem of marine fauna and flora, and the bay serves the coral reef and marine ecosystems of Biscayne National Park. As Biscayne Bay evolved and formed, a natural cyclical change occurred as a result of the large-scale physical variation, such as sea level and climate change. Analysis of sediment core data from Biscayne Bay and Card Sound indicates that the Biscayne Bay ecosystem underwent many substantial changes between the last 100 and 500 years (Ishman 1997). Southern Biscayne Bay, including Card Sound and Barnes Sound, has been relatively isolated from direct marine influence for at least the last two centuries, and this area is less affected by the urbanization that has occurred to the north. Despite its relative isolation, however, the area has changed substantially during the last century (Ishman 1997). At Card Bank, salinity has varied substantially on multidecadal and centennial time scales relative to the variation observed at central Biscayne Bay sites. Marine influence at Card Bank has increased over the last century. The mud banks of central Biscayne Bay have become increasingly marine and increasingly stable (showing less fluctuation in salinity) during the last 100 years (Ishman 1997). The statutory and legal restrictions of surface water use and the list of impaired waters near the Units 6 & 7 plant area are described in Subsections 2.3.2.1.3 and 2.3.3.1.3, respectively.

2.3.1.1.4 Industrial Wastewater Facility

Units 1 through 4 use the cooling canals of the industrial wastewater facility for condenser and auxiliary system cooling (Figure 2.3-3). The industrial wastewater facility also receives cooling tower blowdown from Unit 5 and existing facilities drainage. The industrial wastewater facility is a closed-loop system of canals for cooling water recirculation with no surface water discharge or surface water interaction with surrounding hydrology. The unlined cooling canals act as a cooling basin that covers an area of approximately 5900 acres spread over a length of approximately 5 miles and a width of approximately 2 miles. Plant cooling water discharged to the canals on the northwestern side is distributed into 32 feeder canals flowing south. The feeder canals flow to a single collector canal in the south, which then distributes water to seven return canals flowing north to the intakes, as shown on Figure 2.3-14. The canals are approximately 200 feet wide with a centerline distance of approximately 290 feet (see Figure 2.3-14). The top elevation of the berms is approximately 7.8 feet above mean low water (5.9 feet NAVD 88). The feeder and return canals are shallow, generally 1 to 3 feet deep, with the exception of the westernmost return canal (formerly Card Sound Canal), which extends to a depth of –18 feet NGVD 29 (–19.6 feet NAVD 88). Routine maintenance of the canals is performed for the removal of aquatic vegetation to minimize flow restriction.

Plant circulating water for Units 1 through 4, and cooling tower blowdown from Unit 5 pumped at the northern end of the feeder canals provide the maximum hydraulic head at the northern end of the canals. The total circulating water flow in the industrial wastewater facility for Units 1 through 4 is 4250 cubic-feet per second. The cooling tower blowdown from Unit 5 is approximately 737 acre-feet per month (12.4 cubic feet per second). The hydraulic head is lowest at the north end of the return canals providing required water flow to the intake pumps. The difference in hydraulic head between the westernmost feeder canals and the easternmost return canals is approximately 3 feet that drives the circulating flow in the industrial wastewater facility. Water level measurements and analysis suggest that the industrial wastewater facility acts to attenuate semi-diurnal and diurnal tidal influences from Biscayne Bay. Because the canals are not lined, groundwater flow interacts with water in the cooling canals. The cooling canals also experience losses as a result of evaporation and seepage. Makeup water for the industrial wastewater facility comes from treated process wastewater, rainfall, stormwater runoff, and groundwater infiltration. The water in the industrial wastewater facility is hypersaline with salinity concentrations approximately twice that of Biscayne Bay.

The initial design of the collector canal considered a connection of the canal with Card Sound (extending the westernmost return canal). However, the wastewater permit conditions required the canal to be cut off from Card Sound at the southern end of the industrial wastewater facility. At present, the remnant canal (south of the westernmost return canal) does not receive any surface water flow from the industrial wastewater facility and is only connected to Card Sound.

Along the northwest and west sides of the industrial wastewater facility, an interceptor ditch was constructed that has no surface water connection to the industrial wastewater facility or other surface waters. The interceptor ditch with a bottom elevation of –18 feet mean low water (or –19.9 feet NAVD 88) is located just west of and adjacent to the industrial wastewater facility, and east of the L-31E levee. The purpose of the ditch is to restrict inland movement of water from the industrial wastewater facility by pumping water from the interceptor ditch back into the industrial wastewater facility, thereby maintaining the water level in the ditch lower than the water level in L-31E Canal. Pumping from the interceptor ditch to the industrial wastewater facility is performed based on water level monitoring in the interceptor ditch and L-31E Canal at locations and frequencies agreed upon by FPL and SFWMD. This pumping prevents seepage from the industrial wastewater facility from moving landward toward the L-31E Canal and maintains freshwater west of the interceptor ditch.

2.3.1.1.5 Local Site Drainage

The Units 6 & 7 plant area is separated from the low-lying mangrove flatlands of the Biscayne Bay Coastal Wetlands. The Turkey Point units including the industrial wastewater facility is bordered by Biscayne Bay and the L-31E Canal to the east and west, respectively, by the Florida City Canal to the north, and by Card Sound Road and Card Sound to the south. Because the L-31E levee intercepted freshwater flows that historically discharged as sheet flow to the coastal wetlands and the bay east of the canal, the salinity of the wetlands has increased over time. Outflows from the canals near Units 6 & 7 are controlled by two flow control structures, S-20 and S-20F. Public works projects in the early 1900s in this area for mosquito control and land reclamation included shallow ditches approximately 6 to 10 feet wide. The shallow mosquito ditches run north-south, and the drainage ditches run east-west that provided quick drainage of the wetlands. Remnants of the ditches can still be identified in the area (Ruiz and Ross 2004).

The SFWMD has undertaken a plan (Biscayne Bay Coastal Wetlands Project) to restore the Biscayne Bay ecosystem that would include areas surrounding the Turkey Point units. At present, FPL maintains wetland areas north and west of Unit 5 (TP 5 Mitigation Area). FPL is also implementing a wetland mitigation project west and southwest of the Units 6 & 7 plant area (Everglades Mitigation Bank). These wetland areas are shown on Figure 2.3-2 and Figure 2.3-3. Locations of wetlands near the Units 6 & 7 plant area, as designated by the U.S. Fish and Wildlife Services, are shown on Figure 2.3-15.

The Biscayne Bay Coastal Wetlands Project would provide overland sheet flow in a 13,600-acre area through the construction of spreader canals and other structures (CERP 2008b). The increased natural water flow is designed to improve the ecology of Biscayne Bay including its freshwater and tidal wetlands, nearshore bay habitat, marine nursery habitat, oysters, and the oyster reef community. Any future hydrologic changes brought about by the project would not have any adverse flooding and water use impacts on Units 6 & 7.

The design basis flood elevation for Units 6 & 7 was predicted from a probable maximum surge event combined with the effects of wind-driven wave activity. The design basis flood elevation thus obtained is at 24.8 feet NAVD 88. The corresponding hurricane surge stillwater level is 21.1 feet NAVD 88. The Federal Emergency Management Agency (FEMA) Flood Insurance Study for Dade County indicates that the most severe flooding of the county would be as a result of hurricane storm surge events (FEMA 1994). The Flood Insurance Study estimated the surge elevations (stillwater level) at selected transect locations along the Biscayne Bay shoreline. The Units 6 & 7 plant area lies between Transect 30 in the north to Transect 31 in the south. The maximum stillwater levels in the transects vary between 12.0 feet and 12.4 feet NGVD 29 for a 500-year return period, which are approximately 10.4 feet and 10.8 feet NAVD 88.

2.3.1.2 Groundwater

The regional, local, and site-specific data on the physical and hydrologic characteristics of the groundwater resources are summarized in this subsection to provide the basic data for an evaluation of impacts on the aquifers in the area.

2.3.1.2.1 Description and Onsite Use

This subsection contains a description of the regional and local physiography and geomorphology, groundwater aquifers, geologic formations, and groundwater sources and sinks. Regional and onsite uses of groundwater are presented in Subsection 2.3.2, including groundwater production and groundwater flow requirements of Units 6 & 7.

2.3.1.2.1.1 Site and Regional Physiography and Geomorphology

Units 6 & 7 are located in Miami-Dade County, Florida, approximately 25 miles south of Miami, 8 miles east of Florida City, and 9 miles southeast of Homestead. The Turkey Point plant property is located within the Southern Slopes subprovince of the Southern Zone of the Florida Platform (a partly submerged peninsula of the Continental Shelf) within the Atlantic Coastal Plain physiographic province (Figure 2.3-16). It is bordered on the east by Biscayne Bay, on the west by the Everglades Mitigation Bank, and on the northeast by Biscayne National Park. The Florida Platform is underlain by approximately 4000 to 15,000 feet of clastic deposits (quartz sands, silt, marl, and clay) and nonclastic deposits of carbonate rocks (shell beds, calcareous sandstone, limestone, dolostone, dolomite, and anhydrite). The sediments range in age from Paleozoic to Recent and overlay the basement complex of Jurassic and Paleozoic age. A description of the regional and site-specific geology, physiography, and geomorphology is provided in Section 2.6.

The physiographic features surrounding Units 6 & 7 are the Atlantic Coastal ridge, the Everglades, and the Florida Keys. The geomorphology of Florida has been described in the literature (White 1970 and Randazzo and Jones 1997) as having three zones: Northern, Central, and Southern. The plant property is in the Southern Zone (Figure 2.3-16). The property spans former coastal mangrove swamps and tidal flats along the west margin of Biscayne Bay that were altered to create the existing and industrial wastewater facility/cooling canals.

The existing ground surface in the Units 6 & 7 plant area is generally flat, with elevations ranging from –2.4 to 0.8 feet NAVD 88. Vegetated depressions resulting from surficial erosion or solutioning are observed on the plant area. Two remnant canals cross the Units 6 & 7 plant area and are connected to the industrial wastewater facility on the eastern side. The 5900-acre industrial wastewater facility, of which 4370 acres is water surface, is the predominant surface water feature on the plant property. A detailed description is provided in Subsection 2.3.1.2.2.5.

The surficial geology within the Units 6 & 7 plant area consists primarily of organic muck. The organic muck is described as either light gray–dark gray to pale brown with trace amounts of shell fragments and little to no reaction to hydrochloric acid, or black to brown with organic fibers and strong reaction to hydrochloric acid. The thickness of the muck across the Units 6 & 7 plant area typically varies from 2 to 7 feet with an average thickness of 3.4 feet (MACTEC 2008). The Miami Limestone underlies the muck and is a marine carbonate consisting predominately of white to gray oolitic limestone with varying abundances of fossils such as mollusks, bryozoans, and corals.

2.3.1.2.1.2 Regional Groundwater Aquifers

The regional hydrostratigraphic framework of Florida consists of a thick sequence of Cenozoic sediments which comprise three major aquifers: (1) the surficial aquifer system, (2) intermediate aquifer system/confining unit, and (3) the Floridan aquifer system (SEGS 1986). The hydrologic parameters and lithologies of each aquifer system vary widely across the state. A generalized hydrostratigraphic column is presented in Figure 2.3-17.

Surficial Aquifer System

The surficial aquifer system is defined by the Southeastern Geological Society (SEGS) Ad Hoc Committee (SEGS 1986) as "the permeable hydrologic unit contiguous with the land surface that is comprised principally of unconsolidated to poorly indurated, siliciclastic deposits." Rocks making up the surficial aquifer system belong to all or part of the Upper Miocene to Holocene Series, consisting primarily of quartz sands, shell beds, and carbonates. In southern Florida, the surficial aquifer system consists of the Tamiami, Caloosahatchee, Fort Thompson, and Anastasia Formations; the Key Largo and Miami Limestones; and undifferentiated sediments (SEGS 1986).

The surficial aquifer system is under mainly unconfined conditions; however, beds of low permeability may cause semi-confined or locally confined conditions in its deeper parts. The base of the surficial aquifer system coincides with the top of laterally extensive and vertically persistent beds of low permeability belonging to the intermediate aquifer system/confining unit. Regionally, the thickness of the surficial aquifer system ranges from approximately 20 to 400 feet.

The main aquifer in the surficial aquifer system in southeastern Florida is the Biscayne aquifer, which is used for primary water supply. The Biscayne aquifer has been declared a sole-source aquifer (SSA) by the U.S. Environmental Protection Agency (EPA). An SSA is defined as "an underground water source that supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer. These areas have no alternative drinking water source(s) that could physically, legally, and economically supply all those who depend upon the aquifer for drinking water" (U.S. EPA 2011). Figure 2.3-18 shows the locations of SSAs in EPA Region 4. The figure also contains a description of the limits of the Biscayne SSA. Although the Biscayne aquifer underlies the Units 6 & 7 plant area, it contains saline to saltwater in this area and is not usable as a potable water supply.

Intermediate Aquifer System/Confining Unit

Regionally, a sequence of relatively low-permeability, largely clayey deposits approximately 900 feet thick forms a confining unit that separates the Biscayne aquifer from the underlying, fresh-to-saltwater Floridan aquifer system. The confining unit also contains transmissive units that can locally act as an aquifer system.

The SEGS (1986) defines the intermediate aquifer system/confining unit as "all rocks that lie between and collectively retard the exchange of water between the overlying surficial aquifer system and the underlying Floridan aquifer system." In general, the rocks of this system consist of fine-grained siliciclastic deposits interlayered with carbonate strata of Miocene or younger age.

In areas where poorly yielding to nonwater-yielding units occur, the term "intermediate confining unit" is used. In areas where low- to moderate-yielding units are interlayered with relatively impermeable confining beds, the term "intermediate aquifer system" applies. The aquifer's units within this system contain water under confined conditions. The top of the intermediate aquifer system/confining unit coincides with the base of the surficial aquifer system. The base of the intermediate aquifer, or confining unit, is at the top of the vertically persistent, permeable, carbonate section that comprises the Floridan aquifer system. The sediments comprising the intermediate aquifer system/confining unit are widely variable across the state. In the southern part of the state, the Hawthorn Group, consisting of the Peace River Formation and the Arcadia Formation, forms both an intermediate confining unit and an intermediate aquifer system. The Hawthorn Group sediments are up to approximately 900 feet thick in southern Florida (Figure 2.3-17). In many areas of the state, permeable carbonates occurring at the base of the Hawthorn Group may be hydraulically connected to the Floridan aquifer system and locally form the top of the Upper Floridan aquifer. The intermediate confining unit provides an effective aquiclude for the Floridan aquifer system throughout the state.

Floridan Aquifer System

The Floridan aquifer system underlies approximately 100,000 square miles in southern Alabama, southeastern Georgia, southern South Carolina, and all of Florida. Potable water is present in some parts of the aquifer. As defined by Miller (1986), the Floridan aquifer system is a vertically continuous sequence of interbedded carbonate rocks of Tertiary age that are hydraulically interconnected by varying degrees and with permeabilities several orders of magnitude greater than the hydrogeologic systems above and below. The system may occur as a continuous series of vertically connected carbonate sediments or may be separated by sub-regional to regional confining beds (Miller 1986). The Floridan aquifer formally consists of three main hydrogeologic units: the Upper Floridan aquifer, the middle confining unit, and the Lower Floridan aquifer (Figure 2.3-17). Porosity and permeability in the aquifer units vary widely depending on location and formation.

In southern Florida, the Floridan aquifer system is composed of all or parts of the Cedar Keys Formation, Oldsmar Formation, Avon Park Formation, Ocala Limestone, Suwannee Limestone, and, possibly, the basal carbonates of the Hawthorn Group in limited areas.

In southern Florida, the top of the Floridan aquifer system ranges in elevation from approximately –1000 feet National Geodetic Vertical Datum of 1929 (NGVD 29) to more than –1100 feet NGVD 29 with thicknesses ranging from approximately 2300 feet to more than 3400 feet (Miller 1986). Throughout most of southern Florida, the Floridan aquifer system occurs under confined conditions.

2.3.1.2.1.3 Local Hydrogeology

Two major aquifers underlie the local area including all of Miami-Dade County and the Units 6 & 7 plant area:

- The surficial aquifer system, comprised of the Biscayne aquifer
- The Floridan aquifer system consisting of the Upper Floridan aquifer, the middle confining unit, and the Lower Floridan aquifer

A site-specific hydrostratigraphic column developed from borings drilled up to maximum depths of approximately 615 feet below ground surface (bgs) is presented in Figure 2.3-19.

The Biscayne aquifer extends from near surface to a depth of approximately 240 feet near Fort Lauderdale and approximately 80 to 115 feet locally.

The Upper Floridan aquifer extends from approximately 1000 to 1200 feet bgs. The middle confining unit extends from approximately 1200 to 2400 feet bgs. The Lower Floridan aquifer extends from approximately 2400 feet bgs to an undetermined depth thought to be greater than 4000 feet bgs in the Miami-Dade County area. The Boulder Zone in the Lower Floridan aquifer extends from approximately 2800 to at least 3000 feet bgs at the MDWASD South District Wastewater Treatment Plant (SDWTP)(Starr et al. 2001), which is located approximately 9 miles north of the Units 6 & 7 plant area.

Surficial (Biscayne) Aquifer

The surficial aquifer system comprises all the rocks and sediments from the land surface downward to the top of the intermediate confining unit. These lithologic materials consist primarily of limestones and sandstones with sands, shells, and clayey sand with minor clays and silts. The base of the system is defined by a significant change in hydraulic conductivity. Sedimentary bedrock and unconsolidated sediments in the surficial aquifer system have a wide range of hydraulic properties and locally may be divided into one or more aquifers separated by less-permeable or semi-confining units. Within the surficial aquifer system, the major water-producing unit is the unconfined Biscayne aquifer, which underlies the Units 6 & 7 plant area and all of Miami-Dade County and parts of Broward, Monroe, and Palm Beach counties, as shown in Figure 2.3-21. The aquifer contains carbonate rocks, sandstones, and sand extending from land surface to an elevation of approximately –10 feet NGVD 29 in southern Miami-Dade County and deepening northward to more than elevation –240 feet NGVD 29 in southeastern Palm Beach County and eastern Broward County (Figure 2.3-22). These formations include, from oldest to youngest (bottom to top): the upper portion of the Tamiami Formation, Caloosahatchee Formation, Fort Thompson Formation, Anastasia Formation, Key Largo Limestone, Miami Limestone, and Pamlico Sand (Fish and Stewart 1991). However, the entire sequence of units is not present in any one place. In the vicinity of the plant area, the formations within the Biscayne aquifer include the Miami Limestone, Key Largo Limestone, and the Fort Thompson Formation (Figure 2.3-19). The Fort Thompson Formation and Key Largo Limestone are the major water producing formations within the aquifer (Miller 1990). Site-specific boring data (Subsection 2.3.1.2.1.4) indicates that the maximum thickness of the Biscayne aquifer is approximately 115 feet at the Units 6 & 7 plant area.

The water table occurs primarily within the organic soils (muck) or the Miami Limestone and fluctuates in response to variations in tide levels, recharge, natural discharge, water levels in adjacent canals, and well withdrawal/injection. The aquifer extends beneath Biscayne Bay and the Atlantic Ocean. Because of the aquifer's high permeability, and in response to the lowering of inland groundwater levels due to pumpage, saltwater has migrated inland along the base of the aquifer and affects the entire coastal zone. Saltwater moves inland and upward in response to low inland groundwater levels and moves seaward and downward in response to high inland groundwater levels (Klein and Hull 1978).

Biscayne aquifer groundwater use in the immediate vicinity of the plant area has been limited due to saline to saltwater composition. Figure 2.3-23 (Langevin 2001) shows the approximate location of the freshwater-saltwater interface in the area. The figure indicates that the saltwater interface at the base of the aquifer is approximately 6 to 8 miles inland of the Units 6 & 7 plant area.

Intermediate Confining Unit

The intermediate confining unit (upper confining unit for the Upper Floridan aquifer) extends from the base of the surficial aquifer system to the top of the Floridan aquifer system and is characterized by complex interbedded lithologies of the Hawthorn Group. These lithologies consist primarily of silty clay, calcareous sands, silts, calcareous wackestones, limestones, sandstones and sands, and obtain a thickness of approximately 600 to 1050 feet at Turkey Point (Reese 1994). Site information suggests a thickness of approximately 700 feet just to the north of Units 6 & 7 site (Unit 5 Upper Floridan aquifer production wells PW-3 [JLA Geosciences 2006]) to approximately 1000 feet southwest of the site (Dames & Moore 1975).

The top of the Hawthorn Group occurs at approximately –100 feet MSL southwest of the site (Dames & Moore 1975) to approximately –215 feet MSL at Units 6 & 7 and production well PW-3 (JLA Geosciences 2006) in the vicinity of the site. The unit is not exposed at the land surface. Sand beds and limestone lenses comprise the permeable parts of the system, however, the overall hydraulic conductivity of the group is very low and provides good confinement for the underlying Floridan aquifer system.

Floridan Aquifer System

The Floridan aquifer system underlies the Units 6 & 7 plant area and all of Florida. The system formally consists of three main hydrogeologic units: the Upper Floridan aquifer, the middle confining unit, and the Lower Floridan aquifer (Figure 2.3-17). In the Miami-Dade County area, the top of the Floridan aquifer system is found at a depth of approximately 1000 feet bgs, is approximately 3000 feet thick, and is directly overlain by the intermediate confining unit. The Floridan aquifer system forms the deepest part of the active groundwater flow system in southeastern Florida (Reese 1994 and SEGS 1986).

<u>Floridan Aquifer System: Upper Floridan Aquifer</u>

The top most hydrogeologic unit of the Floridan aquifer system is the Upper Floridan aquifer. This unit is overlain by the intermediate confining layer that acts as a confining unit to the Upper Floridan aquifer (Stewart 1980). The Upper Floridan aquifer consists of several thin water-bearing zones of high permeability interlayered with thick zones of low permeability. The hydrogeology of the Upper Floridan aquifer varies throughout Florida. In southeastern Florida, the aquifer has been interpreted to include a thinner Suwannee Limestone and extends down into the Avon Park Formation (Figure 2.3-17). Confinement is typically better between flow zones in southwestern Florida than in southeastern Florida (Reese and Richardson 2008). In southeastern Florida, the Upper Floridan aquifer ranges from 100 feet to greater than 400 feet in thickness as shown on Figure 2.3-24. In the vicinity of the Turkey Point plant property, the Upper Floridan aquifer is approximately 200 feet thick.

Although the Upper Floridan aquifer is a major source of potable groundwater in much of Florida, water withdrawn from the unit in southeastern Florida, including Miami-Dade County, is brackish and variable in quality (Reese and Richardson 2008).

<u>Floridan Aquifer System: Middle Confining Unit</u>

The middle confining unit of the Floridan aquifer system underlies the Upper Floridan aquifer, separating it from the Lower Floridan aquifer. In many places, the middle confining unit is divided into upper and lower units separated by the Avon Park permeable zone (Figure 2.3-17). The middle confining unit contains beds of micritic limestone (wackestone to mudstone), dolomitic limestone, and dolomite (dolostone) that are distinctly less permeable that the strata of the Upper Floridan aquifer and Lower Floridan aquifer. The elevation of the top of the middle confining unit is approximately –1200 feet NGVD 29 and the thickness is approximately 1000 feet in the vicinity of the Turkey Point plant property (Reese and Richardson 2008).

Floridan Aquifer System: Lower Floridan Aquifer

The Lower Floridan aquifer in southern Florida consists of a thick sequence of low permeability rocks separated by relatively thin permeable zones (Miller 1986). The aquifer underlies the middle confining unit and extends from a depth of approximately 2400 feet bgs to a depth that is undetermined, but thought to be greater than 4000 feet bgs in the Miami-Dade County area. The Lower Floridan aquifer includes the lower part of the Avon Park Formation, the Oldsmar Limestone, and the upper part of the Cedar Keys Formation (Figure 2.3-17). The base of the Lower Floridan aquifer (or the base of the Floridan aquifer system) is marked by impermeable, massive anhydrite beds of the Cedar Keys Formation (Miller 1986).

A highly permeable zone in the Lower Floridan aquifer known as the Boulder Zone occurs in southern Florida. The Boulder Zone contains saltwater and has been permitted by the Florida Department of Environmental Protection as a zone to discharge treated sewage and other wastes disposed of through injection wells operated in South Florida.

In southern Florida, the Lower Floridan aquifer contains thick confining units above the Boulder Zone. These confining units are similar in lithology to the middle confining unit of the Floridan aquifer system (Reese 1994). The base of the Lower Floridan aquifer is below the base of the Boulder Zone, with the lower section consisting of permeable dolomites or dolomitic limestones of the Cedar Keys Formation (Meyer 1989 and Reese 1994).

2.3.1.2.1.4 Site-Specific Hydrogeology

A subsurface investigation was conducted for Units 6 & 7 between February and June 2008 to evaluate soil, bedrock, and groundwater conditions at depths of up to a maximum of approximately 615 feet bgs. Subsurface information was collected from 94 geotechnical borings, 4 cone penetrometer tests (CPTs), 2 test pits, 22 groundwater observation wells, and 2 surface water stations. Data on the borings, test pits, and cone penetrometer tests in the form of boring logs, laboratory test results, etc., are provided in MACTEC 2008.

The surficial aquifer system within the Turkey Point plant property does not contain all of the regionally identified units. Those units identified within the plant property as a result of subsurface investigations are summarized in descending order as:

- Muck — The surface of the site consists of approximately 2 to 6 feet of organic soils called muck. The muck is composed of recent light gray calcareous silts with varying amounts of organic matter. This unit is not considered to extend into Biscayne Bay, where exposed rock and sandy material is present.

- Miami Limestone — The Pleistocene Miami Limestone is a white, porous sometimes sandy, fossiliferous, oolitic limestone.

- Upper Higher Flow Zone — At the boundary between the Miami Limestone and Key Largo Limestone is a laterally continuous, relatively thin layer of high secondary porosity. The Upper Higher Flow Zone was defined based on a review of geophysical logs and drilling records. The primary identifier was the loss drilling fluid identified at the boundary of the Key Largo Limestone and Miami Limestone. This observation was also coincident with an increase in the boring diameter as identified by caliper logging.

- Key Largo Limestone (interpreted as the Fort Thompson Formation elsewhere) — This is a coralline limestone (fossil coral reef) believed to have formed in a complex of shallow-water, shelf-margin reefs and associated deposits along a topgraphic break during the last interglacial period.

- Freshwater Limestone — At the base of the Key Largo Limestone is a layer of dark-gray fine-grained limestone, referred to as the Freshwater Limestone. Where present, the limestone is generally 2 feet or more thick and often possesses a sharp color change from light to dark gray at its base marking the transition from the Key Largo Limestone to the Fort Thompson Formation. It is not considered to be laterally continuous across the Turkey Point plant property.

- Fort Thompson Formation — The Pleistocene Fort Thompson Formation directly underlies the Key Largo Limestone. The Fort Thompson Formation is generally a sandy limestone with zones of uncemented sand interbeds, some vugs, and zones of moldic porosity after gastropod and/or bivalve shell molds and casts.

- Lower Higher Flow Zone — The Lower Higher Flow Zone lies within the Fort Thompson Formation. At the location of Units 6 & 7, a zone of secondary porosity was evident from the drilling and geophysical logs. This occurred at a depth of approximately 15 feet below the top of the Fort Thompson Formation and was assumed to extend across the model domain. Recent regional drilling conducted by the USGS (JLA 2010) did not identify a laterally persistent layer but rather more isolated zones at varying depths below the Upper Higher Flow Zone. In the groundwater flow model (Subsection 2.3.1.2.3), the Lower Higher Flow Zone represents an aggregation of these observations and is conservative due to the fact that it is modeled as laterally extensive.

- Tamiami Formation — The Pliocene Tamiami Formation directly underlies the Fort Thompson Formation. The Tamiami Formation generally consists of well-sorted, silty sand, but is locally interlayered with clayey sand, silt, and clean clay. The contact between the Tamiami Formation and the Fort Thompson Formation is an inferred contact picked as the bottom of the last lens of competent limestone encountered. The Tamiami Formation represents a semi-confining unit.

The most permeable portions of the Miami Limestone and Key Largo Limestone are considered to be acting as one hydrogeological unit and designated the “upper monitoring zone.” The underlying Fort Thompson is designated the “lower monitoring zone.” The maximum thickness of the Biscayne Aquifer is approximately 115 feet at the Units 6 & 7 plant area.

Twenty groundwater observation wells, two deep geotechnical piezometers, and the two surface water monitoring stations were installed in the Units 6 & 7 plant area as follows:

- Ten observation well pairs used for measuring groundwater levels (or 20 individual observation wells) were installed across the plant area. These wells were completed to depths ranging from 24 to 110 feet bgs and were installed in the Miami Limestone/Key Largo Limestone and the Fort Thompson Formation.

- Two deep geotechnical piezometers, one at each reactor site, were installed to a depth of approximately 135 feet bgs. These two piezometers were installed to measure pore pressure in the Tamiami Formation and are not part of the groundwater level monitoring network.

- Two surface water monitoring stations (SW-1 and SW-2) were installed in the canals surrounding the Units 6 & 7 plant area. The pressure transducers were set several feet below the water level in the canals to allow monitoring of the surface water level variations.

Groundwater level and surface water level measurements commenced in the 20 observation wells and 2 surface water stations in June 2008 and continued through June 2010. Observation wells OW-606D and OW-706D, installed as piezometers for geotechnical purposes, are not part of the groundwater level monitoring network. Groundwater level measurements are made using electronic recording pressure transducers.

Figure 2.3-25 shows the locations of the 20 observation wells, 2 piezometers, and 2 surface water stations in the plant area. Table 2.3-14 presents the construction information for the wells. The observation wells are named in three series that represent the location and screened intervals of the wells:

- OW-600 series wells and geotechnical piezometer are located in the Unit 6 power block area and include "U," "L," and "D" suffix wells monitoring the Key Largo Limestone, the Fort Thompson Formation, and the upper Tamiami Formation, respectively.

- OW-700 series wells and geotechnical piezometer are located in the Unit 7 power block area and include "U," "L," and "D" suffix wells monitoring the Key Largo Limestone, the Fort Thompson Formation, and the upper Tamiami Formation, respectively.

- OW-800 series wells are located outside of the power block areas and include "U" and "L" suffix wells that monitor the Key Largo Limestone and the Fort Thompson Formation, respectively.

A supplemental groundwater investigation was conducted between January and March 2009 at the Units 6 & 7 plant area. Four test wells and fifty observation wells were installed for the purpose of conducting aquifer pumping tests. Two pumping wells were located at each unit, with one well completed as an open-hole to test the upper Biscayne aquifer (Key Largo Limestone) and one well completed as an open-hole to test the lower Biscayne aquifer (Fort Thompson Formation). The constant rate pumping tests were conducted in February and March 2009. The observation wells at each unit consisted of five well clusters containing five wells each, installed in the following test zones:

- Upper aquitard (Miami Limestone)
- Upper Biscayne aquifer test zone (Key Largo Limestone)
- Middle aquitard (freshwater limestone unit)
- Lower Biscayne aquifer test zone (Fort Thompson Formation)
- Lower aquitard (Upper Tamiami Formation)

An additional aquifer pumping test was performed on the Turkey Point peninsula (the landmass extending out into Biscayne Bay) to evaluate the hydrogeologic suitability of that area for the installation and operation of radial collector wells. Seven observation wells and one pumping well were installed on the Turkey Point peninsula in February 2009 to support the investigation.

The pumping test interval corresponds to the lower Miami Limestone, a cemented sand and the upper portion of the Key Largo Limestone. The test zone encompassed the likely depth intervals of the radial collector laterals. The pumping and observation wells were completed as open holes. The observation well open hole intervals were located above, at, and below the depth of the test interval. Step drawdown and constant rate tests were performed in April and May 2009 (HDR 2009).

Descriptions and locations of the aquifer pumping test wells and observation wells are presented in Subsection 2.3.1.2.2.3.

2.3.1.2.2 Groundwater Sources and Sinks

This subsection contains a description of the historic groundwater levels, groundwater flow direction(s) and gradients, seasonal and long-term variations of groundwater levels, horizontal and vertical permeability and total and effective porosity of the geologic formations beneath the plant area, reversibility of groundwater flow, the effects of water use on hydraulic gradients and groundwater levels beneath the plant area, and groundwater recharge areas. This information has been organized into five subcategories as follows: (1) groundwater horizontal and vertical flow directions, (2) temporal groundwater trends, (3) aquifer properties, (4) hydrogeochemical characteristics, and (5) groundwater recharge and discharge.

2.3.1.2.2.1 Groundwater Flow Directions

Groundwater flow directions are provided in the following sections by aquifer.

Biscayne Aquifer

Regional groundwater flow in the Biscayne aquifer is generally toward the east-southeast. Figures 2.3-26 and 2.3-27 (Langevin 2001) show potentiometric surface maps of the Biscayne aquifer for May and November of 1993. The potentiometric maps show localized effects from surface water canals and cones of depression associated with groundwater well fields. Based on the regional data, the hydraulic gradient in the vicinity of the Turkey Point plant property is approximately 0.00002 foot per foot. The elevations in NGVD 29 used by the U.S. Geological Survey (USGS) are approximately 1.53 feet higher than the NAVD 88 elevations used for the plant area data (NOAA 2008g).

Potentiometric surface maps for the upper and lower monitoring zones of the Biscayne aquifer in the immediate vicinity of the Units 6 & 7 plant area are shown on Figures 2.3-28 through 2.3-35 and Figures 2.3-69 through 2.3-74). A separate map was prepared for each high and low tide time sequence for the upper (Miami and Key Largo Limestones) and lower (Fort Thompson Formation) monitoring zones. For the purposes of this analysis, high and low tides refer to the approximate local highs and lows obtained from the observation well hydrographs. The water levels were corrected to equivalent reference heads. FSAR Subsection 2.4.12, Appendix 2AA describes the data evaluation process for the transducer generated water level data and the calculation of reference heads from observed head data.

These maps indicate that the highest portion of the potentiometric surface in the lower monitoring zone generally runs from the southwestern portion of the Units 6 & 7 plant area near OW-735L to the central portion of the Units 6 & 7 plant area near OW-706L. Flow patterns extend radially in multiple directions from this high spot, but flow patterns are not symmetrically arrayed. The June 2010 data for the lower zone indicate a general southwest to northeast flow pattern. The lower monitoring zone potentiometric surfaces and resulting flow patterns are similar for all high and low tide conditions examined.

In the upper monitoring zone, a relative high spot in the potentiometric surface runs from the northwest near OW-812U to the center of the Units 6 & 7 plant area near OW-706U. A second high spot in the potentiometric surface is evident in the southeast corner of the Units 6 & 7 plant area near OW-636U. A relatively low region in the potentiometric surface extends from the southwest near OW-735U to the east-central portion of the Units 6 & 7 plant area near OW-805U and OW-606U. The June 2010 data for the upper zone indicate a general east to west flow pattern.

Because of the complexity of the observed flow patterns in the upper and lower monitoring zones, one to three flow path lines were used to calculate horizontal gradients for each potentiometric surface shown in Figures 2.3-28 through 2.3-35 and Figures 2.3-69 through 2.3-74. The average horizontal gradient in the upper monitoring zone across all examined tidal conditions is 0.0003 ft/ft, and the average horizontal gradient in the lower monitoring zone is 0.001 ft/ft.

Vertical hydraulic gradients were computed for selected observation well pairs on the site. Table 2.3-15 presents the vertical hydraulic gradients determined from these well pairs. The overall vertical hydraulic gradient is generally upward across the plant area. The vertical hydraulic gradients do not vary significantly between high and low tidal cycles.

In general the groundwater flow conditions in the Biscayne aquifer at the Units 6 & 7 plant area can be summarized as follows:

- The upper and lower monitoring zones exhibit complex horizontal flow patterns.
- Vertical hydraulic gradients indicate upward flow potential.
- The vertical (upward) gradient is approximately an order of magnitude larger than the horizontal gradient in the lower monitoring zone. The average horizontal gradient in the lower monitoring zone is, in turn, approximately a factor of three larger than the average horizontal gradient in the upper monitoring zone.

Floridan Aquifer

Regional groundwater flow in the Upper Floridan aquifer is generally toward the east. Figure 2.3-36 shows a potentiometric surface map of the Upper Floridan aquifer for May 1980 (Meyer 1989). The apparent hydraulic gradient in the vicinity of the Turkey Point plant property is approximately 0.00006 foot per foot. South Florida is in the brackish to saline portion of the aquifer, and groundwater development has generally been restricted to industrial water supplies.

Determination of groundwater flow directions and hydraulic heads in the Boulder Zone have been unreliable due to the lack of head data and the transitory effects of ocean tides, earth tides, and atmospheric tides (Meyer 1989). Regional groundwater movement in the Lower Floridan aquifer in southern Florida is estimated to follow the circulation pattern described as follows: 1) cold seawater moves inland through the Lower Floridan aquifer, 2) heating of the seawater in the Lower Floridan aquifer during inland movement results in lower fluid density, 3) upwelling of this seawater from the Lower Floridan aquifer occurs through the middle confining unit, and 4) dilution of the seawater (further reducing fluid density) results in its transport back to the ocean by seaward flowing groundwater in the Upper Floridan aquifer. Figure 2.3-48 illustrates this circulation pattern (Meyer 1989). This circulation is generally very slow due to the low permeability of the middle confining unit.

There are no Floridan aquifer monitoring wells installed at the Units 6 & 7 plant area. Dual-zone monitoring wells would be installed as part of the deep injection wells.

2.3.1.2.2.2 Temporal Groundwater Trends

Regional temporal trends in the Biscayne aquifer groundwater levels are monitored by the USGS (USGS 2010) and the SFWMD (SFWMD 2010). Figure 2.3-37 presents a map of wells and surface water control structures in the vicinity of the Turkey Point plant property used for long-term monitoring of groundwater and surface water levels. Figures 2.3-38 and 2.3-39 show the hydrographs for these locations. The locations show varying degrees of short-term tidal influence and fluctuations associated with precipitation events. The long-term trends in the wells and surface water indicate a generally steady water level over the period examined. Well G-1183 shows the largest magnitude of fluctuation with water level elevations ranging from 6.38 to –0.59 feet NGVD 29. The remaining wells show a range of fluctuation of less than 3.5 feet.

Figure 2.3-40 shows hydrographs of the Biscayne aquifer monitoring wells for Units 6 & 7. The hydrographs contain data gaps, which were a result of the data being rejected, a loss of transducer data due to storm preparation activities or equipment failure. A partial listing of water level data from the transducers is presented in FSAR Subsection 2.4.12, Appendix 2AA. Appendix 2AA also describes the data evaluation process for the transducer generated level data. The results of this evaluation indicate that the present data is sufficient for use.

Regional temporal trends in the Floridan aquifer have been monitored by the USGS (2008). A hydrograph of a well completed in the Upper Floridan aquifer is shown on Figure 2.3-41. The wellhead elevation is 4.50 feet NGVD 29 and the hydraulic head inside the well ranges from 30 to 42.6 feet NGVD 29, indicating that the potentiometric surface in this area is above ground surface.

2.3.1.2.2.3 Aquifer Properties

This subsection provides a summary of the regional, local, and site-specific hydrogeologic parameters of the different aquifer units. These parameters include transmissivity, storativity (storage coefficient), specific yield, hydraulic conductivity (permeability), and leakage coefficient (leakance). The following are definitions of these properties:

- Transmissivity — The rate at which a fluid of a specified density and viscosity is transmitted through a unit width of an aquifer or confining bed under a unit hydraulic gradient and is a function of the properties of the fluid, the porous medium, and the thickness of the porous medium (Fetter 1988).

- Storativity (Storage Coefficient) — The volume of water released from or taken into storage per unit surface area of the aquifer per unit change in head (Fetter 1988).

- Specific Yield — The ratio of the volume of water a rock or soil will yield by gravity drainage to the volume of the rock or soil (Fetter 1988).

- Hydraulic Conductivity (Permeability) — A coefficient of proportionality describing flow per unit time under a unit hydraulic gradient through a unit area of a porous medium and is a function of the properties of the fluid and the porous medium (Fetter 1988).

- Leakage Coefficient (Leakance) — The quantity of water that flows across a unit area of the boundary between the main aquifer and its semi-confining bed, typically expressed as $seconds^{-1}$or $days^{-1}$ derived from the relationship K'/b' where K' is the hydraulic conductivity of the semi-confining unit and b' is its thickness (Davis and DeWeist 1966).

Typical values of hydraulic conductivity, porosity, and thickness for different formations in Miami-Dade County are shown on Table 2.3-16 (U.S. EPA 2003). The values are based on weighted averages for management of treated wastewater. The weighted average values presented in Table 2.3-16 were developed by the EPA to support a risk assessment of wastewater disposal. The data were based on a literature review of published values of the hydrogeologic parameters used to characterize the hydrologic units in Miami-Dade County. The weighted means of the data were calculated to determine representative values to be used in the risk assessment. The weighted mean method essentially reduces the effect of extreme data outliers and may not be representative of actual conditions. These values were not used in the hydrogeologic analysis of site conditions.

Table 2.3-17 presents aquifer test results for tests performed within 15 miles of Units 6 & 7. Figure 2.3-42 shows the locations of these tests. The data were obtained from the SFWMD DBHYDRO database and the Dames & Moore site investigation report (SFWMD 2009 and Dames & Moore 1971). The tests were performed in the Biscayne aquifer, the Floridan aquifer, and confining layers. The tests include standard aquifer performance tests and packer tests used for assessment of the injection and confining layers for deep injection well permitting. The Boulder Zone packer tests listed in Table 2.3-17 show transmissivities lower than those reported for other regional testing of the Boulder Zone. The depths given on the table suggest that the tests were performed in the interval between the top of the Lower Floridan aquifer and the top of the Boulder Zone as determined from cross section Y-Y in Reese and Richardson (2008).

Surficial/Biscayne Aquifer

Hydrogeologic properties of the Biscayne aquifer vary based on lithology. Along the coast, where the Biscayne aquifer is the thickest, transmissivities are lower due to the amounts of sandy material. In central and south Miami-Dade County, the aquifer is thinner with higher hydraulic conductivity due to the occurrence of cavernous limestone (Klein and Hull 1978). The permeable limestone content in the aquifer decreases northward and the overall transmissivity of the aquifer decreases with increased sand content. Transmissivities for the highly permeable limestones and less permeable sandstones and sands of the aquifer in the vicinity of Units 6 & 7 have been estimated to range from less than 1.0E06 gallons per day per foot to 3.0E06 gallons per day per foot (Dames & Moore 1971).

According to Parker et al. (1955), the Biscayne aquifer is the most productive of the shallow non-artesian aquifers in the area. The Biscayne aquifer is one of the most permeable in the world with transmissivity values (hydraulic conductivity x saturated thickness) for the highly permeable limestones ranging from 4.0E06 to 15.0E06 gallons per day per foot (5.4E05 to 2.0E06 square feet per day) with a median value of 5.0E06 gallons per day per foot (6.7E05 square feet per day) and storage coefficients ranging from 0.047 to 0.247. In Broward County, transmissivities are reported to range from about 4.0E05 gallons per day per foot (5.4E04 square feet per day) to 4.0E06 gallons per day per foot (5.4E05 square feet per day) with storage coefficients as high as 0.34 (Sherwood et al. 1973). A generalized distribution of the transmissivities in the Biscayne aquifer is presented in Figure 2.3-43 (Merritt 1996).

Large-capacity municipal wells are commonly completed as open holes and yield from approximately 500 to more than 7000 gallons per minute with only small drawdowns. Specific capacities obtained from pumping tests are on the order of 1000 gallons per minute per foot of drawdown in Miami-Dade County (Klein and Hull 1978).

Two studies performed to the northwest of the plant property by the USGS (Cunningham et al. 2004 and Cunningham et al. 2006) examined the vertical variations in aquifer properties of the Biscayne aquifer. Table 2.3-18 presents the results of testing core samples. The locations of the core samples are shown on Figure 2.3-42. Figure 2.3-44 is a plot of core properties versus elevation.The core samples were tested for horizontal air permeability, vertical air permeability, porosity, and grain density. The horizontal air permeability test included a maximum permeability at 90 degrees to the maximum permeability direction to assess horizontal anisotropy. The studies included a detailed examination of the core samples to determine lithology and fossil assemblages. As a result of this examination, the authors were able to subdivide the Biscayne aquifer into a series of high-frequency depositional cycles that ranged from a freshwater to a marine depositional environment. These depositional cycles control the permeability and porosity of the aquifer. The freshwater and transitional portions of the depositional cycles are characterized by lower permeability (<1000 milliDarcies) and porosity (<20 percent), while the marine portions of depositional cycles exhibit higher permeability (>1000 milliDarcies) and porosity (20–40 percent). This general observation appears to support the site-specific findings regarding the fresh water limestone layer and the other marine and transitional units identified at the Units 6 & 7 plant area. The vertical changes in properties as a result of these depositional cycles can be seen on the figure. Figure 2.3-45 presents a plot of the vertical anisotropy ratio ($K_{vertical:}K_{horizontal}$) versus elevation using the vertical permeability and maximum horizontal permeability determined from the USGS laboratory core testing. The graph indicates that the central tendency of the anisotropy measurements is approximately one. This value was used as a starting point for groundwater model calibration.

As part of the Units 6 & 7 investigation, a total of 10 observation wells were installed in the upper part of the Biscayne aquifer in the Miami Limestone/Key Largo Limestone ("U" suffix wells) and 10 observation wells were installed in the Fort Thompson Formation ("L" suffix wells). The screen depths for the upper ("U") wells range from 14 to 28 feet bgs and for the lower ("L") wells they range from 85 to 110 feet bgs. The locations and installation details of the wells are provided in Figure 2.3-25 and Table 2.3-14, respectively.

Thirty-one in situ hydraulic conductivity tests (slug tests) were conducted in these wells. These data were imported into AQTESOLV™ for Windows version 4.5 (Duffield 2007) and evaluated using either the Butler, KGS (Kansas Geological Survey), McElwee-Zenner, or Springer-Gelhar solution methods (MACTEC 2008). Hydraulic conductivity values obtained for wells screened in the upper part ("U" wells) of the Biscayne aquifer range from 3 to 319 feet per day with a geometric mean of 61.3 feet per day. For the wells screened in the lower part ("L" wells) of the aquifer, values range from 1.0 to 120 feet per day with a geometric mean of 20.1 feet per day. The results of the tests are summarized in Table 2.3-19. The results suggest that the rate-limiting recharge of the well filter pack may be influencing the results of the tests. The rate-limiting recharge effects are caused by the formation having a higher hydraulic conductivity than the filter pack material; this results in the filter pack controlling the slug test response rather than the formation. This interpretation is supported by site vicinity aquifer tests (Dames & Moore 1971) and other regional studies (Table 2.3-17) that suggest much higher hydraulic conductivity values for the aquifer. In addition, aquifer pumping tests are, in general, found to yield higher hydraulic conductivity values than slug tests.

Four aquifer pumping tests were conducted in the Units 6 & 7 power block area, in order to determine hydrogeologic properties of the Biscayne aquifer. These tests were performed to measure the hydrogeologic properties of the aquifer units and the overlying or underlying aquitards for use in the design and implementation of the construction dewatering system, development of the site groundwater flow model, and simulation of the radial collector wells in the groundwater model. Two test zones were identified within the Biscayne aquifer: the upper zone, which is located in the Key Largo Limestone, and the lower zone, which is located in the Fort Thompson Formation. The muck and Miami Limestone units are interpreted to have a lower hydraulic conductivity than the underlying Key Largo Limestone. The freshwater limestone layer is interpreted to have a lower hydraulic conductivity than either the overlying Key Largo Limestone or the underlying Fort Thompson Formation. The Tamiami Formation is also interpreted to have a lower hydraulic conductivity than the overlying Fort Thompson Formation. Thus, the Miami Limestone, the freshwater limestone unit, and the Tamiami Formation were treated as aquitards in the subsurface profile. For the conditions at the plant area, the term aquitard is amended from its usual definition as a low permeability unit to a unit that has a much lower permeability than the aquifer units.

A total of four pumping wells and fifty observation wells were installed for aquifer characterization. Two pumping wells and twenty-five observation wells were installed at each unit location. The pumping wells at Unit 6 were designated PW-6U and PW-6L and at Unit 7 were designated PW-7U and PW-7L, with the U/L suffix indicating completion in either the upper (U) or lower (L) Biscayne aquifer test zone. The pumping wells were nominally 30-inches in diameter and were completed as open holes in the test intervals. The upper test zone wells (PW-6U and PW-7U) were both completed at a total depth of 45 feet bgs. The lower test zone wells (PW-6L and PW-7L) were completed at a total depth of 105 feet and 87 feet bgs, respectively. Each aquifer test location had two observation well clusters of five wells each installed at right angles to and approximately 10 feet from the pumping well. Additionally, a shared well cluster of five wells was installed between the two pumping wells at each unit location at a distance of approximately 25 feet. The observation well clusters at Unit 6 (C6-1 through C6-5) and Unit 7 (C7-1 through C7-5) each included wells designated as A through E completed in the following zones:

- Miami Limestone/Upper Aquitard (A)
- Key Largo Limestone/Upper Test Zone (D)
- Freshwater Limestone/Middle Aquitard (B)
- Fort Thompson Formation/Lower Test Zone (E)
- Tamiami Formation/Lower Aquitard (C)

Figure 2.3-46 presents the configuration of the pumping and observation wells for Units 6 & 7.

Each pumping test was conducted at a constant discharge rate and drawdown data was collected for a period of 8 hours, followed immediately by the recovery period during which water level data were collected for an additional 8 hours. The discharge rate for each test was selected based on data collected during a step-drawdown test conducted on each pumping well prior to initiation of the 8 hour drawdown test. Discharge rates for the tests ranged from approximately 3300 gpm to 5100 gpm.

The pumping test results were interpreted using the AQTESOLV™ (Duffield 2007) computer program. This program contains solution options for different hydrogeologic conditions such as unconfined, confined, and leaky conditions. Two interpretation methods were used: the Theis method and the Hantush leaky aquifer with aquitard storage method. The Theis method was applied to the time-drawdown data, to provide an upper bound on transmissivity, because the Theis method assumes no leakage. The Hantush leaky method with aquitard storage was used to evaluate the distance-drawdown and time-drawdown relationships in the pumping zone observation wells ("D" or "E" series wells). Table 2.3-20 presents a summary of the averages of the aquifer testing results. Based on these analyses, the average transmissivity for the upper Biscayne aquifer is approximately 2.3E06 gallons per day per foot and for the lower Biscayne aquifer it is approximately 1.3E05 gallons per day per foot. Details of the pumping tests and the analytical methods are provided in FSAR Subsection 2.4.12, Appendix 2BB.

An additional aquifer pumping test was performed on the Turkey Point peninsula to evaluate the hydrogeologic suitability of that area for the installation and operation of radial collector wells. A single test zone in the upper portion of the Biscayne aquifer was targeted as the production interval. The test zone was completed as a 26-inch diameter open hole in pumping well PW-1 and extended from 22 feet bgs to 46 feet bgs. This interval corresponds to the lower Miami Limestone, a cemented sand and the upper portion of the Key Largo Limestone and encompasses the likely depth intervals of the radial collector well laterals. A plan and geologic cross section at the Turkey Point peninsula from the exploratory drilling and aquifer testing program is presented as Figure 2.3-75 (HDR 2009). Note that the cemented sand indicated in Figure 2.3-75 was not observed in the borings located within the Units 6 & 7 plant area.

Seven observation wells were installed at the site. Four observation wells (MW-2 through MW-5) were installed at distances ranging from 925 feet to 2704 feet from pumping well PW-1. These wells were completed as open holes in the production zone interval. Observation well location MW-1 consisted of three wells. MW-1 DZ was a dual zone observation well constructed to monitor the production zone interval and a zone below the production zone interval in the Fort Thompson Formation (65 ft bgs to 75 ft bgs). Observation well MW-1 IS monitored the upper portion of the production zone interval (24 ft bgs to 35 ft bgs), while observation well MW-1 SS monitored a zone in the Miami Limestone above the production zone interval (12.7 ft bgs to 17.7 ft bgs). The configuration of the pumping and observation wells is shown on Figure 2.3-76.

The pumping test was conducted at a constant discharge rate. Drawdown data was collected for a period of 7 days, followed immediately by the recovery period during which water level data were collected for an additional 7 days. The discharge rate for the test was selected based on data collected during a step-drawdown test conducted in the pumping well prior to initiation of the 7-day constant rate test. The discharge rate for the constant rate test averaged 7100 gpm, and drawdown stabilized in the pumped well at approximately 11 feet bgs (HDR 2009).

The analyses of the drawdown and recovery data were performed with the AquiferWin32® software (Rumbaugh and Rumbaugh 2003) and AQTESOLV® (Duffield 2007). Well hydraulic equations for unconfined aquifers, confined aquifer with leaky conditions and partial penetration, and recovery data were applied. The analytical models that appeared to best fit the observed time drawdown data were the Hantush (1964) and Walton (1962) solutions, indicating a leaky aquifer. Results from the Turkey Point peninsula pumping test indicate a leaky aquifer system with a mean transmissivity value ranging from 700,000 to 1,200,000 ft^2/day (5.2 E06 to 8.9 E06 gallons per day per foot) (HDR 2009).

Intermediate Aquifer System/Confining Unit

The overall hydraulic conductivity of the intermediate aquifer system/confining unit is very low and provides good confinement for the underlying Floridan aquifer system (Bush and Johnston 1988). The leakage coefficient of this confining unit is highly variable, especially in the semi-confined areas where the confining beds may be either sandy or clayey. Leakage coefficient values of the upper confining unit, derived from computer model simulations, range from less than 0.01 inches per year per foot in tightly confined areas to more than 1.00 inches per year per foot in semi-confined areas (Bush and Johnston 1988). According to Bush and Johnston (1988), leakage coefficients calculated from aquifer test data, in general, are much larger than those obtained from simulation, ranging from 0.44 to 88 inches per year per foot. Their analyses indicate that in the majority of locations, leakage coefficients from aquifer test data are too large to realistically represent the exchange of water between the surficial aquifer and the Upper Floridan aquifer. The values obtained from aquifer test data can reflect not only downward leakage from the surficial aquifer, but upward leakage from permeable rocks beneath the pumped interval, as well as leakage from beds of relatively low permeability that might exist within the pumped interval. Upper confining unit leakage coefficients derived from Floridan aquifer test data are composite or lumped properties that include leakage from all available sources.

Floridan Aquifer System

The Floridan aquifer system is a confined series of aquifer zones, separated by aquicludes, that is approximately 3000 feet thick in southeastern Florida. Porosity and permeability in the aquifer vary widely depending on location and formation. High permeability values are the result of both fractured limestone and extensive secondary porosity derived from dissolution of carbonates. In the central part of the Lower Floridan aquifer within the Floridan aquifer system is the Boulder Zone. The Boulder Zone consists mainly of fractured dolostones, in which large cavities develop during drilling as the result of borehole collapse (Safko and Hickey 1992, Duerr 1995, and Maliva and Walker 1998). The Boulder Zone is used for underground injection of industrial and domestic wastes in South Florida.

Floridan Aquifer System: Upper Floridan Aquifer

Hydraulic parameters of the Upper Floridan aquifer vary considerably as a result of the wide variation in hydrogeologic conditions encountered at different locations. According to Johnston and Bush (1988), conditions that most affect transmissivity are the degree of solution development in the aquifer and, to a lesser extent, aquifer thickness. High transmissivities are usually found in the areas having less confinement because circulation of flow helps to develop solution openings in the aquifer. Transmissivities are lowest (less than 50,000 square feet per day) in the Florida panhandle and southernmost Florida (where the aquifer is confined by thick clay sections and contains thick sections of low-permeability limestone) and are highest (greater than 1,000,000 square feet per day) in the karst areas of central and northern Florida where the aquifer is generally unconfined or semi-confined (Johnston and Bush 1988).

Regionally, storage coefficients calculated from aquifer tests conducted in the Upper Floridan aquifer range from a low of 1.0E-05 to a high of 2.0E-2 with most values in the 1.0E-03 to 1.0E-04 range (Johnston and Bush 1988).

Dames & Moore (1975) installed a test production well, designated W-12295 as shown on Figure 2.3-42, and four observation wells southwest of the Units 6 & 7 plant area. They conducted a 90-day continuous pumping test of the principal artesian water-bearing zone (Upper Floridan aquifer). The test production well was completed as an open hole between approximately 1130 feet and 1400 feet bgs. Calculated average values for transmissivity, storage coefficient, and leakance obtained from graphical solutions of the test data were 400,000 gallons per day per foot (53,600 square feet per day), 6.0E-04, and 0.002 gallons per day per cubic foot, respectively. Bush and Johnston (1988) report a transmissivity of approximately 232,000 gallons per day per foot (31,000 square feet per day) for the Upper Floridan aquifer.

The most transmissive zone is generally found at the top of the unit and is estimated to range between 10,000 to 60,000 square feet per day. According to Bush and Johnston (1988), at wells S-1532 and S-1533 on the Turkey Point plant property the transmissivity is 31,000 square feet per day (Reese 1994). Transmissivity of the Upper Floridan aquifer is highest in west central Florida (greater than 100,000 square feet per day) with lower transmissivities (less than 10,000 square feet per day) in central Florida (Reese and Richardson 2008).

The Upper Floridan aquifer water supply wells used for Unit 5 cooling water and Units 1 & 2 process water included the performance of an aquifer pumping test as part of the well installation process. The results of this test indicate a transmissivity of 244,000 gallons per day per foot, a storage coefficient of 2.0E-04, and a leakance of 5.0E-03 gallons per day per cubic foot (6.7E-04 day^{-1}). These values are consistent with the values reported from other nearby tests in the Upper Floridan aquifer.

Floridan Aquifer System: Middle Confining Unit

The middle confining unit of the Floridan aquifer system includes most of the Avon Park Formation (Reese and Richardson 2008) (Figure 2.3-17). Reese (1994) places the base of the middle confining unit at the top of the first permeable zone, which in general is in the Oldsmar Formation. However, this permeable zone has been identified in places to be within the lower Avon Park Formation, above the top of the Oldsmar Formation. The base of the middle confining unit is encountered at a depth of about 2460 feet in a well (MDS-I12) drilled in southeastern Miami-Dade County, 230 feet below the top of the Oldsmar Formation (Reese 1994). Based on core sample analysis, packer tests, and aquifer tests conducted at the MDWASD South District Wastewater Treatment Plant site, the hydraulic conductivity of the middle to lower part of the confining unit ranges from 3.0E-03 to 3.0 feet per day (Reese 1994). Vertical hydraulic conductivity measured in eight core samples from a well drilled in eastern Broward County, reported by Reese (1994), ranged from 1.3E-04 to 0.24 feet per day. Core analyses of the low porosity (<15%) dolostones from the Floridan aquifer middle confining unit in Palm Beach County gave vertical hydraulic conductivities of less than or equal to 1.7E-08 centimeters per second. The lowest recorded value was 2.7E-09 centimeters per second (Maliva et al. 2007).

Floridan Aquifer System: Lower Floridan Aquifer

The Lower Floridan aquifer underlies the middle confining unit and extends from a depth of approximately 2400 feet bgs to a depth that is undetermined, but thought to be greater than 4000 feet bgs in the Miami-Dade County area. This thick sequence of carbonate rocks contains several permeable zones separated by thick confining units (Miller 1986). These confining units are similar in lithology to the middle confining unit of the Floridan aquifer system (Reese 1994). Underlying the confining beds in the lower part of the Lower Floridan aquifer is the highly transmissive Boulder Zone, which is of varying thickness. The base of the Lower Floridan aquifer extends below the base of the Boulder Zone with the lower section consisting of permeable dolomites or dolomitic limestones of the Cedar Keys Formation (Miller 1986, Meyer 1989, and Reese 1994). Because the Lower Floridan aquifer is deeply buried in southern Florida and contains saltwater, the unit has not been intensively drilled or tested; therefore, the hydraulic characteristics are not well known (Miller 1986).

Boulder Zone

The Boulder Zone is a highly transmissive zone of cavernous limestones and dolomites found in the lower Oldsmar Limestone in the Lower Floridan aquifer in southeastern Florida. However, locally the Boulder Zone may range upward to the middle of the Oldsmar Limestone or downward to the top of the Cedar Keys Formation (Miller 1986). It consists mostly of massively bedded dolostones within which secondary permeability has been extensively developed. The term "Boulder Zone" is a misnomer because no boulders are present other than large chunks occasionally broken off during drilling. The difficult slow drilling and rough bit behavior, similar to that observed drilling in boulders, encountered while drilling dolostone, gave rise to the term "Boulder Zone" (Miller 1986). The Boulder Zone can be up to 700 feet in thickness (Reese and Richardson 2008). Based on previous studies in the region (Reese and Richardson 2008, Starr et al. 2001, Dames & Moore, 1975, and Miller 1986), the Boulder Zone underlies a 13-county area in southern Florida with the elevation of the top of the zone ranging from about –2000 feet NGVD 29 to about –3400 feet NGVD 29, Figure 2.3-47 (Miller 1986). The Boulder Zone is found at a depth of approximately 2800 feet at the Turkey Point plant property.

Transmissivities ranging from 3.2E06 to 24.6E06 square feet per day have been reported for the Boulder Zone (Meyer 1989). A measured hydraulic conductivity value of approximately 4250 feet per day was obtained from an injection well at the SDWTP, operated by the MDWASD in Miami-Dade County. This value is approximately two orders of magnitude larger than measured values in the overlying portion of the Lower Floridan aquifer and the middle confining unit (Fish and Stewart 1991).

2.3.1.2.2.4 Hydrogeochemical Characteristics

The state of Florida has conducted an extensive characterization of the background water quality in the major aquifer systems (FGS 1992). The data have been subdivided into properties for each of the water management districts. Tables 2.3-21 and 2.3-22 present typical site-specific geochemical parameters for the Biscayne aquifer, the Floridan aquifer, and precipitation at Everglades National Park.

The state of Florida has classified the groundwater in the vicinity of Turkey Point as Class G-III waters to identify groundwater that has no reasonable potential as a future source of drinking water due to high total dissolved solids content (Merritt 1996). Field-measured groundwater quality indicator parameters (temperature, pH, dissolved oxygen, specific conductivity, turbidity, and oxidation-reduction potential) obtained during the collection of samples from observation wells (installed in the Biscayne aquifer as part of the Units 6 & 7 characterization investigation) are summarized in Table 2.3-21. The results of the laboratory analyses of the water samples are presented in Table 2.3-22.

Water quality data were collected as part of the Turkey Point peninsula pumping test activities. Grab samples, collected at various time intervals, were taken from the test well, monitoring wells, Biscayne Bay, and the Industrial Wastewater Facility. The analytes include cations, anions, and stable isotopes. A summary of the water quality data collected as part of the Turkey Point pumping test is presented in Table 2.3-32. Additional data and information regarding these water quality analyses can be found in HDR 2009.

Although the Upper Floridan aquifer is a major source of potable groundwater in much of Florida, water withdrawn from the unit in southeastern Florida, including Miami-Dade County, is brackish and variable with chloride and dissolved solid concentrations greater than 1000 mg/L. Groundwater samples from the Upper Floridan aquifer production wells at Unit 5 (Table 2.3-22) show an average chloride concentration of 2900 mg/L.

Average dissolved solids concentration of Boulder Zone groundwater is approximately 37,000 mg/L total dissolved solids (Meyer 1989). There is also a pronounced temperature anomaly present in the Boulder Zone with the lowest observed temperatures (approximately 50°F) occurring along the southeastern coast. The temperature increases from the Straits of Florida toward the center of the Florida Plateau, suggesting recharge from cold seawater through the lower part of the Floridan aquifer system. The groundwater circulation pattern is shown on Figure 2.3-48 (Meyer 1989).

Figure 2.3-49 presents a Piper trilinear diagram of the plant property and regional geochemical data. Examination of the diamond field on the diagram indicates that the plant property groundwater, Biscayne Bay, and the industrial wastewater facility data all plot together on the diagram, indicating similar geochemical compositions. These waters are classified as a sodium-chloride water type.

2.3.1.2.2.5 Aquifer Recharge and Discharge

Groundwater Discharge

Natural discharge of groundwater in the Biscayne aquifer is by seepage into streams, canals, or the ocean; by evaporation; and by transpiration by plants. Induced discharge is through wells pumped for municipal, industrial, domestic, and agricultural supplies. Evapotranspiration, transpiration, and groundwater discharge are greatest during the wet season when water levels, temperature, and plant growth rates are high. Pumpage of groundwater constitutes a part of the total discharge from the aquifer. The effect of pumpage is amplified because it is greatest during the dry season when recharge and aquifer storage are least. Most of the water that circulates in the surficial aquifer system is discharged by canals (Fish and Stewart 1991). There is very little direct runoff of precipitation; however, regional discharge of the surficial aquifer into drainage canals and directly into Biscayne Bay is estimated to be approximately 15 to 25 inches per year (Parker et al. 1955). It is estimated that 20 inches of the approximately 60 inches of annual rainfall in Miami-Dade County is lost directly by evaporation, approximately 20 inches is lost by evapotranspiration after infiltration, 16 to 18 inches is discharged by canals and by coastal seepage, and the remainder is used by man (Meyer 1989 and Parker et al. 1955). Nearly 50 percent of the rainfall that infiltrates the Biscayne aquifer is discharged to the ocean (Klein and Hull 1978).

Groundwater Recharge

There are several mechanisms affecting recharge of the surficial/Biscayne aquifer in Miami-Dade County including (Fish and Stewart 1991):

- Infiltration of rainfall or irrigation water through surface materials to the water table
- Infiltration of surface water imported by runoff from the north in the water-conservation areas or by canals
- Infiltration of urban runoff by way of drains, wells, or ponds
- Groundwater inflow from southwestern Broward County

Recharge by rainfall is greatest during the wet season, from June to November, and recharge by canal seepage is greatest during the dry season, from December to May. The average annual rainfall in Miami-Dade County is approximately 60 inches, of which approximately 38 inches is recharge to the aquifer (Parker et al. 1955). Recharge occurs over most of Miami-Dade County during rainstorms. The low coastal groundwater levels and the low, but continuous, seaward gradient indicate the very high transmissivity of the aquifer, the high degree of interconnection between the aquifer and the canals, and the effectiveness of the canals in rapidly draining floodwaters (Fish and Stewart 1991).

Recharge to the Floridan aquifer system is directly related to the confinement of the system. The highest recharge rates occur where the Floridan aquifer is unconfined or poorly confined as in those areas where the system is at or near land surface or where the confining layers are breached by karst or other structural features. The Floridan aquifer system is confined, with upward vertical gradients, and is approximately 1000 feet bgs in the vicinity of the Turkey Point plant property.

Groundwater–Industrial Wastewater Facility Interaction

Units 1–4 use the 5900-acre closed-loop industrial wastewater facility for condenser cooling (Figure 2.3-61). The canals comprising this facility are shallow, approximately 3 feet deep with the exception of the grand canal (main return canal), north discharge canal, south collector canal, and the east return canal, all of which are approximately 18 feet deep. The canals convey warm water south from the existing units and return cooled water for use by Units 1 through 4. The industrial wastewater facility does not directly discharge to fresh or marine surface waters; however, because the canals are not lined, water in the canals interacts with groundwater in the unconfined Biscayne aquifer, which immediately underlies the bottom of the industrial wastewater facility. Makeup water for the industrial wastewater facility comes from treated process water, rainfall, stormwater runoff, and groundwater infiltration. There is a net inflow to the industrial wastewater facility from the Biscayne aquifer beneath the canals. The water in the canals has a salinity greater than that of seawater due to the effects of evaporation, with salinity concentrations approximately twice that of Biscayne Bay.

An interceptor ditch adjacent to the west side of the industrial wastewater facility and east of the L-31E Canal and levee was constructed at the same time as the industrial wastewater facility (Figure 2.3-61). The purpose of the interceptor ditch is to keep water from the industrial wastewater facility from influencing groundwater quality to the west in the upper portion of the aquifer. This is accomplished by the existence of a natural freshwater hydraulic gradient during the wet season and by pumping water as necessary from the interceptor ditch into the westernmost canal (Canal 32) of the industrial wastewater facility during the dry season when natural freshwater hydraulic gradients are low. Operation of the interceptor ditch prevents seepage from the industrial wastewater facility from moving landward toward the L-31E Canal in the upper portion of the aquifer and thereby helps to maintain existing groundwater quality in the Biscayne aquifer west of the interceptor ditch. Table 2.3-23 presents the manual staff gage readings along various transects between the L-31E Canal and the westernmost canal in the industrial wastewater facility from 2008 through February 18, 2011. The table also indicates pumping activities to maintain seaward flow. Figure 2.3-50 presents hydrographs of canal, interceptor ditch, and industrial wastewater facility Canal 32 water elevations for the year 2008.

2.3.1.2.3 Groundwater Flow Model

In order to better characterize the groundwater flow system, a three-dimensional numerical groundwater flow model was used. The model code used was MODFLOW-2000 (Harbaugh et al. 2000) as implemented in the Visual MODFLOW software. The MODFLOW model is a constant-density, three-dimensional finite-difference model, with modular capability to add various equation solvers and boundary conditions to the basic model. The model developed for Units 6 & 7 used a geometric multigrid (GMG) solver.

The groundwater model layers were created based on the local and regional geology conditions at the site, as well as observations made during several field investigations. A general description of the groundwater model setup, including model layers, surface water features incorporated into the model, boundary conditions, and calibration/verification approach is provided in the following paragraphs.

Model Layer 1 — This layer consists of muck onshore and rock and sandy material on the floor of Biscayne Bay. The location of these layers is based on the results of investigations performed in 1971 (Dames & Moore 1971) and 2008 (MACTEC 2008). Specifically, muck is known to be present on land; however, this unit does not extend into Biscayne Bay, where exposed rock and sandy material are present in its place. The Model Layer 1 hydrostratigraphic units in Biscayne Bay were assigned using the Marine Resources Geographic Information System (MRGIS)

"Benthic Habitats — South Florida" file (FWRI 2010). Benthic zones designated as "Continuous Seagrass" were designated as sandy material in Layer 1, as loose material is necessary to support seagrass. "Patchy (Discontinuous) Seagrass" and "Hardbottom with Seagrass" benthic zones were designated as rock in Model Layer 1.

Model Layers 2/3 — This layer consists of marine limestone, referred to as the Miami Limestone. The Miami Limestone is a white, porous sometimes sandy, fossiliferous, oolitic limestone.

Model Layer 4 — This layer consists of marine limestone and is referred to as the Upper Higher Flow Zone. This layer is at the boundary between the Miami Limestone and Key Largo Limestone and can be described as a laterally continuous, relatively thin layer of high secondary porosity.

Model Layer 5/6 — This layer consists of marine limestone and is referred to as the Key Largo Limestone. This is a coralline limestone (fossil coral reef) believed to have formed in a complex of shallow-water, shelf-margin reefs and associated deposits along a topographic break during the last interglacial period.

Model Layer 7 — This layer consists of freshwater limestone and is referred to as the Freshwater Limestone, and where this is absent, the Key Largo Limestone. The limestone is generally two feet or more thick and often possesses a sharp color change from light to dark gray at its base, marking the transition from the Key Largo Limestone to the Fort Thompson Formation.

Model Layer 8/9 and 11/12/13 — This layer consists of marine limestone and is referred to as the Fort Thompson Formation. The Pleistocene Fort Thompson Formation directly underlies the Key Largo Limestone. The Fort Thompson Formation is generally a sandy limestone with zones of uncemented sand interbeds, some vugs, and zones of moldic porosity after gastropod and/or bivalve shell molds and casts.

Model Layer 10 — This layer consists of marine limestone and is referred to as the Lower Higher Flow Zone. At the location of Units 6 & 7, another zone of high secondary porosity was identified within the Fort Thompson Formation from drillers and caliper logs. This layer is approximately 15 feet beneath the top of the Fort Thompson Formation at the location of the proposed power blocks.

Model Layer 14 — This layer consists of well sorted silty sand, but is locally interlayered with clayey sand, silt, and clean clay and is referred to as the Tamiami Formation. The Pliocene Tamiami Formation directly underlies the Fort Thompson Formation. The contact between the Tamiami Formation and the Fort Thompson Formation is an inferred contact picked as the bottom of the last lens of competent limestone encountered. The Tamiami Formation represents a semi-confining unit.

The Upper and Lower Higher Flow Zones are relatively thin zones of high secondary porosity. These zones were defined based on a review of geophysical logs and drilling records and are assumed to be continuous across the model domain. The Upper Higher Flow Zone was primarily identified from the loss of drilling fluid at the boundary of the Key Largo Limestone and Miami Limestone. This observation was also coincident with an increase in the boring diameter as identified by the caliper logging. The Lower Higher Flow Zone was identified at a depth of approximately 15 feet below the top of the Fort Thompson Formation from the 2008 subsurface investigation borings within the Units 6 & 7 plant area. In 2010, 14 borings were drilled in and around the Turkey Point plant area as part of the FPL Units 3 & 4 Uprate Conditions of Certification (JLA Geosciences 2010). These borings did not identify a laterally persistent layer corresponding to the Lower Higher Flow Zone identified within the Units 6 & 7 plant area, but rather more isolated zones at varying depths. As represented in the model, the Lower Higher Flow Zone represents an aggregation of these observations and is conservative due to the fact it is modeled as laterally extensive. The location and lateral persistence of the Upper Higher Flow Zone is generally confirmed by the 2010 borings (JLA Geosciences 2010). Cunningham et al. 2009 discuss the presence and origin of high flow zones in the Biscayne aquifer.

The groundwater model incorporated the local and regional surface water features as different types of boundary conditions, based on the feature and its conceptual contribution to groundwater flow. These boundary conditions include the following:

<u>Biscayne Bay</u> — This feature is located east of Units 6 & 7 and is a shallow, subtropical lagoon along the southeastern coast of Florida. The bay is conceptualized as a general-head boundary at the top of Model Layer 1 to represent the exchange of water between the bay and the underlying aquifer.

The head is specified at -1.05 ft NAVD 88 for the calibration phase of model development, based on the average of the monthly surface elevation between February 2009 and May 2009. The use of this type of boundary condition allows for limiting the exchange of water between Biscayne Bay and the underlying aquifer based on the sea floor sediments.

<u>Cooling Canal System, Card Sound Canal, and other offsite canals</u> — The cooling canals of the industrial wastewater facility are a closed system and do not discharge directly to adjacent surface water; however, the canals are unlined and, therefore, interact with groundwater. The other canals (e.g., Card Sound Canal, L-31E Canal, C-107 Canal, and Florida City Canal) are open systems that also interact with groundwater. The canals are specified as river boundaries to account for surface water-groundwater interaction based on surface water level elevation and conductance of the sides and bottom of the canals.

Finally, other model boundaries were conceptualized and included in the groundwater model as follows:

Recharge/Evaportranspiration Boundary — These boundaries are applied to the top of Model Layer 1. These conditions are applied to land surfaces only, including wetlands. No recharge/evapotranspiration is applied to surface water bodies, buildings, or paved areas.

Horizontal Flow Barrier Boundary — Mechanically Stabilized Earth (MSE) Retaining Wall and Cut-Off Walls for Units 6 & 7. The horizontal flow barrier boundary was used to simulate the effects of the excavation cut-off walls surrounding the power blocks for Units 6 & 7 for construction dewatering and the MSE retaining wall surrounding the plant area.

Model Domain Perimeter — General-head boundary conditions are assigned to the perimeter of all model layers. The general-head boundary represents the influence of conditions beyond the model area.

No-Flow Boundary — Bottom of the model — The bottom of the model is designated a no-flow boundary because water levels in the Biscayne aquifer are expected to be negligibly affected by upward leakage through the Lower Tamiami Formation and Hawthorne Group, which is several hundred feet thick and acts as a confining layer.

No-Flow Boundary — Units 6 & 7 Excavations — The excavations are designated as inactive to flow. Minor seepage will occur through the cut-off walls into the excavations but the quantities will be insignificant.

The numerical groundwater model was then calibrated and validated as follows:

- Three pumping tests were used in the model calibration phase; two of these tests were conducted in the Key Largo Limestone and one in the Fort Thompson Formation.
- The model included a validation step, whereby an additional pumping test was simulated following the calibration phase.
- A range for the hydraulic conductivity anisotropy value of between 8:1 and 15:1 was used for the various hydrogeologic units. These values were determined during calibration and constrained by literature and field observations.

Qualitative comparisons of model results were made to regional potentiometric surface maps (Langevin 2001) and the interaction of groundwater with the cooling canal system. The interaction of groundwater with the cooling canal system was assessed by comparing model results against estimates obtained from an independent steady-state water balance model.

The calibrated and validated groundwater model was then utilized to simulate construction dewatering and steady-state radial collector well operation. The modeling approach and impacts of these predictive runs are further discussed in Sections 4.2 (dewatering) and 5.2 (radial collector well operation). Additionally, Section 5.3 provides a discussion of the ecological impacts of radial collector well operations. A detailed discussion of the groundwater model development, conceptual design, and calibration is presented in FSAR Appendix 2CC.

2.3.2 WATER USE

This section describes surface water and groundwater uses that could affect or be affected by the construction or operation of Units 6 & 7 and associated transmission corridor and offsite facilities. Consumptive and nonconsumptive water uses are identified, and water diversions, withdrawals, consumption, and returns are quantified. In addition, this section describes statutory and legal restrictions on water use and provides the projected water use for Units 6 & 7.

2.3.2.1 Surface Water Use

Surface water bodies around the Turkey Point plant property include Biscayne Bay, Card Sound, the industrial wastewater facility, numerous named and unnamed canals, and various wetlands. Figures 2.3-1 through 2.3-3 show the relationship of the Turkey Point plant property to these major hydrologic features. The locations of designated wetlands near the Turkey Point plant property are shown on Figure 2.3-15.

The natural drainage of the area is to the east and south towards Biscayne Bay. The shallow tidal creeks and swales in the area are submerged, and therefore any flow they may have is sluggish. This, together with the permeable limestone bedrock of the area, results in approximately two-thirds of the rainfall percolating directly to the water table aquifer. In the absence of well-defined stream channels, heavy precipitation runs off in a slow, sheet flow towards the Biscayne Bay.

A complex network of levees, canals, and control structures was constructed to manage the water resources in the lower east coast region of Florida. The major canals, operated and maintained by the SFWMD, are used to prevent low-lying coastal areas from flooding and to prevent saltwater intrusion into coastal aquifers (Wolfert-Lohmann et al. 2007).

The surface water body that is within the hydrologic system where the Units 6 & 7 plant area is located and that could potentially affect or be affected by the construction and operation of the new units is Biscayne Bay. For construction or operation of Units 6 & 7, there would be no surface water withdrawal directly from or discharging to Biscayne Bay. It is noted, however, that one of the two primary sources of makeup water would be saltwater obtained from radial collector wells located on the Turkey Point peninsula, east of the existing units. As described in Subsection 2.3.2.2.2.2, each radial collector well would consist of a central reinforced concrete caisson extending below the ground level with horizontal laterals projecting up to a distance of 900 feet from the caisson in the subsurface beneath the floor of Biscayne Bay. The water recharging the radial collector wells would originate from Biscayne Bay.

2.3.2.1.1 Consumptive Surface Water Use

2.3.2.1.1.1 Present Consumptive Surface Water Use

In South Florida, most (approximately 90 percent) of the water used in homes and businesses comes from groundwater sources, with the remainder coming from surface water sources (SFWMD 2008b).

The consumptive use of water in the state of Florida is regulated by the water management districts, as prescribed in Part II of Chapter 373 of Florida Statute (F.S.). According to the consumptive water-use permit files of SFWMD (2008c), 139 projects in Miami-Dade County were permitted for surface water withdrawals as of October 2008 and are summarized in Table 2.3-24. Eighty-three percent of the permitted projects are for landscape irrigation, and the remaining are for irrigation of golf courses and agriculture, industrial and dewatering uses, and other minor uses. All consumptive surface water uses are self-supplied, and there are no surface water withdrawals for potable water. A total of 9410 million gallons per year are allocated annually for six industrial uses, most of which are used for quarry sites and rock washing facilities. Seven golf course irrigation projects are permitted to withdraw 1360 million gallons per year, and 115 landscape irrigation projects are permitted to withdraw approximately 1123 million gallons of surface water per year.

Figure 2.3-51 shows the location of permitted users within 10 miles of Units 6 & 7, and Table 2.3-25 presents the details of their permits. Onsite ponds/lakes and canals are the major sources of surface water for these users. There are no permitted surface water users in the immediate vicinity of Units 6 & 7. The nearest surface water user is located approximately 6 miles west-northwest of Units 6 & 7.

Because all the surface water uses are self-supplied and have limited metered data, it is difficult to estimate the actual monthly withdrawal rates of surface water. In cases of agricultural and landscape irrigation, however, monthly withdrawal rates can be estimated from the monthly supplemental crop requirement data shown in the water use permit applications (SFWMD 2008c). The monthly supplemental crop requirements are calculated according to the SFWMD's Supplemental Crop Requirement and Withdrawal Calculation (SFWMD 2008d), which varies by crop, soil type, and local climatology. Figure 2.3-52 shows monthly supplemental crop requirement applied for some typical crops in the Homestead area in 2008. As seen in this figure, the monthly supplemental crop requirement has a large seasonal variation—it is high in the spring and summer seasons, and low in the fall and winter seasons.

Most of the freshwater withdrawn from surface water sources is not returned to its surface source. Irrigation water applied for agricultural and landscape uses is consumed by the processes of evapotranspiration and infiltration into the subsurface. As indicated in the SFWMD permit files (SFWMD 2008c), most of the surface water withdrawn for industrial and dewatering uses is drained to sedimentation basins where the water percolates back into an aquifer or is returned to onsite borrow pits/lakes and recycled.

Surface waters of Miami-Dade County serve as receiving water bodies for both domestic and industrial discharges. Table 2.3-26 lists the major facilities that discharge treated wastewater or cooling water into canals, bays, or the open ocean. As seen in this table, the sources of the surface discharge water originate primarily as groundwater. Two MDWASD Wastewater Treatment Plants discharge treated wastewater into the ocean.

According to Ecology & Environment, Inc. (2007), approximately 16.2 million gallons per day of wastewater, which represents approximately 5 percent of the total volume of public water supplied by the MDWASD, is currently reused in the MDWASD system. Most of the reuse is for process water and irrigation at the regional wastewater treatment plants.

2.3.2.1.1.2 Future Consumptive Surface Water Use

The SFWMD prepares water supply plans for each of its four planning areas to support planning initiatives and address local issues. The regional water supply plans encompass a minimum 20-year future planning horizon and are updated every 5 years. Each regional water supply plan update provides revised water demand estimates and projections.

According to the SFWMD's *Water Supply Plan Update 2005–2006* (SFWMD 2006b), the total water demand of the lower east coast region which includes Miami-Dade, Monroe, Broward, and Palm Beach counties will increase by 27 percent between 2005 and 2025, as shown in Table 2.3-27.

Agricultural water withdrawal demands are projected to decline by 9 percent by 2025 due to a decrease in agricultural acreage. However, withdrawal demands for public supply, domestic self-supply, and recreational (landscape and golf course) irrigation are projected to increase by more than 30 percent by 2025.

Power generation water use and withdrawal demand are both expected to increase significantly during the planning period, reflecting the development of new power generation facilities in the lower east coast planning area. Industrial demands, which include construction and mining dewatering, are relatively small and historical data do not indicate any trends in use. Therefore, the industrial water use levels are expected to remain constant through the projection period.

In Miami-Dade County, surface water is rarely used as a source for public or domestic water supply, as already indicated in Table 2.3-24. Moreover, there is no surface water use and withdrawal permit for Units 6 & 7 anticipated in the future. Although the withdrawal demand for recreational water use could be increased in the future, the total consumptive surface water use is not expected to significantly increase in Miami-Dade County.

2.3.2.1.2 Nonconsumptive Surface Water Use

The Turkey Point plant property is adjacent to a large area of protected marine environments: Biscayne National Park is located to the east, and Biscayne Bay Aquatic Preserve (Card Sound portion) and John Pennekamp Coral Reef State Park are located to the southeast as shown in Figure 2.3-53.

As described in NPCA (2006), Biscayne National Park encompasses much of Biscayne Bay, making it one of the largest marine parks in the National Park system. The park protects part of the third-largest coral reef system in the world and the longest stretch of mangrove forest remaining on Florida's east coast, providing habitat and nursery grounds for most of the region's important commercial and recreational fish, shellfish, and crustaceans. It is also a source of environmental education and recreation.

According to Biscayne National Park (BNP 2008a), the park encompasses approximately 181,500 acres, 95 percent of which is under water. Therefore, most of the activities in this national park are water-related activities such as boating, canoeing, diving, fishing, sailing, snorkeling, swimming, and waterskiing.

Commercial fishing has been allowed within the boundaries of Biscayne National Park since the park became a National Monument in 1968. According to the landings data presented by the Fish and Wildlife Research Institute (FWRI 2008), the average annual landing amounts and trips in the entire Miami-Dade County region was 1.7 million pounds and 8186 trips for the period of 2003 through 2007. Four major species represented more than 60 percent of the total amounts: pink shrimp (20 percent), spiny lobster (15.6 percent), bait shrimp (14.1 percent), and ballyhoo (10.8 percent). Major species that commercial harvesters target include pink shrimp, spiny lobster, blue crab, stone crab, and finfish.

Recreational fishing is among the most popular activities undertaken in Biscayne National Park. According to the park's internal annual fisheries report (NPS 2006), the park hosts thousands of recreational fishing vessels annually; the 1997 total was estimated to be approximately 33,000 fishing vessels. Most fishermen tend to be recreational anglers, with approximately 20 percent engaging spearfishing and 30 percent fishing further offshore (east of the park's islands). The areas that most fishermen use are along the reef tract (hard bottom substrate) and the area inside the bay near Adams Key (mixed substrate). The composition of the catch covers common reef species, such as snappers, grunts, and lobster (NPS 2006).

Pleasure boating, or cruising, remains a popular water-based activity in South Florida and in Biscayne National Park. The number of registered vessels has increased steadily, reaching a total of 62,324 registered vessels in Miami-Dade County in 2007. Of this total, 59,651 are pleasure craft, and approximately half of these are between 16 to 26 feet long (Florida Department of Highway Safety and Motor Vehicles 2007).

Diving is also an important recreational activity in and around Biscayne National Park. Survey results estimate that there were 3.25 million person-days spent snorkeling and diving in natural and artificial reefs in Miami-Dade County from June 2000 to May 2001 (Johns et al. 2001). During that period, the estimated total use was 9.17 million person-days, including activities such as fishing and glass-bottom boating.

Biscayne National Park hosts over 500,000 visitors annually (NPS 2009). Biscayne National Park is open year-round, but the majority of park visits occur from April to July and in October. Table 2.3-28 presents the monthly variation of number of visitors for the period of 2005 through 2007. Visitors spent approximately 152,000 person-days per year in the park during the period.

There are several public beaches in Miami-Dade County. Homestead Bayfront Park, which accommodates a natural atoll pool and beach (Miami-Dade County 2008a), is located within 6 miles of the plant area, as shown in Figure 2.3-53. Homestead Bayfront Park also accommodates fishing in designated areas and along the canal and bay for barracuda, snapper, mullet and sea bass (Miami-Dade County 2008b). Five boat ramps and a yachting marina known as Herbert Hoover Marina are located in the park (Miami-Dade County 2008c).

The Atlantic Intracoastal Waterway runs through Biscayne Bay, and Hawk Channel is a shipping lane that transverses Biscayne National Park on the outside of the Keys (NPS 2006). Commercial and noncommercial vessels pass through the waterway along the eastern side of the bay. Traffic includes cargo vessels, transportation vessels, and cruise ships. The navigational usage of the Atlantic Intracoastal Waterway in the Miami-Dade county district is difficult to quantify, but it is expected to be significant based on the large number of registered vessels within the county.

Barges delivering fossil fuel to Units 1 & 2 use Biscayne Bay. The fossil fuels are delivered from the port of Miami through Biscayne Bay to the units typically hauling between 11,500 and 14,000 barrels of bunker “C” fuel oil per trip. The number of barge trips from 2004 to 2008 varied between 95 and 277 per year.

Other than the navigational use of Biscayne Bay for shipping fossil fuel for Units 1 & 2, there are no nonconsumptive surface water uses by the existing units.

As described in Section 3.9, barges delivering components and modules for the construction of Units 6 & 7 would also use Biscayne Bay. There would be approximately 80 round-trip barge deliveries for modules and components for each unit over an approximately six-year duration.

2.3.2.1.3 Statutory and Legal Restrictions on Surface Water Use

The consumptive use of water in the state of Florida is regulated by the water management districts, as prescribed in Part II of Chapter 373 of Florida Statute (F.S.). This regulation applies to public water supplies, agricultural and landscape irrigation, contamination cleanup, commercial/industrial uses, and dewatering/mining activities. Water uses that are exempt from the permitting process include domestic uses for single-family homes, water used for fire fighting, saltwater and reclaimed water uses (SFWMD 2008f).

Specific water body restrictions on water use imposed by federal, state, or local regulations that are relevant to Units 6 & 7 are summarized below:

- Biscayne National Park is designated as an Outstanding Florida Water and an Outstanding National Resource Water pursuant to Rule 62-302.700 of Florida Administrative Code (F.A.C.). Any discharges or activities that may cause degradation of water quality and natural resources, other than that allowed in Rule 62-4.242(2) and (3) of F.A.C., are prohibited.

- The Biscayne Bay Aquatic Preserve is managed by the FDEP in accordance with F.S. 258.397 and F.A.C. 18-18. Activities such as dredging, filling, drilling of wells, and erection of structures are regulated to preserve the water quality and aquatic resources.

- Pursuant to the Resolution (No. Z-56-07, conditions 4 & 5) of the Board of County Commissioners of Miami-Dade County, FPL shall not apply for any water withdrawals from the Biscayne aquifer as a source of cooling water for the proposed facilities, and shall use reclaimed or reuse water to the maximum extent possible.

2.3.2.1.4 Plant Water Use

2.3.2.1.4.1 Existing Units Water Use

Units 1-4 use the 5900-acre closed-loop industrial wastewater facility for condenser and auxiliary system cooling. Condenser cooling water is pumped from the intake portion of the industrial wastewater facility and through the plant’s condensers where it gains heat. The heated water is discharged to the discharge portion of the industrial wastewater facility. The head difference between the discharge and intake in this closed-loop system causes the heated water to flow through the industrial wastewater facility, dissipating heat along the way, and eventually returning the cooled water to the plant intake. The required condenser cooling water is 574,300 gallons per minute (gpm) for Units 1 & 2, and 1.25 million gpm for Units 3 & 4. Incidental rainfall, some stormwater runoff, treated process wastewater, and groundwater inflows, compensate for evaporative cooling losses from this system.

Unit 5 uses a closed-cycle cooling system with mechanical draft cooling towers. The required cooling tower makeup water is supplied by groundwater from the upper production zone of the Floridan aquifer. A 90-day average withdrawal of 14.06 million gallons per day and an average annual withdrawal of 4599 million gallons per year are permitted to be used for cooling water for Unit 5 and process water for Units 1, 2, and 5 (FDEP 2007). The cooling tower makeup water for Unit 5, which is currently withdrawn from the Floridan aquifer, may switch to reclaimed water if a reliable source of reclaimed water becomes available (FDEP 2007).

Units 3 & 4 use approximately 690 gpm of water from the Miami-Dade public water supply system. Plant water use includes process (primary demineralizer water makeup), potable, and fire protection water. The Newton water treatment plant, which is part of Miami-Dade’s public water supply system, supplies the existing units.

The process wastewater from the existing units is released into the industrial wastewater facility, and the sanitary wastewater is sent to an onsite treatment plant and disposed of through an underground injection well.

The State Industrial Wastewater Facility Permit No. FL0001562, issued by the FDEP, authorizes releases of industrial wastewater to the closed-loop cooling system and subsequently to groundwater. The permit does not authorize the existing units to discharge to surface waters of the state. The industrial wastewater facility is an integral part of the existing units design and is not waters of the state.

2.3.2.1.4.2 Units 6 & 7 Water Use

Units 6 & 7 would use closed-cycle, mechanical draft cooling towers for both circulating water system cooling and service water system cooling.

The primary source of makeup water for the circulating water cooling towers would be reclaimed water supplied by the MDWASD South District Wastewater Treatment Plant, which is located approximately 9 miles north of the Turkey Point plant property (Figure 2.3-51). When reclaimed water cannot supply the quantity and/or quality of water needed for the circulating water system, radial collector wells supplying saltwater would be used to supplement the supply. The raw water system would be designed to supply 100 percent of the makeup water from either reclaimed water or saltwater, or any combination of both. The ratio of water supplied by the two makeup water sources would vary depending on the availability of reclaimed water from the MDWASD South District Wastewater Treatment Plant. The circulating water system would be designed to accommodate the differing water quality of the two sources.

Municipal water from the Miami-Dade County public water supply system would serve as the source for potable water, makeup water to the service water system, demineralized water, fire protection, and miscellaneous water uses.

The cooling tower blowdown and wastewater from Units 6 & 7 would be discharged to the Boulder Zone of the Lower Floridan aquifer via deep injection wells, as described in Subsection 3.3.1.2.

The water use quantities and diagrams for the plant during operation are presented in Section 3.3, and water use during construction is discussed in Section 4.2.

Details on the transmission lines are provided in Section 3.7. As presented in Subsection 4.2.1.1.10, the impacts of the transmission line on the surface water use are expected to be small.

2.3.2.2 Groundwater Use

This section contains a description of the historical, current, and projected groundwater use at and in the vicinity of the Turkey Point plant property. SSAs within the region are also identified and described.

The hydrostratigraphic framework of Florida, including Miami-Dade County and the vicinity of the Turkey Point plant property, consists of a thick sequence of Cenozoic sediments that comprise two major aquifers. The two major aquifers are (SEGS 1986):

- The surficial aquifer system, including the Biscayne aquifer.
- The Floridan aquifer system consisting of the Upper Floridan aquifer, the middle confining unit, and the Lower Floridan aquifer. The Floridan aquifer is separated from the Biscayne aquifer by the intermediate confining unit.

The Biscayne aquifer is the most productive of the shallow aquifers in southeastern Florida, and it is the prime source of drinking water for the municipal water systems south of Palm Beach County, including Miami-Dade County. However, saltwater intrusion affects the entire coastal zone of the aquifer, thereby limiting use of the aquifer for drinking water in the vicinity of the Turkey Point plant property as a result of the saline to saltwater composition of the groundwater. Figure 2.3-23 shows the approximate location of the freshwater-saltwater interface in the area. The figure indicates that the saltwater interface at the base of the aquifer is approximately 6 to 8 miles inland of the Turkey Point plant property. Provisional data from the USGS (2009b) showing the 2008 freshwater-saltwater interface in Southeast Florida indicates a similar pattern to that shown on Figure 2.3-23.

The Floridan aquifer system consists of three units in southeastern Florida: the Upper Floridan aquifer, the middle confining unit, and the Lower Floridan aquifer. In southeastern Florida, groundwater in the Upper Floridan aquifer is brackish and variable in quality. The aquifer typically contains saline water, which is defined as greater than 250 mg/L of chloride, or saltwater, which is greater than 19,000 mg/L of chloride as defined (by the SFWMD) (SFWMD 2008g). The Upper Floridan aquifer, however, is the primary aquifer used for seasonal storage of both raw and treated freshwater within the aquifer storage and recovery (ASR) systems in southern Florida. Approximately 30 aquifer storage and recovery sites in southern Florida have their storage zone completed within or planned for the Upper Floridan aquifer (Reese and Richardson 2008).

The Boulder Zone of the Lower Floridan aquifer contains saltwater which is used for deep well injection of treated municipal wastewater and reverse osmosis concentrate in Miami-Dade County. Injection occurs below the middle confining layer at depths of approximately 2800 feet or greater, approximately 900 feet below the base of the lowest underground source of drinking water (USDW) (defined as an aquifer that contains water with a total dissolved solids concentration of less than 10,000 mg/L (U.S. EPA 2003 and Reese and Richardson 2008).

2.3.2.2.1 Regional Groundwater Use

Historical, current, and projected groundwater use in the vicinity of the Turkey Point plant property was evaluated using information from the U. S. Geological Survey (USGS) and the SFWMD.

2.3.2.2.1.1 Historical Groundwater Use

Freshwater withdrawal of groundwater has been monitored for Miami-Dade County by the USGS (Marella 2005 and Marella 2008). In the Miami-Dade County area, freshwater is restricted to the Biscayne aquifer. However, the Turkey Point plant property is in an area of the Biscayne aquifer with Class G-III groundwater (non-potable water use). Groundwater use has shown a steady increase between the 1960s and the present as shown on Figure 2.3-55. The primary groundwater use in Miami-Dade County is for public water supply, followed by agricultural irrigation. Beginning in approximately 1985, a new category of use was introduced—recreational irrigation. This category includes golf course irrigation and other types of turf grass irrigation. Table 2.3-29 presents the groundwater use for each category.

The underlying Upper Floridan aquifer typically contains saline water to saltwater. In 1990 and 1995, no groundwater use was reported from the Floridan aquifer for Miami-Dade County (Marella 1992 and Marella 1999). In 2000, water use of 3.68 million gallons per day from the Upper Floridan aquifer was reported for the county with a use category of industrial (Marella and Berndt 2005).

2.3.2.2.1.2 Current Use

Figure 2.3-56 shows the current groundwater users in Miami-Dade County based on water use permits filed with the SFWMD (SFWMD 2011). The figure does not show wells that do not require a water use permit, such as domestic wells, wells used exclusively for fire fighting, or those wells withdrawing saline or saltwater. Table 2.3-30 lists the public water supply systems in Miami-Dade County along with the population served (FDEP 2008a). Figure 2.3-57 (FDEP 2008d) presents the major well fields in Miami-Dade County and their associated groundwater protection zones.

In addition to the traditional uses of the groundwater aquifer, other uses of the groundwater aquifer are present in south Florida. These include disposal of municipal and industrial wastewater in Class I injection wells and the use of ASR wells. The ASR wells are used to inject raw or partially treated water into the aquifer for later extraction and use. Figure 2.3-58 shows the typical configuration of Class I injection wells and ASR wells in south Florida. ASR wells are typically completed as open-hole wells in the Upper Floridan aquifer. Class I injection wells are typically completed as open-hole wells in the Boulder Zone portion of the Lower Floridan aquifer which is below the lowermost USDW. Figures 2.3-59 and 2.3-60 show the locations of these wells in Florida (FDEP 2008b).

2.3.2.2.1.3 Projected Use

Projected groundwater use in Miami-Dade County was obtained from the *Lower East Coast Water Supply Plan*, 2005–2006 update (SFWMD 2006b). Figure 2.3-55 includes projections of groundwater use through 2025. The projections combine domestic and public water supply categories into one total value.

2.3.2.2.2 Local Groundwater Use

This section provides a description of the current and projected groundwater use in the vicinity of the Turkey Point plant property.

2.3.2.2.2.1 Current Use

Units 1 through 4 use the cooling canals of the industrial wastewater facility for condenser and auxiliary system cooling (Figure 2.3-3). The canals also receive cooling tower blowdown from Unit 5 and existing facilities drainage. The industrial wastewater facility is a closed-loop system (Figure 2.3-61) that includes the canal network adjacent to Units 6 & 7. There are no discharges to surface water from the industrial wastewater facility. Cooling water for Unit 5 and process water for Units 1, 2, and 5 are obtained from Upper Floridan aquifer saline production wells (PW-1, PW-3, and PW-4). The locations of these production wells, which were commissioned in February 2007, are shown in Figure 2.3-62. Monthly production from each of the wells is shown in Figure 2.3-63. The average combined production from the three wells is approximately 170 million gallons per month. Water supply for other water uses at Turkey Point comes from the potable water system of the MDWASD.

A single Class V, Group 3 gravity injection well is used to dispose of up to 35,000 gallons per day of domestic reclaimed water at the Units 3 & 4 wastewater treatment plant. The well, designated IW-1, is open from 42 to 62 feet below ground surface and is 8 inches in diameter.

2.3.2.2.2.2 Projected Use

Reclaimed water from the MDWASD or saltwater from radial collector wells would be the two sources of cooling water for Units 6 & 7. The total makeup flow required from the radial collector wells is estimated to be 86,400 gpm; however, the actual amount of saltwater used would depend on the quality and quantity of reclaimed water available from the MDWASD. Water supply for potable water, service water system makeup, fire protection, and miscellaneous raw water use would be from the MDWASD.

Radial collector wells would consist of a central concrete caisson excavated to an optimal target depth. The caisson diameter is based on the size of pumps and number of laterals required. The optimal target depth of the caisson will be based on the available drawdown and the desired elevation of the laterals. Screened sections will be incorporated along the lateral based on site conditions. Once the caisson and laterals are installed, groundwater will infiltrate into the laterals and flow back to the caisson. The water then will be pumped from the caisson.

Four radial collector wells, each capable of producing approximately 45 million gallons per day, would be installed. Figure 2.3-64 shows the location of the radial collector wells. At any time, one collector well will operate in standby mode as a reserve well in the event of an unplanned well outage or scheduled maintenance event. Each radial collector well would consist of a central reinforced concrete caisson extending below the ground surface with laterals projecting horizontally from the caisson. The laterals would be advanced horizontally a distance of up to 900 feet from the caisson and installed at a depth of approximately 25 to 40 feet below the bottom of Biscayne Bay. The wells would be designed and located to induce infiltration from Biscayne Bay.

Disposal of wastewater from Units 6 & 7 is planned to occur in Class I deep injection wells drilled at the site. The wells would inject the wastewater into the Boulder Zone of the Lower Floridan aquifer at depths of approximately 2900 to 3500 feet below ground surface. This injection zone has been used for the underground disposal of liquid wastes since 1943 (Maliva et al. 2007). The Boulder Zone is located beneath groundwater supplies that are currently or may be used in the future as a source of drinking water. Drinking water supply sources are typically not more than a few hundred feet deep and, therefore, far above the Boulder Zone (U.S. EPA 2000).

The Boulder Zone is permitted by the FDEP as a zone for the discharge of treated sewage and other wastes disposed of through injection wells. The Boulder Zone meets the Florida Department of Environmental Regulations criteria for Class I injection. The Boulder Zone has the following characteristics throughout its extent:

- Deep. The top of the Boulder Zone is 2000 to 3400 feet in depth.
- Confined. There is approximately 800 to 1000 feet of confining limestone and dolomite beds between the Boulder Zone and the base of the Underground Source of Drinking Water.
- Thick. The Boulder Zone is up to 700 feet in thickness.
- Porous. The Boulder Zone has well developed secondary permeability.
- Highly Transmissive. The transmissivity of the Boulder Zone is up to 24.6E06 square feet per day.
- Contains groundwater with total dissolved solids concentration >10,000 mg/L. The average dissolved solids concentration of Boulder Zone groundwater is approximately 37,000 mg/L.

Over 90 Class I injection wells are used to dispose of over 200 million gallons per day of secondary treated wastewater in southeast Florida (Bloetscher and Muniz 2006).

Deep injection wells would be used for the disposal of non-hazardous industrial wastewater consisting of cooling tower blowdown, sanitary wastewater, and miscellaneous plant wastewater from Units 6 & 7. The wastewater disposal requirements for Units 6 & 7 are estimated to be a combined total of approximately 20 million gallons per day when using only reclaimed water from the MDWASD as a cooling water source, and as high as 90 million gallons per day when using only saltwater as a cooling water source. Therefore, the combined disposal volumes are estimated to be between 20 million and 90 million gallons per day when using a combination of reclaimed water and saltwater for cooling. The wells would be Class I industrial injection wells with a total capacity of 90 million gallons per day. The deep injection wells would consist of 10 primary wells and 2 backup wells. The injection zone would be in the Boulder Zone of the Lower Floridan aquifer, which is at a depth of approximately 2900 feet bgs in the plant area. Approximately 800 to 1000 feet of confining limestone and dolomite beds would be present between the injection zone and the base of the USDW.

Deep injection well design includes determining the allowable injection rate and the area of review. Section 62-528.415 (1)(f)2 FAC (FDEP 2008b) states that the hourly peak injection rate should not exceed a velocity of 10 feet per second. Based on a review of data from other deep injection wells in southeast Florida, it is estimated that each deep injection well would have a maximum allowed injection capacity of 18.6 million gallons per day at a peak hourly flow.

However, it is estimated that each well would be operated at an injection rate of approximately 10 million gallons per day.

The casing in the deep injection wells for Units 6 & 7 would be seated at a depth of approximately 2800 feet bgs to maximize the thickness of the confining strata between the injection zone and base of the USDW. Grouting the pilot holes drilled for core and data collection, prior to reaming the holes for casing placement, would be employed to prevent the possible development of double borehole conditions. Additionally, all Class I injection wells are required to have a dual-zone monitoring system that consists of a zone open below the deepest USDW and a zone located in the USDW for geochemical and pressure monitoring.

The temperature and total dissolved solids concentration of the injected effluent will be variable. The injected effluent temperature would vary seasonally. The maximum and minimum expected temperatures would be 91°F and 65°F, respectively. The expected wastewater TDS when using reclaimed water would be 2721 mg/L; when using saltwater from the radial collector wells, the expected wastewater TDS would be 57,030 mg/L. Based on the temperature and TDS values, the density of the injected fluid is estimated to range from 996.8 kilograms per cubic meter (100-percent reclaimed water in the summer) to 1042.2 kilograms per cubic meter (100-percent saltwater in the winter).

2.3.2.2.3 Sole Source Aquifers

EPA has designated two SSAs that are located entirely within the state of Florida, the Volusia-Floridan aquifer and the Biscayne Aquifer, as shown on Figure 2.3-18 (U.S. EPA 2011). The Volusia-Floridan aquifer is located in east-central Florida, well beyond the boundaries of the local hydrogeologic system underlying the plant area; however, the Biscayne aquifer underlies the site and Miami-Dade County. An SSA is defined as “an underground water source that supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer. These areas have no alternative drinking water source(s) that could physically, legally, and economically supply all those who depend upon the aquifer for drinking water” (U.S. EPA 2011). Saltwater intrusion affects the entire coastal zone of the Biscayne aquifer including the Turkey Point plant property. As a result, groundwater beneath the Turkey Point plant property is not used as a drinking water source because of its salinity.

2.3.3 WATER QUALITY

This subsection describes the water quality characteristics of surface water bodies and groundwater aquifers that could affect plant water use, wastewater injection, and stormwater runoff or be impacted by preconstruction/construction and operation of Units 6 & 7.

2.3.3.1 Surface Water

Surface water bodies of primary interest near the Units 6 & 7 plant area include Biscayne Bay, Card Sound/Card Sound Canal, and the cooling canals of the industrial wastewater facility. These water bodies have the potential to be affected as a result of the construction (e.g., surface water runoff), and operation (e.g., radial collector well operation) of Units 6 & 7. They are addressed in the following paragraphs.

2.3.3.1.1 Biscayne Bay and Card Sound/Card Sound Canal

The Units 6 & 7 plant area is located adjacent to Lower Biscayne Bay. Card Sound is south of Biscayne Bay. Card Sound Canal starts at the southern end of the industrial wastewater facility and terminates at Card Sound. Card Sound Canal is not hydraulically connected to the industrial wastewater facility; however, it is connected to Card Sound. Therefore, Card Sound Canal would be expected to have similar water quality to Card Sound. The locations of Biscayne Bay, Card Sound, and the Card Sound Canal relative to Units 6 & 7 are shown in Figures 2.3-1 and 2.3-3.

Biscayne Bay's beauty and utility invites a diversity of recreational and commercial water activities, including powerboating, sailboating, catamaraning, canoeing, sculling, waterskiing, other motorized watercraft, parasailing, swimming, windsurfing, snorkeling, diving, and fishing.

Biscayne Bay is also important navigationally as part of the Intracoastal Waterway and home to the Port of Miami, one of the busiest cargo and passenger ports in the world. Biscayne Bay provides for a variety of educational and research activities. Several marine science and education facilities use Biscayne Bay and include the University of Miami School of Rosenstiel School of Marine and Atmospheric Sciences, Florida International University, Barry University, the National Oceanic & Atmospheric Administration, the Southeast Fisheries Laboratory, and the Miami Seaquarium. The MAST (Maritime and Science Technology) Academy is a local magnet school located on Virginia Key and is dedicated to students interested in marine science. In addition to these institutions, several governmental agencies as well as scientists from remote locations conduct research and education programs pertaining to Biscayne Bay (FDEP 2008f).

To meet the requirements of Section 303(d) of the federal Clean Water Act, the 1999 Florida Watershed Restoration Act was created directing the Florida Department of Environmental Protection (FDEP) to implement a comprehensive, integrated watershed approach to evaluating and managing impacts to Florida's waters (FDEP 2006b). Units 6 & 7 would be located in the Everglades (HUC 090202)/Florida Bay (HUC 090203) watersheds as shown in Figure 2.3-5. This watershed is currently managed by the SFWMD, a regional Florida state-run agency responsible for water quality, flood control, water supply, and environmental restoration in 16 counties from Orlando to the Florida Keys (SFWMD 2008i). South Florida's coastal systems support spiny lobster, penaeid shrimp, blue crab, oyster, spotted sea trout, stone crab, and many other marine and freshwater species of commercial and recreational interest. Coastal ecosystems are especially vulnerable because they attract intense human development, making these areas especially prone to habitat loss and alteration. (SFWMD 2008h) One of the SFWMD's goals is to manage freshwater discharge to south Florida's estuaries in a way that preserves, protects, and, where possible, restores essential estuarine resources. The SFWMD seeks to ensure that estuaries receive not only the right amount of water at the right time but also clean, high-quality water. (SFWMD 2008h)

Biscayne Bay water quality is monitored by the SFWMD through a project with the four-letter code name BISC (renamed BBWQ). Project BISC (Project BBWQ) is monitored by two entities: the Miami-Dade County Department of Environmental Resources Management and the Florida International University. The entities monitor different parts of Biscayne Bay with the same goals, which are to determine water quality and provide data to SFWMD staff and outside agencies. (SFWMD 2011)

Miami-Dade County Department of Environmental Resources Management's monitoring program consists of monthly surface water monitoring in Biscayne Bay and its tributaries. Routine monitoring was initiated to detect spatial and seasonal water quality trends, determine impacts on the health of the bay ecosystem, and identify areas of degradation. (SFWMD 2011)

The program with Florida International University is part of an integrated monitoring network known as the South Florida Coastal Water Quality Monitoring Network. The network monitors water quality on the coastal regions of south Florida. The data generated from the South Florida Coastal Water Quality Monitoring Network is used to examine water quality trends along the Florida coast as well as address issues concerning freshwater inflow, water clarity, salinity, and nutrient availability patterns. (SFWMD 2011)

Project BISC (Project BBWQ) monitors the following parameters: temperature, dissolved oxygen, pH, turbidity, nitrogen oxides, nitrate, ammonia, total Kjeldahl nitrogen, orthophosphate, total phosphate, silica, chlorophyll A, nitrite, total nitrogen, salinity, total organic carbon, and alkaline phosphate. Figure 2.3-66 depicts the monitoring stations that are potentially affected as a result of the construction and operation of Units 6 & 7. Table 2.3-31 presents the monthly average, maximum and minimum water qualities for Project BISC (Project BBWQ) samples collected between 1993 and 2010 at varied depths of sampling local to the Turkey Point plant property. To analyze horizontal variations in Biscayne Bay, the data is presented at two depth ranges: less than 1 meter and greater than or equal to 1 meter. To analyze temporal variations, the data is presented monthly.

Analysis of the data from Project BISC (Project BBWQ) for horizontal spatial variation reveals that alkaline phosphate, silica, and nitrogen oxides are slightly elevated in samples closest to the shore (BISC 101, 110, and 122). Nitrogen oxide is shown to be the highest among the samples taken from the canals (MW01, MW04 and FC03). Total Kjeldahl nitrogen and nitrate are slightly elevated at sampling location BISC 101. Water quality data from samples taken in Card Sound (locations BB47, BB48, BISC 121 and 135) shows no meaningful water quality differences when compared to data from Biscayne Bay. In summary, Biscayne Bay, including Card Sound, is relatively consistent in regard to horizontal spatial variations.

As shown in Table 2.3-31, temperature, dissolved oxygen, and salinity were sampled at two depths and there was no meaningful variation in the data. The water quality data shown in Table 2.3-31 is consistent with the data analyzed for other sample locations in Biscayne Bay at varying depths and, as a result, it can be concluded that Biscayne Bay is relatively consistent in regard to vertical spatial variations in water quality.

Seasonal analysis of the data collected through Project BISC (Project BBWQ) shows higher concentrations of total nitrogen during the summer months for all sampling locations. In addition, the temperature of Biscayne Bay varies from an average monthly maximum of 31.1°C in July at BISC 101 to an average monthly minimum of 17.5°C in January at BB44 (average of samples taken at greater than 1 foot deep). Otherwise, most likely because of the limited atmospheric temperature variation seasonally (Florida's proximity to the equator), there is minimal seasonal variation in Biscayne Bay.

2.3.3.1.2 Industrial Wastewater Facility

Stormwater runoff from the construction and operation of Units 6 & 7 would be routed to the industrial wastewater facility which is described in Subsection 2.3.1.1.4. Water quality sampling and analyses were performed in the industrial wastewater facility in 2003. The results are summarized in Table 2.3-32.

The industrial wastewater facility receives tidal inflow and outflow from the saline aquifer beneath Biscayne Bay because of the exceptional porosity of the underlying rock. The industrial wastewater facility does not directly discharge to fresh or marine surface waters; however, because the canals are not lined, groundwater does interact with water in the industrial wastewater facility. Makeup water for the industrial wastewater facility comes from treated process water, rainfall, stormwater runoff, and groundwater infiltration to replace evaporative and seepage losses. Consequently, the water in the canals is hypersaline because of the effects of evaporation, with salinity concentrations approximately twice that of Biscayne Bay.

Analysis of the industrial wastewater facility temperatures has been performed using a steady-state energy balance model developed for Unit 5 in 2003. This analysis used 5 years of data to predict temperatures in the industrial wastewater facility. Depending on the time of year and plant capacity factors, the temperature of heated water from Units 1 through 4 entering the industrial wastewater facility ranges from approximately 85ºF to 105°F, while cooled water returning to the units ranges from approximately 70ºF to 90°F. The predicted average monthly temperatures in the industrial wastewater facility range from 95.9°F for water entering to 82.6°F for water leaving (i.e., cooling water intakes). The associated predicted annual average temperature difference (ΔT) across the industrial wastewater facility is 13.4°F over the 5-year period analyzed. To predict the maximum temperatures in the industrial wastewater facility, data from June 1998 was used. The highest monthly temperatures were predicted for this period, with the highest temperature reported at 106.1°F, that had cooled down to approximately 94.8°F at the south end of the industrial wastewater facility, and then further cooled to approximately 91.9°F when returning to the units. Because continuous flow through the canals occurs, spatial variations in water quality and seasonal variation, other than temperature, are not expected.

Liquid radioactive waste effluent from Units 3 & 4 is also discharged to the industrial wastewater facility. The tritium level in the cooling canals is monitored and averaged 5250 picocuries per liter during 2000-2007.

2.3.3.1.3 Section 303(d) List of Impaired Waters

Section 303(d) of the Clean Water Act requires states to develop a list of waters not meeting water quality standards or waters not supporting their designated uses. Chapter 99-223, *Laws of Florida*, sets forth the process by which the list is refined through more detailed water quality assessments. Total maximum daily loads are required for the waters determined to be impaired based on these detailed assessments because technology-based effluent limitations, current effluent limitations required by state or local authority, or other pollution-control requirements are not stringent enough to meet current water quality standards. (FDEP 2008e)

To protect present and future most beneficial uses of the waters, water quality criteria have been established for each designated use classification. While some criteria are intended to protect aquatic life, others are designed to protect human health (FDEP 2008f). The Southeast Coast/Biscayne Bay is given surface water Class III-recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife classification.

Biscayne Bay, Card Sound, and Card Sound Canal do not appear on the 2006 Florida 305(b) Report of impaired waters, and are not listed in Section 303(d) impaired waters. Biscayne Bay is described as having "fairly good water quality" (FDEP 2006b).

As shown in Figure 2.3-67, there are only three Section 303(d)-listed waters in the Southeast Florida Coast Water Basin and located within 15 miles of Units 6 & 7. These waters are FL-3303 or C-111 Canal (Aerojet Canal), FL-3033A (a stream in South Dade County), and FL-3304 Canal (Military Canal located at Homestead Air Reserve Base). The closest Section 303(d)-listed water to Units 3 & 4 is the Military Canal at Homestead Air Reserve Base, which is approximately 5 miles from the Units 6 & 7 plant area. The Florida Keys, located just south of Biscayne Bay, are

Section 303(d)-listed waters impaired for nutrients. The Homestead Air Reserve Base is impaired for cadmium, copper, and lead. The Aerojet Canal is impaired for dissolved oxygen and mercury and the FL-3033A stream is impaired for dissolved oxygen and nutrients. Because the Units 6 & 7 plant area is not located close to surface waters on the Section 303(d) list and does not have an intake from or discharge to these water bodies, there would be no interaction between Units 6 & 7 and these Section 303(d)-listed water bodies.

2.3.3.1.4 Surface Water Pollutant Sources

Figure 2.3-68 shows the National Pollutant Discharge Elimination System (NPDES) discharges within 15 miles of Units 6 & 7. The closest industrial NPDES discharger to Units 6 & 7, located adjacent to the plant area, but not permitted to discharge to waters of the state of Florida or waters of the United States, is Units 1 through 5 (Permit Number: FL0001562). All the other permitted NPDES discharges shown on Figure 2.3-68 are remotely located in relation to the plant and, therefore, would not interact with Units 6 & 7.

2.3.3.2 Groundwater

Groundwater in the vicinity of the Turkey Point plant property is not used as a water source because of its salinity. The state of Florida has classified these as Class G-III waters to identify groundwater that has no reasonable potential as a future source of drinking water due to high total dissolved solids content (Merritt 1996). Field-measured groundwater quality indicator parameters (temperature, pH, dissolved oxygen, specific conductivity, turbidity, and oxidation-reduction potential) obtained during the collection of samples from 12 observation wells (installed in the Biscayne aquifer as part of the site characterization investigation) for field-measured parameters are summarized in Table 2.3-22. The results of the laboratory analyses are presented in Table 2.3-23. Table 2.3-32 presents a summary of water quality data collected as part of the Turkey Point peninsula pumping test. Additional data and information regarding these water quality analyses can be found in HDR 2009. The state of Florida has conducted an extensive characterization of the background water quality in the major aquifer systems (FGS 1992). Tables 2.3-22 and 2.3-23 also present typical geochemical parameters for the Biscayne aquifer, the Floridan aquifer, and precipitation at Everglades National Park.

This data was taken from the surficial aquifer at depths of approximately 20 or 100 feet below local ground surface. The location of these wells is shown in Figure 2.3-25.

Chemically, the water in the middle confining unit is similar to seawater, but salinity varies greatly at the top of the unit as the upward moving saline water from the Lower Floridan is blended with the seaward flowing freshwater in the Upper Floridan aquifer (Meyer 1989).

Although the Upper Floridan aquifer is a major source of potable groundwater in much of Florida, water withdrawn from the unit in southeastern Florida, including Miami-Dade County, is brackish and variable with chloride and dissolved solid concentrations greater than 1000 mg/L. Groundwater samples from the Upper Floridan aquifer production wells at Unit 5 show an average chloride concentration of 2900 mg/L.

Treated wastewater, sanitary waste, blowdown, and treated liquid radioactive waste effluent would be injected into the Boulder Zone of the Lower Floridan aquifer via deep injection wells that would terminate approximately 2900-3000 feet below grade. Subsurface injection, the practice of emplacing fluids in a permeable underground aquifer by gravity flow or under pressure through an injection well, is one of a variety of wastewater disposal or reuse methods applied in Florida. Permits for underground injection wells are issued by the FDEP Underground Injection Control Program. The injection wells permitted by the FDEP Underground Injection Control Program are divided into the EPA's five classes (Class I through Class V) based on the similarity in the fluids injected, activities, construction, injection depth, design, and operating techniques (FDEP 2008b, U.S. EPA 2008b). Class I wells are used for discharging wastewater to the Boulder Zone of the Lower Floridan aquifer, where the wastewater from Units 6 & 7 would be injected. The closest facility to Units 6 & 7 currently permitted for subsurface injection is the MDWASD, approximately 9 miles north, which injects secondary treated municipal wastewater. This facility has 13 active Florida Class I wells (wells used to inject nonhazardous waste or municipal waste below the lowermost underground sources of drinking water). The next closest facility to Units 6 & 7 that is permitted for Class I deep well injection is more than 30 miles north with two active wells. Miami-Dade County injects 91.31 million gpd (average annual) to injection wells. Florida has more than 125 active Class I wells, with the majority of these wells being used to dispose nonhazardous, secondary treated effluent from domestic wastewater treatment plants, like the MDWASD (FDEP 2008c).

Additionally, the EPA's *Relative Risk Assessment of Management Options for Treated Wastewater in South Florida* evaluated the potential stressors to human health or ecology (U.S. EPA Apr 2003). These potential stressors include any dissolved or entrained wastewater constituents that may reach receptors in sufficient concentrations to cause adverse human health or ecological effects. In this evaluation, water quality data was obtained from the MDWASD South District Wastewater Treatment Plant, which receives secondary treatment (secondary treatment is the standard practice for municipal wastewater treatment facilities in South Florida). This data was compared to the EPA's maximum contaminant levels for drinking water. Drinking water standards are a good indicator of the health of the groundwater in the Boulder Zone because aquifers above the Boulder Zone are used for drinking water in Florida. It was concluded that South Florida's municipal wastewater (Dade County, Miami-Dade North District) that has received secondary treatment does not exceed the EPA's primary drinking water standard maximum contaminant levels for any constituents at the point of injection to the Boulder Zone. Although FDEP §62-520-410 does not require non-potable water use groundwater aquifers Class G-IV to meet primary drinking water standards, the fact that the Boulder Zone does meet the

EPA's primary drinking water standard maximum contaminant levels is indicative of the health of the groundwater.

Section 2.3 References

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Table 2.3-1
East Miami-Dade County Drainage Subbasin Areas and Outfall Structures

Subbasin Name	Major Canal	Drainage Area	Outfall Structure	Structure Type	Design Headwater Stage	Structure Design Discharge
		Square mile			Feet NGVD 29	Cubic feet per second
C-9[(a)]	Snake Creek Canal (C-9)	98	S-29	Spillway, 4 gates	3.0	4780
C-8	Biscayne Bay Canal (C-8)	31.5	S-28	Spillway, 2 gates	2.3	3220
C-7	Little River Canal (C-7)	35	S-27	Spillway, 2 gates	3.2	2800
C-6	Miami Canal (C-6)	69	S-26 S-25B	Spillway, 2 gates Spillway, 2 gates	4.4 4.4	3400 2000
C-5	Comfort Canal (C-5)	2.3	S-25	Culvert	2.5	260
C-4	Tamiami Canal (C-4)[(b)]	60.9	S-25A	Gated Culvert	N/A[(c)]	N/A
C-3	Coral Gables Canal (C-3)	18	G-97	Weir	4.5	640
C-2	Snapper Creek Canal (C-2)	53	S-22	Spillway, 2 gates	3.5	1950
C-100	C-100 Canal	40.6	S-123	Spillway, 2 gates	2.0	2300
C-1	Black Creek Canal (C-1)	56.9	S-21	Spillway, 3 gates	1.9	2560
C-102	C-102 Canal	25.4	S-21A	Spillway, 2 gates	1.9	1330
C-103	Mowry Canal (C-103)	40.6	S-20F	Spillway, 3 gates	1.9	2900
Homestead	Military Canal	4.7	S-20G	Spillway, 1 gate	2.0	900
North Canal	North Canal[(d)]	7.8	S-20F	Spillway, 3 gates	1.9	2900
Florida City	Florida City Canal[(e)]	12.5	—	—	—	—
Model Land	Model Land Canal	28.1	S-20	Spillway, 1 gate	1.5	450
C-111	C-111 Canal	100	S-197	Gated Culvert	1.4	550

(a) Subbasin C-9 combines areas C-9 West and C-9 East, as shown in Figure 2.3-12
(b) Joins with Subbasins C-5 and C-6 and outflows through S-25 and S-25B
(c) N/A indicates data not available
(d) Outflows through S-20F
(e) No outflow structure joins with the L-31E Canal
Source: Cooper and Lane 1987

Table 2.3-2
Summary of Data Records for Gage Stations at S-197, S-20, S-21A and S-21 Flow Control Structures

Structure	Database Key[(a)]	Station[(b)]	Latitude[(c)]	Longitude[(c)]	Subbasin[(d)]	Data Type[(e)]	Frequency	Statistics	Agency	Start Date[(f)]	End Date[(f)]
S-197	04994	S197_C	251713.4	802629.2	MODEL	FLOW	Daily	Mean	SFWMD	19690623	20000330
	HA458	S197_C	251713.4	802629.2	MODEL	FLOW	Daily	Mean	SFWMD	19971231	Ongoing
	15763	S197_C	251713.4	802629.2	MODEL	FLOW	Daily	Mean	SFWMD	19700101	Ongoing
	04990	S197_H	251713.4	802629.2	MODEL	STG	Daily	Mean	SFWMD	19690623	19930428
	13093	S197_H	251713.4	802629.2	MODEL	STG	Daily	Mean	SFWMD	19900921	19990629
	HA459	S197_H	251713.4	802629.2	MODEL	STG	Daily	Mean	SFWMD	19980129	Ongoing
S-20	13037	S20_H	252201.4	802235.2	FLA CITY	STG	Daily	Mean	SFWMD	19900530	Ongoing
	03846	S20_H	252201.4	802235.2	FLA CITY	STG	Daily	Mean	SFWMD	19671228	19920526
	13036	S20_S	252201.4	802235.2	FLA CITY	FLOW	Daily	Mean	SFWMD	19900530	Ongoing
	03850	S20_S	252201.4	802235.2	FLA CITY	FLOW	Daily	Mean	SFWMD	19680229	19910826
S-21A	04708	S21A_H	253109.4	802046.2	C1	STG	Daily	Mean	SFWMD	19720817	19900130
	06601	S21A_H	253109.4	802046.2	C1	STG	Daily	Mean	SFWMD	19850831	Ongoing
	04712	S21A_S	253109.4	802046.2	C1	FLOW	Daily	Mean	SFWMD	19740116	19900130
	06777	S21A_S	253109.4	802046.2	C1	FLOW	Daily	Mean	SFWMD	19850831	Ongoing
S-21	06597	S21_H	253235.5	801951.4	DA-4	STG	Daily	Mean	SFWMD	19840117	Ongoing
	00677	S21_H	253235.5	801951.4	DA-4	STG	Daily	Mean	USGS	19671001	20041020
	06776	S21_S	253235.5	801951.4	DA-4	FLOW	Daily	Mean	SFWMD	19840117	Ongoing
	00679	S21_S	253235.5	801951.4	DA-4	FLOW	Daily	Mean	USGS	19691101	20040930

(a) Record identification number for SFWMD DBHYDRO database
(b) Suffix designation: C – Culvert, H – Headwaters, S – Spillway
(c) Latitude/longitude format: ddmmss.s, dd – Degrees, mm – Minutes, ss.s – Seconds, latitudes in degrees North, longitudes in degrees West
(d) MODEL - Model Land subbasin, FLA CITY – Florida City subbasin, C1– C1 subbasin, DA-4 – Dade subbasin 4
(e) Flow – flow discharge, STG – stage
(f) Date Format: yyyymmdd, where yyyy – Year, mm – Month, dd – Day
Source: SFWMD 2009

Table 2.3-3 (Sheet 1 of 2)
Mean Monthly Flows at the Canal C-111 Structure S-197

YEAR	Monthly Mean in Cubic Feet per Second											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1970	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	19.278	96.74	45	15.411	8.538	4.083	0	0
1973	0	0	0	0	0	0	3.64	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	4.905	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	79.304	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	26.519	17.269	0	0
1979	0	0	0	0	65.356	0	0	0	47.398	49.93	0	0
1980	0	0	0	0	0	0	76.507	78.337	240.179	29.640	112.646	0
1981	0	52.891	0	0	0	0	0	239.978	536.729	105.378	0	0
1982	0	0	0	0	0	170.247	28.94	0	63.522	129.102	144.590	0
1983	96.527	373.798	452.039	79.333	0	334.074	100.896	157.914	328.885	12.586	0	0
1984	0	0	51.403	0	82.276	0	116.553	43.698	14.174	0	0	0
1985	0	0	0	0	0	0	60.308	0	134.999	0	0	0
1986	0	0	0	0	0	60.811	0	290.441	110.000	0	8.963	6.990
1987	58.032	0	0	0	0	0	0	0	41.852	250.42	92.859	0
1988	0	0	0	0	0	342.095	0	916.717	39.972	92.99	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	46.051	0	0
1992	0	0	0	0	0	459.429	94.048	115.695	82.059	0	0	0
1993	0	0	0	0	0	0	0	0	0	41.968	0	0
1994	0	0	0	0	0	0	0	0	74.269	95.552	332.916	0
1995	0	0	0	0	0	341.752	125.366	269.349	122.944	690.039	8.278	0

Table 2.3-3 (Sheet 2 of 2)
Mean Monthly Flows at the Canal C-111 Structure S-197

YEAR	Monthly Mean in Cubic Feet per Second											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1996	0	0	0	0	0	257.087	8.231	0	0	178.448	0	0
1997	0	0	0	0	0	505.727	0	0	82.344	0	0	16.801
1998	0	0	0	0	0	0	0	0	472.435	0	27.967	0
1999	0	0	0	0	0	0	0	0	74.81	608.412	0	0
2000	0	0	0	0	0	0	0	0	21.391	393.893	0	0
2001	0	0	0	0	0	0	0	80.273	40.494	219.259	0	0
2002	0	0	0	0	0	134.37	132.425	0	0	0	0	0
2003	0	0	0	0	0	0	0	0	30.410	26.294	0	0
2004	0	0	0	0	0	0	0	0	0	38.366	0	0
2005	0	0	0	0	0	113.481	0	444.112	349.756	167.782	0	0
2006	0	0	0	0	0	0	0	0	0	0	0	0
2007	0	0	0	0	0	24.685	0	0	0	113.736	0	0
2008	0	0	0	0	0	0	0	70.182	—	—	—	—
Mean	3.963	10.941	12.909	2.034	4.280	74.867	20.303	69.923	77.465	87.137	19.164	0.626

Source: SFWMD 2009

Table 2.3-4 (Sheet 1 of 2)
Mean Monthly Water Level at the Canal C-111 Structure S-197 (Headwater)

YEAR	Monthly Mean in Feet NGVD 29											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1970	1.518	1.506	1.290	0.732	0.232	1.346	1.513	1.316	1.350	1.519	1.464	1.207
1971	0.851	0.619	0.136	-0.467	-0.535	0.461	1.224	1.278	1.451	1.519	1.529	1.407
1972	1.348	1.315	1.148	1.284	1.364	1.717	1.660	1.490	1.675	1.667	1.654	1.512
1973	1.465	1.407	1.188	0.790	0.376	0.760	1.477	1.676	1.721	1.690	1.538	1.375
1974	1.389	1.027	0.348	-0.239	-0.072	1.076	1.347	1.444	1.477	1.580	1.387	1.395
1975	1.197	0.856	0.231	-0.468	0.375	1.179	1.628	1.574	1.497	1.516	1.513	1.289
1976	1.011	0.905	0.733	0.594	1.041	1.697	1.485	1.706	1.778	1.617	1.499	1.389
1977	1.414	1.328	1.114	0.521	1.267	1.593	1.388	1.483	1.866	1.679	1.565	1.608
1978	1.556	1.611	1.590	1.334	1.505	1.629	1.749	1.728	1.999	1.995	1.832	1.608
1979	1.579	1.415	1.009	0.503	1.697	1.625	1.581	1.603	1.820	1.934	1.682	1.723
1980	1.594	1.620	1.476	1.359	1.328	1.736	1.749	1.778	1.865	1.893	1.838	1.797
1981	1.617	1.592	1.565	0.976	0.536	1.133	1.317	1.536	1.929	1.791	1.774	1.558
1982	1.366	1.168	0.940	1.038	1.477	1.741	1.593	1.686	1.796	2.079	2.014	1.805
1983	1.848	2.122	2.107	2.161	1.549	1.955	1.807	2.030	2.272	2.161	2.004	1.698
1984	1.576	1.372	1.289	1.248	0.922	1.773	1.912	2.099	2.150	2.094	1.759	1.612
1985	1.472	1.354	1.226	1.336	1.257	1.346	2.023	2.215	2.358	2.522	2.310	1.900
1986	1.862	1.548	1.552	1.664	1.245	1.847	2.315	2.353	2.405	1.914	1.818	1.854
1987	1.952	1.607	1.782	1.466	1.482	1.414	1.713	1.841	2.091	2.633	2.621	2.381
1988	1.953	1.623	1.357	0.927	1.564	2.350	2.629	2.309	2.627	2.455	1.883	1.664
1989	1.488	1.205	1.028	1.279	1.155	1.025	1.792	1.983	2.032	1.801	1.661	1.560
1990	1.334	1.014	0.972	1.034	0.859	1.492	1.548	2.160	2.095	2.147	1.707	1.614
1991	1.529	1.345	1.350	1.172	1.335	2.170	1.965	2.021	2.493	2.594	2.114	1.715
1992	1.617	1.583	1.396	1.305	0.857	1.848	2.145	1.982	2.428	2.068	2.120	1.830

Table 2.3-4 (Sheet 2 of 2)
Mean Monthly Water Level at the Canal C-111 Structure S-197 (Headwater)

YEAR	Monthly Mean in Feet NGVD 29											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1993	2.138	1.821	1.667	1.555	1.290	2.121	2.018	2.014	2.316	2.472	2.224	1.722
1994	1.721	1.937	1.852	1.537	1.785	1.992	1.595	2.078	2.569	2.531	2.414	2.500
1995	2.445	2.122	1.899	1.685	1.962	2.194	2.427	2.549	2.656	2.603	2.392	1.931
1996	1.894	1.602	1.421	1.093	1.339	2.271	2.043	1.811	2.167	2.400	1.929	1.687
1997	1.684	1.654	1.382	1.144	1.354	2.385	2.258	2.356	2.574	2.275	1.760	2.185
1998	1.928	2.180	2.268	2.016	1.962	1.743	1.719	2.103	2.195	2.373	2.281	1.937
1999	1.926	1.718	1.441	0.877	1.035	1.957	2.152	2.217	2.521	2.549	2.379	2.172
2000	2.190	2.125	1.878	1.796	1.319	1.801	2.117	2.431	2.519	2.514	1.996	1.949
2001	1.648	1.314	1.116	0.832	1.212	1.253	1.994	2.368	2.433	2.560	2.446	2.229
2002	2.078	1.777	1.586	1.110	0.709	2.231	2.507	2.369	2.368	2.023	1.710	1.905
2003	1.605	1.326	1.423	1.763	1.953	2.376	2.073	2.396	2.583	2.411	2.419	2.266
2004	1.856	1.941	1.560	1.140	0.976	0.827	1.239	2.257	2.349	2.269	2.253	1.939
2005	1.640	1.503	1.439	1.450	1.399	2.321	2.422	2.445	2.732	2.645	2.354	2.230
2007	1.666	1.595	1.531	1.596	1.715	2.311	2.547	2.291	2.169	2.519	2.189	1.765
2008	1.600	1.528	1.343	1.597	1.255	1.593	2.152	2.345	2.456	—	—	—
Mean	1.650	1.509	1.333	1.130	1.161	1.688	1.876	1.990	2.162	2.138	1.946	1.780

Source: SFWMD 2009

Table 2.3-5 (Sheet 1 of 2)
Mean Monthly Flows in the Canal L-31E at Structure S-20

YEAR	Monthly Mean in Cubic Feet per Second											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	—	—	—	3.2	0
1969	1.507	0	25.242	4.747	0	42.24	32.724	0	106.301	80.99	284.187	
1970	0	0	0	0	0	4.567	-0.173	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0.289	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0.777	0.052	1.165	0.085
1975	0	0	0	0	0	0	0.078	0	0.17	0	0	0
1976	0	0	0	0	0	0	0	3.701	75.683	0.243	0	0
1977	0	0	0	0	30.657	59.678	0	0	116.304	9.482	0	0
1978	0	0	0	0	0	4.948	1.159	16.284	21.56	45.93	24.549	0
1979	0	0	0	0	0	0	0	8.022	57.789	80.121	0	0
1980	23.595	0	0	0	0	59.211	35.737	26.648	45.653	40.799	26.491	0
1981	0	0	0	0	0	0	0	105.314	128.263	83.247	0	0
1982	0	0	0	0	0	40.808	0	0	0	11.921	0	0
1983	40.372	0	0	0	2.832	0	0	0	106.754	0	0.219	0
1984	0	0	0	0	0	0	0	0	0.582	38.388	0	0
1985	0	0	0	0	0	0	57.109	58.302	22.063	38.642	0	0
1986	0	0	0	0	0	15.749	41.475	0.087	0	15.926	1.833	0
1987	43.152	0	23.583	0.016	0	0	0	0	22.114	106.246	46.753	0
1988	0	0	0	0	0	161.759	149.41	179.534	38.577	0	0	0
1989	0	0	0	0	0	0	0	38.758	0.219	0	0	0
1990	0	0	0	0	0	0	0	106.017	45.836	10.81	0	0

Table 2.3-5 (Sheet 2 of 2)
Mean Monthly Flows in the Canal L-31E at Structure S-20

YEAR	Monthly Mean in Cubic Feet per Second											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1991	0	0.095	0.159	2.227	0.251	0	0	0	0	149.682	49.295	
1992	N/A[(a)]	0	2.307	0	0	81.074	149.633	62.117	86.822	0	0	0
1993	0	0	0	0	0	0	0	25.621	57.057	N/A	N/A	N/A
1994	N/A	N/A	0	0	0	0	0	0.115	63.734	108.26	103.73	70.832
1995	0	0	0.868	0	0	95.945	57.231	90.961	109.186	201.169	28.057	0
1996	0	0	0	0	0	187.071	114.843	0.298	0	49.303	0	0.033
1997	0	0.078	0	0	0	603.788	0	143.963	399.966	7.812	0	63.708
1998	0	17.561	0	0	0	N/A	N/A	N/A	N/A	0	0.027	0.038
1999	N/A	N/A	N/A	0	0	59.886	22.741	52.061	52.330	119.456	42.276	0.188
2000	1.274		0	0	0	0	0	0	51.708	76.003	-4.708	0
2001	0	0	0	0	0	20.359	21.717	51.343	76.752	31.414	19.377	0
2002	-4.001	0	0	0	0	102.642	129.294	0.003	0	0	0.000	0.042
2003	0.003	0.010	0	0	0	0	0.001	0	39.591	60.012	51.666	0.023
2004	0.066	0	0.052	0	0	0	0.001	0	0	0	N/A	N/A
2005	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2006	0	0	0	0	0	0	108.994	0.008	0.000	0.035	0.001	0
2007	0	0	0	0	0	88.319	76.108	0	35.958	-19.527	N/A	N/A
2008	0	0	0	0	0	0	0	102.019	0	—	—	—
Mean	3.117	0.522	1.450	0.189	0.912	45.230	27.733	29.755	48.937	38.469	19.945	4.217

(a) N/A indicates data not available

Source: SFWMD 2009

Table 2.3-6 (Sheet 1 of 2)
Mean Monthly Water Levels in the L-31E Canal at Structure S-20 (Headwaters)

YEAR	Monthly Mean in Feet NGVD 29											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	0.924	0.785	0.574	0.216	1.697	2.092	2.096	1.763	1.877	2.454	1.469	1.016
1969	1.272	1.089	1.232	1.121	1.277	2.006	1.744	1.557	1.846	2.004	1.873	1.404
1970	1.228	1.210	0.867	0.496	0.435	1.566	1.622	1.205	1.485	1.783	1.473	1.067
1971	0.790	0.761	0.401	-0.040	-0.102	0.793	1.295	1.465	1.617	1.755	1.901	1.550
1972	1.379	1.320	1.003	1.333	1.480	1.832	1.678	1.532	1.958	1.894	1.855	1.473
1973	1.496	1.496	1.356	1.258	0.826	1.004	1.853	1.788	2.091	2.175	1.875	1.600
1974	1.382	1.014	0.706	0.594	0.902	1.428	1.811	1.869	1.800	2.299	1.823	1.702
1975	1.364	1.234	0.968	0.551	1.082	1.601	2.265	1.977	1.827	1.801	1.800	1.451
1976	1.132	0.984	0.956	0.982	1.230	2.230	1.964	1.948	2.087	1.954	1.655	1.424
1977	1.318	1.230	1.209	0.982	1.754	1.844	1.506	1.762	2.071	1.994	1.806	1.732
1978	1.491	1.566	1.535	1.344	1.592	1.949	1.846	1.889	2.110	2.259	2.179	1.731
1979	1.645	1.234	1.015	0.803	1.762	1.883	1.592	1.642	2.054	2.153	1.947	1.807
1980	1.523	1.617	1.312	1.412	1.285	1.925	2.036	2.018	2.132	2.045	2.067	1.830
1981	1.432	1.505	1.342	0.956	1.030	1.318	1.367	2.010	2.354	2.408	2.348	1.683
1982	1.140	1.194	1.092	1.459	1.854	2.192	2.039	2.079	1.894	2.336	2.350	1.927
1983	1.814	2.101	1.809	1.422	0.902	1.729	1.870	2.041	2.170	2.278	2.064	1.592
1984	1.587	1.321	1.318	1.186	1.066	2.177	2.191	2.125	2.202	2.273	1.980	1.639
1985	1.429	1.378	1.390	1.300	1.488	1.685	2.212	2.184	2.378	2.334	2.058	1.895
1986	1.731	1.390	1.356	1.486	1.432	1.967	1.944	1.978	2.137	2.029	1.830	1.944
1987	1.901	1.539	1.831	1.441	1.618	1.632	1.886	2.063	2.108	2.384	2.301	1.946
1988	1.748	1.564	1.362	1.228	1.825	2.289	2.256	2.335	2.123	2.237	1.933	1.590
1989	1.406	1.339	1.355	1.504	1.548	1.548	2.073	2.198	2.224	2.154	1.886	1.722
1990	1.513	1.338	1.433	1.508	1.414	1.900	2.035	2.149	2.023	2.083	1.918	1.564

Table 2.3-6 (Sheet 2 of 2)
Mean Monthly Water Levels in the L-31E Canal at Structure S-20 (Headwaters)

YEAR	Monthly Mean in Feet NGVD 29											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1991	1.355	1.242	1.358	1.233	1.380	2.260	2.004	1.730	2.260	2.529	2.207	1.636
1992	1.507	1.495	1.303	1.436	1.104	2.018	2.228	1.847	1.808	2.090	1.872	1.592
1993	1.951	1.789	1.450	1.459	1.253	2.179	1.892	2.072	2.057	2.197	1.728	1.624
1994	1.688	1.784	1.782	1.351	1.674	2.031	1.670	1.961	2.201	2.295	2.391	2.083
1995	1.814	1.467	1.495	1.399	1.708	2.150	2.140	2.141	2.267	2.332	1.985	1.598
1996	1.640	1.378	1.242	1.137	1.428	2.039	1.901	1.730	2.156	2.235	1.985	1.655
1997	1.760	1.782	1.342	1.364	1.720	2.291	2.159	2.082	2.158	2.124	1.775	1.963
1998	1.739	2.067	1.955	1.412	1.359	1.658	1.684	1.952	2.069	1.966	2.063	1.724
1999	1.716	1.443	1.213	0.969	1.433	2.181	2.010	2.159	2.282	2.679	2.085	1.758
2000	1.380	1.230	1.347	1.211	1.782	2.063	2.022	2.096	2.435	1.771	1.964	0.000
2001	1.615	1.158	1.233	1.099	1.599	1.631	2.125	1.997	2.073	2.216	2.179	1.737
2002	1.411	1.417	1.475	1.162	1.167	2.172	2.055	2.047	2.101	1.802	1.787	1.724
2003	1.356	1.232	1.365	1.653	1.789	1.948	1.698	1.924	2.118	1.937	2.050	1.729
2004	1.458	1.626	1.305	1.188	1.170	0.980	1.296	1.846	1.958	2.034	1.932	1.446
2005	1.275	1.303	1.211	1.240	1.302	2.127	2.025	2.180	2.300	2.035	1.533	1.371
2006	1.227	1.321	1.086	1.355	1.413	1.980	1.880	1.914	1.989	2.051	1.804	1.659
2007	1.553	1.491	1.266	1.682	1.914	2.205	2.066	2.049	2.083	2.375	N/A[(a)]	N/A
2008	1.437	1.409	1.378	1.437	1.263	1.658	1.921	1.988	2.108	—	—	—
Mean	1.476	1.386	1.274	1.179	1.362	1.858	1.901	1.934	2.073	2.144	1.942	1.605

(a) N/A indicates data not available

Source: SFWMD 2009

Table 2.3-7 (Sheet 1 of 2)
Mean Monthly Flows in the Princeton Canal at Structure S-21A

YEAR	Monthly Mean in Cubic Feet per Second											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1974	9.435	0	0	0	0	0	32.84	55.339	54.278	49.674	75.27	82.035
1975	4.747	0	0	0	0	3.025	95.608	35.223	30.335	33.959	20.947	1.215
1976	0	7.712	0	0	18.548	117.709	44.113	73.103	83.76	38.139	35.222	32.355
1977	2.655	4.198	0	0	64.372	112.828	64.626	83.935	176.795	65.827	45.415	19.826
1978	20.417	38.995	37.522	43.604	38.447	102.558	84.474	59.364	N/A[a]	N/A	N/A	N/A
1979	N/A	N/A	13.417	68.191	1051.47	307.851	375.055	372.993	98.64	376.168	320.883	294.474
1980	67.74	21.967	56.912	57.65	13.838	210.051	179.707	187.95	114.565	153.029	195.734	102.176
1981	44.347	51.843	37.898	10.1	0	0	0	383.346	285.008	73.878	119.334	23.698
1982	0.007	11.398	0.647	125.831	83.497	313.143	153.097	154.617	100.653	215.819	250.798	102.82
1983	189.691	469.708	1333.76	334.007	57.05	99.966	60.42	160.741	274.665	139.755	111.76	93.85
1984	70.448	74.615	81.103	63.543	27.797	94.174	142.746	41.639	69.896	73.726	79.649	66.527
1985	27.484	3.726	21.169	4.88	6.728	8.845	62.25	22.043	31.973	25.926	14.955	45.541
1986	78.845	27.175	61.792	31.395	1.78	57.659	33.898	58.089	107.032	52.864	69.996	60.653
1987	50.722	24	59.869	8.248	8.674	15.223	92.143	57.107	126.581	189.892	164.684	94.396
1988	47.966	33.688	31.374	0.239	40.66	258.467	68.005	212.75	34.153	55.578	32.958	11.474
1989	21.769	12.651	9.38	33.061	17.165	2.189	33.193	84.996	39.75	47.731	28.744	9.885
1990	0	0	8.298	29.27	34.061	36.054	88.441	137.671	87.143	123.553	53.003	4.9
1991	0	0.76	7.084	1.446	86.171	172.545	100.563	63.064	121.688	253.953	107.368	75.455
1992	64.85	52.447	54.478	54.825	1.999	382.2	96.134	243.132	127.167	122.511	221.32	86.207
1993	171.185	68.823	78.011	69.455	55.609	143.798	73.026	43.203	105.048	182.708	135.688	91.928
1994	85.937	152.05	83.005	99.623	56.702	73.905	46.621	122.298	196.47	137.074	381.629	128.094
1995	117.867	44.154	39.982	51.118	79.55	238.251	124.943	179.08	151.179	346.364	120.264	52.75
1996	66.487	35.889	30.943	18.43	63.053	269.232	83.949	99.303	115.444	185.69	66.505	30.116

Table 2.3-7 (Sheet 2 of 2)
Mean Monthly Flows in the Princeton Canal at Structure S-21A

YEAR	Monthly Mean in Cubic Feet per Second											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1997	107.126	33.513	23.898	28.421	10.995	350.415	61.169	118.172	232.901	92.902	68.711	132.915
1998	67.46	118.244	130.06	43.857	7.093	9.721	31.652	138.74	275.595	98.768	186.898	49.636
1999	96.239	55.918	28.174	0.003	6.797	183.58	105.567	152.807	247.516	507.426	136.659	128.483
2000	97.294	80.866	56.941	63.135	17.474	67.439	108.355	131.344	138.044	474.344	79.037	223.266
2001	55.809	16.575	34.604	25.216	38.249	82.513	157.76	169.212	321.322	382.933	201.383	110.312
2002	75.508	74.604	102.733	30.66	5.745	280.486	364.62	80.11	369.277	123.284	147.597	107.289
2003	34.029	7.663	65.534	90.772	164.064	226.718	70.154	240.216	237.285	162.985	231.379	112.74
2004	114.212	121.945	54.576	14.329	1.654	0.009	44.222	183.182	225.799	285.275	147.807	103.87
2005	55.799	33.831	52.935	17.276	19.514	365.851	145.679	423.939	408.996	253.485	161.395	56.957
2006	67.375	94.428	66.376	42.824	44.279	46.991	180.394	117.288	185.094	102.259	108.915	93.871
2007	68.548	67.974	17.493	40.3	45.059	186.579	176.821	78.382	141.404	203.069	135.269	26.473
2008	8.28	5.932	19.43	72.587	11.467	110.57	103.732	217.908	122.309	—	—	—
Mean	58.538	54.332	77.126	44.980	62.273	140.873	105.314	142.351	159.934	170.623	129.005	80.491

(a) N/A indicates data not available

Source: SFWMD 2009

Table 2.3-8 (Sheet 1 of 2)
Mean Monthly Water Levels in the Princeton Canal at Structure S-21A (Headwaters)

YEAR	Monthly Mean in Feet NGVD 29											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1974	1.332	1.129	1.138	0.815	0.959	1.213	1.383	1.555	1.725	1.901	2.253	0.76
1975	1.475	1.187	0.842	0.42	0.528	N/A[(a)]	N/A	N/A	N/A	N/A	N/A	N/A
1976	N/A	1.731	1.827	1.914	2.001	2.088	2.168	2.158	2.137	2.116	2.096	2.022
1977	1.579	1.6	1.174	1.016	1.433	1.496	1.628	1.763	2.147	2.218	2.095	1.846
1978	1.694	1.558	1.754	1.783	1.895	1.975	1.989	1.992	1.968	1.947	1.742	1.721
1979	1.683	1.463	1.345	0.744	1.157	1.369	1.689	2.014	2.245	2.086	1.609	2.028
1980	1.761	1.765	1.683	1.666	1.922	1.801	1.819	1.97	1.945	1.819	1.665	1.566
1981	1.4	1.453	1.454	1.538	1.262	1.44	2.134	2.087	1.684	1.665	2.071	1.903
1982	2.068	1.969	1.73	1.786	1.762	1.576	1.732	1.953	2.169	2.073	1.928	1.579
1983	1.659	1.106	1.466	1.458	1.512	1.603	1.504	1.695	1.498	1.878	N/A	N/A
1984	N/A	N/A	N/A	1.369	1.314	1.208	1.398	2.145	2.113	1.998	1.931	1.73
1985	1.553	1.556	1.501	1.722	1.623	1.738	1.69	1.501	1.832	1.931	1.815	1.803
1986	1.584	1.391	1.591	1.543	1.84	1.912	1.985	2.058	2.13	2.151	1.909	1.629
1987	1.535	1.941	1.629	1.724	1.839	1.905	1.97	2.037	2.103	2.023	1.727	1.522
1988	1.611	1.66	1.709	1.834	2.025	1.798	1.714	1.692	2.036	2.098	1.443	1.598
1989	1.759	1.689	1.598	1.557	1.736	1.759	1.793	1.828	1.863	1.868	1.818	1.536
1990	1.746	1.595	1.773	1.694	1.636	2.098	2.051	1.999	2.056	1.847	1.891	1.89
1991	1.722	1.719	1.866	1.714	1.616	2.056	2.07	2.09	2.061	1.864	1.613	1.373
1992	1.534	1.619	1.668	1.684	1.609	1.682	2.038	1.885	1.913	1.782	1.449	1.284
1993	1.318	1.57	1.493	1.655	1.818	1.941	2.077	2.106	2.046	1.753	1.376	1.356
1994	1.284	1.444	1.497	1.55	2.039	2.078	2.089	2.046	1.682	1.484	1.528	1.433
1995	1.254	1.437	1.685	1.675	1.77	1.787	1.864	1.582	1.659	1.571	1.206	1.619
1996	1.677	1.705	1.608	1.705	2.041	1.736	1.818	2.047	1.94	1.548	1.459	1.64

Table 2.3-8 (Sheet 2 of 2)
Mean Monthly Water Levels in the Princeton Canal at Structure S-21A (Headwaters)

YEAR	Monthly Mean in Feet NGVD 29											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1997	1.416	1.719	1.728	1.723	2.086	1.801	2.037	2.03	1.843	1.701	1.433	1.439
1998	1.66	1.373	1.486	1.537	2.002	2.045	2.113	1.668	1.802	1.7	1.35	1.726
1999	1.615	1.663	1.717	1.734	1.969	1.727	1.957	1.955	1.934	1.869	1.409	1.303
2000	1.434	1.654	1.68	1.728	1.923	1.968	2.043	1.997	2.017	1.711	1.45	1.597
2001	1.681	1.733	1.71	1.717	2.064	2.062	1.999	1.555	1.608	1.693	1.515	1.309
2002	1.457	1.634	1.616	1.698	1.614	1.599	1.646	2.074	1.624	1.393	1.303	1.277
2003	1.622	1.949	1.834	1.666	1.63	1.514	1.663	1.526	1.621	1.524	1.495	1.311
2004	1.275	1.348	1.682	1.733	1.941	1.463	1.73	1.476	1.394	1.523	1.384	1.261
2005	1.502	1.724	1.695	1.726	1.997	1.518	1.885	1.908	1.607	1.646	1.46	1.967
2006	1.66	1.654	1.665	1.815	1.875	2.094	1.732	1.862	2.018	1.731	1.364	1.425
2007	1.668	1.67	1.812	2.039	2.114	1.998	2.002	2.068	2.003	1.78	1.451	1.846
2008	1.816	1.721	1.911	1.894	2.003	1.998	2.04	1.791	1.867	—	—	—
Mean	1.577	1.592	1.605	1.588	1.730	1.766	1.866	1.886	1.891	1.815	1.632	1.572

(a) N/A indicates data not available

Source: SFWMD 2009

Table 2.3-9 (Sheet 1 of 2)
Mean Monthly Flows in the Black Creek Canal at Structure S-21

YEAR	Monthly Mean in Cubic Feet per Second											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1969	—	—	—	—	—	—	—	—	—	—	363.533	203.935
1970	113.071	86.357	87.516	3.667	32.742	223.973	405.839	136.645	144.733	199.161	113.723	5.71
1971	0	0	0	0	0	11.4	38.977	206.452	433.767	141.00	161.8	56.194
1972	23.742	17.586	31.645	26.88	152.213	392.303	206.742	170.774	249.433	173.613	150.133	71.348
1973	49.839	54.571	9.935	3.523	0	10.5	94.742	299.419	334.667	159.29	43.053	10.806
1974	64.00	0	0	0	0	0	152.871	123.103	135.767	189.419	76.113	71.452
1975	1.677	0	0	0	4.323	62.08	195.323	132.29	126.833	212.452	184.2	45.71
1976	0	19.041	3.774	0	72.548	403.567	146.774	322.29	373.1	133.355	156.533	81.00
1977	82.871	39.336	3.548	0	337.871	256.533	212.935	208.806	714.2	227.71	169.133	149.706
1978	N/A[a]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	286.452	266.867	53.077
1979	39.742	2.118	0.742	147.133	376.935	121.4	168.226	126.129	342.033	348.968	87.667	115.574
1980	83.00	81.807	55.581	70.833	102.323	263.8	206.968	268.516	320.7	165.226	193.333	60.00
1981	28.419	80.036	26.903	0	0	0	0	551.645	791.133	303.129	142.473	66.839
1982	81.161	146.786	81.174	236.367	187.329	417.567	153.903	231.968	496.067	318.935	367.033	144.194
1983	109.871	325.332	387.806	190.7	42.774	1151.23	184.968	433.868	459.6	316.29	126.667	86.29
1984	46.903	31.966	127.577	31.583	136.739	355.8	463.613	516.097	558.567	595.677	26.067	0
1985	0	0.304	0.003	0	0	11.647	245.968	135.132	195.9	143.968	139.593	135.384
1986	89.077	9.621	89.677	20.667	25.842	146.213	95.161	130.929	108.333	73.032	50.967	77.935
1987	85.839	44.893	47.226	28.467	53.29	7.467	42.161	10.226	83.133	219.226	69.138	46.903
1988	25.774	14.759	8.871	4.333	59.8	531.967	153.323	422.467	46.367	70.867	24.207	3.567
1989	4.1	4.607	3.733	2.933	57.259	15.133	63.00	52.129	33.2	38.097	30.233	13.355
1990	34.52	149.292	256.088	160.496	33.442	317.631	131.319	198.869	94.819	146.608	35.793	7.291
1991	0.484	0.357	0.286	14.881	48.113	207.505	179.625	284.815	375.555	528.618	116.626	4.474

Table 2.3-9 (Sheet 2 of 2)
Mean Monthly Flows in the Black Creek Canal at Structure S-21

YEAR	Monthly Mean in Cubic Feet per Second											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1992	0.381	1.42	15.937	13.568	7.465	347.896	171.25	192.409	474.359	89.909	226.841	29.021
1993	222.444	47.409	44.073	110.976	85.589	354.5	119.3	90.136	152.886	342.589	109.203	9.018
1994	43.762	174.738	71.703	60.836	110.167	167.21	89.916	271.454	594.523	575.636	662.847	268.017
1995	367.651	226.985	80.073	65.508	106.159	450.776	403.799	619.149	566.021	832.155	396.028	81.116
1996	94.213	56.224	32.052	0	84.74	588.074	207.946	126.247	266.319	176.66	169.56	10.228
1997	28.792	11.903	0	16.576	73.356	24.883	186.66	252.386	464.535	166.624	24.263	239.284
1998	208.252	351.905	334.38	133.637	129.326	31.362	128.917	109.435	152.856	408.19	451.057	94.114
1999	228.022	91.506	23.212	6.516	51.438	306.899	273.907	341.364	249.443	-199.16	184.773	36.565
2000	22.748	37.451	24.186	71.223	18.967	60.176	195.201	283.803	194.159	323.833	49.375	190.364
2001	21.085	0	2.363	12.046	85.385	80.084	290.448	528.428	312.307	332.213	118.061	116.599
2002	157.957	69.728	212.451	13.274	6.501	321.608	655.617	475.612	429.076	150.229	349.113	285.442
2003	118.357	50.457	89.819	80.03	421.771	648.237	298.798	488.602	586.424	384.12	430.864	51.456
2004	15.993	234.295	20.356	4.065	33.779	0.119	15.127	551.962	468.00	461.935	424.301	229.754
2005	3.429	0	6.63	1.704	33.513	576.389	566.696	248.34	430.815	343.049	65.844	157.406
2006	72.209	53.517	26.728	15.268	24.845	25.007	473.775	339.882	546.94	263.886	149.359	65.278
2007	15.796	12.107	0.003	54.565	18.664	398.945	192.742	83.746	172.323	470.974	287.835	9.794
2008	6.197	21.613	6.103	62.842	16.64	231.963	372.791	593.504	367.183	—	—	—
Mean	68.194	67.106	58.215	43.818	79.785	250.575	215.403	277.869	338.055	266.156	184.467	86.774

(a) N/A indicates data not available

Source: SFWMD 2009

Table 2.3-10 (Sheet 1 of 2)
Mean Monthly Water Levels in the Black Creek Canal at Structure S-21

YEAR	Monthly Mean in Feet NGVD 29											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1969	1.784	1.799	1.747	1.867	1.792	1.798	1.972	2.015	2.062	2.064	2.043	1.796
1970	2.043	2.052	2.064	2.182	1.794	1.995	2.026	2.144	2.154	2.153	2.196	2.192
1971	1.905	1.659	1.279	0.768	0.564	1.41	2.192	2.162	2.042	2.082	2.111	2.177
1972	2.198	2.157	2.042	1.887	1.961	1.942	1.909	1.973	2.013	2.002	1.971	2.033
1973	2.06	2.041	2.107	1.611	1.075	1.176	1.99	1.931	1.946	1.995	2.046	2.024
1974	2.012	2.042	1.42	0.858	0.793	1.643	2.006	2.025	2.028	2.073	2.11	2.072
1975	2.257	1.944	1.467	0.752	1.193	2.092	1.928	2.059	2.008	2.015	2.029	2.133
1976	2.144	2.017	2.059	1.565	1.93	1.933	2.088	1.959	1.927	2.008	2.076	2.162
1977	2.197	2.26	2.207	1.669	1.795	1.901	1.994	1.948	1.928	1.949	1.969	1.909
1978	N/A[(a)]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.157	2.13	2.197
1979	2.244	2.203	1.934	1.476	2.066	2.175	2.105	2.148	2.079	2.135	2.274	2.213
1980	2.26	2.276	2.282	2.304	2.319	2.194	2.135	2.136	2.118	2.175	2.159	2.238
1981	2.349	2.239	2.32	1.932	1.695	1.965	2.197	2.005	1.95	2.202	2.459	2.116
1982	1.903	1.925	1.946	1.916	2.079	2.109	2.12	1.94	2.221	2.07	2.089	2.237
1983	2.07	1.886	1.843	1.668	1.863	1.842	2.221	2.166	1.876	2.029	1.833	1.818
1984	1.891	1.917	1.905	1.986	1.736	2.119	2.021	2.103	2.145	2.152	2.253	2.23
1985	2.03	2.071	2.05	2.079	1.898	2.122	2.142	2.235	2.211	2.208	2.274	2.256
1986	2.04	2.356	1.982	2.207	2.247	2.178	2.223	2.214	1.973	2.248	2.328	2.105
1987	1.838	1.888	2.172	2.048	2.128	2.281	2.263	2.356	2.268	2.133	2.225	2.245
1988	2.273	2.332	2.304	2.154	2.287	2.032	2.197	1.647	2.353	2.207	2.317	2.206
1989	2.196	2.142	1.983	2.021	1.974	1.924	2.225	2.264	2.298	2.293	2.269	2.229
1990	2.072	1.891	1.999	2.298	2.084	2.32	2.243	2.223	2.232	2.21	2.303	2.233
1991	1.959	1.904	2.034	1.952	1.925	2.229	2.181	2.097	2.098	2.095	2.256	2.251

Table 2.3-10 (Sheet 2 of 2)
Mean Monthly Water Levels in the Black Creek Canal at Structure S-21

YEAR	Monthly Mean in Feet NGVD 29											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1992	2.276	2.351	2.126	2.346	1.955	1.814	2.104	2.08	N/A	2.115	1.795	2.214
1993	2.044	2.185	2.116	2.138	2.234	1.653	1.926	2.123	2.059	2.07	2.132	2.28
1994	2.209	1.969	2.164	2.18	2.13	2.037	2.156	2.054	1.657	1.838	1.853	1.655
1995	1.536	1.497	1.681	1.938	2.106	1.854	1.978	1.636	1.656	1.561	1.507	1.743
1996	1.713	1.764	1.831	2.137	2.195	1.781	1.866	2.182	2.001	1.884	1.808	2.113
1997	2.165	2.264	2.243	2.223	2.098	1.863	2.065	2.03	1.817	2.078	2.255	1.939
1998	2.008	1.695	1.846	2.08	2.132	2.21	2.078	1.97	1.838	1.64	1.581	2.035
1999	1.985	2.173	2.265	2.241	2.211	1.951	1.98	1.964	1.997	1.72	1.947	2.214
2000	2.259	2.227	2.251	2.117	2.206	2.146	2.074	1.957	2.059	1.849	1.863	2.039
2001	2.259	2.138	2.074	2.193	2.174	2.162	1.971	1.968	1.81	1.924	1.794	1.692
2002	1.563	1.958	1.977	2.199	1.9	1.841	1.818	2.201	1.859	1.782	1.679	1.54
2003	1.691	1.774	1.685	1.729	1.969	2.023	1.919	1.929	2.017	2.096	2.076	2.206
2004	2.221	1.948	2.249	2.216	2.188	1.873	1.958	1.859	1.74	1.838	1.751	1.771
2005	2.037	2.179	2.227	2.147	2.188	1.701	2.014	1.86	1.798	1.814	1.829	2.036
2006	2.209	2.203	2.238	2.244	2.121	2.262	2.054	1.961	2.032	2.122	1.713	1.814
2007	2.29	2.263	2.224	2.152	2.246	1.887	2.048	2.128	2.106	2.102	2.093	2.302
2008	2.269	2.196	2.154	2.135	2.237	2.171	1.881	1.673	1.876	—	—-	—
Mean	2.057	2.039	2.006	1.931	1.928	1.957	2.050	2.023	1.996	2.022	2.030	2.062

(a) N/A indicates data not available

Source: SFWMD 2009

Table 2.3-11
NOAA Tide Gages Surrounding the Turkey Point Plant Property and Corresponding Tidal Range

Site Number	Site Name	Latitude	Longitude	Start Date	End Date	Great Diurnal Tide Range[(a)] Feet
8723289	Cutler, Biscayne Bay, FL	25° 36.9'	80° 18.3'	5/1/1970	3/31/1972	2.13
8723355	Ragged Key No. 5, Biscayne Bay, FL	25° 31.4'	80° 10.5'	8/1/1987	9/30/1987	1.68
8723393	Elliott Key (Outside), FL	25° 28.6'	80° 10.8'	7/1/1974	7/31/1974	2.53
8723409	Elliott Key Harbor, Elliott Key, FL	25° 27.2'	80° 11.8'	7/1/1974	8/31/1987	1.66
8723423	Turkey Point, Biscayne Bay, FL	25° 26.2'	80° 19.8'	5/1/1970	8/31/1993	1.78
8723465	East Arsenicker, Card Sound, FL	25° 22.4'	80° 17.4'	12/1/1971	2/29/1972	1.02
8723439	Billys Point, Elliott Key, FL	25° 24.9'	80° 12.6'	7/1/1974	7/31/1974	1.64
8723506	Pumpkin Key, Card Sound, FL	25° 19.5'	80° 17.6'	8/1/1987	9/30/1987	0.75
8723534	Card Sound Bridge, FL	25° 17.3'	80° 22.2'	5/1/1970	7/31/1971	0.63
8723214[(b)]	Virginia Key, FL	25° 43.9'	80° 9.7'	1/1/1996	9/30/2008	2.24
8723970[(b)]	Vaca Key, FL	24° 42.7'	81° 6.3'	12/1/1995	9/30/2008	0.97
8724580[(b)]	Key West, FL	24° 33.2'	81° 48.5'	11/27/1973	9/30/2008	1.81

(a) Great diurnal tide range is the difference between the mean higher high and mean lower low tide levels
(b) Active stations

Source: NOAA 2008b, NOAA 2008c, NOAA 2008d, and NOAA 2008e

Table 2.3-12
Highest and Lowest (Top 10) Tidal Levels at NOAA Virginia Key, Florida; Vaca Key, Florida; and Key West, Florida Gages for the Data Period Given in Table 2.3-10

	Virginia Key[(a)]				Vaca Key[(b)]				Key West[(c)]			
	Highest		Lowest		Highest		Lowest		Highest		Lowest	
Rank	feet NAVD 88	Date[(d)]	feet NAVD 88	Date[(d)]	feet NAVD 88	Date[(d)]	feet NAVD 88	Date[(d)]	feet NAVD 88	Date[(d)]	feet NAVD 88	Date[(d)]
1	2.79	20051024	–3.28	19940329	5.43	20051024	–2.39	19710204	3.18	20051024	–3.42	19140412
2	2.17	20050920	–3.06	19960217	1.19	20050826	–2.26	19890409	1.98	19650908	–3.42	19280219
3	2.15	19941115	–2.91	19980101	1.06	19741007	–2.24	19760112	1.69	20050921	–3.32	19260212
4	2.12	19991015	–2.88	20010110	1.03	20080926	–2.23	19860815	1.57	19980925	–3.32	19131227
5	1.92	20080926	–2.88	20030119	1.01	19991016	–2.23	19911220	1.42	20011105	–3.32	19160106
6	1.81	20080926	–2.87	20041215	1.01	20080905	–2.22	19710510	1.37	20080926	–3.32	19201225
7	1.78	20080927	–2.86	19960308	0.98	20011106	–2.22	19740103	1.31	20080910	–3.32	19240518
8	1.74	20080925	–2.86	20030120	0.93	19790119	–2.21	19731223	1.30	19951026	–3.16	19891214
9	1.74	20080928	–2.84	20041213	0.89	20011105	–2.21	19770407	1.27	19951025	–3.12	19880320
10	1.72	20051016	–2.82	20010206	0.87	20080930	–2.21	19790131	1.25	20080925	–3.11	19940329

(a) Tidal elevations converted from station datum to NAVD 88, which is located 12.13 feet above the station datum (NOAA 2008c)
(b) Tidal elevations converted from station datum to NAVD 88, which is located 3.88 feet above the station datum (NOAA 2008d)
(c) Tidal elevations converted from station datum to NAVD 88, which is located 6.32 feet above the station datum (NOAA 2008e)
(d) Date format: yyyymmdd, where, yyyy – Year, mm – Month, and dd - Day

Source: NOAA 2008c, NOAA 2008d, NOAA 2008e

Table 2.3-13
Freshwater Inflow to Biscayne Bay from Drainage Canals over the Period from 1994 to 2003

	Canal Input (Cubic Feet per Second)		
	Annual Mean	Wet Season	Dry Season
North Bay			
Snake Creek	335.8	537.3	191.9
Arch Creek	1.4	1.4	1.5
Biscayne Canal	132.5	224.2	66.9
Little River	220.0	306.6	158.2
Miami River Canal	530.0	535.0	526.0
Total	1219.7	1604.5	944.5
Central Bay			
Coral Gables Waterway	15.9	30.6	5.4
Snapper Creek	186.7	316.8	93.8
Cutler Drain	46.1	86.6	19.0
Total	248.7	434.0	118.2
South Bay			
Military Canal	21.9	36.0	11.8
Mowry Canal	231.5	354.9	143.3
Black Creek	223.4	357.1	127.9
Princeton Canal	126.3	187.8	82.4
Total	603.1	935.8	365.4
Grand mean	2071.5	2974.3	1428.1

Source: Cacci and Boyer 2005

Table 2.3-14
Summary of Units 6 & 7 Observation Well Construction Data

Well Number	Borehole Depth (feet bgs)	Well Depth (feet bgs)	Coordinates (Florida East State Plane) in feet		Screened Interval (feet bgs)	Top of Casing Elevation (feet NAVD 88)	Height of Casing (feet above ground service)	Pad Elevation (feet NAVD 88)
			Northing	Easting				
OW-606D	137.0	136.0	396962.8	876712.9	125–135	1.70	3.2	–1.6
OW-606L	110.0	108.0	396979.9	876732.6	97–107	1.31	2.8	–1.5
OW-606U	30.2	29.0	396938.0	876734.8	18–28	1.37	3.2	–1.8
OW-621L	110.0	109.6	397364.5	876970.0	98.6–108.6	3.07	3.0	0.1
OW-621U	30.0	28.4	397375.8	876930.0	17.4–27.4	3.88	3.3	0.6
OW-636L	111.0	108.1	395290.8	877257.2	97.1–107.1	2.89	3.4	–0.4
OW-636U	29.8	28.0	396960.1	875864.4	17–27	2.82	3.4	–0.6
OW-706D	138.4	135.1	396960.1	875864.4	123.8–133.8	2.22	3.3	–1.1
OW-706L	112.0	111.0	396978.2	875904.6	100–110	2.26	3.2	–1.0
OW-706U	29.0	28.0	396940.1	875895.7	17–27	1.70	3.2	–1.5
OW-721L	109.0	107.0	397321.5	876120.3	96–106	2.06	3.2	–1.2
OW-721U	26.0	25.0	397361.2	876121.4	14–24	2.07	3.1	–1.1
OW-735L	110.0	107.9	395824.3	875669.5	96.9–106.9	2.70	3.4	–0.7
OW-735U	28.0	27.0	395823.3	875709.2	16–26	2.82	3.3	–0.5
OW-802L	110.0	109.0	398817.1	876255.7	98–108	2.16	3.3	–1.2
OW-802U	27.0	26.0	398820.2	876243.7	15–25	2.23	3.4	–1.2
OW-805L	97.0	96.0	396883.0	877239.5	85–95	2.25	3.7	–1.5
OW-805U	30.0	29.0	396842.8	877240.9	18–28	1.28	2.8	–1.6
OW-809L	110.0	106.5	397007.9	875152.3	95.5–105.5	2.38	3.3	–0.9
OW-809U	27.0	26.0	397045.8	875152.4	15–25	2.55	3.2	–0.7
OW-812L	109.0	108.0	368892.8	875045.5	97–107	2.15	3.3	–1.2
OW-812U	27.0	26.0	398933.9	875043.5	15–25	2.22	3.0	–0.8

Table 2.3-15 (Sheet 1 of 4)
Vertical Hydraulic Gradients

Well Pair	Date/Time	Tide Condition	Upper Screened Interval Midpoint (feet NAVD 88)	Lower Screened Interval Midpoint (feet NAVD 88)	∆L (feet)	Upper Reference Head (feet NAVD 88)	Lower Reference Head (feet NAVD 88)	∆h (feet)	Vertical Hydraulic Gradient i (feet/feet)
OW-606U/L	6/29/2008 7:00	High	–24.8	–103.5	78.7	–0.55	0.12	0.67	0.008
OW-606U/L	6/29/2008 14:00	Low	–24.8	–103.5	78.7	–0.84	–0.17	0.67	0.008
OW-606U/L	8/15/2008 10:00	High	–24.8	–103.5	78.7	–0.22	0.34	0.56	0.007
OW-606U/L	8/15/2008 17:00	Low	–24.8	–103.5	78.7	–0.64	–0.09	0.54	0.007
OW-606U/L	1/20/2009 19:00	High	–24.8	–103.5	78.7	—1.74	–1.27	0.47	0.006
OW-606U/L	1/21/2009 2:00	Low	–24.8	–103.5	78.7	–2.36	–1.89	0.47	0.006
OW-606U/L	7/15/2009 7:00	High	–24.8	–103.5	78.7	–0.22	0.32	0.54	0.007
OW-606U/L	7/15/2009 14:00	Low	–24.8	–103.5	78.7	–0.38	0.16	0.54	0.007
OW-606U/L	6/15/2010 2:00	High	–24.8	–103.5	78.7	0.11	0.39	0.29	0.004
OW-606U/L	6/15/2010 9:00	Low	–24.8	–103.5	78.7	–0.20	0.08	0.28	0.004
OW-621U/L	6/29/2008 7:00	High	–21.8	–103.5	81.7	–0.39	0.81	1.19	0.015
OW-621U/L	6/29/2008 14:00	Low	–21.8	–103.5	81.7	–0.69	0.49	1.19	0.015
OW-621U/L	8/15/2008 10:00	High	–21.8	–103.5	81.7	–0.70	1.12	1.16	0.014
OW-621U/L	8/15/2008 17:00	Low	–21.8	–103.5	81.7	–0.04	0.68	1.17	0.014
OW-621U/L	10/5/2008 1:00	High	–21.8	–103.5	81.7	–0.49	2.34	1.11	0.014
OW-621U/L	10/5/2008 8:00	Low	–21.8	–103.5	81.7	1.22	1.86	1.10	0.013
OW-621U/L	1/20/09 19:00	High	–21.8	–103.5	81.7	–1.58	–0.31	1.28	0.016
OW-621U/L	1/21/09 2:00	Low	–21.8	–103.5	81.7	–2.22	–0.93	1.29	0.016
OW-621U/L	7/15/09 7:00	High	–21.8	–103.5	81.7	0.07	0.49	0.42	0.005
OW-621U/L	7/15/09 14:00	Low	–21.8	–103.5	81.7	–0.10	0.32	0.42	0.005
OW-621U/L	1/15/10 11:00	High	–21.8	–103.5	81.7	0.64	1.07	0.43	0.005
OW-621U/L	1/15/10 18:00	Low	–21.8	–103.5	81.7	0.24	0.66	0.42	0.005
OW-621U/L	6/15/2010 2:00	High	–21.8	–103.5	81.7	–0.08	0.43	0.52	0.006
OW-621U/L	6/15/2010 9:00	Low	–21.8	–103.5	81.7	–0.41	0.09	0.50	0.006
OW-636U/L	6/29/2008 7:00	High	–22.6	–102.5	79.9	–0.32	0.02	0.34	0.004
OW-636U/L	6/29/2008 14:00	Low	–22.6	–102.5	79.9	–0.65	–0.28	0.37	0.005
OW-636U/L	8/15/2008 10:00	High	–22.6	–102.5	79.9	0.01	0.35	0.34	0.004
OW-636U/L	8/15/2008 17:00	Low	–22.6	–102.5	79.9	–0.43	–0.05	0.38	0.005
OW-636U/L	10/5/2008 1:00	High	–22.6	–102.5	79.9	1.20	1.01	0.29	0.004

Table 2.3-15 (Sheet 2 of 4)
Vertical Hydraulic Gradients

Well Pair	Date/Time	Tide Condition	Upper Screened Interval Midpoint (feet NAVD 88)	Lower Screened Interval Midpoint (feet NAVD 88)	∆L (feet)	Upper Reference Head (feet NAVD 88)	Lower Reference Head (feet NAVD 88)	∆h (feet)	Vertical Hydraulic Gradient i (feet/feet)
OW-636U/L	10/5/2008 8:00	Low	–22.6	–102.5	79.9	0.72	0.46	0.30	0.004
OW-636U/L	7/15/2009 7:00	High	–22.6	–102.5	79.9	0.18	0.29	0.28	0.004
OW-636U/L	7/15/2009 14:00	Low	–22.6	–102.5	79.9	0.01	0.44	0.28	0.004
OW-636U/L	1/15/2010 11:00	High	–22.6	–102.5	79.9	0.49	1.00	0.51	0.006
OW-636U/L	1/15/2010 18:00	Low	–22.6	–102.5	79.9	0.12	0.66	0.54	0.007
OW-636U/L	6/15/2010 2:00	High	–22.6	–102.5	79.9	–0.13	0.63	0.76	0.009
OW-636U/L	6/15/2010 9:00	Low	–22.6	–102.5	79.9	–0.48	0.29	0.77	0.010
OW-706U/L	1/15/2010 11:00	High	–23.5	–106	82.5	0.46	0.95	0.48	0.006
OW-706U/L	1/15/2010 18:00	Low	–23.5	–106	82.5	0.23	0.72	0.49	0.006
OW-706U/L	6/15/2010 2:00	High	–23.5	–106	82.5	–0.17	0.66	0.84	0.010
OW-706U/L	6/15/2010 9:00	Low	–23.5	–106	82.5	–0.34	0.50	0.84	0.010
OW-735U/L	6/29/2008 7:00	High	–21.5	–102.6	81.1	–0.12	2.18	2.30	0.028
OW-735U/L	6/29/2008 14:00	Low	–21.5	–102.6	81.1	–0.24	2.07	2.31	0.028
OW-735U/L	8/5/2008 10:00	High	–21.5	–102.6	81.1	0.15	2.44	2.28	0.028
OW-735U/L	8/15/2008 17:00	Low	–21.5	–102.6	81.1	–0.12	2.18	2.30	0.028
OW-735U/L	10/5/2008 1:00	High	–21.5	–102.6	81.1	1.48	3.54	2.06	0.025
OW-735U/L	10/5/2008 8:00	Low	–21.5	–102.6	81.1	1.26	3.33	2.07	0.025
OW-735U/L	7/15/2009 7:00	High	–21.5	–102.6	81.1	0.93	1.21	0.28	0.003
OW-735U/L	7/15/2009 14:00	Low	–21.5	–102.6	81.1	0.82	1.10	0.28	0.003
OW-735U/L	1/15/2010 11:00	High	–21.5	–102.6	81.1	1.67	2.05	0.38	0.005
OW-735U/L	1/15/2010 18:00	Low	–21.5	–102.6	81.1	1.47	1.86	0.39	0.005
OW-735U/L	6/15/2010 2:00	High	–21.5	–102.6	81.1	0.62	0.78	0.17	0.002
OW-735U/L	6/15/2010 9:00	Low	–21.5	–102.6	81.1	0.47	0.64	0.18	0.002
OW-802U/L	6/15/2010 2:00	High	–21.2	–104.2	83.0	–0.43	0.30	0.73	0.009
OW-802U/L	6/15/2010 9:00	Low	–21.2	–104.2	83.0	–0.66	0.08	0.73	0.009
OW-805U/L	6/29/2008 7:00	High	–24.6	–91.5	66.9	–0.51	0.45	0.96	0.014
OW-805U/L	6/29/2008 14:00	Low	–24.6	–91.5	66.9	–0.86	0.09	0.95	0.014
OW-805U/L	8/15/200810:00	High	–24.6	–91.5	66.9	–0.18	0.71	0.89	0.013
OW-805U/L	8/15/2008 17:00	Low	–24.6	–91.5	66.9	–0.66	0.29	0.95	0.014
OW-805U/L	10/5/2008 1:00	High	–24.6	–91.5	66.9	1.03	1.95	0.92	0.014

Table 2.3-15 (Sheet 3 of 4)
Vertical Hydraulic Gradients

Well Pair	Date/Time	Tide Condition	Upper Screened Interval Midpoint (feet NAVD 88)	Lower Screened Interval Midpoint (feet NAVD 88)	∆L (feet)	Upper Reference Head (feet NAVD 88)	Lower Reference Head (feet NAVD 88)	∆h (feet)	Vertical Hydraulic Gradient i (feet/feet)
OW-805U/L	10/5/2008 8:00	Low	–24.6	–91.5	66.9	0.52	1.44	0.93	0.014
OW-805U/L	1/20/2009 19:00	High	–24.6	–91.5	66.9	–1.69	–0.79	0.90	0.013
OW-805U/L	1/21/2009 2:00	Low	–24.6	–91.5	66.9	–2.32	–1.41	0.90	0.013
OW-805U/L	7/15/2009 7:00	High	–24.6	–91.5	66.9	–0.08	0.45	0.54	0.008
OW-805U/L	7/15/2009 14:00	Low	–24.6	–91.5	66.9	–0.25	0.28	0.54	0.008
OW-805U/L	1/15/2010 11:00	High	–24.6	–91.5	66.9	0.59	1.13	0.54	0.008
OW-805U/L	1/15/2010 18:00	Low	–24.6	–91.5	66.9	0.15	0.70	0.55	0.008
OW-805U/L	6/15/2010 2:00	High	–24.6	–91.5	66.9	0.07	0.49	0.43	0.006
OW-805U/L	6/15/2010 9:00	Low	–24.6	–91.5	66.9	–0.29	0.13	0.42	0.006
OW-809U/L	6/29/2008 7:00	High	–20.7	–101.4	80.7	–0.42	0.57	0.99	0.012
OW-809U/L	6/29/2008 14:00	Low	–20.7	–101.4	80.7	–0.50	0.49	0.99	0.012
OW-809U/L	8/15/2008 10:00	High	–20.7	–101.4	80.7	–0.17	0.71	0.88	0.011
OW-809U/L	8/15/2008 17:00	Low	–20.7	–101.4	80.7	–0.39	0.49	0.88	0.011
OW-809U/L	10/5/2008 1:00	High	–20.7	–101.4	80.7	1.26	2.06	0.80	0.010
OW-809U/L	10/5/2008 8:00	Low	–20.7	–101.4	80.7	1.11	1.90	0.79	0.010
OW-809U/L	1/20/2009 19:00	High	–20.7	–101.4	80.7	–1.67	–0.89	0.78	0.010
OW-809U/L	1/21/2009 2:00	Low	–20.7	–101.4	80.7	–2.28	–1.51	0.77	0.010
OW-809U/L	7/15/2009 7:00	High	–20.7	–101.4	80.7	–0.06	0.85	0.91	0.011
OW-809U/L	7/15/2009 14:00	Low	–20.7	–101.4	80.7	–0.15	0.75	0.90	0.011
OW-809U/L	6/15/2010 2:00	High	–20.7	–101.4	80.7	–0.13	0.70	0.82	0.010
OW-809U/L	6/15/2010 9:00	Low	–20.7	–101.4	80.7	–0.19	0.63	0.82	0.010
OW-812U/L	6/29/2008 7:00	High	–20.8	–103.2	82.4	–0.19	0.70	0.89	0.011
OW-812U/L	6/29/2008 14:00	Low	–20.8	–103.2	82.4	–0.29	0.58	0.87	0.011
OW-812U/L	8/15/2008 10:00	High	–20.8	–103.2	82.4	0.05	0.95	0.89	0.011
OW-812U/L	8/15/2008 17:00	Low	–20.8	–103.2	82.4	–0.18	0.71	0.89	0.011
OW-812U/L	7/15/2009 7:00	High	–20.8	–103.2	82.4	0.47	0.71	0.24	0.003
OW-812U/L	7/15/2009 14:00	Low	–20.8	–103.2	82.4	0.38	0.61	0.24	0.003
OW-812U/L	1/15/2010 11:00	High	–20.8	–103.2	82.4	1.27	1.27	0.00	0.000
OW-812U/L	1/15/2010 18:00	Low	–20.8	–103.2	82.4	1.12	1.10	–0.01	0.000

Table 2.3-15 (Sheet 4 of 4)
Vertical Hydraulic Gradients

Well Pair	Date/Time	Tide Condition	Upper Screened Interval Midpoint (feet NAVD 88)	Lower Screened Interval Midpoint (feet NAVD 88)	ΔL (feet)	Upper Reference Head (feet NAVD 88)	Lower Reference Head (feet NAVD 88)	Δh (feet)	Vertical Hydraulic Gradient i (feet/feet)
OW-812U/L	6/15/2010 2:00	High	–20.8	–103.2	82.4	0.09	0.27	0.17	0.002
OW-812U/L	6/15/2010 9:00	Low	–20.8	–103.2	82.4	0.02	0.16	0.14	0.002

Δh = Lower Reference Head — Upper Reference Head
ΔL = Lower Screened Interval Midpoint — Upper Screened Interval Midpoint
i = Δh/ΔL (negative value indicates downward flow potential and positive value indicates upward flow potential)
Reference Head values are estimated using the density of water in the well and correcting the water level to the average density of seawater in Biscayne Bay.

Table 2.3-16
Representative Hydrogeologic Properties in Miami-Dade County[a]

Hydrogeologic Unit or Subunit	Hydraulic Conductivity (feet per day)		Porosity	Approximate Depth (feet bgs)	Unit Thickness (feet)
	Horizontal	Vertical			
Biscayne aquifer	1524	15	0.31	0–230	230
Intermediate confining unit	90	0.1–2.38	0.1–0.31	230–840	610
Upper Floridan aquifer	42	0.42–2.38	0.1–0.32	840–2060	1220
Middle confining unit	4.7	0.04–1.50[b]	0.1–0.43	2060–2550	490
Lower Floridan aquifer	0.01	0.1	0.1–0.4	2550–2750	200[c]
Boulder Zone	6540	65	0.2	2750–3250	500

(a) Values in this table represent weight and averages for risk assessment for measurement of treated wastewater and thus may not be representative of actual conditions.

(b) The vertical hydraulic conductivity included here may be two to three orders of magnitude higher than other measurements in South Florida. Maliva et. al. 2007 indicates a vertical hydraulic conductivity range of 3E-04 to 3E-05 feet per day based on core measurements.

(c) The Lower Floridan aquifer extends below the Boulder Zone; the thickness presented is only for the portion above the Boulder Zone.

Adapted from U.S. EPA 2003

Table 2.3-17 (Sheet 1 of 7)
Regional Aquifer Properties

Site	Test Type[c]	Start Test Date Time	Pumped Well	Pumped Well X-Coord. (feet)	Pumped Well Y-Coord. (feet)	Discharge Rate (g/min)	Transmissivity (ft^2/day)	Hours Pumped	Storativity	Tested Interval Min. (ft)	Tested Interval Max. (ft)	Horizontal K (feet/day)	No. Monitored Wells	Leakance (1/day)	Aquifer	Comments
Florida Keys Aqueduct Auth Jr Dean WTP-Florida City[a]	APT	08-OCT-2003 0000	FKAAFCEW1	818,318	403,673	280	10,790	72		880	1,353				Upper Floridan Aquifer	Specific capacity: 15 gpm/ft **Water was blended with raw water from Biscayne aquifer well field and apt initiated as step test to accommodate discharge to sewer system. Initial pump rate of 280 gpm; increased to 500 gpm and 750 gpm for first 24 hours. Rate decreased to 600 gpm for remainder of test as TDS concentration rose at 750 gpm.
Florida Keys Aqueduct Auth Jr Dean WTP-Florida City[a]	Packer	02-JUL-2003 0000	FKAAFCEW1	818,318	403,673	25	29			1,050	1,150				Upper Floridan Aquifer	Packer test #1 Specific capacity: 0.3 gpm/ft Salt plug in well was not completely purged prior to start of test- the initial static water level assumed to be the level to which the water level in the drill stem recovered at conclusion of test.
Florida Keys Aqueduct Auth Jr Dean WTP-Florida City[a]	Packer	09-JUL-2003 0000	FKAAFCEW1	818,318	403,673	85				1,220	1,283				Upper Floridan Aquifer	Packer test #2 Specific capacity: 12 gpm/ft Parameters not analyzed-no typical pump or recovery curves-water level responded so quickly to the start and stop of test.

**Table 2.3-17 (Sheet 2 of 7)
Regional Aquifer Properties**

Site	Test Type[c]	Start Test Date Time	Pumped Well	Pumped Well X-Coord. (feet)	Pumped Well Y-Coord. (feet)	Discharge Rate (g/min)	Transmissivity (ft^2/day)	Hours Pumped	Storativity	Tested Interval Min. (ft)	Tested Interval Max. (ft)	Horizontal K (feet/day)	No. Monitored Wells	Leakance (1/day)	Aquifer	Comments
Florida Keys Aqueduct Auth Jr Dean WTP-Florida City[a]	Packer	10-JUL-2003 0000	FKAAFCEW1	818,318	403,673	82	2,200			1,150	1,213				Upper Floridan Aquifer	Packer test #3 Specific capacity: 3 gpm/ft.
Florida Keys Aqueduct Auth Jr Dean WTP-Florida City[a]	Packer	22-JUL-2003 0000	FKAAFCEW1	818,318	403,673	60	492			880	1,040				Upper Floridan Aquifer	Packer test #4 Specific capacity: 2 gpm/ft.
Homestead Air Force Base[a]	Step-Draw down	25-DEC-1991 0000	G-3314	801,450	426,168		1,000,000			21	48	37,000			Surficial Aquifer System	Step drawdown test. Limits of the aquifer testing resulted in the transmissivity and conductivity values being greater than the values listed. For example the transmissivity may say 1,000,000 but it was actually 1,000,000+.
Camp Owaissa-Bauer[a]	Step-Draw down	25-DEC-1991 0000	G-3315	833,217	432,443		1,000,000			32	69	27,000			Surficial Aquifer System	Step drawdown test. Limits of the aquifer testing resulted in the transmissivity and conductivity values being greater than the values listed. For example the transmissivity may say 1,000,000 but it was actually 1,000,000+.

Table 2.3-17 (Sheet 3 of 7)
Regional Aquifer Properties

Site	Test Type(c)	Start Test Date Time	Pumped Well	Pumped Well X-Coord. (feet)	Pumped Well Y-Coord. (feet)	Discharge Rate (g/min)	Transmissivity (ft^2/day)	Hours Pumped	Storativity	Tested Interval Min. (ft)	Tested Interval Max. (ft)	Horizontal K (feet/day)	No. Monitored Wells	Leakance (1/day)	Aquifer	Comments
Camp Owaissa-Bauer(a)	Other	25-DEC-1991 0000	G-3315	833,217	432,443		65			94	111.5	3.7			Surficial Aquifer System	Specific capacity test.
Levee 31w (At Structure 175)(a)	Other	25-DEC-1991 0000	G-3319	796,786	394,757		1,000,000			21	39.3	55,000			Surficial Aquifer System	Step drawdown test. Limits of the aquifer testing resulted in the transmissivity and conductivity values being greater than the values listed. For example the transmissivity may say 1,000,000 but it was actually 1,000,000+.
Naval Station(a)	Other	25-DEC-1991 0000	G-3320	831,332	399,726		1,000,000			32	80	21,000			Surficial Aquifer System	Step drawdown test. Limits of the aquifer testing resulted in the transmissivity and conductivity values being greater than the values listed. For example the transmissivity may say 1,000,000 but it was actually 1,000,000+.
Homestead Air Force Base Well Field 2(a)	Specific Capacity	01-JAN-2000 0000	HAFB-1	852,589	423,035	900	60,000				30				Surficial Aquifer System	Transmissivity value was estimated from specific capacity value. Prepared in cooperation with the SFWMD, this data was compiled from Metro-Dade Water and Sewer Authority or from SFWMD files.

Table 2.3-17 (Sheet 4 of 7)
Regional Aquifer Properties

Site	Test Type[c]	Start Test Date Time	Pumped Well	Pumped Well X-Coord. (feet)	Pumped Well Y-Coord. (feet)	Discharge Rate (g/min)	Transmissivity (ft^2/day)	Hours Pumped	Storativity	Tested Interval Min. (ft)	Tested Interval Max. (ft)	Horizontal K (feet/day)	No. Monitored Wells	Leakance (1/day)	Aquifer	Comments
MDWASD SDWTP[a]	Packer	25-AUG-1977 0812	MDWSA_I5	876,304	442,461	50	8.54	0.7		2,737	2,759		1		Boulder Zone	Packer test 1 of 10 Leakance was not determined due to very small drawdown in Boulder Zone.
MDWASD SDWTP[a]	Packer	25-AUG-1977 1225	MDWSA_I5	876,304	442,461	4	12.47	3.2		2,697	2,727				Boulder Zone	Packer test 2 of 10 Pump adjusted to 7.9 gpm at time 1310 and to 23 gpm at time 1424 leakance was not determined due to very small drawdown in Boulder Zone.
MDWASD SDWTP[a]	Packer	25-AUG-1977 2317	MDWSA_I5	876,304	442,461	24.5	18.97	3.31		2,367	2,397				Boulder Zone	Packer test 3 of 10 (parts 1 & 2) Pump was stopped at 42 min into pumping at rate of 12.8 gpm (part 1); began pumping again at rate of 24.5 gpm for 2.6 hours--transmissivity is average of the two tests. Leakance was not determined due to very small drawdown in Boulder Zone.
MDWASD SDWTP[a]	Packer	26-AUG-1977 0747	MDWSA_I5	876,304	442,461	61	47.43	1.55		2,407	2,759				Boulder Zone	Packer test 4 of 10 Leakance was not determined due to very small drawdown in Boulder Zone.

Table 2.3-17 (Sheet 5 of 7)
Regional Aquifer Properties

Site	Test Type[c]	Start Test Date Time	Pumped Well	Pumped Well X-Coord. (feet)	Pumped Well Y-Coord. (feet)	Discharge Rate (g/min)	Transmissivity (ft^2/day)	Hours Pumped	Storativity	Tested Interval Min. (ft)	Tested Interval Max. (ft)	Horizontal K (feet/day)	No. Monitored Wells	Leakance (1/day)	Aquifer	Comments
MDWASD SDWTP[a]	Packer	26-AUG-1977 1558	MDWSA_I5	876,304	442,461	42.5	23.98	1.28		1,968	1,998				Boulder Zone	Packer test 5 of 10 Leakance was not determined due to very small drawdown in Boulder Zone.
MDWASD SDWTP[a]	Packer	26-AUG-1977 1814	MDWSA_I5	876,304	442,461	61	88.48	0.5		2,008	2,759				Boulder Zone	Packer test 6 of 10 Leakance was not determined due to very small drawdown in Boulder Zone.
MDWASD SDWTP[a]	Packer	27-AUG-1977 1150	MDWSA_I5	876,304	442,461	55	19.38	1.88		2,543	2,573				Boulder Zone	Packer test 7 of 10 Leakance was not determined due to very small drawdown in Boulder Zone.
MDWASD SDWTP[a]	Packer	27-AUG-1977 1628	MDWSA_I5	876,304	442,461	33	44.17	1.78		2,583	2,759				Boulder Zone	Packer test 8 of 10 pumping rate was increased to 60 gpm at time 1733 Leakance was not determined due to very small drawdown in Boulder Zone.
MDWASD SDWTP[a]	Packer	28-AUG-1977 0130	MDWSA_I5	876,304	442,461	12	35.77	2.8		2,692	2,759				Boulder Zone	Packer test 9 of 10 Leakance was not determined due to very small drawdown in Boulder Zone.
MDWASD SDWTP[a]	Packer	28-AUG-1977 0554	MDWSA_I5	876,304	442,461	20	13.01	2.4		2,652	2,682				Boulder Zone	Packer test 10 of 10 Leakance was not determined due to very small drawdown in Boulder Zone.

Table 2.3-17 (Sheet 6 of 7)
Regional Aquifer Properties

Site	Test Type[c]	Start Test Date Time	Pumped Well	Pumped Well X-Coord. (feet)	Pumped Well Y-Coord. (feet)	Discharge Rate (g/min)	Transmissivity (ft^2/day)	Hours Pumped	Storativity	Tested Interval Min. (ft)	Tested Interval Max. (ft)	Horizontal K (feet/day)	No. Monitored Wells	Leakance (1/day)	Aquifer	Comments
Florida City[a]	Specific Capacity	01-JAN-2000 0000	S-3051	826,078	407,075	900	220,000				47.5				Surficial Aquifer System	Transmissivity value was estimated from specific capacity value. Prepared in cooperation with the SFWMD, this data was compiled from Metro-Dade Water and Sewer Authority or from SFWMD files.
Florida City[a]	Specific Capacity	01-JAN-2000 0000	S-3052	825,987	406,974	590	160,000			40	60				Surficial Aquifer System	Trasmissivity value was estimated from specific capacity value. Prepared in cooperation with the SFWMD, this data was compiled from Metro-Dade Water and Sewer Authority or from SFWMD files.
Harris Park Power Plant[a]	Specific Capacity	01-JAN-2000 0000	S-3060	833,747	414,778	3,000	240,000	4		40	60				Surficial Aquifer System	Trasmissivity value was estimated from specific capacity value. Prepared in cooperation with the SFWMD, this data was compiled from Metro-Dade Water and Sewer Authority or from SFWMD files.
Harris Park Power Plant[a]	Specific Capacity	01-JAN-2000 0000	S-3061	833,105	414,775	3,000	110,000	9		40	60				Surficial Aquifer System	Trasmissivity value was estimated from specific capacity value. Prepared in cooperation with the SFWMD, this data was compiled from Metro-Dade Water and Sewer Authority or from SFWMD files.

Table 2.3-17 (Sheet 7 of 7)
Regional Aquifer Properties

Site	Test Type[c]	Start Test Date Time	Pumped Well	Pumped Well X-Coord. (feet)	Pumped Well Y-Coord. (feet)	Discharge Rate (g/min)	Transmissivity (ft^2/day)	Hours Pumped	Storativity	Tested Interval Min. (ft)	Tested Interval Max. (ft)	Horizontal K (feet/day)	No. Monitored Wells	Leakance (1/day)	Aquifer	Comments
Turkey Point Area – Floridan Aquifier System[a]	APT	24-APR-2006 0000	TKPT-PW1	874,572	402,532	4,500	33,062	72	0.0002	1,003	1,242		3	0.005	Upper Floridan Aquifer	Average of results from Hantush-Jacob, leaky confined aquifer solution. Tidal effects negligible.
Turkey Point Area – Floridan Aquifier System[a]	APT	16-OCT-1974 1000	W-12295	851,079	370,735	5,000	67,750.68	2,160	0.005	1,126	1,400		5	6.68E-06	Floridan Aquifer System	Very long-term (90 day) test. Barometric eff. Est. = 100%. Graphical plots of drawdown vs time indicated that despite the very long duration of the test full equilibrium had not been reached. Recommended values based on drawdowns from the furthest observation wells (r=2000' & r=45000'). Leakance values are based on drawdown in lower monitor zone (so leakance for middle confining unit). Estimated effective porosity = 0.30.
Turkey Point Area[b]	APT	Jun-71	GH-11B	864,806	384,465	1,380	401,070	4	0.35	15	50		5		Biscayne Aquifer	No apparent tidal influence during the test.
Turkey Point Area [b]	APT	Jun-71	GH-14A	873,673	400,465	1,380	133,690	4	0.35	15	40		6		Biscayne Aquifer	Tidal fluctuations observed during the test.
Turkey Point Area[b]	APT	Jun-71	GH-14B	873,673	400,465	1,380	200,535	2	0.2	15	50		6		Biscayne Aquifer	Tidal fluctuations observed during the test.

(a) SFWMD 2009
(b) Dames & Moore 1971
(c) APT = Aquifer Pumping Test

Table 2.3-18 (Sheet 1 of 15)
Regional Hydrogeologic Properties from Rock Core Samples

Boring	Depth (feet)	Surface Elevation (ft MSL)	Midpoint Elevation (ft MSL)	High Frequency Cycle or Formation	Permeability (K_{air}) (millidarcies)				Porosity (percent)	Grain Density (grams per cubic centimeter)[(a)]	Sample Type	Source
					Steady-State	Maximum Horizontal	Horizontal 90°	Vertical				
G-3672	16	20	4	HFC5	0.69	NM	NM	NM	27.4	2.68	core plug	1
G-3672	17	20	3	HFC5	96.3	NM	NM	NM	33.9	2.68	core plug	1
G-3672	18.25–18.75	20	1.5	HFC5	175	NM	NM	NM	37.0	2.66	core plug	1
G-3673	17–17.5	20	2.75	HFC5	654	NM	NM	NM	37.1	2.66	core plug	1
G-3674	4.25–5	10	5.63	HFC5	515	NM	NM	NM	37.5	2.67	core plug	1
G-3675	4.25–4.5	8	3.62	HFC5	98.1	NM	NM	NM	22.0	2.69	core plug	1
G-3675	4.5-5	8	3.25	HFC5	599	NM	NM	NM	29.5	2.67	core plug	1
G-3711	4	10	6	HFC5	NM	25,764	12,875	13,372	46.7	2.69	whole core	1
G-3712	6.21	10	3.79	HFC5	NM	NM	NM	14,159	47.8	2.70	whole core	1
G-3714	9.46	13	3.54	HFC5	NM	NM	NM	9,494	49.3	2.67	whole core	1
G-3770	4.05–4.22	6.7	2.61	HFC5	NM	4,564	1,531	7,099	41.6	2.66	whole core	2
G-3778	8.46–8.73	16.4	7.76	HFC5	NM	1,684	79	220	40.4	2.70	whole core	2
G-3778	9.4–9.67	16.4	6.82	HFC5	NM	11,659	10,201	1,990	45.4	2.70	whole core	2
G-3778	9.92–10.11	16.4	6.39	HFC5	NM	1,116	966	14,750	46.1	2.70	whole core	2
G-3778	11.03–11.24	16.4	5.27	HFC5	NM	19,355	19,355	2,291	41.6	2.67	whole core	2
G-3778	13.08–13.48	16.4	3.12	HFC5	NM	10,178	9,159	3,605	43.2	2.69	whole core	2
G-3778	13.48–13.90	16.4	2.71	HFC5	NM	8,638	5,757	6,157	43.2	2.69	whole core	2
G-3778	13.90–14.28	16.4	2.31	HFC5	NM	10,356	10,356	3,727	44.7	2.69	whole core	2
G-3778	14.28-14.70	16.4	1.91	HFC5	NM	8,357	7,312	2,687	44.7	2.68	whole core	2
G-3778	15.03-15.36	16.4	1.21	HFC5	NM	10,155	8,884	6,520	45.9	2.71	whole core	2
G-3779	14.93-15.26	16.2	1.07	HFC5	NM	2,703	2,101	2,121	47.0	2.72	whole core	2
G-3779	15.26–15.55	16.2	0.8	HFC5	NM	4,178	4,178	2,107	46.7	2.72	whole core	2
G-3779	15.75–15.96	16.2	0.35	HFC5	NM	17,818	9,646	1,347	44.2	2.70	whole core	2
G-3779	16.25–16.63	16.2	–0.23	HFC5	NM	7,566	3,360	3,195	45.5	2.72	whole core	2
G-3779	16.63–17.09	16.2	–0.66	HFC5	NM	7,805	6,829	2,973	47.6	2.72	whole core	2

Table 2.3-18 (Sheet 2 of 15)
Regional Hydrogeologic Properties from Rock Core Samples

Boring	Depth (feet)	Surface Elevation (ft MSL)	Midpoint Elevation (ft MSL)	High Frequency Cycle or Formation	Permeability (K_{air}) (millidarcies)				Porosity (percent)	Grain Density (grams per cubic centimeter)[a]	Sample Type	Source
					Steady-State	Maximum Horizontal	Horizontal 90°	Vertical				
G-3779	17.51–17.93	16.2	–1.52	HFC5	NM	6,717	4,797	3,023	44.3	2.71	whole core	2
G-3779	17.93–18.39	16.2	–1.96	HFC5	NM	7,101	4,436	2,239	44.4	2.71	whole core	2
G-3779	18.39–18.77	16.2	–2.38	HFC5	NM	8,022	5,728	2,168	44.5	2.70	whole core	2
G-3791	6.42–6.8	8	1.39	HFC5	NM	10,733	10,733	4,357	44.5	2.71	whole core	2
G-3791	7.05–7.38	8	0.78	HFC5	NM	12,695	12,695	4,423	49.4	2.69	whole core	2
G-3794	6.68–7.10	9	2.11	HFC5	NM	2,257	1,544	2,044	42.6	2.70	whole core	2
G-3675	6.0	8	2.00	HFC4	NM	9,080	2,054	NM	34.7	2.70	whole core	1
G-3683	12.5	12	–0.5	HFC4	NM	13.8	2.56	11.3	16.7	2.72	whole core	1
G-3689	15.3	9	–6.3	HFC4	NM	950	337	0.03	18.6	2.72	whole core	1
G-3692	10.8	9	–1.8	HFC4	221.32	NM	NM	NM	23.3	2.71	core plug	1
G-3694	16	10	–6	HFC4	NM	83.2	42.5	11.8	17.3	2.71	whole core	1
G-3696	19	10	–9	HFC4	NM	1,035	680	5,624	12.5	2.71	whole core	1
G-3697	12.9	9	–3.9	HFC4	NM	0.67	0.5	0.18	18.9	2.72	whole core	1
G-3697	13	9	–4	HFC4	NM	18.2	0.05	0.02	8.3	2.72	whole core	1
G-3713	9.28	10	0.72	HFC4	NM	2,204	1,835	922	27.3	2.70	whole core	1
G-3717	11.75	9	–2.75	HFC4	NM	7,017	4,302	248	11.0	2.69	whole core	1
G-3721	9.75	10	0.25	HFC4	NM	82.5	21.1	10.6	16.4	2.70	whole core	1
G-3725	9.92	6	–3.92	HFC4	NM	6,964	3,731	758	14.8	2.69	whole core	1
G-3730	9	6	–3	HFC4	NM	1,319	47.3	262	13.7	2.68	whole core	1
G-3731	9.67	6.7	–2.97	HFC4	NM	144	0.03	201	5.9	2.69	whole core	1
G-3770	4.38–4.59	6.7	2.22	HFC4	NM	2	0.3	0.02	10.1	2.70	whole core	2
G-3770	4.76–5.01	6.7	1.82	HFC4	NM	1,067	949	1,090	27.3	2.69	whole core	2
G-3771	6.85–7.1	6	–0.98	HFC4	NM	0.04	0.04	13,108	15.0	2.68	whole core	2
G-3771	7.1–7.4	6	–1.25	HFC4	NM	831	215	2,463	10.1	2.68	whole core	2
G-3771	7.4–7.7	6	–1.55	HFC4	NM	0.02	0.02	0.01	7.8	2.68	whole core	2
G-3771	7.8–8.1	6	–1.95	HFC4	NM	694	600	1	16.9	2.68	whole core	2

Table 2.3-18 (Sheet 3 of 15)
Regional Hydrogeologic Properties from Rock Core Samples

Boring	Depth (feet)	Surface Elevation (ft MSL)	Midpoint Elevation (ft MSL)	High Frequency Cycle or Formation	Permeability (K_{air}) (millidarcies)				Porosity (percent)	Grain Density (grams per cubic centimeter)[(a)]	Sample Type	Source
					Steady-State	Maximum Horizontal	Horizontal 90°	Vertical				
G-3789	10.29–10.46	8	–2.38	HFC4	NM	10,040	7,529	2,118	37.2	2.73	whole core	2
G-3790	11.6–11.85	8	–3.72	HFC4	NM	11,017	9,442	1,727	16.8	2.70	whole core	2
G-3790	17.43–17.72	8	–9.58	HFC4	NM	43	28	31	11.2	2.69	whole core	2
G-3790	18.17–18.42	8	–10.3	HFC4	NM	708	567	359	15.0	2.70	whole core	2
G-3790	18.55–18.71	8	–10.63	HFC4	NM	3,813	1,670	997	26.0	2.72	whole core	2
G-3791	14.11–14.36	8	–6.24	HFC4	NM	734	291	1,750	21.6	2.68	whole core	2
G-3791	15.45–15.68	8	–7.56	HFC4	NM	560	453	255	24.6	2.69	whole core	2
G-3792	13.15–13.35	8	–5.25	HFC4	NM	1	0.05	0.01	6.9	2.69	whole core	2
G-3794	6.82–7.09	9	2.04	HFC4	NM	31	19	16	16.1	2.71	whole core	2
G-3794	7.42–7.67	9	1.46	HFC4	NM	799	671	348	21.4	2.71	whole core	2
G-3794	8.65–8.92	9	0.22	HFC4/3	NM	366	40	19	13.1	2.70	whole core	2
G-3794	9.38–9.63	9	–0.5	HFC4	NM	869	810	391	16.2	2.72	whole core	2
G-3672	20.5	20	–0.5	HFC3	NM	750	280	0.2	13.5	2.75	whole core	1
G-3672	24	20	–4	HFC3	3,098	NM	NM	NM	32.1	2.71	core plug	1
G-3673	20–20.75	20	–0.38	HFC3	1,699	NM	NM	NM	19.1	2.70	core plug	1
G-3673	23.5–24	20	–3.75	HFC3	3,704	NM	NM	NM	30.9	2.68	core plug	1
G-3673	24.5–25	20	–4.75	HFC3	80.6	NM	NM	NM	14.6	2.71	core plug	1
G-3673	27.25–27.75	20	–7.5	HFC3	4,657	NM	NM	NM	28.8	2.70	core plug	1
G-3673	30.75–31.25	20	–11	HFC3	9,443	NM	NM	NM	20.6	2.69	core plug	1
G-3673	32–32.3	20	–12.15	HFC3	10.1	NM	NM	NM	19.3	2.68	core plug	1
G-3674	15.5–16	10	–5.75	HFC3	5,222	NM	NM	NM	27.4	2.69	core plug	1
G-3674	18	10	–8	HFC3	NM	2,428	1,582	0.05	21.0	2.70	whole core	1
G-3674	18.5–19	10	–8.75	HFC3	0.01	NM	NM	NM	20.8	2.70	core plug	1
G-3675	8	8	0	HFC3	NM	856	847	0.52	21.3	2.70	whole core	1
G-3675	9–9.5	8	–1.25	HFC3	112	NM	NM	NM	21.4	2.70	core plug	1
G-3678	23.3	9	–14.3	HFC3	NM	3,758	1,754	8,662	19.7	2.71	whole core	1

Table 2.3-18 (Sheet 4 of 15)
Regional Hydrogeologic Properties from Rock Core Samples

Boring	Depth (feet)	Surface Elevation (ft MSL)	Midpoint Elevation (ft MSL)	High Frequency Cycle or Formation	Permeability (K_{air}) (millidarcies) Steady-State	Maximum Horizontal	Horizontal 90°	Vertical	Porosity (percent)	Grain Density (grams per cubic centimeter)[(a)]	Sample Type	Source
G-3679	14.6	9	–5.6	HFC3	8,818	NM	NM	NM	46.6	2.71	core plug	1
G-3679	15.6	9	–6.6	HFC3	NM	3,410	1,101	14,000	20.9	2.71	whole core	1
G-3681	15.6	9	–6.6	HFC3	NM	20.1	2.56	0.72	12.8	2.72	whole core	1
G-3688	13.3	9.5	–3.8	HFC3	NM	0.15	0.07	<0.01	6.5	2.71	whole core	1
G-3689	28.5	9	–19.5	HFC3	NM	19,323	19,323	15,112	25.8	2.72	whole core	1
G-3690	11.7	9	–2.7	HFC3	NM	202	20.8	235	10.2	2.73	whole core	1
G-3691	22.3	8	–14.3	HFC3	NM	6,501	4,332	7,474	32.4	2.71	whole core	1
G-3695	15.5	9.5	–6	HFC3	NM	0.14	0.11	0.02	10.6	2.70	whole core	1
G-3695	20	9.5	–10.5	HFC3	NM	58.5	13.7	532	16.7	2.72	whole core	1
G-3696	19.5	10	–9.5	HFC3	NM	355	291	0.12	13.9	2.71	whole core	1
G-3710	19.25	10	–9.25	HFC3	NM	11,227	11,227	12,900	22.6	2.72	whole core	1
G-3710	24.33	10	–14.33	HFC3	NM	1,315	998	9,754	14.7	2.71	whole core	1
G-3710	26.3	10	–16.3	HFC3	34,400	NM	NM	NM	35.2	2.72	core plug	1
G-3711	27.33	10	–17.33	HFC3	NM	1,031	1,007	6.18	25.9	2.71	whole core	1
G-3713	22.5	10	–9.83	HFC3	NM	27.5	0.18	840	16.0	2.71	whole core	1
G-3713	23.75	10	–13.75	HFC3	NM	31,148	29,419	8,171	32.3	2.72	whole core	1
G-3714	18.83	9	–9.83	HFC3	NM	13,356	11,685	11,642	36.6	2.71	whole core	1
G-3715	16.88	9	–7.88	HFC3	NM	2,606	1,968	2,226	31.1	2.71	whole core	1
G-3717	20.29	9	–11.29	HFC3	NM	20,592	18,303	13,217	23.4	2.71	whole core	1
G-3717	21.25	9	–12.25	HFC3	NM	16.3	10.5	92.3	20.3	2.70	whole core	1
G-3717	23.58	9	–14.58	HFC3	NM	8,458	4,229	12,213	21.8	2.70	whole core	1
G-3719	8.75	9	0.25	HFC3	NM	4.1	0.12	4.13	10.4	2.71	whole core	1
G-3719	14.57	9	–5.57	HFC3	NM	8,067	6,054	8,532	34.8	2.72	whole core	1
G-3720	18.71	9	–9.71	HFC3	NM	16,478	16,478	11,878	38.0	2.73	whole core	1
G-3722	15.62	10	–5.62	HFC3	NM	1,867	1,787	2,273	37.1	2.65	whole core	1
G-3722	17.33	10	–7.33	HFC3	NM	5,263	4,426	7,190	41.7	2.72	whole core	1

Table 2.3-18 (Sheet 5 of 15)
Regional Hydrogeologic Properties from Rock Core Samples

Boring	Depth (feet)	Surface Elevation (ft MSL)	Midpoint Elevation (ft MSL)	High Frequency Cycle or Formation	Permeability (K_{air}) (millidarcies)				Porosity (percent)	Grain Density (grams per cubic centimeter)[(a)]	Sample Type	Source
					Steady-State	Maximum Horizontal	Horizontal 90°	Vertical				
G-3724	9.67	9	–0.67	HFC3	NM	673	597	404	12.6	2.69	whole core	1
G-3724	14.08	9	–5.08	HFC3	NM	18,308	7,891	5,100	44.6	2.72	whole core	1
G-3725	18.83	6	–12.83	HFC3	NM	12,191	8,125	6,354	41.1	2.72	whole core	1
G-3728	9	7	–2	HFC3	NM	1,200	1,200	607	20.5	2.70	whole core	1
G-3730	21.58	6	–15.58	HFC3	NM	8,452	6,500	15,894	15.5	2.70	whole core	1
G-3731	11.75	10	–1.75	HFC3	NM	2,595	1,842	1,839	31.0	2.71	whole core	1
G-3734	9.13	8	–1.13	HFC3	NM	15.5	10.9	20.2	13.1	2.70	whole core	1
G-3770	9–9.29	6.7	–2.45	HFC3	NM	0.2	0.03	0.02	12.5	2.70	whole core	2
G-3770	9.46–9.67	6.7	–2.86	HFC3	NM	20	11	167	14.9	2.69	whole core	2
G-3770	9.94–10.23	6.7	–3.39	HFC3	NM	1,345	1,125	1,142	22.7	2.69	whole core	2
G-3770	10.86–11.19	6.7	–4.32	HFC3	NM	1,637	1,059	648	26.4	2.70	whole core	2
G-3770	13.9–14.34	6.7	–7.42	HFC3	NM	2,389	2,296	20,140	46.8	2.70	whole core	2
G-3770	14.34–14.74	6.7	–7.84	HFC3	NM	3,471	2,726	18,802	45.8	2.70	whole core	2
G-3770	14.74–15.07	6.7	–8.2	HFC3	NM	3,389	3,389	17,827	48.3	2.70	whole core	2
G-3770	18.49–18.78	6.7	–11.94	HFC3	NM	3,278	3,278	13,992	26.6	2.69	whole core	2
G-3771	8.60–8.85	6	–2.72	HFC3	NM	5	0.2	258	12.2	2.69	whole core	2
G-3771	8.85–9.1	6	–2.98	HFC3	NM	1,511	1,151	3,152	15.7	2.68	whole core	2
G-3771	9.5–9.77	6	–3.64	HFC3	NM	263	188	194	14.5	2.69	whole core	2
G-3771	9.89–10.1	6	–4	HFC3	NM	1,717	1,552	1,277	19.7	2.69	whole core	2
G-3771	10.23–10.56	6	–4.4	HFC3	NM	667	601	370	19.7	2.69	whole core	2
G-3771	10.56–10.85	6	–4.7	HFC3	NM	2,350	2,268	13,272	29.7	2.68	whole core	2
G-3771	11.15–11.4	6	–5.28	HFC3	NM	329	270	317	24.1	2.70	whole core	2
G-3771	11.65–11.94	6	–5.8	HFC3	NM	1,427	1,366	363	25.9	2.70	whole core	2
G-3771	12.52–12.71	6	–6.62	HFC3	NM	2,459	2,346	8,483	25.2	2.70	whole core	2
G-3771	12.98–13.19	6	–7.08	HFC3	NM	1,528	1,251	4,877	26.9	2.71	whole core	2
G-3771	13.60–13.89	6	–7.74	HFC3	NM	3,391	3,391	14,564	40.3	2.73	whole core	2

Table 2.3-18 (Sheet 6 of 15)
Regional Hydrogeologic Properties from Rock Core Samples

Boring	Depth (feet)	Surface Elevation (ft MSL)	Midpoint Elevation (ft MSL)	High Frequency Cycle or Formation	Permeability (K_{air}) (millidarcies)				Porosity (percent)	Grain Density (grams per cubic centimeter)[(a)]	Sample Type	Source
					Steady-State	Maximum Horizontal	Horizontal 90°	Vertical				
G-3771	14.06–14.4	6	–8.23	HFC3	NM	2,731	1,306	16,468	42.1	2.72	whole core	2
G-3771	16.5–16.85	6	–10.68	HFC3	NM	2,783	2,783	15,965	17.6	2.69	whole core	2
G-3771	16.88–17.09	6	–10.98	HFC3	NM	3,427	3,182	9,885	17.6	2.69	whole core	2
G-3778	15.86–16.15	16.4	0.4	HFC3	NM	0.02	0.001	0.001	7.2	2.70	whole core	2
G-3778	16.15–16.44	16.4	0.1	HFC3	NM	0.02	0.02	0.3	6.1	2.71	whole core	2
G-3778	16.69–16.82	16.4	–0.36	HFC3	NM	19	0.3	8	7.2	2.73	whole core	2
G-3778	17.24–17.59	16.4	–1.02	HFC3	NM	2,713	2,469	301	19.3	2.70	whole core	2
G-3778	26.01–26.18	16.4	–9.7	HFC3	NM	NM	NM	1,569	48.4	2.75	whole core	2
G-3778	31.06–31.16	16.4	–14.71	HFC3	NM	11,797	5,363	951	39.7	2.75	whole core	2
G-3778	31.75–31.65	16.4	–15.3	HFC3	NM	22,704	22,704	2,213	40.8	2.73	whole core	2
G-3778	35–35.17	16.4	–18.68	HFC3	NM	3,993	2,966	2,253	41.5	2.71	whole core	2
G-3778	35.54–35.87	16.4	–19.3	HFC3	NM	217	4	602	24.3	2.70	whole core	2
G-3779	21.6–21.85	16.2	–5.52	HFC3	NM	0.001	0.001	0.001	5.5	2.71	whole core	2
G-3779	21.95–22.25	16.2	–5.9	HFC3	NM	0.2	0.02	0.3	7.1	2.71	whole core	2
G-3779	24.38–24.57	16.2	–8.28	HFC3	NM	5,268	4,811	1,652	46.9	2.79	whole core	2
G-3779	25.53–26.03	16.2	–9.58	HFC3	NM	7,228	6,424	4,169	50.2	2.81	whole core	2
G-3779	26.95–27.18	16.2	–10.86	HFC3	NM	14,754	NM	2,103	45.5	2.76	whole core	2
G-3779	35.06–35.37	16.2	–19.02	HFC3	NM	9,319	6,211	3,806	28.1	2.72	whole core	2
G-3789	13.68–13.93	8	–5.8	HFC3	NM	2,470	1,082	159	8.6	2.70	whole core	2
G-3789	14.59–14.76	8	–6.68	HFC3	NM	7,529	6,694	1,333	31.4	2.72	whole core	2
G-3789	15.85–16.08	8	–7.96	HFC3	NM	1,249	1,067	512	26.0	2.71	whole core	2
G-3789	19.63–19.94	8	–11.78	HFC3	NM	12,974	12,974	3,645	31.1	2.74	whole core	2
G-3789	20.15–20.44	8	–12.3	HFC3	NM	12,213	10,855	2,566	21.5	2.72	whole core	2
G-3789	20.86–21.24	8	–13.05	HFC3	NM	5,315	4,961	3,274	32.6	2.74	whole core	2
G-3789	21.49–21.93	8	–13.71	HFC3	NM	4,336	3,716	4,770	29.3	2.74	whole core	2
G-3789	22.06–22.56	8	–14.31	HFC3	NM	7,484	6,235	4,189	33.5	2.75	whole core	2

Table 2.3-18 (Sheet 7 of 15)
Regional Hydrogeologic Properties from Rock Core Samples

Boring	Depth (feet)	Surface Elevation (ft MSL)	Midpoint Elevation (ft MSL)	High Frequency Cycle or Formation	Permeability (K_{air}) (millidarcies)				Porosity (percent)	Grain Density (grams per cubic centimeter)[(a)]	Sample Type	Source
					Steady-State	Maximum Horizontal	Horizontal 90°	Vertical				
G-3789	25.32–25.47	8	–17.4	HFC3	NM	54	1	1,578	17.9	2.71	whole core	2
G-3790	22.79–23	8	–14.9	HFC3	NM	4,478	4,277	507	27.0	2.73	whole core	2
G-3790	24–24.33	8	–16.16	HFC3	NM	10,076	7,195	2,084	27.7	2.73	whole core	2
G-3790	31.5–31.88	8	–23.69	HFC3	NM	2,566	1,970	2,765	30.2	2.72	whole core	2
G-3790	31.88–32.25	8	–24.19	HFC3/2	NM	3,335	3,160	3,661	32.6	2.72	whole core	2
G-3791	16.06–16.28	8	–8.17	HFC3	NM	0.02	0.02	0.02	12.7	2.69	whole core	2
G-3791	16.47–16.80	8	–8.64	HFC3	NM	476	0.2	7	14.7	2.70	whole core	2
G-3791	19.3–19.59	8	–11.74	HFC3	NM	5,258	4,343	2,439	29.7	2.71	whole core	2
G-3791	23.28–23.74	8	–15.51	HFC3	NM	4,338	4,049	3,037	30.0	2.72	whole core	2
G-3791	24.41–24.66	8	–16.54	HFC3	NM	15,535	13,980	2,858	30.0	2.72	whole core	2
G-3791	24.91–25.24	8	–17.08	HFC3	NM	8,994	8,994	3,097	32.7	2.72	whole core	2
G-3791	27.93–28.30	8	–20.1	HFC3	NM	10,831	10,831	4,639	29.6	2.72	whole core	2
G-3791	29.25–29.67	8	–21.46	HFC3	NM	6,663	3,805	4,054	19.7	2.70	whole core	2
G-3792	14.41–14.58	8	–6.5	HFC3	NM	4,247	4,106	769	17.4	2.70	whole core	2
G-3793	6.98–7.27	10	2.88	HFC3	NM	283	271	463	13.6	2.71	whole core	2
G-3794	12.7–12.89	9	–3.8	HFC3	NM	5,268	2,401	533	20.2	2.71	whole core	2
G-3794	17.63–18.01	9	–8.82	HFC3	NM	10,356	692	1,032	12.8	2.71	whole core	2
G-3794	20.18–20.60	9	–11.39	HFC3	NM	4,333	3,999	1,930	23.2	2.70	whole core	2
G-3673	46.5–47.25	20	–26.88	HFC2	<0.01	NM	NM	NM	12.8	2.69	core plug	1
G-3674	26.5–27	10	–16.75	HFC2	5011	NM	NM	NM	19.6	2.70	core plug	1
G-3675	20.4	20	–0.4	HFC2	<0.01	NM	NM	NM	6.6	2.68	core plug	1
G-3675	23.5	8	–15.5	HFC2	NM	0.12	0.06	<0.01	11.3	2.69	whole core	1
G-3675	24.5–25	8	–16.75	HFC2	5,027	NM	NM	NM	22.9	2.68	core plug	1
G-3675	31.75–32	8	–23.88	HFC2	<0.01	NM	NM	NM	12.5	2.70	core plug	1
G-3675	50.75–51	8	–42.88	HFC2	1,688	NM	NM	NM	27.8	2.68	core plug	1
G-3679	28.3	9	–19.3	HFC2	0.3	NM	NM	NM	25.7	2.72	core plug	1

Table 2.3-18 (Sheet 8 of 15)
Regional Hydrogeologic Properties from Rock Core Samples

Boring	Depth (feet)	Surface Elevation (ft MSL)	Midpoint Elevation (ft MSL)	High Frequency Cycle or Formation	Permeability (K_{air}) (millidarcies)				Porosity (percent)	Grain Density (grams per cubic centimeter)[(a)]	Sample Type	Source
					Steady-State	Maximum Horizontal	Horizontal 90°	Vertical				
G-3681	43.3	9	–34.3	HFC2	NM	0.08	0.05	0.02	11.6	2.72	whole core	1
G-3685	28.5	9	–19.5	HFC2	NM	10.6	0.71	1,949	13.9	2.71	whole core	1
G-3690	22	9	–13	HFC2	NM	670	638	711	13.8	2.71	whole core	1
G-3697	27.5	9	–18.5	HFC2	NM	0.45	0.4	0.16	23.2	2.72	whole core	1
G-3710	30.33	10	–20.33	HFC2	NM	4,754	1,357	92.5	33.7	2.72	whole core	1
G-3718	24.4	9	–15.4	HFC2	9.49	NM	NM	NM	24.1	2.72	core plug	1
G-3718	24.38	9	–15.38	HFC2	NM	47	11.3	179	24.3	2.70	whole core	1
G-3720	22	9	–13	HFC2	NM	7.33	0.61	10,875	17.0	2.71	whole core	1
G-3721	20.5	10	–10.5	HFC2	NM	0.14	0.04	0.62	20.5	2.81	whole core	1
G-3722	29.42	10	–19.42	HFC2	NM	9,580	6,385	9,704	25.2	2.70	whole core	1
G-3727	23.29	8	–14.29	HFC2	NM	0.19	0.14	0.01	15.2	2.71	whole core	1
G-3729	24.12	6	–18.12	HFC2	NM	4.51	1.03	570	21.8	2.71	whole core	1
G-3731	30.71	10	–20.71	HFC2	NM	7.23	0.53	10,038	18.2	2.72	whole core	1
G-3732	25.5	6	–19.5	HFC2	NM	28.7	22.9	206	11.5	2.71	whole core	1
G-3734	24	8	–16	HFC2	NM	667	332	17,567	23.4	2.72	whole core	1
G-3733	46.25–46.44	6	–40.34	HFC2	NM	138	94	66	17.4	2.70	whole core	2
G-3733	48.63–48.79	6	–42.71	HFC2	NM	101	18	202	23.6	2.71	whole core	2
G-3733	49.04–49.42	6	–43.23	HFC2	NM	3,932	2,449	59	26.1	2.70	whole core	2
G-3733	49.67–49.92	6	–43.8	HFC2	NM	1,432	249	112	21.7	2.70	whole core	2
G-3770	20.5–20.79	6.7	–13.94	HFC2	NM	3,830	3,458	13,701	34.2	2.70	whole core	2
G-3770	24.26–24.47	6.7	–17.66	HFC2	NM	11,232	11,232	10,294	47.7	2.70	whole core	2
G-3770	25.03–25.34	6.7	–18.48	HFC2	NM	5,616	5,616	14,886	32.6	2.70	whole core	2
G-3770	25.63–25.92	6.7	–19.08	HFC2	NM	1,742	1,421	12,891	24.9	2.71	whole core	2
G-3770	29.47–29.87	6.7	–22.97	HFC2	NM	361	2	18,551	22.2	2.71	whole core	2
G-3770	30.04–30.27	6.7	–23.46	HFC2	NM	3,073	1,634	10,694	28.9	2.70	whole core	2
G-3770	37.69–38.02	6.7	–31.16	HFC2	NM	4,917	4,917	7,419	35.1	2.70	whole core	2

Table 2.3-18 (Sheet 9 of 15)
Regional Hydrogeologic Properties from Rock Core Samples

Boring	Depth (feet)	Surface Elevation (ft MSL)	Midpoint Elevation (ft MSL)	High Frequency Cycle or Formation	Permeability (K_{air}) (millidarcies)				Porosity (percent)	Grain Density (grams per cubic centimeter)[(a)]	Sample Type	Source
					Steady-State	Maximum Horizontal	Horizontal 90°	Vertical				
G-3770	40.93–41.28	6.7	–34.4	HFC2	NM	4,470	2,037	5,524	30.8	2.68	whole core	2
G-3770	44.88–45.21	6.7	–38.34	HFC2	NM	NM	0.6	NM	30.7	2.69	whole core	2
G-3770	45.4–45.63	6.7	–38.82	HFC2	NM	7,375	3,361	2,481	27.8	2.70	whole core	2
G-3770	50.9–51.13	6.7	–44.32	HFC2	NM	0.2	0.2	3	17.0	2.70	whole core	2
G-3770	51.3–51.72	6.7	–44.81	HFC2	NM	14	0.2	0.1	17.7	2.71	whole core	2
G-3770	51.72–52.14	6.7	–45.23	HFC2	NM	0.2	0.1	0.1	16.6	2.69	whole core	2
G-3770	52.29–52.62	6.7	–45.76	HFC2	NM	20	0.3	0.1	21.1	2.70	whole core	2
G-3771	18.0–18.38	6	–12.19	HFC2	NM	983	248	5	19.2	2.71	whole core	2
G-3771	18.38–18.67	6	–12.52	HFC2	NM	18	0.07	1	18.6	2.71	whole core	2
G-3771	18.67–19.02	6	–12.84	HFC2	NM	10	0.5	1,925	23.3	2.71	whole core	2
G-3771	19.29–19.64	6	–13.46	HFC2	NM	2,135	813	16,070	24.6	2.70	whole core	2
G-3771	19.64–20.02	6	–13.83	HFC2	NM	11,534	11,534	15,745	24.9	2.70	whole core	2
G-3771	20.15–20.48	6	–14.32	HFC2	NM	11,316	11,316	16,068	31.7	2.71	whole core	2
G-3771	20.61–20.98	6	–14.8	HFC2	NM	10,615	10,615	17,158	30.3	2.71	whole core	2
G-3771	25.77–26.14	6	–19.96	HFC2	NM	10,341	5,168	17,428	15.9	2.70	whole core	2
G-3771	27.94–28.27	6	–22.1	HFC2	NM	11,646	11,646	15,674	25.9	2.70	whole core	2
G-3771	29.57–29.84	6	–23.7	HFC2	NM	1	0.04	1	13.1	2.71	whole core	2
G-3771	29.84–30.07	6	–23.96	HFC2	NM	0.04	0.04	0.5	13.2	2.71	whole core	2
G-3771	30.42–30.57	6	–24.5	HFC2	NM	0.2	0.1	634	13.8	2.69	whole core	2
G-3771	30.61–30.76	6	–24.68	HFC2	NM	7	0.3	2,057	17.5	2.70	whole core	2
G-3771	31.58–31.91	6	–25.74	HFC2	NM	527	41	787	20.1	2.69	whole core	2
G-3771	32.16–32.41	6	–26.28	HFC2	NM	7,887	7,887	5,732	22.7	2.70	whole core	2
G-3771	32.7–32.95	6	–26.82	HFC2	NM	215	37	456	17.3	2.70	whole core	2
G-3771	32.95–33.24	6	–27.1	HFC2	NM	314	70	492	18.5	2.71	whole core	2
G-3771	33.24–33.53	6	–27.38	HFC2	NM	6,446	6,446	7,001	17.7	2.71	whole core	2
G-3771	34.18–34.47	6	–28.32	HFC2	NM	14,112	14,112	6,410	34.9	2.71	whole core	2

Table 2.3-18 (Sheet 10 of 15)
Regional Hydrogeologic Properties from Rock Core Samples

Boring	Depth (feet)	Surface Elevation (ft MSL)	Midpoint Elevation (ft MSL)	High Frequency Cycle or Formation	Permeability (K_{air}) (millidarcies)				Porosity (percent)	Grain Density (grams per cubic centimeter)[(a)]	Sample Type	Source
					Steady-State	Maximum Horizontal	Horizontal 90°	Vertical				
G-3771	40.49–40.72	6	–34.6	HFC2	NM	922	665	749	25.1	2.71	whole core	2
G-3771	40.91–41.12	6	–35.02	HFC2	NM	NM	76	NM	30.2	2.72	whole core	2
G-3771	47.93–48.03	6	–41.98	HFC2	NM	4	1	81	22.2	2.70	whole core	2
G-3771	48.23–48.52	6	–42.38	HFC2	NM	315	70	394	27.6	2.72	whole core	2
G-3771	49.06–49.27	6	–43.16	HFC2	NM	109	49	38	29.2	2.71	whole core	2
G-3771	49.27–49.5	6	–43.38	HFC2	NM	4,106	2,878	803	31.0	2.71	whole core	2
G-3771	49.65–49.88	6	–43.76	HFC2	NM	5,789	5,789	5,235	34.3	2.71	whole core	2
G-3771	50.09–50.15	6	–44.12	HFC2	NM	4,550	3,327	136	25.7	2.71	whole core	2
G-3778	38.6–38.88	16.4	–22.34	HFC2	NM	109	80	100	38.5	2.71	whole core	2
G-3778	39.2–39.37	16.4	–22.88	HFC2	NM	87	81	273	35.6	2.72	whole core	2
G-3778	40.96–41.25	16.4	–24.7	HFC2	NM	5,985	5,129	4,145	42.6	2.73	whole core	2
G-3778	52.27–52.52	16.4	–36	HFC2	NM	2,726	1,890	2,321	21.3	2.71	whole core	2
G-3778	54.16–54.43	16.4	–37.9	HFC2	NM	28	4	588	22.2	2.71	whole core	2
G-3778	55.13–55.23	16.4	–38.78	HFC2	NM	77	42	310	20.0	2.72	whole core	2
G-3778	59.2–59.47	16.4	–42.94	HFC2	NM	20,467	20,467	2,452	23.5	2.70	whole core	2
G-3778	59.8–60.05	16.4	–43.52	HFC2	NM	18,720	18,720	3,490	21.5	2.70	whole core	2
G-3779	46.8–46.97	16.2	–30.68	HFC2	NM	114	91	574	37.1	2.73	whole core	2
G-3779	47.39–47.6	16.2	–31.3	HFC2	NM	358	26	801	35.4	2.75	whole core	2
G-3779	47.6–47.81	16.2	–31.5	HFC2	NM	873	680	57	36.0	2.73	whole core	2
G-3779	49.18–49.31	16.2	–33.04	HFC2	NM	4,595	3,201	1,682	29.6	2.72	whole core	2
G-3779	49.5–49.63	16.2	–33.36	HFC2	NM	10,813	7,053	893	25.6	2.73	whole core	2
G-3779	49.88–50.07	16.2	–33.78	HFC2	NM	2,137	2,137	1,647	32.2	2.73	whole core	2
G-3779	52.19–52.57	16.2	–36.18	HFC2	NM	2,165	1,866	4,821	16.8	2.71	whole core	2
G-3779	54.3–54.68	16.2	–38.26	HFC2	NM	49	33	365	24.1	2.72	whole core	2
G-3779	54.94–55.06	16.2	–38.8	HFC2	NM	16	16	926	18.4	2.69	whole core	2
G-3779	58.21–58.42	16.2	–42.12	HFC2	NM	17,621	17,621	4,697	26.7	2.71	whole core	2

Table 2.3-18 (Sheet 11 of 15)
Regional Hydrogeologic Properties from Rock Core Samples

Boring	Depth (feet)	Surface Elevation (ft MSL)	Midpoint Elevation (ft MSL)	High Frequency Cycle or Formation	Permeability (K_{air}) (millidarcies)				Porosity (percent)	Grain Density (grams per cubic centimeter)[(a)]	Sample Type	Source
					Steady-State	Maximum Horizontal	Horizontal 90°	Vertical				
G-3779	58.75–58.92	16.2	–42.64	HFC2	NM	26,236	26,236	2,252	23.5	2.70	whole core	2
G-3779	59.09–59.26	16.2	–42.98	HFC2	NM	25,120	268	2,588	12.0	2.69	whole core	2
G-3779	59.59–60.01	16.2	–43.6	HFC2	NM	9,599	8,638	5,542	29.4	2.72	whole core	2
G-3789	27.67–28	8	–19.84	HFC2	NM	1,529	782	2,465	23.1	2.72	whole core	2
G-3789	28–28.27	8	–20.14	HFC2	NM	2,784	2,784	1,966	23.1	2.71	whole core	2
G-3789	28.27–28.58	8	–20.42	HFC2	NM	5,618	5,185	2,975	22.8	2.72	whole core	2
G-3789	28.88–29.07	8	–20.98	HFC2	NM	5,784	3,439	2,170	20.8	2.72	whole core	2
G-3789	29.24–29.39	8	–21.32	HFC2	NM	9,142	8,230	1,615	22.9	2.72	whole core	2
G-3789	29.68–30.03	8	–21.86	HFC2	NM	506	250	495	22.6	2.73	whole core	2
G-3789	31.61–32.15	8	–23.88	HFC2	NM	77	46	4	29.4	2.73	whole core	2
G-3789	32.23–32.56	8	–24.4	HFC2	NM	214	184	255	32.0	2.73	whole core	2
G-3789	33.86–34.19	8	–26.08	HFC2	NM	41	0.4	0.1	22.1	2.73	whole core	2
G-3789	34.4–34.73	8	–26.56	HFC2	NM	696	365	184	25.1	2.72	whole core	2
G-3789	34.9–35.15	8	–27.02	HFC2	NM	1,096	888	1,232	30.0	2.73	whole core	2
G-3789	37.33–37.54	8	–29.44	HFC2	NM	0.4	0.2	0.05	18.4	2.71	whole core	2
G-3789	40.66–40.87	8	–32.76	HFC2	NM	38	0.4	61	18.1	2.73	whole core	2
G-3789	42.57–42.92	8	–34.74	HFC2	NM	0.02	0.001	2,840	13.5	2.71	whole core	2
G-3789	52–52.17	8	–44.08	HFC2	NM	28	23	89	17.9	2.69	whole core	2
G-3789	53.10–53.56	8	–45.33	HFC2	NM	1,874	1,055	238	25.8	2.69	whole core	2
G-3790	32.25–32.54	8	–24.4	HFC2	NM	2,016	1,328	3,268	28.2	2.72	whole core	2
G-3790	34.2–34.45	8	–26.32	HFC2	NM	952	713	299	37.4	2.72	whole core	2
G-3790	39.31–39.69	8	–31.5	HFC2	NM	0.2	0.2	0.2	26.7	2.72	whole core	2
G-3790	40.54–40.96	8	–32.75	HFC2	NM	0.08	0.08	4,391	19.4	2.71	whole core	2
G-3790	41.21–41.5	8	–33.36	HFC2	NM	0.02	0.02	4	13.0	2.72	whole core	2
G-3790	41.68–41.95	8	–33.82	HFC2	NM	9	9	12	19.3	2.72	whole core	2
G-3790	42.38–42.71	8	–34.54	HFC2	NM	3,539	0.05	1,796	22.5	2.72	whole core	2

Table 2.3-18 (Sheet 12 of 15)
Regional Hydrogeologic Properties from Rock Core Samples

Boring	Depth (feet)	Surface Elevation (ft MSL)	Midpoint Elevation (ft MSL)	High Frequency Cycle or Formation	Permeability (K_{air}) (millidarcies)				Porosity (percent)	Grain Density (grams per cubic centimeter)[(a)]	Sample Type	Source
					Steady-State	Maximum Horizontal	Horizontal 90°	Vertical				
G-3790	44.63–44.8	8	–36.72	HFC2	NM	24	7	273	14.5	2.71	whole core	2
G-3790	49.76–50.01	8	–41.88	HFC2	NM	9,569	7,973	2,300	21.1	2.71	whole core	2
G-3790	50.18–50.42	8	–42.3	HFC2	NM	9,077	7,260	8	21.5	2.69	whole core	2
G-3790	52.98–53.23	8	–45.1	HFC2	NM	297	282	75	26.8	2.70	whole core	2
G-3790	56.17–56.5	8	–48.25	HFC2	NM	309	2	2	19.2	2.70	whole core	2
G-3790	57.83–57.71	8	–50.27	HFC2	NM	380	6	0.5	22.1	2.70	whole core	2
G-3791	30.63–30.88	8	–22.76	HFC2	NM	2,101	1,641	1,047	37.8	2.70	whole core	2
G-3791	32–32.29	8	–24.14	HFC2	NM	1,084	658	1,016	29.5	2.71	whole core	2
G-3791	32.83–33.25	8	–25.04	HFC2	NM	8,854	6,885	4,117	45.4	2.73	whole core	2
G-3791	33.75–34.21	8	–25.98	HFC2	NM	8,555	8,555	4,957	30.4	2.72	whole core	2
G-3791	34.38–34.8	8	–26.59	HFC2	NM	8,854	6,885	3,050	22.2	2.71	whole core	2
G-3791	38.13–38.42	8	–30.3	HFC2	NM	6,413	5,557	1,936	31.6	2.72	whole core	2
G-3791	38.63–38.96	8	–30.8	HFC2	NM	8,100	6,942	3,334	31.0	2.71	whole core	2
G-3791	41.21–41.59	8	–33.4	HFC2	NM	1,762	1,560	2,110	32.0	2.70	whole core	2
G-3791	41.96–42.38	8	–34.17	HFC2	NM	2,634	2,406	3,304	36.0	2.71	whole core	2
G-3791	42.38–42.59	8	–34.48	HFC2	NM	4,338	3,407	2,223	32.0	2.70	whole core	2
G-3791	43.42–43.65	8	–35.54	HFC2	NM	16,346	14,529	2,125	25.5	2.71	whole core	2
G-3791	51.35–51.68	8	–43.52	HFC2	NM	2,612	1,729	1,589	15.4	2.70	whole core	2
G-3791	51.68–52.06	8	–43.87	HFC2	NM	2,472	1,831	6	17.7	2.70	whole core	2
G-3792	26.06–26.39	8	–18.22	HFC2	NM	10,954	0.2	764	24.2	2.70	whole core	2
G-3792	26.39–26.72	8	–18.56	HFC2	NM	2,082	2,005	1,405	30.1	2.71	whole core	2
G-3792	27.14–27.45	8	–19.3	HFC2	NM	812	462	1,337	18.3	2.71	whole core	2
G-3792	27.83–28.25	8	–20.04	HFC2	NM	4,123	4,123	3,265	16.9	2.71	whole core	2
G-3792	28.25–28.58	8	–20.42	HFC2	NM	7,454	6,211	2,502	20.1	2.72	whole core	2
G-3792	32.82–33.24	8	–25.03	HFC2	NM	3,836	564	296	18.4	2.71	whole core	2
G-3792	34.17–34.50	8	–26.34	HFC2	NM	40	39	1	13.4	2.68	whole core	2

Table 2.3-18 (Sheet 13 of 15)
Regional Hydrogeologic Properties from Rock Core Samples

Boring	Depth (feet)	Surface Elevation (ft MSL)	Midpoint Elevation (ft MSL)	High Frequency Cycle or Formation	Permeability (K_{air}) (millidarcies) Steady-State	Maximum Horizontal	Horizontal 90°	Vertical	Porosity (percent)	Grain Density (grams per cubic centimeter)[(a)]	Sample Type	Source
G-3792	34.50–34.88	8	–26.69	HFC2	NM	589	346	0.02	15.5	2.69	whole core	2
G-3792	34.88–35.09	8	–26.98	HFC2	NM	0.1	0.1	0.2	10.8	2.69	whole core	2
G-3792	38.63–38.96	8	–30.8	HFC2	NM	404	265	6	19.9	2.70	whole core	2
G-3792	43.15–43.53	8	–35.34	HFC2	NM	2	0.04	0.02	13.3	2.70	whole core	2
G-3792	45.27–45.5	8	–37.38	HFC2	NM	1,736	53	1,517	9.9	2.70	whole core	2
G-3792	45.6–45.98	8	–37.79	HFC2	NM	699	470	3,333	8.3	2.69	whole core	2
G-3792	50.05–50.3	8	–42.18	HFC2	NM	15	0.4	591	19.7	2.70	whole core	2
G-3792	51.69–51.98	8	–43.84	HFC2	NM	13,265	11,938	4,010	23.4	2.71	whole core	2
G-3792	62.71–63.04	8	–54.88	HFC2	NM	533	495	155	21.5	2.72	whole core	2
G-3792	66.81–67.06	8	–58.94	HFC2	NM	0.3	0.02	0.2	13.8	2.71	whole core	2
G-3792	67.39–67.72	8	–59.56	HFC2	NM	7,869	5,619	0.02	18.3	2.71	whole core	2
G-3792	67.72—68.05	8	–59.88	HFC2	NM	8,022	4,199	1	17.5	2.71	whole core	2
G-3792	69.47–69.89	8	–61.68	HFC2	NM	273	12	0.03	13.8	2.71	whole core	2
G-3792	76–76.25	8	–68.12	HFC2	NM	23,984	4,012	1,387	30.8	2.72	whole core	2
G-3793	13.88–14.21	10	–4.04	HFC2	NM	9,081	3,403	3,906	22.8	2.70	whole core	2
G-3793	17.21–17.63	10	–7.42	HFC2	NM	4,268	3,047	3,067	17.9	2.71	whole core	2
G-3793	27–27.21	10	–17.1	HFC2	NM	962	3	5	22.8	2.71	whole core	2
G-3793	28.68–29.01	10	–18.84	HFC2	NM	12,480	9,599	3,023	31.2	2.72	whole core	2
G-3793	29.18–29.6	10	–19.39	HFC2	NM	19,318	15,000	1,502	23.4	2.73	whole core	2
G-3793	31.75–31.94	10	–21.84	HFC2	NM	27,411	21,083	1,290	27.0	2.72	whole core	2
G-3793	32.11–32.36	10	–22.24	HFC2	NM	15,136	13,622	1,742	29.3	2.71	whole core	2
G-3793	39.52–39.9	10	–29.71	HFC2	NM	929	678	940	22.0	2.71	whole core	2
G-3793	39.9–40.28	10	–30.09	HFC2	NM	1,865	1,678	1,626	22.8	2.71	whole core	2
G-3793	40.44—40.73	10	–30.58	HFC2	NM	571	28	1,657	20.1	2.72	whole core	2
G-3793	41.15–41.42	10	–31.34	HFC2	NM	52	41	1,853	17.9	2.71	whole core	2
G-3793	52.98–53.25	10	–43.12	HFC2	NM	3,616	2,218	357	27.1	2.70	whole core	2

Table 2.3-18 (Sheet 14 of 15)
Regional Hydrogeologic Properties from Rock Core Samples

Boring	Depth (feet)	Surface Elevation (ft MSL)	Midpoint Elevation (ft MSL)	High Frequency Cycle or Formation	Permeability (K_{air}) (millidarcies)				Porosity (percent)	Grain Density (grams per cubic centimeter)[(a)]	Sample Type	Source
					Steady-State	Maximum Horizontal	Horizontal 90°	Vertical				
G-3793	53.79–53.98	10	–43.88	HFC2	NM	327	13	189	22.7	2.70	whole core	2
G-3794	19.4–19.73	9	–10.56	HFC2	NM	439	316	2,251	15.0	2.77	whole core	2
G-3794	24.18–24.51	9	–15.34	HFC2	NM	2,317	1,958	3,592	22.0	2.71	whole core	2
G-3794	30.72–30.97	9	–21.84	HFC2	NM	5,055	226	233	29.6	2.72	whole core	2
G-3673	51–51.5	20	–31.25	HFC1	34.3	NM	NM	NM	37.3	2.68	core plug	1
G-3674	39.25–40	10	–29.62	HFC1	77.6	NM	NM	NM	12.3	2.70	core plug	1
G-3674	49–49.75	10	–39.38	HFC1	<0.01	NM	NM	NM	21.2	2.68	core plug	1
G-3674	52.1	10	–42.1	HFC1	2.19	NM	NM	NM	18.1	2.69	core plug	1
G-3675	64.5–65	8	–56.75	HFC1	<0.01	NM	NM	NM	17.7	2.69	core plug	1
G-3678	33.3	9	–24.3	HFC1	NM	2,244	997	18,223	16.1	2.71	whole core	1
G-3679	36.7	9	–27.7	HFC1	NM	1,870	0.54	13,498	20.7	2.71	whole core	1
G-3731	39.08	10	–29.08	HFC1	NM	3,530	1,463	13,050	20.4	2.71	whole core	1
G-3732	39.5	6	–33.5	HFC1	194.3	NM	NM	NM	10.8	2.71	core plug	1
G-3732	42.4–42.7	6	–36.55	HFC1	NM	NM	NM	13,362	34.8	2.68	whole core	1
G-3732	44	6	–38	HFC1	165.3	NM	NM	NM	16.2	2.71	core plug	1
G-3674	83.5–84	10	–73.75	Tamiami	16,584	NM	NM	NM	42.6	2.68	core plug	1
G-3770	64.59–64.8	6.7	–58	Tamiami	NM	1,956	1,831	1,236	28.2	2.74	whole core	2
G-3770	64.92–65.38	6.7	–58.45	Tamiami	NM	1,996	1,996	2,862	29.0	2.72	whole core	2
G-3770	69.88–70.17	6.7	–63.35	Tamiami	NM	1,983	63	296	19.7	2.72	whole core	2
G-3770	70.17–70.42	6.7	–63.6	Tamiami	NM	1,402	1,329	343	22.6	2.72	whole core	2
G-3770	70.42–70.67	6.7	–63.85	Tamiami	NM	2,186	1,994	1,878	26.1	2.72	whole core	2
G-3771	54.21–54.46	6	–48.35	Tamiami	NM	13	13	32	23.3	2.74	whole core	2
G-3771	55.47–55.7	6	–49.58	Tamiami	NM	36	12	116	19.0	2.74	whole core	2
G-3771	55.89–56.08	6	–49.98	Tamiami	NM	39	2	37	18.4	2.74	whole core	2
G-3771	58.93–59.18	6	–53.06	Tamiami	NM	2,650	2,467	2,490	26.3	2.77	whole core	2
G-3771	59.93–60.1	6	–54.02	Tamiami	NM	4,825	4,669	2,077	38.2	2.79	whole core	2

Table 2.3-18 (Sheet 15 of 15)
Regional Hydrogeologic Properties from Rock Core Samples

Boring	Depth (feet)	Surface Elevation (ft MSL)	Midpoint Elevation (ft MSL)	High Frequency Cycle or Formation	Permeability (K_{air}) (millidarcies)				Porosity (percent)	Grain Density (grams per cubic centimeter)(a)	Sample Type	Source
					Steady-State	Maximum Horizontal	Horizontal 90°	Vertical				
G-3771	74.27–74.44	6	–68.36	Tamiami	NM	4,302	3,625	4,127	40.6	2.74	whole core	2
G-3771	74.57–74.78	6	–68.68	Tamiami	NM	7,091	7,091	5,116	40.3	2.72	whole core	2
G-3793	63.95–64.12	10	–54.04	Tamiami	NM	20,433	15,889	735	11.5	2.69	whole core	2
G-3793	64.29–64.62	10	–54.46	Tamiami	NM	12,171	10,954	2,042	14.5	2.69	whole core	2
G-3793	64.92–64.96	10	–54.94	Tamiami	NM	4,964	4,964	465	11.2	2.69	whole core	2
G-3794	59.23–59.65	9	–49.44	Tamiami	NM	4,690	3,607	2,006	15.7	2.72	whole core	2
G-3794	61.02–61.52	9	–52.27	Tamiami	NM	100	17	11	15.8	2.69	whole core	2
G-3794	61.94–62.27	9	–53.1	Tamiami	NM	2,807	2,010	638	26.4	2.74	whole core	2
G-3794	63.13–63.38	9	–54.26	Tamiami	NM	61	0.1	204	10.0	2.72	whole core	2
G-3794	64.07–64.57	9	–55.32	Tamiami	NM	1,952	837	0.03	21.0	2.76	whole core	2

(a) Reported as grams per centimeter in the references
Sources: 1 – Cunningham et al. 2004
2 – Cunningham et al. 2006
NM = Not measured

Table 2.3-19 (Sheet 1 of 4)
Slug Test Hydraulic Conductivity Summary

Observation Well	Test Date	Surface Elevation (NAVD 88)	Screened Interval (feet bgs)	Geologic Unit	Saturated Thickness (feet)	Solution	Hydraulic Conductivity in feet per day		
							Falling	Rising	Arithmetic Mean
OW-606U Test #1	5/20/2008	–1.4	18–28	Miami Limestone	29.9	KGS	NC	97.98	97.98
OW-606U Test #1						Springer-Gelhar	NC	134.80	134.80
OW-606U Test #2						KGS	NC	92.02	92.02
OW-606U Test #2						Springer-Gelhar	NC	123.10	123.10
OW-606U Average							**N/A**	**111.98**	**111.98**
OW-606L Test #1	5/18/2008	–1.4	97–107	Lower Fort Thompson Formation	92.0	Butler	119.90	30.16	75.03
OW-606L Test #1						McElwee-Zenner	117.80	NC	117.80
OW-606L Test #1						KGS	NC	35.04	35.04
OW-606L Test #2						Butler	NC	67.40	67.40
OW-606L Test #2						McElwee-Zenner	NC	66.13	66.13
OW-606L Average							**118.85**	**49.68**	**72.74**
OW-621U	5/20/2008	0.2	17.4–27.4	Miami Limestone	27.6	KGS	NC	94.35	94.35
OW-621U						Springer-Gelhar	NC	68.89	68.89
OW-621U Average							**N/A**	**81.62**	**81.62**
OW-621L Test #1	5/17/2008	0.2	98.6–108.6	Lower Fort Thompson Formation	88.5	Butler	91.59	31.07	61.33
OW-621L Test #1						KGS	71.28	33.31	52.30
OW-621L Test #2						Butler	NC	35.72	35.72
OW-621L Test #2						KGS	NC	30.40	30.40
OW-621L Test #3						Butler	NC	16.65	16.65
OW-621L Test #3						KGS	NC	16.66	16.66
OW-621L Average							**81.44**	**27.30**	**40.84**
OW-636U Test #1	5/21/2008	–1.1	17–27	Miami Limestone	28.9	KGS	NC	57.27	57.27
OW-636U Test #1						Springer-Gelhar	NC	50.64	50.64
OW-636U Test #2						KGS	NC	79.27	79.27
OW-636U Test #2						Springer-Gelhar	NC	64.33	64.33

Table 2.3-19 (Sheet 2 of 4)
Slug Test Hydraulic Conductivity Summary

Observation Well	Test Date	Surface Elevation (NAVD 88)	Screened Interval (feet bgs)	Geologic Unit	Saturated Thickness (feet)	Solution	Hydraulic Conductivity in feet per day		
							Falling	Rising	Arithmetic Mean
OW-636U Average							**N/A**	**62.88**	**62.88**
OW-636L	5/21/2008	–1.1	97.1–107.1	Lower Fort Thompson Formation	88.0	Butler	NC	10.08	10.08
OW-636L						KGS	NC	10.58	10.58
OW-636L						Butler	NC	9.425	9.43
OW-636L						KGS	NC	10.01	10.01
OW-636L Average							**N/A**	**10.02**	**10.02**
OW-706U Test #1	5/16/2008	–1.2	17–27	Miami Limestone	30.7	KGS	6.423	31.19	18.81
OW-706U Test #1						Springer-Gelhar	83.78	30.27	57.03
OW-706U Test #1						Hvorslev	0.7146	NC	0.71
OW-706U Test #1						Bouwer-Rice	0.5455	NC	0.55
OW-706U Test #2						Springer-Gelhar	NC	70.18	70.18
OW-706U Test #2						KGS	NC	76.09	76.09
OW-706U Average							**22.87**	**51.93**	**37.40**
OW-706L	5/16/2008	–1.2	100–110	Lower Fort Thompson Fm	82.8	Butler	21.20	25.09	23.15
OW-706L						KGS	21.97	26.07	24.02
OW-706L Average							**21.59**	**25.58**	**23.58**
OW-721U Test #1	5/15/2008	–1.5	14–24	Miami Limestone	24.8	Springer-Gelhar	45.50	27.03	36.27
OW-721U Test #1						KGS	45.50	32.46	38.98
OW-721U Test #2						Springer-Gelhar	NC	24.39	24.39
OW-721U Test #2						KGS	NC	32.47	32.47
OW-721U Average							**45.50**	**29.09**	**37.29**
OW-721L Test #1	5/15/2008	–1.5	96–106	Lower Fort Thompson Formation	90.0	Butler	2.726	11.59	7.16
OW-721L Test #1						KGS	1.13	2.91	1.13
OW-721L Test #2						Butler	NC	2.839	2.84
OW-721L Test #2						KGS	NC	1.325	1.33
OW-721L Average							**1.93**	**4.67**	**3.30**
OW-735 U Test #1	5/15/2008	–0.8	16–26	Miami Limestone	26.5	Springer-Gelhar	319.20	58.21	188.70
OW-735 U Test #1						KGS	109.50	84.68	97.09
OW-735 U Test #2						Springer-Gelhar	NC	80.18	80.18
OW-735 U Test #2						KGS	NC	70.70	70.70

Table 2.3-19 (Sheet 3 of 4)
Slug Test Hydraulic Conductivity Summary

Observation Well	Test Date	Surface Elevation (NAVD 88)	Screened Interval (feet bgs)	Geologic Unit	Saturated Thickness (feet)	Solution	Hydraulic Conductivity in feet per day		
							Falling	Rising	Arithmetic Mean
OW-735U Average							**214.35**	**73.44**	**143.90**
OW-735L Test #1	5/13/2008	–0.8	96.9–106.9	Lower Fort Thompson Fm	87.0	Butler	49.09	42.01	45.55
OW-735L Test #1						KGS	20.57	32.05	26.31
OW-735L Average							**34.83**	**37.03**	**35.93**
OW-802U	5/20/2008	–1.5	15–27	Miami Limestone	25.8	KGS	NC	41.06	41.06
OW-802U						Springer-Gelhar	NC	31.90	31.90
OW-802U Average							**N/A**	**36.48**	**36.48**
OW-802L	5/20/2008	–1.5	98–108	Lower Fort Thompson Fm	88.0	Butler	NC	23.28	23.28
OW-802L						KGS	NC	30.99	30.99
OW-802L Average							**N/A**	**27.14**	**27.14**
OW-805U	6/6/2008	–1.6	18–28	Miami Limestone	32.3	KGS	NC	101.7	101.70
OW-805U						Butler	NC	136.4	136.40
OW-805U						Springer-Gelhar	NC	107.1	107.10
OW-805U Average							**N/A**	**115.07**	**115.07**
OW-805L	6/6/2008	–1.6	85–95	Lower Fort Thompson Fm	67.5	Butler	NC	5.269	5.27
OW-805L						KGS	NC	5.936	5.94
OW-805L Average							**N/A**	**5.60**	**5.60**
OW-809U Test #1	5/15/2008	–1.3	15–25	Miami Limestone	25.5	Springer-Gelhar	91.20	60.67	75.90
OW-809U Test #1						KGS	102.90	82.32	92.60
OW-809U Test #2						Springer-Gelhar	NC	26.86	26.86
OW-809U Test #2						KGS	NC	35.94	35.94
OW-809U Average							**97.05**	**51.45**	**74.25**
OW-809L	5/15/2008	–1.3	95.5–105.5	Lower Fort Thompson Fm	88.0	KGS	108.60	36.57	72.60
OW-809L						Butler	103.70	33.43	68.57
OW-809L Average							**106.15**	**35.00**	**70.58**
OW-812U	5/20/2008	–1.4	15–25	Miami Limestone	25.5	KGS	NC	31.24	31.24
OW-812U						Springer-Gelhar	NC	24.49	24.49

Table 2.3-19 (Sheet 4 of 4)
Slug Test Hydraulic Conductivity Summary

Observation Well	Test Date	Surface Elevation (NAVD 88)	Screened Interval (feet bgs)	Geologic Unit	Saturated Thickness (feet)	Solution	Hydraulic Conductivity in feet per day		
							Falling	Rising	Arithmetic Mean
OW-812U Average							**N/A**	**27.87**	**27.87**
OW-812L	5/20/2008	–1.4	97–107	Lower Fort Thompson Fm	86.0	Butler	NC	21.01	21.01
OW-812L						KGS	NC	21.20	21.20
OW-812L Average							**N/A**	**21.11**	**21.11**

Geometric Mean: Upper: 61.3 feet per day
Lower: 20.1 feet per day

Source: Appendix G Groundwater Data, MACTEC 2008
N/A = Not Applicable
NC = Not Conducted
KGS = Kansas Geological Survey
For wells with multiple tests, test results were averaged and used to calculate the geometric mean.
Data from these tests are considered not valid due to rate-limiting recharge effects from the filter pack.

Table 2.3-20
Summary of Units 6 & 7 Aquifer Pumping Test Results

Geologic Unit	Thickness (ft)	Test Well	Aquifer Transmissivity (gpd/ft)[a]	Aquifer Storativity (dimensionless)[a]	Hydraulic Conductivity (K_h or K_v)		
					gpd/ft^2[a]	ft/d[a]	cm/s[a]
Miami Limestone (K_v)	8	PW-6U	—	—	103	14	0.005
	13	PW-7U	—	—	173	23	0.008
Key Largo Limestone (K_h)	33	PW-6U	2,331,000	0.00015	71,000	9,400	3.3
	24	PW-7U	2,200,000	0.0022	92,000	12,000	4.3
freshwater limestone (K_v)	11	PW-6U	—	—	46	6	0.002
	19	PW-7U	—	—	54	7	0.003
	11	PW-6L	—	—	2	0.2	7×10^{-5}
	19	PW-7L	—	—	3	0.4	1×10^{-4}
Fort Thompson Formation (K_h)	57	PW-6L	122,000	0.00016	2,140	286	0.1
	36	PW-7L	131,200	0.0003	3,600	490	0.2
Tamiami Formation (K_v)	18	PW-6L	—	—	7,940	1,061	0.4
	18	PW-7L	—	—	649	87	0.03

(a) All values are averages.

Table 2.3-21
Summary of Units 6 & 7 Groundwater Field Measurements

Well ID	Sample Date	Temperature (°Celsius)	pH (standard units)	Dissolved Oxygen (milligrams per liter)	Specific Conductance (milliSiemens per centimeter)	Turbidity (Nephelometric Turbidity Units)	Oxidation-Reduction Potential (millivolts)
OW-606L[(a)]	5/28/2008	28.29	7.08	9.92	52.8, 72.4[(c)]	0.77	–370
OW-606U[(a)]	5/28/2008	28.71	6.84	1.66	66.9, 62.8[(c)]	0.34	–344
OW-621L[(a)]	6/4/2008	27.80	7.06	1.66	>99.9, 73.9[(c)]	0.21	–349
OW-621U[(a)]	5/29/2008	27.82	7.08	0.05	91.0, 58.3[(c)]	2.91	–351
OW-706L[(a)]	5/29/2008	29.61	6.83	1.49	46.4, 48.6[(c)]	0.20	–351
OW-706U[(a)]	5/29/2008	30.85	6.65	1.13	76.6, 77.3[(c)]	0.83	–392
OW-721L[(a)]	5/28/2008	28.56	6.76	1.18	74.3, 73.7[(c)]	7.55	–370
OW-721U[(a)]	5/28/2008	28.92	7.10	10.6	53.1, 63.8[(c)]	0.36	–364
OW-735U[(a)]	5/27/2008	29.47	7.00	0.02	86.6, 77.5[(c)]	0.92	–360
OW-802U[(a)]	6/5/2008	28.27	6.80	1.90	82.8, 70.8[(c)]	0.48	–322
OW-805U[(a)]	6/5/2008	28.26	7.10	1.19	60.9, 59.8[(c)]	0.32	–346
OW-809U[(a)]	5/27/2008	30.82	6.98	0.01	83.9, 79.0[(c)]	0.97	–371
OW-606L[(d)]	11/12/2009	26.90	7.04	0.16	88.40	NM	–199.7
OW-606U[(d)]	11/12/2009	26.61	7.07	0.33	72.20	NM	–197.6
OW-621L[(d)]	11/13/2009	27.93	7.29	0.11	90.45	NM	–185.3
OW-621U[(d)]	11/16/2009	27.96	7.27	0.16	81.41	NM	–183.4
OW-706L[(d)]	11/12/2009	28.67	7.16	0.23	55.63	NM	–101.6
OW-706U[(d)]	11/12/2009	28.20	7.05	0.19	98.91	NM	–241.2
OW-721L[(d)]	11/16/2009	28.58	7.12	0.15	103.2	NM	–188.4
OW-721U[(d)]	11/16/2009	28.58	7.17	0.12	95.07	NM	–179.3
OW-735U[(d)]	11/12/2009	29.46	7.03	0.19	108.0	NM	–206.9
OW-802U[(d)]	11/13/2009	26.60	7.08	0.16	76.47	NM	–178.0
OW-805U[(d)]	11/16/2009	27.17	7.16	0.25	82.62	NM	–121.4
OW-809U[(d)]	11/13/2009	29.24	7.02	0.13	94.76	NM	–197.4
ENP Precipitation[(b)]	mean	NM	4.98	NM	0.016	NM	NM
Surficial Aquifer SFWMD[(b)]	median	24.8	6.9	NM	0.619	NM	NM
Floridan Aquifer SFWMD[(b)]	median	26.3	7.4	NM	1.787	NM	NM
Cooling Canal	average	30.05	8.02	8.70	NM	1.92	NM
L-31N	average	NM	NM	NM	NM	NM	NM
Biscayne Bay	average	NM	NM	NM	NM	NM	NM
Upper Floridan Production well	mean	NM	7.70	NM	NM	1.1	NM

ENP = Everglades National Park NM = Not Measured
(a) Appendix G Groundwater, MACTEC 2008
(b) FGS 1992
(c) Samples collected February 3-5, 2009
(d) Samples collected and analyzed during routine groundwater level monitoring

Table 2.3-22 (Sheet 1 of 4)
Units 6 & 7 Hydrogeochemical Data

Constituent		TDS	Calcium	Iron	Magnesium	Manganese	Potassium	Silica	Silicon	Sodium
Location ID	**Date Collected**	**milligrams/Liter**								
OW-606L[a]	5/28/2008	34,320[i], 47,047[i][j]	632[b]	<0.050U[c]	1,880[b]	0.0391	549[b]	3	<250[b][c]	15,100[b]
OW-606U[a]	5/28/2008	43,485[i], 40,804[i][j]	535[b]	0.318[b][d]	1,730[b]	0.0354	525[b]	0.729	<250[b][c]	14,400[b]
OW-621L[a]	6/4/2008	64,935[i][k], 48, 045[i][j]	574[b]	<50[b][c]	1,960[b]	<2[b][c]	586[b]	133[d][e]	62.1[b][d][e]	16,300[b]
OW-621U[a]	5/29/2008	59,150[i], 37,901[i][j]	492[b]	0.453[b][d]	1,600[b]	0.0368	476[b]	0.637	<250[b][c]	13,100[b]
OW-706L[a]	5/29/2008	30,160[i], 31,610[i][j]	413[b]	0.531[b][d]	1,170[b]	0.0083	327[b]	8	<250[b][c]	9,440[b]
OW-706U[a]	5/29/2008	49,790[i], 50,229[i][j]	725[b]	0.178[b][d]	2,150[b]	0.0435	658[b]	2	<250[b][c]	17,500[b]
OW-721L[a]	5/28/2008	48,295[i], 47,912[i][j]	667[b]	0.362[b][d]	2,020[b]	0.0462	587[b]	3	<250[b][c]	16,300[b]
OW-721U[a]	5/28/2008	34,515[i], 41,472[i][j]	603[b]	0.329[b][d]	1,890[b]	0.0581	569[b]	0.848	<250[b][c]	15,400[b]
OW-735U[a]	5/27/2008	56,290[i], 50,351[i][j]	749[b]	0.133[b][d]	2,140[b]	0.0327	655[b]	<0.250[c]	<250[b][c]	17,700[b]
OW-802U[a]	6/5/2008	53,820[i], 46,022[i][j]	579[b]	<50[b][c]	1,980[b]	<2[b][c]	586[b]	143[e]	66.7[b][e]	16,400[b]
OW-805U[a]	6/5/2008	39,585[i], 38,853[i][j]	447[b]	<50[b][c]	1,570[b]	<2[b][c]	493[b]	107[e]	49.9[b][e]	13,200[b]
OW-809U[a]	5/27/2008	54,535[i], 51,356[i][j]	704[b]	0.158[b][d]	2,040[b]	0.0281	607[b]	<0.250[c]	<250[b][c]	16,700[b]
OW-606L[l]	11/12/2009	49,500	808[b][d]	<2.5[d]	2500[b][d]	0.0379[b][e]	735[b][d]	6.68	3.12[b][e]	15,000[b][d]
OW-606U[l]	11/12/2009	38,500	820[b][d]	0.593[b][d][e]	2680[b][d]	0.0504[b][e]	757[b][d]	6.03	2.82[b][e]	12,000[b][d]
OW-621L[l]	11/13/2009	46,200	910[b][d]	0.549[b][d][e]	3080[b][d]	0.0334[b][e]	844[b][d]	7.79	3.64[b][e]	14,800[b][d]
OW-621U[l]	11/16/2009	34,600	602[b]	0.754[b][d][e]	2030[b][d]	0.0397[b][e]	550[b][d]	4.77	2.23[b][d][e]	11,800[b][d]
OW-706L[l]	11/12/2009	27,600	831[b][d]	1.340[b][d][e]	2330[b][d]	0.0113[b][e]	616[b][d]	22.90	10.70[b][e]	8,920[b][d]
OW-706U[l]	11/12/2009	48,900	1120[b][d]	0.829[b][d][e]	3760[b][d]	0.0739[b][e]	1030[b][d]	7.08	3.31[b][e]	15,200[b][d]
OW-721L[l]	11/16/2009	45,700	1200[b][d]	0.782[b][d][e]	4000[b][d]	0.0669[b][e]	1110[b][d]	12.30	5.77[b][d][e]	15,300[b][d]
OW-721U[l]	11/16/2009	40,500	673[b]	<2.5[b][d]	2110[b][d]	0.0669[b][e]	614[b][d]	4.99	2.33[b][d][e]	12,600[b][d]
OW-735U[l]	11/12/2009	54,500	1070[b][d]	0.656[b][d][e]	3740[b][d]	0.0491[b][e]	1010[b][d]	7.36	3.44[b][e]	14,700[b][d]
OW-802U[l]	11/13/2009	44,200	988[b][d]	1.030[b][d][e]	3310[b][d]	0.0805[b][e]	889[b][d]	7.58	3.54[b][e]	14,100[b][d]
OW-805U[l]	11/16/2009	32,300	645[b]	0.908[b][d][e]	2140[b][d]	0.0311[b][e]	602[b][d]	4.62	2.16[b][d][e]	11,800[b][d]

Table 2.3-22 (Sheet 2 of 4)
Units 6 & 7 Hydrogeochemical Data

Constituent		TDS	Calcium	Iron	Magnesium	Manganese	Potassium	Silica	Silicon	Sodium
Location ID	Date Collected	milligrams/Liter								
OW-809U(l)	11/13/2009	54,200	1110(b)(d)	0.946(b)(d)(e)	3810(b)(d)	0.0554(b)(e)	1050(b)(d)	6.57	3.07(b)(e)	16,100(b)(d)
ENP Precipitation(f)(g)	mean		0.36		0.2		0.2			1.32
Surficial Aquifer SFWMD(g)	median	388	98	0.88	3.9		1.3			21.1
Floridan Aquifer SFWMD(g)	median	1,138	67.2	<0.05(c)	46.4		9.5			220.5
Cooling Canal	average	54,500	720		2,050		680	0.52		
L-31N	average	370	70		5.35		6.3			
Biscayne Bay	average	33,757	446		1,270		421	0.32		
Upper Floridan Production well	average	5,451	149	0.28	177	<0.07	77	12		

Table 2.3-22 (Sheet 3 of 4)
Units 6 & 7 Hydrogeochemical Data

Constituent		Bromide	Chloride	Fluoride	Sulfate	Nitrate	Nitrite	Bicarbonate	Carbonate	Total Alkalinity	Ammonia[h]
Location ID	**Date Collected**	**milligrams/Liter**									
OW-606L[a]	5/28/2008	62.5	29,600	<20.0[c]	3,860	<0.20[c]	<200[c]	165	<5.0[c]	165	1.58
OW-606U[a]	5/28/2008	56.6	27,900	<20.0[c]	3,470	<0.20[c]	<200[c]	155	<5.0[c]	155	0.844
OW-621L[a]	6/4/2008	65.9	31,300[d]	<20.0[c]	3,610	<0.20[c]	<200[c]	181	<5.0[c]	181	1.30
OW-621U[a]	5/29/2008	50.6	25,500	<1.0[c]	3,210	<4.0[c]	<200[c]	189	<5.0[c]	189	0.588
OW-706L[a]	5/29/2008	37.7[e]	19,100	<1.0[c]	2,280	<4.0[c]	<200[c]	191	<5.0[c]	191	0.61
OW-706U[a]	5/29/2008	70.5	33,300	<1.0[c]	3,850	<4.0[c]	<200[c]	204	<5.0[c]	204	2.09
OW-721L[a]	5/28/2008	64.9	31,100	<20.0[c]	3,990	<0.20[c]	<200[c]	180	<5.0[c]	180	1.82
OW-721U[a]	5/28/2008	60.1	29,900	<20.0[c]	3,860	<0.20[c]	<200[c]	164	<5.0[c]	164	1.68
OW-735U[a]	5/27/2008	262	37,500	<20.0[c]	4,090	<4.0[c]	<200[c]	179	<5.0[c]	179	2.15
OW-802U[a]	6/5/2008	65.1	31,600[d]	<20.0[c]	3,720	<0.20[c]	<200[c]	178	<5.0[c]	178	1.40
OW-805U[a]	6/5/2008	53.6	27,600[d]	<20.0[c]	3,070	<0.20[c]	<200[c]	177	<5.0[c]	177	0.548
OW-809U[a]	5/27/2008	241[e]	35,900	<1.0[c]	4,050	<4.0[c]	<200[c]	177	<5.0[c]	177	2.21
OW-606L[l]	11/12/2009	107	28,800	<2.0[c]	3,870	<0.40[c]	<4.0[c]	148[d]	<5.0[c]	148[d]	1.30
OW606U[l]	11/12/2009	85.7	22,600	<2.0[c]	3,560	<0.40[c]	<4.0[c]	163[d]	<5.0[c]	163[d]	0.486
OW-621L[l]	11/13/2009	101	29,000	<2.0[c]	3,880	<0.40[c]	<4.0[c]	168[d]	<5.0[c]	168[d]	1.26
OW-621U[l]	11/16/2009	83.3	24,800	<2.0[c]	3,280[d]	<0.40[c]	<4.0[c]	177[d]	<5.0[c]	177[d]	0.385
OW-706L[l]	11/12/2009	62.9	16,300	<2.0[c]	2,450	<0.40[c]	<4.0[c]	168[d]	<5.0[c]	168[d]	0.485
OW-706U[l]	11/12/2009	112	30,700	<2.0[c]	4,110	<0.40[c]	<20[c]	162[d]	<5.0[c]	162[d]	1.43
OW-721L[l]	11/16/2009	104	31,000	<2.0[c]	4,400[d]	0.14[e]	<4.0[c]	166[d]	<5.0[c]	166[d]	1.31
OW-721U[l]	11/16/2009	88.8	27,100	<2.0[c]	3,720[d]	<0.40[c]	<4.0[c]	164[d]	<5.0[c]	164[d]	0.796
OW-735U[l]	11/12/2009	119	32,300	<2.0[c]	4,330	<0.40[c]	<20[c]	161[d]	<5.0[c]	161[d]	1.63
OW-802U[l]	11/13/2009	97.5	27,700	<2.0[c]	3,710	<0.40[c]	<4.0[c]	163[d]	<5.0[c]	163[d]	1.05
OW-805U[l]	11/16/2009	86	24,000	<2.0[c]	3,510[d]	<0.40[c]	<4.0[c]	173[d]	<5.0[c]	173[d]	0.424
OW-809U[l]	11/13/2009	115	33,700	<2.0[c]	4,400	<0.40[c]	<4.0[c]	170[d]	<5.0[c]	170[d]	1.64
ENP Precipitation[f][g]	mean		2		1.14	0.73					0.22
Surficial Aquifer SFWMD[g]	median		48	0.2	12	<0.01[c]		263		251	
Floridan Aquifer SFWMD[g]	median		420	0.81	176	<0.01[c]				130	
Cooling Canal	average		30,000		3,950			165		165	0.16
L-31N	average		59		26	1.05		200		200	
Biscayne Bay	average		18,582		2,447			102		102	0.1

Table 2.3-22 (Sheet 4 of 4)
Units 6 & 7 Hydrogeochemical Data

Constituent		Bromide	Chloride	Fluoride	Sulfate	Nitrate	Nitrite	Bicarbonate	Carbonate	Total Alkalinity	Ammonia[h]
Location ID	Date Collected	milligrams/Liter									
Upper Floridan Production well	average		2,909	1.6	661	<0.01[c]		196			

Not analyzed (shaded cells)

SFWMD = South Florida Water Management District
(a) MACTEC 2008.
(b) Spiked analyte recovery is outside stated control limits. Method performance confirmed using Laboratory Control Spike sample results.
(c) Analyte not detected at or above the method detection limit.
(d) Method blank contamination. The associated method blank contains the target analyte at a reportable level. These data should be used with caution.
(e) Estimated result. Result is less than the reporting limit.
(f) Everglades National Park.
(g) FGS 1992.
(h) Test conducted on Nitrogen, as Ammonia.
(i) TDS is estimated as specific conductance in milliSiemens per centimeter x 1000 x 0.65, specific conductance values are listed in Table 2.3-21.
(j) Based on specific conductance measurements collected February 3-5, 2009.
(k) Assumes specific conductance equals 99 milliSiemens per centimeter.
(l) Samples collected and analyzed during routine groundwater level monitoring.

Table 2.3-23 (Sheet 1 of 5)
Staff Gage Readings at L-31E, Interceptor Ditch, and Industrial Wastewater Facility Canal 32

Date	Line A			Line B			Line C			Line D			Line E		
	L-31E Elevation (feet NGVD 29)	Interceptor Ditch Elevation (feet NGVD 29)	C-32 Elevation (feet NGVD 29)	L-31E Elevation (feet NGVD 29)	Interceptor Ditch Elevation (feet NGVD 29)	C-32 Elevation (feet NGVD 29)	L-31E Elevation (feet NGVD 29)	Interceptor Ditch Elevation (feet NGVD 29)	C-32 Elevation (feet NGVD 29)	L-31E Elevation (feet NGVD 29)	Interceptor Ditch Elevation (feet NGVD 29)	C-32 Elevation (feet NGVD 29)	L-31E Elevation (feet NGVD 29)	Interceptor Ditch Elevation (feet NGVD 29)	C-32 Elevation (feet NGVD 29)
1/8/2008	1.50	1.36	1.56	1.54	1.24	1.72	1.47	1.28	1.60	1.48	1.28	1.22	1.45	1.28	0.98
1/14/2008	1.39	0.90	1.62	1.38	0.88	1.60	1.36	0.90	1.50	1.38	0.90	1.10	1.36	1.02	0.80
1/23/2008	1.46	1.27	1.61	1.50	1.26	1.58	1.48	1.28	1.46	1.48	1.26	1.08	1.44	1.28	0.92
1/28/2008	1.68	1.24	1.58	1.70	1.10	1.56	1.68	1.16	1.46	1.68	1.14	1.10	1.64	1.26	0.92
2/4/2008	1.55	1.26	1.38	1.58	1.20	1.80	1.54	1.20	1.62	1.52	1.22	1.20	1.48	1.18	0.90
2/14/2008	1.54	1.22	1.58	1.58	1.22	1.50	1.56	1.22	1.43	1.56	1.24	0.90	1.52	1.20	0.82
2/21/2008	1.51	1.20	1.72	1.56	1.19	1.62	1.54	1.20	1.50	1.50	1.20	0.60	1.46	0.74	1.20
2/29/2008	ND	1.19	1.48	1.56	1.15	1.50	1.54	1.16	1.40	1.54	1.20	1.00	1.50	1.18	0.79
3/4/2008	ND	1.00	1.78	1.40	0.98	1.40	1.32	1.00	1.34	1.32	1.00	1.10	1.22	0.94	0.80
3/13/2008	ND	0.90	1.80	NR	0.90	1.65	0.94	1.10	1.60	0.90	1.00	1.10	1.20	ND	ND
3/17/2008	ND	0.68	1.70	1.10	0.66	1.60	1.10	0.70	1.60	1.08	0.70	1.12	1.06	0.76	0.88
3/27/2008	1.64	1.28	1.68	1.64	1.28	1.58	1.64	1.28	1.48	1.64	1.32	1.08	1.64	1.30	0.84
4/2/2008	1.40	1.10	1.58	1.40	1.10	1.48	1.40	1.10	1.38	1.40	1.12	1.00	1.40	1.14	0.70
4/7/2008	1.66	1.40	1.54	NR	1.40	1.44	NR	1.36	1.34	1.66	1.40	0.96	1.66	1.40	0.74
4/9/2008	1.66	0.94	1.38	1.66	0.94	1.36	1.68	0.98	1.30	1.68	1.04	1.02	1.68	1.28	0.90
4/17/2008	1.58	1.20	1.30	1.58	1.20	1.26	1.58	1.20	1.20	1.60	1.24	0.92	1.58	1.24	0.78
4/24/2008	1.46	1.20	1.58	1.46	1.20	1.50	1.46	1.20	1.46	1.46	1.24	1.08	1.46	1.30	0.82
4/28/2008	1.29	0.70	1.74	1.29	0.64	1.64	1.28	0.60	1.54	1.28	0.60	1.12	1.28	0.60	0.96
5/7/2008	1.38	1.12	1.82	1.38	1.10	1.70	1.38	1.10	1.58	1.38	1.14	1.10	1.38	1.18	0.80
5/8/2008	1.28	0.70	2.00	1.28	0.70	1.86	1.28	0.68	1.70	1.28	0.70	1.22	1.26	0.70	0.92
5/14/2008	1.14	0.94	1.90	1.14	0.94	1.78	1.14	0.94	1.68	1.14	1.00	1.18	1.15	1.00	0.80
5/15/2008	1.06	0.50	1.96	1.06	0.54	1.84	1.06	0.53	1.72	1.06	0.52	1.24	1.06	0.52	1.13
5/20/2008	1.20	1.00	1.94	1.20	1.00	1.80	ND	1.00	1.64	1.20	1.00	1.18	1.20	1.00	0.80
5/21/2008	1.12	0.56	2.00	1.12	0.56	1.84	1.12	0.52	1.70	1.10	0.54	1.20	1.10	0.52	0.90
5/30/2008	1.66	1.29	1.77	1.66	1.29	1.67	1.66	1.30	1.62	1.66	1.35	1.14	1.65	1.29	0.83
6/3/2008	1.62	1.23	1.91	1.61	1.29	1.86	1.62	1.28	1.68	1.63	1.30	1.24	1.64	1.28	0.95
6/16/2008	1.44	1.16	1.85	1.44	1.15	1.45	1.44	1.13	1.61	1.43	1.17	1.14	1.42	1.20	0.82
6/18/2008	2.00	1.46	1.91	2.02	1.46	1.80	2.02	1.46	1.64	2.00	1.48	1.35	2.10	1.46	0.99
6/25/2008	1.99	1.57	1.80	1.99	1.58	1.70	1.99	1.59	1.30	2.10	1.57	1.10	2.10	1.60	0.99
7/3/2008	1.90	1.50	1.99	1.93	1.49	1.63	1.90	1.50	1.51	1.90	1.45	1.16	1.90	1.54	0.99
7/18/2008	2.10	1.63	1.80	2.09	1.64	1.75	2.09	1.64	1.60	2.15	1.66	1.66	2.14	1.66	1.10
7/29/2008	1.90	1.68	1.80	1.95	1.64	1.70	1.95	1.62	1.60	1.99	1.66	1.22	1.88	1.68	1.08
8/20/2008	2.44	2.00	2.15	2.44	2.18	2.00	2.40	2.18	1.84	2.36	2.18	1.58	2.28	2.20	1.46

Table 2.3-23 (Sheet 2 of 5)
Staff Gage Readings at L-31E, Interceptor Ditch, and Industrial Wastewater Facility Canal 32

Date	Line A			Line B			Line C			Line D			Line E		
	L-31E Elevation (feet NGVD 29)	Interceptor Ditch Elevation (feet NGVD 29)	C-32 Elevation (feet NGVD 29)	L-31E Elevation (feet NGVD 29)	Interceptor Ditch Elevation (feet NGVD 29)	C-32 Elevation (feet NGVD 29)	L-31E Elevation (feet NGVD 29)	Interceptor Ditch Elevation (feet NGVD 29)	C-32 Elevation (feet NGVD 29)	L-31E Elevation (feet NGVD 29)	Interceptor Ditch Elevation (feet NGVD 29)	C-32 Elevation (feet NGVD 29)	L-31E Elevation (feet NGVD 29)	Interceptor Ditch Elevation (feet NGVD 29)	C-32 Elevation (feet NGVD 29)
8/27/2008	1.88	1.85	1.84	1.88	1.85	1.70	1.87	1.85	1.65	1.85	1.87	1.39	1.75	1.90	1.30
9/3/2008	2.25	1.84	1.86	2.25	1.55	1.50	2.25	1.85	1.75	2.26	1.90	1.59	2.25	1.99	1.58
9/10/2008	2.20	2.04	1.98	2.21	2.04	1.90	2.20	2.02	1.75	2.20	2.06	1.60	2.20	2.08	1.52
9/15/2008	2.16	1.94	1.88	2.16	1.94	1.80	2.16	1.94	1.70	2.16	1.96	1.52	2.16	2.00	1.48
9/17/2008	2.14	1.92	1.82	2.14	1.92	1.75	2.14	1.92	1.70	2.14	1.96	1.51	2.14	1.98	1.50
10/6/2008	2.50	2.38	2.14	2.50	2.39	2.10	2.50	2.38	2.06	2.48	2.40	1.94	2.42	2.40	1.92
10/28/2008	1.98	1.96	1.72	1.98	1.98	1.71	1.98	1.96	1.68	1.96	2.00	1.58	1.94	2.06	1.66
11/3/2008	1.74	1.82	1.70	1.74	1.80	1.68	1.80	1.78	1.48	1.86	1.84	1.48	1.84	1.92	1.48
11/18/2008	1.82	1.62	1.58	1.82	1.60	1.52	1.84	1.60	1.58	1.84	1.64	1.16	1.84	1.68	1.12
12/3/2008	1.68	1.40	1.42	1.70	1.40	1.36	1.70	1.46	1.30	1.70	1.44	1.02	1.72	1.44	0.94
12/9/2008	1.62	1.32	1.42	1.62	1.32	1.34	1.60	1.34	1.24	1.61	1.34	0.96	1.61	1.34	0.80
12/16/2008	1.52	1.20	1.50	1.54	1.20	1.40	1.54	1.20	1.28	1.54	1.22	0.90	1.56	1.24	0.74
12/22/2008	1.44	1.14	1.32	1.46	1.14	1.20	1.46	1.14	1.12	1.46	1.16	0.80	1.48	1.18	0.68
12/29/2008	1.38	1.04	1.28	1.40	1.04	1.16	1.38	1.04	1.06	1.38	1.04	0.70	1.40	1.00	0.56
1/5/2009	1.36	1.02	1.26	1.38	1.02	1.16	1.36	1.02	1.06	1.36	1.04	0.70	1.38	1.04	0.50
1/12/2009	1.24	0.90	1.40	1.20	0.90	1.28	1.24	0.90	1.14	1.24	0.90	0.70	1.26	0.88	0.50
1/20/2009	1.18	0.88	1.42	1.18	0.88	1.32	1.16	0.86	1.16	1.18	0.90	0.70	1.18	0.88	0.48
1/26/2009	1.12	0.84	1.38	1.12	0.84	1.28	1.12	0.84	1.12	1.12	0.86	0.70	1.14	0.84	0.50
2/2/2009	1.10	0.86	1.46	1.10	0.86	1.34	1.10	0.86	1.18	1.10	0.86	0.74	1.10	0.86	0.48
2/10/2009	1.12	0.88	1.50	1.14	0.88	1.44	1.14	0.84	1.24	0.94	0.90	0.80	1.14	0.90	0.56
2/13/2009	0.94	0.10	1.42	0.94	0.10	1.30	0.94	0.10	1.18	0.94	0.26	0.66	0.94	0.66	0.56
2/17/2009	1.09	0.74	1.34	1.10	0.76	1.24	1.09	0.82	1.12	1.10	0.82	0.68	1.10	0.84	0.50
2/25/2009	1.08	0.50	1.32	0.98	0.52	1.22	0.98	0.52	1.10	0.98	0.58	0.74	1.00	0.54	0.78
3/3/2009	0.92	0.20	1.40	0.92	0.20	1.29	0.92	0.46	1.16	0.92	0.52	0.70	0.92	0.68	0.48
3/11/2009	0.88	0.14	1.46	0.88	0.14	1.30	0.88	0.40	1.20	0.88	0.46	0.70	0.88	0.60	0.50
3/16/2009	0.94	0.20	1.42	0.94	0.20	1.22	0.94	0.46	1.18	0.94	0.64	0.74	0.94	0.66	0.54
3/23/2009	1.70	0.82	1.20	1.70	0.84	1.18	1.70	1.08	1.14	1.70	1.06	0.92	1.70	1.24	0.88
3/31/2009	1.54	1.04	1.27	1.54	1.03	1.14	1.54	1.03	1.08	1.53	1.03	0.79	1.53	1.11	0.64
4/7/2009	1.12	0.78	1.02	1.14	0.78	0.92	1.14	0.80	0.84	1.14	0.84	0.58	1.16	0.90	0.52
4/13/2009	0.96	0.66	1.26	0.96	0.66	1.18	0.96	0.66	1.00	0.96	0.70	0.62	0.96	0.68	0.40
4/20/2009	0.80	0.58	1.46	0.80	0.58	1.32	0.80	0.60	1.18	0.80	0.62	0.68	0.80	0.66	0.42
4/27/2009	0.54	<0.10	1.50	0.54	<0.10	1.40	0.54	<0.10	1.28	0.54	<0.10	0.84	0.54	0.48	0.60
5/4/2009	0.56	0.10	1.50	0.56	0.10	1.40	0.56	0.02	1.22	0.56	0.02	0.80	0.56	0.50	0.58
5/11/2009	0.54	0.08	1.62	0.54	0.06	1.50	0.54	0.06	1.30	0.54	0.08	0.84	0.54	0.42	0.58
5/18/2009	0.72	0.24	1.60	0.72	0.24	1.48	0.72	0.24	1.30	0.72	0.24	0.86	0.72	0.54	0.60

Table 2.3-23 (Sheet 3 of 5)
Staff Gage Readings at L-31E, Interceptor Ditch, and Industrial Wastewater Facility Canal 32

	Line A			Line B			Line C			Line D			Line E		
Date	L-31E Elevation (feet NGVD 29)	Interceptor Ditch Elevation (feet NGVD 29)	C-32 Elevation (feet NGVD 29)	L-31E Elevation (feet NGVD 29)	Interceptor Ditch Elevation (feet NGVD 29)	C-32 Elevation (feet NGVD 29)	L-31E Elevation (feet NGVD 29)	Interceptor Ditch Elevation (feet NGVD 29)	C-32 Elevation (feet NGVD 29)	L-31E Elevation (feet NGVD 29)	Interceptor Ditch Elevation (feet NGVD 29)	C-32 Elevation (feet NGVD 29)	L-31E Elevation (feet NGVD 29)	Interceptor Ditch Elevation (feet NGVD 29)	C-32 Elevation (feet NGVD 29)
5/26/2009	2.10	1.30	1.78	2.10	1.30	1.68	2.10	1.30	1.54	2.10	1.32	1.28	2.10	1.38	1.18
6/11/2009	2.30	2.02	1.98	2.20	2.03	1.93	2.24	2.04	1.82	2.26	2.04	1.57	2.26	2.08	1.52
6/23/2009	2.22	1.86	1.84	2.20	1.86	1.75	2.20	1.89	1.69	2.21	1.90	1.38	2.22	1.86	1.25
7/13/2009	2.11	1.69	1.70	2.10	1.69	1.59	2.09	1.70	1.46	2.10	1.72	1.16	2.11	1.70	1.10
7/27/2009	2.00	1.66	1.66	2.00	1.65	1.57	1.99	1.64	1.44	1.99	1.68	1.15	2.01	1.67	1.06
8/12/2009	1.79	1.45	1.49	1.79	1.46	1.38	1.77	1.48	1.22	1.77	1.46	0.94	1.78	1.48	0.83
8/27/2009	1.72	1.40	1.44	1.72	1.39	1.39	1.70	1.40	1.20	1.69	1.41	0.92	1.74	1.43	0.85
8/31/2009	2.20	1.87	1.55	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
9/10/2009	2.46	2.16	1.76	2.46	2.15	1.68	2.44	2.16	1.64	2.45	2.18	1.58	2.45	2.20	1.55
9/29/2009	2.36	2.16	1.76	2.36	2.16	1.69	2.34	2.15	1.65	2.34	2.15	1.58	2.36	2.17	1.60
10/14/2009	2.26	1.95	1.48	2.25	1.95	1.46	2.23	1.96	1.40	2.24	1.96	1.20	2.24	1.98	1.20
10/28/2009	2.08	1.88	1.58	2.07	1.88	1.38	2.07	1.87	1.36	2.06	1.87	1.26	2.06	1.86	1.20
11/12/2009	1.90	1.74	1.29	1.89	1.75	1.24	1.88	1.74	1.16	1.88	1.76	1.16	1.88	1.78	1.19
11/30/2009	2.48	2.16	1.68	2.48	2.20	1.67	2.47	2.16	1.60	2.46	1.99	1.50	2.46	1.99	1.52
12/10/2009	2.36	2.00	1.66	2.34	2.05	1.58	2.32	2.01	1.48	2.32	2.02	1.32	2.32	2.01	1.28
12/16/2009	2.30	1.96	1.66	2.29	2.00	1.58	2.28	1.98	1.44	2.28	2.00	1.28	2.28	1.98	1.30
12/24/2009	2.44	2.10	1.56	2.44	2.16	1.52	2.42	2.12	1.48	2.42	2.16	1.40	2.42	2.14	1.40
12/29/2009	2.36	2.00	1.44	2.35	2.06	1.38	2.34	2.02	1.36	2.34	2.08	1.28	2.36	2.04	1.30
1/8/2010	2.14	1.80	1.58	2.12	1.83	1.48	2.12	1.82	1.36	2.12	1.82	1.16	2.14	1.78	1.14
1/12/2010	2.06	1.72	1.46	2.06	1.76	1.38	2.04	1.72	1.28	2.04	1.76	1.08	2.07	1.74	1.08
1/22/2010	1.90	1.56	1.38	1.89	1.60	1.26	1.87	1.58	1.10	1.86	1.60	0.86	1.86	1.56	0.82
1/27/2010	1.84	1.54	1.18	1.84	1.58	1.10	1.82	1.58	1.02	1.84	1.58	0.88	1.84	1.57	0.86
2/2/2010	1.88	1.62	1.54	1.87	1.66	1.44	1.86	1.63	1.28	1.86	1.65	0.98	1.86	1.64	0.90
2/8/2010	1.88	1.56	1.26	1.87	1.60	1.18	1.86	1.56	1.08	1.86	1.60	0.90	1.86	1.59	0.90
2/15/2010	1.84	1.54	1.46	1.82	1.54	1.30	1.81	1.54	1.20	1.81	1.56	0.90	1.80	1.56	0.80
2/24/2010	1.80	1.50	1.40	1.78	1.54	1.43	1.76	1.50	1.14	1.79	1.56	0.90	1.76	1.54	0.86
3/1/2010	1.78	1.48	1.40	1.76	1.54	1.28	1.76	1.50	1.14	1.76	1.51	0.89	1.74	1.50	0.86
3/8/2010	1.64	1.36	1.30	1.64	1.42	1.20	1.64	1.40	1.06	1.64	1.40	0.80	1.64	1.38	0.76
3/15/2010	1.50	1.24	1.20	1.50	1.29	1.09	1.48	1.28	0.96	1.48	1.26	0.66	1.48	1.28	0.58
3/22/2010	1.46	1.22	1.44	1.45	1.26	1.30	1.44	1.22	1.11	1.44	1.23	0.76	1.44	1.24	0.60
3/25/2010	1.32	0.66	1.50	1.29	0.68	1.36	1.28	0.98	1.18	1.29	0.99	0.79	1.29	1.04	0.59
3/29/2010	1.48	0.72	1.78	1.44	0.70	1.54	1.40	1.10	1.28	1.36	1.10	0.86	1.34	1.18	0.56
4/1/2010	1.37	0.60	1.54	1.36	0.66	1.40	1.33	1.00	1.22	1.34	1.06	0.86	1.34	1.10	0.70
4/5/2010	1.26	0.50	1.46	1.22	0.56	1.34	1.22	0.90	1.14	1.22	0.96	0.86	1.22	1.00	0.70
4/9/2010	1.20	0.44	1.60	1.14	0.48	1.46	1.13	0.82	1.20	1.16	0.86	0.82	1.12	0.90	0.60

Table 2.3-23 (Sheet 4 of 5)
Staff Gage Readings at L-31E, Interceptor Ditch, and Industrial Wastewater Facility Canal 32

	Line A			Line B			Line C			Line D			Line E		
Date	L-31E Elevation (feet NGVD 29)	Interceptor Ditch Elevation (feet NGVD 29)	C-32 Elevation (feet NGVD 29)	L-31E Elevation (feet NGVD 29)	Interceptor Ditch Elevation (feet NGVD 29)	C-32 Elevation (feet NGVD 29)	L-31E Elevation (feet NGVD 29)	Interceptor Ditch Elevation (feet NGVD 29)	C-32 Elevation (feet NGVD 29)	L-31E Elevation (feet NGVD 29)	Interceptor Ditch Elevation (feet NGVD 29)	C-32 Elevation (feet NGVD 29)	L-31E Elevation (feet NGVD 29)	Interceptor Ditch Elevation (feet NGVD 29)	C-32 Elevation (feet NGVD 29)
4/12/2010	1.58	0.80	1.46	1.52	0.88	1.34	1.50	1.20	1.20	1.52	1.26	0.88	1.54	1.30	0.76
4/15/2010	1.60	0.78	1.38	1.56	0.84	1.28	1.56	1.20	1.16	1.56	1.26	0.96	1.58	1.30	0.88
4/19/2010	1.74	1.38	1.38	1.69	1.40	1.28	1.68	1.43	1.18	1.69	1.48	0.96	1.71	1.50	0.96
4/26/2010	1.60	1.30	1.72	1.54	1.34	1.54	1.52	1.30	1.32	1.51	1.32	0.94	1.50	1.32	0.70
4/29/2010	1.99	1.16	1.71	1.94	1.20	1.60	1.90	1.49	1.40	1.90	1.54	1.15	1.90	1.58	1.04
5/3/2010	1.98	1.55	1.74	1.92	1.58	1.58	1.88	1.56	1.36	1.88	1.58	1.08	1.88	1.55	0.94
5/12/2010	1.78	1.44	1.48	1.74	1.48	1.36	1.68	1.44	1.22	1.68	1.48	0.94	1.68	1.50	0.80
5/17/2010	1.64	1.34	1.70	1.58	1.38	1.54	1.54	1.34	1.34	1.54	1.36	1.00	1.53	1.37	0.79
5/20/2010	1.74	1.02	1.66	1.68	1.06	1.56	1.68	1.38	1.38	1.68	1.40	1.06	1.69	1.44	0.94
5/24/2010	1.66	0.88	1.62	1.60	0.94	1.54	1.58	1.28	1.38	1.58	1.30	0.96	1.58	1.39	0.92
5/28/2010	1.88	1.10	1.78	1.80	1.14	1.66	1.84	1.52	1.52	1.84	1.56	1.26	1.84	1.64	1.14
6/1/2010	1.91	1.02	1.68	1.86	1.10	1.60	1.80	1.42	1.44	1.80	1.46	1.20	1.80	1.50	1.10
6/7/2010	1.96	1.59	1.70	1.90	1.62	1.60	1.94	1.60	1.48	1.94	1.60	1.12	1.86	1.64	1.00
6/14/2010	2.21	1.84	1.78	2.10	1.88	1.68	2.10	1.84	1.52	2.11	1.88	1.29	2.12	1.88	1.22
6/21/2010	2.08	1.72	1.64	2.02	1.76	1.58	1.96	1.74	1.44	1.96	1.78	1.18	1.98	1.78	1.10
6/28/2010	1.93	1.58	1.68	1.86	1.61	1.58	1.81	1.59	1.38	1.80	1.60	1.10	1.80	1.60	0.96
7/6/2010	2.00	1.66	1.54	1.96	1.70	1.46	1.90	1.68	1.34	1.90	1.70	1.10	1.90	1.72	1.02
7/12/2010	2.15	1.84	1.62	2.10	1.86	1.54	2.14	1.82	1.42	2.14	1.86	1.16	2.14	1.86	1.12
7/19/2010	2.25	1.86	1.66	2.20	1.89	1.58	2.16	1.87	1.44	2.16	1.89	1.22	2.16	1.88	1.10
7/26/2010	2.33	1.94	1.68	2.27	1.97	1.60	2.22	1.94	1.46	2.22	1.97	1.27	2.22	1.96	1.22
8/11/2010	2.55	2.18	1.78	2.49	2.20	1.66	2.44	2.18	1.60	2.44	2.18	1.60	2.39	2.20	1.40
8/23/2010	2.20	1.92	1.68	2.12	1.94	1.58	2.02	1.90	1.44	2.02	1.92	1.12	2.00	1.92	1.08
9/14/2010	2.42	2.12	1.72	2.34	2.16	1.66	2.30	2.12	1.56	2.30	2.14	1.46	2.28	2.16	1.46
9/27/2010	2.48	2.18	1.74	2.40	2.18	1.68	2.38	2.16	1.58	2.36	2.18	1.46	2.36	2.19	1.40
10/4/2010	2.92	2.66	2.00	2.86	2.68	2.02	2.82	2.68	2.02	2.80	2.70	2.00	2.76	2.68	2.08
10/18/2010	2.52	2.32	1.72	2.44	2.34	1.70	2.39	2.30	1.68	2.38	2.34	1.68	2.34	2.36	1.68
11/2/2010	2.20	1.90	1.52	2.14	1.94	1.42	2.12	1.90	1.36	2.12	1.94	1.24	2.12	1.94	1.22
11/22/2010	2.02	1.82	1.60	1.94	1.86	1.54	1.92	1.84	1.44	1.92	1.86	1.38	1.94	1.80	1.36
12/6/2010	1.88	1.56	1.52	1.80	1.62	1.42	1.78	1.60	1.32	1.78	1.62	1.16	1.79	1.64	1.08
12/16/2010	1.80	1.49	1.46	1.72	1.54	1.36	1.70	1.52	1.27	1.70	1.54	1.08	1.71	1.50	1.00
12/20/2010	1.74	1.42	1.46	1.68	1.46	1.36	1.66	1.45	1.02	1.66	1.45	1.02	1.67	1.46	0.98
12/30/2010	1.62	1.27	1.42	1.52	1.30	1.32	1.48	1.28	1.22	1.48	1.31	0.95	1.45	1.30	0.85
1/3/2011	1.54	1.20	1.36	1.46	1.22	1.26	1.42	1.20	1.14	1.44	1.21	0.90	1.44	1.21	0.79
1/6/2011	1.44	0.72	1.30	1.35	0.78	1.20	1.33	0.98	1.06	1.32	1.00	0.80	1.32	1.04	0.70
1/10/2011	1.40	1.04	1.32	1.30	1.08	1.20	1.30	1.06	1.08	1.30	1.08	0.82	1.29	1.07	0.66

Table 2.3-23 (Sheet 5 of 5)
Staff Gage Readings at L-31E, Interceptor Ditch, and Industrial Wastewater Facility Canal 32

	Line A			Line B			Line C			Line D			Line E		
Date	L-31E Elevation (feet NGVD 29)	Interceptor Ditch Elevation (feet NGVD 29)	C-32 Elevation (feet NGVD 29)	L-31E Elevation (feet NGVD 29)	Interceptor Ditch Elevation (feet NGVD 29)	C-32 Elevation (feet NGVD 29)	L-31E Elevation (feet NGVD 29)	Interceptor Ditch Elevation (feet NGVD 29)	C-32 Elevation (feet NGVD 29)	L-31E Elevation (feet NGVD 29)	Interceptor Ditch Elevation (feet NGVD 29)	C-32 Elevation (feet NGVD 29)	L-31E Elevation (feet NGVD 29)	Interceptor Ditch Elevation (feet NGVD 29)	C-32 Elevation (feet NGVD 29)
1/13/2011	1.28	0.50	1.29	1.20	0.55	1.19	1.20	0.84	1.10	1.20	0.89	0.80	1.20	0.96	0.68
1/18/2011	2.00	1.13	1.46	1.90	1.14	1.34	1.88	1.44	1.22	1.87	1.46	1.00	1.86	1.50	0.90
1/28/2011	2.04	1.49	1.36	1.96	1.52	1.28	1.93	1.50	1.20	1.93	1.54	0.92	1.94	1.46	0.86
2/1/2011	1.94	1.42	1.40	1.84	1.46	1.28	1.82	1.42	1.18	1.82	1.46	0.90	1.82	1.42	0.72
2/8/2011	1.72	1.24	1.26	1.62	1.28	1.20	1.60	1.26	1.08	1.60	1.28	0.78	1.60	1.28	0.68
2/18/2011	1.39	1.08	1.30	1.29	1.12	1.22	1.28	1.09	1.20	1.28	1.13	0.82	1.29	1.19	0.66

[yellow] Pumping Required   ND = No data; NR = Data not readable

Table 2.3-24
Surface Water Uses in Miami-Dade County Permitted by SFWMD

Use Category	Number of Permits	Annual Allocation[(a)] (Million Gallon)
Public supply	1	0.04[(b)]
Industrial	6	9,411
Agricultural	3	57
Nursery	2	23
Aquaculture	1	27
Golf Course	7	1,360
Landscape	115	1,123
Dewatering	4	N.S.[(c)]

(a) For some permits that have no annual allocation data, the average daily allocations multiplied by 365 are assumed.
(b) This use is for a temporary construction trailer bathroom purposes.
(c) Not Specified.
Source: Estimates based on SFWMD 2008c

Table 2.3-25 (Sheet 1 of 3)
SFWMD Surface Water Use Permits within a 10-mile Radius of the Units 6 & 7 Plant Area

Permit No.	Expiration Date	Permit Type	Water Use	Acres	Water Source	Permitted Allocation (million gallons)			Location from the Site	
						Annual	Maximum Monthly	Maximum Daily	Direction	Approximate Distance (Mile)
13-00168-W	3/1/2013	General (>3, <=15 MGM[(a)])	Golf Course	100	Onsite Lake(s)	115.8	14.7		WNW	7
13-00221-W	9/26/2009	General	Landscape	4.02	SFWMD Canal (C-1)	—	—	18,300 gallons	NNW	9
13-02079-W	9/16/2023	General (<3 MGM)	Landscape	15.64	Onsite Lake(s)	17.383	2.1178		NW	7
13-02354-W	10/6/2024	General (minor)	Landscape	26.41	Onsite Lake(s)	20.73	2.8		WNW	7.5
13-02429-W	11/16/2024	General (<3 MGM)	Landscape	8.09	Onsite Lake(s)/Pond(s)	6.3503	0.868		NW	6.5
13-02461-W	12/15/2024	General (<3 MGM)	Landscape	15	Onsite Lake(s)	11.7744	1.6095		N	9
13-02518-W	3/8/2025	General (<3 MGM)	Landscape	6.64	Onsite Lake(s)/Pond(s)	5.2121	0.7125		NW	6.5
13-02571-W	7/17/2025	General (minor)	Landscape	10.75	Onsite Lake(s)/Pond(s)	8.4383	1.1534		NW	7.2
13-02578-W	1/9/2026	General (<3 MGM)	Landscape	4.24	Onsite Lake(s)	3.3282	0.4549		N	9
13-02613-W	9/16/2025	General (<3 MGM)	Landscape	6.1	Biscayne Aquifer/ Onsite Canal(s)	7.0618	0.8956		NW	8
13-02624-W	1/30/2027	General (<3 MGM)	Landscape	21.3	Onsite Lake(s)/Pond(s)	21.2379	2.6613		N	9
13-02633-W	6/30/2026	General (<3 MGM)	Agricultural	27.5	Onsite Lake(s)	21.5864	2.9507		NNW	6.6
13-02643-W	10/17/2025	General (<3 MGM)	Landscape	3.82	Onsite Lake(s)/Pond(s)	2.9986	0.4099		NW	6.5
13-02723-W	5/1/2026	General (<3 MGM)	Landscape	10.37	Onsite Lake(s)/Pond(s)	8.14	1.1127		WNW	8
13-02754-W	4/9/2026	General (<3 MGM)	Landscape	7.93	Onsite Lake(s)/Pond(s)	6.2247	0.8509		WNW	6

Table 2.3-25 (Sheet 2 of 3)
SFWMD Surface Water Use Permits within a 10-mile Radius of the Units 6 & 7 Plant Area

Permit No.	Expiration Date	Permit Type	Water Use	Acres	Water Source	Permitted Allocation (million gallons)			Location from the Site	
						Annual	Maximum Monthly	Maximum Daily	Direction	Approximate Distance (Mile)
13-02778-W	5/27/2026	General (<3 MGM)	Landscape	6.32	Onsite Lake(s)	6.199	0.9793		N	9
13-02823-W	1/14/2027	General (<3 MGM)	Landscape	9.64	Onsite Lake(s)	—	—		N	9
13-02844-W	10/26/2026	General (<3 MGM)	Landscape	7.22	Onsite Lake(s)	5.6517	0.7725		N	9
13-02858-W	8/13/2026	General (<3 MGM)	Landscape	9.5	Onsite Lake(s)/Pond(s)	7.4571	1.0193		NW	7.2
13-02864-W	8/13/2026	General (<3 MGM)	Landscape	6.67	Onsite Lake(s)/Pond(s)	5.2357	0.7157		NW	7.2
13-02886-W	9/23/2026	General (<3 MGM)	Landscape	0.82	SFWMD Canal (C-103)	0.9493	0.1204		NW	8
13-02911-W	8/22/2026	General (<3 MGM)	Landscape	5.25	Onsite Canal(s)	6.0778	0.7708		NW	8
13-02915-W	1/12/2027	General (<3 MGM)	Landscape	1.5	SFWMD Canal (C-1)	1.1774	0.1609		NNW	9
13-03023-W	12/18/2026	General (<3 MGM)	Landscape	8	Onsite Lake(s)/Pond(s)	9.2614	1.1746		NW	7.5
13-03046-W	12/22/2026	General (<3 MGM)	Landscape	8.32	Onsite Lake(s)	8.2957	1.0395		N	9
13-03105-W	2/16/2027	General (<3 MGM)	Landscape	2.2	Onsite Lake(s)	2.5469	0.323		WNW	8
13-03201-W	4/3/2027	General (<3 MGM)	Landscape	1	SFWMD Canal (C-1)	—	—	5,000 gallons	NNW	10
13-03469-W	5/18/2027	General (<3 MGM)	Landscape	10.91	Onsite Lake(s)/Pond(s)	12.6302	1.6019		NW	8.2
13-03492-W	7/12/2012	General (minor)	Landscape	62.17	Onsite Lake(s)	71.9727	9.1282		NNW	8.5
13-03586-W	5/20/2027	General (<3 MGM)	Landscape	18	Onsite Lake(s)	14.1293	1.9313		WNW	6.3
13-03796-W	7/13/2009	Individual	Industrial	320	Onsite Borrow Pit(s)	504	42		WNW	7

Table 2.3-25 (Sheet 3 of 3)
SFWMD Surface Water Use Permits within a 10-mile Radius of the Units 6 & 7 Plant Area

Permit No.	Expiration Date	Permit Type	Water Use	Acres	Water Source	Permitted Allocation (million gallons)			Location from the Site	
						Annual	Maximum Monthly	Maximum Daily	Direction	Approximate Distance (Mile)
13-03960-W	11/4/2028	General (<3 MGM)	Landscape	6.6	Biscayne Aquifer/ Onsite Lake(s)	7.6407	0.9691		WNW	7.5
13-04010-W	1/8/2028	General (<3 MGM)	Landscape	5	Onsite Lake(s)	3.9248	0.5365		WNW	9
13-04043-W	3/14/2028	General (<3 MGM)	Landscape	15	Biscayne Aquifer/ Onsite Lake(s)	11.7744	1.6095		NNW	9

(a) MGM: Million Gallons per Month.

Source: SFWMD 2008c

Table 2.3-26
Wastewater Discharges into Surface Water of the Miami-Dade County

Wastewater	Facility ID	Facility Name	FDEP Rated Capacity (mgd)	Surface Discharge (mgd)[(a)]	Water Body		Location from the Site	
					Source	Discharge	Direction	Approximate Distance (mile)
Domestic	FL0032182	MDWASD North District WWTP	112.5	72.76	Groundwater (Wastewater)	Ocean Outfall	NNE	36.5
	FLA024805	MDWASD Central District WWTP	143	112.86	Groundwater (Wastewater)	Ocean Outfall	NE	25
	FLA013623	Casa Granada Condominium	0.02	—	Groundwater	C-100 Canal	N	15
Industrial	FL0001481	FPL Cutler Power Plant	313	177.4	Seawater (Biscayne Bay)	Biscayne Bay	NNE	14.7
	FL0036978	Elizabeth Arden	0.14	0.04	Groundwater + Stormwater	Graham Dairy Canal (via Storm sewer system)	N	33
	FL0002721	Homestead Municipal Power Plant	7.248	1.35	Groundwater (Onsite well)	C-103 Canal (via Unnamed drainage ditch)	WNW	9.2

(a) Estimated average flow.

MGD = million gallons per day
Source: FDEP 2004a, FDEP 2004b, FDEP 2005, FDEP 2006a, FDEP 2008c, and SFWMD 2006c

Table 2.3-27
Present and Future Consumptive Water Use for Lower East Coast Region[a] of SFWMD

	Use Categories						
	Public Water Supply	Domestic Self-Supply	Agriculture	Power Generation	Recreation	Commercial & Industrial	Total
Estimated, 2005 (MGD)	869.0	36.6	429.7	4.5	48.6	61.3	1,449.7
Projected, 2025 (MGD)	1,173.6	48.9	393.0	102.6	63.6	61.3	1,843.0
% Change	35%	34%	–9%	2,180%	31%	0%	27%

(a) The Lower East Coast region includes all of Miami-Dade, Broward and Palm Beach counties, most of Monroe County, and the eastern portions of Hendry and Collier counties.
Source: SFWMD 2006b.

Table 2.3-28
Visitation of Biscayne National Park in 2005–2007

Month	Visitors (persons)				Visitor-Days (person-days)[a]			
	2005	2006	2007	Average	2005	2006	2007	Average
January	36,890	41,208	44,672	40,923	9,222	14,850	15,248	13,107
February	29,993	34,520	34,284	32,932	7,498	10,828	11,369	9,898
March	35,935	39,131	45,363	40,143	8,983	12,886	12,496	11,455
April	49,550	50,254	45,652	48,485	12,387	14,095	14,677	13,720
May	50,283	50,464	40,736	47,161	12,570	14,758	11,263	12,864
June	61,005	65,065	52,932	59,667	15,251	16,266	13,233	14,917
July	87,592	83,212	62,126	77,643	21,898	20,803	15,531	19,411
August	45,859	47,226	52,222	48,436	11,464	11,806	13,055	12,108
September	26,186	34,903	41,955	34,348	6,546	8,725	10,888	8,720
October	75,962	97,418	31,017	68,132	18,990	25,258	8,754	17,667
November	26,160	31,227	32,998	30,128	6,540	8,818	9,706	8,355
December	38,313	34,208	33,485	35,335	9,578	9,112	10,307	9,666
Annual	563,728	608,836	517,442	563,335	140,927	168,205	146,527	151,886

(a) A visitor-day is defined as number of visitor hours divided by 12.
Source: NPS 2009.

Table 2.3-29
Historical and Projected Groundwater Use in Miami-Dade County

Year	Groundwater Use/Projected Use in million gallons per day					
	Public Supply	Domestic	Commercial	Agricultural	Recreational	Power Generation
1965	202.3	9.6	5	67.9		0.3
1970	212.1	9.13	7.7	44.8		0.04
1975	270.5	9.5	3.38	87.66		0.04
1977	280.15	3.98	6.73	101.06		0
1980	314.29	18.38	19.73	86.98		0
1985	339.77	13.32	15.78	103.68	13.5	0
1990	337.69	10.75	40.34	115.01	20.55	2.26
1995	386.6	12.71	38.82	95.95	14.24	2.1
2000	394.29	4.85	41.65	86.55	8.51	2.08
2005	400.01	2.78	40.08	58.06	13.40	0.42
2010	407.8		41.7	92.1	10.4	14.2
2015	435.2		41.7	91.5	12	14.2
2020	459.6		41.7	90.8	13.6	14.2
2025	483.1		41.7	90.2	15.1	69.8

(shaded) Projected (Projected use includes public supply and domestic as a single value)

Sources:
1965-2000 Appendix 1 of Marella 2005
2005 Marella 2008
2010-2025 SFWMD 2006b

**Table 2.3-30 (Sheet 1 of 6)
Public Water Supply Systems in Miami-Dade County**

Public Water System ID	Type	Mailing Name	City	Owner Type	Population Served	Design Capacity (gpd)
4130077	Community	Bal Harbour Village	Bal Harbour	Municipality	3,299	0
4130089	Community	Bay Harbor Islands Town of	Bay Harbor Islands	Municipality	5,146	0
4130255	Community	Florida City	Florida City	Municipality	9,445	4,000,000
4130588	Community	Redlands Mobile Home Park	Miami	Investor	160	100,000
4130604	Community	Hialeah City of	Hialeah	Municipality	210,000	40,000,000
4130645	Community	Homestead City of	Homestead	Municipality	39,000	19,200,000
4130662	Community	Indian Creek Village	Miami Beach	Authority/Commission/ District	103	0
4130833	Community	Jones' Trailer Park	Miami	Investor	120	100,000
4130871	Community	Mdwasa — Main System	Miami	Municipality	2,100,000	442,740,000
4130901	Community	Miami Beach City of	Miami Beach	Municipality	87,933	0
4130970	Community	North Bay Village City of	North Bay Village	Municipality	6,733	6,480,000
4130977	Community	North Miami City of	North Miami	Municipality	80,000	9,300,000
4131001	Community	Opa Locka City of	Opa Locka	Municipality	15,250	6,900,000
4131202	Community	Mdwasa/Rex Utilities	Miami	Investor	41,500	12,030,000
4131206	Community	Rex Utilities Inc/Redavo	Homestead	Municipality	385	0
4131312	Community	Silver Palm Mobile Homes	Miami	Investor	250	122,000
4131403	Community	Americana Village	Miami	Investor	2,100	500,000
4131424	Community	Surfside Town of	Surfside	Municipality	5,600	1,512,000
4131474	Community	Medley Water Department	Miami	Municipality	1,098	1,800,000
4131531	Community	Virginia Gardens Village of	Virginia Gardens	Municipality	2,212	0
4131558	Community	West Miami City of	West Miami	Municipality	5,863	0
4131618	Community	North Miami Beach	North Miami Beach	Municipality	170,000	32,000,000
4134357	Community	FKAA J. Robert Dean W.T.P.	Florida City	State	86,000	29,800,000
4134358	Community	Dade Juvenile Residential Facility	Florida City	Investor	50	35,000

Table 2.3-30 (Sheet 2 of 6)
Public Water Supply Systems in Miami-Dade County

Public Water System ID	Type	Mailing Name	City	Owner Type	Population Served	Design Capacity (gpd)
4134365	Community	Hialeah Gardens	Hialeah Gardens	Municipality	19,297	0
4130048	Noncommunity	Anderson's Corner Grocery	Miami	Investor	35	8,000
4130053	Noncommunity	Hightailin' It	Miami	Investor	205	28,000
4130112	Noncommunity	Benson Lighting	Miami	Investor	25	36,000
4130159	Noncommunity	Brooks (J R) & Son	Homestead	Investor	100	80,000
4130320	Noncommunity	Camp Owaissa Bauer	Miami	Municipality	146	183,000
4130496	Noncommunity	Franksher Building	Miami	Investor	25	64,000
4130721	Noncommunity	Miami Everglades Campground	Miami	Unknown	562	122,000
4130793	Noncommunity	Deluxe Motel	Leisure City	Investor	50	46,000
4130811	Noncommunity	De Leon Harvesting	Homestead	Investor	30	36,000
4130823	Noncommunity	Dan Lewis Properties	Miami	Investor	25	15,000
4130891	Noncommunity	Roberts Air	Homestead	Municipality	25	28,000
4130893	Noncommunity	Dade Homestead GAA - Admin.	Homestead	Municipality	25	3,200
4130894	Noncommunity	Dade Homestead GAA Skydive	Homestead	Municipality	25	6,400
4130897	Noncommunity	Dade Landscape Nursery	Miami	Municipality	40	86,000
4130933	Noncommunity	Monkey Jungle	Miami	Investor	300	122,000
4130951	Noncommunity	Last Chance Lounge	Florida City	Investor	100	5,000
4131080	Noncommunity	Kimre Inc.	Miami	Investor	25	17,000
4131185	Noncommunity	Grove Inn	Miami	Investor	25	36,000
4131192	Noncommunity	Redland Golf & Country Club	Homestead	Investor	25	19,200
4131217	Noncommunity	Cemex Cement Mill	Miami	Investor	130	720,000
4131250	Noncommunity	America's Best Inn	Homestead	Investor	50	61,000
4131313	Noncommunity	Silver Palms Methodist Church	Homestead	Other	200	36,000

**Table 2.3-30 (Sheet 3 of 6)
Public Water Supply Systems in Miami-Dade County**

Public Water System ID	Type	Mailing Name	City	Owner Type	Population Served	Design Capacity (gpd)
4131961	Noncommunity	Redland Fruit And Spice Park	Miami	County	55	46,000
4131962	Noncommunity	Castellow Hammock Park	Miami	County	68	1,700
4134228	Noncommunity	Chevron Krome	Homestead	Investor	25	5,000
4134234	Noncommunity	Cemex Materials — Sweetwater	Miami	Investor	50	5,000
4134237	Noncommunity	Jack's Bait & Tackle	Florida City	Investor	200	3,200
4134301	Noncommunity	Iglesia Buen Samaritano	Miami	Investor	100	12,000
4134328	Noncommunity	Diamond R. Fertilizer	Homestead	Investor	40	1,000
4134334	Noncommunity	Costa Nursery Ii	Miami	Investor	25	1,000
4134338	Noncommunity	Benito Juarez Park	Homestead	County	100	1,700
4134363	Noncommunity	Homestead Jehovah's Witness	Homestead	Other	100	8,000
4134379	Noncommunity	Bernecker's Nursery	Miami	Investor	25	5,000
4134382	Noncommunity	Butler's Nursery	Miami	Investor	25	5,000
4134387	Noncommunity	Coconut Palm Trading Post	Homestead	Investor	300	50,000
4134388	Noncommunity	Coffey's Market	Miami	Investor	35	5,000
4134393	Noncommunity	Coopertown	Miami	Investor	100	5,000
4134394	Noncommunity	Costa Nursery	Miami	Investor	150	5,000
4134400	Noncommunity	El Nopal	Miami	Investor	25	5,000
4134402	Noncommunity	Greenleaf Nursery	Homestead	Investor	25	5,000
4134417	Noncommunity	Redland Tavern	Goulds	Investor	40	200
4134420	Noncommunity	Safari Restaurant	Miami	Investor	150	5,000
4134430	Noncommunity	Tom Thumb #122	Miami 33170	Investor	25	5,000
4134431	Noncommunity	Redland Exxon	Miami	Investor	25	5,000

Table 2.3-30 (Sheet 4 of 6)
Public Water Supply Systems in Miami-Dade County

Public Water System ID	Type	Mailing Name	City	Owner Type	Population Served	Design Capacity (gpd)
4134434	Noncommunity	Community Asphalt	Hialeah	Investor	25	5,000
4134439	Noncommunity	Cemex-F.E.C. office	Hialeah	Investor	160	3,000
4134442	Noncommunity	Redland Community Church	Miami	Investor	500	3,000
4134443	Noncommunity	Comcast Cable	Miami	Other	225	3,000
4134446	Noncommunity	Kent Motel	Goulds	Investor	50	3,000
4134448	Noncommunity	Palms Professional Center	Miami	Investor	25	3,000
4134451	Noncommunity	Farm Credit Service	Homestead Fl 33090	Investor	25	2,720
4134453	Noncommunity	Cemex-F.E.C. Shop	Hialeah	Investor	35	16,000
4134459	Noncommunity	Circle D Farms	Homestead	Investor	25	3,000
4134462	Noncommunity	Redlands Grocery	Homestead	Investor	200	3,000
4134464	Noncommunity	Sunrise Adult Group Home (15190)	Homestead	Investor	25	2,000
4134465	Noncommunity	Sunrise Adult Services (29800)	Homestead	Investor	80	2,000
4134468	Noncommunity	U-Haul Rental & Services	Miami	Investor	25	3,000
4134499	Noncommunity	Our Lady of Mercy Cemetery	Doral	Investor	50	2,000
4134506	Noncommunity	First Baptist Church Redland	Homestead	Other	120	2,000
4134508	Noncommunity	Aviary Bird Shop	Goulds	Investor	25	2,000
4134512	Noncommunity	De Leon Bromeliads	Miami	Investor	54	5,000
4134516	Noncommunity	Tom Thumb #127	Hialeah	Investor	25	24,000
4134519	Noncommunity	Okeechobee Barrier	Miami	State	39	9,600

Table 2.3-30 (Sheet 5 of 6)
Public Water Supply Systems in Miami-Dade County

Public Water System ID	Type	Mailing Name	City	Owner Type	Population Served	Design Capacity (gpd)
4134522	Noncommunity	1st Baptist Church of Homestead	Homestead	Other	300	5,000
4134523	Noncommunity	Women's Club of Homestead	Homestead	Other	25	3,300
4134524	Noncommunity	Krome Avenue Church	Miami	Other	150	7,200
4134525	Noncommunity	Cemex Hydro-Conduit	Miami	Investor	28	1,400
4134527	Noncommunity	Cemex Employees	Miami	Investor	150	3,750
4134528	Noncommunity	Fruticuba	Miami	Investor	50	3,200
4134531	Noncommunity	Tom Thumb 131	Homestead	Investor	25	1,000
4134532	Noncommunity	Sunoco Krome Ave	Miami	Investor	25	5,000
4134533	Noncommunity	Gator Park	Miami	Investor	25	3,000
4134535	Noncommunity	Vila & Sons	Medley	Investor	25	50
4134537	Noncommunity	Mannheime Foundation	Homestead	Investor	50	0
4134538	Noncommunity	BT South DBA Boody Trap	Homestead	Investor	30	120
4134540	Noncommunity	Chevron Gas Station	Miami	Investor	80	320
4134543	Noncommunity	Schnebly Winery	Homestead	Investor	25	4,800
4130322	Nontransient Noncommunity	Redland Jr. High School	Homestead	Municipality	1,496	144,000
4130445	Nontransient Noncommunity	Tropical Research & Education Center	Homestead	State	100	38,400
4130934	Nontransient Noncommunity	Montessori Country School	Homestead	Investor	120	38,000
4131958	Nontransient Noncommunity	Sunrise Community	Miami	Investor	120	150,000
4134300	Nontransient Noncommunity	Redland Christian Academy	Homestead	Other	300	10,000

Table 2.3-30 (Sheet 6 of 6)
Public Water Supply Systems in Miami-Dade County

Public Water System ID	Type	Mailing Name	City	Owner Type	Population Served	Design Capacity (gpd)
4134385	Nontransient Noncommunity	Unitarian Universal Congr'n of Miami	Miami	Investor	75	5,000
4134498	Nontransient Noncommunity	Creative Years	Miami	Investor	100	2,000
4134502	Nontransient Noncommunity	Christian Family Worship Center	Homestead	Investor	200	9,600
4134513	Nontransient Noncommunity	Miami Intl Airport	Miami	County	26,800	0
4130900	Noncommunity	Homestead Executive Jet Center	Homestead	Municipality	75	3,200
4134520	Noncommunity	Rancho Gaspar	Miami	Investor	90	9,600
4134539	Noncommunity	Grandma’s U-Pick	Miami	Investor	40	1,000
4134547	Noncommunity	Glaser Farms	Miami	Investor	35	43,000
4134548	Noncommunity	Sunshine Organic Farms	Miami	Investor	50	43,000
4134549	Noncommunity	Robert Is Here	Florida City	Investor	25	1,000
4134550	Noncommunity	Coral Reef Driver License Office	Miami	State	100	0
4134551	Noncommunity	Tropical Village Farm (Wintergreen Nur)	Miami	Investor	25	0
4134553	Noncommunity	United Miami Orchids	Homestead	Investor	40	0
4134546	Nontransient Noncommunity	My Little Angels Daycare	Homestead	Investor	100	30,000

Note: gpd = gallons per day

Source: FDEP 2010

Table 2.3-31 (Sheet 1 of 36)
Biscayne Bay Water Quality

Sample Location BB47 – Average, Maximum and Minimum Monthly Results for 1993-2010													
Depth < 1 m													
Parameters[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEMP. Deg. C	Avg	17.45	20.86	21.27	23.74	25.75	28.33	29.88	30.64	29.41	27.57	25.85	21.09
	Max	23.60	23.71	24.37	26.73	28.43	30.81	31.39	31.91	30.40	29.75	27.72	25.65
	Min	13.38	15.86	17.84	16.00	16.00	16.00	28.15	29.15	27.20	25.01	22.18	15.89
D.O. mg/L	Avg	7.76	6.24[1]	6.87	6.39	6.20	5.62	5.53	5.56	5.44	5.97	6.13	7.06
	Max	8.25	7.87	7.76	6.76	6.56	6.44	5.95	6.38	6.01	6.50	6.95	8.20
	Min	7.09	0.19	5.90	5.92	5.60	5.15	4.61	5.06	4.56	5.39	5.14	6.01
PH UNITS	Avg	8.05	8.10	8.10	8.09	8.17	7.98	8.06	7.94	7.94	7.92	8.02	8.05
	Max	8.17	8.30	8.34	8.26	8.44	8.20	8.17	8.16	8.12	7.97	8.13	8.22
	Min	7.91	7.87	7.74	7.78	7.83	7.62	7.97	7.04	7.80	7.78	7.87	7.79
TURB. NTU	Avg	0.93	0.30	0.45	0.45	0.43	0.50	ND	0.20	0.20	0.60	0.35	0.33
	Max	1.3	0.30	0.60	0.54	0.70	0.70	ND	0.20	0.20	0.90	0.40	0.40
	Min	0.20	0.30	0.30	0.40	0.30	0.40	ND	0.20	0.20	0.30	0.30	0.20
NOX mg/L	Avg	0.03	<0.01	<0.01	0.01	<0.01	0.02	ND	<0.01	<0.01	0.08	<0.01	<0.01
	Max	0.03	<0.01	<0.01	0.02	<0.01	0.05	ND	<0.01	<0.01	0.2	<0.01	<0.01
	Min	0.03	<0.01	<0.01	<0.01	<0.01	<0.01	ND	<0.01	<0.01	<0.01	<0.01	<0.01
NH4 mg/L	Avg	0.060	0.080	0.070	0.077	0.11	0.070	ND	0.11	0.090	0.085	0.080	0.073
	Max	0.070	0.080	0.090	0.080	0.11	0.090	ND	0.11	0.090	0.090	0.090	0.080
	Min	<0.040	0.080	0.050	0.070	0.11	0.030	ND	0.11	0.090	0.080	0.070	0.070
TKN mg/L	Avg	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	ND	<0.08	<0.08	0.2	0.3	0.2
	Max	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	ND	<0.08	<0.08	0.3	0.6	0.2
	Min	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	ND	<0.08	<0.08	<0.08	0.09	0.2
OPO4 mg/L	Avg	0.002	0.002	<0.002	<0.002	<0.002	<0.002	ND	<0.002	<0.002	<0.002	<0.002	<0.002
	Max	0.002	0.002	<0.002	<0.002	<0.002	<0.002	ND	<0.002	<0.002	<0.002	<0.002	<0.002
	Min	0.002	0.002	<0.002	<0.002	<0.002	<0.002	ND	<0.002	<0.002	<0.002	<0.002	<0.002
TPO4 mg/L	Avg	0.002	0.004	0.003	0.002	<0.002	0.003	ND	0.003	0.003	0.003	0.003	0.002
	Max	0.002	0.004	0.003	0.002	<0.002	0.003	ND	0.003	0.003	0.004	0.004	<0.002
	Min	0.002	0.004	<0.002	0.002	<0.002	0.003	ND	0.003	0.003	<0.002	<0.002	<0.002
CHLOR A mg/M3	Avg	0.29	0.48	0.28	0.30	0.47	0.68	0.38	0.41	0.42	0.72	0.48	0.36[1]
	Max	0.45	0.91	0.47	0.50	1.1	1.1	0.74	0.68	0.53	1.1	0.75	0.55
	Min	0.12	0.21	<0.16	0.20	0.17	0.27	<0.16	0.24	0.26	0.36	0.22	0.030
SAL. PSU.	Avg	30.3	31.6	32.5	33.8	35.0	34.4	33.7	34.4	32.6	29.0	29.6	30.0
	Max	32.8	33.9	34.6	35.6	38.3	37.8	37.5	37.3	36.3	32.1	33.6	33.9
	Min	28.6	22.3	28.3	32.6	31.2	29.8	26.3	23.0	25.9	25.6	23.8	24.2
TOC mg/L	Avg	3.70	7.27	4.40	4.09	4.67	6.44	ND	ND	7.54	7.16	4.70	7.49
	Max	3.70	7.27	6.30	4.73	5.40	6.44	ND	ND	7.54	8.07	4.70	7.49
	Min	3.70	7.27	2.50	2.80	3.20	6.44	ND	ND	7.54	6.25	4.70	7.49

Table 2.3-31 (Sheet 2 of 36)
Biscayne Bay Water Quality

Sample Location BB47 – Average, Maximum and Minimum Monthly Results for 1993-2010													
Depth ≥ 1 m													
Parameters[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEMP. Deg. C	Avg	18.31	20.67	21.63	24.73	26.38	29.06	30.03	30.47	29.25	27.77	24.85	22.39
	Max	24.05	23.72	27.14	26.87	28.45	30.90	31.79	31.90	30.42	30.59	28.31	26.23
	Min	13.42	15.81	17.85	22.76	22.96	27.72	28.14	29.16	27.20	25.01	22.20	16.05
D.O. mg/L	Avg	7.67	7.23[1]	6.88	6.42	6.24	5.67	5.53	5.35	5.29	5.83	6.51	6.62
	Max	8.46	8.00	7.83	7.08	7.27	6.94	6.04	5.89	6.14	6.74	7.25	8.16
	Min	6.49	1.25	5.23	5.94	5.49	4.97	4.61	3.37	4.58	5.32	4.34	4.88
PH UNITS	Avg	8.03	8.04	8.06	8.07	8.18	7.99	8.05	7.92	7.94	7.87	8.01	8.02
	Max	8.17	8.30	8.34	8.25	8.44	8.21	8.17	8.16	8.11	8.00	8.13	8.22
	Min	7.87	7.87	7.75	7.78	7.82	7.63	7.82	7.04	7.72	7.70	7.83	7.78
TURB. NTU	Avg	0.97	0.92	0.66	0.59	0.84	0.33[1]	0.43	0.53	0.56	0.61	0.46	0.35
	Max	1.7	2.2	1.5	1.5	2.3	7.6	1.0	1.3	2.4	1.6	1.10	0.50
	Min	0.13	<0.10	0.10	0.16	0.10	0.20	0.11	0.25	0.19	0.11	<0.10	0.10
NOX mg/L	Avg	0.02	0.02	0.02	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.05	0.04
	Max	0.04	0.06	0.05	0.02	0.02	0.02	0.04	0.03	0.03	0.07	0.1	0.1
	Min	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	0.01
NH4 mg/L	Avg	0.070	0.053	0.062	0.064	0.073	0.060	0.064	0.038	0.051	0.068	0.050	0.062
	Max	0.160	0.110	0.10	0.13	0.13	0.13	0.11	0.090	0.080	0.14	0.090	0.09
	Min	0.010	<0.010	<0.010	<0.010	<0.010	0.03	0.02	0.0092	<0.010	0.020	0.010	0.030
TKN mg/L	Avg	ND	ND	ND	ND	ND	ND	<0.08	ND	ND	ND	ND	ND
	Max	ND	ND	ND	ND	ND	ND	<0.08	ND	ND	ND	ND	ND
	Min	ND	ND	ND	ND	ND	ND	<0.08	ND	ND	ND	ND	ND
OPO4 mg/L	Avg	ND	ND	ND	ND	ND	ND	<0.002	ND	ND	ND	ND	ND
	Max	ND	ND	ND	ND	ND	ND	<0.002	ND	ND	ND	ND	ND
	Min	ND	ND	ND	ND	ND	ND	<0.002	ND	ND	ND	ND	ND
TPO4 mg/L	Avg	0.003	0.002	0.0018	0.003	0.002	0.003	0.002	0.003	0.003	0.002	0.002	0.002
	Max	0.004	0.004	0.0030	0.005	0.003	0.003	0.003	0.007	0.006	0.002	0.008	0.003
	Min	<0.001	<0.001	<0.0001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.0010	<0.001	<0.001
CHLOR A mg/M3	Avg	ND	ND	0.23	ND	0.64	ND	0.55	ND	ND	ND	ND	ND
	Max	ND	ND	0.23	ND	0.64	ND	0.55	ND	ND	ND	ND	ND
	Min	ND	ND	0.23	ND	0.64	ND	0.55	ND	ND	ND	ND	ND
SAL. PSU.	Avg	30.8	32.4	32.7	34.4	35.8	35.2	34.2	35.0	33.2	30.3	29.2	30.0
	Max	32.9	34.1	36.0	35.9	38.3	37.9	37.5	37.4	36.3	33.9	35.0	33.9
	Min	28.6	28.4	28.3	32.9	31.7	29.8	26.3	27.9	25.9	25.5	23.9	24.5
TOC mg/L	Avg	ND	ND	ND	ND	ND	ND	4.17	ND	ND	ND	ND	ND
	Max	ND	ND	ND	ND	ND	ND	4.17	ND	ND	ND	ND	ND
	Min	ND	ND	ND	ND	ND	ND	4.17	ND	ND	ND	ND	ND

Table 2.3-31 (Sheet 3 of 36)
Biscayne Bay Water Quality

Sample Location BB48 – Average, Maximum and Minimum Monthly Results for 1993-2010													
Depth < 1 m													
Parameters[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEMP. Deg. C	Avg	17.70	21.18	21.03	23.49	25.95	28.37	29.75	30.46	29.08	27.78	25.69	21.063
	Max	23.55	23.69	24.48	26.69	28.64	30.98	31.47	31.58	30.09	30.10	28.14	25.94
	Min	13.43	16.69	18.13	16.00	16.00	16.00	27.70	28.94	26.64	25.66	21.61	15.35
D.O. mg/L	Avg	7.72	7.32[1]	7.13	6.37	6.13	5.34	5.28	5.11	5.25	5.86	6.50	7.08
	Max	8.38	7.86	8.05	7.34	6.70	6.71	6.02	6.27	5.72	6.30	7.05	8.53
	Min	6.82	0.25	5.83	5.81	5.47	4.65	4.08	4.43	4.32	5.06	5.91	5.97
PH UNITS	Avg	8.08	8.11	8.13	8.09	8.19	8.00	8.10	7.94	7.91	7.92	8.03	8.06
	Max	8.25	8.22	8.40	8.28	8.49	8.28	8.22	8.21	8.14	8.00	8.11	8.26
	Min	7.85	7.87	7.76	7.81	7.80	7.61	7.95	7.18	7.80	7.71	7.92	7.77
TURB. NTU	Avg	0.83	0.30	0.53	0.43	0.47	0.60	ND	0.40	0.40	0.55	0.30	0.27
	Max	1.0	0.30	0.60	0.69	0.80	1.00	ND	0.40	0.40	0.80	0.30	0.30
	Min	0.50	0.30	0.50	0.30	0.30	0.40	ND	0.40	0.40	0.30	0.30	0.20
SAL. PSU.	Avg	28.3	29.8	30.1	32.1[1]	33.3	32.3	30.9	32.1	30.1	26.9	27.0	27.7
	Max	30.7	32.8	34.1	33.8	38.5	38.1	36.0	35.9	34.1	31.8	33.1	31.9
	Min	23.9	24.2	23.9	5.20	28.4	25.6	24.1	21.5	20.5	21.3	21.6	22.1
Sample Location BB48 – Average, Maximum and Minimum Monthly Results for 1993-2010													
Depth ≥ 1 m													
Parameters[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEMP. Deg. C	Avg	18.03	20.80	21.85	24.57	26.37	29.04	29.901	30.22	28.89	27.65	24.53	22.42
	Max	23.97	23.71	27.31	26.69	28.60	31.00	31.45	31.57	30.11	30.32	28.13	26.12
	Min	13.47	16.70	18.12	22.96	22.89	27.38	27.78	28.93	26.65	25.66	21.60	15.36
D.O. mg/L	Avg	7.60	6.95	6.94	6.30	6.04	5.59	5.29	5.37	5.14	5.83	6.75	6.82
	Max	8.20	8.06	7.92	6.94	6.82	6.73	5.93	6.66	6.03	6.96	7.41	8.56
	Min	6.74	1.67	5.60	5.71	5.02	4.84	4.08	4.65	4.33	5.20	6.44	5.95
PH UNITS	Avg	8.06	8.10	8.09	8.10	8.18	8.03	8.08	7.96	7.94	7.87	8.02	8.05
	Max	8.25	8.26	8.40	8.28	8.49	8.29	8.22	8.21	8.12	7.94	8.11	8.26
	Min	7.84	7.87	7.75	7.78	7.80	7.61	7.80	7.18	7.80	7.68	7.91	7.78
TURB. NTU	Avg	0.77	0.46[1]	0.87	1.6	0.90	0.68	0.57	0.80	0.52	0.56	0.98	0.35
	Max	1.8	21	1.5	7.7	2.2	1.4	1.7	2.2	1.0	1.0	3.2	0.60
	Min	0.15	<0.10	0.24	0.11	0.10	0.20	0.14	0.20	0.30	<0.10	<0.10	<0.10
SAL. PSU.	Avg	28.5	30.4	30.7	32.1	34.4	33.5	31.4	32.0	30.5	27.0	26.7	27.3
	Max	31.2	32.8	34.5	33.9	38.7	38.1	36.1	35.2	34.4	31.9	33.1	32.0
	Min	25.8	25.7	23.9	29.3	28.9	25.4	25.0	24.8	20.4	21.6	21.9	22.3

Table 2.3-31 (Sheet 4 of 36)
Biscayne Bay Water Quality

Sample Location BISC 101 – Average, Maximum and Minimum Monthly Results for 1993-2010 Depth < 1 m													
Parameters[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEMP. Deg. C	Avg	18.6	22.1	22.8	25.5	28.3	29.4	31.0	30.4	28.9	27.1	23.3	20.8
	Max	24.8	25.9	28.9	28.6	31.0	32.9	32.8	32.8	30.3	30.3	27.4	27.3
	Min	9.0	19.7	18.5	20.7	24.7	27.4	29.3	27.3	27.6	23.4	18.7	12.0
D.O. mg/L	Avg	8.12	6.87	6.65	7.06	6.60	6.21	6.14	5.33	5.96	6.52	7.70	7.98
	Max	9.80	9.30	8.70	8.02	8.60	10.8	8.60	7.00	7.60	8.34	9.33	9.59
	Min	4.30	3.73	3.96	4.90	4.40	4.40	2.97	3.10	4.40	4.40	6.10	6.70
PH UNITS	Avg	8.13	8.19	8.20	7.99	8.28	8.14	8.07	8.08	7.96	8.08	8.06	8.17
	Max	8.70	8.39	8.50	8.40	8.40	8.50	8.40	8.50	8.00	8.40	8.30	8.30
	Min	8.02	8.06	8.03	7.20	8.10	8.00	7.90	7.90	7.80	7.90	8.00	8.00
TURB. NTU	Avg	0.69	0.82	0.65	0.55	0.60	0.79	0.70	0.66	1.2	1.6	0.62	0.88
	Max	1.5	4.2	1.3	1.2	1.2	3.5	1.2	1.8	3.7	11.5	1.1	2.5
	Min	0.24	0.20	0.13	0.10	0.20	0.27	0.30	0.20	0.20	0.20	0.20	0.10
NOX mg/L	Avg	0.15	0.084	0.040	0.033	0.0093	0.27	0.064	0.20	0.18	0.30	0.23	0.16
	Max	0.29	0.321	0.210	0.247	0.029	1.1	0.26	0.82	0.57	1.2	0.43	0.39
	Min	0.0050	0.0052	0.0015	0.00090	0.00060	0.00080	0.00090	0.0025	0.0077	0.010	0.0020	0.019
NO2 mg/L	Avg	0.0040	0.0025	0.0021	0.0014	0.0011	0.0084	0.0036	0.0072	0.0082	0.0097	0.010	0.0071
	Max	0.0078	0.0058	0.0062	0.0052	0.0023	0.020	0.0097	0.020	0.017	0.028	0.032	0.016
	Min	0.00070	0.00020	0.00050	0.00010	<0.0003	0.00060	0.00070	0.00100	0.0011	0.0012	0.0024	0.00060
NH4 mg/L	Avg	0.0318	0.0197	0.0141	0.0189	0.0105	0.0466	0.0230	0.0399	0.0496	0.0466	0.0526	0.0362
	Max	0.0900	0.0700	0.0700	0.0600	0.0162	0.126	0.0550	0.0881	0.0765	0.103	0.120	0.0927
	Min	0.00190	0.00460	0.00220	0.00210	0.00570	0.00690	0.00500	0.00660	0.00790	0.00380	0.00200	0.00360
TKN mg/L	Avg	0.29	0.24	0.11	0.10	0.25	0.31	0.58	0.24	0.36	0.24	0.43	0.31
	Max	0.71	0.39	0.14	0.12	0.25	0.36	0.58	0.55	0.46	0.51	0.83	0.39
	Min	<0.080	0.14	<0.080	0.070	0.25	0.25	0.58	<0.080	0.27	<0.080	0.27	0.22
OPO4 mg/L	Avg	0.0013	0.0014	0.0016	0.0016	0.0012	0.0038	0.0016	0.0016	0.0015	0.0025	0.0013	0.0016
	Max	0.0028	0.0022	0.0029	0.0024	<0.0020	0.014	0.0039	0.0040	0.0029	0.0076	0.0026	0.0037
	Min	0.00010	0.00030	0.00010	0.00030	0.00020	0.00010	0.00030	0.00040	0.00020	0.00040	0.00010	0.00030
TPO4 mg/L	Avg	0.0055	0.0041	0.0038	0.0039	0.0042	0.0073	0.0059	0.006	0.0078	0.0093	0.0062	0.0063
	Max	0.014	0.0067	0.011	0.013	0.0072	0.016	0.014	0.016	0.025	0.037	0.013	0.021
	Min	<0.0020	0.0020	0.0010	0.0004	<0.0020	<0.0020	0.0024	0.0031	0.0019	<0.0020	0.0020	<0.0020
SIO2 mg/L	Avg	0.185	ND	0.0280	0.0795	0.147	ND	0.140	0.174	ND	0.477	0.189	ND
	Max	0.708	ND	0.0280	0.176	0.255	ND	0.277	0.174	ND	0.859	0.189	ND
	Min	0.0120	ND	0.0280	0.0330	0.0580	ND	0.0330	0.174	ND	0.062	0.189	ND
CHLOR A mg/M3	Avg	0.37	0.49	0.42	0.31	0.38	0.46	0.42	0.40	0.57	0.56	0.42	0.39
	Max	<1.0	1.3	1.2	<1.0	1.3	1.1	0.94	0.94	1.5	1.7	<1.0	<1.0
	Min	0.20	0.10	0.10	0.10	0.20	0.20	0.20	0.18	0.10	0.10	0.10	<0.16
NO3 mg/L	Avg	0.136	0.0636	0.0316	0.0341	0.00850	0.258	0.0862	0.219	0.193	0.326	0.191	0.156
	Max	0.282	0.315	0.204	0.242	0.0272	1.08	0.246	0.803	0.555	1.17	0.415	0.376
	Min	0.0123	0.00430	0.000800	0.000200	0.000600	0.000300	0.000400	0.00150	0.00660	0.00790	0.00200	0.0175
TOT N MG N/L	Avg	0.47	0.35	0.28	0.41	0.34	0.39	0.34[1]	0.60[1]	0.46[1]	0.54	0.51	0.65
	Max	0.59	0.48	0.55	0.55	0.45	0.64	21	13	37	0.77	0.81	0.99
	Min	0.39	0.27	0.14	0.18	0.15	0.21	0.32	0.32	0.27	0.40	0.33	0.22
SAL. psu	Avg	26.4	29.1	31.1	33.8	36.7	31.3	31.7	29.7	27.1	22.1	21.9	24.6
	Max	30.5	35.6	37.0	40.7	40.8	41.2	40.7	36.1	36.4	29.6	30.2	29.2
	Min	16.9	24.0	24.5	27.0	28.7	12.3	4.81	19.7	13.9	13.3	12.8	15.7
TOC mg/L	Avg	4.01	3.88	4.18	4.71	5.56	4.18	5.67	5.11	5.43	4.35	4.46	4.03
	Max	5.16	4.92	7.61	6.94	13.1	5.39	10.7	7.78	9.70	6.49	6.97	5.49
	Min	3.08	2.88	2.34	3.22	2.70	2.90	2.74	3.26	3.14	3.32	3.05	3.00
AlkPO4 nM/minmL	Avg	0.24	0.58	0.26	0.36	0.49	0.37	0.43	0.43	0.40	0.33	0.29	0.23
	Max	0.53	3.2	0.45	0.88	0.87	0.74	0.99	0.89	0.76	0.66	0.69	0.48
	Min	0.12	0.16	0.14	0.13	0.21	0.14	0.20	0.21	0.090	0.14	0.12	0.13

Table 2.3-31 (Sheet 5 of 36)
Biscayne Bay Water Quality

Sample Location BISC101 – Average, Maximum and Minimum Monthly Results for 1993-2010													
Depth ≥ 1 m													
Parameters[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEMP. Deg. C	Avg	19.0	22.3	23.6	26.2	28.8	29.5	31.1	30.9	29.7	27.6	23.4	21.8
	Max	24.9	24.8	28.9	28.6	31.0	32.9	32.8	32.9	31.0	31.1	27.5	27.3
	Min	9.18	19.6	18.9	20.6	25.8	27.5	29.3	27.5	27.6	23.4	19.2	12.3
D.O. mg/L	Avg	7.93	7.83	7.15	6.86	7.88	6.53	6.66	5.38	6.03	7.01	7.86	7.80
	Max	10.1	9.60	9.70	8.60	12.90	10.7	8.70	7.20	10.90	12.0	9.70	9.24
	Min	3.80	3.39	3.92	4.90	4.60	4.60	3.00	3.70	4.30	4.90	6.30	7.00
PH UNITS	Avg	8.02	8.11	8.14	8.15	ND	8.09	7.86	8.03	7.96	8.01	8.10	8.19
	Max	8.02	8.11	8.14	8.15	ND	8.09	7.86	8.03	7.96	8.01	8.10	8.19
	Min	8.02	8.11	8.14	8.15	ND	8.09	7.86	8.03	7.96	8.01	8.10	8.19
SAL. psu	Avg	26.6	28.2	30.3	34.1	35.6	32.1	30.4	30.7	27.5	25.9	21.6	24.7
	Max	29.5	36.0	37.1	40.7	40.9	41.3	40.7	37.5	36.4	30.3	28.2	30.6
	Min	23.4	24.0	25.0	27.3	30.5	22.9	18.8	22.4	13.9	20.6	12.7	17.8

Table 2.3-31 (Sheet 6 of 36)
Biscayne Bay Water Quality

Sample Location BISC113 – Average, Maximum and Minimum Monthly Results for 1993-2010

Depth < 1 m

Parameters[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEMP. Deg. C	Avg	20.0	21.2	23.1	25.1	27.4	28.6	30.6	30.5	29.5	27.0	23.8	22.1
	Max	24.0	23.8	28.3	27.8	30.3	31.2	31.6	32.3	31.2	29.1	25.9	26.6
	Min	15.4	18.3	19.6	20.6	24.6	27.0	29.2	28.3	28.8	23.6	20.5	18.0
D.O. mg/L	Avg	6.9	7.1	6.7	6.5	6.2	5.8	5.6	5.7	5.8	6.0	6.7	7.1
	Max	7.9	8.2	8.3	7.1	7.4	7.0	6.5	6.5	8.0	7.4	7.7	9.0
	Min	4.5	6.2	4.2	5.8	5.0	5.0	4.6	5.2	4.8	5.1	6.3	6.1
PH UNITS	Avg	8.23	8.20	8.17	7.91	8.26	8.18	8.21	8.21	8.02	8.11	8.03	7.99
	Max	8.70	8.34	8.40	8.40	8.31	8.50	8.40	8.80	8.20	8.40	8.20	8.10
	Min	8.00	8.00	8.03	7.66	8.10	8.00	8.08	8.00	7.90	7.91	7.90	7.90
TURB. NTU	Avg	1.1	0.77	0.84	0.85	0.80	0.79	0.91	0.67	0.91	1.0	1.5	1.2
	Max	2.1	1.5	1.7	1.8	1.8	1.5	2.1	1.0	1.6	1.8	4.5	2.6
	Min	0.10	0.10	0.30	0.30	0.40	0.20	0.31	0.30	0.50	0.30	0.10	0.40
NOX mg/L	Avg	0.0100	0.00630	0.00520	0.00470	0.00530	0.0322	0.0093	0.0106	0.0149	0.0156	0.0205	0.0157
	Max	0.0434	0.0100	0.00820	0.0114	0.00780	0.212	0.0190	0.0202	0.0263	0.0617	0.0965	0.0505
	Min	0.00270	0.00150	0.00270	0.00190	0.00270	0.00670	0.00360	0.00360	0.00130	0.00420	0.00270	0.00590
NO2 mg/L	Avg	0.0010	0.0011	0.0010	0.00070	0.00090	0.0019	0.0012	0.0015	0.0015[1]	0.0015	0.0016	0.0013
	Max	0.0015	0.0020	0.0030	0.0014	0.0012	0.0064	0.0022	0.0023	8.0	0.0030	0.0040	0.0030
	Min	0.00060	0.00050	0.00010	0.00020	<0.00030	0.00080	0.00070	0.00040	0.00080	0.00060	0.00060	<0.00030
NH4 mg/L	Avg	0.0114	0.0135	0.0098	0.0107	0.0143	0.0224	0.0229	0.0286	0.0321	0.027	0.0266	0.0211
	Max	0.0193	0.0268	0.0258	0.0183	0.0236	0.0333	0.0411	0.0453	0.0513	0.0440	0.0542	0.0364
	Min	0.00730	0.00570	0.00280	0.00690	0.00670	0.01550	0.00680	0.0121	0.0214	0.0123	0.00780	0.00600
TKN mg/L	Avg	0.140	0.139	ND	ND	ND	ND	ND	ND	ND	0.1735	0.188	0.123
	Max	0.140	0.139	ND	ND	ND	ND	ND	ND	ND	0.182	0.188	0.123
	Min	0.140	0.139	ND	ND	ND	ND	ND	ND	ND	0.165	0.188	0.123
OPO4 mg/L	Avg	0.00050	0.00060	0.00090	0.00110	0.00080	0.00090	0.0012	0.00090	0.00110	0.00070	0.00070	0.0012
	Max	<0.00090	<0.0016	0.0024	<0.0019	0.0022	0.0028	0.0044	0.0018	0.0041	0.0014	0.0015	0.0033
	Min	0.00010	0.00010	0.00010	0.00020	0.00010	0.00020	0.00020	0.00020	0.00010	0.00010	0.00010	0.00010
TPO4 mg/L	Avg	0.0055	0.0045	0.0033	0.0046	0.0048	0.0074	0.0072	0.0065	0.0059	0.0067	0.0058	0.0058
	Max	0.013	0.0064	0.0051	0.012	0.0068	0.018	0.013	0.013	0.020	0.031	0.013	0.013
	Min	0.0033	0.0032	0.0020	0.0020	0.0026	0.0032	0.0021	0.0032	0.0022	0.0032	0.0032	0.0025
SIO2 mg/L	Avg	0.015	ND	0.0070	0.011	0.015	ND	0.057	0.028	ND	0.032	<0.0020	ND
	Max	0.030	ND	0.0070	0.017	0.033	ND	0.10	0.028	ND	0.067	<0.0020	ND
	Min	0.0010	ND	0.0070	<0.0020	0.005	ND	0.028	0.028	ND	0.010	<0.0020	ND
CHLOR A mg/M3	Avg	0.29	0.35	0.31	0.22	0.25	0.35	0.26	0.23	0.25	0.39	0.33	0.36
	Max	0.65	1.1	1.0	0.84	1.0	1.2	0.32	0.40	0.40	0.97	0.64	0.81
	Min	0.10	<0.10	0.10	0.10	0.10	0.10	0.16	0.20	0.10	<0.10	0.20	0.20
NO3 mg/L	Avg	0.00970	0.00600	0.00390	0.00410	0.00440	0.0276	0.00780	0.00910	0.0144	0.0135	0.0183	0.0131
	Max	0.0419	0.00880	0.00720	0.0114	0.00670	0.205	0.0168	0.0191	0.0233	0.0590	0.0933	0.0482
	Min	0.00190	0.00230	0.00120	0.00160	0.00170	0.00360	0.00220	0.00230	0.00890	0.00300	0.00150	0.00530
TOT N MG N/L	Avg	0.32	ND	0.20	0.23	0.23	0.22	0.22[1]	0.34[1]	0.20[1]	0.30	0.33	0.17
	Max	0.40	ND	0.31	0.47	0.30	0.32	14	19	25	0.43	0.61	0.29
	Min	0.23	ND	0.08	0.10	0.12	0.12	0.19	0.21	0.16	0.16	0.14	0.090
SAL. psu	Avg	34.9	35.3	36.7	37.9	38.1	36.1	36.5	36.1	35.6	33.8	33.6	33.6
	Max	36.5	37.2	37.8	39.3	40.4	39.9	41.4	38.6	37.9	37.1	37.5	37.0
	Min	33.3	32.4	34.8	35.7	36.2	28.1	31.6	31.6	30.8	31.3	27.5	23.5
TOC mg/L	Avg	2.65	2.77	2.43	2.78	3.81	2.91	3.34	2.91	2.85	2.53	2.70	2.58
	Max	3.16	4.05	4.14	4.82	8.81	4.19	5.55	3.86	4.98	3.73	4.25	3.28
	Min	2.00	1.90	1.68	1.40	2.32	2.00	2.24	1.75	1.74	1.51	2.03	2.02
AlkPO4 nM/minmL	Avg	0.075	0.17	0.094	0.14	0.18	0.21	0.22	0.21	0.12	0.14	0.11	0.091
	Max	0.12	0.80	0.15	0.26	0.24	0.29	0.31	0.35	0.19	0.27	0.15	0.17
	Min	0.039	0.037	0.054	0.070	0.13	0.11	0.090	0.111	0.040	0.060	0.040	0.040

Table 2.3-31 (Sheet 7 of 36)
Biscayne Bay Water Quality

Sample Location BISC 113 – Average, Maximum and Minimum Monthly Results for 1993-2010													
Depth ≥ 1 m													
Parameters[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEMP. Deg. C	Avg	19.3	21.3	23.3	25.5	28.0	28.6	30.5	30.4	29.6	27.0	23.6	22.1
	Max	23.4	23.8	28.3	27.8	30.3	31.2	31.3	32.4	31.3	28.9	25.9	26.6
	Min	15.2	18.0	19.6	20.6	25.1	27.0	29.2	28.3	28.9	23.6	20.5	18.0
D.O. mg/L	Avg	6.9	7.1	6.7	6.3	6.2	5.9	5.7	5.7	5.5	5.8	7.0	6.7
	Max	8.1	8.3	8.4	6.9	7.4	7.0	6.5	6.3	6.9	6.8	8.2	7.2
	Min	3.9	6.2	4.1	5.7	5.2	4.8	4.5	5.1	4.6	5.1	6.4	6.0
SAL. psu	Avg	34.5	34.8	36.2	37.6	37.9	35.9	36.1	35.2	34.8	33.6	33.4	33.7
	Max	35.9	37.0	37.9	39.3	40.0	39.9	41.5	38.6	37.2	37.1	36.3	35.7
	Min	33.3	32.4	33.0	35.7	36.0	28.0	31.5	31.6	30.7	31.3	28.7	29.7

Table 2.3-31 (Sheet 8 of 36)
Biscayne Bay Water Quality

Sample Location BISC 116 – Average, Maximum and Minimum Monthly Results for 1993-2010													
Depth < 1 m													
Parameters[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEMP. Deg. C	Avg	19.6	21.5	23.2	25.0	27.5	28.6	30.8	30.6	29.6	26.9	24.0	22.2
	Max	23.6	23.9	28.4	28.0	30.6	31.1	32.2	32.3	31.6	29.1	26.5	26.2
	Min	15.5	18.7	19.4	20.1	24.5	27.2	28.9	28.3	28.7	23.3	20.8	17.9
D.O. mg/L	Avg	7.1	7.0	6.5	6.5	6.2	5.5	5.3	5.3	5.2	5.9	6.6	6.9
	Max	8.6	7.9	7.3	8.0	7.7	7.0	6.3	6.5	6.1	7.7	7.8	8.9
	Min	4.4	6.4	3.9	5.4	5.3	4.9	3.8	4.3	2.8	4.4	5.8	5.6
PH UNITS	Avg	8.21	8.20	8.19	7.73	8.29	8.14	8.14	8.07	7.96	8.10	8.00	7.99
	Max	8.60	8.34	8.50	8.40	8.37	8.50	8.40	8.70	8.10	8.40	8.20	8.20
	Min	8.01	8.00	8.02	7.30	8.20	8.00	8.00	7.90	7.84	7.90	7.90	7.90
TURB. NTU	Avg	1.7	1.1	1.1	0.92	0.75	0.85	0.83	0.61	0.78	1.5	1.5	1.3
	Max	5.3	2.8	3.0	1.9	2.4	2.2	2.8	1.8	1.8	4.9	5.3	5.9
	Min	0.10	0.40	0.30	0.30	0.10	0.20	0.40	0.20	0.40	0.40	0.30	0.10
NOX mg/L	Avg	0.0145	0.00830	0.00530	0.00530	0.00570	0.0100	0.00800	0.0124	0.0150	0.0468	0.0280	0.0177
	Max	0.0757	0.0160	0.0110	0.0112	0.00820	0.0139	0.0247	0.0254	0.0231	0.240	0.112	0.0464
	Min	0.00210	0.00260	0.00250	0.00190	0.00280	0.00390	0.000900	0.00380	0.00860	0.00560	0.00710	0.00470
NO2 mg/L	Avg	0.0011	0.0012	0.00090	0.00070	0.0010	0.0014	0.0014	0.0015	0.0013[1]	0.0027	0.0019	0.0015
	Max	0.0021	0.0021	0.0023	0.0019	0.0015	0.0019	0.0030	0.0030	8.0	0.0078	0.0040	0.0040
	Min	0.00060	0.00050	0.00010	<0.00030	<0.00030	0.00080	0.00070	0.00030	0.00040	0.00080	0.00020	<0.00030
NH4 mg/L	Avg	0.00730	0.00840	0.00730	0.00620	0.00970	0.0110	0.0108	0.0130	0.0151	0.0230	0.0134	0.0128
	Max	0.0123	0.0190	0.0203	0.0120	0.0175	0.0163	0.0209	0.0284	0.0214	0.0686	0.0194	0.0278
	Min	0.00280	0.00200	0.00160	0.00220	0.00430	0.00500	<0.000800	0.00510	0.00870	0.00540	0.00430	0.000900
TKN mg/L	Avg	0.144	0.18	ND	ND	ND	ND	ND	ND	ND	0.1315	0.185	0.141
	Max	0.144	0.18	ND	ND	ND	ND	ND	ND	ND	0.138	0.185	0.141
	Min	0.144	0.18	ND	ND	ND	ND	ND	ND	ND	0.125	0.185	0.141
OPO4 mg/L	Avg	0.00050	0.00060	0.00060	0.00100	0.00080	0.0011	0.0010	0.0013	0.0011	0.00090	0.00070	0.0010
	Max	0.0010	<0.0016	<0.0016	0.0020	0.0014	0.0023	0.0042	0.0047	0.0034	0.0019	0.0019	0.0031
	Min	0.00020	0.00020	0.00010	0.00010	0.00020	0.00030	0.00010	0.00020	0.00030	0.00020	0.00010	0.00010
TPO4 mg/L	Avg	0.0050	0.0046	0.0035	0.0046	0.0054	0.0057	0.0063	0.0061	0.0086	0.0065	0.0062	0.0061
	Max	0.0092	0.0069	0.0053	0.012	0.011	0.012	0.012	0.012	0.030	0.020	0.014	0.017
	Min	0.0028	0.0021	0.0019	0.0018	0.0028	0.0024	0.0017	0.0031	0.0020	0.0035	0.0039	0.0028
SIO2 mg/L	Avg	0.0522	ND	0.0180	0.0175	0.0250	ND	0.0684	0.0490	ND	0.0178	0.00200	ND
	Max	0.338	ND	0.0180	0.0271	0.0470	ND	0.127	0.0490	ND	0.0640	0.00200	ND
	Min	0.00200	ND	0.0180	0.00450	0.00700	ND	0.0400	0.0490	ND	<0.00200	0.00200	ND
CHLOR A mg/M3	Avg	0.42	0.41	0.30	0.21	0.24	0.28	0.21	0.22	0.21	0.46	0.37	0.33
	Max	1.3	1.5	1.2	0.82	1.2	0.93	0.60	0.40	0.30	1.5	0.68	0.80
	Min	0.10	<0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	<0.10	0.20	0.20
NO3 mg/L	Avg	0.0127	0.00630	0.00410	0.00470	0.00460	0.00810	0.00700	0.0109	0.0137	0.0394	0.0267	0.0154
	Max	0.0736	0.0102	0.00870	0.0112	0.00730	0.0120	0.0217	0.0251	0.0212	0.232	0.109	0.0425
	Min	0.000800	0.00200	0.00150	0.00150	0.00240	0.00310	0.00320	0.00270	0.00610	0.00450	0.00570	0.00400
TOT N MG N/L	Avg	0.32	ND	ND	0.23	0.23	0.27	0.22[1]	0.33[1]	0.21[1]	0.24	0.33	0.20
	Max	0.37	ND	ND	0.48	0.32	0.43	16.86	19.73	14.31	0.41	0.49	0.34
	Min	0.26	ND	ND	0.080	0.14	0.11	0.16	0.20	0.19	0.15	0.22	0.080
SAL. psu	Avg	34.0	34.8	36.0	37.7	37.6	36.1	36.1	35.5	35.0	31.7	32.4	33.5
	Max	36.5	37.1	37.8	39.2	39.0	38.5	39.0	37.9	36.7	36.0	35.9	36.4
	Min	32.0	30.9	31.4	36.1	36.3	34.2	30.7	32.7	30.8	25.6	25.4	30.0
TOC mg/L	Avg	2.81	2.97	2.67	2.61	3.62	2.85	2.93	2.93	2.82	2.96	2.95	2.91
	Max	3.30	3.63	4.38	4.75	8.76	5.06	4.38	3.97	3.91	4.84	4.73	3.85
	Min	1.99	2.06	1.96	1.12	2.17	1.89	1.87	1.65	1.71	1.41	1.55	1.97
AlkPO4 nM/minmL	Avg	0.087	0.17	0.095	0.11	0.13	0.15	0.15	0.12	0.12	0.15	0.11	0.089
	Max	0.16	0.80	0.14	0.16	0.19	0.22	0.25	0.18	0.20	0.31	0.24	0.13
	Min	0.040	0.046	0.060	0.070	0.079	0.049	0.093	0.055	0.020	0.060	0.060	0.050

Table 2.3-31 (Sheet 9 of 36)
Biscayne Bay Water Quality

Sample Location BISC 116 – Average, Maximum and Minimum Monthly Results for 1993-2010													
Depth ≥ 1 m													
Parameters[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEMP. Deg. C	Avg	19.4	21.8	23.5	25.6	28.2	28.8	30.5	30.6	29.7	27.1	23.9	22.1
	Max	23.7	23.9	28.4	28.0	30.7	31.1	32.3	32.3	31.6	29.0	26.5	26.3
	Min	15.0	18.4	19.5	20.2	25.1	27.2	28.9	28.3	28.7	23.3	20.8	17.9
D.O. mg/L	Avg	6.8	7.1	6.5	6.3	6.3	5.7	5.1	5.4	5.1	5.2	6.8	6.6
	Max	8.2	7.9	7.3	7.5	8.6	7.2	6.4	6.6	6.3	6.8	8.2	7.3
	Min	3.6	6.3	3.9	5.6	5.2	5.1	3.8	4.4	2.8	4.2	6.0	5.6
SAL. psu	Avg	33.8	34.5	35.7	37.3	37.5	35.8	35.6	35.3	34.7	32.8	32.7	33.0
	Max	35.6	36.7	37.1	39.3	39.0	38.5	38.9	38.0	36.7	36.8	35.8	35.7
	Min	32.5	32.4	33.0	36.1	36.0	33.9	30.9	32.7	30.6	25.6	29.1	30.0

Table 2.3-31 (Sheet 10 of 36)
Biscayne Bay Water Quality

Sample Location BISC 121 – Average, Maximum and Minimum Monthly Results for 1993-2010													
Depth < 1 m													
Parameters[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEMP. Deg. C	Avg	18.1	21.7	22.4	25.1	27.8	29.5	30.7	30.5	29.4	26.8	23.1	20.7
	Max	23.2	25.5	28.6	28.4	30.4	32.2	32.2	32.4	31.9	29.3	26.3	25.7
	Min	9.15	18.2	17.7	20.5	24.6	27.4	29.6	28.7	28.1	23.6	18.7	13.1
D.O. mg/L	Avg	7.51	6.21	6.58	6.39	6.43	5.75	5.93	5.49	6.09	6.31	7.01	7.36
	Max	9.18	7.90	7.29	7.81	7.41	6.50	6.80	6.60	8.34	7.80	8.33	9.13
	Min	4.20	2.29	4.10	5.05	5.10	4.00	4.00	4.90	4.60	4.50	6.10	5.93
PH UNITS	Avg	8.07	8.06	8.12	7.99	8.25	8.16	8.15	8.03	7.89	8.03	7.98	8.05
	Max	8.70	8.32	8.40	8.40	8.40	8.50	8.40	8.70	8.00	8.40	8.20	8.20
	Min	7.94	7.82	8.00	7.10	8.16	8.00	8.02	7.89	7.80	7.90	7.89	7.87
TURB. NTU	Avg	0.77	0.81	0.70	0.89	0.66	0.68	0.56	0.48	0.66	0.93	0.89	0.69
	Max	1.9	2.0	2.4	2.1	1.3	1.9	1.4	1.0	1.8	2.1	2.5	1.7
	Min	0.10	0.10	0.30	0.20	0.10	0.10	0.20	0.10	0.30	0.20	0.20	0.20
NOX mg/L	Avg	0.0602	0.00910	0.00620	0.00570	0.00530	0.00830	0.00890	0.0100	0.0101	0.0361	0.0376	0.0210
	Max	0.260	0.0344	0.0200	0.0103	0.0103	0.0149	0.0329	0.0301	0.0284	0.100	0.115	0.0938
	Min	0.00170	0.000800	0.00130	0.00210	0.00200	0.00390	0.00050	0.00140	0.00280	0.00590	0.00730	0.00400
NO2 mg/L	Avg	0.0014	0.0015	0.0012	0.0011	0.0010	0.0014	0.0015	0.0016	0.0017[1]	0.0033	0.0031	0.0031
	Max	0.0023	0.0031	0.0037	<0.0020	<0.0020	<0.0020	0.0031	0.0024	8.0	0.0077	0.0080	0.019
	Min	0.00050	<0.00030	0.00020	0.00050	<0.00030	0.0010	0.00030	0.00010	0.00090	0.0011	0.0011	0.00010
NH4 mg/L	Avg	0.022	0.025	0.016	0.018	0.021	0.028	0.024	0.029	0.027	0.033	0.028	0.027
	Max	0.10	0.090	0.070	0.080	0.14	0.10	0.090	0.090	0.080	0.10	0.090	0.080
	Min	0.0033	0.0017	0.0023	0.0024	0.0055	0.0068	<0.00080	0.0053	0.010	0.0093	0.0079	0.0043
TKN mg/L	Avg	0.1	0.1	0.1	0.2	0.1	0.1	0.2	0.1	0.2	0.2	0.2	0.2
	Max	0.2	0.2	0.1	0.2	0.1	0.2	0.3	0.2	0.4	0.3	0.3	0.3
	Min	0.1	<0.08	<0.08	0.2	<0.08	0.1	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
OPO4 mg/L	Avg	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Max	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.0030	<0.002	0.0039	<0.002	0.0026	0.0035
	Min	0.0002	0.0001	0.0002	0.0002	0.0003	0.0002	0.0001	0.0005	0.0002	0.0002	0.0002	0.0002
TPO4 mg/L	Avg	0.0042	0.0039	0.0038	0.0045	0.0060	0.0050	0.0065	0.0061	0.0068	0.0056	0.0054	0.0055
	Max	0.0070	0.0064	0.0061	0.014	0.018	0.011	0.016	0.0098	0.030	0.015	0.013	0.013
	Min	<0.0020	<0.0020	0.0027	0.0020	<0.0020	<0.0020	0.0021	0.0026	0.0017	<0.0020	0.0030	<0.0020
SIO2 mg/L	Avg	0.038	ND	0.064	0.022	0.036	ND	0.106	0.14	ND	0.11	<0.0020	ND
	Max	0.161	ND	0.064	0.037	0.06	ND	0.23	0.14	ND	0.31	<0.0020	ND
	Min	<0.0020	ND	0.064	<0.0020	0.019	ND	0.045	0.14	ND	0.0030	<0.0020	ND
CHLOR A mg/M3	Avg	0.34	0.47	0.36	0.34	0.36	0.65	0.26	0.30	0.34	0.55	0.46	0.38
	Max	<1.0	1.6	1.1	<1.0	<1.0	3.0	0.48	0.43	0.71	1.2	<1.0	<1.0
	Min	0.10	0.10	0.10	0.10	<0.10	0.10	0.10	0.18	0.10	0.10	0.20	0.20
NO3 mg/L	Avg	0.0074	0.0071	0.0038	0.0039	0.004	0.0064	0.0076	0.009	0.0085	0.0321	0.0368	0.0191
	Max	0.016	0.031	0.016	0.0085	0.0090	0.013	0.030	0.028	0.024	0.094	0.112	0.075
	Min	0.00020	0.00020	0.00060	0.0015	0.00090	0.0025	0.00020	0.00010	0.0013	0.0046	0.0042	0.0029
TOT N MG N/L	Avg	0.33	0.33	0.21	0.26	0.23	0.24	0.22[1]	0.34[1]	0.22[1]	0.37	0.29	0.23
	Max	0.35	0.33	0.35	0.56	0.30	0.53	15	20	17	0.56	0.39	0.29
	Min	0.30	0.33	0.10	0.080	0.12	0.089	0.16	0.23	0.18	0.17	0.14	0.20
SAL. psu	Avg	32.4865	33.7	34.9	36.7	37.3	34.9	32.4	35.2	33.7	30.0	29.7	31.0
	Max	35.87	37.1	37.7	39.2	39.1	38.7	38.6	37.8	37.2	37.8	35.1	35.7
	Min	29.4	25.8	30.4	32.7	33.9	31.8	21.0	27.7	29.2	24.3	24.6	24.3
TOC mg/L	Avg	3.5592	3.56	3.58	2.97	3.62	3.47	3.74	3.75	4.18	3.87	3.79	3.62
	Max	4.93	4.21	6.93	5.39	6.79	6.22	5.98	5.85	5.88	6.33	6.04	5.34
	Min	2.55	2.27	1.70	1.90	1.70	1.98	1.90	2.30	2.12	1.97	2.93	2.60
AlkPO4 nM/minmL	Avg	0.0825	0.20	0.10	0.15	0.17	0.18	0.17	0.16	0.13	0.14	0.15	0.12
	Max	0.13	0.94	0.16	0.35	0.27	0.22	0.27	0.23	0.20	0.24	0.35	0.21
	Min	0.040	0.059	0.070	0.090	0.13	0.12	0.12	0.12	0.020	0.060	0.090	0.050

Table 2.3-31 (Sheet 11 of 36)
Biscayne Bay Water Quality

Sample Location BISC 121 – Average, Maximum and Minimum Monthly Results for 1993-2010													
Depth ≥ 1 m													
Parameters[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEMP. Deg. C	Avg	18.7	21.7	23.3	25.7	28.1	29.3	30.6	30.7	29.8	27.2	23.3	21.5
	Max	23.2	24.0	28.6	28.0	30.4	32.4	31.9	32.3	31.9	29.4	26.3	26.7
	Min	9.4	18.6	17.8	20.4	25.2	27.3	29.5	28.7	28.1	23.6	18.9	13.1
D.O. mg/L	Avg	7.12	6.85	6.56	6.44	6.34	5.71	5.77	5.72	5.48	5.80	7.23	6.99
	Max	9.48	8.10	7.63	7.20	7.20	6.90	7.10	6.90	7.39	7.00	8.80	8.80
	Min	3.60	2.88	4.10	4.50	5.10	4.30	4.10	4.40	3.60	4.50	6.10	5.60
PH UNITS	Avg	7.9	7.8	8.0	8.2	ND	8.2	8.1	7.9	7.9	7.9	7.9	8.2
	Max	7.9	7.8	8.0	8.2	ND	8.2	8.1	7.9	7.9	7.9	7.9	8.2
	Min	7.9	7.8	8.0	8.2	ND	8.2	8.1	7.9	7.9	7.9	7.9	8.2
SAL. psu	Avg	31.7	33.4	33.9	36.4	36.9	34.4	34.7	34.6	33.9	30.6	30.1	30.5
	Max	33.3	36.2	36.4	39.0	38.6	38.6	38.8	38.0	38.3	37.8	35.2	33.8
	Min	29.9	31.1	30.6	32.6	34.1	31.8	28.3	28.1	29.7	25.7	24.9	24.7

Table 2.3-31 (Sheet 12 of 36)
Biscayne Bay Water Quality

Sample Location BISC 122 – Average, Maximum and Minimum Monthly Results for 1993-2010													
Depth < 1 m													
Parameters[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEMP. Deg. C	Avg	18.5	21.7	22.4	25.0	28.0	29.3	30.6	30.4	29.1	26.8	23.1	20.5
	Max	23.8	25.6	28.6	28.4	30.7	32.5	32.9	35.1	32.2	29.7	26.6	26.0
	Min	9.33	18.6	18.0	20.7	24.8	26.7	29.0	27.6	27.5	23.3	18.3	12.3
D.O. mg/L	Avg	7.7	6.2	6.4	6.4	6.3	6.0	5.8	5.5	6.2	6.6	7.4	7.6
	Max	9.6	8.4	7.8	8.0	7.6	7.1	8.2	7.6	7.5	8.6	9.3	9.4
	Min	3.7	2.4	4.2	4.0	4.7	4.8	3.8	4.4	4.0	5.1	6.1	6.2
PH UNITS	Avg	8.11	8.18	8.21	8.00	8.30	8.22	8.15	8.14	8.00	8.12	8.08	8.13
	Max	8.70	8.40	8.40	8.40	8.36	8.50	8.50	8.70	8.10	8.40	8.30	8.30
	Min	7.98	7.99	8.09	7.59	8.20	8.10	8.00	7.90	7.90	7.99	8.00	8.00
TURB. NTU	Avg	0.66	0.62	0.70	0.66	0.52	0.58	0.60	0.60	0.80	0.93	0.83	0.71
	Max	1.5	0.9	1.4	1.1	1.0	1.8	1.0	1.2	1.7	2.4	3.8	2.3
	Min	0.10	0.10	0.30	0.20	0.30	0.10	0.30	0.10	0.20	0.30	0.10	0.20
NOX mg/L	Avg	0.108	0.0365	0.0172	0.0113	0.00590	0.0304	0.0111	0.0444	0.108	0.1527	0.136	0.0724
	Max	0.25	0.221	0.0562	0.0667	0.011	0.114	0.019	0.2873	0.3116	0.6	0.362	0.314
	Min	0.00290	0.00370	0.00150	0.000900	0.000800	0.00210	0.00120	0.00680	0.0136	0.0133	0.00400	0.00530
NO2 mg/L	Avg	0.0029	0.0021	0.0015	0.0013	0.0012	0.0022	0.0020	0.0030	0.0034[1]	0.0073	0.0048	0.004
	Max	0.0052	0.0039	0.0055	0.0029	<0.0020	0.0049	0.004	0.0057	8.0	0.020	0.0098	0.011
	Min	0.00090	0.00070	0.00040	<0.00030	<0.0003	0.00020	0.00050	0.0013	0.0013	0.0011	0.0016	<0.00030
NH4 mg/L	Avg	0.0271	0.0231	0.0174	0.0193	0.0222	0.0385	0.0299	0.0290	0.0415	0.0441	0.0375	0.0298
	Max	0.0900	0.0700	0.0700	0.0800	0.110	0.120	0.0900	0.0600	0.110	0.0951	0.100	0.0900
	Min	0.00510	0.00500	0.00290	0.00390	<0.00500	0.00670	<0.000800	0.0106	0.00780	0.0114	0.00860	0.00510
TKN mg/L	Avg	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.4	0.2	0.3	0.2
	Max	0.3	0.2	0.2	0.2	0.2	0.3	0.6	0.2	0.4	0.4	0.3	0.3
	Min	<0.08	0.1	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	0.4	0.1	0.3	<0.08
OPO4 mg/L	Avg	0.0013	0.0013	0.0015	0.0012	0.0011	0.0014	0.0013	0.0015	0.0016	0.0022	0.0014	0.0019
	Max	0.0026	<0.0020	<0.0020	<0.0020	<0.0020	0.0036	0.0036	0.0024	0.0041	0.0072	0.0024	0.0035
	Min	0.00010	0.00030	0.00040	0.00010	0.00010	0.00020	0.00010	0.00060	0.00020	0.00030	0.00030	0.00010
TPO4 mg/L	Avg	0.0047	0.0037	0.0038	0.0038	0.0057	0.0055	0.0060	0.0058	0.008	0.0057	0.0057	0.0053
	Max	0.0083	0.0057	0.0075	0.012	0.014	0.011	0.011	0.011	0.034	0.019	0.011	0.012
	Min	<0.0020	0.0020	<0.0020	<0.0020	<0.0020	0.0020	0.0016	0.0020	0.0019	<0.0020	<0.0020	<0.0020
SIO2 mg/L	Avg	0.090	ND	0.014	0.028	0.064	ND	0.16	0.17	ND	0.1971	<0.0020	ND
	Max	0.26	ND	0.014	0.070	0.095	ND	0.27	0.17	ND	0.831	<0.0020	ND
	Min	0.0010	ND	0.014	0.0020	0.028	ND	0.025	0.17	ND	0.062	<0.0020	ND
CHLOR A mg/M3	Avg	0.4	0.4	0.3	0.3	0.3	0.5	0.3	0.3	0.4	0.7	0.5	0.4
	Max	<1	1	1	<1	1	1	0.6	0.5	0.9	4	<1	<1
	Min	0.1	<0.1	0.1	0.1	0.1	0.2	0.1	0.2	0.1	<0.1	0.2	0.2
NO3 mg/L	Avg	0.0762	0.0438	0.0097	0.0095	0.0052	0.0296	0.0104	0.0476	0.0695	0.1091	0.1056	0.0719
	Max	0.1786	0.2172	0.0508	0.0638	0.0095	0.1094	0.0167	0.2817	0.2981	0.3223	0.3544	0.303
	Min	0.002	0.0026	0.0001	0.0004	0.0001	0.0012	0.0016	0.0041	0.0116	0.009	0.0153	0.0045
TOT N MG N/L	Avg	0.390	0.373	0.239	0.315	0.246	0.342	0.230[1]	0.423[1]	0.280[1]	0.425	0.410	0.405
	Max	0.420	0.440	0.440	0.610	0.310	0.660	18.1	17.0	16.8	0.590	0.500	0.640
	Min	0.360	0.319	0.124	0.0900	0.119	0.170	0.140	0.230	0.260	0.260	0.250	0.110
SAL. psu	Avg	29.8	31.4	33.8	36.3	37.8	35.1	35.2	34.1	29.5	25.1	24.6	27.2
	Max	35.0	37.4	38.6	39.8	41.1	40.5	40.1	38.0	37.9	34.1	32.1	32.8
	Min	23.6	26.1	26.4	31.3	33.8	28.7	27.2	26.8	18.6	15.5	18.9	20.3
TOC mg/L	Avg	3.64	3.90	4.17	3.48	4.03	4.32	5.37	4.64	5.05	4.20	4.20	4.11
	Max	4.74	4.95	7.45	6.06	7.27	6.08	9.42	7.06	9.14	5.71	6.43	6.11
	Min	2.90	2.68	2.20	2.62	2.42	2.89	2.23	2.62	2.80	2.54	2.86	3.10
AlkPO4 nM/minmL	Avg	0.18	0.38	0.20	0.25	0.32	0.41	0.40	0.36	0.31	0.34	0.27	0.27
	Max	0.29	1.5	0.35	0.38	0.46	0.88	0.90	0.58	0.65	0.78	0.49	0.56
	Min	0.10	0.12	0.11	0.12	0.15	0.20	0.18	0.21	0.14	0.15	0.13	0.14

Table 2.3-31 (Sheet 13 of 36)
Biscayne Bay Water Quality

Sample Location BISC 122 – Average, Maximum and Minimum Monthly Results for 1993-2010													
Depth ≥ 1 m													
Parameters[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEMP. Deg. C	Avg	18.7	22.1	23.5	25.5	28.3	29.0	30.5	30.5	29.5	27.1	23.3	21.2
	Max	23.8	23.9	28.6	28.4	30.7	32.5	33.1	32.7	32.3	29.8	26.6	26.0
	Min	9.4	18.6	18.0	20.7	25.9	26.7	29.0	27.6	27.5	23.3	18.7	12.2
D.O. mg/L	Avg	7.4	7.0	6.9	6.7	6.4	6.2	6.0	5.5	5.9	6.3	7.4	7.2
	Max	9.3	8.3	8.9	7.5	7.8	7.4	8.1	7.6	7.6	8.1	9.5	9.3
	Min	3.8	2.6	4.2	5.9	5.3	5.0	3.7	4.4	3.9	4.9	6.5	6.2
PH UNITS	Avg	7.99	8.01	8.23	8.13	ND	8.28	8.00	8.07	8.00	8.12	8.05	8.18
	Max	7.99	8.01	8.23	8.13	ND	8.28	8.00	8.07	8.00	8.12	8.05	8.18
	Min	7.99	8.01	8.23	8.13	ND	8.28	8.00	8.07	8.00	8.12	8.05	8.18
SAL. psu	Avg	28.4	30.2	32.8	36.0	37.1	34.7	34.3	33.7	31.0	26.2	24.6	26.3
	Max	31.2	36.0	36.5	39.7	40.4	40.5	40.1	37.8	37.9	33.6	28.2	31.2
	Min	24.2	26.6	27.9	31.2	34.8	30.6	27.2	26.8	19.4	15.5	21.0	22.0

Table 2.3-31 (Sheet 14 of 36)
Biscayne Bay Water Quality

Sample Location BISC 123 – Average, Maximum and Minimum Monthly Results for 1993-2010													
Depth < 1 m													
Parameters[2]		**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
TEMP. Deg. C	**Avg**	18.8	21.5	22.2	25.0	27.8	29.2	30.5	30.1	29.0	27.1	23.0	20.6
	Max	23.6	25.6	28.5	28.1	30.3	32.6	32.4	32.0	31.9	32.7	26.1	26.6
	Min	9.52	18.2	17.9	20.8	24.8	26.9	28.9	27.7	27.5	23.3	18.6	12.3
D.O. mg/L	**Avg**	7.4	6.2	6.2	6.4	6.2	5.8	5.4	5.6	6.1	6.3	7.1	7.5
	Max	9.0	8.1	7.2	7.6	7.1	7.1	6.3	7.8	6.9	7.9	8.5	9.1
	Min	3.9	2.7	3.9	4.3	4.7	4.5	3.4	4.4	5.4	5.2	5.7	6.2
PH UNITS	**Avg**	8.01	8.15	8.14	7.95	8.27	8.15	8.15	8.12	7.80	8.08	8.04	8.09
	Max	8.20	8.38	8.40	8.40	8.35	8.40	8.50	8.70	8.10	8.40	8.20	8.22
	Min	7.95	8.02	8.00	7.50	8.10	8.00	7.99	7.90	6.41	7.94	7.97	7.90
TURB. NTU	**Avg**	1.0	0.79	0.76	0.92	0.66	0.64	0.78	0.65	0.78	0.91	1.1	0.90
	Max	2.7	2.1	1.9	3.0	2.1	1.9	1.6	1.9	1.5	2.5	4.0	3.2
	Min	0.10	0.20	0.13	0.20	0.30	0.20	0.40	0.10	0.20	0.20	0.20	0.15
NOX mg/L	**Avg**	0.0522	0.0385	0.0139	0.00850	0.0104	0.0461	0.0244	0.0217	0.0630	0.126	0.0817	0.0598
	Max	0.120	0.2404	0.0451	0.0135	0.0183	0.164	0.106	0.0489	0.154	0.652	0.170	0.224
	Min	0.00620	0.00420	0.00430	0.00290	0.00170	<0.0100	0.00120	<0.0100	0.0200	0.0150	0.0266	0.0112
NO2 mg/L	**Avg**	0.0022	0.0020	0.0013	0.0011	0.0013	0.0028	0.0025	0.0027	0.0037[1]	0.0051	0.0036	0.0027
	Max	0.0033	0.0036	0.0035	0.0026	0.0020	0.0050	0.0057	0.0040	8.0	0.019	0.010	0.0078
	Min	0.0011	0.00090	0.00040	0.00050	<0.00030	0.0013	0.0011	0.0017	0.0015	0.0016	0.0014	0.0001
NH4 mg/L	**Avg**	0.0137	0.0271	0.0181	0.0119	0.0213	0.0387	0.0227	0.0355	0.0406	0.037	0.0324	0.0288
	Max	0.0280	0.0900	0.0800	0.0500	0.110	0.120	0.0453	0.120	0.0913	0.0900	0.110	0.0900
	Min	0.00750	0.00460	0.00370	0.00430	0.00630	0.00950	0.00250	0.00960	0.0130	0.00800	0.00680	0.00470
TKN mg/L	**Avg**	0.16	0.14	0.10	0.16	0.12	0.14	0.23	0.083	0.18	0.17	0.21	0.16
	Max	0.23	0.18	0.14	0.24	0.15	0.25	0.53	0.090	0.39	0.27	0.27	0.27
	Min	<0.080	0.12	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	0.16	<0.080
OPO4 mg/L	**Avg**	0.0014	0.0011	0.0012	0.0014	0.0010	0.0015	0.0011	0.0020	0.0016	0.0013	0.0014	0.0015
	Max	0.0031	0.0020	<0.0020	0.0021	<0.0020	<0.0020	0.0029	0.0061	0.0032	<0.0020	0.0032	0.0022
	Min	0.00020	0.00010	0.00010	0.00020	0.00020	0.00030	0.00010	0.00020	0.00040	0.00020	0.00020	0.00020
TPO4 mg/L	**Avg**	0.0045	0.0036	0.0033	0.0042	0.0048	0.0051	0.0055	0.0055	0.0062	0.0051	0.0054	0.0052
	Max	0.0082	0.0060	0.0052	0.015	0.0083	0.011	0.015	0.0090	0.019	0.010	0.012	0.012
	Min	<0.0020	0.0020	<0.0020	0.0019	<0.0020	<0.0020	0.0017	0.0033	0.0021	<0.0020	0.002	<0.0020
SIO2 mg/L	**Avg**	0.083	ND	0.017	0.025	0.035	ND	0.096	0.042	ND	0.067	<0.0020	ND
	Max	0.31	ND	0.017	0.043	0.059	ND	0.181	0.042	ND	0.12	<0.0020	ND
	Min	0.0090	ND	0.017	0.016	0.022	ND	0.036	0.042	ND	0.018	<0.0020	ND
CHLOR A mg/M3	**Avg**	0.3	0.4	0.4	0.3	0.3	0.5	0.3	0.3	0.3	0.5	0.4	0.3
	Max	<1	1	<1	<1	1	2	0.6	0.5	0.5	1	<1	<1
	Min	0.1	0.1	<0.1	0.1	<0.1	0.2	0.1	0.2	0.1	<0.1	0.1	0.1
NO3 mg/L	**Avg**	0.0499	0.0448	0.0118	0.00830	0.00950	0.0472	0.0271	0.0212	0.0634	0.105	0.0630	0.0593
	Max	0.117	0.2368	0.0417	0.0174	0.0163	0.159	0.100	0.0465	0.147	0.633	0.109	0.216
	Min	0.00470	0.00320	0.00390	0.00220	0.000700	0.0109	0.00450	0.00880	0.0176	0.0100	0.0250	0.00980
TOT N MG N/L	**Avg**	0.34	0.36	0.21	0.29	0.21	0.30	0.23[1]	0.32[1]	0.33[1]	0.29	0.26	ND
	Max	0.34	0.40	0.40	0.59	0.28	0.67	18	21	17	0.37	0.34	ND
	Min	0.33	0.32	0.11	0.12	0.13	0.12	0.17	0.22	0.28	0.21	0.16	ND
SAL. psu	**Avg**	32.3	33.0	34.6	37.2	38.1	35.4	35.2	35.2	32.4	28.8	28.7	30.4
	Max	36.7	38.2	39.2	40.3	40.3	40.1	39.7	38.2	37.0	35.3	34.6	34.3
	Min	28.2	28.4	29.6	32.8	35.5	28.9	26.2	29.2	24.2	22.5	24.4	21.2
TOC mg/L	**Avg**	3.21	3.17	3.68	3.05	3.31	3.27	4.70	3.65	3.65	4.34	3.38	3.51
	Max	3.96	4.00	6.52	5.29	5.71	5.00	10.53	6.26	5.27	10.40	5.38	5.28
	Min	2.41	2.57	1.90	1.89	1.80	2.54	1.94	2.10	2.12	1.64	2.49	2.76
AlkPO4 nM/minmL	**Avg**	0.10	0.20	0.13	0.14	0.17	0.22	0.25	0.18	0.16	0.16	0.14	0.11
	Max	0.14	0.75	0.26	0.24	0.25	0.28	0.44	0.23	0.29	0.23	0.23	0.14
	Min	0.040	0.083	0.070	0.069	0.11	0.15	0.15	0.067	0.080	0.070	0.080	0.060

Table 2.3-31 (Sheet 15 of 36)
Biscayne Bay Water Quality

Sample Location BISC 123 – Average, Maximum and Minimum Monthly Results for 1993-2010													
Depth ≥ 1 m													
Parameters[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEMP. Deg. C	**Avg**	18.5	21.5	23.0	25.5	28.0	28.9	30.3	30.1	29.4	27.0	23.2	21.5
	Max	23.0	23.8	28.5	28.1	30.3	32.5	32.5	31.8	32.0	29.0	26.1	26.5
	Min	9.52	18.2	18.3	20.7	25.7	27.0	29.0	27.7	27.7	23.4	18.9	12.8
D.O. mg/L	**Avg**	7.2	6.8	6.5	6.5	6.1	5.6	5.5	5.6	5.8	5.9	7.0	7.0
	Max	8.8	8.0	7.3	8.0	8.5	7.1	6.2	7.9	7.2	6.9	8.9	8.8
	Min	3.8	3.1	3.9	5.8	4.8	4.4	4.4	4.7	4.5	5.2	6.2	6.0
PH UNITS	**Avg**	7.96	8.04	8.14	8.11	ND	8.12	7.97	8.11	7.94	7.99	7.99	8.14
	Max	7.96	8.04	8.14	8.11	ND	8.12	7.97	8.11	7.94	7.99	7.99	8.14
	Min	7.96	8.04	8.14	8.11	ND	8.12	7.97	8.11	7.94	7.99	7.99	8.14
SAL. psu	**Avg**	31.0	32.2	33.7	36.6	37.7	35.1	34.2	34.5	32.5	30.0	29.1	30.3
	Max	34.0	36.0	37.3	40.3	40.3	39.4	39.7	38.2	37.0	35.2	34.6	33.6
	Min	28.2	28.8	29.6	32.8	35.5	30.8	26.2	29.2	24.2	25.1	24.4	25.8

Table 2.3-31 (Sheet 16 of 36)
Biscayne Bay Water Quality

Sample Location BISC 124 – Average, Maximum and Minimum Monthly Results for 1993-2010

Depth < 1 m

Parameters[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEMP. Deg. C	Avg	19.4	21.0	23.1	25.3	27.3	28.6	30.7	30.5	29.2	27.0	23.9	22.3
	Max	23.1	23.9	28.0	27.4	30.3	31.1	31.8	32.0	31.2	29.0	26.0	25.7
	Min	14.4	18.2	19.1	20.7	24.9	27.2	28.7	28.4	28.2	23.8	20.6	18.2
D.O. mg/L	Avg	7.1	7.0	6.7	6.5	6.4	6.1	5.5	5.7	5.7	6.0	6.6	7.1
	Max	8.5	8.0	8.0	7.2	7.7	8.1	6.2	6.5	6.5	7.3	7.2	9.0
	Min	4.3	6.1	4.2	5.8	5.2	5.2	3.9	5.0	5.0	5.2	5.9	6.3
PH UNITS	Avg	8.21	8.25	8.18	7.76	8.30	8.26	8.23	8.25	8.02	8.10	8.04	8.00
	Max	8.60	8.35	8.40	8.50	8.40	8.60	8.40	8.90	8.10	8.40	8.20	8.10
	Min	8.02	8.10	8.06	7.20	8.20	8.10	8.10	8.00	7.90	7.95	7.90	7.90
TURB. NTU	Avg	0.99	0.90	0.92	0.83	0.58	0.83	0.90	0.66	0.87	1.02	0.91	0.89
	Max	2.5	2.1	3.0	2.8	1.0	1.6	1.9	1.4	1.5	2.0	1.7	2.0
	Min	0.10	0.20	0.30	0.30	0.20	0.30	0.60	0.10	0.30	0.60	0.20	0.30
NOX mg/L	Avg	0.00640	0.00710	0.00390	0.00390	0.00260	0.01990	0.00840	0.01030	0.00780	0.0139	0.0149	0.0221
	Max	0.0261	0.0139	0.0102	0.0176	0.00610	0.126	0.0258	0.0241	0.0183	0.0387	0.0508	0.0941
	Min	0.00210	0.000600	0.000500	0.000800	0.000700	0.00300	0.000800	0.00250	0.00130	0.00300	0.00150	0.00290
NO2 mg/L	Avg	0.0010	0.0011	0.0012	0.00070	0.00070	0.0012	0.0011	0.0015	0.0014[1]	0.0015	0.0017	0.0014
	Max	0.0021	0.0022	0.0032	0.0017	0.0015	0.0034	0.0025	0.0024	8.0	0.0040	0.0060	0.0038
	Min	0.00040	0.00040	0.00010	0.00020	<0.00030	0.00060	0.00040	0.00020	0.00040	0.00060	0.00010	<0.00030
NH4 mg/L	Avg	0.0114	0.0122	0.00880	0.00920	0.0121	0.0203	0.0208	0.0264	0.0367	0.0240	0.0250	0.0223
	Max	0.0222	0.0250	0.0212	0.0174	0.0178	0.0359	0.0324	0.0367	0.120	0.0390	0.0541	0.0593
	Min	0.00270	0.00290	0.00310	0.00460	0.00540	0.0105	0.00110	0.0117	0.0203	0.00750	0.00350	0.00350
TKN mg/L	Avg	0.171	0.171	ND	ND	ND	ND	ND	ND	0.142	0.176	0.289	0.236
	Max	0.171	0.171	ND	ND	ND	ND	ND	ND	0.142	0.176	0.289	0.236
	Min	0.171	0.171	ND	ND	ND	ND	ND	ND	0.142	0.176	0.289	0.236
OPO4 mg/L	Avg	0.00070	0.0010	0.00090	0.0010	0.00050	0.0012	0.0011	0.0017	0.0014	0.00090	0.00090	0.0011
	Max	0.0010	0.0026	<0.0016	0.002	0.0019	0.0028	0.0034	0.0058	0.0034	0.0018	0.0019	0.0026
	Min	0.00010	0.00020	0.00020	0.00020	0.00010	0.00020	0.00010	0.00030	0.00030	0.00030	0.00020	0.00020
TPO4 mg/L	Avg	0.0045	0.0042	0.0032	0.0043	0.0046	0.0050	0.0056	0.0056	0.0053	0.0049	0.0053	0.0061
	Max	0.0073	0.0060	0.0047	0.010	0.0098	0.010	0.012	0.012	0.015	0.0080	0.011	0.017
	Min	0.0022	0.0021	0.00090	0.0018	0.0021	0.0025	0.0019	0.0036	0.0020	0.0028	0.0030	0.0026
SIO2 mg/L	Avg	0.0100	ND	ND	0.00940	0.0215	ND	0.0710	0.0520	ND	0.0268	<0.00200	ND
	Max	0.0190	ND	ND	0.0130	0.0460	ND	0.103	0.0520	ND	0.0610	<0.00200	ND
	Min	0.00190	ND	ND	0.00310	0.0110	ND	0.0330	0.0520	ND	0.00500	<0.00200	ND
CHLOR A mg/M3	Avg	0.2	0.3	0.3	0.2	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.3
	Max	0.7	1	1	0.9	1	0.6	0.4	0.4	1	0.8	0.8	0.8
	Min	0.1	<0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.1	<0.1	0.2	0.2
NO3 mg/L	Avg	0.00570	0.00600	0.00230	0.00280	0.00200	0.0153	0.00760	0.00820	0.00610	0.00970	0.0118	0.0170
	Max	0.0253	0.0129	0.00920	0.0177	0.00550	0.123	0.0234	0.0217	0.0152	0.0338	0.0482	0.0903
	Min	0.00130	0.000600	0.000400	0.000500	0.000400	0.00120	0.00260	0.00190	0.000200	0.000500	0.000200	0.00190
TOT N MG N/L	Avg	0.28	0.33	0.20	0.31	ND	ND	0.23[1]	0.30[1]	0.25[1]	0.20	0.18	0.16
	Max	0.28	0.33	0.35	0.54	ND	ND	17	15	17	0.28	0.25	0.26
	Min	0.28	0.33	0.08	0.11	ND	ND	0.15	0.20	0.15	0.12	0.10	0.07
SAL. psu	Avg	34.0	35.0	36.3	37.6	37.9	36.6	36.1	35.9	35.3	33.7	33.6	33.8
	Max	36.5	37.2	37.9	39.3	39.2	40.7	40.6	38.3	37.6	36.8	37.1	36.6
	Min	24.5	32.1	32.4	35.2	36.1	31.6	31.4	31.0	29.7	30.6	31.0	28.0
TOC mg/L	Avg	2.66	2.69	2.48	2.83	2.82	3.49	4.19	3.38	2.90	2.79	2.62	2.80
	Max	3.44	3.27	4.33	4.75	4.06	5.33	11.98	4.49	4.20	3.91	4.34	3.77
	Min	2.09	1.79	1.80	1.86	1.97	2.48	2.39	2.12	1.47	1.18	1.46	2.11
AlkPO4 nM/minmL	Avg	0.068	0.18	0.11	0.13	0.18	0.22	0.25	0.23	0.17	0.16	0.11	0.086
	Max	0.090	0.78	0.14	0.20	0.23	0.32	0.43	0.37	0.30	0.23	0.20	0.16
	Min	0.040	0.070	0.070	0.070	0.120	0.170	0.148	0.141	0.080	0.060	0.060	0.040

**Table 2.3-31 (Sheet 17 of 36)
Biscayne Bay Water Quality**

Sample Location BISC 124 – Average, Maximum and Minimum Monthly Results for 1993-2010													
Depth ≥ 1 m													
Parameters[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEMP. Deg. C	Avg	19.3	20.9	23.2	25.6	27.8	29.0	30.6	30.4	29.4	27.1	23.5	22.4
	Max	23.1	23.9	28.0	27.3	30.3	31.2	31.5	32.0	31.3	29.0	26.0	26.0
	Min	14.2	17.9	19.2	20.7	25.1	27.5	28.8	28.4	28.4	23.8	20.6	18.7
D.O. mg/L	Avg	6.9	7.1	6.7	6.4	6.5	6.2	5.6	5.7	5.6	5.8	6.5	6.8
	Max	8.2	8.1	8.5	6.9	8.2	8.6	6.3	6.5	6.2	6.8	7.5	7.4
	Min	3.8	6.1	4.3	5.7	5.2	5.3	4.0	5.2	4.9	5.2	6.2	6.3
SAL. psu	Avg	34.2	34.7	36.0	37.4	37.8	36.7	35.7	35.2	34.6	33.3	33.1	33.3
	Max	36.1	37.2	37.8	39.3	39.2	40.7	40.7	38.8	37.6	36.9	36.2	35.7
	Min	31.6	32.1	32.4	35.2	36.0	34.5	31.4	31.0	29.7	30.6	31.0	28.0

Table 2.3-31 (Sheet 18 of 36)
Biscayne Bay Water Quality

Sample Location BISC 135 – Average, Maximum and Minimum Monthly Results for 1993-2010													
Depth < 1 m													
Parameters[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEMP. Deg. C	Avg	19.7	21.9	23.3	25.0	27.6	28.8	30.8	30.7	29.5	26.7	23.8	22.3
	Max	22.9	25.8	28.4	27.9	29.6	31.1	32.0	31.8	31.6	28.9	26.3	24.6
	Min	16.0	19.1	19.9	21.4	25.1	27.3	29.5	28.7	28.1	23.8	20.8	18.5
D.O. mg/L	Avg	7.2	7.2	6.7	6.6	6.4	6.0	5.8	5.6	6.0	6.6	6.8	7.4
	Max	8.1	9.0	8.1	7.7	8.0	6.7	6.3	6.6	8.3	7.9	7.4	8.8
	Min	4.1	6.3	4.2	5.9	5.3	5.3	4.7	4.8	4.8	5.2	6.1	6.8
PH UNITS	Avg	8.14	8.20	8.17	7.90	8.28	8.15	8.23	8.16	7.94	8.07	8.00	8.00
	Max	8.80	8.37	8.50	8.40	8.40	8.30	8.50	8.70	8.10	8.40	8.20	8.19
	Min	7.90	8.10	8.03	7.10	8.20	8.00	8.08	8.00	7.80	7.90	7.90	7.88
TURB. NTU	Avg	0.37	0.44	0.45	0.68	0.39	0.52	0.42	0.37	0.61	1.00	0.81	0.66
	Max	0.70	0.74	0.80	1.4	0.61	1.1	1.1	1.1	1.8	2.3	3.2	2.1
	Min	0.10	0.20	0.20	0.10	0.10	0.20	0.10	0.10	0.20	0.20	0.10	0.10
NOX mg/L	Avg	0.0056	0.00930	0.00530	0.00460	0.00420	0.0117	0.0238	0.00840	0.0112	0.0516	0.0475	0.0199
	Max	0.0139	0.0396	0.0145	0.0109	0.00610	0.0254	0.140	0.0208	0.0179	0.123	0.125	0.0476
	Min	0.00190	0.000900	0.000600	0.000800	0.00130	0.00400	0.00090	0.00220	0.00200	0.00320	0.00580	0.00790
NO2 mg/L	Avg	0.0013	0.0016	0.0010	0.0009	0.0011	0.0020	0.0014	0.0018	0.0022[1]	0.0046	0.0045	0.0026
	Max	<0.0020	0.0039	<0.0020	0.0020	<0.0020	0.0036	0.0031	0.0029	8.0	0.0079	0.0096	0.0054
	Min	0.00070	0.00060	0.00030	0.00030	<0.00030	0.00030	0.00080	0.00040	0.00100	0.00070	0.0014	0.00020
NH4 mg/L	Avg	0.0100	0.00980	0.00710	0.00690	0.00930	0.0209	0.0110	0.0167	0.0241	0.0314	0.0242	0.0147
	Max	0.0185	0.0280	0.0106	0.0092	0.0213	0.0475	0.0138	0.0313	0.0724	0.0706	0.0503	0.0273
	Min	0.00490	0.00290	0.00450	0.00390	0.00440	0.00680	<0.000800	0.00790	0.01000	0.00670	0.00850	0.00530
TKN mg/L	Avg	0.28	0.21	0.22	0.27	0.2	0.43	0.62	0.46	0.49	0.37	0.31	0.3
	Max	0.28	0.21	0.22	0.27	0.2	0.43	0.62	0.46	0.49	0.37	0.31	0.3
	Min	0.28	0.21	0.22	0.27	0.2	0.43	0.62	0.46	0.49	0.37	0.31	0.3
OPO4 mg/L	Avg	0.00070	0.0012	0.0014	0.0026	0.0011	0.0012	0.0023	0.0017	0.0024	0.0018	0.00090	0.0015
	Max	<0.002	<0.0020	<0.0020	0.0090	<0.0020	0.0026	0.0047	0.0052	0.0041	0.0047	<0.0020	0.0042
	Min	0.00020	0.00030	0.00020	0.00020	0.00020	0.00030	0.00090	0.00010	0.0010	0.00020	0.00020	0.00010
TPO4 mg/L	Avg	0.0049	0.0041	0.0037	0.0077	0.0083	0.0078	0.0085	0.0062	0.0053	0.0057	0.0057	0.0055
	Max	0.0077	0.0056	0.0059	0.013	0.025	0.015	0.024	0.013	0.013	0.016	0.012	0.015
	Min	<0.0020	0.0028	0.0018	0.0029	0.0038	0.0038	0.0030	0.0028	0.0028	0.0020	0.0030	0.0020
SIO2 mg/L	Avg	0.023	ND	0.0080	0.031	0.048	ND	0.12	0.070	ND	0.096	0.024	ND
	Max	0.040	ND	0.0080	0.074	0.067	ND	0.27	0.070	ND	0.26	0.024	ND
	Min	0.0040	ND	0.0080	0.011	0.024	ND	0.040	0.070	ND	0.0010	0.024	ND
CHLOR A mg/M3	Avg	0.4	0.4	0.4	0.3	0.4	0.5	0.3	0.5	0.3	0.6	0.6	0.5
	Max	<1	1	1	<1	1	1	0.6	0.9	0.8	2	1	<1
	Min	0.1	<0.1	<0.1	0.2	0.1	0.1	0.2	0.2	0.1	0.2	0.3	0.2
NO3 mg/L	Avg	0.00410	0.00720	0.00420	0.00320	0.00320	0.00830	0.0230	0.00700	0.0110	0.0456	0.0407	0.0171
	Max	0.0130	0.0357	0.0126	0.0106	0.00530	0.0226	0.140	0.0203	0.0161	0.116	0.119	0.0422
	Min	0.000900	0.000100	0.000100	0.000300	0.000500	0.000700	0.000800	0.00130	0.00810	0.00240	0.00440	0.00570
TOT N MG N/L	Avg	0.32	0.33	0.21	0.28	0.24	0.24	0.27[1]	0.29[1]	0.37[1]	0.31	0.33	ND
	Max	0.32	0.36	0.32	0.56	0.32	0.50	13	22	15	0.42	0.50	ND
	Min	0.31	0.31	0.11	0.13	0.17	0.13	0.24	0.21	0.22	0.20	0.22	ND
SAL. psu	Avg	32.2	33.0	34.5	36.2	37.3	35.1	34.5	34.1	33.2	29.2	28.8	30.2
	Max	34.7	36.3	37.8	38.7	39.9	40.2	40.8	39.9	39.7	37.7	35.2	34.7
	Min	28.9	24.1	27.8	31.9	31.2	30.1	26.0	29.7	28.5	22.9	21.9	23.5
TOC mg/L	Avg	3.58	3.65	3.32	3.57	3.60	4.58	5.23	5.03	5.43	4.94	4.21	3.90
	Max	5.19	4.73	3.85	4.43	4.41	6.67	7.38	99.00	6.59	8.87	6.05	4.58
	Min	2.75	2.97	2.99	2.90	2.50	3.46	3.15	4.19	4.19	3.10	3.14	3.40
AlkPO4 Nm/minmL	Avg	0.083	0.21	0.11	0.13	0.17	0.17	0.20	0.18	0.15	0.15	0.11	0.092
	Max	0.12	0.80	0.22	0.21	0.28	0.24	0.31	0.26	0.21	0.25	0.17	0.14
	Min	0.050	0.080	0.080	0.080	0.11	0.10	0.11	0.13	0.030	0.080	0.080	0.050

Table 2.3-31 (Sheet 19 of 36) Biscayne Bay Water Quality

Sample Location BISC 135 – Average, Maximum and Minimum Monthly Results for 1993-2010													
Depth ≥ 1 m													
Parameters[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEMP. Deg. C	Avg	18.9	21.4	23.6	25.0	27.7	29.0	30.6	30.8	30.2	26.7	23.3	21.9
	Max	22.8	24.3	28.4	28.4	29.3	31.1	31.8	33.1	31.9	29.2	26.5	25.0
	Min	15.9	18.4	19.8	21.3	25.1	27.8	29.5	28.7	28.7	23.8	20.8	19.0
D.O. mg/L	Avg	7.0	7.6	6.7	6.4	6.7	5.7	5.9	5.6	5.1	5.9	7.0	7.0
	Max	8.2	9.5	8.3	7.6	8.4	7.1	7.2	6.6	6.3	7.0	8.9	7.5
	Min	3.6	6.5	4.2	5.9	5.4	4.8	4.7	4.6	3.3	4.3	6.3	6.8
SAL. psu	Avg	31.4	33.1	33.8	35.4	37.1	35.4	34.6	34.5	34.5	30.9	29.2	31.6
	Max	33.5	36.0	35.4	38.2	38.5	40.2	40.9	39.9	39.7	37.7	35.1	34.4
	Min	28.9	31.3	28.4	31.9	33.3	32.3	29.4	30.9	29.9	25.2	23.3	28.8

Table 2.3-31 (Sheet 20 of 36)
Biscayne Bay Water Quality

Sample Location BISC 111 – Average, Maximum and Minimum Monthly Results for 1993-2010

Depth < 1 m

Parameters[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEMP. Deg. C	Avg	20.0	22.1	23.0	25.4	27.6	28.9	30.7	30.5	29.3	27.3	23.8	22.1
	Max	24.4	26.6	28.1	27.8	30.2	31.2	31.5	32.0	31.5	30.0	26.1	25.9
	Min	13.5	19.1	19.5	20.7	24.9	27.3	28.8	28.2	28.1	22.9	20.9	17.8
D.O. mg/L	Avg	7.2	6.7	6.8	6.6	6.4	6.2	5.7	5.4	5.5	6.3	6.5	7.0
	Max	8.7	7.7	8.3	7.6	7.8	9.3	7.7	6.2	8.5	7.8	7.1	9.5
	Min	4.8	5.4	4.1	5.4	5.2	5.1	4.2	4.9	4.0	4.7	5.2	6.3
PH UNITS	Avg	8.14	8.23	8.26	7.99	8.32	8.24	8.28	8.19	7.94	8.05	8.02	8.02
	Max	8.60	8.37	8.50	8.50	8.50	8.50	8.50	8.80	8.10	8.30	8.20	8.15
	Min	8.00	8.10	8.10	7.30	8.20	8.10	8.13	8.00	7.88	7.95	7.90	7.90
TURB. NTU	Avg	1.0	0.93	0.89	0.91	0.74	0.75	0.78	0.68	1.1	1.0	2.1	1.6
	Max	2.2	2.0	3.9	2.2	1.8	1.4	1.5	1.4	3.5	4.9	19	12
	Min	0.10	0.10	0.30	0.28	0.40	0.40	0.32	0.20	0.50	0.20	0.30	0.11
NOX mg/L	Avg	0.0023	0.0047	0.003	0.0039	0.0032	0.020	0.0092	0.0048	0.014	0.023	0.0078	0.014
	Max	0.0051	0.014	0.0060	0.011	<0.0050	0.13	0.034	0.0101	0.039	0.22	0.027	0.082
	Min	0.00040	0.00090	0.0013	0.00070	0.00090	0.0030	0.00070	0.00090	0.0028	0.0016	0.0025	0.00060
NO2 mg/L	Avg	0.00090	0.00090	0.0010	0.00080	0.0010	0.0020	0.0014	0.0015	0.0022[1]	0.0019	0.0016	0.0014
	Max	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0055	0.0029	0.0021	8.0	0.0080	0.0029	0.0042
	Min	0.00030	0.00010	0.00020	<0.00030	<0.00030	0.0012	0.00040	0.00050	0.0012	0.00010	0.00010	<0.00030
NH4 mg/L	Avg	0.0057	0.0067	0.0061	0.0064	0.0081	0.013	0.012	0.013	0.021	0.024	0.0081	0.0093
	Max	0.011	0.013	0.021	0.014	0.015	0.048	0.025	0.021	0.091	0.11	0.011	0.029
	Min	0.0024	0.0020	<0.00080	0.0029	0.0038	0.0041	0.0027	0.0062	0.0093	0.0029	0.0030	0.0023
TKN mg/L	Avg	0.12	0.13	0.090	0.18	0.16	0.19	0.33	0.17	0.17	0.11	0.15	0.20
	Max	0.14	0.17	0.090	0.18	0.16	0.19	0.33	0.17	0.21	0.16	0.16	0.28
	Min	0.090	0.090	0.090	0.18	0.16	0.19	0.33	0.17	0.13	<0.080	0.15	0.11
OPO4 mg/L	Avg	0.00070	0.0010	0.00120	0.0011	0.0010	0.0010	0.0011	0.0012	0.0015	0.0013	0.00090	0.0011
	Max	<0.0020	<0.0020	0.0024	0.0025	<0.0020	0.0033	0.0043	0.0022	0.0037	<0.0020	<0.0020	0.0030
	Min	0.00020	0.00020	0.00020	0.00020	0.00020	0.00010	0.00010	0.00020	0.00020	0.00020	0.00010	0.00010
TPO4 mg/L	Avg	0.0052	0.0049	0.0037	0.0046	0.0047	0.0053	0.0062	0.0056	0.0055	0.0048	0.0057	0.0061
	Max	0.0089	0.009	0.0064	0.016	0.0099	0.012	0.013	0.014	0.019	0.012	0.012	0.014
	Min	0.0025	0.0020	0.0020	0.0022	0.0029	0.0030	0.0016	0.0030	0.0018	<0.0020	0.0020	0.0020
SIO2 mg/L	Avg	0.0062	ND	0.017	0.013	0.038	ND	0.049	0.021	ND	0.027	0.0060	ND
	Max	0.017	ND	0.017	0.017	0.060	ND	0.086	0.021	ND	0.080	0.0060	ND
	Min	0.0017	ND	0.017	0.0020	0.014	ND	0.020	0.021	ND	0.0010	0.0060	ND
CHLOR A mg/M3	Avg	0.3	0.4	0.4	0.3	0.3	0.3	0.2	0.3	0.3	0.4	0.4	0.3
	Max	<1	<1	<1	<1	<1	1	0.4	0.4	1	<1	<1	<1
	Min	0.1	<0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	<0.	0.1	0.1
NO3 mg/L	Avg	0.0020	0.0034	0.0021	0.0033	0.0021	0.015	0.0083	0.0039	0.012	0.023	0.0060	0.014
	Max	<0.0050	0.014	0.0060	0.011	<0.0050	0.13	0.031	0.0086	0.036	0.21	0.025	0.078
	Min	0.00010	0.00040	0.00020	0.00020	0.00030	0.00060	0.0011	0.0016	0.0015	0.00090	0.00010	0.00080
TOT N MG N/L	Avg	0.32	0.27	0.16	0.22	0.20	0.18	0.23[1]	0.33[1]	0.23[1]	0.26	0.24	0.16
	Max	0.40	0.27	0.34	0.38	0.30	0.33	18	27	16	0.35	0.43	0.32
	Min	0.24	0.27	0.07	0.09	0.10	0.10	0.16	0.19	0.16	0.17	0.10	0.060
SAL. psu	Avg	35.2	35.9	36.6	36.8	37.9	36.4	36.4	36.7	35.2	33.7	34.1	34.8
	Max	37.2	37.5	37.7	38.8	40.4	39.9	39.4	38.3	37.9	36.3	37.4	37.0
	Min	32.4	32.6	34.5	26.6	36.1	29.0	30.5	34.0	30.2	29.5	31.3	29.0
TOC mg/L	Avg	2.53	2.53	2.18	2.45	3.15	2.97	3.21	3.14	2.55	3.32	2.41	2.50
	Max	3.76	3.69	3.49	4.59	6.95	4.52	4.71	4.12	3.61	7.64	4.13	2.87
	Min	1.70	1.71	1.44	1.12	1.90	2.30	1.48	2.23	1.59	0.90	1.02	1.94
AlkPO4 Nm/minmL	Avg	0.066	0.16	0.099	0.12	0.14	0.18	0.19	0.17	0.13	0.12	0.089	0.079
	Max	0.081	0.77	0.20	0.21	0.19	0.26	0.36	0.22	0.24	0.19	0.15	0.12
	Min	0.040	0.044	0.060	0.080	0.10	0.12	0.11	0.078	0.040	0.050	0.050	0.030

Table 2.3-31 (Sheet 21 of 36)
Biscayne Bay Water Quality

Sample Location BISC 111 – Average, Maximum and Minimum Monthly Results for 1993-2010													
Depth ≥ 1 m													
Parameters[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEMP. Deg. C	Avg	19.1	21.6	23.2	25.6	27.9	29.0	30.5	30.5	29.4	27.2	23.4	22.2
	Max	24.4	24.6	28.0	27.8	30.2	31.2	31.5	32.1	31.5	29.9	25.4	25.9
	Min	13.5	19.1	19.4	20.7	25.3	27.3	28.8	28.2	28.1	22.9	20.9	17.8
D.O. mg/L	Avg	6.9	7.1	6.7	6.6	6.4	6.2	5.7	5.3	5.1	5.9	6.6	6.8
	Max	8.6	7.8	8.4	7.5	7.8	9.4	6.4	6.1	6.3	9.1	9.2	7.7
	Min	3.9	5.9	4.2	5.4	5.0	5.1	4.3	4.6	3.9	4.7	5.1	6.3
SAL. psu	Avg	34.5	35.5	36.1	37.3	37.5	36.1	36.2	36.1	35.1	33.5	33.9	33.8
	Max	35.9	37.5	37.7	38.9	38.8	39.4	39.4	38.2	37.4	36.2	36.1	36.2
	Min	32.4	33.2	34.5	36.0	36.0	32.4	30.5	34.1	30.2	30.0	32.2	29.0

Table 2.3-31 (Sheet 22 of 36)
Biscayne Bay Water Quality

Sample Location BISC 112 – Average, Maximum and Minimum Monthly Results for 1993-2010

Depth < 1 m

Parameters[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEMP. Deg. C	Avg	20.3	22.2	23.1	25.6	27.7	29.1	30.8	30.6	29.5	27.0	23.9	22.3
	Max	23.8	27.0	28.2	27.9	30.3	31.5	31.8	32.3	32.0	29.5	26.4	25.9
	Min	13.7	18.0	19.3	20.6	24.4	27.2	29.1	28.2	28.3	23.3	21.0	17.7
D.O. mg/L	Avg	7.1	6.8	6.8	6.7	6.3	6.2	5.3	5.4	5.3	5.9	6.6	7.2
	Max	8.3	7.6	8.6	7.8	8.0	10.2	7.1	7.7	6.9	7.7	8.5	9.7
	Min	4.6	5.9	4.7	5.3	5.0	5.0	3.8	4.0	3.7	4.7	5.7	5.7
PH UNITS	Avg	8.16	8.23	8.24	7.88	8.21	8.18	8.20	8.14	7.96	8.09	8.04	8.04
	Max	8.70	8.35	8.40	8.50	8.30	8.40	8.40	8.70	8.10	8.40	8.15	8.27
	Min	7.98	8.10	8.03	7.10	8.17	8.10	8.11	7.98	7.90	7.97	7.90	7.90
TURB. NTU	Avg	0.94	1.2	1.0	0.83	0.74	0.79	0.68	0.68	0.82	0.83	1.5	1.0
	Max	1.7	3.1	4.3	1.9	1.6	1.3	1.2	2.2	2.3	1.8	5.9	2.4
	Min	0.10	0.20	0.30	0.38	0.40	0.10	0.27	0.20	0.20	0.30	0.40	0.40
NOX mg/L	Avg	0.0015	0.0024	0.0025	0.0040	0.0025	0.029	0.0049	0.0047	0.0064	0.0030	0.0030	0.0043
	Max	0.0037	0.0082	0.0058	0.011	0.0045	0.206	0.011	0.022	0.019	0.0063	0.0082	0.018
	Min	0.00050	0.00070	0.0012	0.0018	0.00080	0.00040	0.00070	0.0012	0.0018	0.00070	0.00080	0.00040
NO2 mg/L	Avg	0.00060	0.00080	0.00080	0.00080	0.00070	0.0015	0.0011	0.0012	0.0013[1]	0.00070	0.00090	0.00080
	Max	0.0014	0.0017	0.0017	0.0017	0.0011	0.0049	0.0016	0.0021	8.0	0.0012	0.0020	0.0025
	Min	0.00010	0.00020	0.00010	<0.00030	<0.00030	0.00040	0.00070	0.00010	0.00060	<0.00030	0.00010	<0.00030
NH4 mg/L	Avg	0.0048	0.0075	0.0066	0.0063	0.0090	0.012	0.011	0.013	0.015	0.0076	0.0060	0.0069
	Max	0.010	0.019	0.022	0.016	0.017	0.033	0.022	0.023	0.045	0.012	0.015	0.017
	Min	0.0015	0.0021	0.00070	0.0029	0.0048	0.0041	0.0005	0.0050	0.0064	0.0035	0.0028	0.0012
TKN mg/L	Avg	0.153	0.155	ND	ND	ND	ND	ND	ND	0.159	0.132	0.175	0.105
	Max	0.153	0.155	ND	ND	ND	ND	ND	ND	0.159	0.132	0.175	0.105
	Min	0.153	0.155	ND	ND	ND	ND	ND	ND	0.159	0.132	0.175	0.105
OPO4 mg/L	Avg	0.0005	0.001	0.001	0.0009	0.0008	0.001	0.001	0.0008	0.0016	0.0008	0.0006	0.001
	Max	<0.0009	0.002	0.002	<0.002	0.001	0.003	0.004	0.002	0.004	0.002	0.001	0.004
	Min	0.0002	0.0002	0.0001	0.0001	0.0003	0.0002	0.0001	0.0002	0.0002	0.0001	0.0001	0.0001
TPO4 mg/L	Avg	0.0059	0.0051	0.0039	0.0050	0.0052	0.0069	0.0072	0.0061	0.0065	0.0067	0.0071	0.0069
	Max	0.010	0.0073	0.0063	0.012	0.0078	0.014	0.020	0.014	0.018	0.026	0.013	0.014
	Min	0.0033	0.0029	0.0025	0.0030	0.0027	0.0025	0.0021	0.0033	0.0026	0.0038	0.0040	0.0027
SIO2 mg/L	Avg	0.0057	ND	0.042	0.011	0.028	ND	0.033	0.022	ND	0.015	0.0040	ND
	Max	0.011	ND	0.042	0.0194	0.035	ND	0.063	0.022	ND	0.032	0.0040	ND
	Min	0.0010	ND	0.042	<0.0020	0.020	ND	0.0018	0.022	ND	0.0010	0.0040	ND
CHLOR A mg/M3	Avg	0.2	0.3	0.3	0.2	0.2	0.3	0.2	0.2	0.3	0.5	0.3	0.3
	Max	0.5	1	1	0.9	1	1	0.4	0.3	1	2	0.7	1
	Min	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	<0.1	0.2	0.2
NO3 mg/L	Avg	0.0010	0.0016	0.0018	0.0027	0.0016	0.024	0.004	0.0039	0.0048	0.0024	0.003	0.0032
	Max	0.0023	0.0081	0.0052	0.011	0.0036	0.20	0.0094	0.022	0.018	0.0052	0.010	0.010
	Min	0.00010	0.00020	0.00040	0.00040	0.00010	0.00070	0.00050	0.00060	0.00080	0.00010	0.00020	0.00030
TOT N MG N/L	Avg	0.28	0.29	0.16	0.21	0.20	0.15	0.23[1]	0.32[1]	0.18[1]	0.25	0.26	ND
	Max	0.30	0.29	0.28	0.44	0.28	0.28	15	30	15	0.32	0.38	ND
	Min	0.25	0.29	0.070	0.08	0.096	0.075	0.14	0.19	0.15	0.18	0.17	ND
SAL. psu	Avg	35.6	35.9	36.6	37.1	36.7	35.9	36.6	36.4	35.7	34.4	35.0	35.5
	Max	37.5	37.5	37.5	38.2	38.9	38.3	38.5	38.3	38.0	36.2	38.2	37.3
	Min	33.9	33.3	34.2	36.1	29.2	29.0	33.3	34.3	33.4	31.6	33.3	33.3
TOC mg/L	Avg	2.66	2.33	2.04	2.43	2.66	2.80	2.67	2.61	2.26	2.44	2.24	2.29
	Max	3.33	3.43	3.26	4.52	4.12	4.33	4.42	3.81	3.60	3.44	4.07	2.98
	Min	2.10	1.53	0.92	1.29	1.71	2.13	1.57	1.90	1.51	0.75	1.22	1.32
AlkPO4 Nm/minmL	Avg	0.055	0.13	0.071	0.090	0.12	0.13	0.14	0.15	0.11	0.10	0.074	0.065
	Max	0.10	0.540	0.090	0.19	0.17	0.19	0.26	0.21	0.17	0.18	0.11	0.10
	Min	0.020	0.044	0.040	0.050	0.070	0.056	0.087	0.087	0.040	0.070	0.040	0.040

Table 2.3-31 (Sheet 23 of 36)
Biscayne Bay Water Quality

Sample Location BISC 112 – Average, Maximum and Minimum Monthly Results for 1993-2010													
Depth ≥ 1 m													
Parameters[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEMP. Deg. C	Avg	19.4	21.6	23.1	25.7	28.1	29.0	30.6	30.4	29.6	27.1	23.4	22.2
	Max	23.7	24.3	28.2	27.9	30.4	31.4	31.9	32.3	32.0	29.6	26.1	25.9
	Min	13.7	18.1	19.3	20.6	25.7	27.1	29.1	28.2	28.3	23.3	21.0	17.8
D.O. mg/L	Avg	6.9	7.0	6.6	6.4	6.2	6.2	5.1	4.9	5.0	5.6	6.2	6.7
	Max	8.4	8.0	8.7	8.2	8.8	10.6	7.1	6.2	6.9	8.4	7.0	7.5
	Min	3.8	5.8	4.7	5.0	4.8	4.6	3.7	3.4	4.0	4.5	5.7	5.9
SAL. psu	Avg	35.1	35.8	36.0	37.2	37.0	35.6	36.1	35.8	35.3	34.3	34.7	35.0
	Max	36.1	37.5	37.1	38.3	38.4	38.9	38.1	37.9	36.9	36.0	36.1	36.8
	Min	33.9	34.0	34.2	36.1	36.0	29.3	33.3	34.3	33.7	31.6	33.3	33.3

Table 2.3-31 (Sheet 24 of 36)
Biscayne Bay Water Quality

Sample Location BISC 110 – Average, Maximum and Minimum Monthly Results for 1993-2010													
Depth < 1 m													
Parameters[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEMP. Deg. C	Avg	20.4	22.3	23.2	25.8	28.1	28.9	31.1	30.6	29.2	27.1	24.0	22.3
	Max	24.4	25.7	28.8	28.4	30.6	30.8	32.2	32.1	30.6	30.1	27.5	27.1
	Min	14.7	18.0	19.4	21.1	24.7	27.2	28.5	27.4	27.8	23.6	20.2	17.7
D.O. mg/L	Avg	7.3	6.9	6.5	6.8	6.4	6.3	5.8	5.6	6.0	6.5	7.1	7.2
	Max	8.2	8.6	8.1	8.5	7.9	9.9	8.1	6.3	8.5	7.7	8.4	8.3
	Min	3.9	5.1	4.1	4.6	4.6	5.0	2.5	4.9	5.0	5.2	6.5	6.5
PH UNITS	Avg	8.12	8.17	8.12	7.79	8.22	8.16	8.17	8.11	8.02	8.08	8.06	8.06
	Max	8.70	8.37	8.40	8.40	8.36	8.60	8.40	8.30	8.10	8.40	8.20	8.23
	Min	7.99	8.00	7.96	7.30	8.10	8.00	8.00	8.00	7.90	7.93	7.98	7.90
TURB. NTU	Avg	0.70	0.81	0.57	0.66	0.57	0.78	0.65	0.48	0.79	0.84	0.56	0.77
	Max	1.8	2.3	1.7	1.4	1.6	3.4	1.7	0.90	1.4	2.7	0.90	1.8
	Min	0.10	0.20	0.13	0.20	0.10	0.10	0.20	0.15	0.20	0.30	0.20	0.15
NOX mg/L	Avg	0.0607	0.0397	0.0324	0.0102	0.0103	0.133	0.0616	0.0496	0.141	0.114	0.0822	0.142
	Max	0.179	0.191	0.145	0.0517	0.0302	0.510	0.408	0.126	0.473	0.291	0.311	0.473
	Min	0.00700	0.00440	0.00160	0.00290	0.000800	0.00820	0.00230	0.00450	0.0240	0.00490	0.00550	0.00860
NO2 mg/L	Avg	0.0024	0.0021	0.0018	0.0014	0.0014	0.0055	0.0033	0.0031	0.0066[1]	0.0057	0.0040	0.0053
	Max	0.0051	0.0043	0.0049	0.0027	0.0028	0.018	0.011	0.0065	8.0	0.023	0.0091	0.015
	Min	0.0010	0.00060	0.00020	0.00070	<0.00030	0.0011	0.00070	0.0012	0.0025	0.00050	0.00010	0.00060
NH4 mg/L	Avg	0.0129	0.0139	0.0105	0.00850	0.0122	0.0293	0.0158	0.0222	0.0376	0.0319	0.0189	0.0254
	Max	0.0284	0.0265	0.0318	0.0247	0.0244	0.0805	0.0268	0.0336	0.0846	0.125	0.0494	0.0758
	Min	0.00660	0.00300	0.00130	0.00390	0.00600	0.00760	0.000400	0.00760	0.0120	0.00420	0.00790	0.00300
TKN mg/L	Avg	0.21	0.20	0.18	0.17	0.15	0.16	0.43	0.29	0.27	0.23	0.22	0.24
	Max	0.27	0.26	0.18	0.17	0.15	0.16	0.43	0.29	0.27	0.24	0.24	0.26
	Min	0.16	0.14	0.18	0.17	0.15	0.16	0.43	0.29	0.26	0.23	0.21	0.23
OPO4 mg/L	Avg	0.00090	0.0012	0.0012	0.0011	0.0007	0.0014	0.0010	0.0017	0.0016	0.0013	0.0012	0.0017
	Max	<0.0020	<0.0020	<0.0020	0.0025	<0.0020	0.0033	0.0029	0.0059	0.0026	0.0026	0.0022	0.0041
	Min	0.00030	0.00060	0.00040	0.00010	0.00020	0.00020	0.00010	0.00050	0.00060	0.00010	0.00020	0.00030
TPO4 mg/L	Avg	0.0046	0.0043	0.0036	0.0044	0.0046	0.0065	0.0068	0.0058	0.0071	0.0059	0.0054	0.0061
	Max	0.0075	0.0070	0.0068	0.013	0.0082	0.016	0.018	0.016	0.026	0.013	0.010	0.019
	Min	0.0020	0.0020	0.0013	0.0017	0.0027	0.0020	0.0020	0.0027	0.0015	<0.0020	0.0020	0.0020
SIO2 mg/L	Avg	0.018	ND	0.021	0.054	0.081	ND	0.089	0.29	ND	0.16	0.018	ND
	Max	0.034	ND	0.021	0.14	0.18	ND	0.14	0.29	ND	0.34	0.018	ND
	Min	<0.0020	ND	0.021	0.016	0.026	ND	0.034	0.29	ND	0.0030	0.018	ND
CHLOR A mg/M3	Avg	0.3	0.5	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4
	Max	<1	1	1	<1	1	1	0.4	0.5	1	<1	<1	<1
	Min	0.1	<0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.1	<0.1	0.2	0.1
NO3 mg/L	Avg	0.0634	0.0400	0.0309	0.0094	0.0089	0.117	0.0584	0.0464	0.134	0.108	0.0786	0.143
	Max	0.175	0.187	0.140	0.0507	0.0282	0.492	0.397	0.119	0.456	0.286	0.302	0.458
	Min	0.00740	0.00350	0.000800	0.00190	0.000400	0.00620	0.00120	0.00340	0.0180	0.00440	0.00430	0.00760
TOT N MG N/L	Avg	0.38	0.31	0.20	0.26	0.26	0.33	0.25[1]	0.45[1]	0.37[1]	0.36	0.29	ND
	Max	0.42	0.31	0.36	0.52	0.34	0.58	20	13	17	0.38	0.35	ND
	Min	0.34	0.31	0.09	0.11	0.17	0.11	0.21	0.26	0.26	0.33	0.20	ND
SAL. psu	Avg	30.7	32.6	34.0	36.2	37.6	33.4	33.8	33.3	30.5	27.8	28.7	29.3
	Max	34.5	37.3	37.7	40.2	41.1	40.6	40.3	37.3	36.6	33.0	33.6	33.6
	Min	21.5	24.9	24.1	30.8	31.7	19.3	21.1	23.6	15.1	23.4	19.9	18.3
TOC mg/L	Avg	3.27	3.27	3.35	3.46	3.51	3.60	3.93	4.16	3.60	3.72	3.35	3.71
	Max	4.37	4.35	6.25	5.96	5.41	5.98	5.57	7.84	5.31	5.73	5.11	6.53
	Min	2.19	2.34	2.30	2.09	1.80	2.20	2.13	2.35	2.60	2.32	2.00	2.64
AlkPO4 Nm/minmL	Avg	0.15	0.25	0.14	0.18	0.23	0.23	0.27	0.25	0.21	0.21	0.14	0.132
	Max	0.55	0.93	0.32	0.39	0.77	0.50	0.84	0.51	0.43	0.32	0.25	0.235
	Min	0.070	0.080	0.080	0.070	0.10	0.13	0.14	0.14	0.11	0.10	0.070	0.060

Table 2.3-31 (Sheet 25 of 36)
Biscayne Bay Water Quality

Sample Location BISC 110 – Average, Maximum and Minimum Monthly Results for 1993-2010													
Depth ≥ 1 m													
Parameters[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEMP. Deg. C	Avg	19.7	22.2	23.7	26.2	28.5	29.2	30.9	30.7	29.4	27.4	23.6	22.4
	Max	24.4	24.6	28.8	28.4	30.7	30.8	32.2	32.0	30.6	30.3	27.5	27.1
	Min	14.7	18.0	19.4	21.0	25.8	27.5	28.5	27.4	28.4	23.7	20.2	17.7
D.O. mg/L	Avg	7.3	7.6	6.7	6.5	6.6	6.6	6.5	5.5	6.2	6.5	7.4	7.3
	Max	8.5	8.9	8.1	8.6	7.7	10.6	8.8	6.3	9.3	8.6	8.6	8.4
	Min	3.8	5.8	4.2	4.6	4.4	5.2	4.5	4.8	5.0	5.2	6.5	6.6
SAL. psu	Avg	28.4	30.9	31.7	35.5	36.7	34.2	32.0	32.5	28.7	27.9	27.2	27.8
	Max	33.1	36.0	37.2	40.2	41.1	40.7	40.3	38.0	36.6	33.0	34.0	32.1
	Min	21.7	24.9	24.1	30.7	31.7	27.5	21.1	23.7	15.0	23.3	19.9	18.5

Table 2.3-31 (Sheet 26 of 36)
Biscayne Bay Water Quality

Sample Location MW01 – Average, Maximum and Minimum Monthly Results for 1993-2010													
Depth < 1 m													
Parameters[2]		**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
TEMP. Deg. C	**Avg**	20.60	22.18	22.01	24.59	26.54	28.01	29.34	30.71	27.49	27.15	26.06	22.28
	Max	24.79	24.81	24.81	27.71	30.23	30.79	31.50	32.69	30.65	29.59	28.79	25.49
	Min	16.08	16.72	19.29	16.00	16.00	16.00	25.42	27.45	25.87	25.07	22.92	15.65
D.O. mg/L	**Avg**	6.76	5.74	6.81	6.04	5.06	5.28	5.22	4.52	4.26	5.21	5.21	6.24
	Max	8.37	8.15	8.85	7.12	5.91	6.72	7.34	6.59	6.00	7.18	6.82	8.47
	Min	5.32	2.65	4.72	4.76	3.79	3.37	2.44	2.57	3.06	3.16	3.91	2.88
PH UNITS	**Avg**	7.85	7.91	8.03	8.09	8.10	7.67	7.82	7.74	7.46	7.50	7.68	7.81
	Max	8.18	8.15	8.40	8.26	8.61	8.11	8.17	8.04	7.78	7.72	7.85	8.29
	Min	7.58	7.66	7.71	7.72	7.62	7.27	7.40	6.90	7.27	7.27	7.39	7.30
TURB. NTU	**Avg**	1.1	0.6	1.2	1.0	1.4	1.2	ND	0.70	0.50	1.4	1.1	0.50
	Max	1.3	0.6	1.3	1.7	2.2	1.3	ND	0.70	0.50	2.3	1.5	0.60
	Min	0.80	0.60	0.90	0.60	0.60	1.1	ND	0.70	0.50	0.50	0.60	0.40
NOX mg/L	**Avg**	0.74	0.58	0.19	0.87	0.020	0.99	ND	0.30	1.6	0.68	1.1	0.58
	Max	0.74	0.79	0.27	0.87	0.030	1.3	ND	0.30	1.6	0.76	1.8	0.87
	Min	0.74	0.16	0.030	0.87	<0.010	0.83	ND	0.30	1.6	0.59	0.36	0.28
NH4 mg/L	**Avg**	0.035	0.050	0.060	0.040	0.095	0.050	ND	0.10	0.040	0.060	0.11	0.060
	Max	<0.040	0.060	0.060	0.060	0.13	0.050	ND	0.10	0.040	0.080	0.12	0.070
	Min	0.030	0.030	0.060	0.030	0.060	0.050	ND	0.10	0.040	0.040	0.090	0.050
TKN mg/L	**Avg**	<0.080	ND	0.21	ND	0.14	ND	ND	ND	0.27	ND	0.42	ND
	Max	<0.080	ND	0.21	ND	0.14	ND	ND	ND	0.27	ND	0.47	ND
	Min	<0.080	ND	0.21	ND	0.14	ND	ND	ND	0.27	ND	0.37	ND
OPO4 mg/L	**Avg**	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.003	<0.002	0.003
	Max	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.003	<0.002	0.003
	Min	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.003	<0.002	0.003
TPO4 mg/L	**Avg**	0.0050	0.0050	0.0083	0.0070	0.0060	0.0123	ND	0.0070	ND	0.0030	0.0060	0.0050
	Max	0.0050	0.0050	0.017	0.0070	0.0080	0.014	ND	0.0070	ND	0.0030	0.0070	0.0050
	Min	0.0050	0.0050	0.0040	0.0070	0.0040	0.0090	ND	0.0070	ND	0.0030	0.0050	0.0050
CHLOR A mg/M3	**Avg**	0.27	0.55	0.77	0.32	0.91	1.1	ND	0.80	0.13	0.57	0.66	1.1
	Max	0.27	0.55	0.77	0.32	1.3	1.5	ND	0.80	0.13	0.75	0.82	1.4
	Min	0.27	0.55	0.77	0.32	0.53	0.65	ND	0.80	0.13	0.22	0.33	0.64
SAL. psu	**Avg**	14.0	15.8	19.6	21.2	26.6	13.8	17.0[1]	20.5[1]	7.3[1]	9.4[1]	11.0[1]	14.4
	Max	24.2	27.9	31.2	34.1	36.5	29.2	32.0	31.6	25.3	13.7	20.1	27.4
	Min	1.80	5.00	8.40	7.40	14.1	7.62	0.600	0.800	0.500	0.400	0.0100	2.80

Table 2.3-31 (Sheet 27 of 36)
Biscayne Bay Water Quality

Sample Location MW01 – Average, Maximum and Minimum Monthly Results for 1993-2010													
Depth ≥ 1 m													
Parameters[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEMP. Deg. C	Avg	19.01	21.26	22.01	24.35	26.59	29.52	30.30	30.62	28.08	27.23	25.17	22.97
	Max	24.64	24.66	27.20	26.83	29.30	31.11	32.81	32.79	30.75	30.93	28.73	26.23
	Min	13.89	14.61	18.26	21.44	22.05	27.44	25.44	27.31	25.83	24.68	21.28	14.77
D.O. mg/L	Avg	7.39	7.04	6.89	5.71	5.41	5.12	4.60	4.11	3.81	4.56	5.73	5.90
	Max	8.98	9.35	8.41	6.74	6.69	8.01	7.11	6.27	5.53	6.22	8.62	8.70
	Min	5.49	3.15	5.16	4.20	3.72	2.55	2.24	2.15	2.89	3.08	2.95	2.79
PH UNITS	Avg	8.01	8.10	8.14	8.15	8.25	8.02	8.04	7.85	7.63	7.64	7.89	7.90
	Max	8.23	8.39	8.46	8.31	8.68	8.35	8.45	8.18	7.94	8.01	8.34	8.32
	Min	7.59	7.78	7.78	7.79	7.81	7.56	7.59	7.10	7.28	7.26	7.41	7.31
TURB. NTU	Avg	1.2	1.6	1.5	1.3	1.4	1.6	1.2	1.0	0.87	8.8	1.2	1.5
	Max	2.5	3.2	3.3	2.5	3.3	2.7	3.2	2.2	1.6	34	2.7	3.3
	Min	0.24	0.11	0.17	0.16	0.20	0.53	0.18	0.47	0.22	0.11	<0.10	0.20
NOX mg/L	Avg	0.59	0.45	0.46	0.10	0.17	0.47	0.67	0.52	1.3	1.6	0.98	0.77
	Max	1.4	1.0	1.4	0.51	0.66	1.0	2.5	2.2	2.2	2.7	1.3	1.1
	Min	0.16	0.010	0.010	<0.010	<0.010	<0.010	0.030	<0.010	0.060	0.90	0.54	0.11
NH4 mg/L	Avg	0.093	0.046	0.053	0.070	0.077	0.053	0.031	0.054	0.066	0.038	0.054	0.060
	Max	0.33	0.11	0.10	0.14	0.16	0.16	0.060	0.11	0.11	0.080	0.080	0.080
	Min	<0.010	<0.010	0.020	0.020	0.010	<0.010	<0.010	<0.0079	0.010	<0.010	0.030	0.040
TKN mg/L	Avg	ND	ND	ND	ND	ND	ND	0.16	ND	ND	ND	ND	ND
	Max	ND	ND	ND	ND	ND	ND	0.16	ND	ND	ND	ND	ND
	Min	ND	ND	ND	ND	ND	ND	0.16	ND	ND	ND	ND	ND
TPO4 mg/L	Avg	0.0083	0.0077	0.0090	0.0064	0.0070	0.0090	0.0067	0.0125	0.014	0.015	0.0088	0.012
	Max	0.018	0.013	0.018	0.011	0.011	0.020	0.018	0.039	0.029	0.040	0.018	0.030
	Min	0.0030	0.0040	0.0050	<0.0030	0.0040	0.0040	<0.0010	<0.0010	<0.0010	0.0020	0.0030	0.0010
SAL. psu	Avg	20.4	22.4	23.5	29.1	30.8	27.5	25.0[1]	26.2[1]	18.6[1]	16.5[1]	14.2	16.7
	Max	26.3	29.0	32.0	36.3	40.6	37.4	35.2	35.0	31.7	31.5	28.0	25.7
	Min	2.40	5.00	8.70	19.1	19.4	8.60	0.600	0.800	0.500	0.400	2.20	2.90

Table 2.3-31 (Sheet 28 of 36)
Biscayne Bay Water Quality

Sample Location MW04 – Average, Maximum and Minimum Monthly Results for 1993-2010													
Depth < 1 m													
Parameters[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEMP. Deg .C	Avg	22.15	22.98	23.34	24.65	26.45	28.35	28.63	28.92	26.56	26.34	25.07	22.92
	Max	25.10	24.84	27.14	26.75	29.43	29.69	30.46	31.03	27.91	28.69	26.22	25.88
	Min	18.12	20.01	20.59	16.00	16.00	27.01	25.75	26.46	25.92	25.48	23.39	20.12
D.O. mg/L	Avg	6.15	6.36	7.85	8.45	8.22	5.72	6.00	6.06	3.67	4.32	5.52	5.53
	Max	8.50	8.30	10.2	10.2	12.9	7.46	9.53	8.94	6.81	5.77	6.52	7.04
	Min	4.01	3.38	5.92	7.32	4.84	4.61	3.85	3.27	2.18	3.17	4.56	1.48
PH UNITS	Avg	7.39	7.57	7.62	7.73	7.80	7.54	7.46	7.49	7.27	7.37	7.33	7.48
	Max	7.61	7.93	7.85	7.96	7.96	7.61	7.98	7.87	7.51	7.66	7.55	7.74
	Min	7.21	7.30	7.37	7.16	7.34	7.37	7.19	7.26	7.07	7.15	6.85	6.99
TURB. NTU	Avg	0.80	0.30	0.53	0.93	0.47	2.3	0.50	0.60	0.50	0.50	0.40	0.30
	Max	0.80	0.30	0.60	1.58	0.60	2.3	0.50	0.60	0.50	0.50	0.40	0.30
	Min	0.80	0.30	0.50	0.60	0.40	2.3	0.50	0.60	0.50	0.50	0.40	0.30
NOX mg/L	Avg	ND	2.33	1.48	1.89	2.07	2.21	1.50	1.99	1.01	2.12	2.18	1.74
	Max	ND	2.64	1.65	1.92	<2.08	2.21	1.50	1.99	1.01	2.12	2.18	1.74
	Min	ND	2.17	1.14	1.82	<2.06	2.21	1.50	1.99	1.01	2.12	2.18	1.74
NH4 mg/L	Avg	<0.04	0.02	<0.01	0.04	0.02	0.06	0.03	<0.01	0.03	0.01	0.01	0.04
	Max	<0.04	0.03	<0.01	0.04	0.02	0.06	0.03	<0.01	0.03	0.01	0.01	0.04
	Min	<0.04	<0.0100	<0.01	0.03	0.02	0.06	0.03	<0.01	0.02	0.01	0.01	0.04
TKN mg/L	Avg	<0.10	ND	0.27	ND	0.25	ND	0.27	ND	0.23	ND	0.41	ND
	Max	<0.10	ND	0.40	ND	0.25	ND	0.27	ND	0.23	ND	0.41	ND
	Min	<0.10	ND	0.21	ND	0.25	ND	0.27	ND	0.23	ND	0.41	ND
OPO4 mg/L	Avg	<0.001	<0.002	<0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
	Max	<0.001	<0.002	<0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
	Min	<0.001	<0.002	<0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
TPO4 mg/L	Avg	0.001	0.004	0.005	0.006	0.003	0.007	0.004	0.004	0.005	0.006	0.003	0.007
	Max	0.001	0.004	0.006	0.007	0.003	0.007	0.004	0.004	0.005	0.006	0.003	0.007
	Min	0.001	0.004	0.004	0.005	0.003	0.007	0.004	0.004	0.005	0.006	0.003	0.007
SAL. psu	Avg	0.80	0.47	0.62	0.52	0.48	0.38	0.36	0.33	0.40	0.39	0.45	0.70[1]
	Max	3.6	0.76	1.5	0.90	1.00	0.50	0.40	0.40	0.60	0.50	0.60	12
	Min	0.40	0.10	0.30	0.20	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.40

Table 2.3-31 (Sheet 29 of 36)
Biscayne Bay Water Quality

Sample Location MW04 – Average, Maximum and Minimum Monthly Results for 1993-2010													
Depth ≥ 1 m													
Parameters[2]		**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
TEMP. Deg. C	**Avg**	21.19	22.50	23.46	25.45	26.94	27.20	27.28	27.68	26.16	26.68	25.13	24.16
	Max	25.07	24.78	26.95	26.60	29.49	29.73	29.94	30.03	27.52	30.61	29.43	26.26
	Min	17.35	19.64	19.90	24.61	24.73	25.50	25.22	26.16	25.30	25.30	23.07	21.62
D.O. mg/L	**Avg**	6.13	7.34	7.68	8.08	8.45	5.08	5.87	5.49	3.22	3.86	5.10	4.74
	Max	8.62	9.44	10.5	10.3	18.0	7.63	12.0	9.08	6.81	5.71	6.54	7.06
	Min	3.34	3.02	4.78	1.82	2.40	0.95	1.21	2.56	1.26	1.13	0.54	2.49
PH UNITS	**Avg**	7.47	7.58	7.59	7.68	7.74	7.37	7.32	7.39	7.21	7.28	7.26	7.38
	Max	8.16	7.95	7.82	7.98	7.97	7.56	7.97	7.85	7.50	7.66	7.56	7.72
	Min	7.17	7.25	7.20	7.15	7.29	7.17	6.93	7.07	6.96	6.94	6.81	7.03
TURB. NTU	**Avg**	1.3	0.55	0.78	0.94	1.5	0.73	1.1	0.65	0.58	3.2	0.52	0.51
	Max	5.9	0.80	1.4	2.1	2.4	1.5	2.6	1.0	1.1	17	1.1	1.4
	Min	0.17	<0.10	0.13	<0.10	0.60	0.18	0.40	0.27	0.30	0.11	<0.10	0.18
NOX mg/L	**Avg**	2.45	2.39	2.28	2.17	1.88	1.80	2.21	2.05	2.25	2.35	2.48	2.36
	Max	3.04	3.09	3.19	3.09	2.67	2.68	3.50	3.43	3.20	3.23	3.12	2.58
	Min	1.71	1.51	1.51	1.82	0.180	0.800	0.990	1.58	1.23	1.38	1.95	2.15
NH4 mg/L	**Avg**	0.03	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.04	0.02	0.02	0.02
	Max	0.09	0.06	0.04	0.03	<0.0400	0.08	0.07	0.05	0.10	0.06	0.03	0.03
	Min	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.008	<0.01	<0.01	0.01	<0.01
TKN mg/L	**Avg**	0.2	3	0.9	ND	0.2	0.4	0.5	ND	0.4	ND	0.2	0.2
	Max	0.5	3	2	ND	0.3	0.4	0.7	ND	0.5	ND	0.3	0.2
	Min	0.08	3	0.3	ND	0.2	0.3	0.3	ND	0.4	ND	0.1	0.2
OPO4 mg/L	**Avg**	0.003	0.003	0.003	0.003	0.003	0.005	0.005	0.005	0.005	0.024	0.003	0.002
	Max	0.004	0.004	0.004	0.003	0.005	0.006	0.009	0.007	0.006	0.067	0.003	0.003
	Min	<0.002	0.002	0.001	<0.002	<0.001	0.003	0.002	0.003	0.003	<0.002	0.002	<0.002
TPO4 mg/L	**Avg**	0.004	0.005	0.003	0.004	0.004	0.004	0.006	0.005	0.009	0.02	0.003	0.005
	Max	0.006	0.01	0.005	0.005	0.006	0.006	0.01	0.009	0.05	0.10	0.008	0.01
	Min	0.002	0.003	<0.0001	<0.003	<0.001	0.002	0.003	<0.001	<0.001	0.002	0.002	0.003
SAL. psu	**Avg**	0.98[1]	0.42[1]	0.44[1]	0.51	0.68[1]	0.55[1]	0.50	0.40	0.64	0.62[1]	0.47[1]	0.69[1]
	Max	23	16	13	1.2	16.6	7.3	1.5	0.8	2.2	20	12	11
	Min	0.40	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.40

Table 2.3-31 (Sheet 30 of 36)
Biscayne Bay Water Quality

Sample Location BB41 – Average, Maximum and Minimum Monthly Results for 1993-2010													
Depth < 1 m													
Parameters[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEMP. Deg. C	Avg	17.35	21.37	20.82	23.41	25.97	28.42	29.80	30.34	29.00	27.63	25.70	21.31
	Max	24.07	23.96	24.74	26.82	28.47	30.30	31.45	31.53	30.05	30.41	28.20	26.13
	Min	12.96	15.82	17.74	16.00	16.00	16.00	27.40	29.36	26.30	25.18	21.50	15.12
D.O. mg/L	Avg	7.88	6.39	7.15	6.49	6.15	5.72	5.43	5.37	5.75	6.03	6.48	7.20
	Max	8.57	7.84	7.83	6.85	6.58	6.88	6.32	6.40	6.28	6.65	7.73	8.34
	Min	6.88	3.12	6.11	6.09	5.51	5.19	4.73	4.63	4.97	5.38	5.63	6.61
PH UNITS	Avg	8.02	8.09	8.09	8.06	8.14	7.99	8.12	7.98	7.95	8.00	8.09	8.07
	Max	8.21	8.29	8.27	8.21	8.35	8.20	8.35	8.12	8.16	8.04	8.19	8.22
	Min	7.83	7.95	7.78	7.80	7.76	7.68	7.94	7.17	7.84	7.92	8.02	7.81
TURB. NTU	Avg	0.6	0.4	0.7	0.6	0.5	0.6	ND	0.3	0.7	0.5	0.4	0.4
	Max	0.7	0.4	0.8	0.6	0.8	0.8	ND	0.3	0.7	0.7	0.5	0.4
	Min	0.3	0.4	0.6	0.6	0.4	0.5	ND	0.3	0.7	0.3	0.3	0.3
NOX mg/L	Avg	0.04	0.03	<0.01	<0.01	<0.01	0.02	ND	<0.01	0.06	0.05	0.05	0.07
	Max	0.06	0.04	<0.01	<0.01	<0.01	0.03	ND	<0.01	0.06	0.06	0.06	0.1
	Min	0.01	<0.01	<0.01	<0.01	<0.01	0.02	ND	<0.01	0.06	0.04	0.03	<0.01
NH4 mg/L	Avg	0.072	0.11	0.065	0.070	0.10	0.083	ND	0.12	0.10	0.090	0.11	0.085
	Max	0.090	0.13	0.080	0.090	0.10	0.10	ND	0.12	0.10	0.10	0.14	0.090
	Min	<0.0400	0.090	0.050	0.030	0.10	0.03	ND	0.12	0.10	0.080	0.070	0.080
TKN mg/L	Avg	<0.08	<0.08	0.09	<0.08	<0.08	<0.08	ND	<0.08	0.2	0.3	0.3	<0.08
	Max	<0.08	<0.08	0.09	<0.08	<0.08	<0.08	ND	<0.08	0.2	0.3	0.5	<0.08
	Min	<0.08	<0.08	0.09	<0.08	<0.08	<0.08	ND	<0.08	0.2	0.3	0.2	<0.08
OPO4 mg/L	Avg	0.003	0.003	<0.002	<0.002	<0.002	<0.002	ND	<0.002	<0.002	<0.002	<0.002	<0.002
	Max	0.003	0.003	<0.002	<0.002	<0.002	<0.002	ND	<0.002	<0.002	<0.002	<0.002	<0.002
	Min	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	ND	<0.002	<0.002	<0.002	<0.002	<0.002
TPO4 mg/L	Avg	0.002	0.003	0.003	<0.002	<0.002	0.002	ND	<0.002	0.005	0.003	0.003	<0.002
	Max	<0.002	0.003	0.004	<0.002	<0.002	0.002	ND	<0.002	0.005	0.003	0.003	<0.002
	Min	0.001	0.002	<0.002	<0.002	<0.002	0.002	ND	<0.002	0.005	<0.002	<0.002	<0.002
CHLOR A mg/M3	Avg	0.20	0.33	0.20	0.16	0.23	0.35	ND	0.43	0.47	0.48	0.31	0.22
	Max	0.27	0.47	0.2	0.18	0.27	0.39	ND	0.61	0.58	0.87	0.43	0.29
	Min	<0.16	0.20	0.19	0.12	0.17	0.26	ND	0.34	0.24	0.19	0.21	0.17
SAL. psu	Avg	32.0	32.5	32.4	34.3	35.9	34.3	33.7	34.5	32.2	30.8	29.4	31.3
	Max	34.0	33.3	34.8	36.2	39.2	40.0	38.3	38.4	37.6	34.3	34.8	33.5
	Min	28.2	29.9	28.7	32.7	33.6	24.1	28.0	24.9	24.7	26.1	24.9	24.3
TOC mg/L	Avg	<3.02	7.02	2.88	3.46	5.00	7.07	ND	ND	8.96	5.65	3.80	6.07
	Max	<3.02	7.02	3.46	4.19	5.00	7.07	ND	ND	8.96	6.48	3.80	6.07
	Min	<3.02	7.02	2.30	2.00	5.00	7.07	ND	ND	8.96	4.81	3.80	6.07

Table 2.3-31 (Sheet 31 of 36)
Biscayne Bay Water Quality

Sample Location BB41 – Average, Maximum and Minimum Monthly Results for 1993-2010													
Depth ≥ 1 m													
Parameters[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEMP. Deg. C	Avg	18.21	20.70	21.46	24.46	26.33	29.01	29.83	30.08	28.75	27.47	24.61	22.38
	Max	23.93	23.96	27.05	26.79	28.50	30.40	31.33	31.55	30.00	30.40	28.20	26.10
	Min	12.94	15.82	17.74	22.40	22.75	27.73	27.42	29.35	26.30	25.22	21.51	15.12
D.O. mg/L	Avg	7.91	7.13	7.15	6.61	6.38	6.02	5.58	5.57	5.73	6.26	6.99	7.17
	Max	8.59	7.99	7.95	7.18	7.07	7.25	7.03	6.22	6.47	7.45	7.80	8.26
	Min	7.45	3.67	6.09	6.12	5.58	5.31	4.91	4.70	5.03	5.52	6.32	6.56
PH UNITS	Avg	8.06	8.08	8.09	8.07	8.15	8.03	8.11	7.97	7.99	7.99	8.12	8.09
	Max	8.22	8.30	8.27	8.21	8.36	8.25	8.30	8.17	8.14	8.11	8.24	8.22
	Min	7.88	7.95	7.78	7.80	7.76	7.68	7.95	7.17	7.83	7.92	8.02	7.81
TURB. NTU	Avg	0.94	0.87	0.89	0.56	0.82	0.63	0.51	0.73	0.44	0.54	0.58	0.44
	Max	1.5	2.4	1.9	1.0	1.2	1.5	1.1	1.2	0.89	0.90	1.1	0.80
	Min	0.21	0.14	0.12	0.12	0.40	0.10	0.12	0.32	0.30	0.12	<0.10	0.17
NOX mg/L	Avg	0.04	0.02	0.02	0.02	0.01	0.02	0.03	0.03	0.05	0.05	0.11	0.06
	Max	0.06	0.05	0.07	0.02	0.03	0.04	0.06	0.08	0.1	0.09	0.2	0.2
	Min	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.01	0.02	0.04	0.03	<0.01
NH4 mg/L	Avg	0.07	0.05	0.07	0.08	0.07	0.10	0.07	0.04	0.04	0.06	0.05	0.07
	Max	0.2	0.1	0.1	0.2	0.1	0.2	0.1	0.09	0.08	0.1	0.1	0.1
	Min	<0.01	<0.01	<0.01	<0.01	<0.0100	0.04	0.01	<0.008	0.02	0.01	<0.01	0.05
TKN mg/L	Avg	ND	ND	ND	ND	ND	ND	<0.08	ND	ND	ND	ND	ND
	Max	ND	ND	ND	ND	ND	ND	<0.08	ND	ND	ND	ND	ND
	Min	ND	ND	ND	ND	ND	ND	<0.08	ND	ND	ND	ND	ND
OPO4 mg/L	Avg	ND	ND	ND	ND	ND	ND	<0.002	ND	ND	ND	ND	ND
	Max	ND	ND	ND	ND	ND	ND	<0.002	ND	ND	ND	ND	ND
	Min	ND	ND	ND	ND	ND	ND	<0.002	ND	ND	ND	ND	ND
TPO4 mg/L	Avg	0.002	0.003	0.002	<0.002	<0.0018	0.002	<0.002	0.002	0.002	0.004	0.003	<0.001
	Max	0.004	0.007	0.004	<0.003	<0.003	0.003	<0.003	0.003	0.004	0.008	0.007	<0.001
	Min	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CHLOR A mg/M3	Avg	ND	ND	ND	ND	ND	ND	ND	0.26	ND	ND	ND	ND
	Max	ND	ND	ND	ND	ND	ND	ND	0.26	ND	ND	ND	ND
	Min	ND	ND	ND	ND	ND	ND	ND	0.26	ND	ND	ND	ND
SAL. psu	Avg	31.4	32.3	32.3	34.7	36.3	36.5	34.4	35.2	33.0	31.1	28.8	30.2
	Max	34.1	33.4	36.8	36.3	39.2	40.0	38.4	39.0	37.6	34.4	34.8	33.6
	Min	28.3	29.9	18.3	32.7	33.7	32.3	28.8	26.7	24.6	26.1	24.8	24.3
TOC mg/L	Avg	ND	ND	ND	ND	ND	ND	3.65	ND	ND	ND	ND	ND
	Max	ND	ND	ND	ND	ND	ND	3.65	ND	ND	ND	ND	ND
	Min	ND	ND	ND	ND	ND	ND	3.65	ND	ND	ND	ND	ND

Table 2.3-31 (Sheet 32 of 36)
Biscayne Bay Water Quality

Sample Location BB44 – Average, Maximum and Minimum Monthly Results for 1993-2010													
Depth < 1 m													
Parameters[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEMP. Deg. C	Avg	17.33	20.81	20.63	23.36	25.92	28.32	29.78	30.53	28.96	27.57	25.56	21.06
	Max	23.54	23.84	24.40	26.81	28.72	30.76	31.55	31.69	29.68	30.35	27.96	25.75
	Min	12.52	15.46	18.06	16.00	16.00	16.00	27.92	29.23	26.44	24.97	21.19	14.74
D.O. mg/L	Avg	7.41	5.69	6.84	6.35	5.92	5.16	5.22	4.91	4.94	5.85	5.96	6.68
	Max	8.16	7.78	7.32	6.62	6.25	6.21	5.75	5.33	5.31	6.64	6.94	8.07
	Min	6.44	0.97	5.81	5.64	5.39	4.45	4.45	3.76	4.09	4.75	4.68	5.71
PH UNITS	Avg	8.04	8.05	8.10	8.07	8.17	7.98	8.05	7.89	7.89	7.89	8.01	8.00
	Max	8.17	8.29	8.25	8.25	8.43	8.13	8.13	8.05	8.11	7.97	8.08	8.21
	Min	7.87	7.85	7.76	7.85	7.79	7.65	7.76	7.04	7.71	7.77	7.95	7.73
TURB. NTU	Avg	1.7	0.50	1.9	0.52	0.53	0.63	ND	0.30	0.50	1.1	0.40	0.75
	Max	2.2	0.50	2.6	0.55	0.80	1.1	ND	0.30	0.50	1.7	0.50	1.2
	Min	0.70	0.50	0.40	0.50	0.40	0.40	ND	0.30	0.50	0.40	0.30	0.30
NOX mg/L	Avg	0.08	<0.01	<0.01	<0.01	<0.01	0.02	ND	0.01	0.02	0.05	<0.01	<0.01
	Max	0.08	<0.01	<0.01	<0.01	<0.01	0.03	ND	0.01	0.02	0.08	<0.01	<0.01
	Min	0.08	<0.01	<0.01	<0.01	<0.01	0.01	ND	0.01	0.02	<0.01	<0.01	<0.01
NH4 mg/L	Avg	0.07	0.09	0.09	0.08	0.1	0.08	ND	0.1	0.1	0.1	0.05	0.08
	Max	0.08	0.09	0.1	0.09	0.1	0.1	ND	0.1	0.1	0.1	0.09	0.08
	Min	<0.04	0.09	0.05	0.07	0.1	0.03	ND	0.1	0.1	0.09	<0.01	0.07
TKN mg/L	Avg	<0.08	<0.08	0.3	<0.08	<0.08	<0.08	ND	<0.08	<0.08	0.1	0.3	<0.08
	Max	<0.08	<0.08	0.3	<0.08	<0.08	<0.08	ND	<0.08	<0.08	0.2	0.6	<0.08
	Min	<0.08	<0.08	0.3	<0.08	<0.08	<0.08	ND	<0.08	<0.08	<0.08	<0.08	<0.08
OPO4 mg/L	Avg	0.003	<0.002	<0.002	<0.002	<0.002	<0.002	ND	<0.002	<0.002	<0.002	<0.002	<0.002
	Max	0.003	<0.002	<0.002	<0.002	<0.002	<0.002	ND	<0.002	<0.002	<0.002	<0.002	<0.002
	Min	0.003	<0.002	<0.002	<0.002	<0.002	<0.002	ND	<0.002	<0.002	<0.002	<0.002	<0.002
TPO4 mg/L	Avg	<0.002	0.003	0.002	0.002	<0.002	0.003	ND	0.002	0.005	0.003	0.004	<0.002
	Max	<0.002	0.003	0.003	0.002	<0.002	0.003	ND	0.002	0.005	0.004	0.005	<0.002
	Min	<0.001	0.003	0.002	0.002	<0.002	0.003	ND	0.002	0.005	<0.002	<0.002	<0.002
CHLOR A mg/M3	Avg	0.24	0.71	0.40	0.23	0.21	0.47	ND	0.26	0.57	0.83	0.33	0.33
	Max	0.24	0.71	0.40	0.23	0.21	0.47	ND	0.26	0.57	1.4	0.34	0.33
	Min	0.24	0.71	0.40	0.23	0.21	0.47	ND	0.26	0.57	0.28	0.31	0.32
SAL. psu	Avg	32.6	34.2	34.8	36.3	36.7	35.4	35.4	36.1	34.4	31.8	32.6	33.1
	Max	34.3	36.3	37.0	37.2	38.2	38.4	37.5	38.6	36.9	35.5	36.2	35.3
	Min	30.2	30.6	30.7	35.2	34.5	29.6	31.7	32.2	30.5	28.0	27.6	30.1
TOC mg/L	Avg	3.10	6.16	4.17	3.20	4.00	<5.78	ND	ND	6.86	5.65	3.60	5.75
	Max	3.10	6.16	4.17	3.20	4.00	<5.78	ND	ND	6.86	6.14	3.60	5.75
	Min	3.10	6.16	4.17	3.20	4.00	<5.78	ND	ND	6.86	5.15	3.60	5.75

Table 2.3-31 (Sheet 33 of 36)
Biscayne Bay Water Quality

Sample Location BB44 – Average, Maximum and Minimum Monthly Results for 1993-2010													
Depth $\geq$ 1 m													
Parameters[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEMP. Deg. C	Avg	17.54	20.44	21.34	24.41	26.26	29.01	29.79	30.23	28.76	27.50	24.40	22.17
	Max	23.47	23.83	26.98	26.81	28.72	30.67	31.56	31.80	29.68	30.33	27.97	25.76
	Min	12.53	15.47	18.16	22.35	22.66	27.53	27.95	29.23	26.46	25.09	21.21	14.80
D.O. mg/L	Avg	7.44	6.81	6.85	6.28	5.97	5.41	5.28	4.99	4.90	5.72	6.45	6.49
	Max	7.94	7.97	7.55	6.73	6.47	6.41	5.89	5.58	5.55	8.52	7.10	7.97
	Min	6.67	3.00	5.34	5.41	5.41	4.54	4.46	4.28	4.08	4.99	4.74	5.72
PH UNITS	Avg	8.02	8.03	8.06	8.09	8.16	7.99	8.05	7.89	7.91	7.86	8.02	8.03
	Max	8.17	8.32	8.26	8.25	8.43	8.13	8.13	8.07	8.10	7.96	8.08	8.20
	Min	7.87	7.79	7.76	7.85	7.79	7.65	7.77	7.04	7.71	7.77	7.94	7.73
TURB. NTU	Avg	1.5	1.3	0.95	0.71	0.63	0.62	0.59	0.67	0.77	0.62	0.43	0.48
	Max	2.9	4.7	2.1	1.9	1.4	0.90	1.0	1.1	2.5	0.91	0.60	0.90
	Min	0.41	0.16	<0.10	0.14	0.10	0.40	0.12	0.38	0.32	0.27	0.11	<0.10
NOX mg/L	Avg	0.02	0.02	0.01	0.01	0.01	<0.01	0.01	0.01	0.02	0.02	0.04	0.02
	Max	0.05	0.05	0.02	0.02	0.02	<0.01	0.02	0.02	0.03	0.04	0.06	0.03
	Min	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.03	<0.01
NH4 mg/L	Avg	0.06	0.06	0.07	0.07	0.07	0.06	0.06	0.03	0.05	0.06	0.05	0.08
	Max	0.2	0.12	0.1	0.1	0.1	0.1	0.1	0.07	0.09	0.09	0.1	0.1
	Min	<0.01	0.03	<0.01	<0.01	<0.01	0.02	0.01	<0.01	0.01	0.04	<0.01	0.03
TKN mg/L	Avg	ND	ND	ND	ND	ND	ND	<0.08	ND	ND	ND	ND	ND
	Max	ND	ND	ND	ND	ND	ND	<0.08	ND	ND	ND	ND	ND
	Min	ND	ND	ND	ND	ND	ND	<0.08	ND	ND	ND	ND	ND
OPO4 mg/L	Avg	ND	ND	ND	ND	ND	ND	<0.002	ND	ND	ND	ND	ND
	Max	ND	ND	ND	ND	ND	ND	<0.002	ND	ND	ND	ND	ND
	Min	ND	ND	ND	ND	ND	ND	<0.002	ND	ND	ND	ND	ND
TPO4 mg/L	Avg	0.003	0.002	0.002	0.003	0.0024	0.002	0.002	0.003	0.003	0.002	0.002	0.002
	Max	0.004	<0.003	0.005	0.004	0.004	0.003	<0.003	0.009	0.008	0.005	0.004	0.005
	Min	<0.001	<0.001	<0.00001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CHLOR A mg/M3	Avg	ND	ND	ND	ND	ND	ND	0.24	ND	ND	ND	ND	ND
	Max	ND	ND	ND	ND	ND	ND	0.24	ND	ND	ND	ND	ND
	Min	ND	ND	ND	ND	ND	ND	0.24	ND	ND	ND	ND	ND
SAL. psu	Avg	32.3	34.0	34.8	36.5	37.1	36.2	35.5	36.2	34.6	32.0	31.6	32.6
	Max	34.3	35.4	37.1	37.4	38.9	38.5	37.5	38.9	36.9	35.7	36.2	35.3
	Min	30.3	30.9	26.3	35.3	34.6	33.3	31.8	32.2	30.5	26.4	27.7	30.0
TOC mg/L	Avg	ND	ND	ND	ND	ND	ND	2.93	ND	ND	ND	ND	ND
	Max	ND	ND	ND	ND	ND	ND	2.93	ND	ND	ND	ND	ND
	Min	ND	ND	ND	ND	ND	ND	2.93	ND	ND	ND	ND	ND

Table 2.3-31 (Sheet 34 of 36)
Biscayne Bay Water Quality

Sample Location BB45 – Average, Maximum and Minimum Monthly Results for 1993-2010													
Depth < 1 m													
Parameters[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEMP. Deg. C	Avg	16.89	20.68	20.52	23.36	25.68	28.14	29.74	30.31	28.95	27.48	25.39	21.19
	Max	23.31	23.60	24.34	26.65	28.17	30.36	31.44	31.58	30.01	30.21	27.56	25.62
	Min	11.95	14.69	17.62	16.00	16.00	16.00	27.91	29.03	26.27	24.74	20.83	15.20
D.O. mg/L	Avg	7.89	6.11[1]	6.95	6.03	5.74	5.07	5.11	5.00	5.06	5.85	5.92	6.79
	Max	8.97	8.06	7.75	6.51	7.17	6.30	5.67	6.56	5.74	6.32	7.13	8.32
	Min	6.67	0.11	5.97	4.88	5.14	3.65	4.20	3.65	3.87	4.75	4.74	5.88
PH UNITS	Avg	8.09	8.07	8.09	8.07	8.15	7.96	8.07	7.88	7.92	7.88	8.01	8.04
	Max	8.20	8.30	8.31	8.21	8.53	8.18	8.19	8.10	8.10	8.01	8.16	8.25
	Min	7.89	7.85	7.77	7.80	7.88	7.68	7.87	7.04	7.79	7.74	7.89	7.79
TURB. NTU	Avg	0.80	0.40	0.83	0.59	0.67	0.43	ND	0.30	0.30	0.60	0.30	0.30
	Max	1.2	0.40	0.90	0.78	1.40	0.70	ND	0.30	0.30	0.90	0.30	0.30
	Min	0.60	0.40	0.70	0.50	0.30	0.30	ND	0.30	0.30	0.30	0.30	0.30
SAL. psu	Avg	29.9[1]	32.4	33.7	34.7	33.1	35.0	34.5	35.4	33.1	31.1	28.4	31.2
	Max	32.5	34.7	36.4	36.5	38.5	38.0	37.3	38.4	36.6	33.5	34.6	34.4
	Min	0.900	27.9	29.4	33.2	4.50	32.2	28.6	27.3	27.8	27.5	8.6	27.4

Sample Location BB45 – Average, Maximum and Minimum Monthly Results for 1993-2010													
Depth ≥ 1 m													
Parameters[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEMP. Deg C	Avg	17.60	20.15	21.33	24.19	26.12	28.86	29.86	30.14	28.84	27.49	24.33	22.19
	Max	23.31	23.67	26.84	26.65	28.13	30.42	31.45	31.60	30.02	30.23	27.66	25.70
	Min	11.95	14.69	17.64	21.77	22.51	27.54	27.92	29.01	26.29	24.77	20.84	15.25
D.O. mg/L	Avg	7.84	6.91	6.87	6.05	5.89	5.36	5.19	4.91	5.07	5.73	6.42	6.62
	Max	9.14	8.24	7.83	6.66	7.03	6.36	5.94	5.82	5.90	7.04	7.61	7.73
	Min	6.78	2.07	5.55	4.90	5.22	3.98	4.29	3.67	3.70	4.85	4.71	5.87
PH UNITS	Avg	8.06	8.06	8.07	8.06	8.18	8.00	8.06	7.89	7.94	7.86	8.04	8.05
	Max	8.21	8.36	8.31	8.22	8.53	8.17	8.17	8.10	8.08	8.00	8.16	8.24
	Min	7.88	7.85	7.77	7.80	7.88	7.68	7.87	7.03	7.79	7.74	7.89	7.79
TURB. NTU	Avg	0.76	1.47	0.97	0.90	0.90	1.32	0.59	0.69	0.49	0.50	0.84	0.53
	Max	2.0	5.3	2.8	2.4	1.7	5.1	1.6	1.7	1.0	1.1	2.9	0.9
	Min	0.11	0.10	0.10	0.17	0.20	0.12	0.10	0.29	0.21	0.10	0.10	0.13
SAL. psu	Avg	29.7	32.2	33.7	59.6	36.2	35.5	34.7	35.3	33.5	31.9	29.4	30.4
	Max	32.7	34.8	36.5	354.0	38.6	38.0	37.4	38.4	36.7	33.6	34.7	34.4
	Min	27.6	27.5	29.4	33.6	33.3	32.4	29.0	27.4	27.8	27.6	25.8	27.7

Table 2.3-31 (Sheet 35 of 36)
Biscayne Bay Water Quality

Sample Location FC03 – Average, Maximum and Minimum Monthly Results for 1993-2010													
Depth < 1 m													
Parameters[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEMP. Deg. C	Avg	21.11	24.05	23.23	25.68	27.10	28.00	27.39	27.49	26.40	26.02	25.47	21.44
	Max	21.74	24.88	27.01	26.71	28.33	29.14	28.50	28.42	27.20	27.64	26.23	25.37
	Min	19.83	22.81	22.30	25.19	24.49	26.80	25.33	26.12	24.76	25.31	24.15	19.76
D.O. mg/L	Avg	7.24	6.73	7.90	8.64	7.82	6.70	5.29	4.55	4.49	3.51	5.13	7.15
	Max	7.91	9.02	8.31	9.97	8.61	7.67	5.93	5.57	6.00	5.06	6.05	7.98
	Min	6.57	5.15	7.76	7.95	6.70	5.74	4.19	2.57	2.17	2.55	3.26	4.95
PH UNITS	Avg	7.46	7.28	7.53	7.68	7.62	7.35	7.22	7.33	7.34	7.05	7.40	7.70
	Max	7.70	7.43	7.77	7.91	7.87	7.47	7.31	7.39	7.49	7.12	7.61	7.87
	Min	7.27	7.24	6.95	7.42	7.49	6.95	7.05	7.24	7.14	6.99	6.89	7.34
TURB. NTU	Avg	ND	0.4	0.4	0.5	0.3	0.5	0.4	0.5	0.2	0.5	0.5	0.2
	Max	ND	0.4	0.4	0.5	0.3	0.5	0.4	0.5	0.2	0.5	0.5	0.2
	Min	ND	0.4	0.4	0.5	0.3	0.5	0.4	0.5	0.2	0.5	0.5	0.2
NOX mg/L	Avg	ND	1.09	1.01	1.19	1.00	1.08	0.890	1.09	1.17	0.840	0.890	0.930
	Max	ND	1.09	1.01	1.19	1.00	1.08	0.890	1.09	1.17	0.840	0.890	0.930
	Min	ND	1.09	1.01	1.19	1.00	1.08	0.890	1.09	1.17	0.840	0.890	0.930
NH4 mg/L	Avg	ND	0.01	<0.01	<0.01	ND	0.02	0.02	<0.01	0.01	<0.01	<0.01	<0.01
	Max	ND	0.01	<0.01	<0.01	ND	0.02	0.02	<0.01	0.01	<0.01	<0.01	<0.01
	Min	ND	0.01	<0.01	<0.01	ND	0.02	0.02	<0.01	0.01	<0.01	<0.01	<0.01
TKN mg/L	Avg	ND	ND	<0.080	ND	0.13	ND	0.19	ND	0.20	ND	0.37	ND
	Max	ND	ND	<0.080	ND	0.13	ND	0.19	ND	0.20	ND	0.37	ND
	Min	ND	ND	<0.080	ND	0.13	ND	0.19	ND	0.20	ND	0.37	ND
OPO4 mg/L	Avg	ND	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
	Max	ND	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
	Min	ND	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
TPO4 mg/L	Avg	ND	0.003	0.002	<0.002	0.002	0.003	0.002	0.002	0.002	0.003	0.003	<0.002
	Max	ND	0.003	0.002	<0.002	0.002	0.003	0.002	0.002	0.002	0.003	0.003	<0.002
	Min	ND	0.003	0.002	<0.002	0.002	0.003	0.002	0.002	0.002	0.003	0.003	<0.002
SAL. psu	Avg	0.29	0.29	0.29	0.27	0.29	0.29	0.32	0.32	0.33	0.27	0.28	0.28
	Max	0.30	0.30	0.30	0.30	0.30	0.30	0.50	0.40	0.46	0.30	0.30	0.30
	Min	0.28	0.27	0.27	0.20	0.28	0.27	0.28	0.27	0.28	0.25	0.27	0.30

Table 2.3-31 (Sheet 36 of 36)
Biscayne Bay Water Quality

Sample Location FC03 – Average, Maximum and Minimum Monthly Results for 1993-2010													
Depth ≥ 1 m													
Parameters[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TEMP. Deg. C	Avg	21.10	23.41	23.73	25.95	25.92	27.20	26.56	26.83	25.84	26.53	25.38	23.41
	Max	21.73	24.65	26.98	26.69	28.10	28.78	28.38	28.31	27.14	27.67	26.23	25.47
	Min	19.81	22.77	22.28	25.15	24.48	26.58	25.31	26.11	24.75	25.29	24.01	19.79
D.O. mg/L	Avg	7.16	7.93	8.07	8.93	7.36	6.82	4.75	3.94	2.91	4.33	4.10	6.09
	Max	7.85	9.10	8.63	10.23	8.14	7.78	5.50	5.95	6.12	5.62	5.96	7.29
	Min	6.49	4.83	7.72	7.93	6.25	5.65	4.17	2.66	2.05	2.54	3.25	4.96
PH UNITS	Avg	7.430	7.302	7.433	7.673	7.676	7.211	7.157	7.280	7.240	7.075	7.147	7.507
	Max	7.710	7.400	7.770	7.950	7.850	7.500	7.340	7.400	7.460	7.100	7.620	7.850
	Min	7.200	7.230	6.940	7.420	7.480	6.800	6.960	7.160	7.100	7.020	6.880	7.330
TURB. NTU	Avg	0.4	0.5	0.8	1	1	0.9	0.4	0.6	0.5	1.3	0.4	0.5
	Max	0.4	0.5	1.2	2	2	1	0.4	1	0.5	3	0.7	0.8
	Min	0.3	0.4	0.5	0.4	0.6	0.5	0.3	0.4	0.4	0.3	0.3	0.4
NOX mg/L	Avg	1.23	1.33	1.28	1.31	0.870	1.16	1.03	1.05	0.937	0.887	1.15	0.880
	Max	1.35	1.42	1.41	1.45	1.28	1.18	1.06	1.17	1.23	1.01	1.39	0.880
	Min	1.06	1.22	1.10	1.14	0.400	1.14	0.960	0.970	0.730	0.640	1.03	0.880
NH4 mg/L	Avg	0.02	0.02	0.02	0.02	0.04	0.02	0.04	0.06	0.06	0.05	0.03	0.02
	Max	0.03	0.03	0.02	0.04	0.08	0.03	0.05	0.09	0.1	0.1	0.06	0.03
	Min	0.01	<0.01	0.01	0.01	<0.01	<0.01	0.02	<0.008	0.03	0.02	<0.01	<0.01
TKN mg/L	Avg	0.25	ND	0.50	ND	0.30	0.25	0.37	ND	0.43	0.28	0.40	0.20
	Max	0.30	ND	1.2	ND	0.40	0.30	0.50	ND	0.70	0.28	0.40	0.20
	Min	0.20	ND	0.10	ND	0.19	0.20	0.30	ND	0.30	0.28	0.40	0.20
OPO4 mg/L	Avg	0.003	0.003	0.003	<0.002	0.003	0.003	0.003	0.004	0.004	0.003	<0.002	0.003
	Max	0.004	0.004	0.004	<0.002	0.005	0.004	0.005	0.004	0.005	0.004	<0.002	0.004
	Min	<0.002	0.002	0.002	<0.002	<0.001	0.002	<0.002	0.004	0.003	<0.002	<0.002	<0.002
TPO4 mg/L	Avg	0.003	0.004	0.005	0.003	0.004	0.003	0.003	0.002	0.005	0.004	0.003	0.003
	Max	0.004	0.004	0.007	0.004	0.007	0.005	0.005	<0.003	0.007	0.005	0.004	0.003
	Min	<0.002	0.004	0.004	0.002	<0.001	0.002	0.001	<0.001	<0.003	0.003	0.003	0.003
SAL. psu	Avg	0.29	0.30	0.30	0.27	0.30	0.30	0.35	0.38	0.38	0.28	0.29	0.29
	Max	0.30	0.30	0.30	0.30	0.30	0.30	0.50	0.50	0.51	0.30	0.30	0.30
	Min	0.28	0.27	0.27	0.20	0.28	0.27	0.28	0.27	0.28	0.25	0.27	0.28

1 Concentrations for certain years appear as outliers with other sample data collected for the month. The outliers were removed to calculate the average concentrations but are still shown as maximums or minimums so that all sample data collected is captured.

2 ND = No data; TEMP. = Temperature; D.O. = Dissolved Oxygen; TURB. = Turbidity; NOX = Nitrate + Nitrite; NO2 = Nitrite; NO3 = Nitrate; NH4 = Ammonia; TOT N = Total Nitrogen; TKN = Total Kjeldahl Nitrogen; OPO4 = Orthophosphate; TPO4 = Total Phosphate; AlkPO4 = Alkaline Phosphate; SIO2 = Silica (Silicon Dioxide); CHLOR A = Chlorophyll A; SAL. = Salinity; TOC = Total Organic Carbon

Table 2.3-32
Water Quality Summary from Turkey Point Pumping Test

Locations	Total Dissolved Solids	Chloride	Sulfate	Bromide	Bicarbonate Alkalinity	Boric Acid	Calcium	Magnesium	Potassium	Sodium	Strontium
PW-1	33931	19407	2724	99	167	24	427	1289	431	10284	7.9
Biscayne Bay	41600	22475	3400	98	120	29	476	1545	506	12067	9.1
Industrial Wastewater Facility	66167	37400	6200	150	184	42	780	2367	773	18800	15.7

Source: HDR 2009
Notes: All units are mg/L
Fluoride results are either non-detect or between MDL and PQL.
All results presented are averages.
Additional information regarding the sampling and analyses conducted for the Turkey Point Pumping Test can be found in HDR 2009.

Figure 2.3-1 Major Hydrological Features Near Units 6 & 7

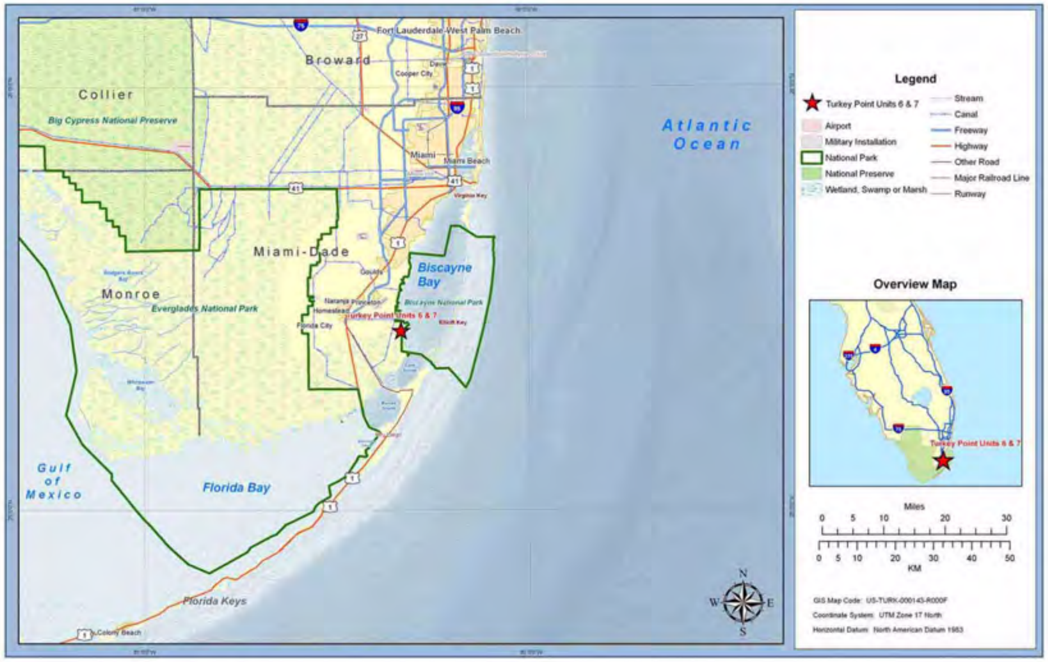


Figure 2.3-2 Areas Surrounding the Turkey Point Plant Property

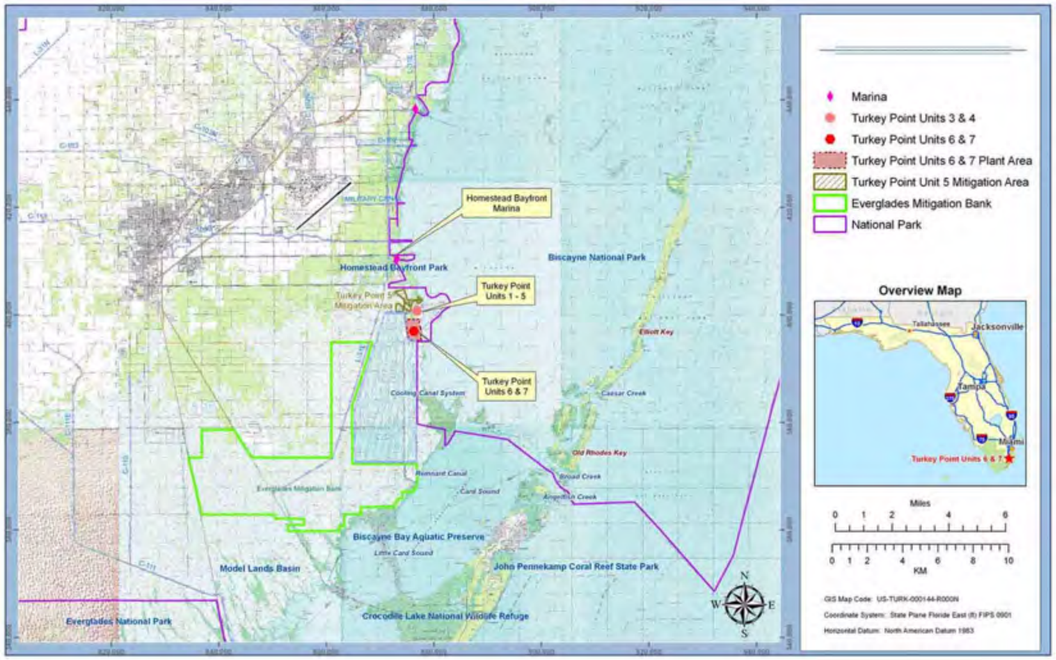


Figure 2.3-3 The Turkey Point Plant Property Including the Industrial Wastewater Facility

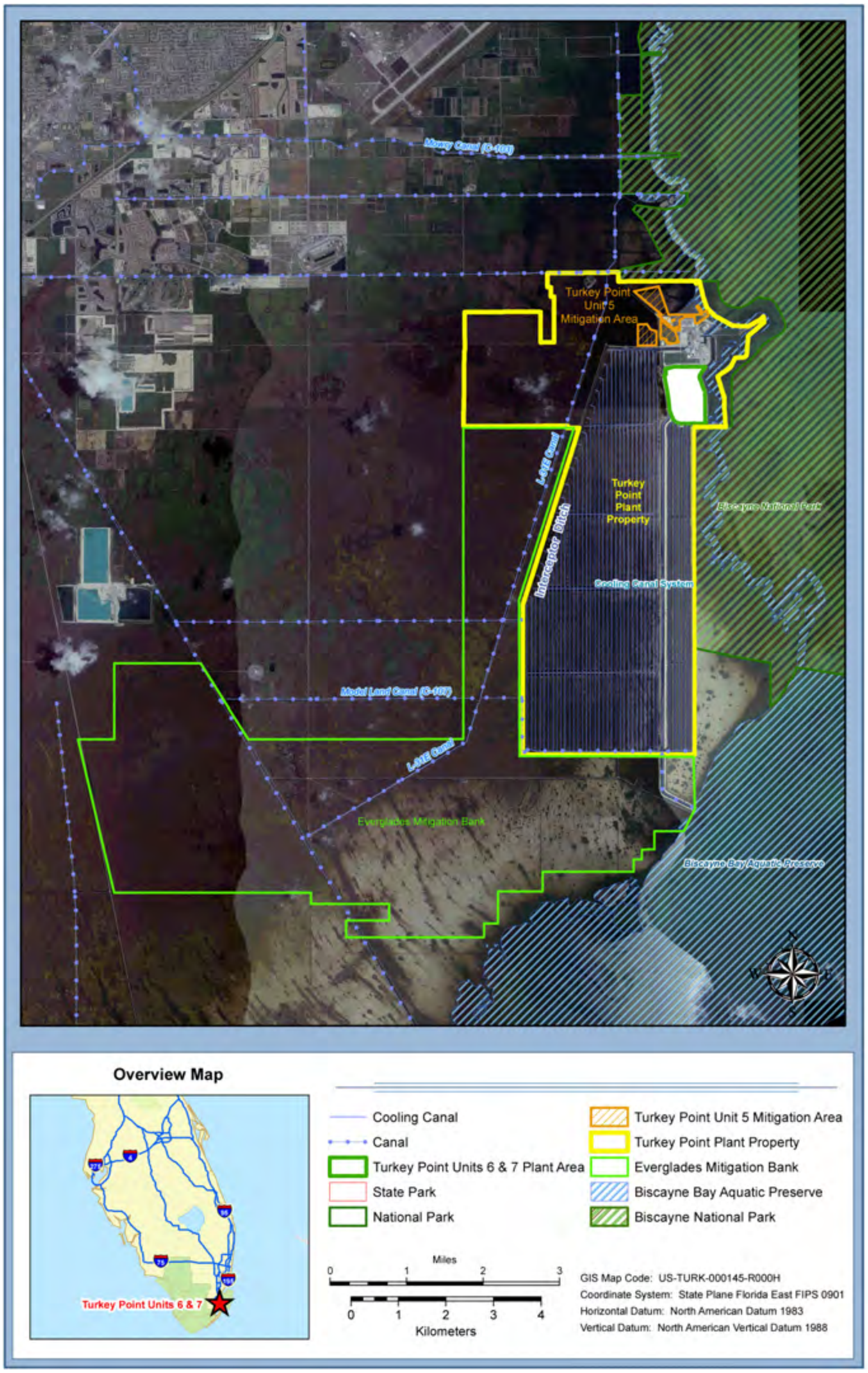


Figure 2.3-4 General Arrangement of Units 6 & 7

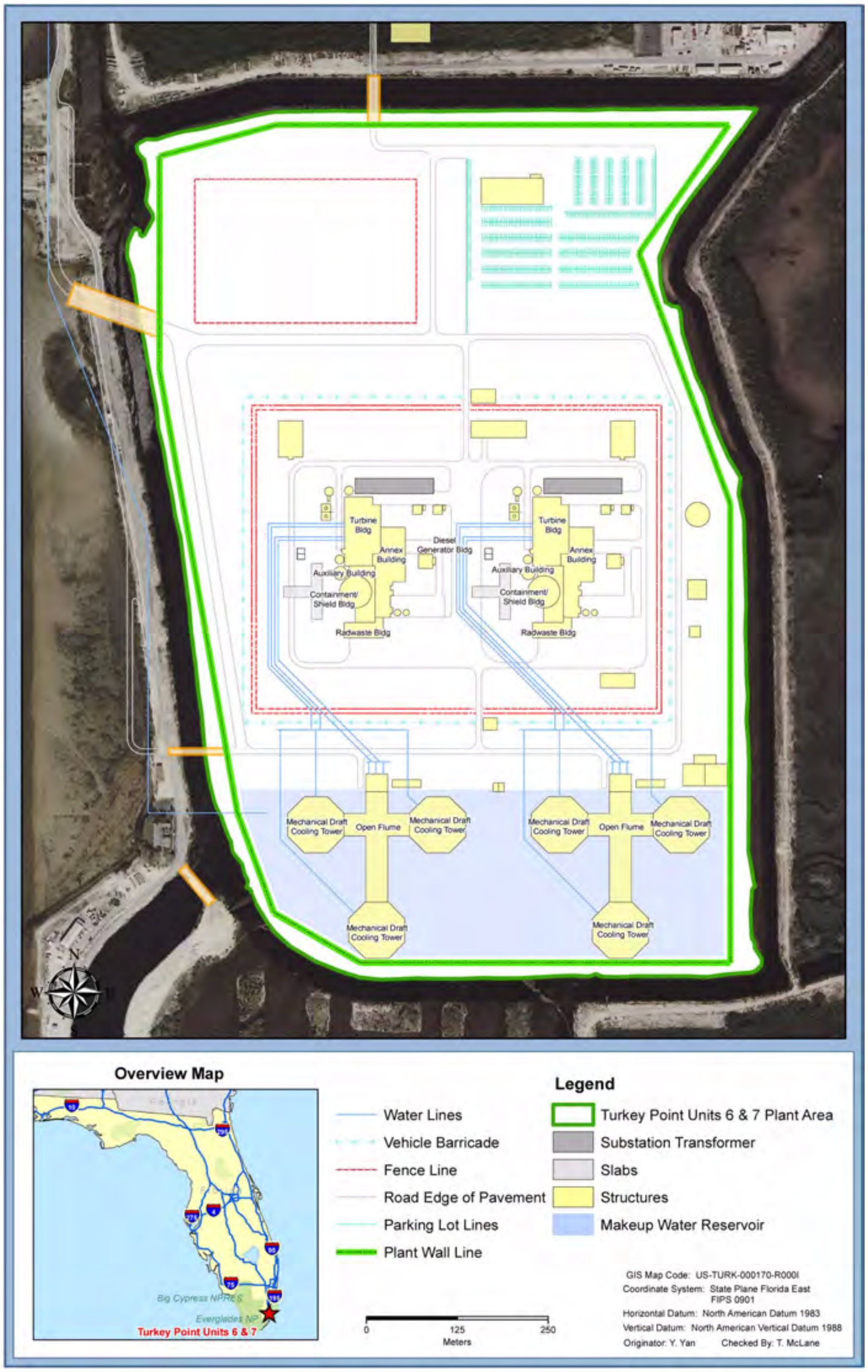
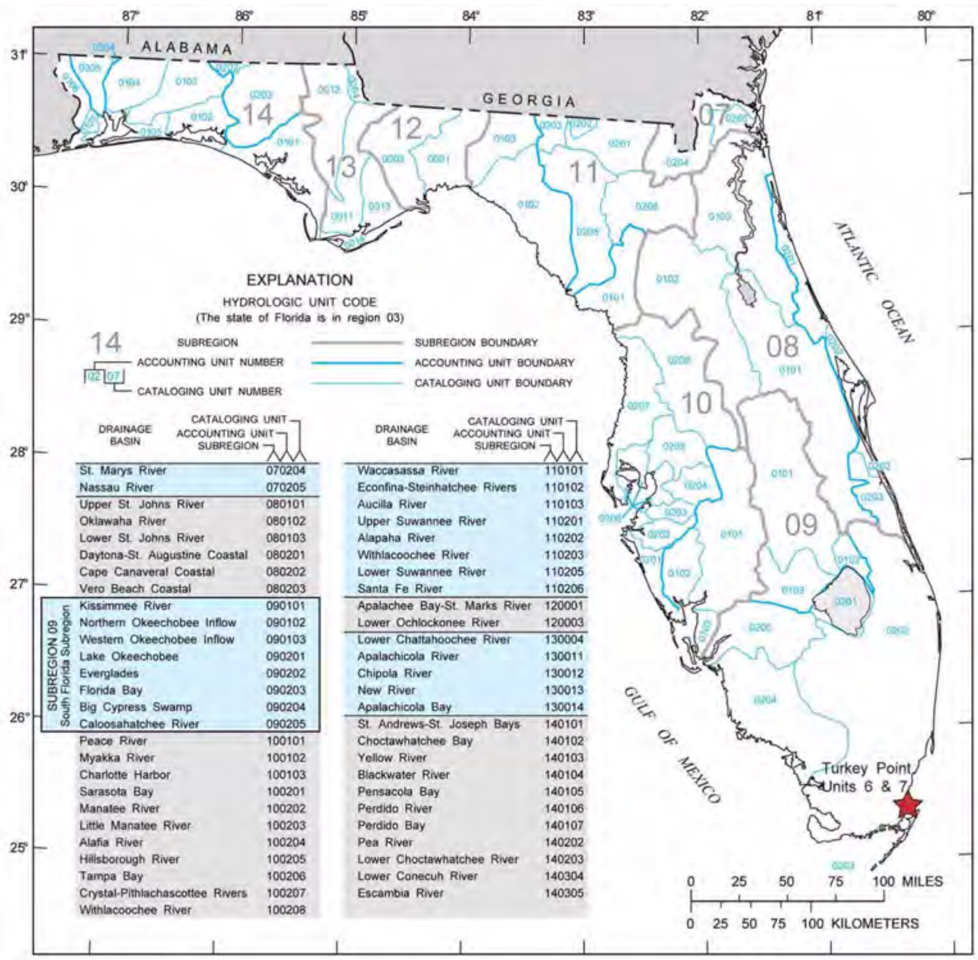


Figure 2.3-5 Map of South Florida Watershed Subregions

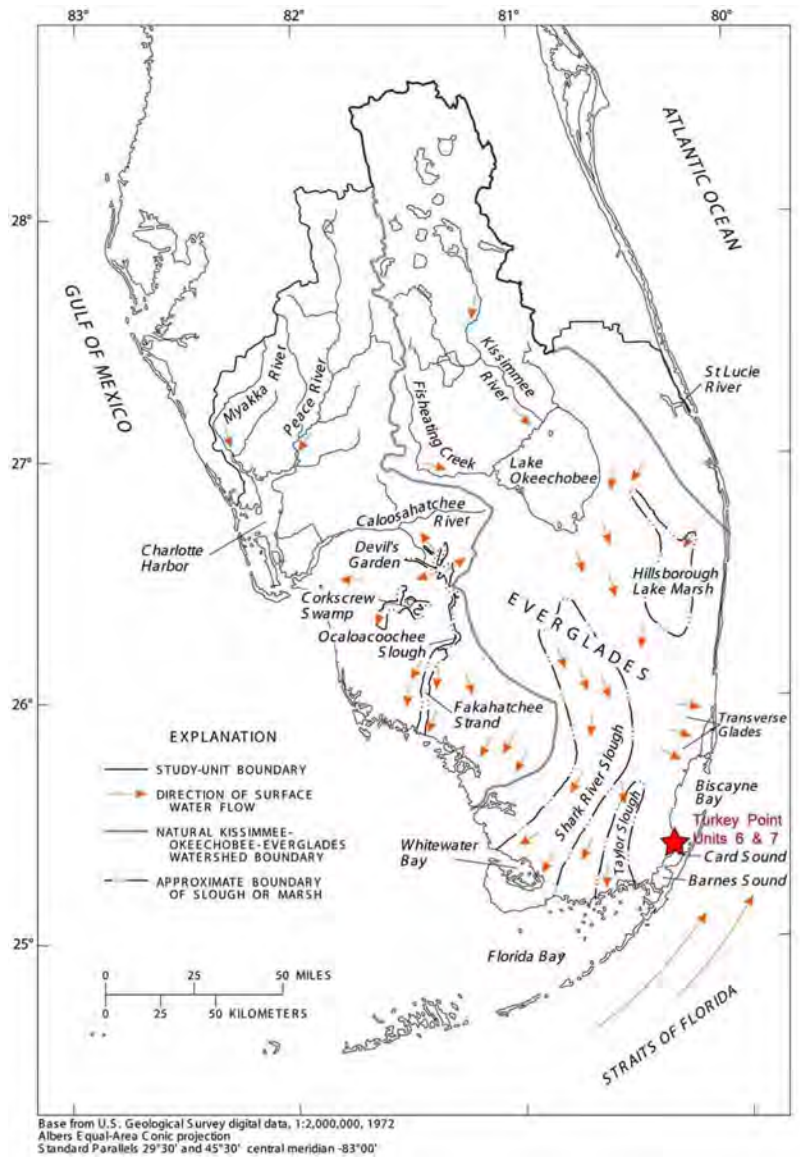


DRAINAGE BASIN	SUBREGION / ACCOUNTING UNIT / CATALOGING UNIT
St. Marys River	070204
Nassau River	070205
Upper St. Johns River	080101
Oklawaha River	080102
Lower St. Johns River	080103
Daytona-St. Augustine Coastal	080201
Cape Canaveral Coastal	080202
Vero Beach Coastal	080203
Kissimmee River	090101
Northern Okeechobee Inflow	090102
Western Okeechobee Inflow	090103
Lake Okeechobee	090201
Everglades	090202
Florida Bay	090203
Big Cypress Swamp	090204
Caloosahatchee River	090205
Peace River	100101
Myakka River	100102
Charlotte Harbor	100103
Sarasota Bay	100201
Manatee River	100202
Little Manatee River	100203
Alafia River	100204
Hillsborough River	100205
Tampa Bay	100206
Crystal-Pithlachascottee Rivers	100207
Withlacoochee River	100208

DRAINAGE BASIN	SUBREGION / ACCOUNTING UNIT / CATALOGING UNIT
Waccasassa River	110101
Econfina-Steinhatchee Rivers	110102
Aucilla River	110103
Upper Suwannee River	110201
Alapaha River	110202
Withlacoochee River	110203
Lower Suwannee River	110205
Santa Fe River	110206
Apalachee Bay-St. Marks River	120001
Lower Ochlockonee River	120003
Lower Chattahoochee River	130004
Apalachicola River	130011
Chipola River	130012
New River	130013
Apalachicola Bay	130014
St. Andrews-St. Joseph Bays	140101
Choctawhatchee Bay	140102
Yellow River	140103
Blackwater River	140104
Pensacola Bay	140105
Perdido River	140106
Perdido Bay	140107
Pea River	140202
Lower Choctawhatchee River	140203
Lower Conecuh River	140304
Escambia River	140305

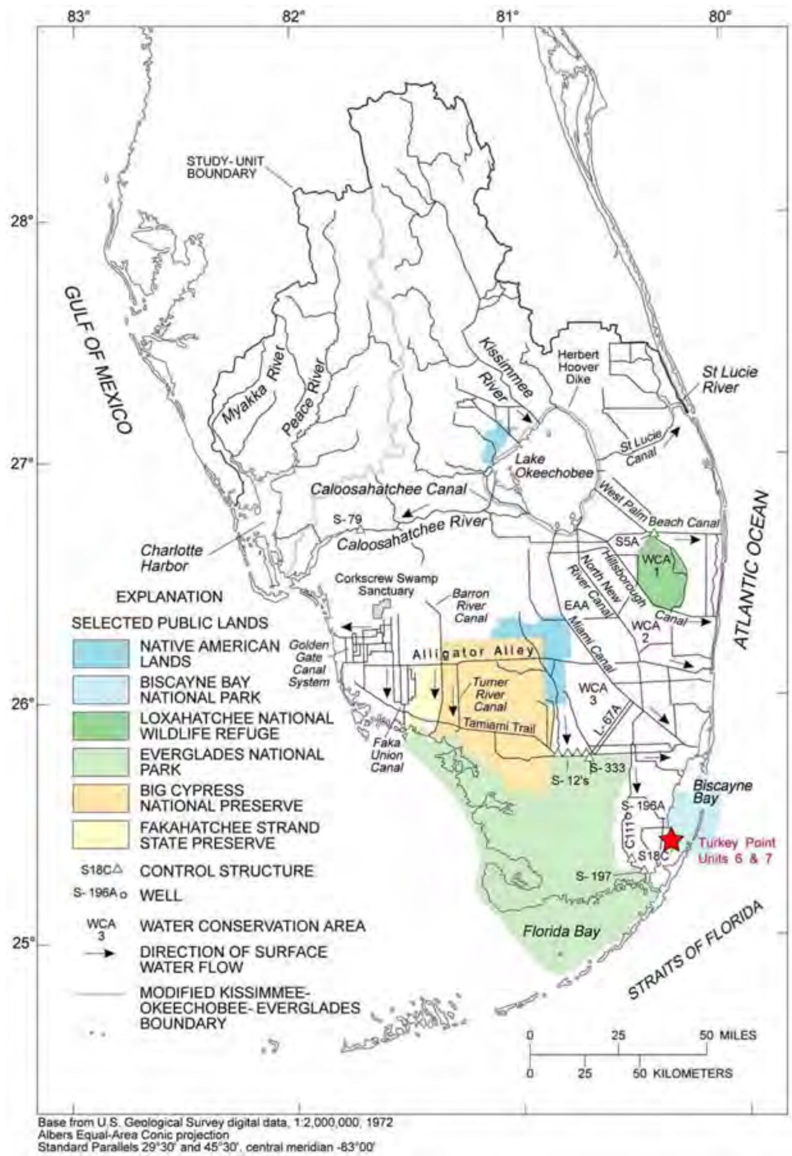
Modified from Marella 1999

Figure 2.3-6 Hydrologic Features and Predevelopment Flow Patterns within the South Florida Watershed



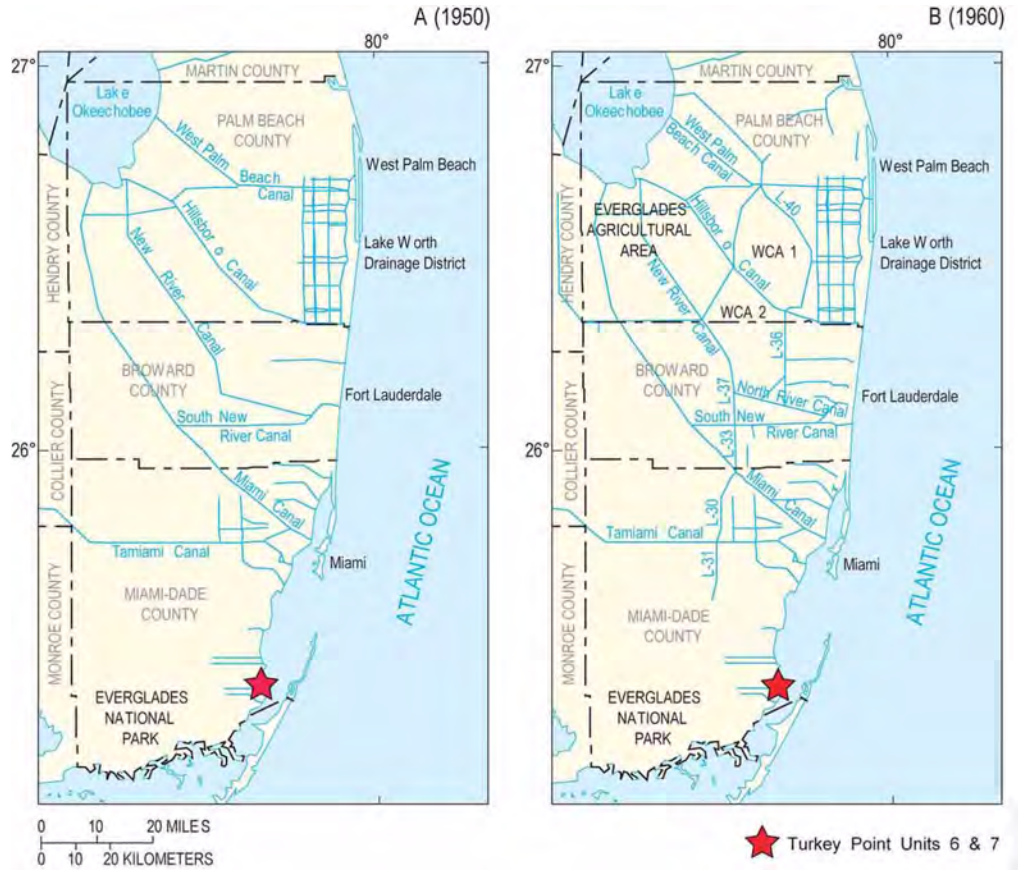
Modified from McPherson and Halley 1997

Figure 2.3-7 Selected Public Lands and Post-Development Flow Alteration within the South Florida Watershed



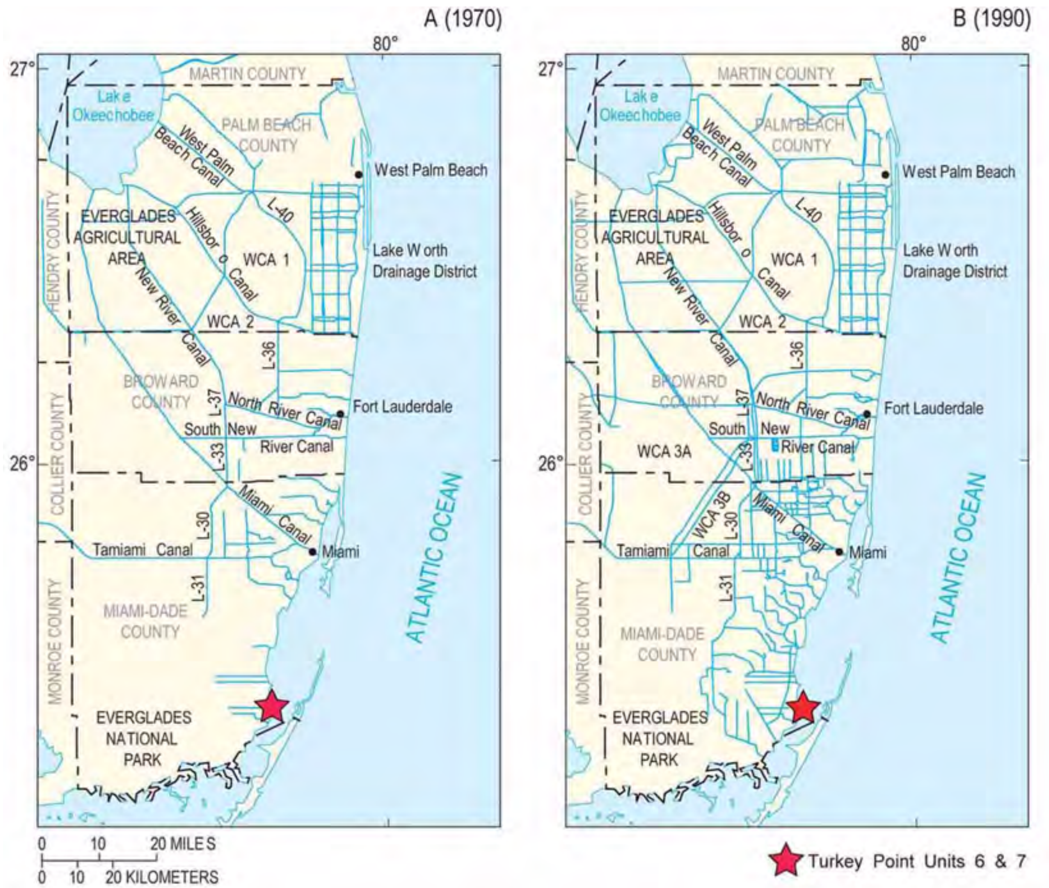
Modified from McPherson and Halley 1997

Figure 2.3-8 Surface Water Conveyance System in the South Florida Region in (A) 1950 and (B) 1960



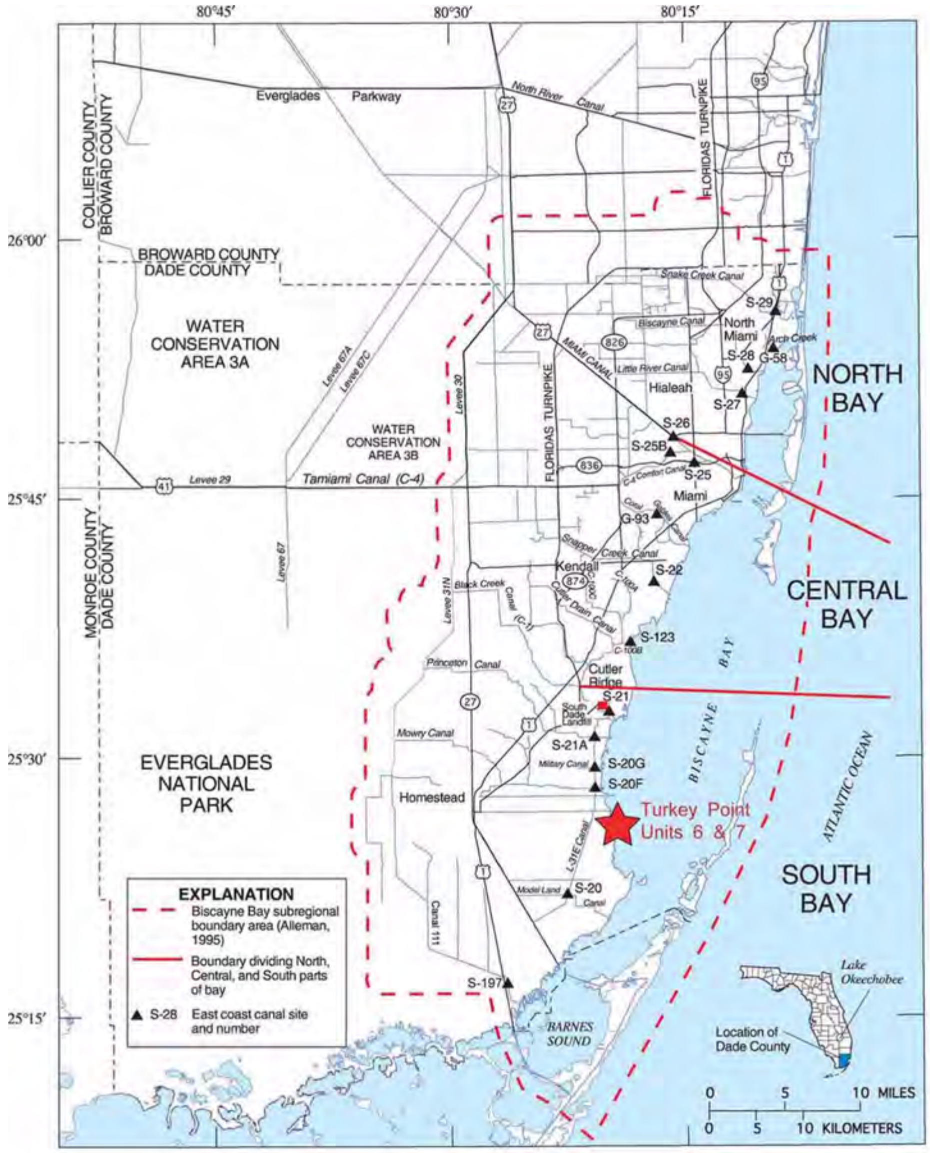
Modified from Renken et al. 2005

Figure 2.3-9 Surface Water Conveyance System in the South Florida Region in (A) 1970 and (B) 1990



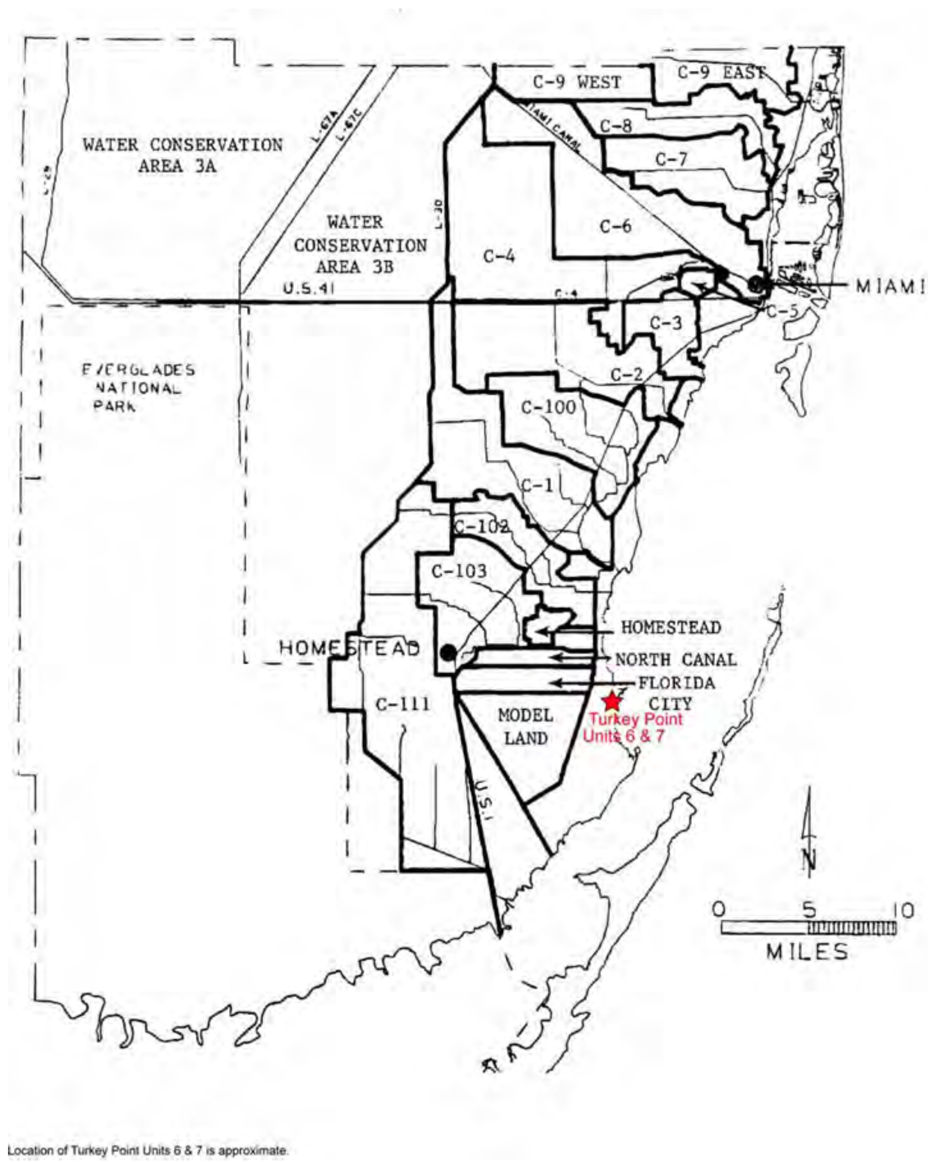
Modified from Renken et al. 2005

Figure 2.3-10 Locations of ENP-SDCS and C&SF Project Canals, Coastal Control Structures, and Planning Zones of the Biscayne Bay



Modified from Lietz 1999

Figure 2.3-11 Locations of Eastern Dade County Surface Water Management Basins



Modified from Cooper and Lane 1987

Figure 2.3-12 Locations of NOAA Tide Gages

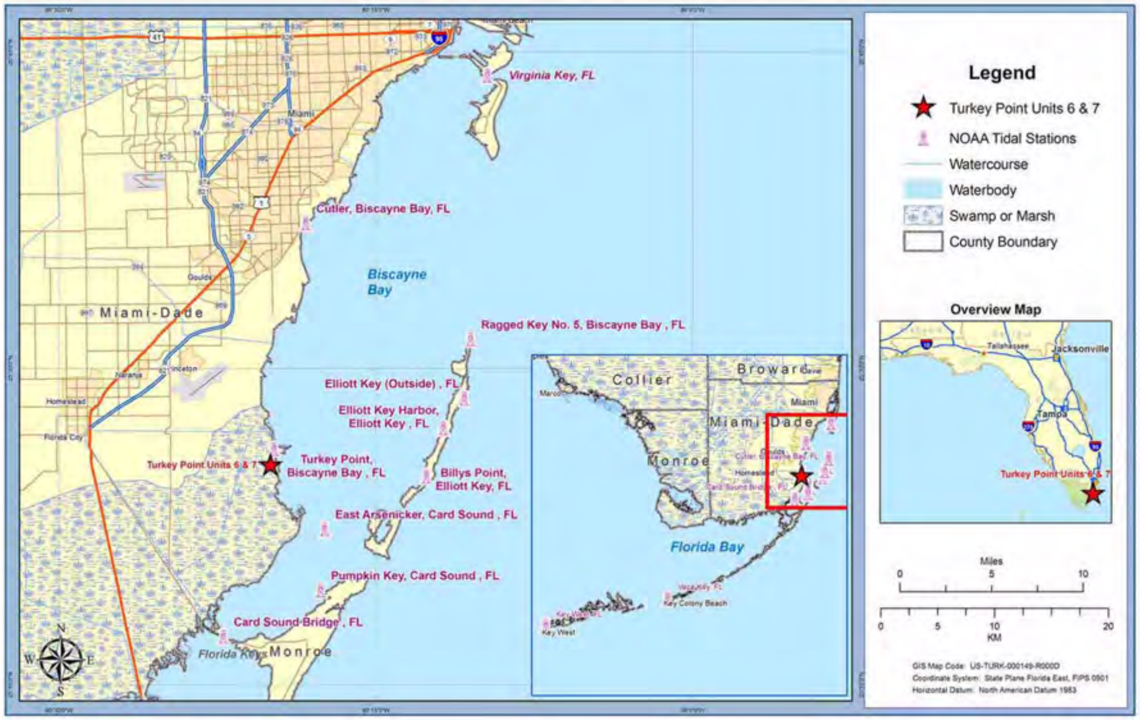


Figure 2.3-13 Biscayne Bay Bathymetry

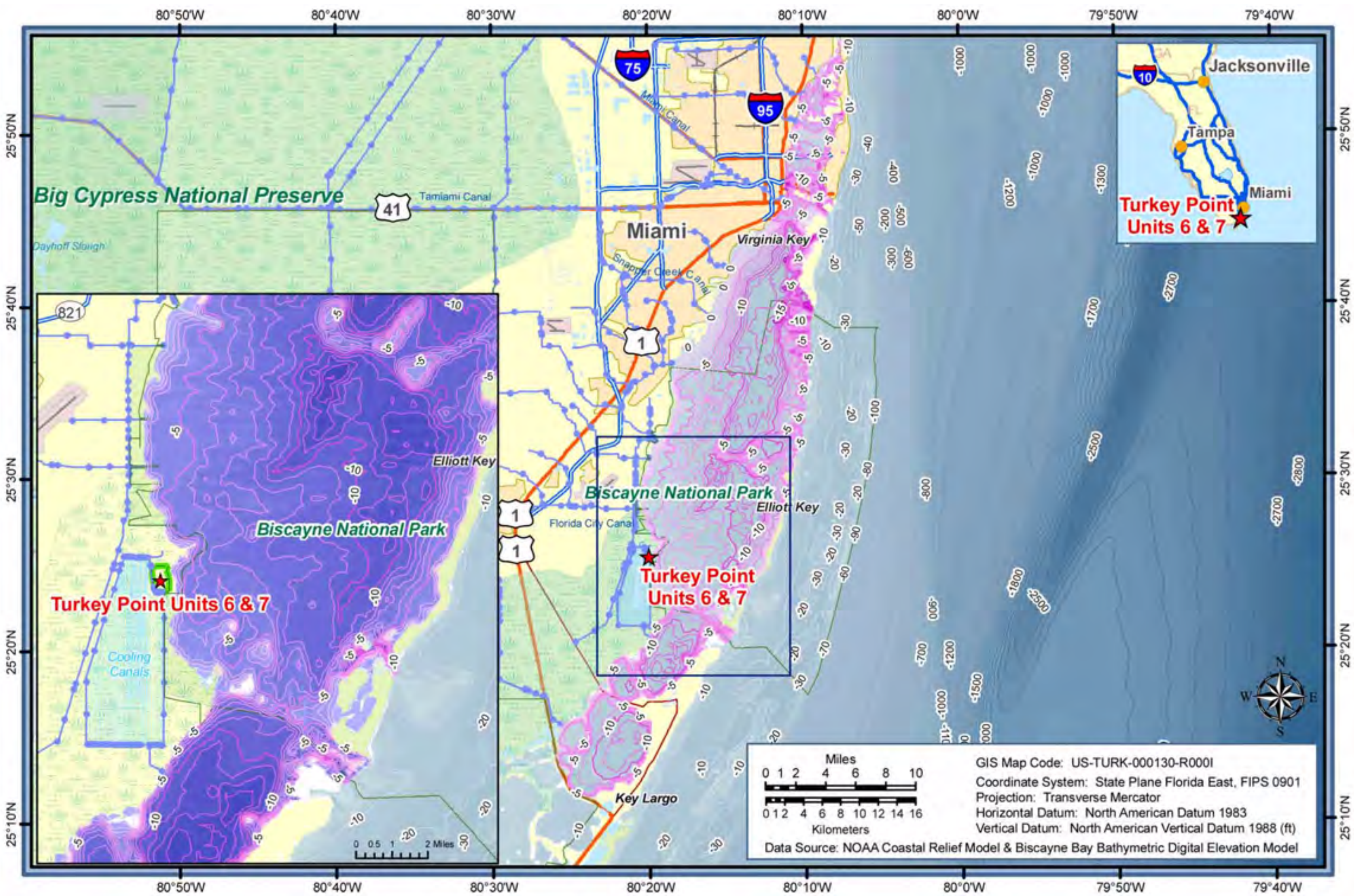


Figure 2.3-14 Designed Layout of the Industrial Wastewater Facility

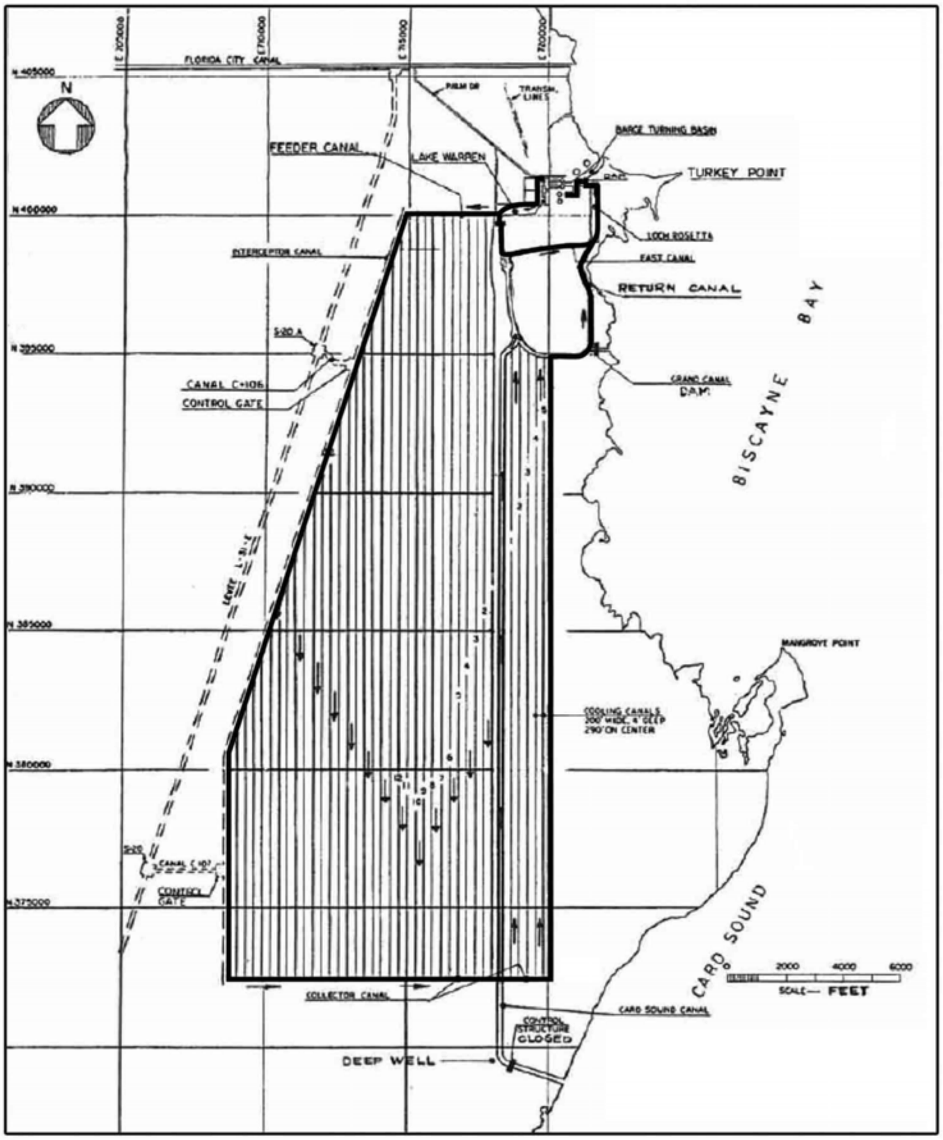


Figure 2.3-15 Locations of Wetlands Designated by U.S. Fish and Wildlife Services Near the Turkey Point Plant Property

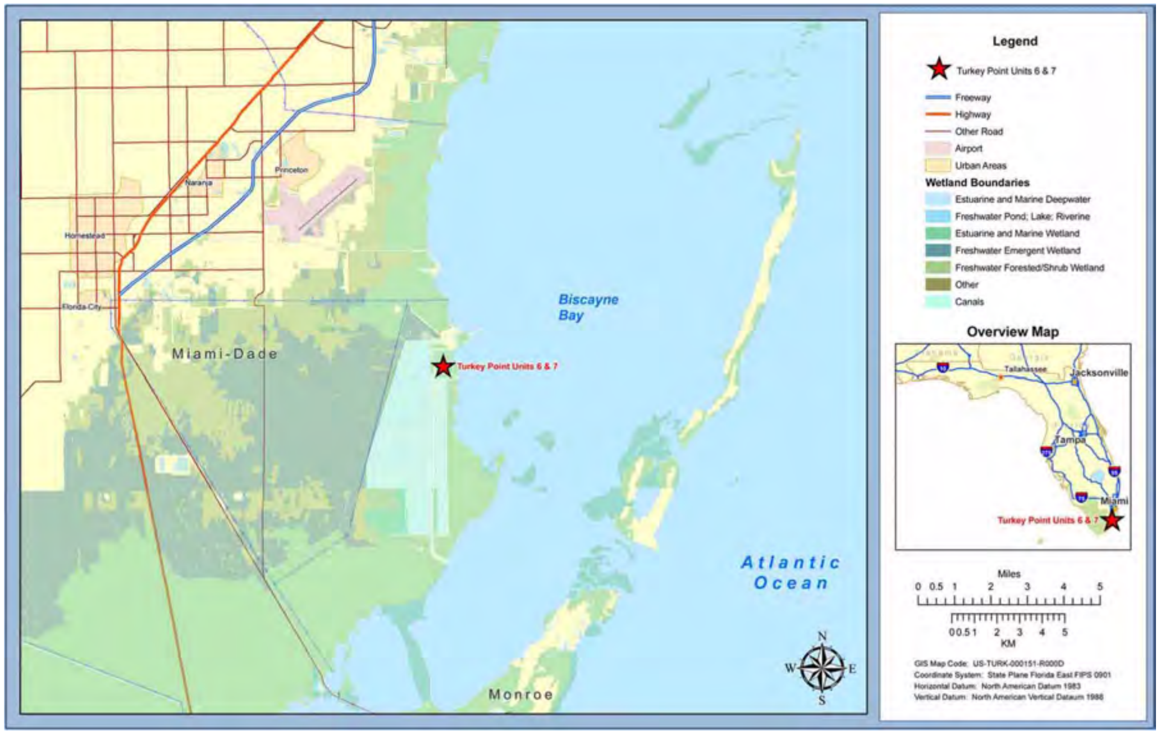
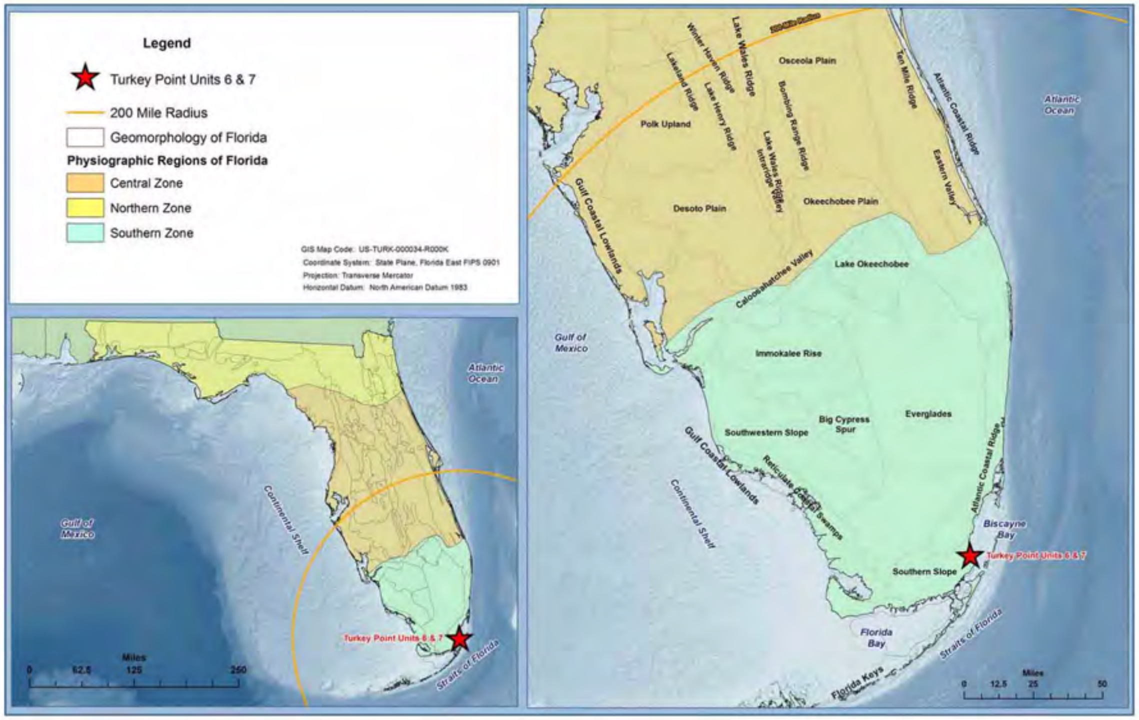
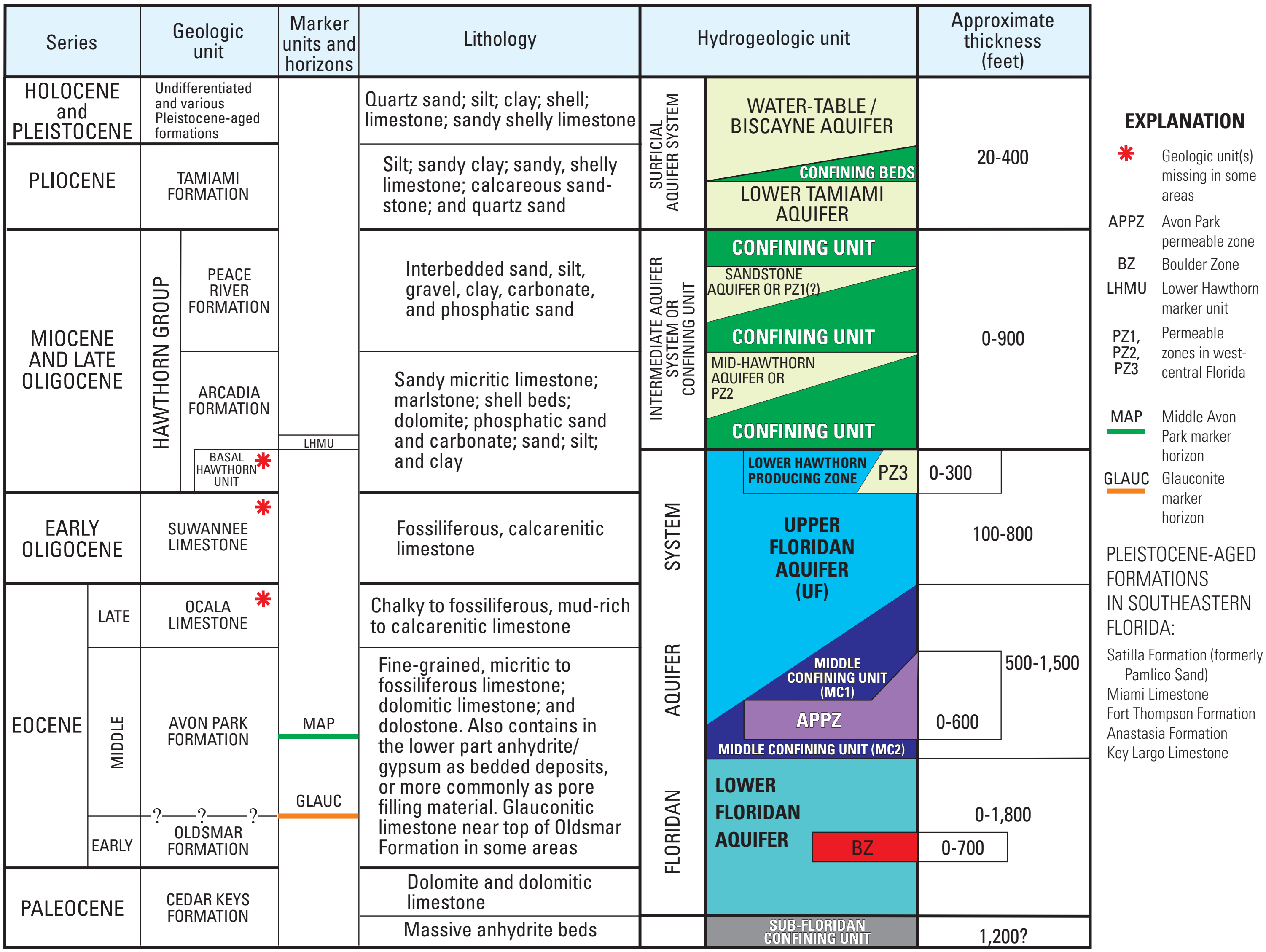


Figure 2.3-16 Physiographic Features



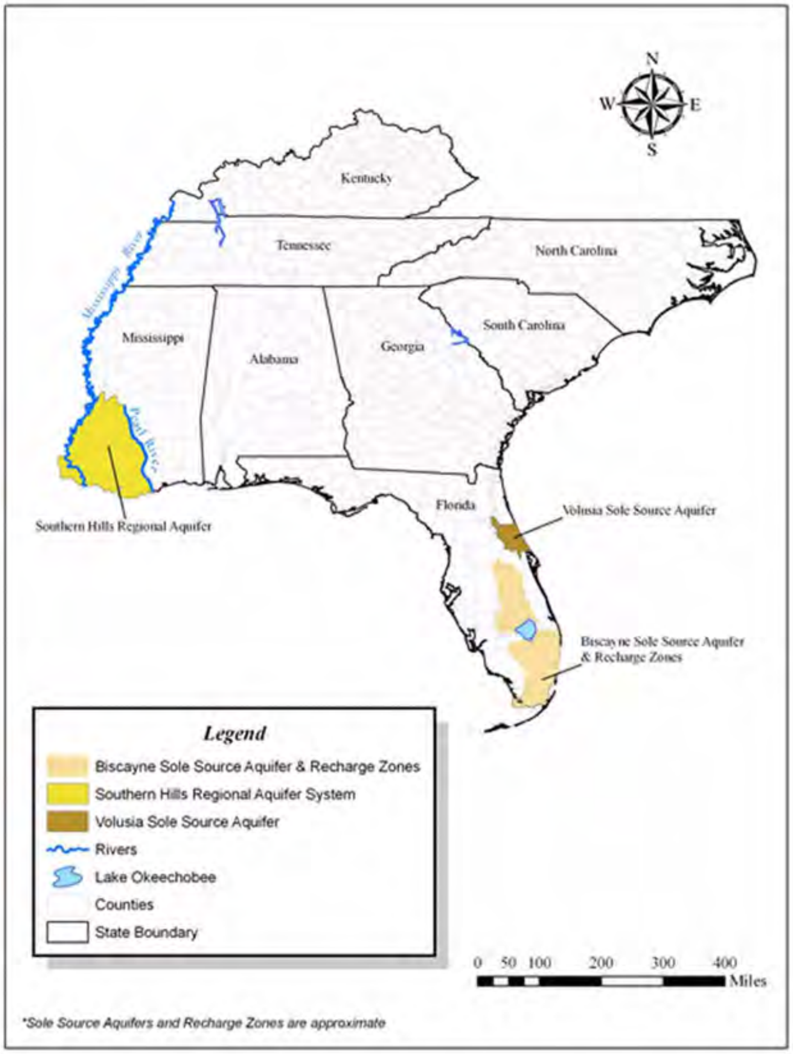
Modified from Randazzo and Jones 1997 and White 1970

Figure 2.3-17 Regional Generalized Hydrostratigraphic Column



Source: Reese and Richardson 2008

Figure 2.3-18 Approximate Boundaries of Region 4 Sole Source Aquifers



Source: U.S. EPA 2011

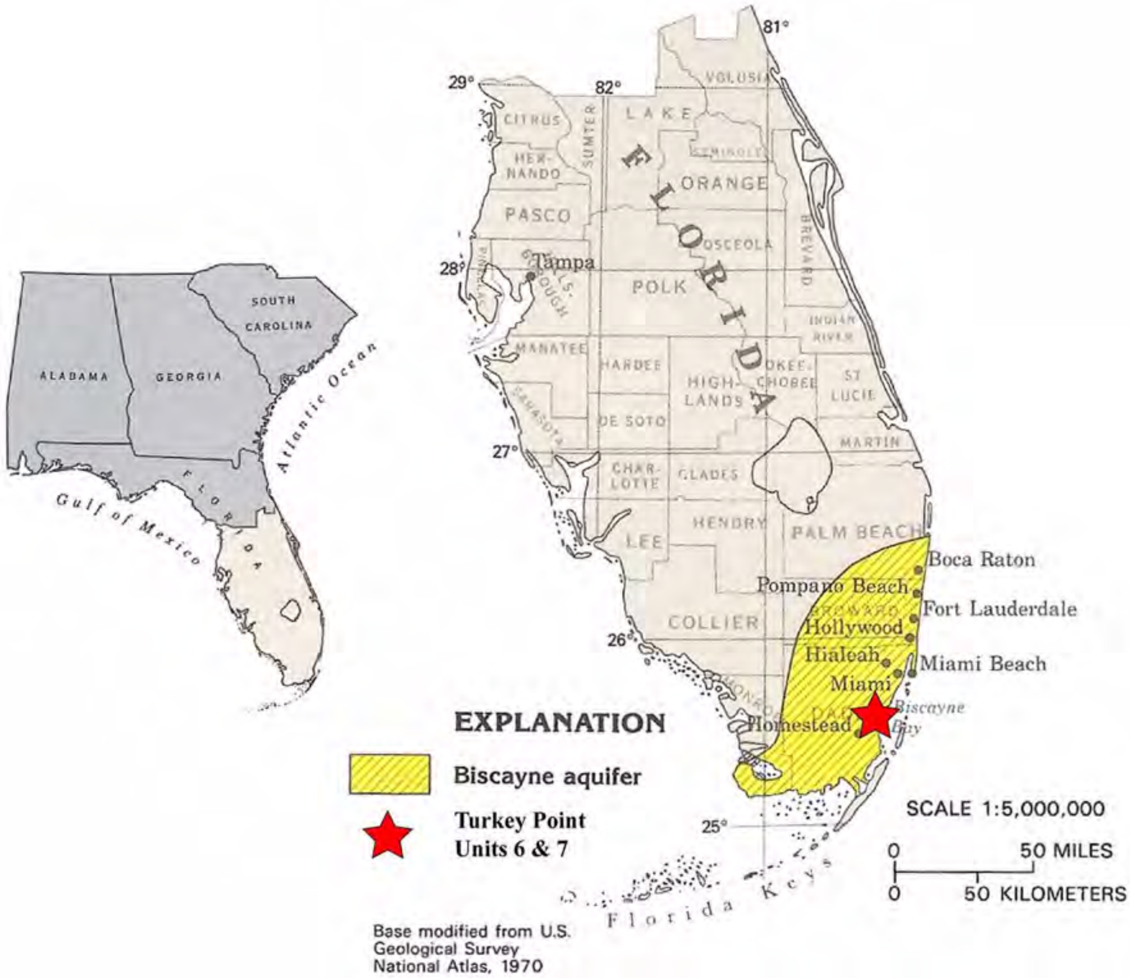
Figure 2.3-19 Site Hydrostratigraphic Column

ERATHEM	SYSTEM	SERIES	HYDROGEOLOGIC UNIT		STRATIGRAHIC UNIT		LITHOLOGY	APPROXIMATE TOP ELEVATION (feet NAVD 88)	APPROXIMATE THICKNESS (feet)
CENOZOIC	QUATERNARY	HOLOCENE	Surficial aquifer system	Biscayne aquifer	organic muck		organic soil and silt	0	3
		PLEISTOCENE			Miami Limestone		sandy, oolitic limestone	-3	25
					Key Largo Limestone		well indurated, vuggy, coralline limestone	-28	22
					Fort Thompson Formation		poor/well indurated fossiliferous limestone	-50	65
	TERTIARY	PLIOCENE		Semi-confining unit	Tamiami Formation		sand and silt with calcarenite limestone	-115	105
		MIOCENE	Intermediate confining unit		Hawthorn Group	Peace River Formation	silty calcareous sand and silt	formation contact based on natural gamma signature -220	235
						Arcadia Formation	calcareous wackestone with indurated limestones, sandstone, and sand	-455	>160 drilling ended at -616.5 feet NAVD 88

Color represents similar composition (carbonates, clastics, and organics).

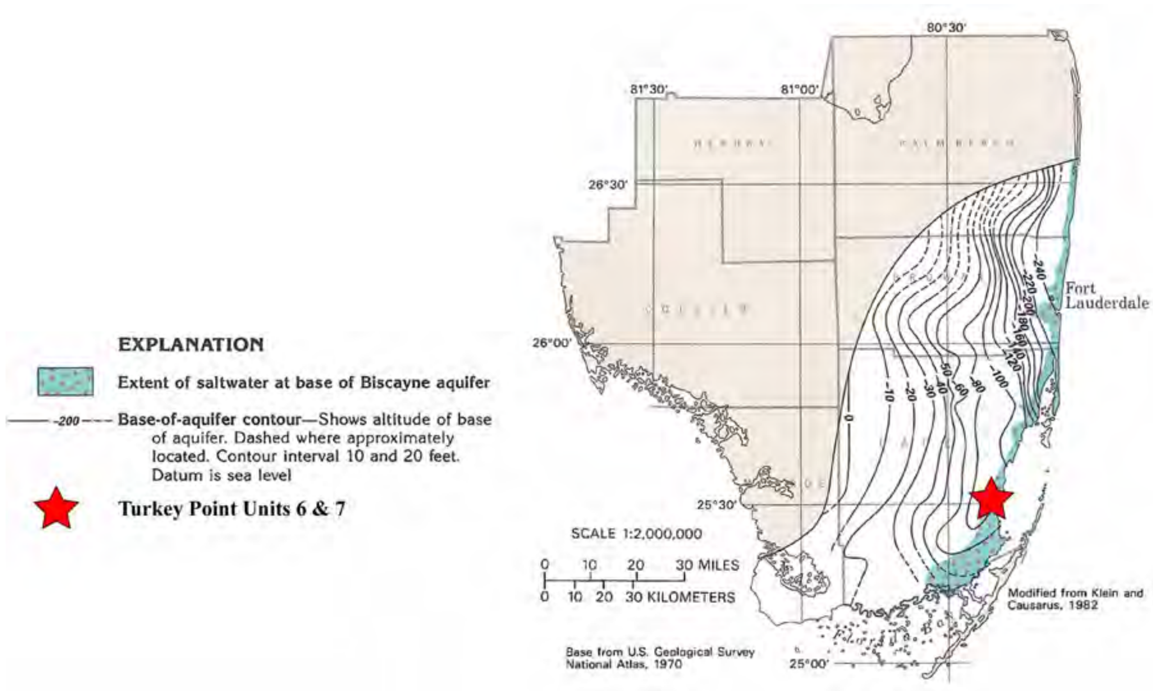
Figure 2.3-20 Not Used

Figure 2.3-21 Location of the Biscayne Aquifer in Southeast Florida



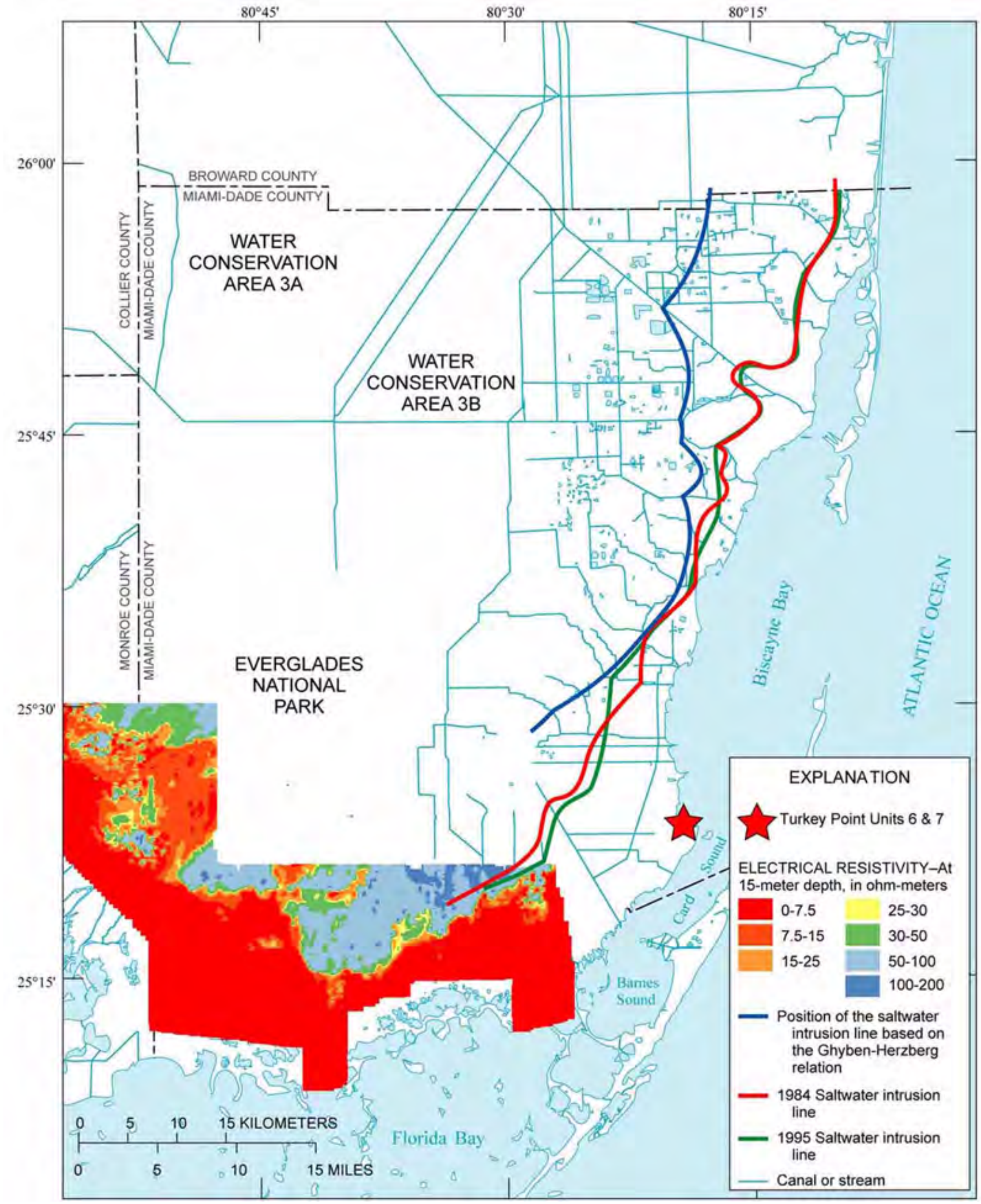
Modified from Miller 1990

Figure 2.3-22 Base of the Biscayne Aquifer



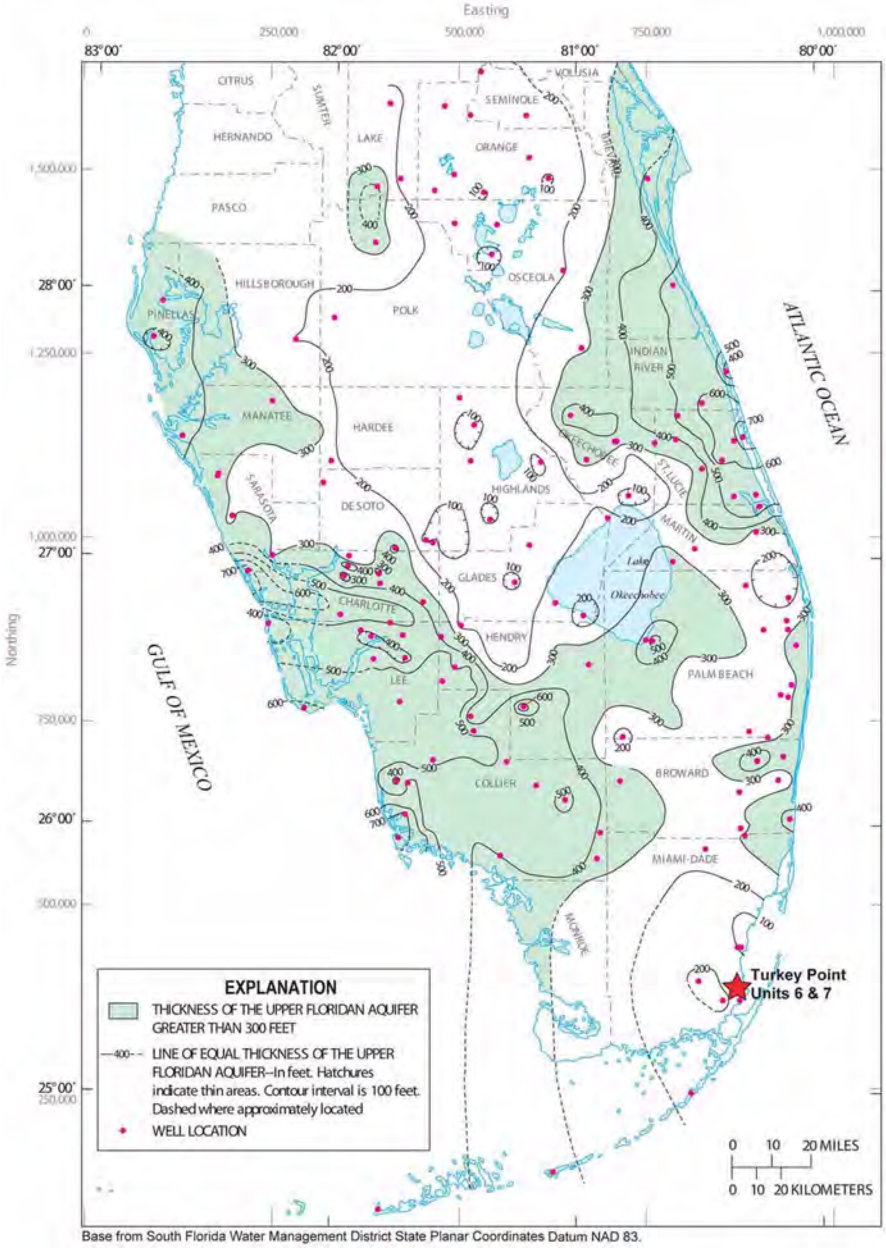
Modified from Miller 1990

Figure 2.3-23 Location of the Freshwater-Saltwater Interface



Modified from Langevin 2001

Figure 2.3-24 Thickness of the Upper Floridan Aquifer



Modified from Reese and Richardson 2008

Figure 2.3-25 Units 6 & 7 Observation Well Locations

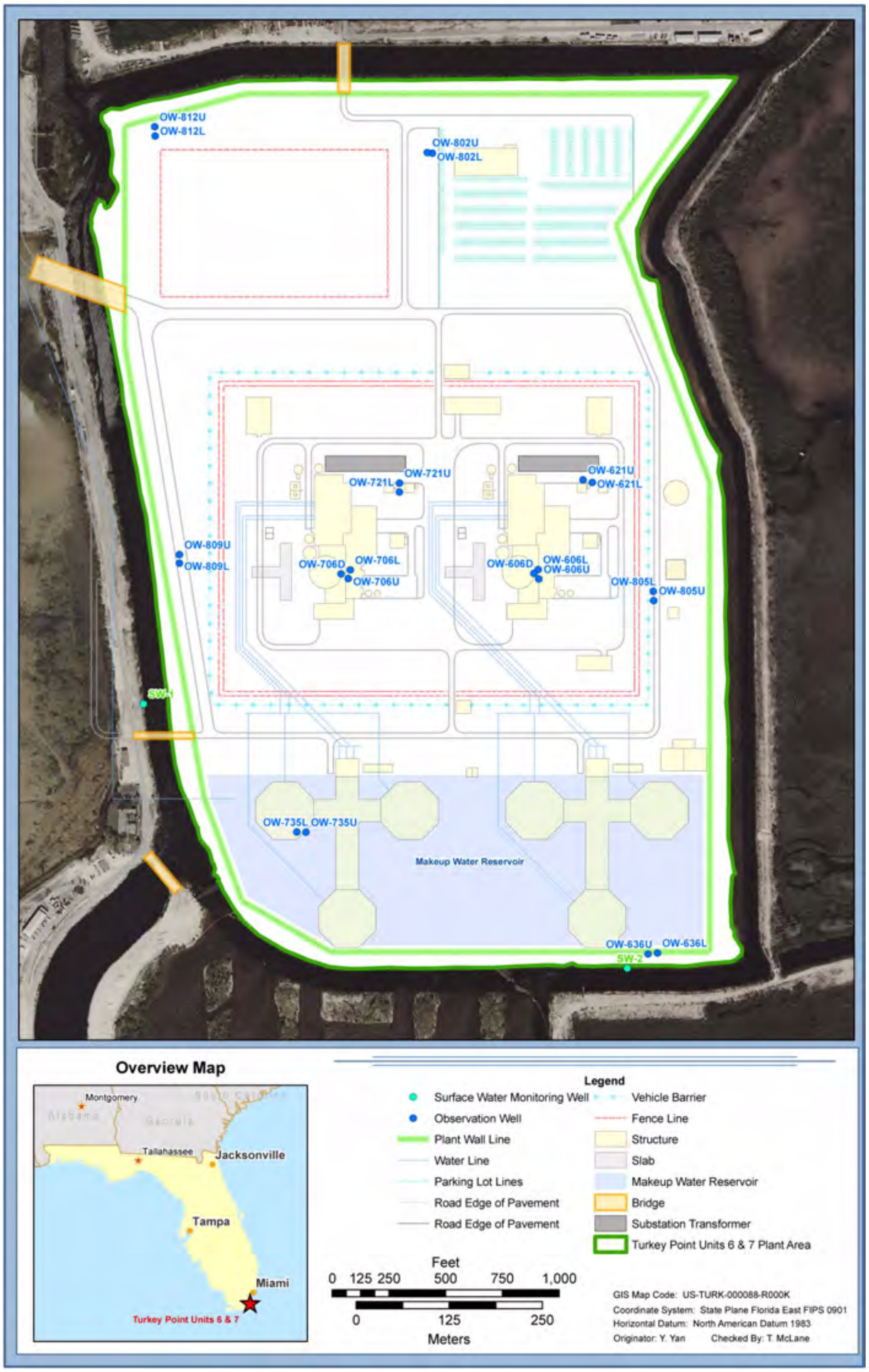
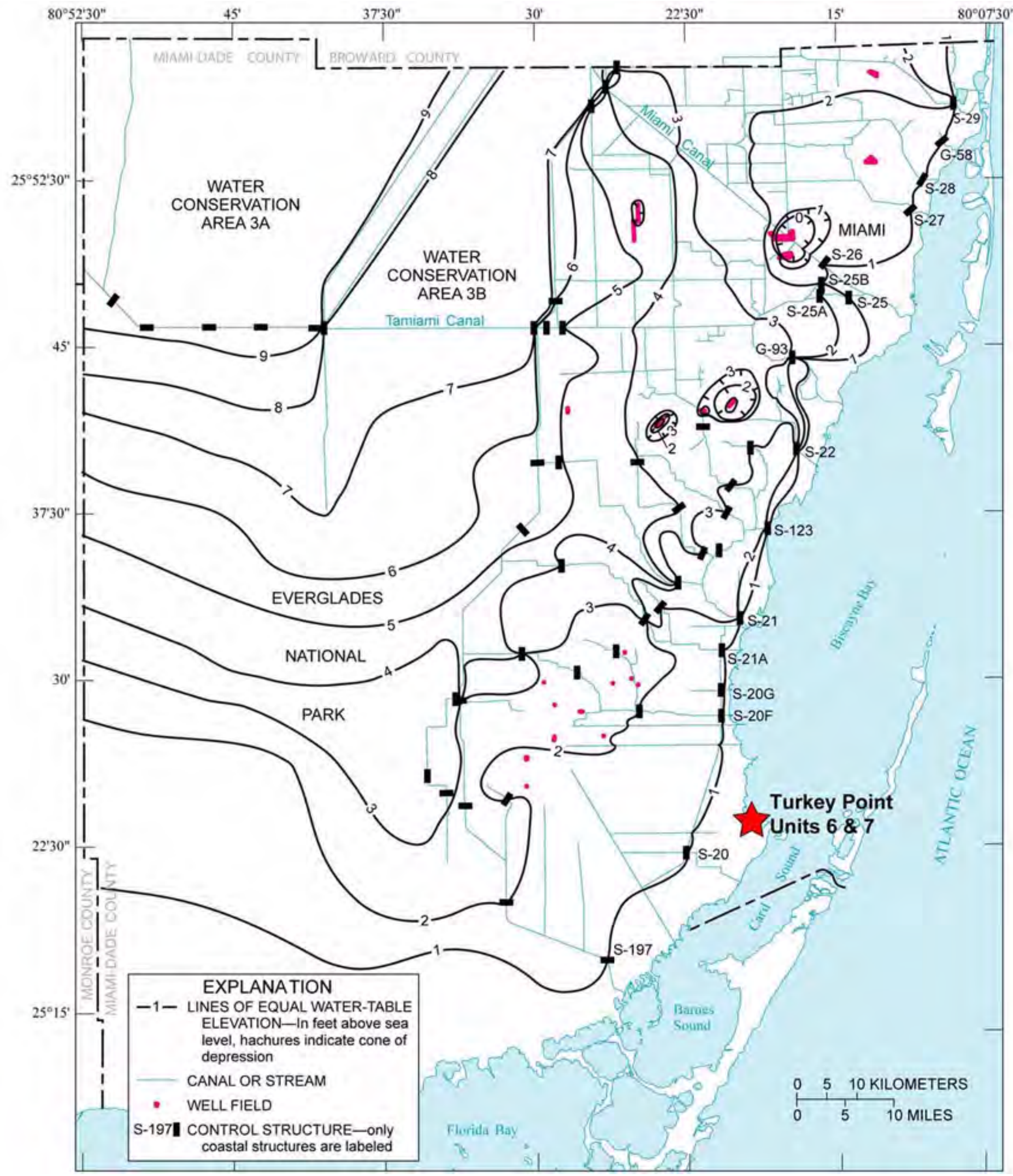
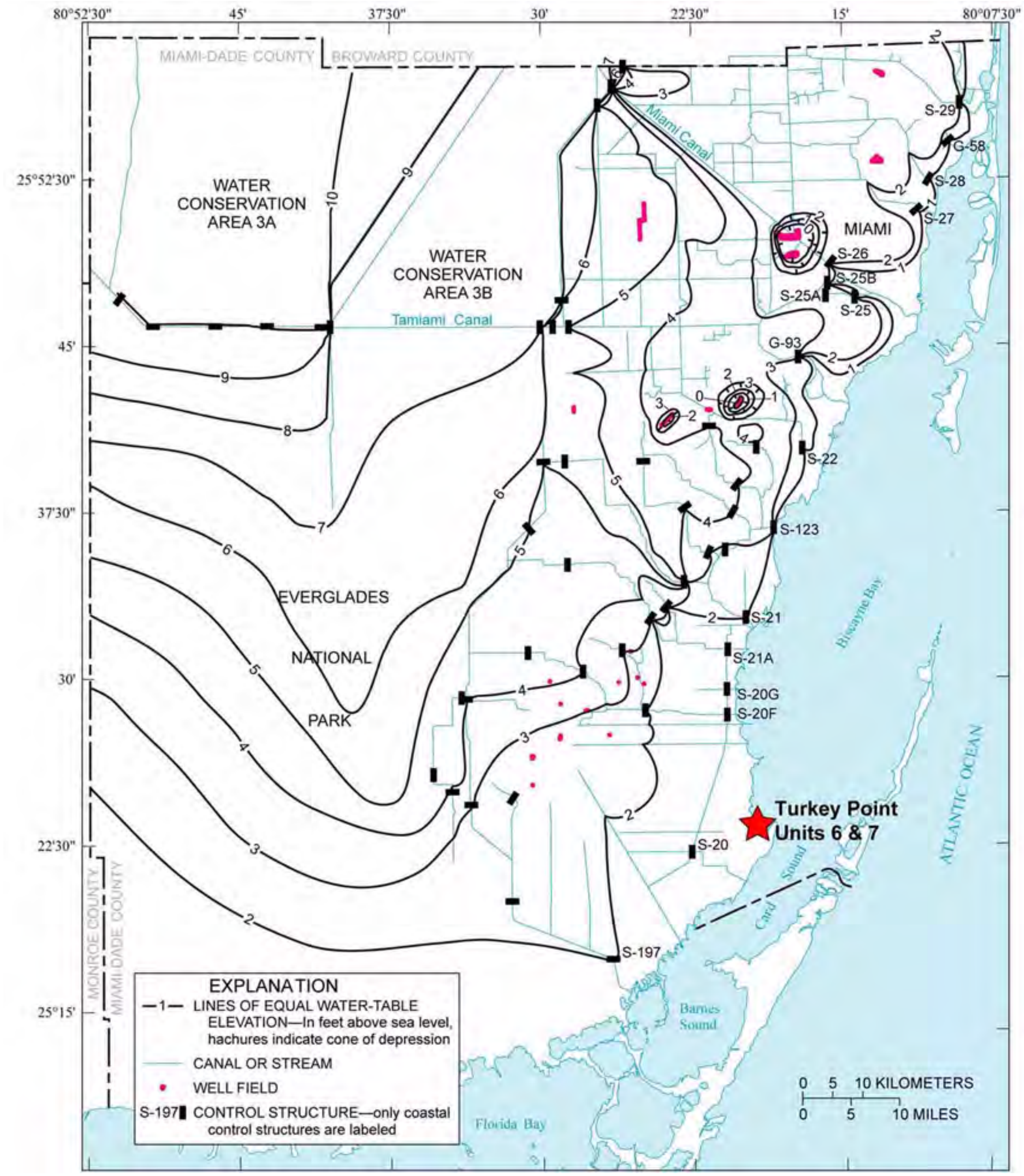


Figure 2.3-26 May 1993 Biscayne Aquifer Potentiometric Surface Map



Modified from Langevin 2001

Figure 2.3-27 November 1993 Biscayne Aquifer Potentiometric Surface Map



Modified from Langevin 2001

Figure 2.3-28 Biscayne Aquifer Potentiometric Surface Map, Upper Monitoring Interval, June 29, 2008 (Sheet 1 of 2) High Tide

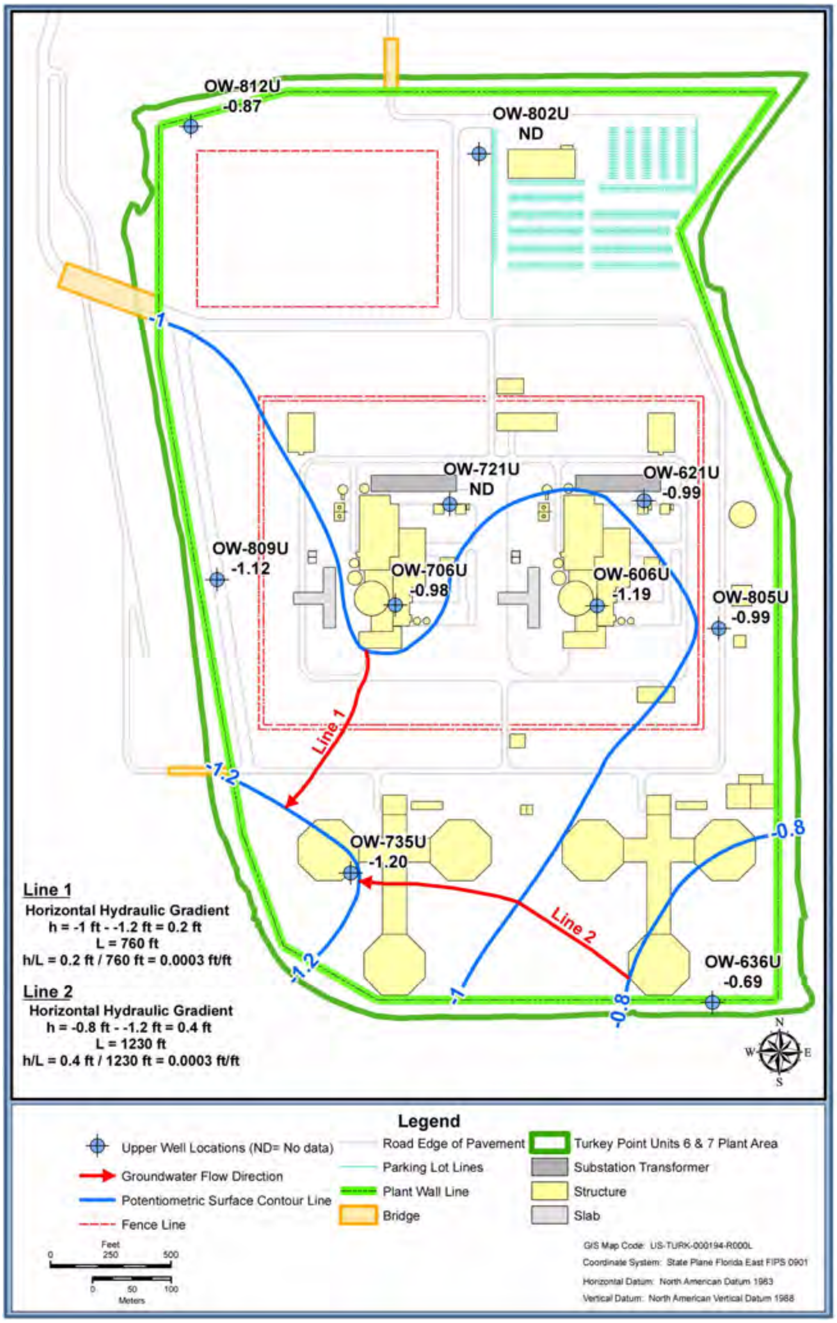


Figure 2.3-28 Biscayne Aquifer Potentiometric Surface Map, Upper Monitoring Interval, June 29, 2008 (Sheet 2 of 2) Low Tide

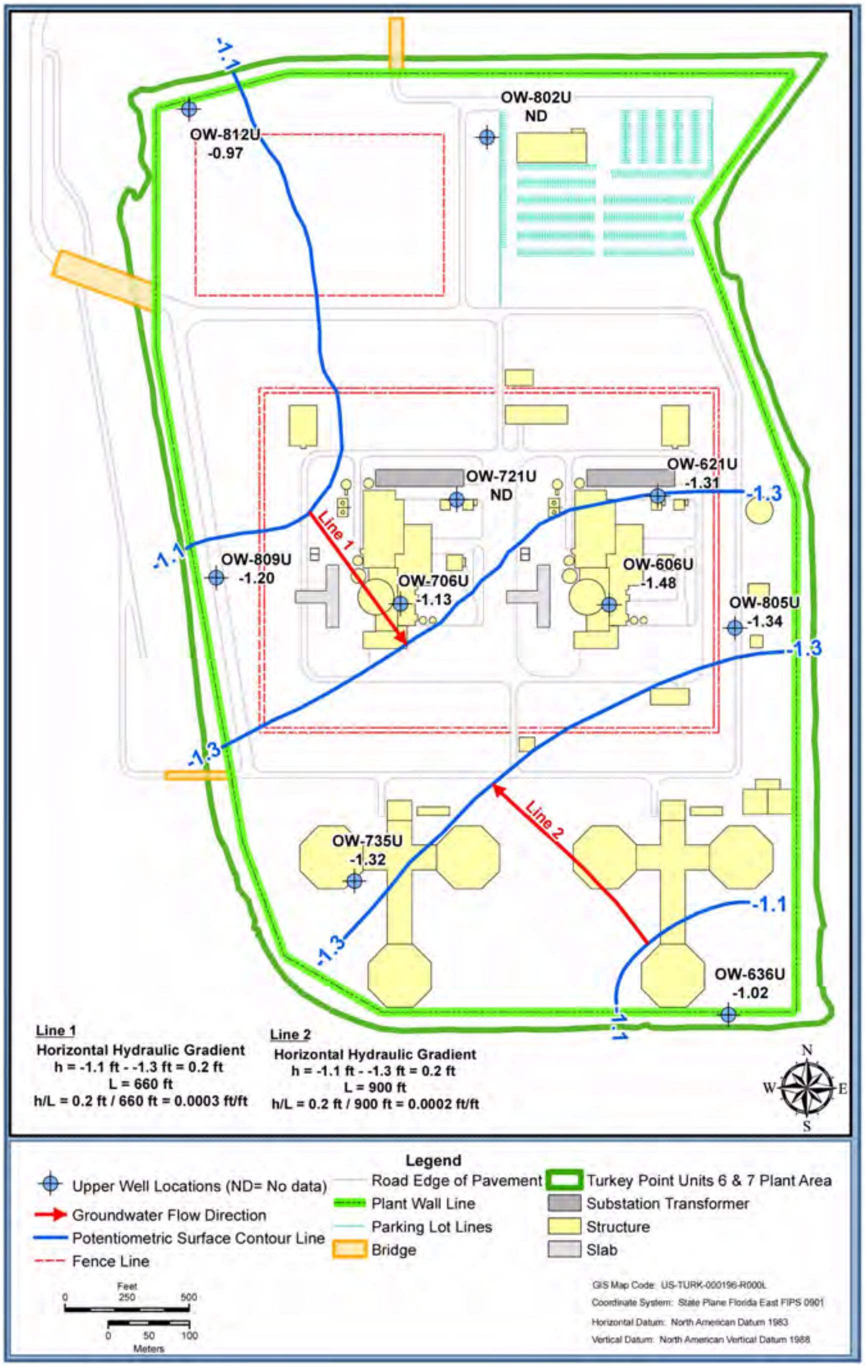


Figure 2.3-29 Biscayne Aquifer Potentiometric Surface Map, Lower Monitoring Interval, June 29, 2008 (Sheet 1 of 2) High Tide

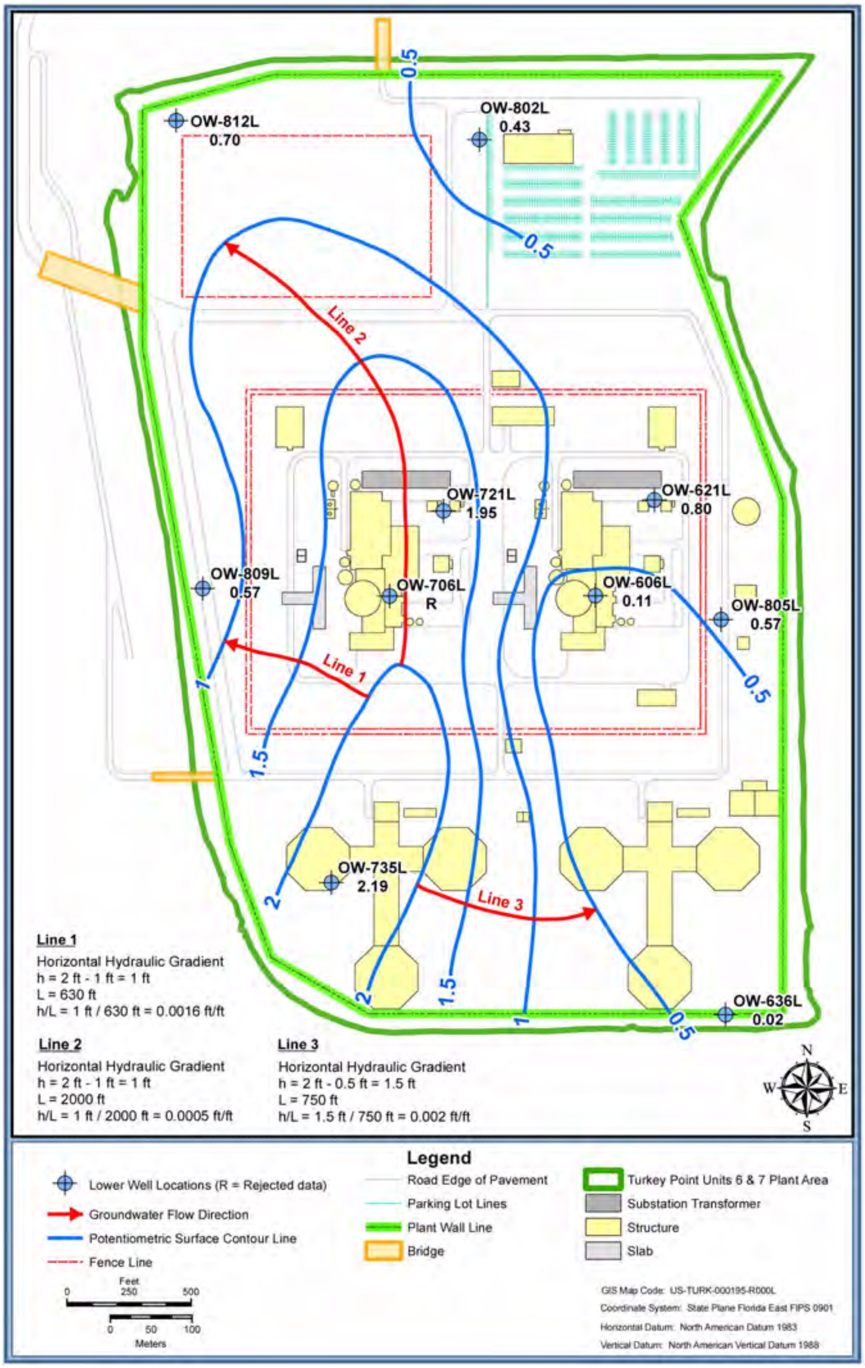


Figure 2.3-29 Biscayne Aquifer Potentiometric Surface Map, Lower Monitoring Interval, June 29, 2008 (Sheet 2 of 2) Low Tide

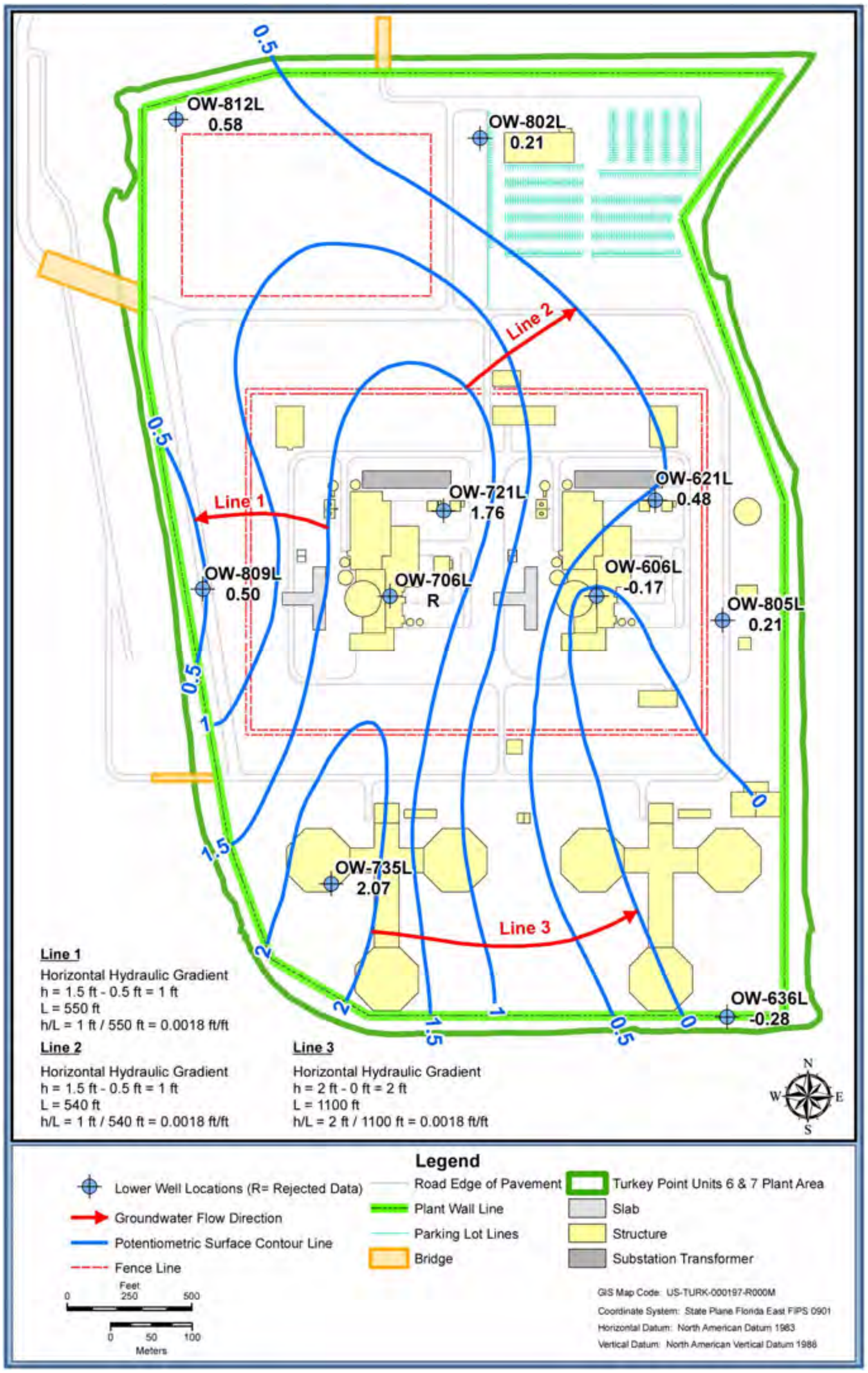


Figure 2.3-30 Biscayne Aquifer Potentiometric Surface Map, Upper Monitoring Interval, August 15, 2008 (Sheet 1 of 2) High Tide

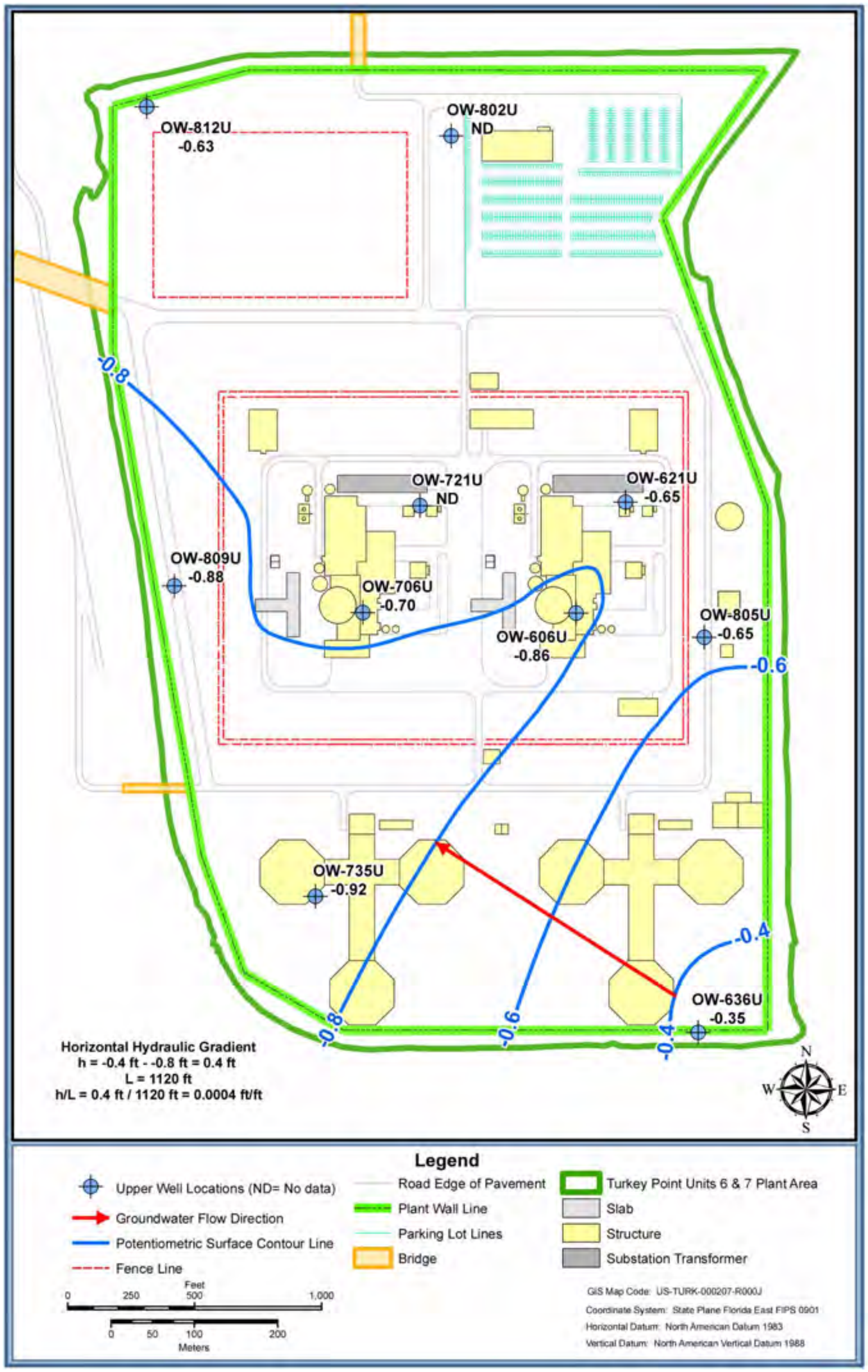


Figure 2.3-30 Biscayne Aquifer Potentiometric Surface Map, Upper Monitoring Interval, August 15, 2008 (Sheet 2 of 2) Low Tide

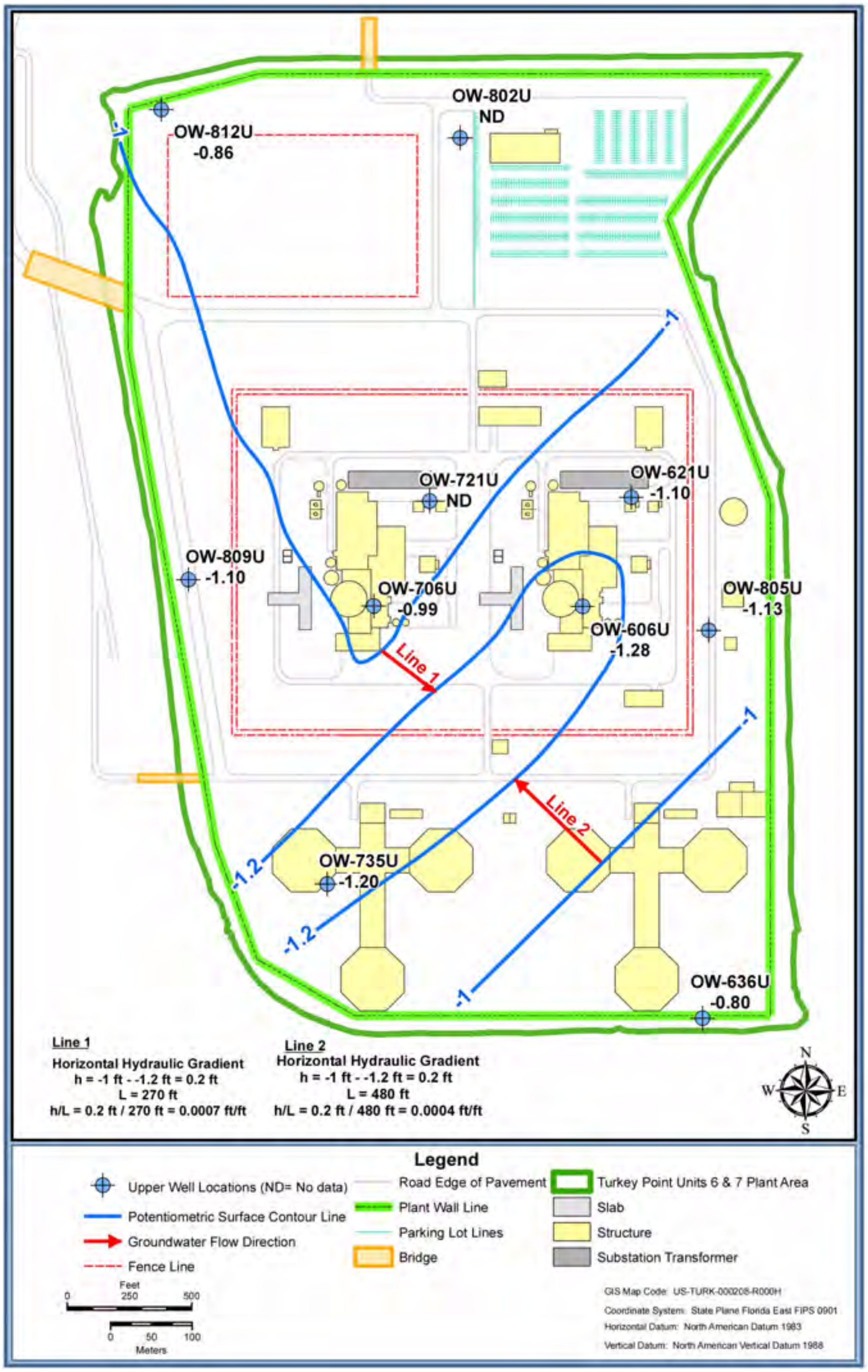


Figure 2.3-31 Biscayne Aquifer Potentiometric Surface Map, Lower Monitoring Interval, August 15, 2008 (Sheet 1 of 2) High Tide

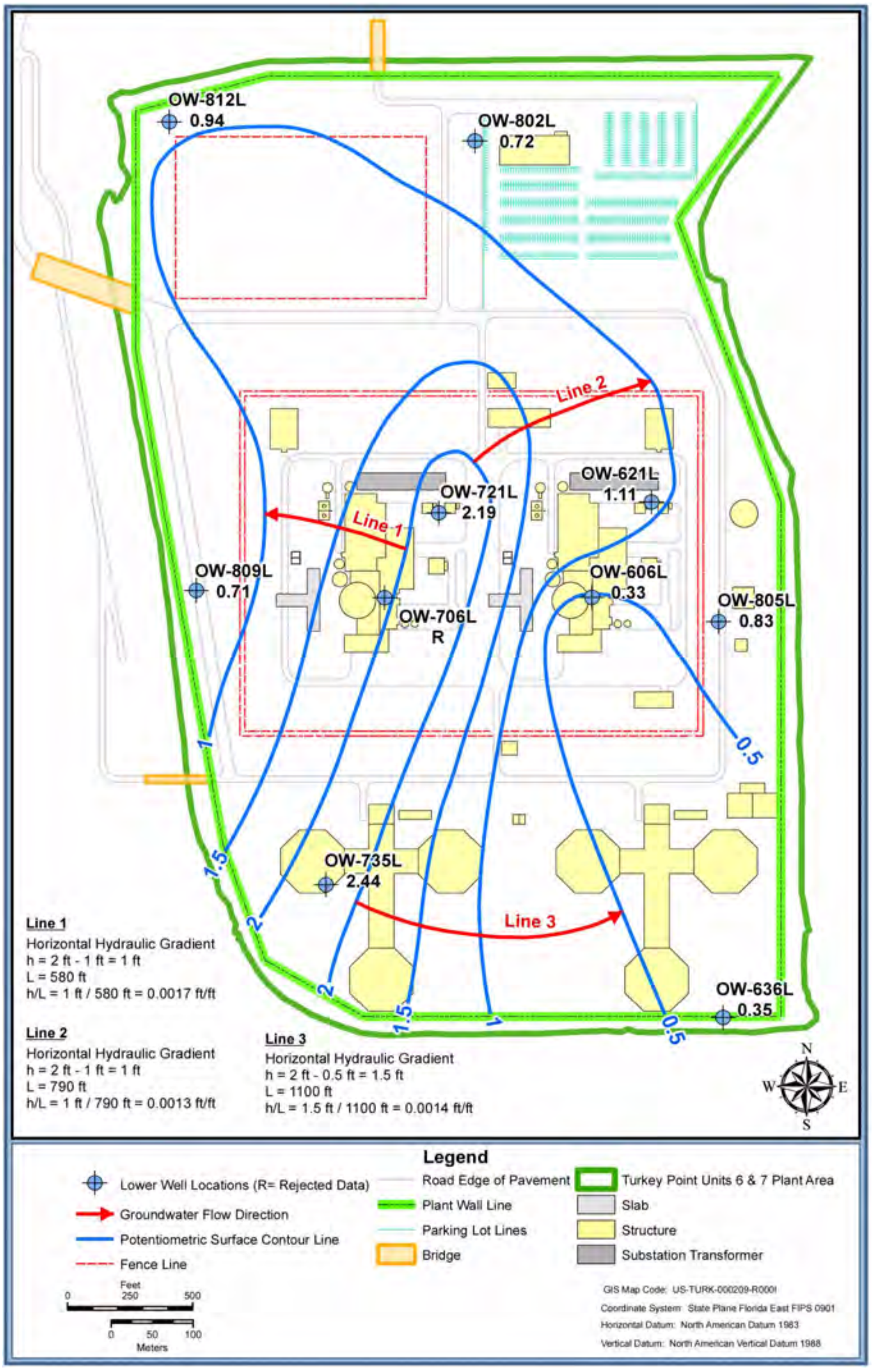


Figure 2.3-31 Biscayne Aquifer Potentiometric Surface Map, Lower Monitoring Interval, August 15, 2008 (Sheet 2 of 2) Low Tide

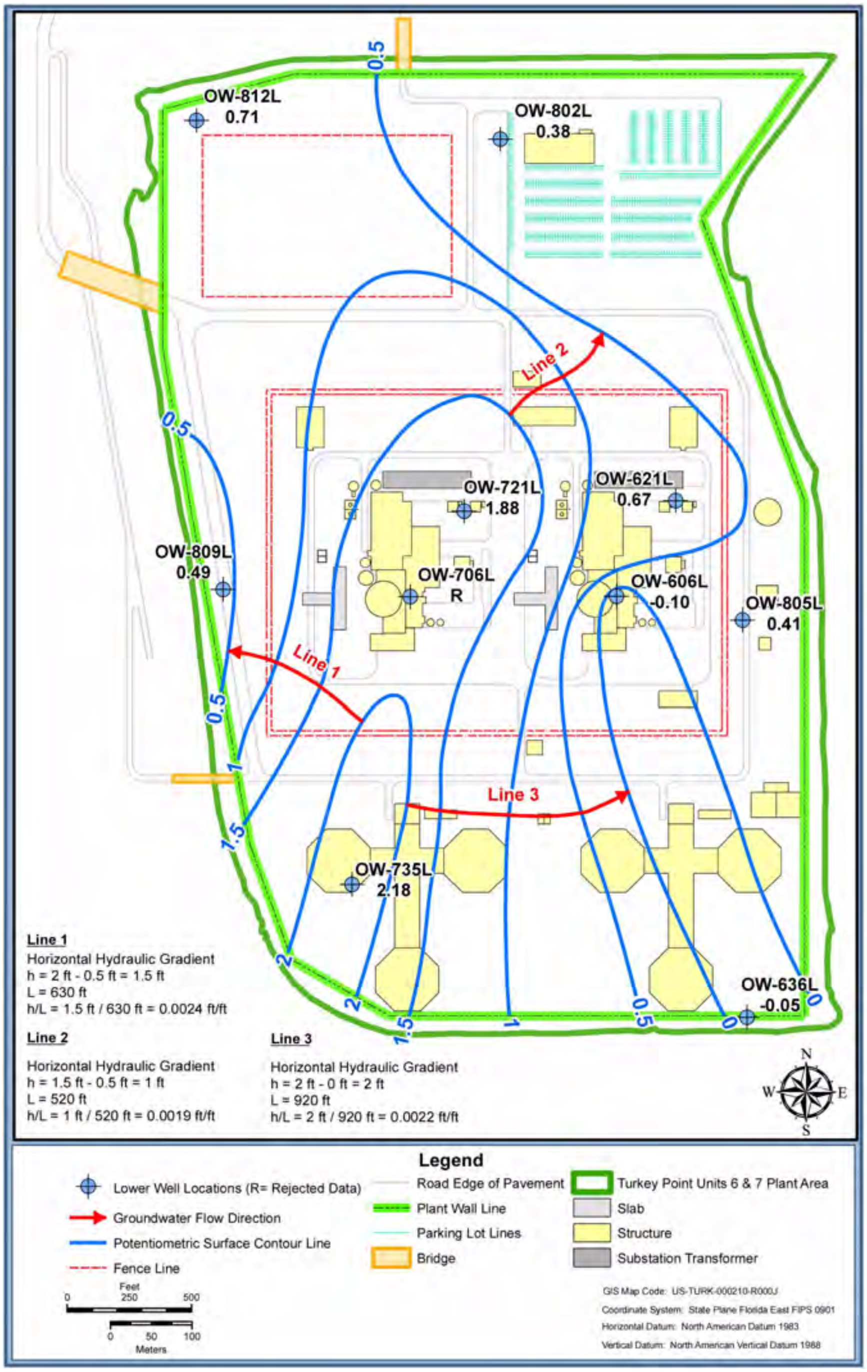


Figure 2.3-32 Biscayne Aquifer Potentiometric Surface Map, Upper Monitoring Interval, October 5, 2008 (Sheet 1 of 2) High Tide

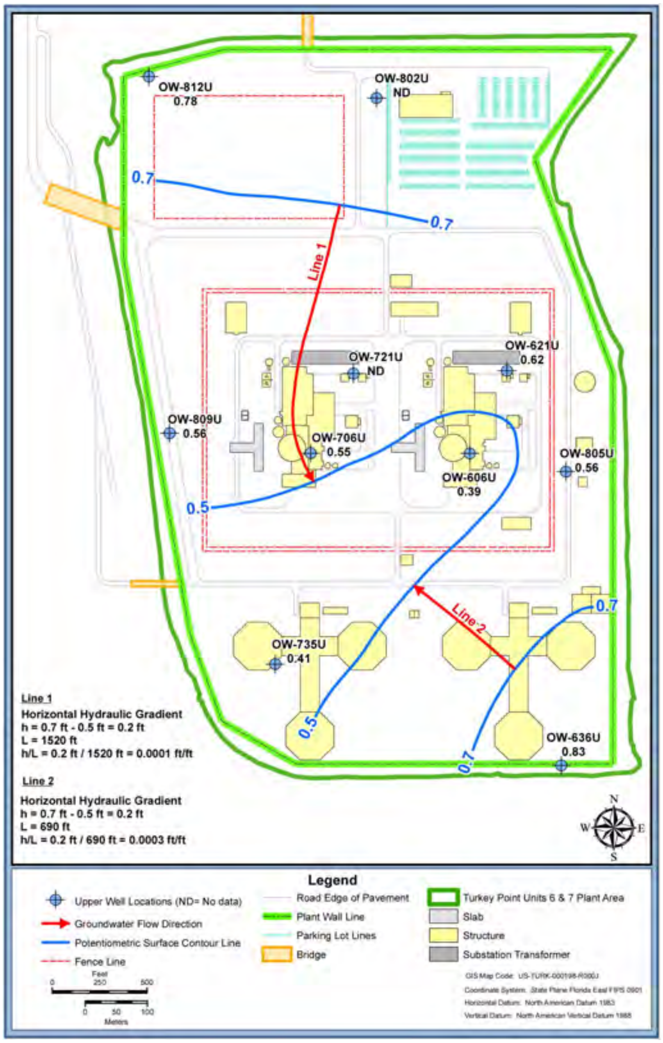


Figure 2.3-32 Biscayne Aquifer Potentiometric Surface Map, Upper Monitoring Interval, October 5, 2008 (Sheet 2 of 2) Low Tide

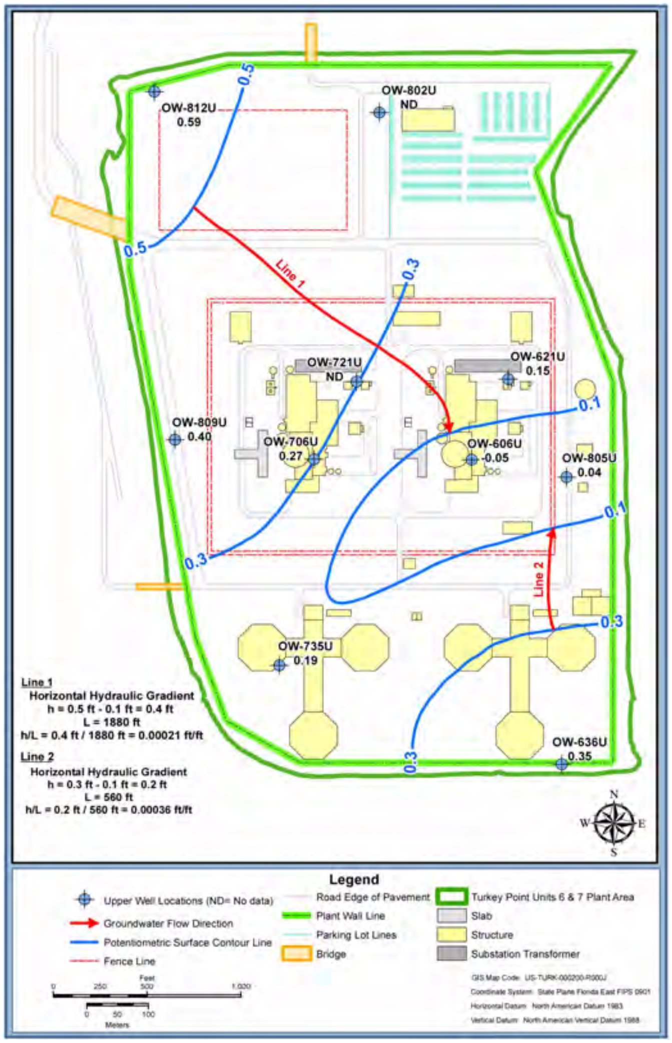


Figure 2.3-33 Biscayne Aquifer Potentiometric Surface Map, Lower Monitoring Interval, October 5, 2008 (Sheet 1 of 2) High Tide

Figure 2.3-33 Biscayne Aquifer Potentiometric Surface Map, Lower Monitoring Interval, October 5, 2008 (Sheet 2 of 2) Low Tide

Figure 2.3-34 Biscayne Aquifer Potentiometric Surface Map, Upper Monitoring Interval, January 20-21, 2009 (Sheet 1 of 2) High Tide

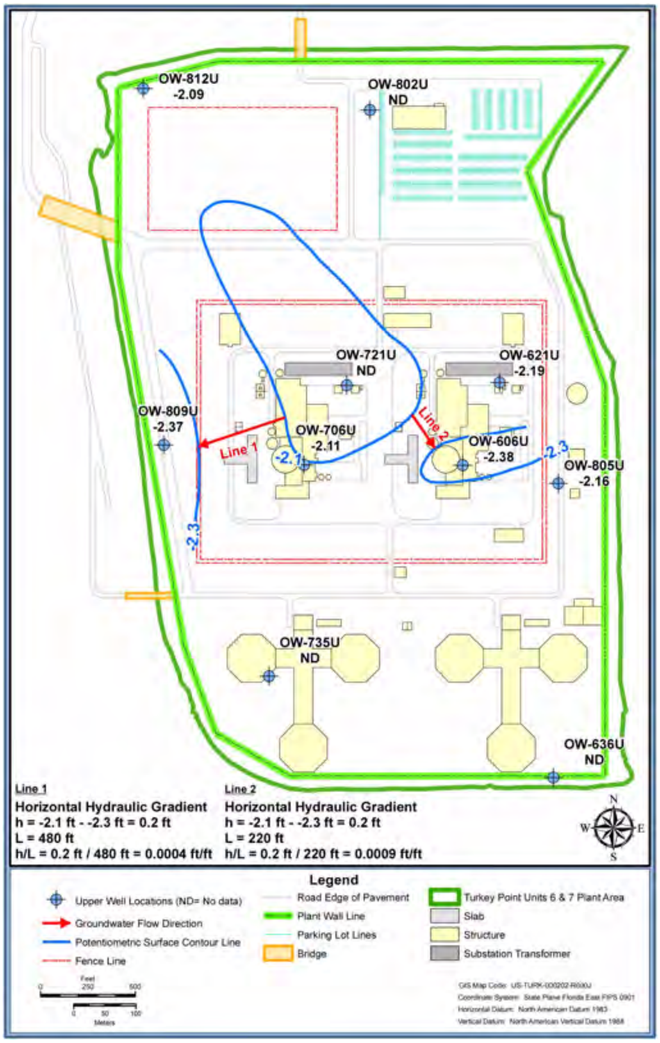


Figure 2.3-34 Biscayne Aquifer Potentiometric Surface Map, Upper Monitoring Interval, January 20-21, 2009 (Sheet 2 of 2) Low Tide

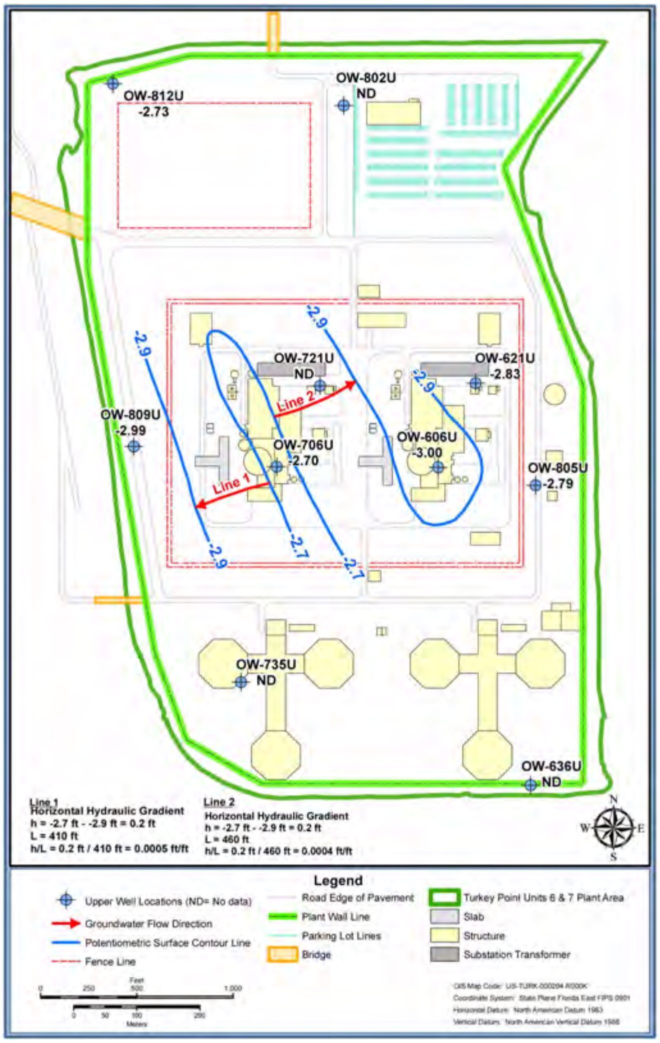


Figure 2.3-35 Biscayne Aquifer Potentiometric Surface Map, Lower Monitoring Interval, January 20-21, 2009 (Sheet 1 of 2) High Tide

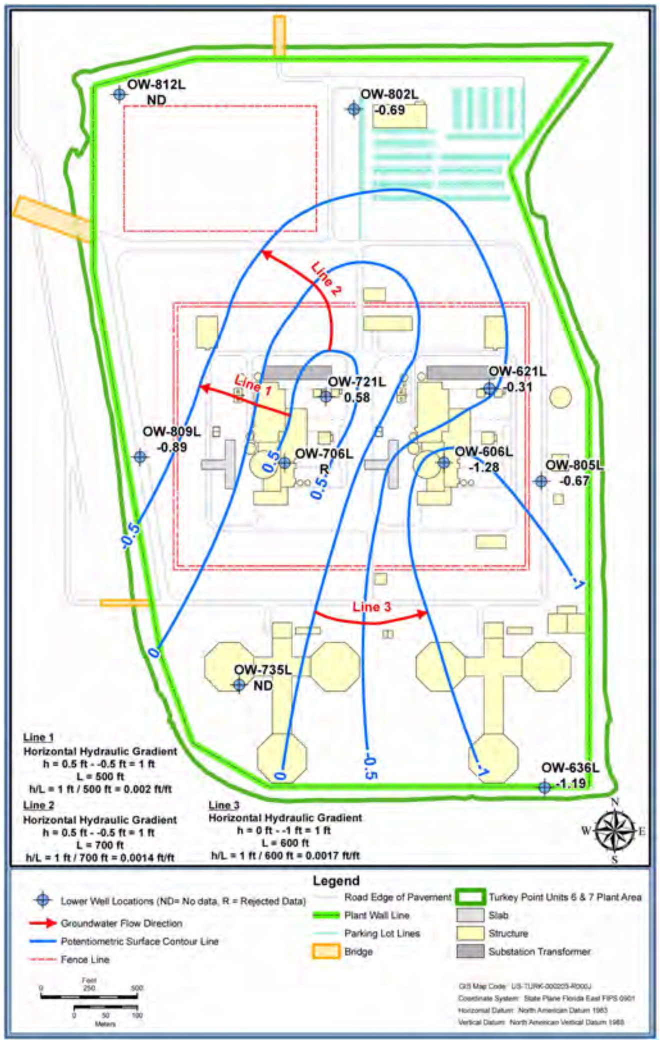


Figure 2.3-35 Biscayne Aquifer Potentiometric Surface Map, Lower Monitoring Interval, January 20-21, 2009 (Sheet 2 of 2) Low Tide

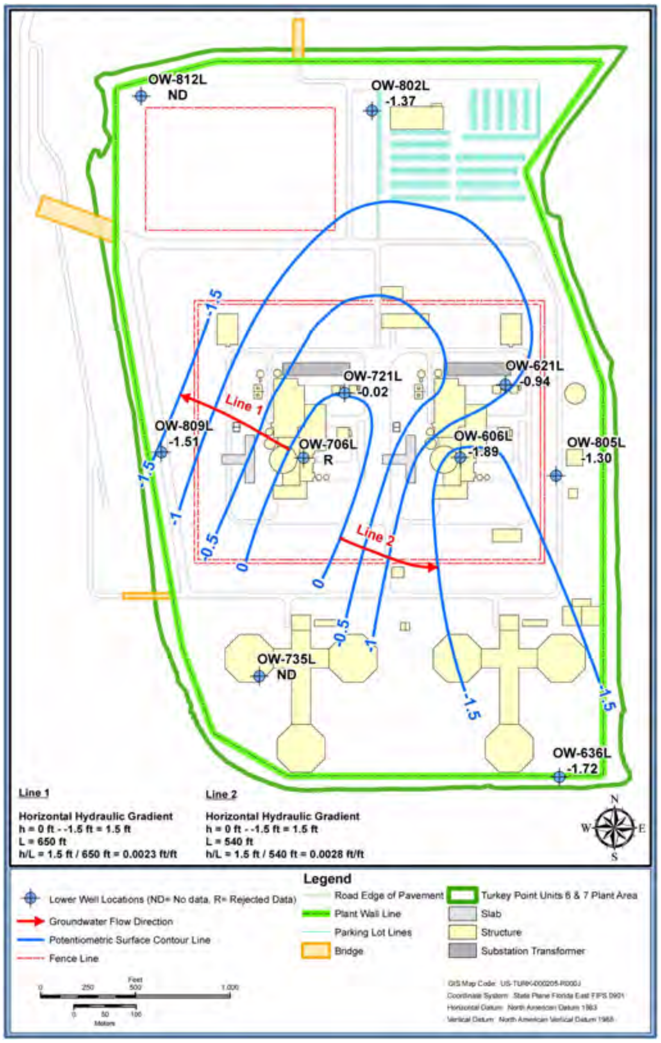
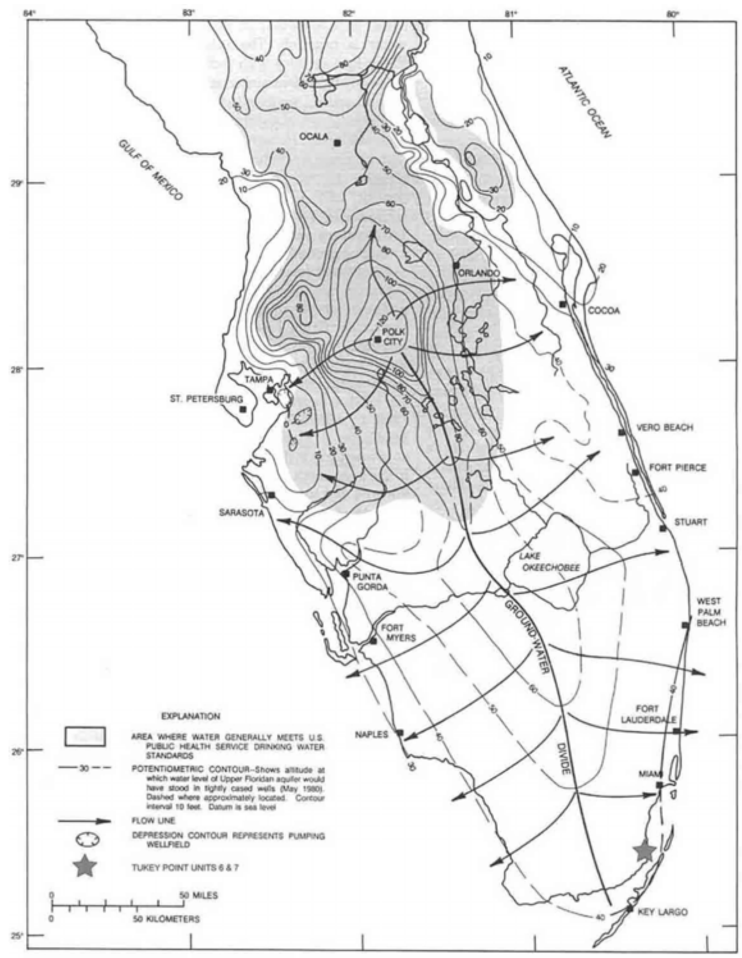


Figure 2.3-36 May 1980 Upper Floridan Aquifer Potentiometric Surface Map



Modified from Meyer 1989

Figure 2.3-37 Observation Wells and Surface Water Monitoring Locations in the Vicinity of the Turkey Point Plant Property

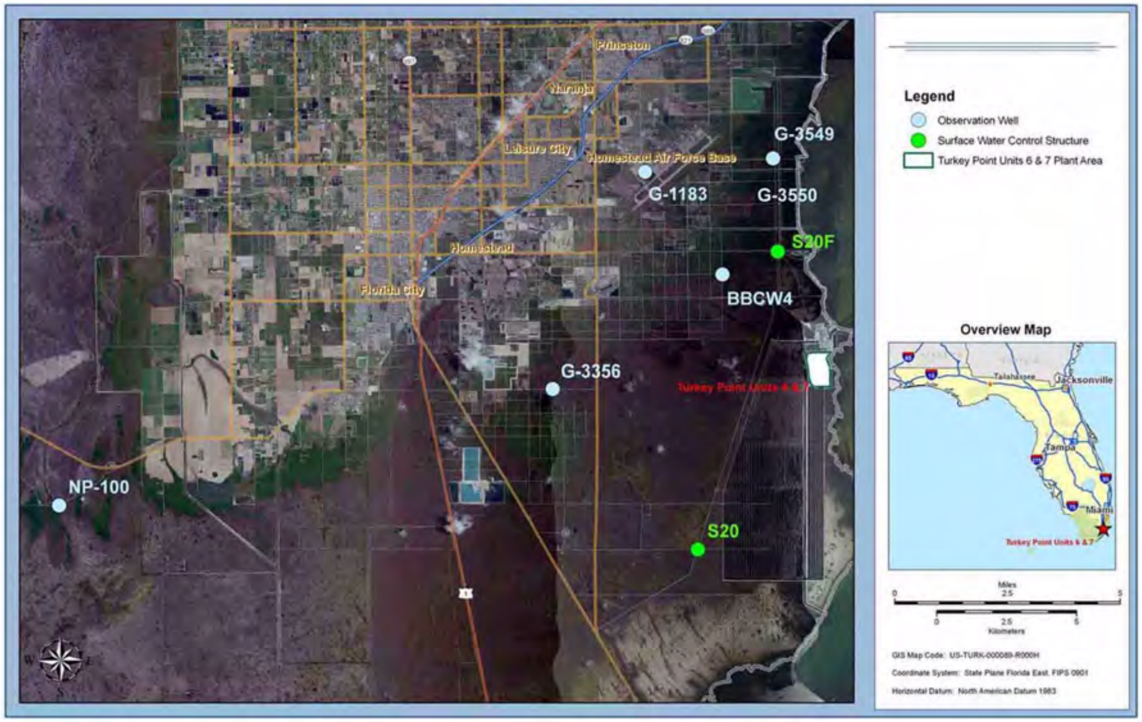
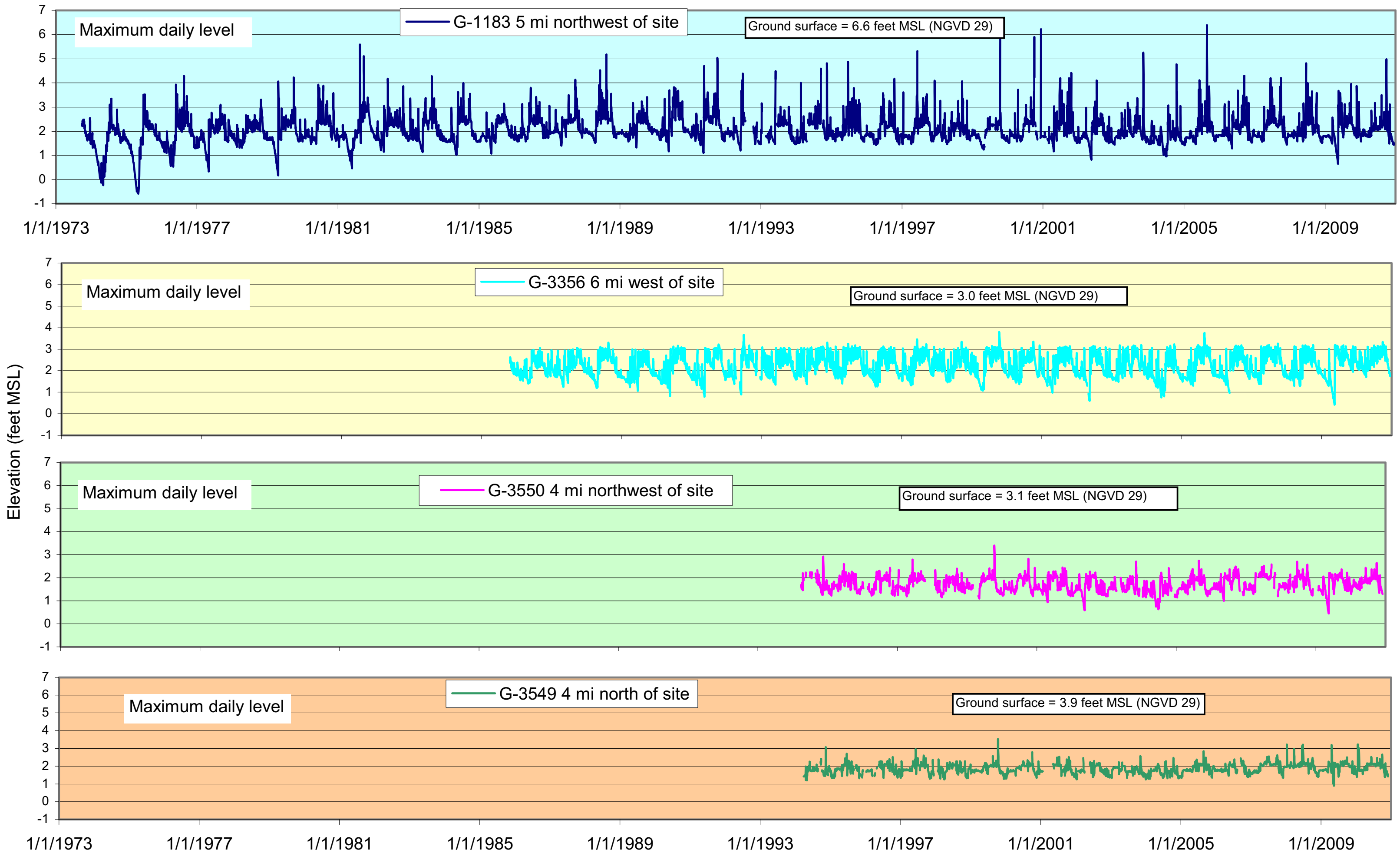
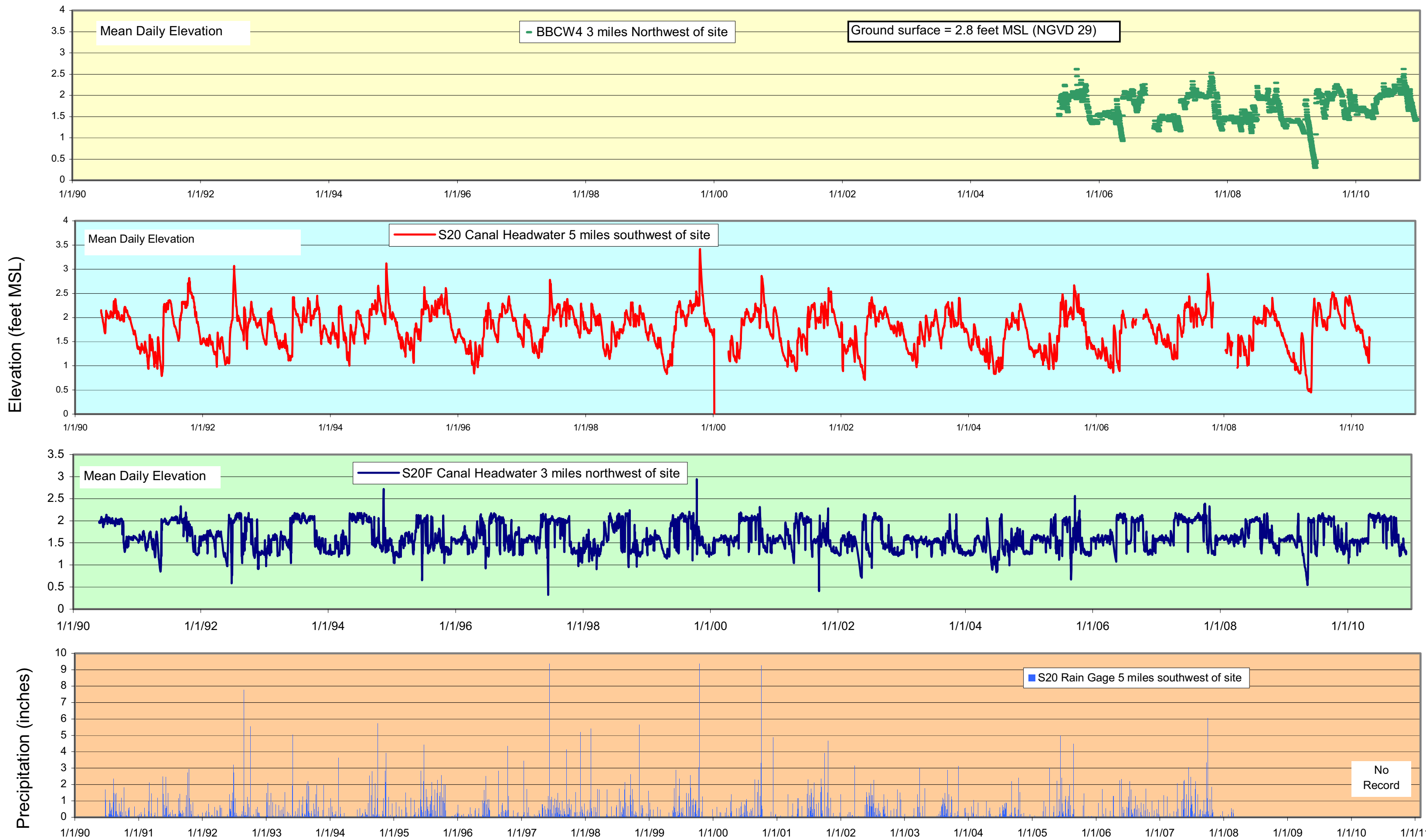


Figure 2.3-38 Hydrographs of U.S. Geological Survey Wells in the Biscayne Aquifer



Reference USGS 2010

Figure 2.3-39 Hydrographs of South Florida Water Management District Well and Canal Levels and Precipitation



Reference SFWMD 2010

Figure 2.3-40 Hydrographs of Units 6 & 7 Biscayne Aquifer Observation Wells (Sheet 1 of 11)

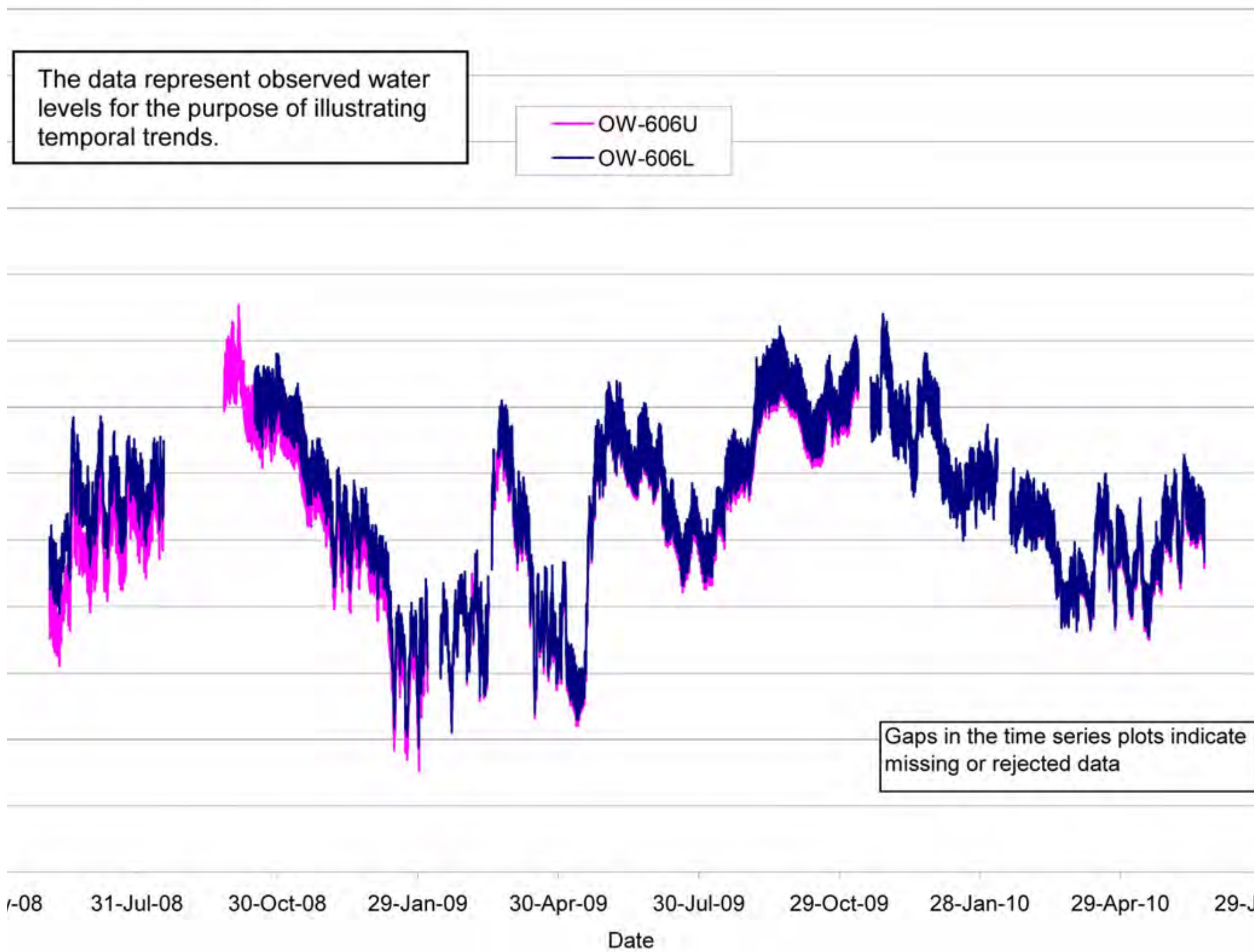


Figure 2.3-40 Hydrographs of Units 6 & 7 Biscayne Aquifer Observation Wells (Sheet 2 of 11)

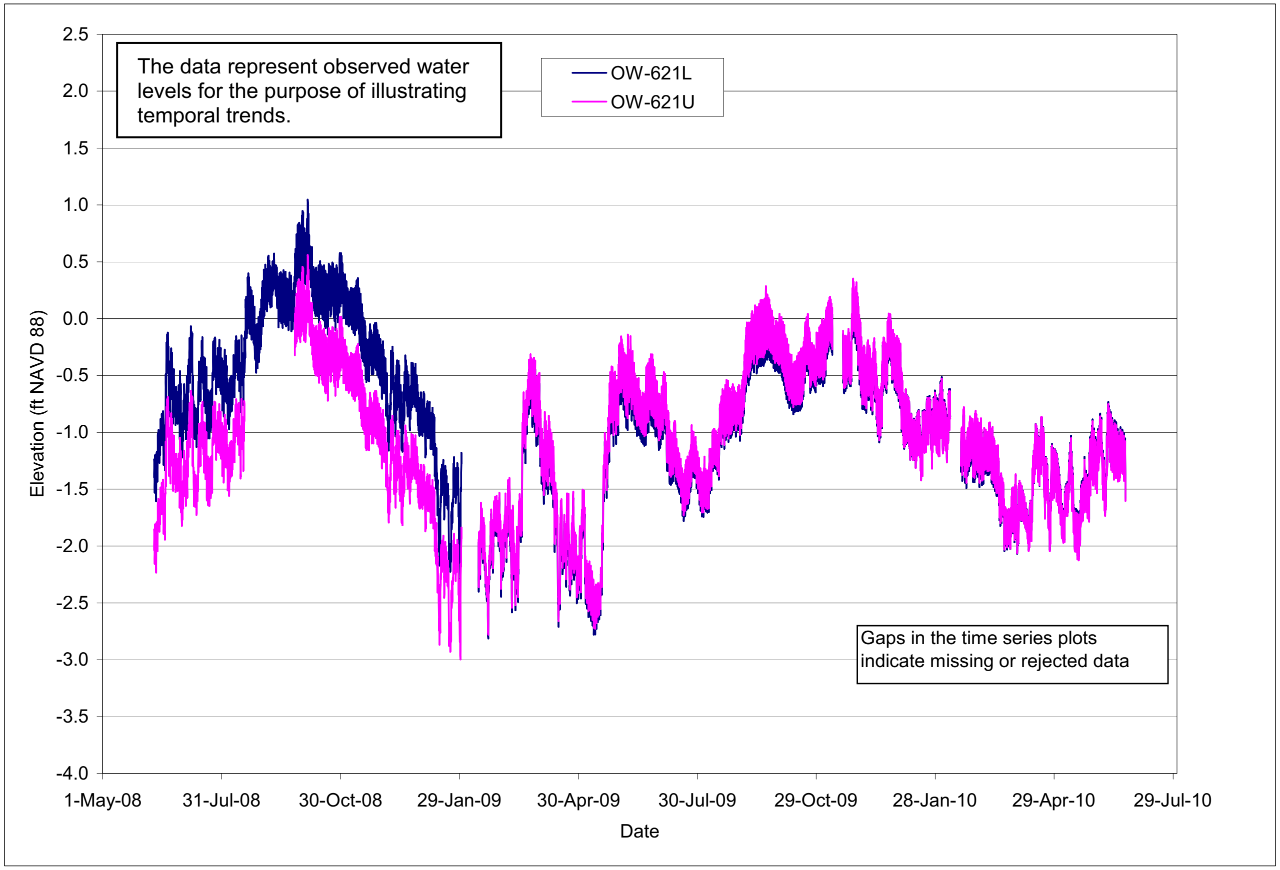


Figure 2.3-40 Hydrographs of Units 6 & 7 Biscayne Aquifer Observation Wells (Sheet 3 of 11)

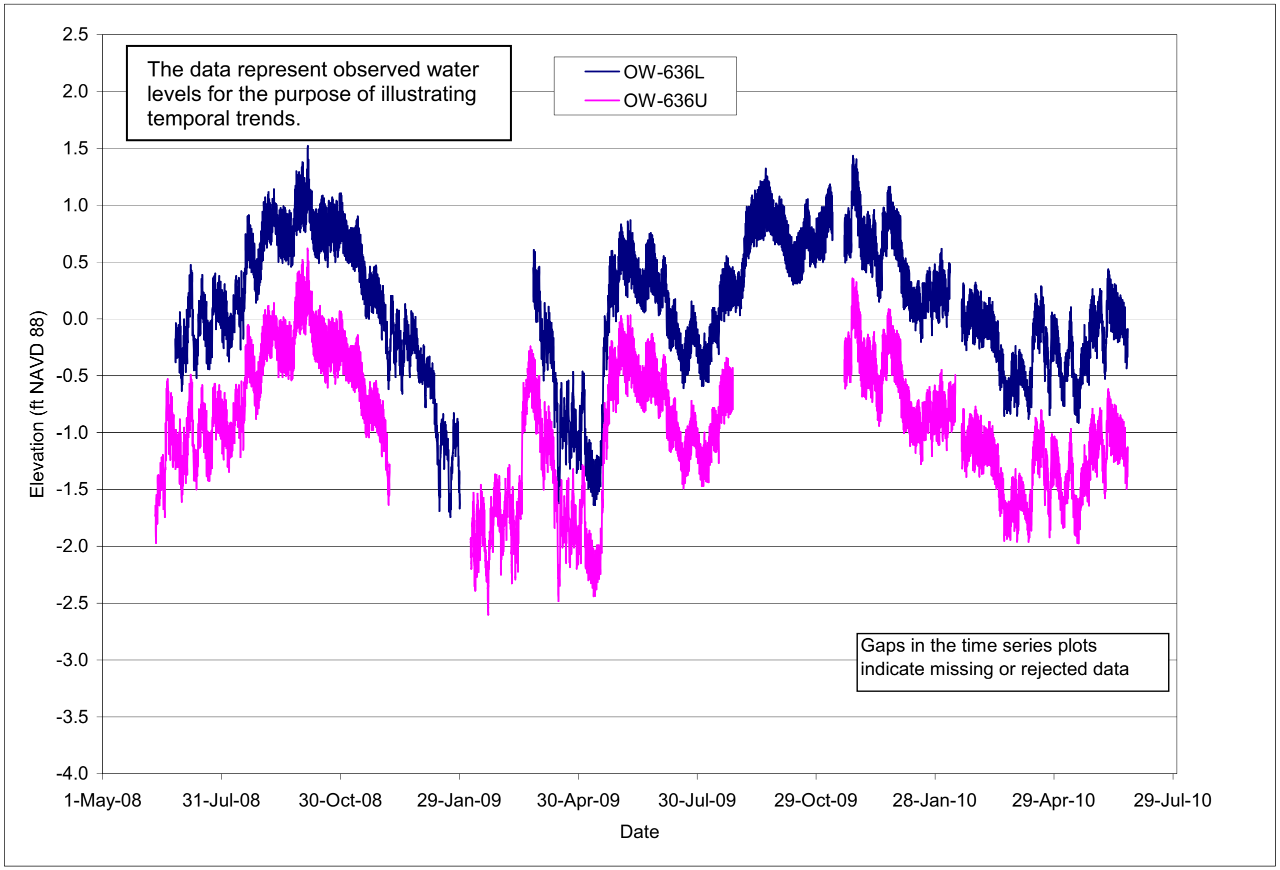


Figure 2.3-40 Hydrographs of Units 6 & 7 Biscayne Aquifer Observation Wells (Sheet 4 of 11)

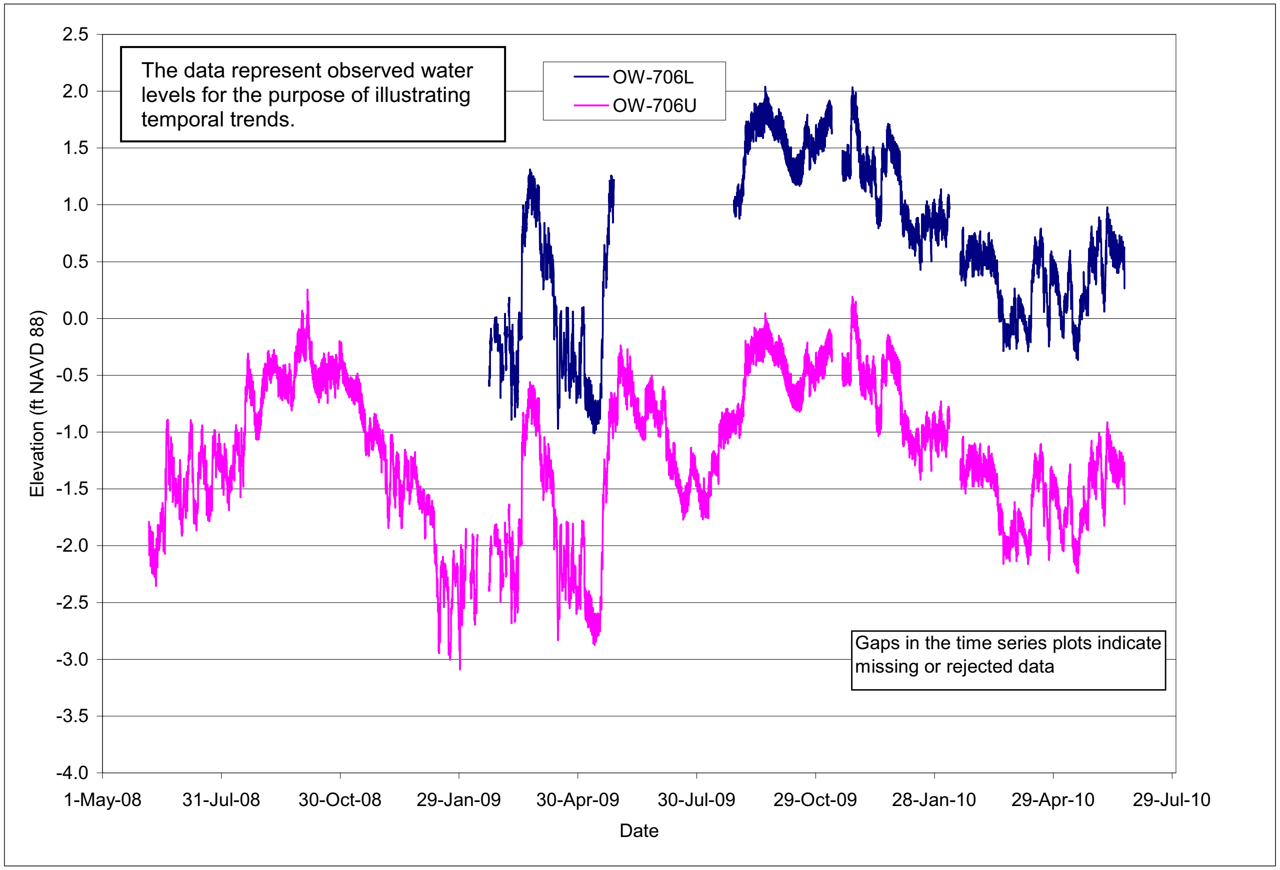


Figure 2.3-40 Hydrographs of Units 6 & 7 Biscayne Aquifer Observation Wells (Sheet 5 of 11)

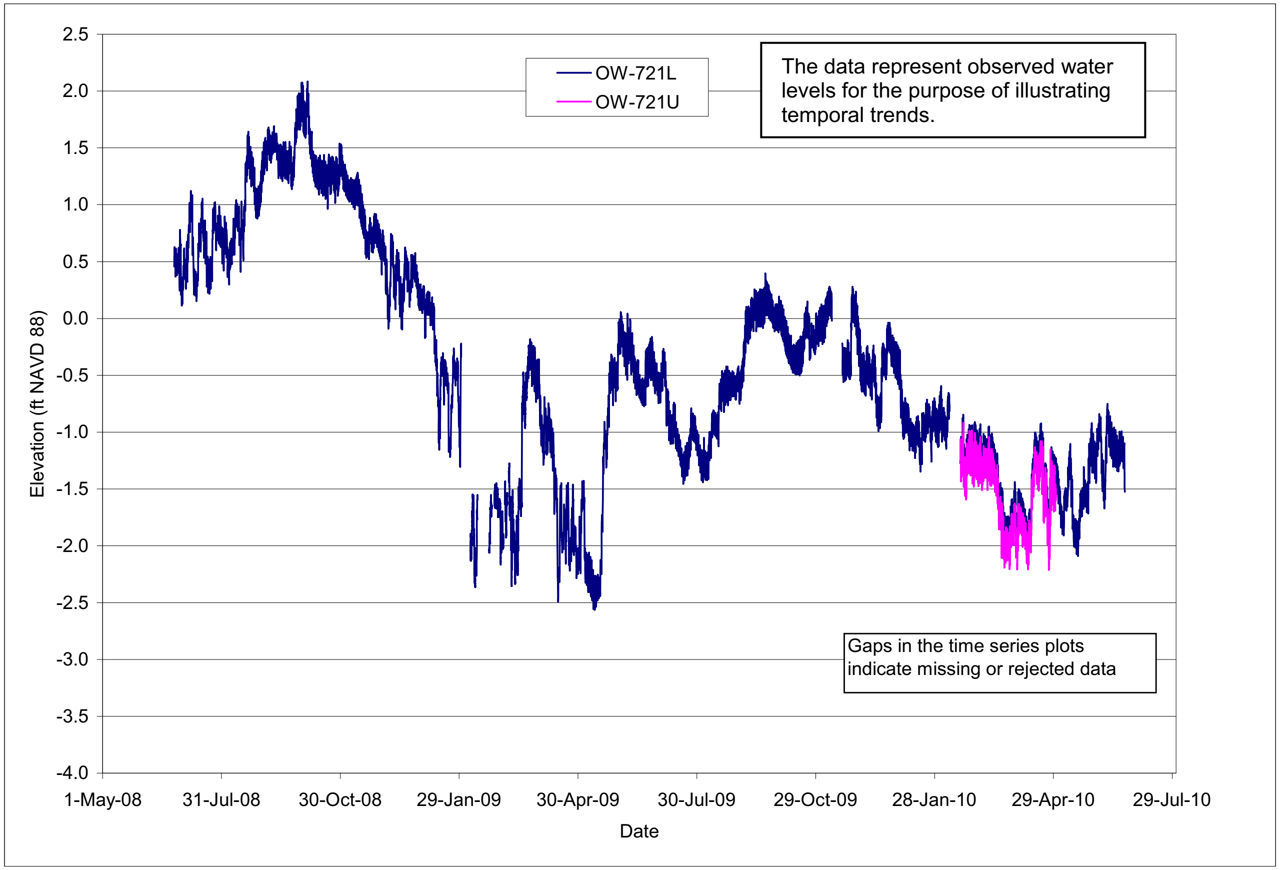


Figure 2.3-40 Hydrographs of Units 6 & 7 Biscayne Aquifer Observation Wells (Sheet 6 of 11)

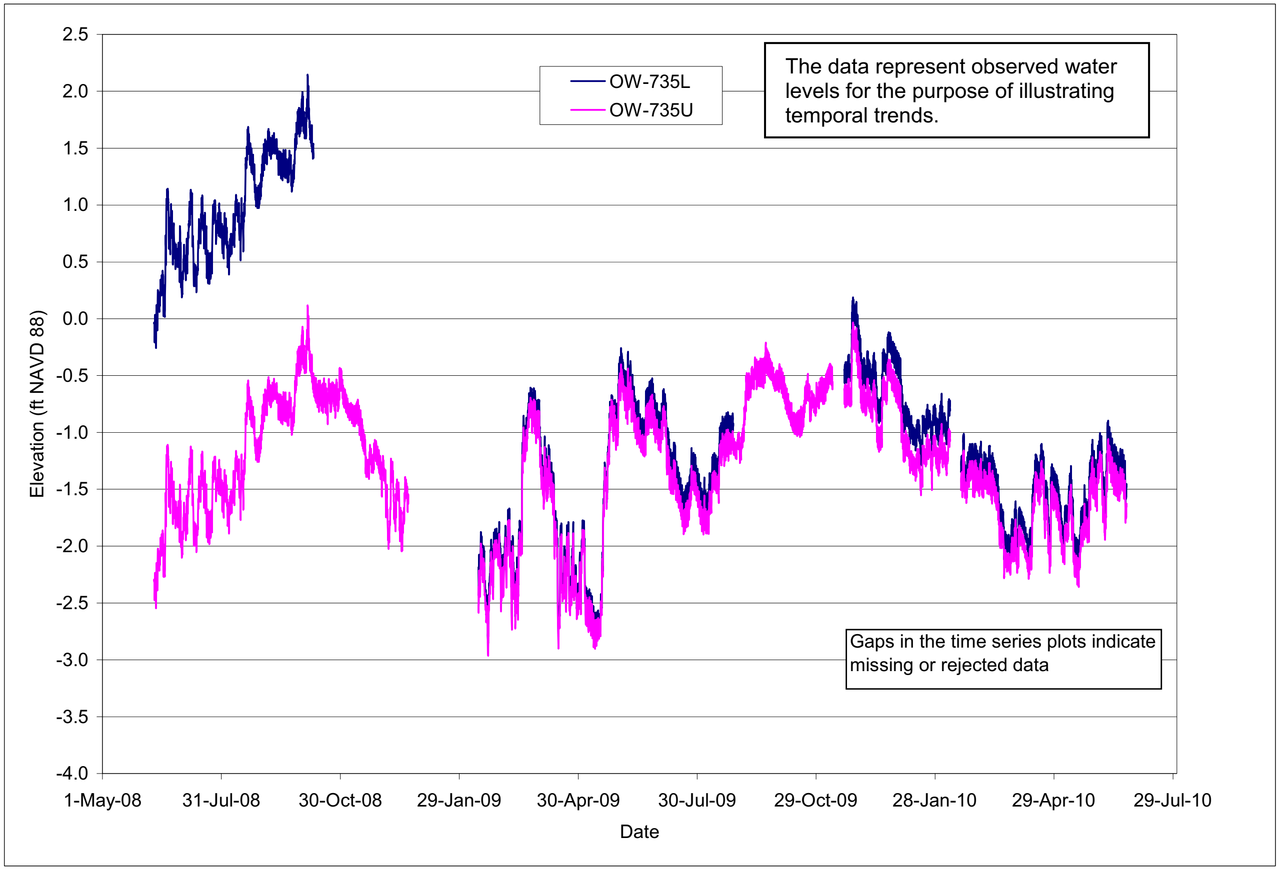


Figure 2.3-40 Hydrographs of Units 6 & 7 Biscayne Aquifer Observation Wells (Sheet 7 of 11)

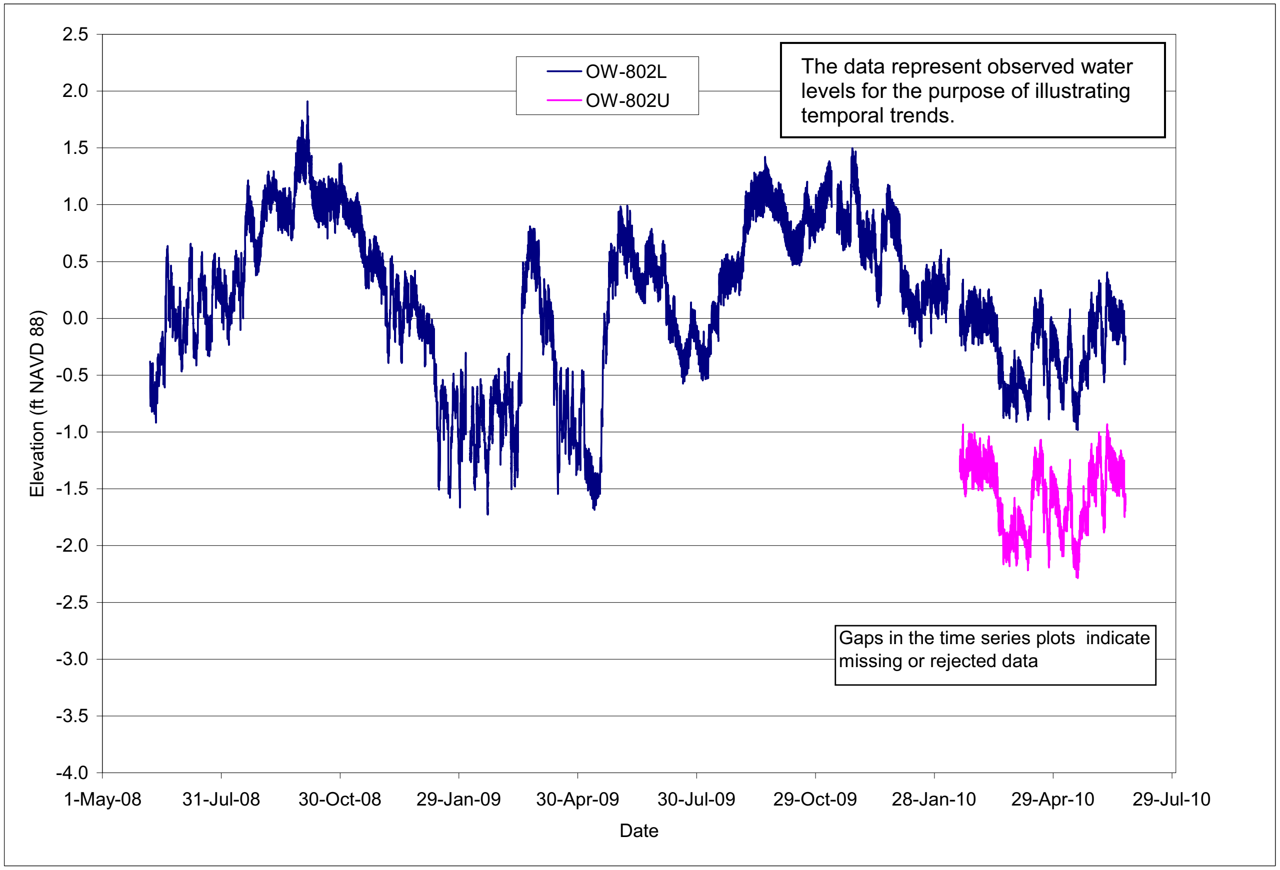


Figure 2.3-40 Hydrographs of Units 6 & 7 Biscayne Aquifer Observation Wells (Sheet 8 of 11)

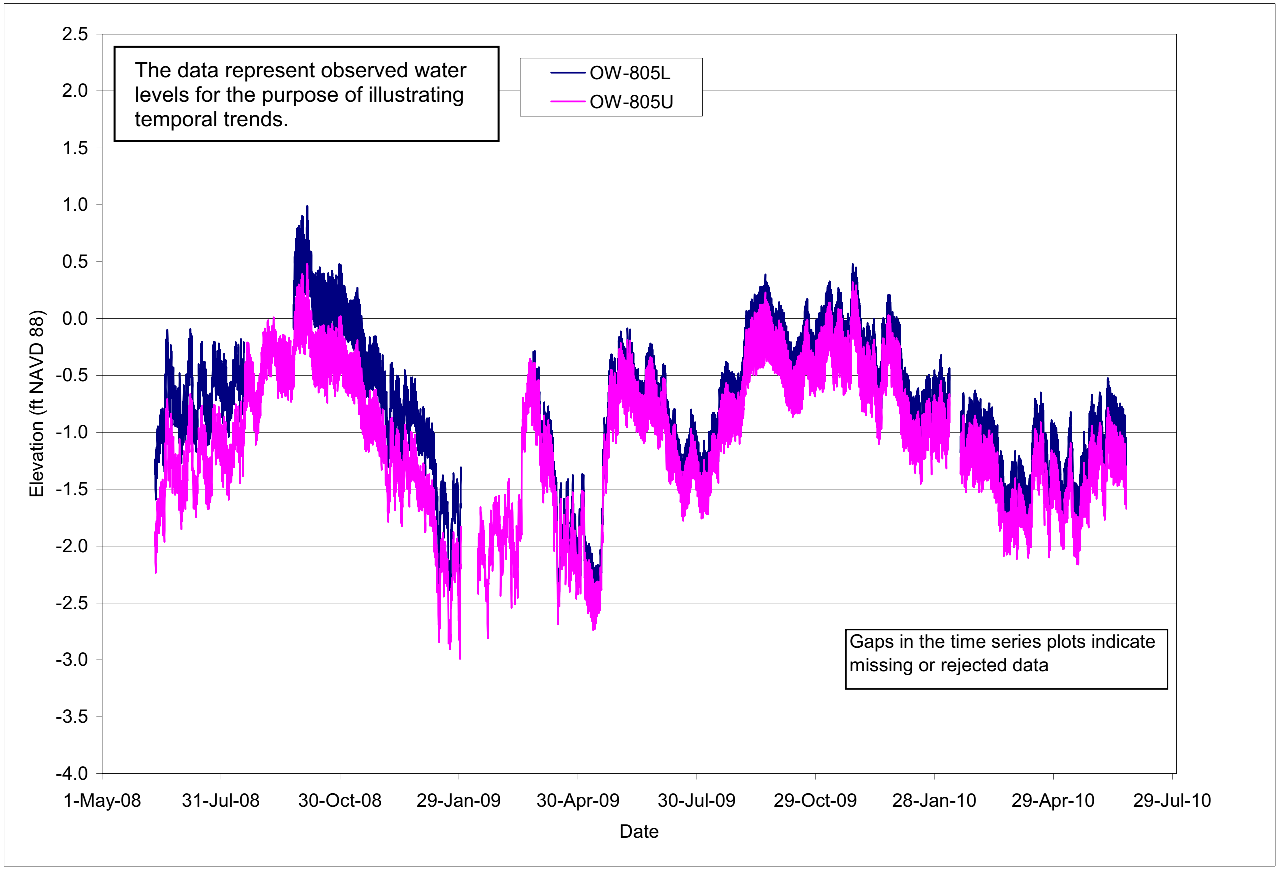


Figure 2.3-40 Hydrographs of Units 6 & 7 Biscayne Aquifer Observation Wells (Sheet 9 of 11)

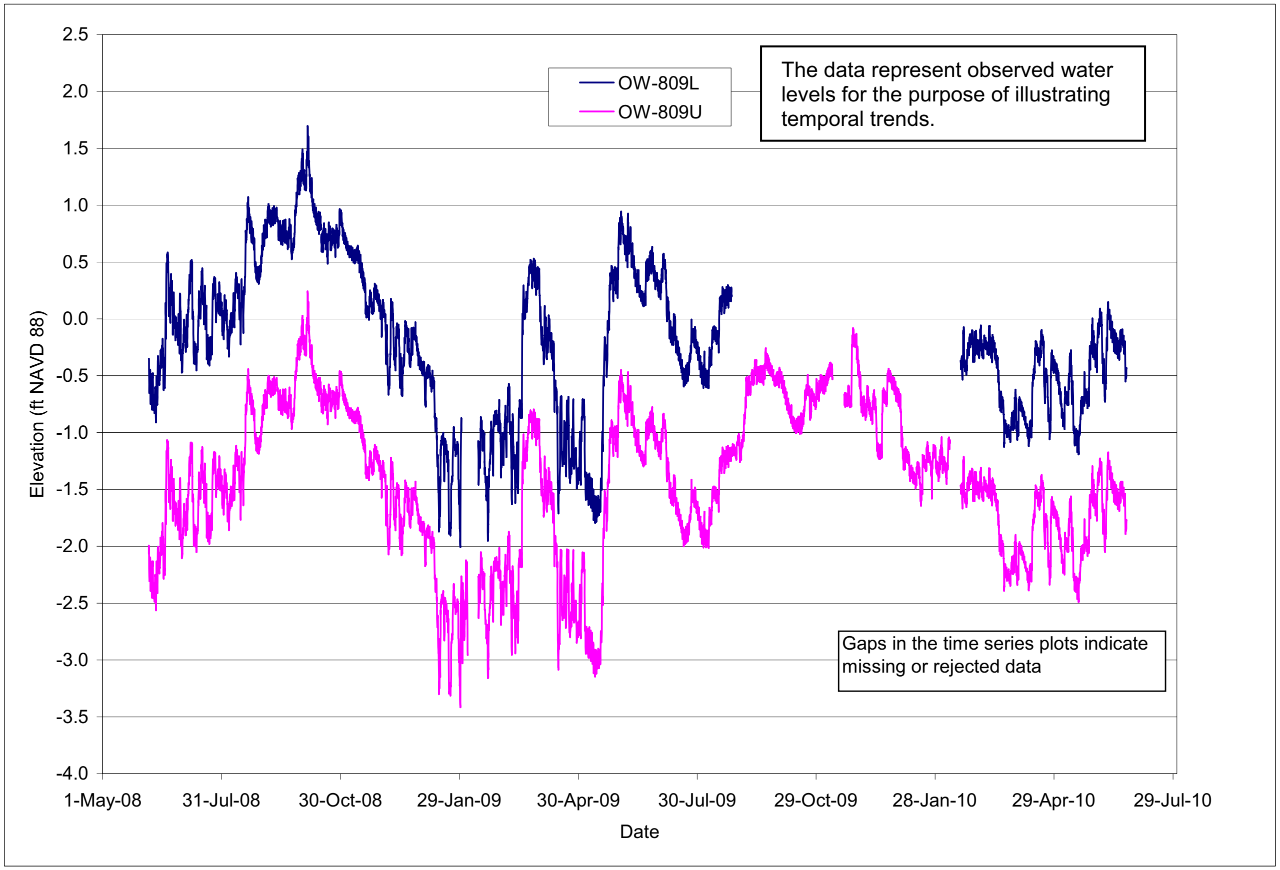


Figure 2.3-40 Hydrographs of Units 6 & 7 Biscayne Aquifer Observation Wells (Sheet 10 of 11)

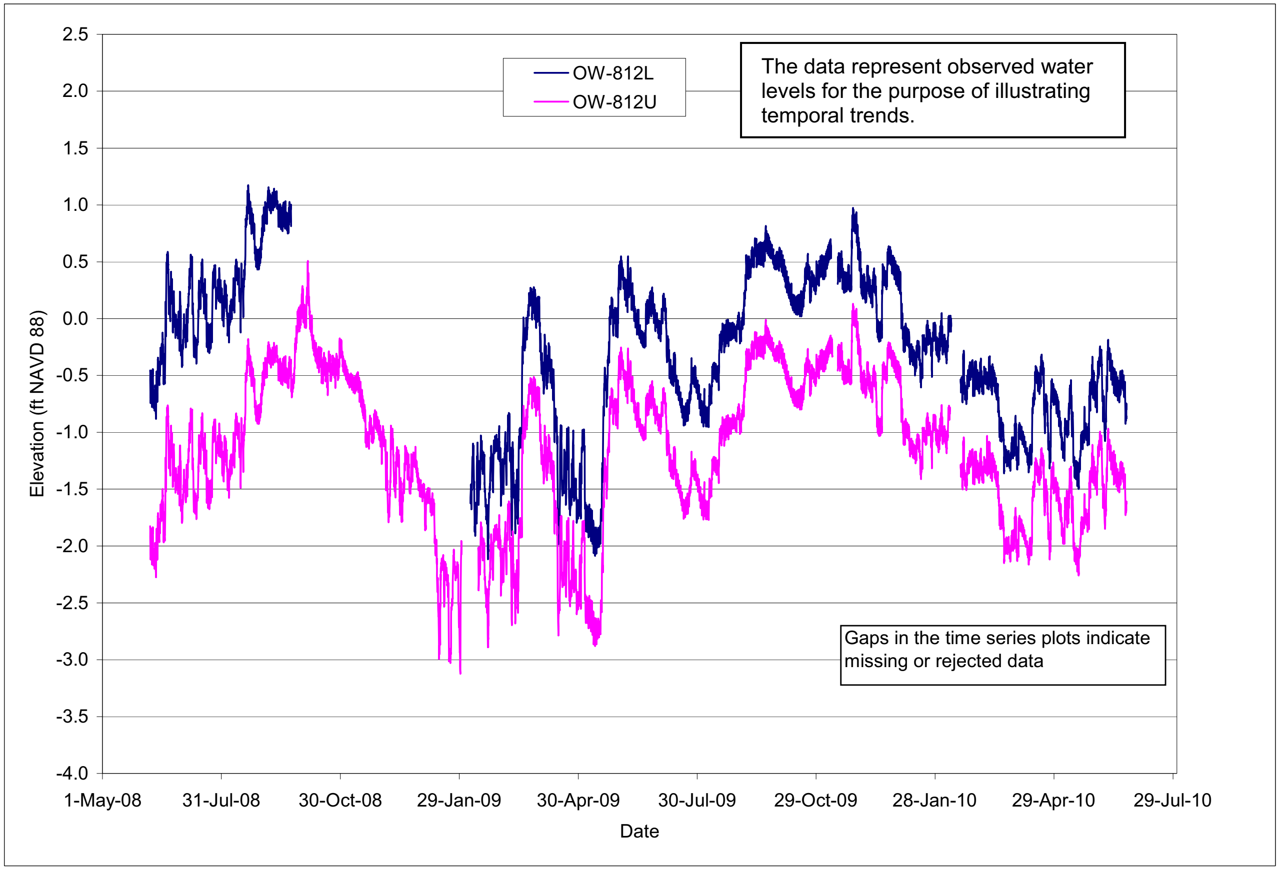


Figure 2.3-40 Hydrographs of Units 6 & 7 Biscayne Aquifer Observation Wells (Sheet 11 of 11)

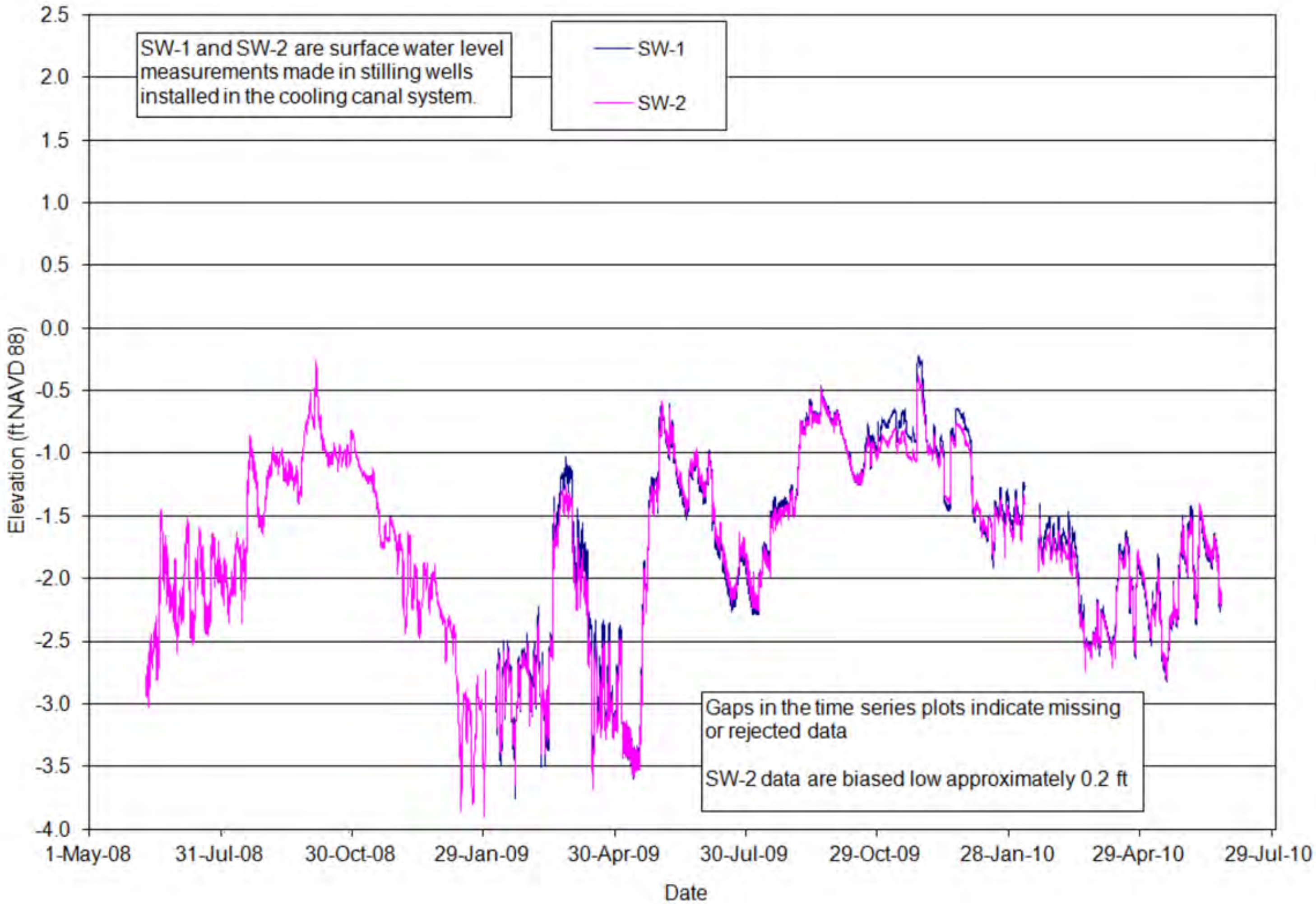
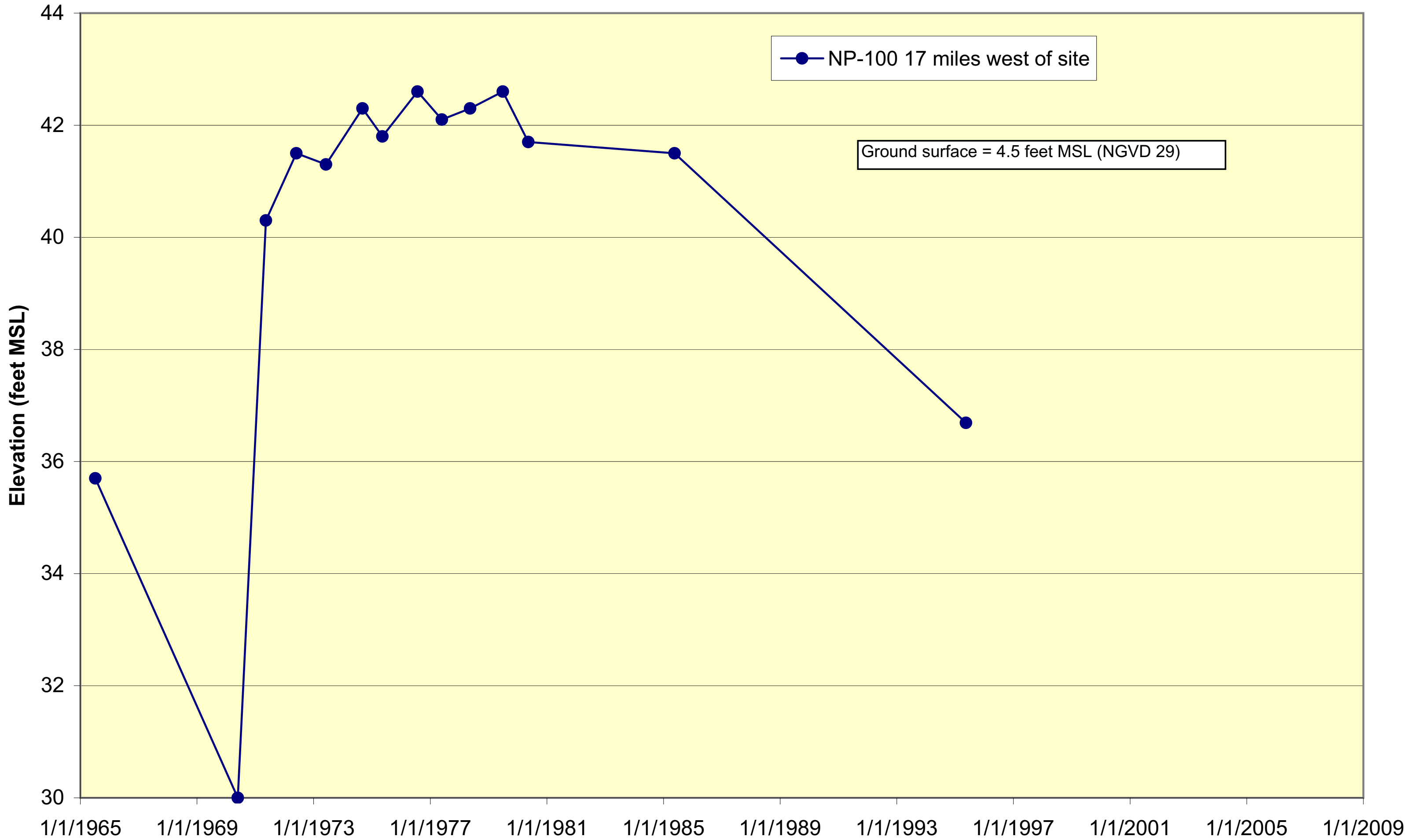


Figure 2.3-41 Hydrograph of US Geological Survey Well in the Upper Floridan Aquifer



Reference USGS 2008

Figure 2.3-42 Regional Aquifer Test Locations

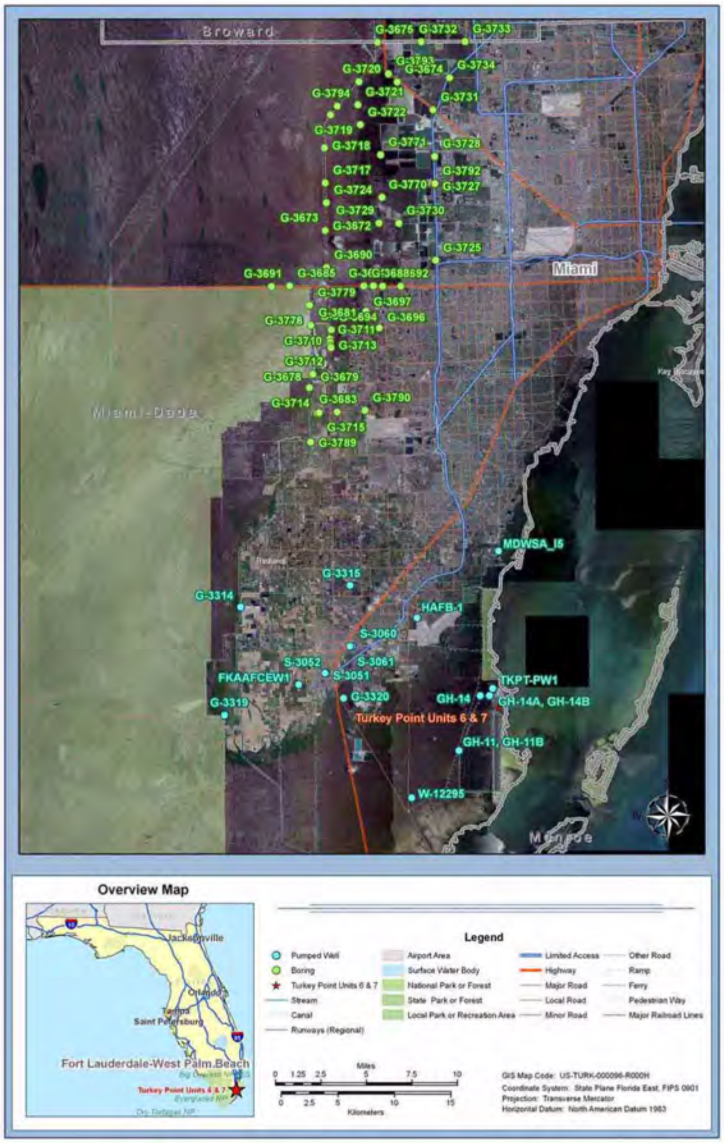
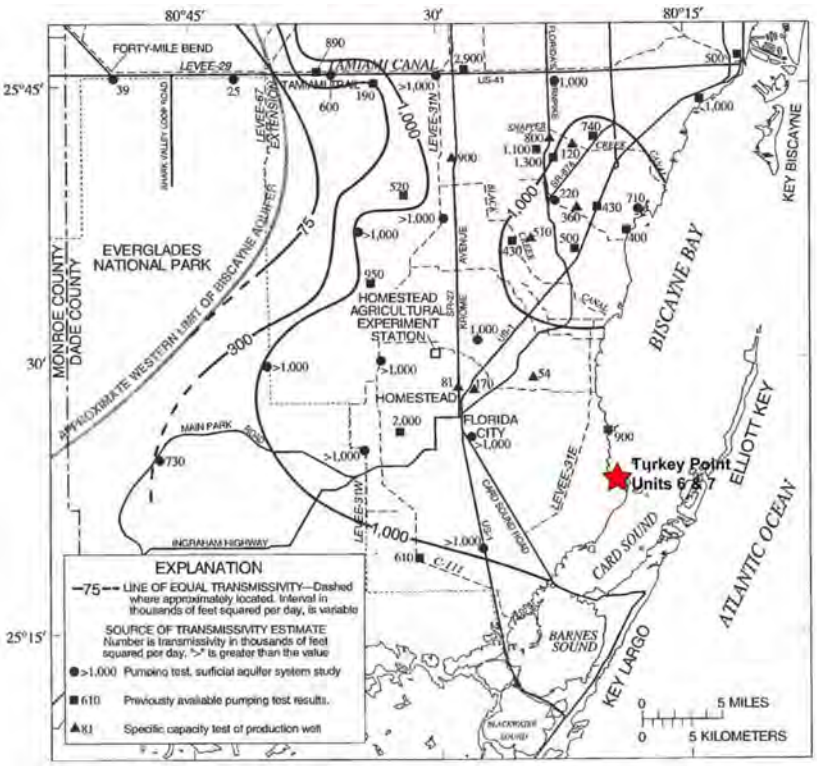
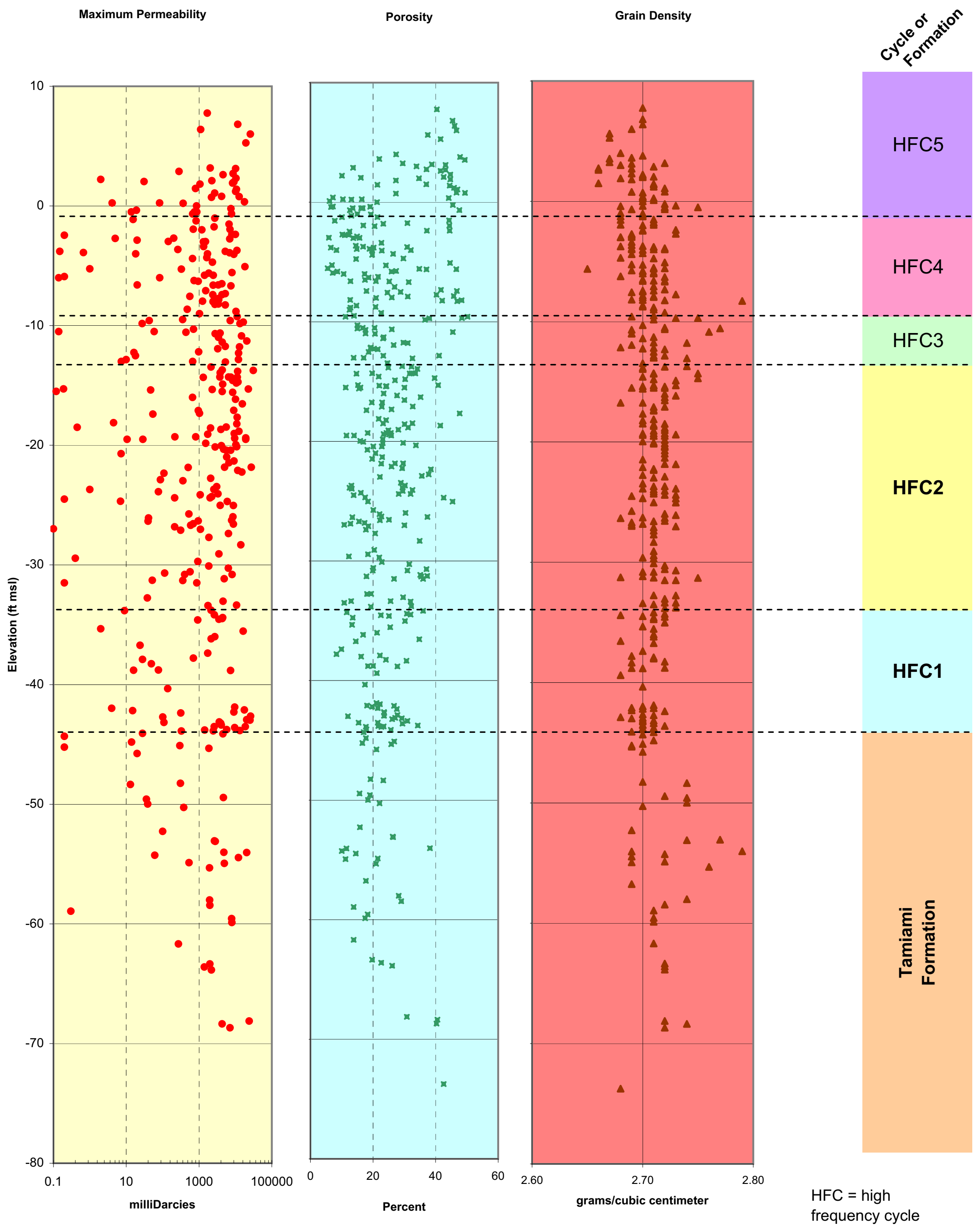


Figure 2.3-43 Biscayne Aquifer Regional Transmissivity



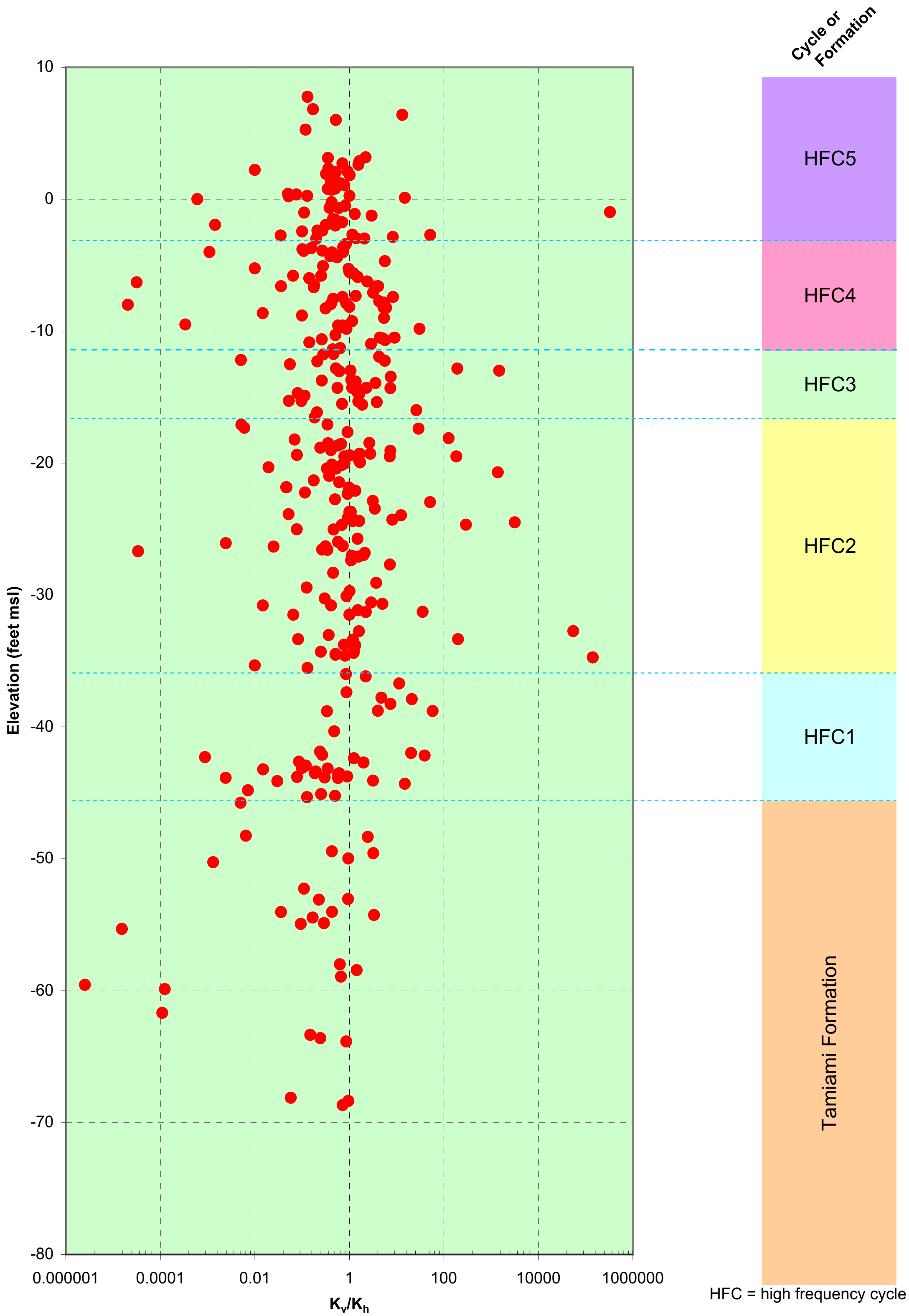
Modified from Merritt 1996

Figure 2.3-44 Formation Properties from Rock Core Testing



Data Source Table 2.3-18

Figure 2.3-45 Vertical Anisotropy Ratio from Rock Core Testing



Data Source Table 2.3-18

Figure 2.3-46 Units 6 & 7 Aquifer Pumping Test Locations

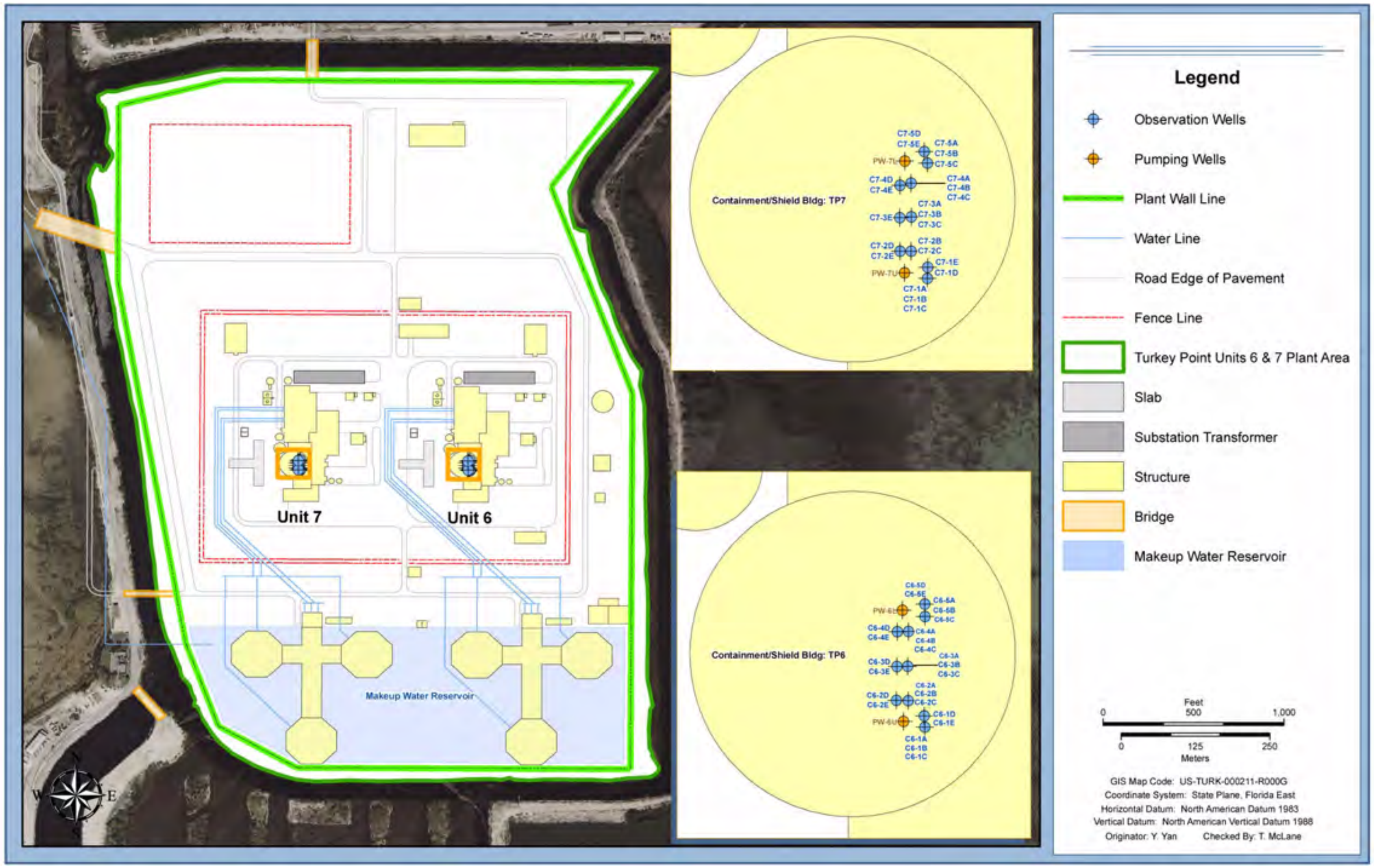


Figure 2.3-47 The Boulder Zone in Southern Florida

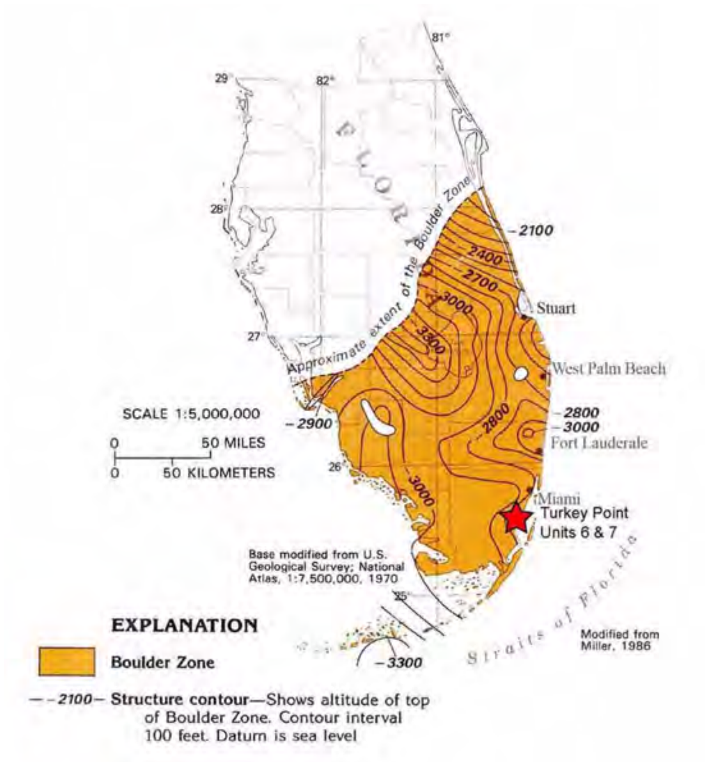
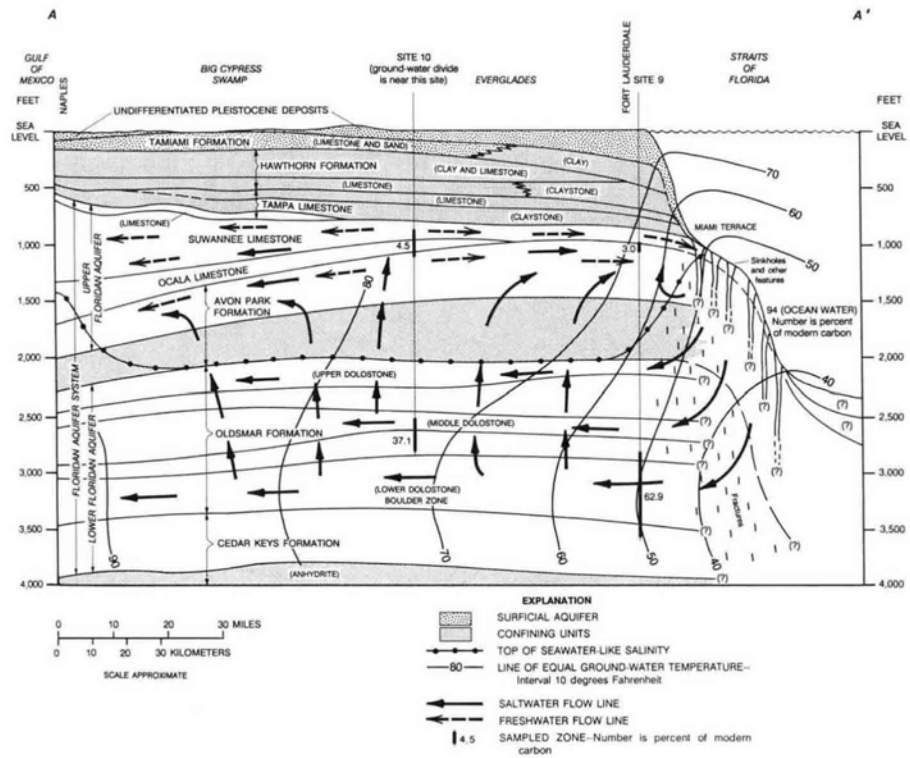


Figure 2.3-48 Generalized Hydrogeologic Section



Source: Meyer 1989

Figure 2.3-49 Piper Trilinear Diagram of Hydrogeochemical Samples

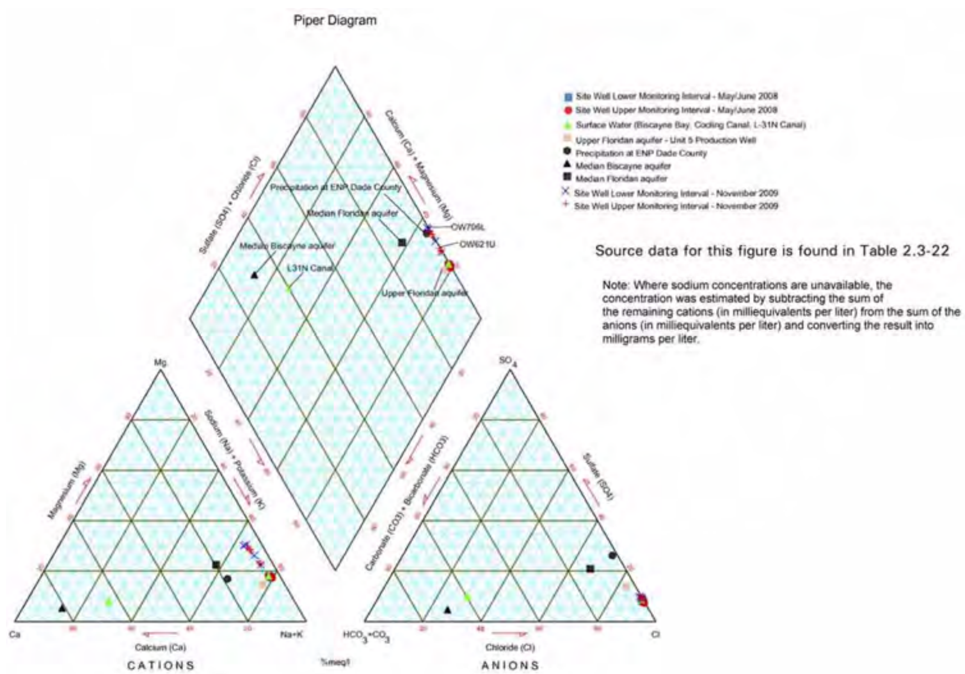


Figure 2.3-50 Hydrographs of L-31E Canal, Interceptor Ditch, and Industrial Wastewater Facility Canal 32

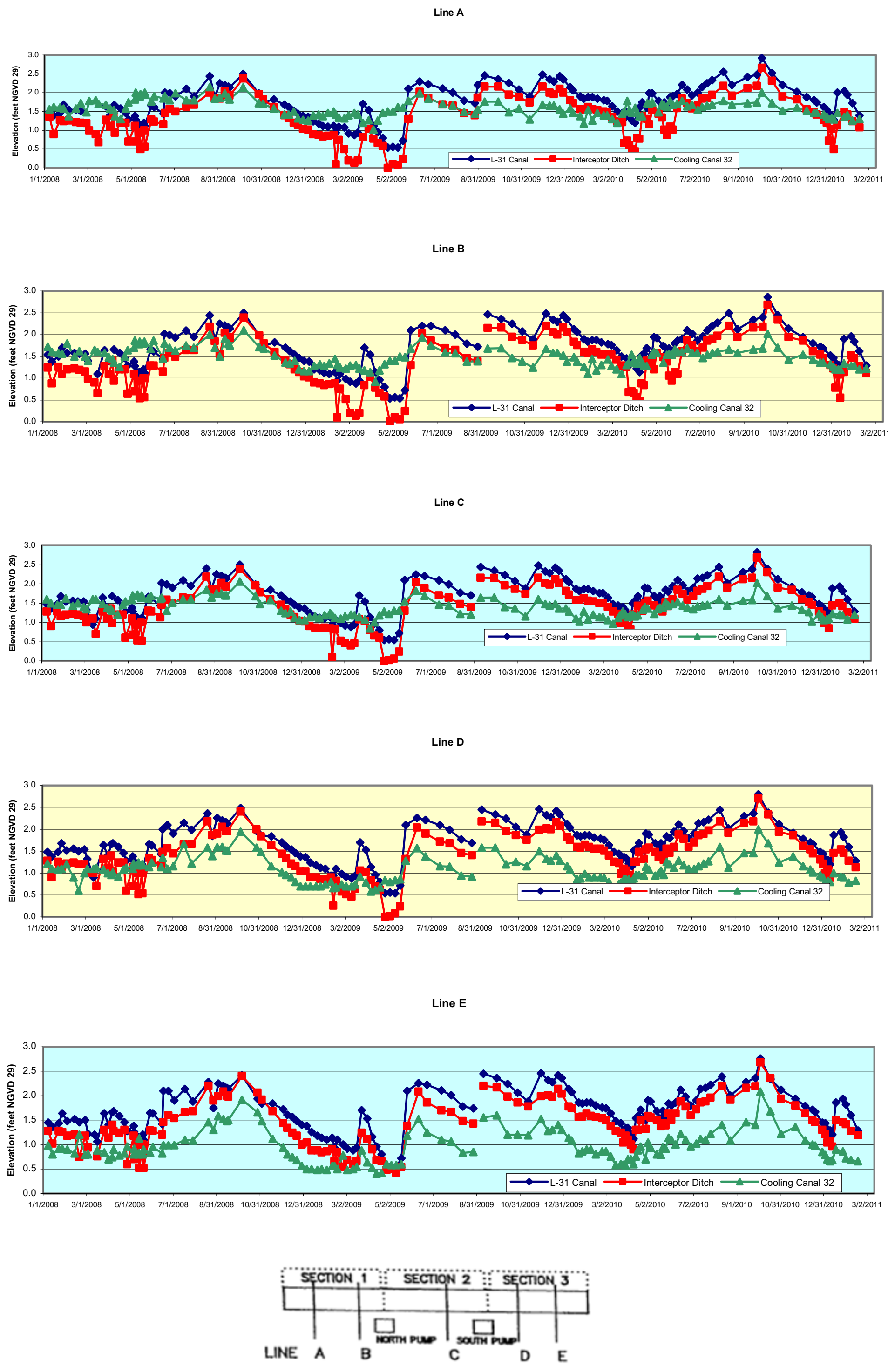
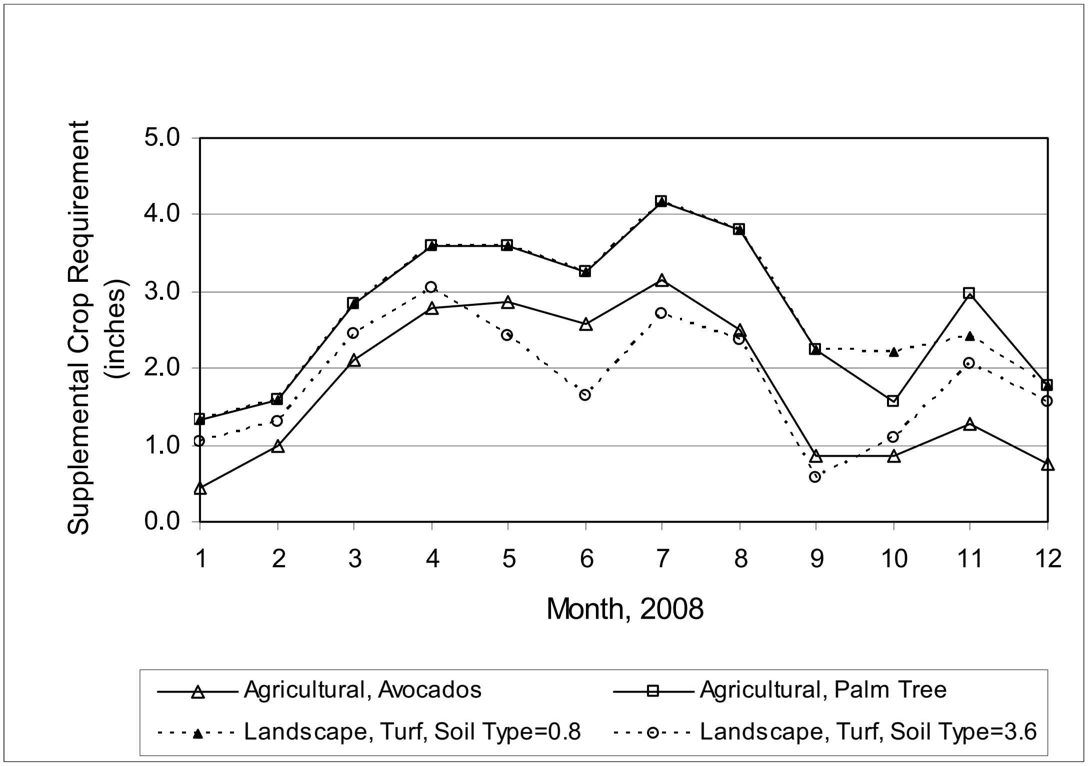


Figure 2.3-51 Location of Consumptive Surface Water Users within a 10-Mile Radius

Figure 2.3-52 Estimated Monthly Surface Water Withdrawal for Agricultural and Landscape Irrigation

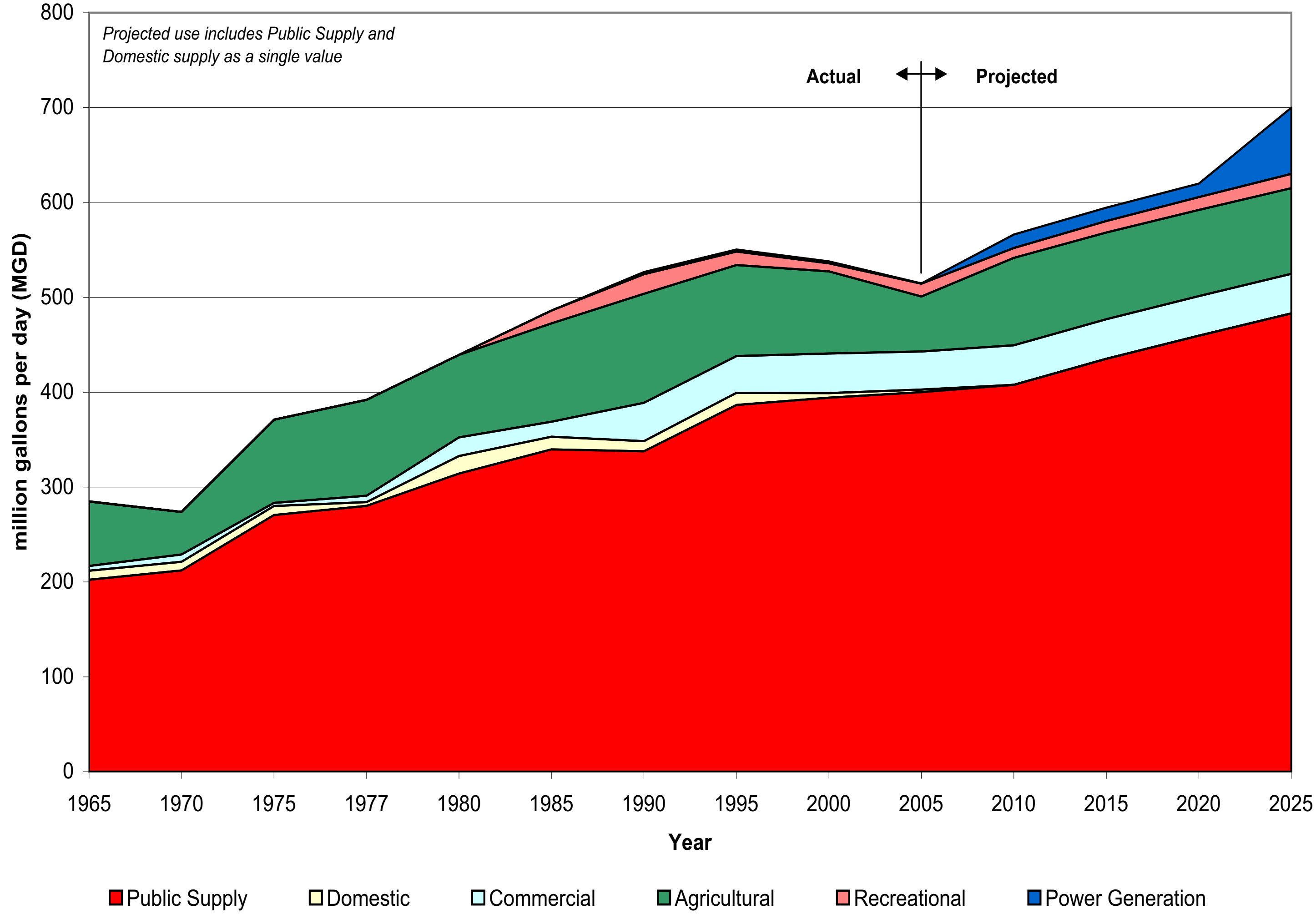


Source: SFWMD 2008c (Permit Nos. 13-04030-W, 13-03793-W, 13-04416-W, 13-04010-W)

Figure 2.3-53 Location of Nonconsumptive Surface Water Users within a 6-Mile Radius

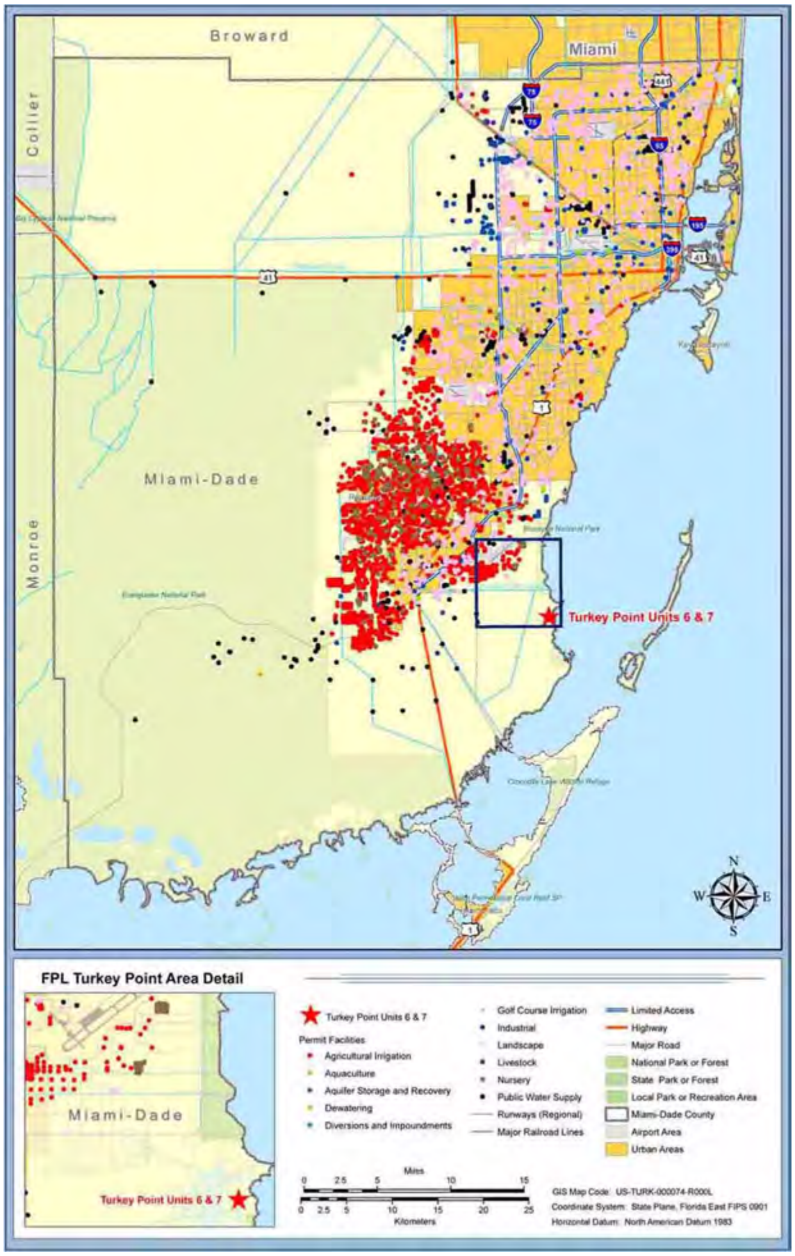
Figure 2.3-54 Not Used

Figure 2.3-55 Withdrawals of Groundwater in Miami-Dade County



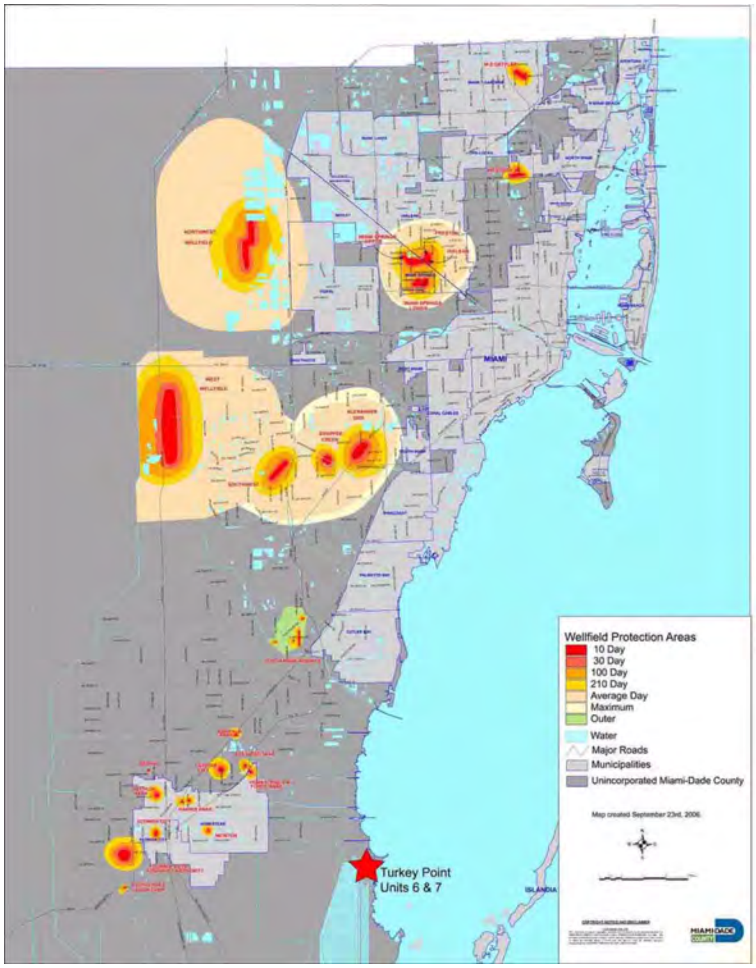
Sources:
1965-2000 Appendix 1 of Marella 2005
2005 Marella 2008
2010-2025 SFWMD 2006b

Figure 2.3-56 Permitted Freshwater Wells in Miami-Dade County



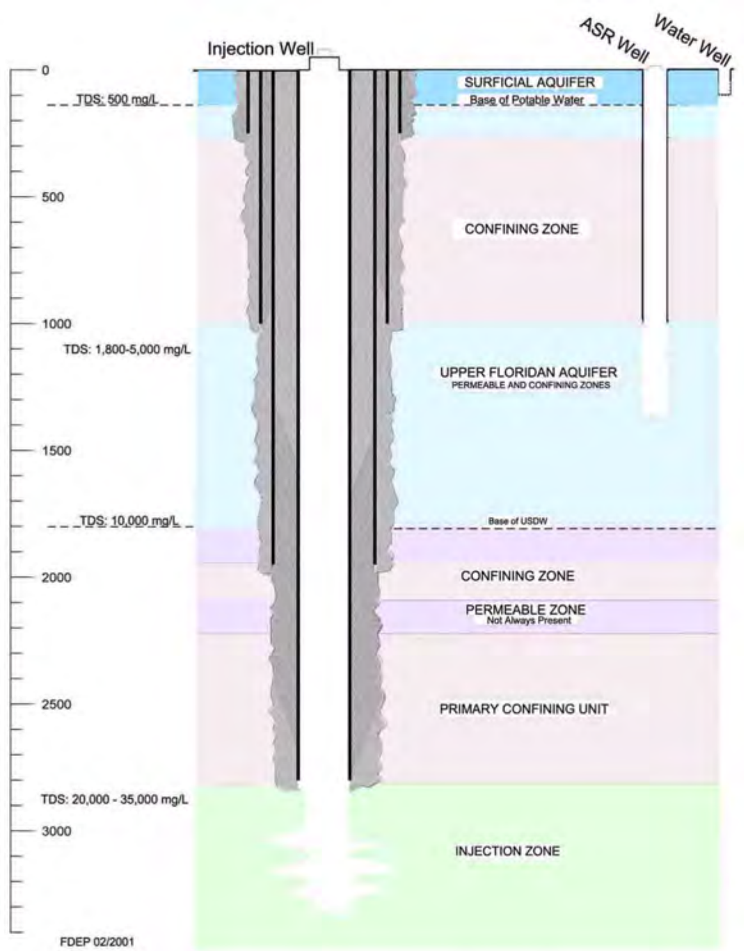
Data Source: SFWMD 2010

Figure 2.3-57 Miami-Dade County Wellfields and Wellfield Protection Area



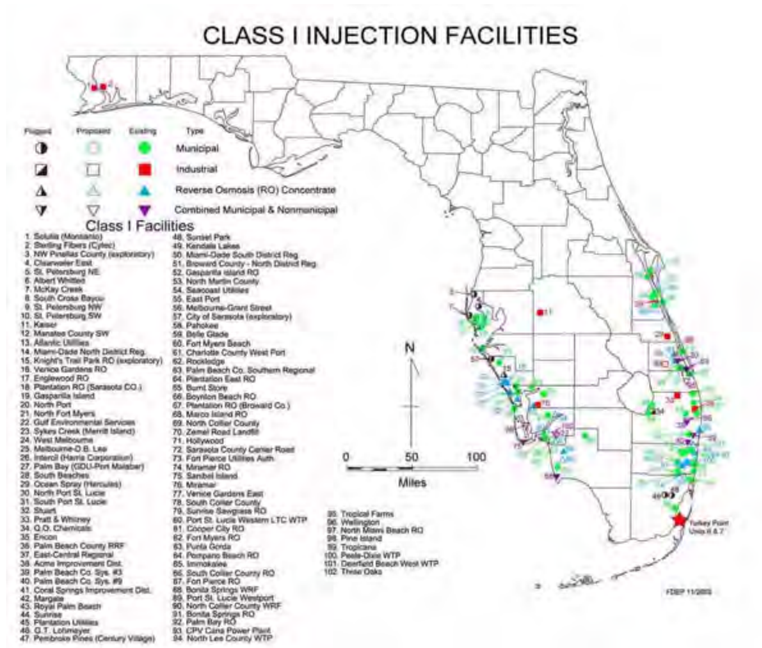
Modified from FDEP 2008d

Figure 2.3-58 Typical Municipal Class I Injection Well, Aquifer Storage and Recovery Well, and Water Well in Southeast Florida



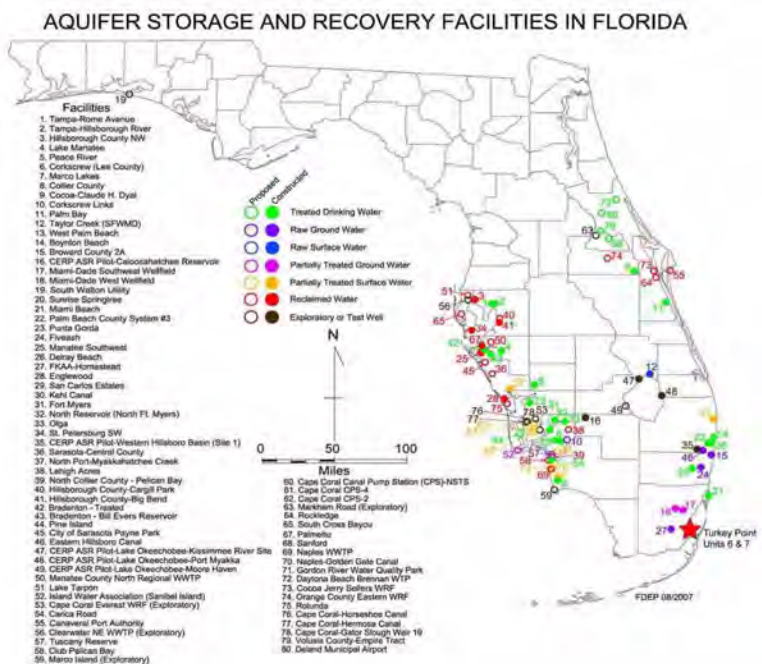
Source: FDEP 2008b
Note: The subsurface conditions and well completions shown in this figure may not represent the conditions beneath Units 6 & 7. This figure is a generalized representation of these types of wells presented in the Underground Injection Control Program website by the FDEP.

Figure 2.3-59 Class I Injection Wells



Modified from FDEP 2008b

Figure 2.3-60 Aquifer Storage and Recovery Map



Modified from FDEP 2008b

Figure 2.3-61 Industrial Wastewater Facility

Figure 2.3-62 Upper Floridan Production Wells for Units 1, 2, 5

Figure 2.3-63 Units 1, 2, 5 Monthly Groundwater Use

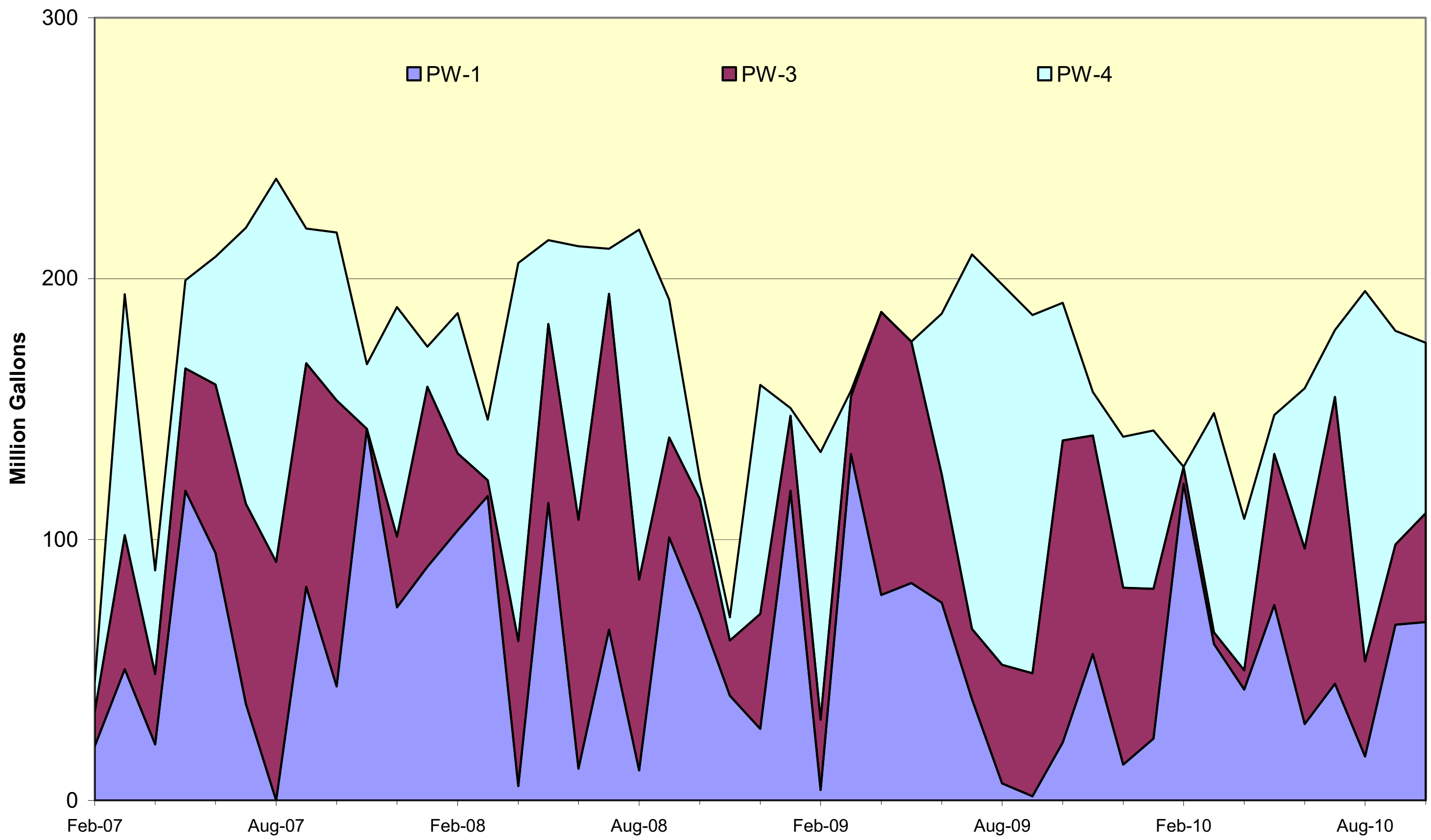


Figure 2.3-64 Radial Collector Well Area

Figure 2.3-65 Not Used

Figure 2.3-66 Biscayne Bay Water Quality Monitoring Stations Near Turkey Point Plant Property

Figure 2.3-67 303(d)-Listed Impaired Water Located Near Turkey Point Plant Property

Figure 2.3-68 NPDES Dischargers Located Near Turkey Point Property

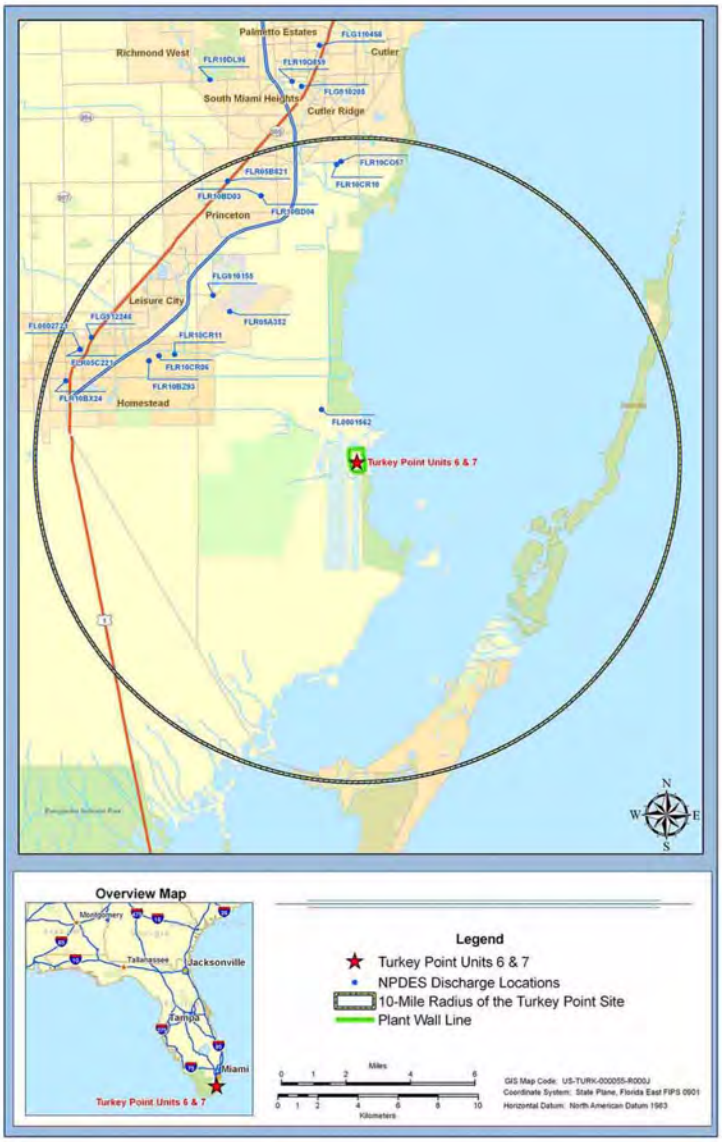


Figure 2.3-69 Biscayne Aquifer Potentiometric Surface Map, Upper Monitoring Interval, July 15, 2009 (Sheet 1 of 2) High Tide

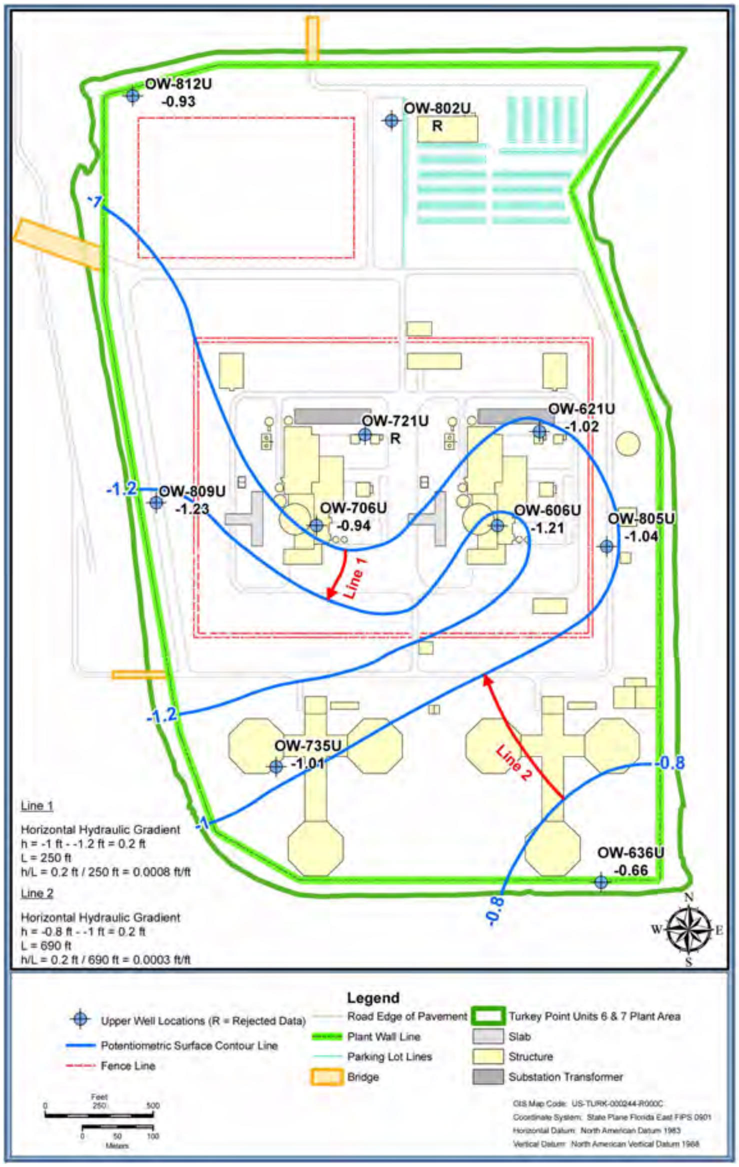


Figure 2.3-69 Biscayne Aquifer Potentiometric Surface Map, Upper Monitoring Interval, July 15, 2009 (Sheet 2 of 2) Low Tide

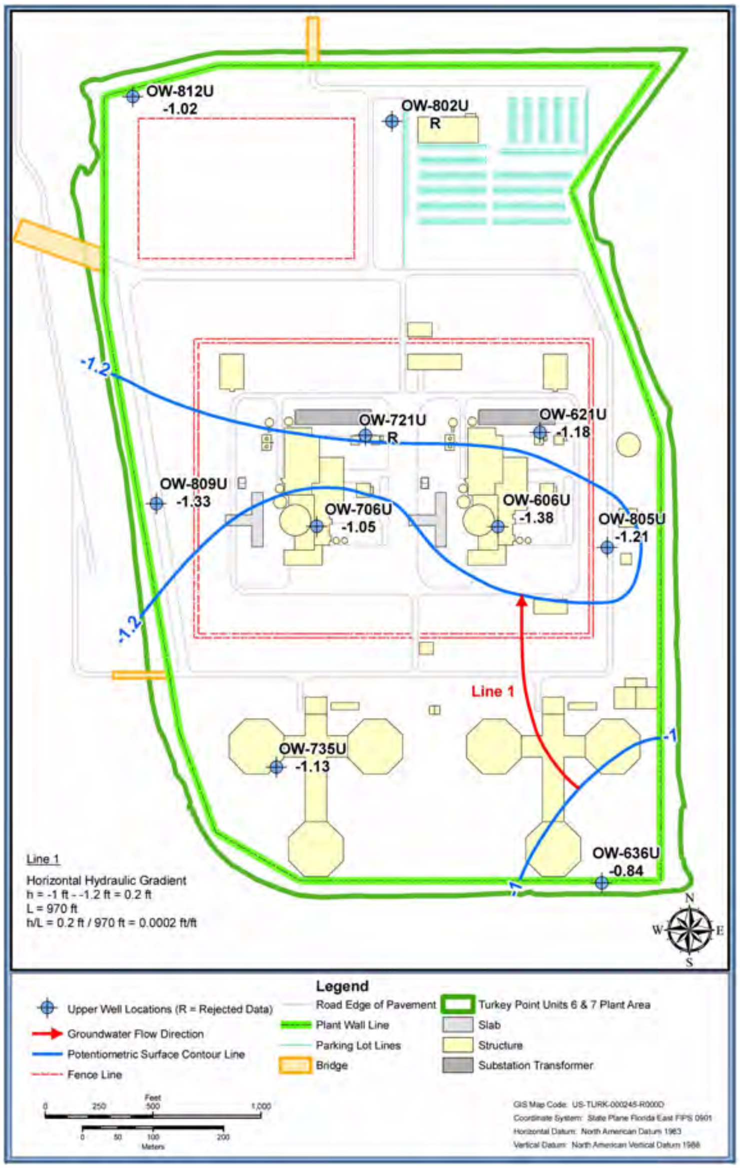


Figure 2.3-70 Biscayne Aquifer Potentiometric Surface Map, Lower Monitoring Interval, July 15, 2009 (Sheet 1 of 2) High Tide

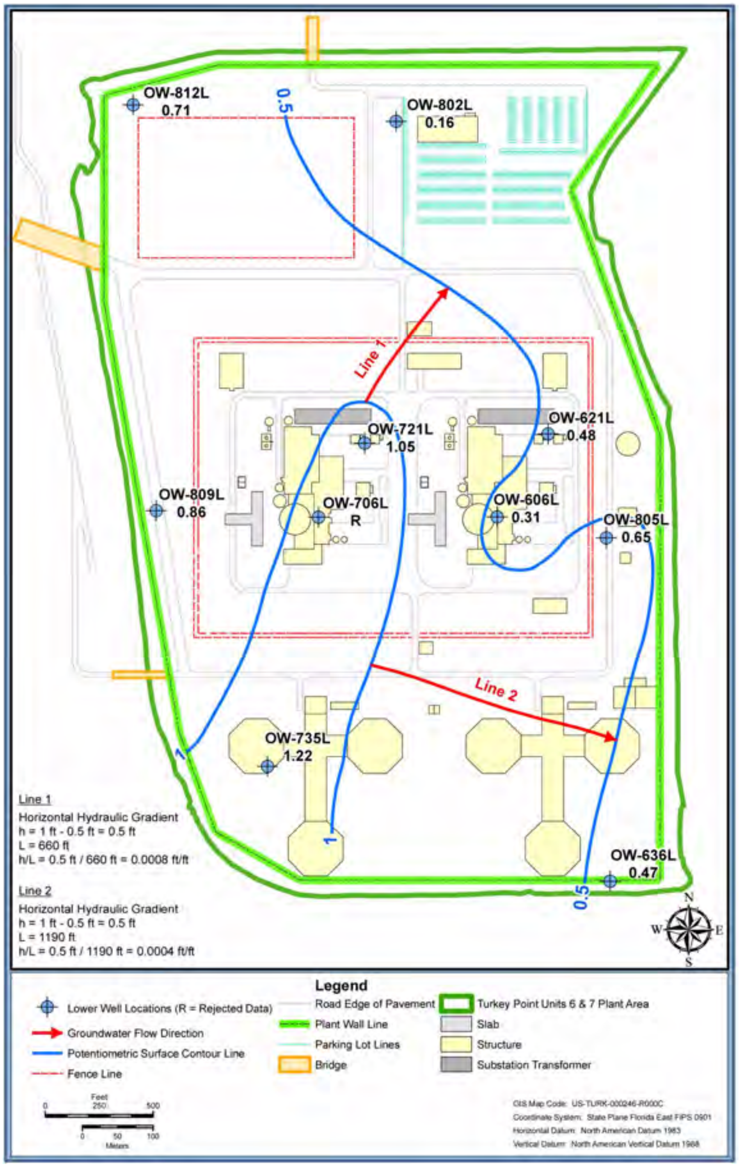


Figure 2.3-70 Biscayne Aquifer Potentiometric Surface Map, Lower Monitoring Interval, July 15, 2009 (Sheet 2 of 2) Low Tide

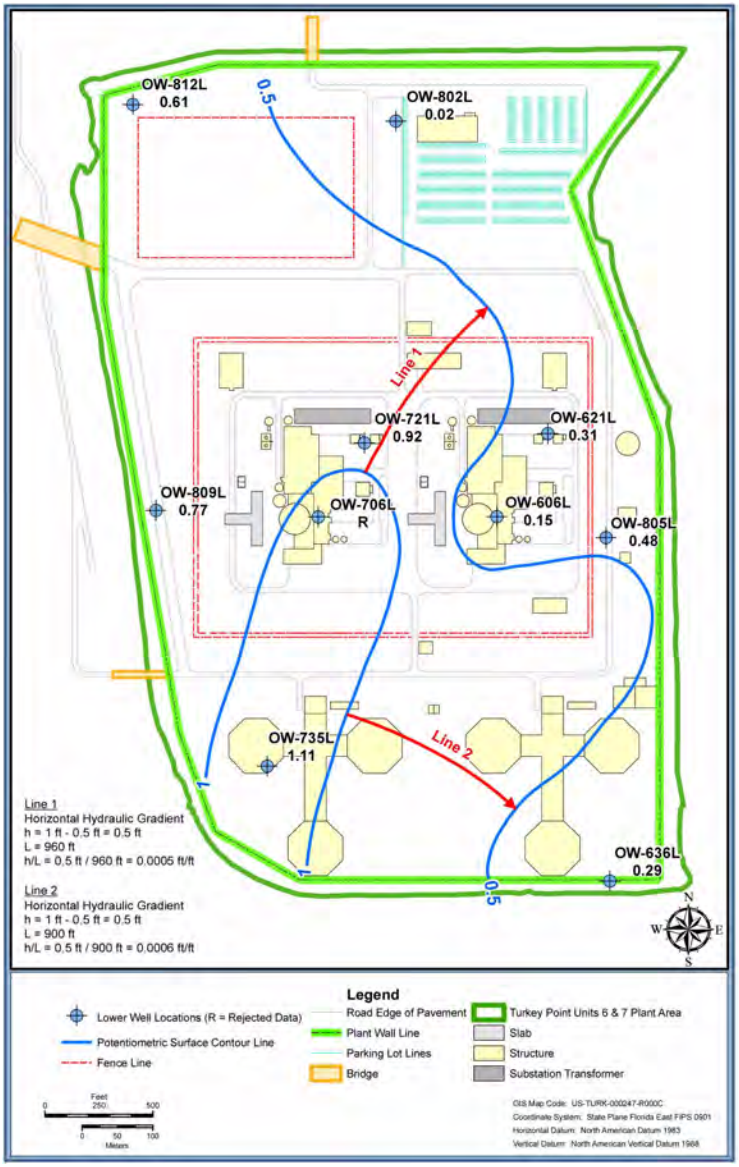


Figure 2.3-71 Biscayne Aquifer Potentiometric Surface Map, Upper Monitoring Interval, January 15, 2010 (Sheet 1 of 2) High Tide

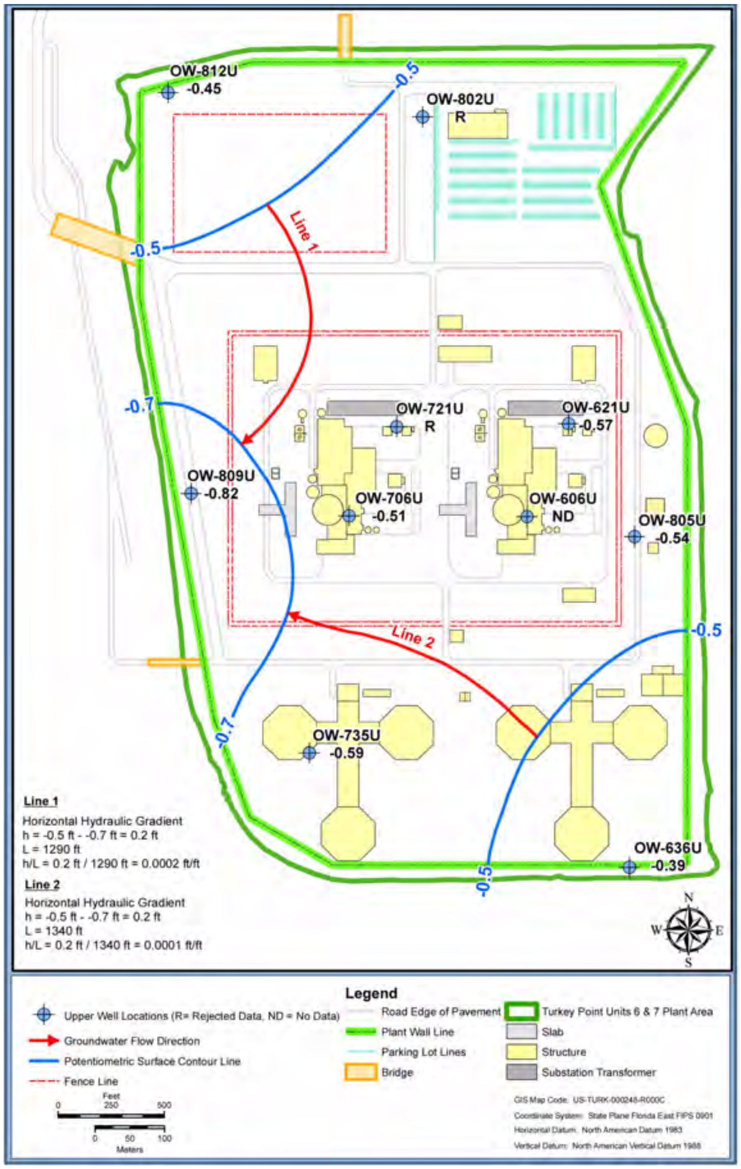


Figure 2.3-71 Biscayne Aquifer Potentiometric Surface Map, Upper Monitoring Interval, January 15, 2010 (Sheet 2 of 2) Low Tide

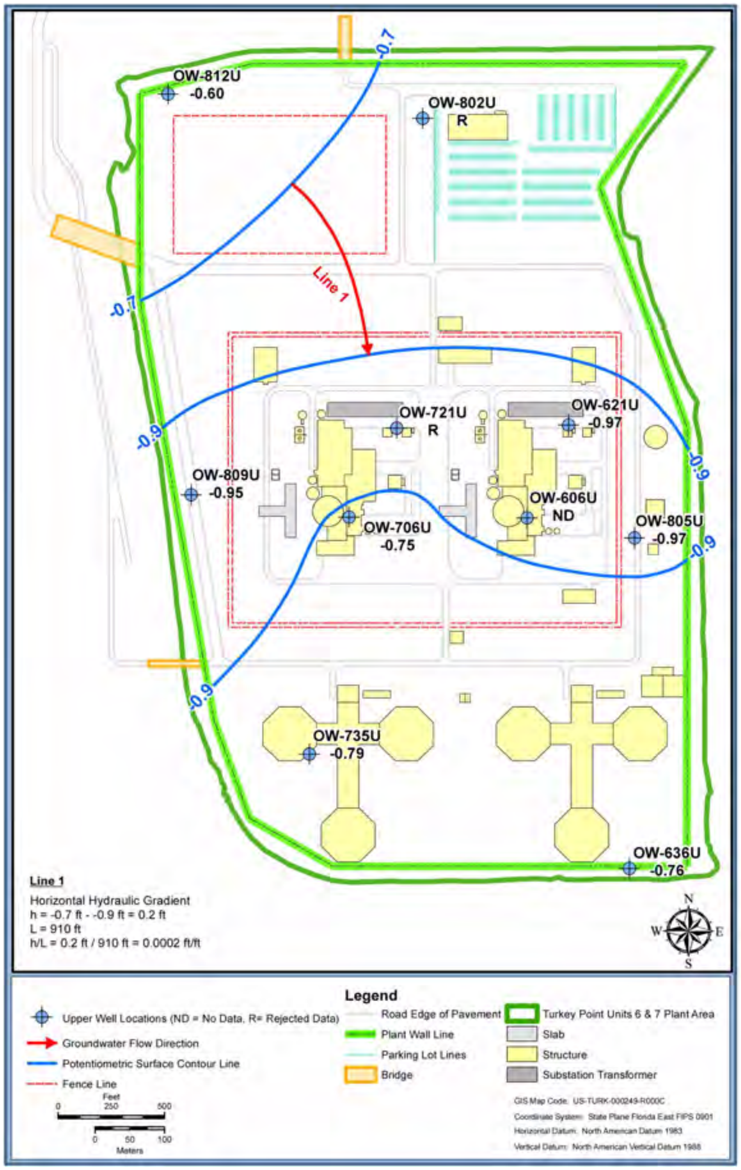


Figure 2.3-72 Biscayne Aquifer Potentiometric Surface Map, Lower Monitoring Interval, January 15, 2010 (Sheet 1 of 2) High Tide

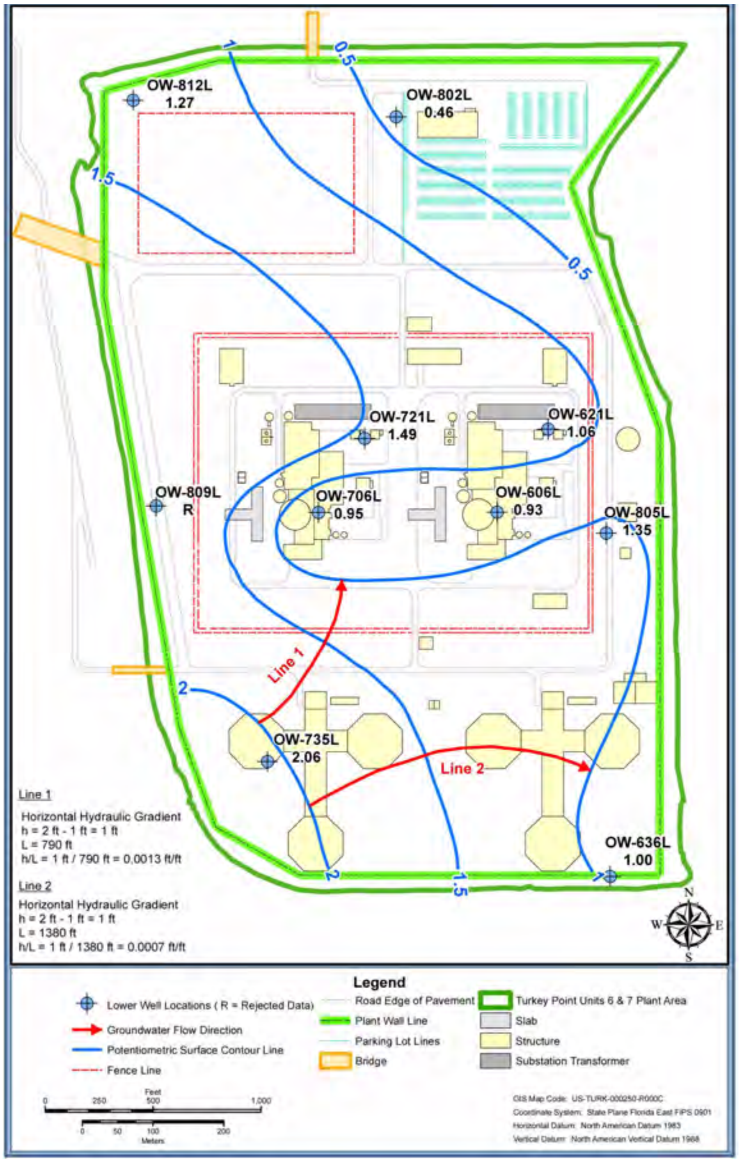


Figure 2.3-72 Biscayne Aquifer Potentiometric Surface Map, Lower Monitoring Interval, January 15, 2010 (Sheet 2 of 2) Low Tide

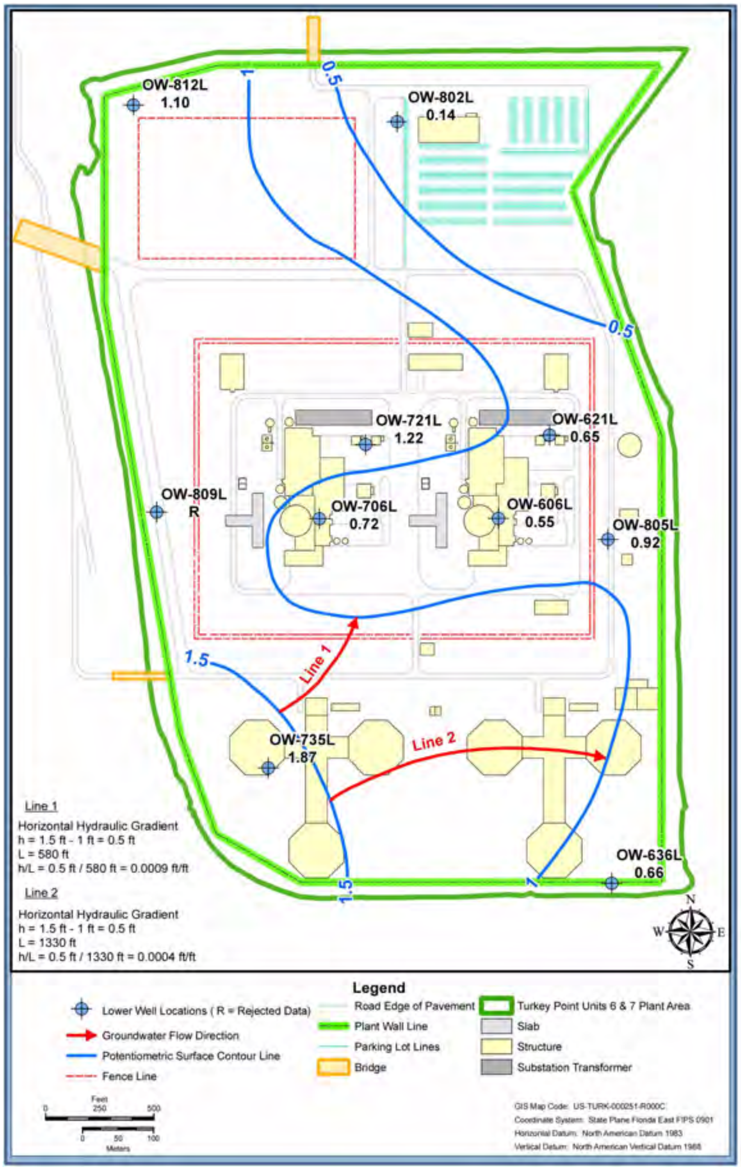


Figure 2.3-73 Biscayne Aquifer Potentiometric Surface Map, Upper Monitoring Interval, June 15, 2010 (Sheet 1 of 2) High Tide

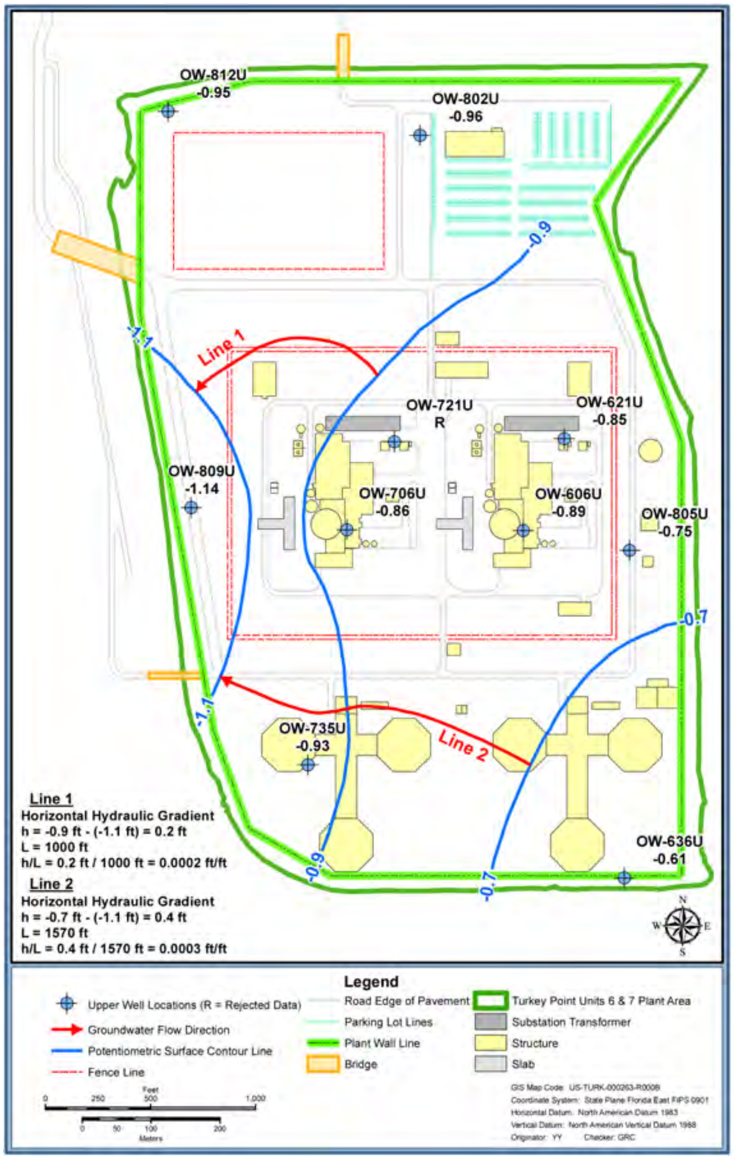


Figure 2.3-73 Biscayne Aquifer Potentiometric Surface Map, Upper Monitoring Interval, June 15, 2010 (Sheet 2 of 2) Low Tide

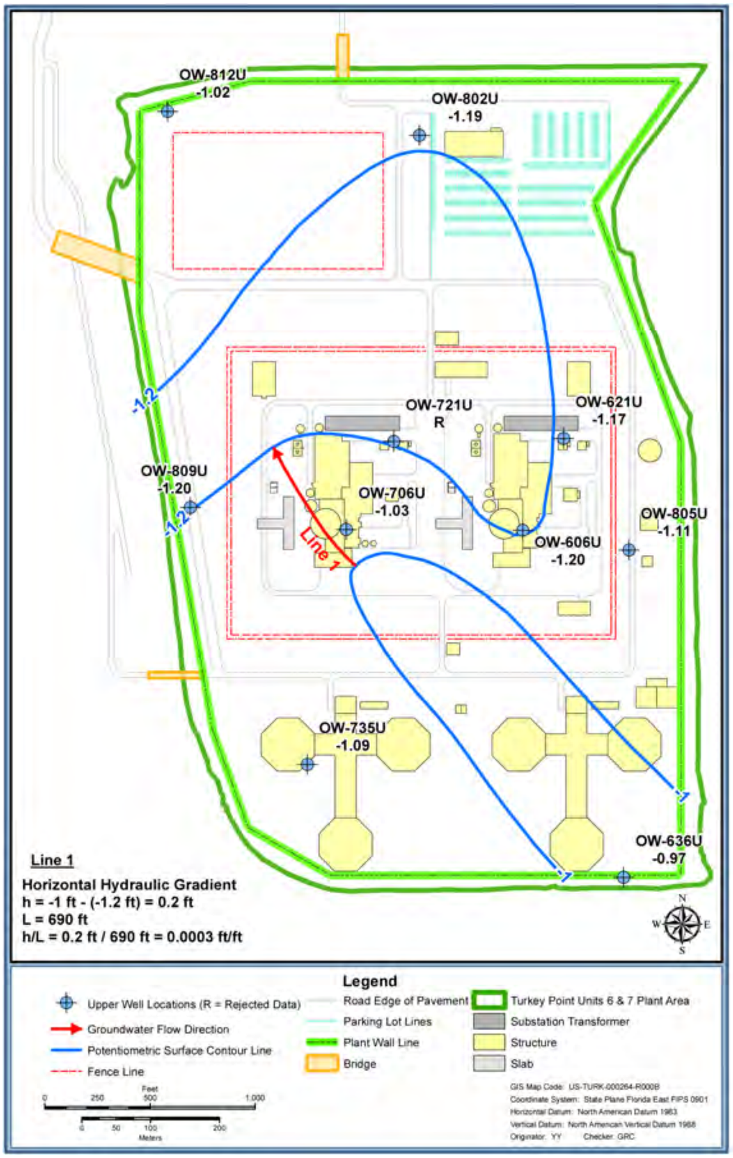


Figure 2.3-74 Biscayne Aquifer Potentiometric Surface Map, Lower Monitoring Interval, June 15, 2010 (Sheet 1 of 2) High Tide

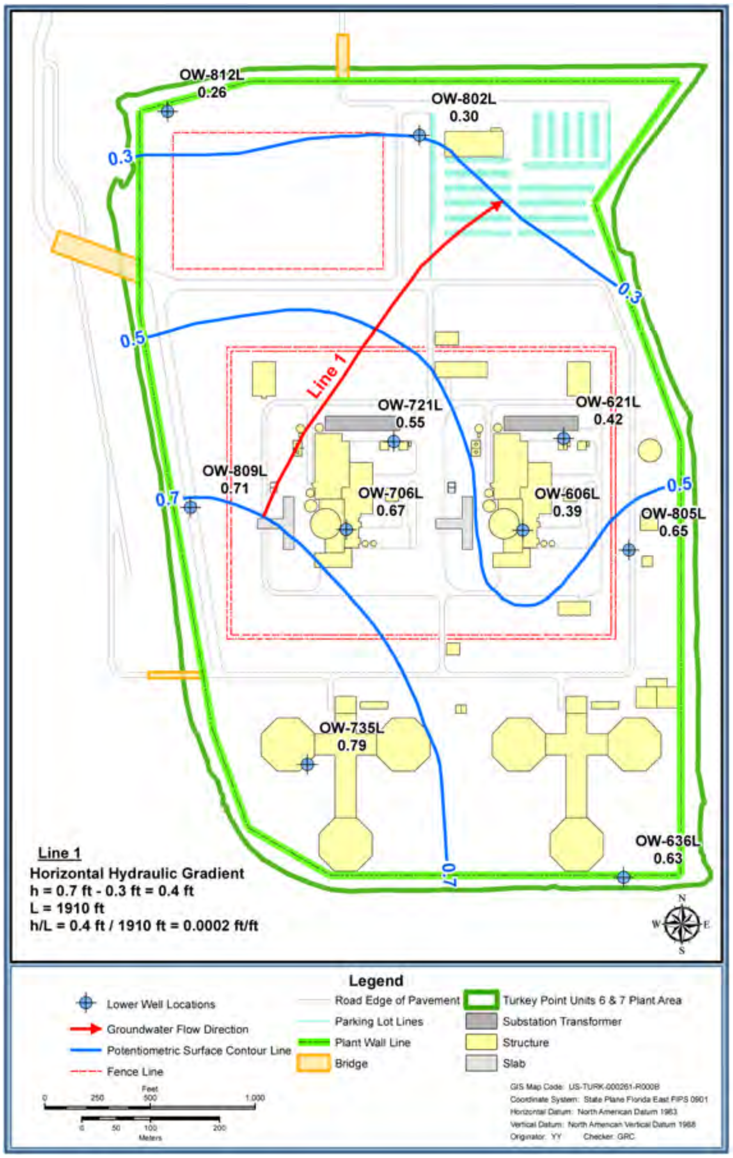
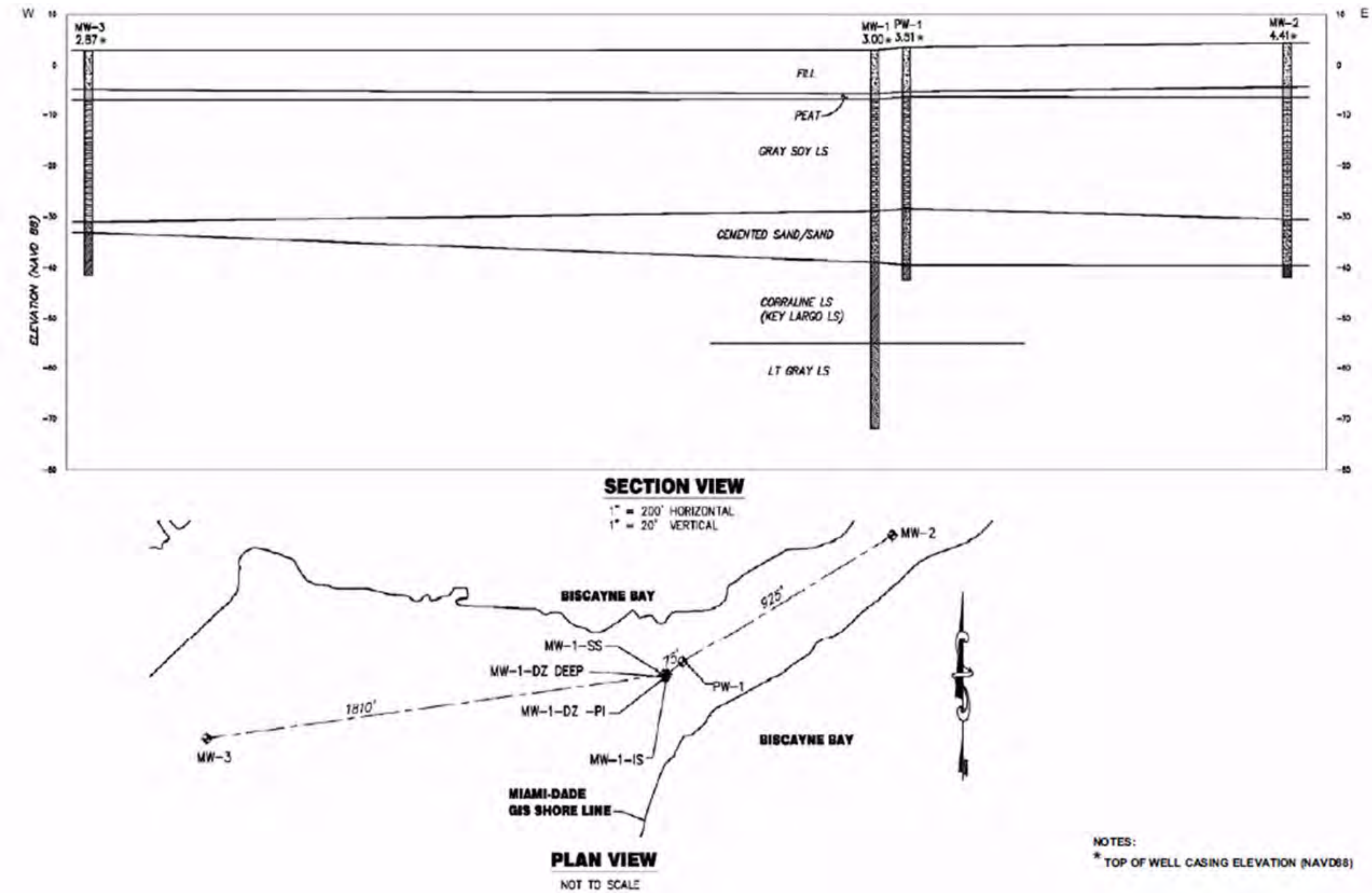


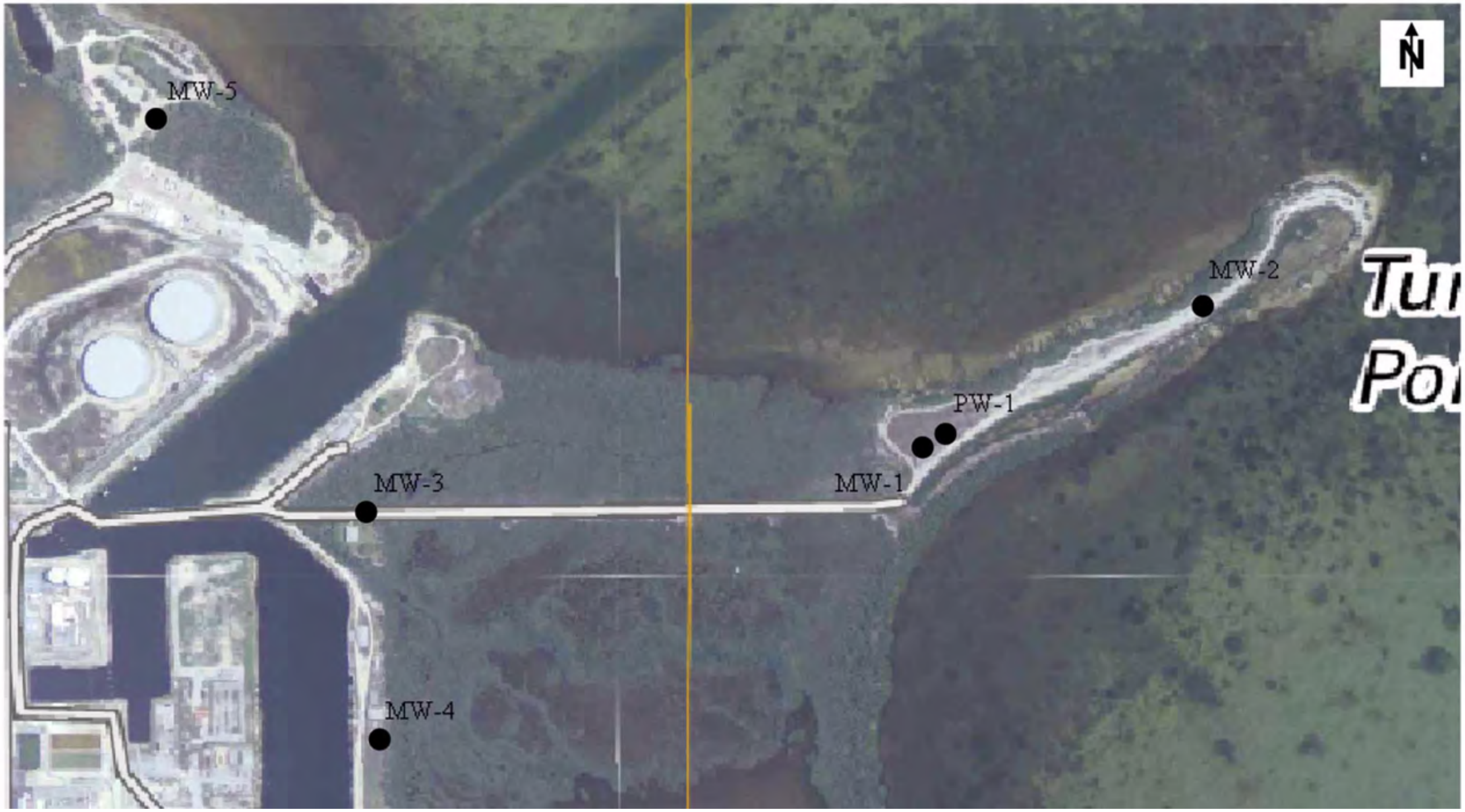
Figure 2.3-74 Biscayne Aquifer Potentiometric Surface Map, Lower Monitoring Interval, June 15, 2010 (Sheet 2 of 2) Low Tide

Figure 2.3-75 Stratigraphic Cross Section from Wells Drilled for Turkey Point Peninsula Aquifer Performance Test



Source: Reference HDR 2009

Figure 2.3-76 Layout of Pumping Test PW-1



SECTION 2.4: ECOLOGY

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2.4 ECOLOGY

This section describes the terrestrial and aquatic resources found within the planned construction areas, the Turkey Point plant property, and the southeastern region of Florida. It provides the baseline from which to assess potential impacts of construction activities and facility operations associated with Units 6 & 7.

Regional Landscape

The approximately 9400-acre Turkey Point plant property is located in Miami-Dade County, Florida, approximately 25 miles south of Miami on the coast adjacent to Biscayne Bay and Card Sound (Figure 2.4-1). The plant property is located within the subtropical coastal ecosystem of southeastern Florida. Much of the original coastal zone in the region has been converted to agriculture or residential/developed land. However, the Turkey Point plant property lies in a largely rural area dominated by swamp/marsh areas, even though the property is relatively close (25 miles) to the metropolis of Miami. The predominant land uses within 6 miles of the center point of Units 6 & 7 are listed in Table 2.2-2. This area is typified by low elevation, generally less than elevation 10 feet (NAVD 88) (up to 10 miles west of Biscayne Bay), with open marsh and mangrove swamp habitats interspersed with tidal creek drainages flowing east and south toward Biscayne Bay and Card Sound. Many of the wetlands have become degraded by invasive exotic species such as Brazilian pepper (*Schinus terebinthifolius*), Australian pine (*Casuarina equisetifolia*), melaleuca (*Melaleuca quinquenervia*), and old world climbing fern (*Lygodium* species).

The hydrology of southern Florida is influenced by an extensive system of canals and levees created to buffer climatic extremes (flooding and drought). These water management structures were built in the 1950s and 1960s by the federal government and are managed by the South Florida Water Management District (SFWMD), a state agency. Approximately 1800 miles of canals and levees currently exist in southern Florida including Miami-Dade County, the location of the Turkey Point plant property. The corridors containing the proposed transmission lines and reclaimed water pipelines cross several of these canals.

General Site Description

The Turkey Point plant property contains two natural gas/oil steam electric generating units (Units 1 & 2), two pressurized water reactor nuclear units (Units 3 & 4), and one natural gas combined-cycle steam electric generating unit (Unit 5). Approximately 340 acres of the Turkey Point plant property consist of generating facilities, buildings, and parking areas, switchyard, and transmission line corridors associated with Units 1 through 5 (Subsection 2.2.1.1). In addition to the existing generating facilities and supporting infrastructure, a major landscape feature of the site is the approximately 5900-acre (2 miles by 5 miles) industrial wastewater facility. Current land use at the Turkey Point property is described in Section 2.2 and shown in Figure 2.2-3. The existing Turkey Point facilities were established on mangrove-covered tidal flats, on land elevated by fill material. Although numerous drainage ditches and the industrial wastewater facility are located throughout the plant property, it contains no lakes or perennial streams. The Turkey Point plant property lies immediately adjacent to Biscayne Bay and Card Sound. The interface between the plant property and the bay/sound is primarily red mangrove (*Rhizophora mangle*) swamp. Seagrass beds containing shoal grass (*Halodule wrightii*), turtle grass (*Thalassia testudinum*), and manatee grass (*Syringodium filiforme*) are found throughout Biscayne Bay (NPS 1999).

Units 1-4 use the cooling canals of the industrial wastewater facility for condenser and auxiliary system cooling. The industrial wastewater facility also receives cooling tower blowdown from Unit 5. It is a closed-loop system that includes the canals adjacent to the Units 6 & 7 plant area (Figure 2.4-1). The industrial wastewater facility consists of 32 canals that carry warm water south away from the units and 7 canals that return cooled water to the units. Approximately 4400 acres of the industrial wastewater facility are open water. The canals are 200 feet wide and 1 to 3 feet deep. The berms are approximately 90 feet wide. Activities within the industrial wastewater facility include aquatic plant removal (3-year cycle), terrestrial vegetation removal from the berms (10-year cycle), and monitoring of the American crocodile (*Crocodylus acutus*) (see Subsection 2.4.1.2). The shallow canals are hypersaline (typically 40–50 parts per thousand [ppt] salinity), with water temperatures as high as 100.4°F (38°C). Because of these environmental conditions, the resident fish assemblage is dominated by species adapted to living in harsh conditions (e.g., sheepshead minnow and several *Fundulus* species). The approximately 167 miles of the industrial wastewater facility are not waters of the United States or the state.

<u>Units 6 & 7 Plant Area</u>

The power blocks, makeup water reservoir, switchyard, and other infrastructure would be located on the Units 6 & 7 plant area, immediately south of Units 3 & 4 within the industrial wastewater facility. The plant area is approximately 218 acres that is a sparsely vegetated hypersaline mudflat, buffered from tidal influence by the industrial wastewater facility (see Figure 2.4-2). Two remnant canals cross the plant area. An ecological assessment of the Units 6 & 7 plant area and the adjacent laydown area was conducted in 2008, including habitat characterization and surveys for federal and state listed species. Wetlands were the primary habitat types occurring on this site, with non-wetland habitats making up the remainder.

Wetland habitats within the Units 6 & 7 plant area and the adjacent laydown area include mudflats (187.5 acres), remnant and active canals (25 acres), dwarf mangrove (17 acres), open water (16 acres), mangrove heads (12 acres), and wetland spoil areas (10 acres). Encircled by canals, the sparsely vegetated mudflats are typically inundated by water 7 to 8 months out of the year and a few hardy plant species that can tolerate these conditions persist, including saltwort (*Batis maritima*), sea oxeye daisies (*Borrichia* spp.), woody glasswort (*Salicornia virginica*), and dwarf glasswort (*Salicornia bigelovii*). Dwarf mangrove habitats contain red mangrove as well as a few white mangrove (*Laguncularia racemosa*) and black mangrove (*Avicennia germinans*) stunted by high salinities and fluctuating water levels. The mangroves are located within the open water area on the western edge of the laydown area. The open water area joins the upper end of the industrial wastewater facility. Harsh conditions in the open water area limit submerged aquatic vegetation to scattered patches of widgeon grass (*Ruppia maritima*) and shoal grass. Mangrove heads, remnants of the original tidal creeks, contain primarily red mangrove, but white mangrove and black mangrove are also present. The connection between these creeks and Biscayne Bay were severed during construction of the industrial wastewater facility. Wetland spoil areas adjacent to remnant canals are typically occupied by Australian pine, buttonwood (*Conocarpus erectus*), and mangrove.

Non-wetland areas within the Units 6 & 7 plant area and adjacent laydown area include approximately 20 acres of fill area/roadway habitat and approximately 8 acres of upland spoil piles (Figure 2.4-2). The former are limerock aggregate uplands filled for construction of access roads, parking areas, and the land utilization facility. These areas are dominated by maintained grasses with wetland edges containing Brazilian pepper, buttonwood, and assorted herbaceous plants. Upland spoil piles were formed with spoil from the canal dredging operation. The vegetation in these areas is dominated by exotics such as Brazilian pepper and Australian pine, as well as poisonwood (*Metopium toxiferum*), buttonwood, wild sage (*Lantana involucrata*), ground orchid (*Bletia* spp.), and sea grape (*Cocoloba uvifera*).

The surface grade of the plant area varies from approximately elevation –2.4 to 0.8 feet (NAVD 88). The eastern margins of the plant area slope gently to the east perimeter canal, which is separated from Biscayne Bay by a 15 foot-high berm. There is no berm between the Units 6 & 7 plant area and the canal; however, when water levels rise in the canal, there is sheet flow to the west and the mudflats are inundated. The remnant canals would be eliminated during filling of the Units 6 & 7 plant area.

Laydown Areas

Two laydown areas would be created, 46 acres and 6 acres in extent. These areas consist largely of habitats including reservoirs larger than 500 acres, dwarf mangroves, and fill areas.

Nuclear Administration and Training Buildings and Parking Area

Nuclear administration and training buildings and a parking area would be located on two adjacent parcels (32 total acres) immediately north of the Units 6 & 7 plant area. These parcels consist largely of mangrove swamps and fill areas.

Reclaimed Water Pipelines and FPL Reclaimed Water Treatment Facility

Underground pipelines would bring reclaimed water from the Miami-Dade Water and Sewer Department (MDWASD) South District Wastewater Treatment Plant (SDWWTP) to the FPL reclaimed water treatment facility for eventual use as makeup water. The pipelines would extend approximately 9 miles between the SDWWTP and the FPL reclaimed water treatment facility. For about 6.5 miles of their length, the pipelines would be collocated with the existing Clear Sky-to-Davis transmission line right-of-way and adjacent road and canal rights-of-way. Primary land covers are summarized in Table 2.2-6. The FPL reclaimed water treatment facility would be established on approximately 44 acres of sawgrass, dwarf mangroves, mixed wetland hardwoods and roads and highways positioned between SW 344th Street/Palm Drive and the test canals. This habitat is primarily sawgrass with some areas of dwarf mangroves. The portion of the reclaimed water pipelines on the Turkey Point plant property (from the MDWASD South District Wastewater Treatment Plant to the FPL reclaimed water treatment facility, and from the FPL reclaimed water treatment facility to the makeup water reservoir) would potentially impact a variety of land cover types, with the majority land type consisting of dwarf mangroves.

Potable Water Pipelines

Potable water pipelines, approximately 10 miles in length, would bring potable water from the Miami-Dade County Water and Sewer Department to the Units 6 & 7 plant area. The pipelines would generally follow existing roadways/corridors. Much of the pipelines would be adjacent to or within the corridors containing the access road improvements and construction along SW 328th Street/N. Canal Drive to SW 117th Avenue to SW 359th Street to the plant area. The habitats/ land covers associated with this corridor include a variety of land cover types, with the majority land type consisting of farms, wetlands, and roads.

Radial Collector Wells and Pipelines

Radial collector wells would provide a backup source of makeup water for Units 6 & 7. Four radial collector wells would be located on a 3-acre area on the northeastern tip of Turkey Point. Each radial collector well would consist of a central reinforced concrete caisson extending below the ground level with laterals projecting from the caisson. The well laterals would be advanced horizontally a distance of up to 900 feet and installed at a depth of approximately 25 to 40 feet below the bottom of Biscayne Bay. The well location area is primarily industrial habitat, with a thin strip of mangroves on the Biscayne Bay shore. Water supply pipelines from the radial collector wells to the cooling towers on the plant area would occupy approximately 13 acres and would be trenched under an existing perimeter access road, potentially impacting land types including stream and waterways/canals, mangrove swamps, and fill areas.

An additional 3-acre laydown area for the radial collector well construction would be built along the northwest-facing shore of barge turning basin, on previously disturbed industrial habitat.

Spoil Areas

Spoils from the Units 6 & 7 plant area, FPL reclaimed water treatment facility, and other construction locations would be deposited on three areas (total approximately 211 acres) within the industrial wastewater facility. Two of these areas would be located on wide berms on either side of Grand Canal, the primary north-south canal in the center of the facility. The third would be along a strip of land below the southern end of the industrial wastewater facility. All three areas have been used historically for spoil deposition and contain scattered patches of early succession vegetation (grasses, low shrubs, etc.).

Equipment Barge Unloading Area and Heavy Haul Road

The existing barge turning basin would be expanded, with a 0.31-acre equipment barge unloading area to be excavated, as part of a total disturbed area of 0.75 acres, on previously disturbed industrial lands, classified as electric power facilities, on a shore of the barge turning area. A heavy haul road would be built over existing roads between the equipment barge unloading area and the Units 6 & 7 plant area.

Transmission Laydown Areas

In support of transmission expansion, an approximately 3-acre laydown area would be established on previously disturbed lands (concrete pads currently functioning as parking areas), made up of ditches, dwarf mangroves and electric power facilities, on the north side of SW 360th Street.

Previously Disturbed Areas on the Turkey Point Plant Property

Several previously disturbed areas on the Turkey Point plant property would be impacted including: security buildings and associated pull-off and parking areas, transmission infrastructure improvements (e.g., towers and bridges), sanitary waste pipeline from the existing units to the Units 6 & 7 plant area. These areas are typically previously filled areas or existing concrete pads.

Access Roads

A total of 10.8 miles of roadway expansions and improvements would be needed for construction-related travel (workers, fill material deliveries, equipment, etc.) for Units 6 & 7. These improvements would be located adjacent to and along existing roads, transmission rights-of-ways, and canals. The access roads would traverse a variety of land cover types, the majority of which includes wetlands, farms, and disturbed areas.

FPL-Owned Fill Source

Offsite borrow material would be supplied from an approximately 300 acre site about 4.8 miles northwest of Units 6 & 7, other regional sources, or reused material. Most of the 300-acre site is comprised of tree nurseries, Brazilian pepper, ditches, exotic wetland hardwoods, wetland scrub, freshwater marshes and roads and highways.

Transmission Corridors

Transmission lines would extend, primarily along existing transmission corridors, from the Turkey Point plant property to the Levee, Pennsuco, Davis, and Miami substations (Figure 2.2-5). Existing transmission lines generally pass through typical habitats associated with the coastal region of southeast Florida. For the Clear Sky to Levee lines, land use classes are outlined in Table 2.2-3. Some remnant pine rockland habitat is found along this line. This line would extend approximately 43 miles. The initial segment of this corridor would be new construction, crossing the northern end of the industrial wastewater facility and requiring new towers/poles and several bridges across the canals to access the tower sites on the berms. The line continues west for approximately 12 miles and turns north toward Levee. The northern section of this line crosses the eastern portion of the ENP (Figure 2.2-5). A likely alternative to impacting the ENP (West Option) follows the same corridor from Turkey Point, but shifts east to border the ENP (East Option) rather than cross it (Figure 2.2-5). A land exchange has been proposed to relocate the approximately 8-mile-long segment of this corridor within the ENP to the periphery of the park.

The route of the Clear Sky to Pennsuco line would use the Clear Sky to Levee corridor, then bypass the Levee substation and follow an existing 230 kV transmission easement for approximately 8 miles to connect to the existing Pennsuco substation. Land types traversed are described in Table 2.2-3.

The Clear Sky to Davis corridor would extend approximately 19 miles north from the Turkey Point plant property through land use classes described in Table 2.2-3, using existing transmission rights-of-way.

The Davis to Miami corridor extends east for approximately 4 miles from the substation through land use classes outlined in Table 2.2-3, although it borders two protected pine rockland areas. This segment of the corridor is typically mowed to a low level. The corridor would then extend to the north for approximately 13 miles along a Miami Metro bus and rail corridor adjacent to U.S. Highway 1 through areas shown in Table 2.2-3.

2.4.1 TERRESTRIAL ECOLOGY

2.4.1.1 Terrestrial Wildlife

Wildlife species found in and around the Turkey Point plant property are typical of those in southeastern Florida coastal areas. Approximately 90 species of birds have been observed on or near the Turkey Point plant property and associated transmission corridors during surveys from 1972 and more recent surveys (2005–2009) (Table 2.4-1). These observed species reflect the predominance of aquatic habitats within and adjacent to the property. They include 19 shorebird species, 11 wading bird species, 6 seabird species, and 5 other waterbird species (pelicans, cormorants, mergansers). Several of these avian species are listed as endangered or designated as species of special concern and are described in Subsection 2.4.1.1. A late winter survey for birds around the construction areas resulted in 36 avian species observed (see Table 2.4-1). Nine avian species (25%) were considered wintering birds, including most of the shorebirds. Most wading birds were relatively common, and the double-crested cormorant (*Phalacrocorax minor*) and white ibis (*Eudocimous albus*) were considered abundant. The predominance of observed water birds (wading birds, shorebirds, pelicans, etc.) was indicative of the primary habitats available: the industrial wastewater facility and the adjacent mangrove wetlands. A late summer survey in June 2009 occurred to document wet/breeding season avian species. The late summer survey for birds around the construction areas resulted in 39 avian species observed. Wading birds, shorebirds and other water birds made up over half (54 percent) of the species observed. Such species as white ibis, least tern, white-crowned pigeon, common ground-dove, prairie warbler, red-winged blackbird and common nighthawk were the most abundant species observed on site. The breeding season was evident by the presence of juvenile (young-of-the-year) birds, including juveniles of most species of wading birds and shorebirds. The species composition is consistent with the predominance of aquatic/wetland habitats available at the site.

The diversity of mammalian fauna observed in surveys from the 1970s to the present is limited, also due to the predominance of aquatic habitats. Mammals observed on the property include white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), opossum (*Didelphis virginiana*), eastern cottontail (*Silvilagus floridanus*), and various species of small rodents (Table 2.4-2). A small mammal trapping effort in April 2009 indicated that cotton rats (*Sigmodon hispidus*) and black rats (*Rattus rattus*) were the dominant small mammals in the construction activity areas (Figure 2.4-3a). They were the only mammal species captured during 345 trap-nights (Sherman live traps). Cotton rats were found essentially site-wide and were relatively abundant whereas black rats were primarily found within the Units 6 & 7 plant area and adjacent mangrove areas. Based on pedestrian surveys, raccoons were also wide-spread and relatively abundant. Marsh rabbits (*Silvilagus palustris*) and/or their sign were relatively common within the vegetated portions of the spoil deposition areas. White-tailed deer and Virginia opossum sign were seen in the mangrove areas west of the industrial wastewater facility and along

SW 344th Street/Palm Drive, respectively. No bats were observed during one hour of surveys between the existing facilities and a mangrove area.

Other fauna observed on the Turkey Point plant property since the 1970s include reptiles and amphibians (Table 2.4-2). The American crocodile is the most conspicuous reptile on site, breeding in the industrial wastewater facility and using all canals as travel corridors (see details in Subsection 2.4.1.1). Surveys for reptiles, excluding American crocodiles, and amphibians occurred from April 13–16, 2009 and employed coverboards, minnow traps, dip nets, and pedestrian searches. Twenty coverboards were installed in late March of 2009 (Figure 2.4-2) within several areas that would be disturbed during Units 6 & 7 plant construction and checked daily during the week of April 13–16. Four minnow traps were set adjacent to Palm Drive (reclaimed water treatment facility site) and 7 were set in the standing water within the administrative building/parking area site (two mangrove areas immediately north of the Units 6 & 7 plant area). The minnow traps were checked each day for two days. Dip nets were dragged through aquatic vegetation within the two mangrove areas. Planned construction areas were searched during approximately 1000 minutes of pedestrian surveys (all areas combined). The April 2009 survey efforts documented four species of snakes, three species of lizards, three species of amphibians, and one species of turtle (Table 2.4-2). Based on these surveying efforts, only the Cuban brown anole (*Anolis sangrei*) was considered relatively abundant. Four of the 12 herpetological species observed were exotic species: Cuban brown anole, green iguana (*Iguana iguana*), Mediterranean gecko (*Hemidactylus turcicus*), and greenhouse frog (*Eleutherodactylus planirostris*).

Several of the animal species observed within the Turkey Point plant property are considered an invasive or exotic species and several exotic plant species (see the preceding section) exist on the property. Many other exotic animal species exist within the region, some as close as the adjacent Everglades Mitigation Bank (EMB) (see Subsection 2.4.1.3) (FPL 2008a), and, therefore, could exist on the Turkey Point plant property. These exotic species include marine toad (*Bufo marinus*), Cuban tree frog (*Osteopilus septentrionalis*), rock dove (*Columba livia*), scarlet ibis (*Eudocimus rubber*), spectacled caiman (*Caiman crocodylus*), and Indo-pacific gecko (*Hemidactylus garnoti*).

Wildlife species found within the Turkey Point plant property are common to the region and would be expected to be found in off-site project areas associated with Units 6 & 7: access roads, reclaimed water pipelines, transmission corridors and FPL owned fill source.

Although the Turkey Point plant property hosts such potential disease vectors as ticks and mosquitoes, no vector-borne diseases resulting from them are known.

2.4.1.2 Threatened and Endangered Species

The U.S. Fish and Wildlife Service (USFWS) is responsible for designating areas as “critical habitat” for federally listed endangered and threatened species. Such areas are protected to aid the recovery of the species and may require special management activities. Critical habitats associated with two species found in the Turkey Point plant property are addressed below within the descriptions of the individual species.

Endangered and threatened species listed for Miami-Dade County, the location of the Turkey Point plant property and the existing and proposed transmission corridors, are identified in Table 2.4-3 although only a few species exist on Turkey Point plant property. The list is based on classifications of the USFWS (USFWS Feb 2008a) and Florida Natural Areas Inventory (FNAI 2008). Four federally-listed species have been observed within the Turkey Point plant property: American crocodile, Eastern indigo snake, Florida manatee, and wood stork. As described below, several state-listed species have also been observed. Approximately 170 animal and plant species are either federal- or state-listed as endangered, threatened, or candidates, or designated (not listed) species of special concern for Miami-Dade County, with the vast majority being plant species (Table 2.4-3). It should be noted that records of federally-listed species on the state and federal Web sites occasionally differ, with the state including all counties within the historical range of these species and the federal listing including only counties with sightings. As a conservative approach, species in counties from both sources have been included. Also, it is acknowledged that these listings reflect only recorded or historical occurrences and the possibility exists that other (unrecorded) rare species might exist in this county. Contacts have been initiated with the appropriate federal and state agencies regarding the existence of endangered and threatened species.

American crocodiles inhabit coastal estuarine marshes, tidal swamps, and creeks/canals of southern Florida, the Caribbean, and Central America. They were down-listed from federally endangered to threatened in 2007 because populations were expanding (USFWS Mar 2007a). Their recovery was linked to the conservation efforts at Turkey Point. Construction of the industrial wastewater facility eliminated several thousand acres of relatively natural potential habitat (tidal mangrove) for this species in the 1970s. However, crocodiles discovered and colonized the industrial wastewater facility, which now hosts approximately one-third to one-half of the breeding population of crocodiles in the United States. From 2005 to 2008, FPL biologists have reported 21 to 26 crocodile nests in the industrial wastewater facility, making it the second largest breeding aggregation in the state of Florida. A crocodile management plan prescribes maintenance procedures for the industrial wastewater facility (timing and method of vegetation clearing in canals and on berms) least likely to disturb nests, hatchlings, and adults. Additional management activities have included excavating small ponds on and around the berms as sanctuaries and/or freshwater catchments, clearing berms of exotic vegetation and providing shade by planting native tree species. FPL has also established a crocodile monitoring program to document breeding success and survival within the industrial wastewater facility. This monitoring includes hatchling studies involving weighing, measuring, and permanently marking (clipping scutes and embedding microchips with unique identification numbers) individual hatchlings. Much of the Turkey Point plant property and adjacent lands to the east, south, and west, including the Units 6 & 7 plant area, have been designated critical habitat for the American crocodile (Figure 2.4-4; USFWS Sep 1977). Most crocodile nesting occurs in the southwestern corner of the industrial wastewater facility; however, a limited number of nests have been observed on berms within the northern portion of the return canals (Figure 2.4-5). Nesting crocodiles have never been documented within the Units 6 & 7 plant area. The plant area consists primarily of low areas that are not typically used by crocodiles because of lack of suitable nesting substrate and limiting foraging opportunities. A limited number of crocodiles have been observed basking on the perimeter shore of the plant area.

Crocodiles are unlikely to be found within aquatic habitats west of the L-31E Canal associated with the access roads, reclaimed water pipelines, FPL-owned fill source, and transmission corridors.

Wood storks (*Mycteria americana*) are large wading birds that nest in trees and shrubs over water and forage on fish in shallow wetlands in the southeastern United States. They are federal- and state-listed as endangered. They feed by touch, literally bumping into their prey, and thus require shallow wetlands relatively clear of vegetation in order to forage efficiently. They are seen in low numbers in the shallow portions of the industrial wastewater facility during the winter months. Three wood storks were observed foraging/roosting in shallow wetlands in the laydown area immediately west of the Units 6 & 7 plant area. They do not nest on or near the Turkey Point plant property but have historically nested in three colonies south of Tamiami Trail and one colony north of Tamiami Trail. Portions of both corridors fall within the core foraging areas of a total of nine colonies (radius of 18.4 miles around each colony). Wood storks could also be found within aquatic habitats associated with the access roads, reclaimed water pipelines, and FPL-owned fill source. Critical habitat has not been defined for this species.

The Eastern indigo snake (*Drymarchon corais couperi*) is a federally threatened species that inhabits a variety of habitats in the southeastern United States from scrub and sandhill to wet prairies and mangrove swamps. Their existence is frequently linked to gopher tortoise populations and use of their subterranean burrows. Indigo snakes have been observed south of the industrial wastewater facility in the Everglades Mitigation Bank (in 2004) and within an area south of SW 344th Street/Palm Drive, adjacent to the FPL child daycare facility (in 1981) and at two locations in the Eastern Preferred transmission line corridor (in 2011). Eastern indigo snakes could also be found within appropriate habitats found near the access roads, reclaimed water pipelines, FPL-owned fill source, and transmission corridors. Critical habitat has not been defined for the indigo snake.

Manatees (*Trichechus manatus*) are large marine mammals that frequent warm water estuarine habitats including rivers, marshes, bays, and sounds in Florida and other southeastern coastal states. They use warm water refuges in the cooler months, including freshwater springs and heated effluent from power plants. Manatees are federal- and state-listed as endangered, and their critical habitat includes Biscayne Bay and Card Sound adjacent to the Turkey Point plant property and the streams, rivers, and canals entering these water bodies (Figure 2.4-3a; USFWS Sep 1977). Manatees have been observed in the barge turning basin and nearby state canals.

Four endangered and one threatened species of sea turtle inhabit Biscayne Bay and Card Sound at varying times of the year. These include the endangered green sea turtle (*Chelonia mydas*), leatherback sea turtle (*Dermochelys coriacea*), hawksbill sea turtles (*Erytmochelys imbricata*), Kemp's ridley sea turtle (*Lepidochelys kempii*), and threatened loggerhead sea turtle (*Caretta caretta*). Of these, the loggerhead turtle is the most common in the vicinity of the Turkey Point plant property. These turtles typically forage within the bay and sound, but beach habitats that they need for their nesting do not exist on the mainland shoreline near Turkey Point. It should be noted that the Kemp's ridley sea turtle is not listed for Miami-Dade County, but is listed for the adjacent Monroe County.

The Florida panther (*Felis concolor coryi*) is a large, federally endangered cat that inhabits the Everglades region. Their population size within the region is estimated at fewer than 60 animals. They use a combination of upland hammocks and dense saw palmetto thickets and prey on deer and feral hogs. State-maintained databases of (1) movement patterns of radio-collared panthers (approximately 30 years of data), (2) panther mortalities (typically collisions with motor vehicles; approximately 40 years of data), and (3) panther den locations (approximately 16 years of data) were examined relative to the various construction areas, some of which are within or adjacent to the primary and secondary zones of the Panther Focus Area (PFA). There have been no confirmed panther movements/occurrences, mortalities, or dens found on the main plant site, within the corridors of the proposed reclaimed or potable water pipelines, or within the FPL-owned fill source area. There have been no movements/occurrences of radio-collared panthers and no known dens within 5 miles of the proposed access road modifications since 1988. There have been no known mortalities of panthers within 2 miles of the proposed access road modifications since 1988, but one mortality occurred in 2007 within 5 miles of the proposed access road. Multiple movements/occurrences and one den are known near the two Clear Sky to Levee transmission line options and five mortalities have occurred within 5 miles of these corridors.

The Everglades snail kite (*Rostrhamus sociabilis plumbeus*) is a federally endangered species that inhabits tropical, open freshwater marshes and shallow lakes in southern Florida. They depend on apple snails (*Pomacea paludosa*) as prey, caught at the surface of freshwater marshes. Critical habitat exists west and north of the proposed Clear Sky to Levee transmission corridors (Figure 2.4-4; USFWS Sep 1977), but a single Everglades snail kite was observed in the area of the proposed transmission corridors bordering the ENP during recent reconnaissance. The species has been documented using the wetlands of the EMB adjacent to the Turkey Point plant property as recently as 2003.

The Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*) is a federally endangered species that inhabits seasonally inundated freshwater interior marshes. There may be scattered populations of these sparrows in Miami-Dade County, primarily in prairies to the east of Shark Slough in the ENP. These prairies do not occur on the Turkey Point plant property and the species has not been observed on the property. Critical habitat exists within the ENP; smaller critical habitat areas occur northwest of nearby Florida City (Figure 2.4-4; USFWS Nov 2007b).

The bald eagle (*Haliaeetus leucocephalus*) was de-listed in 2007, but remains protected under the Bald and Golden Eagle Protection Act. Eagles do not nest on or near the Turkey Point plant property, but some have been observed flying near the existing units and along the transmission corridors and a single adult eagle was observed perched near the northwest corner of the industrial wastewater facility. Eagle nesting has historically occurred within one mile of the West Preferred corridor in the Doral area.

Several state-listed species have been observed on or adjacent to the Units 6 & 7 plant area. These include two threatened species: the least tern (*Sterna antillarum*) and the white-crowned pigeon (*Columba leuccephala*). A Florida burrowing owl (*Athene cunicularia floridana*), designated as "species of special concern," was observed on one occasion in 2010 along the main north-south access road in the southern portion of the industrial wastewater facility. Florida burrowing owls typically inhabit open, well-drained landscapes such as pastures and mowed areas. Six wading birds designated as “species of special concern” have been observed on or adjacent to the 6 & 7 plant area: little blue heron (*Egretta caerulea*), roseate spoonbill (*Ajaia ajaja*), snowy egret (*Egretta thula*), tricolored heron (*Egretta tricolor*), reddish egret (*Egretta rufescens*), and white ibis (*Eudocimus albus*). Many of these wading bird species were observed during 2008–2009 reconnaissance along the transmission corridors and all wading bird species could possibly use appropriate wetland habitats associated with the access roads, reclaimed water pipelines, FPL-owned fill source, and transmission corridors.

No federal- or state-listed plants (see Table 2.4-3) have been observed on the Units 6 & 7 plant area. Multiple surveys of the transmission corridors for federal and state-listed plants in 2008 and 2009 documented 36 listed species (Table 2.4-4). Three were federally-listed candidate species: Florida brickell-bush (*Brickellia mosieri*), pineland deltoid spurge (*Chamaesyce deltoidea ssp. pinetorum*), and sand flax (*Linum arenicola*). All three, as well as several state-listed species, are endemic pine rockland habitats. A 9-acre pine rockland area (maintained by fire, not mowing) contained 23 listed plant species. Pine rocklands are savanna-like forests on limestone outcrops. They have a single canopy species, South Florida slash pine (*Pinus elliottii var. densa*), and a dense understory of shrubs and herbs. Pine rocklands are typically fire-maintained communities, fire serving to eliminate many invading hardwoods and exotic plant species and reduce duff layers (USFWS 1999).

Several listed plant species were found on disturbed habitats (e.g., spoil piles). Spoil piles/ disturbed areas adjacent to the existing corridor within the Turkey Point plant property (exiting west from the facility) contained three species of state listed species: locustberry (*Byrsonima lucida*), Mullein nightshade (*Solanum donianum*), and West Indian trema (*Trema lamarckianum*). These same plant species could possibly occur in similar habitat along the access road and reclaimed water pipeline corridor.

2.4.1.3 Other Important Species and Habitats

"Important species" are defined in the *Standard Review Plans for Environmental Reviews for Nuclear Power Plants* (NUREG-1555) as those that are federally or state-listed as threatened or endangered, proposed for listing as threatened or endangered, commercially or recreationally valuable, essential to the maintenance or survival of species that are rare or commercially or recreationally valuable, critical to the structure and function of the local terrestrial ecosystem, or serve as biological indicators. Game species fall within the "commercially or recreationally valuable" species category. The primary game species on the Turkey Point plant property are white tailed deer, rabbits, and mourning doves. Hunting and/or trapping of game animals is not allowed on Turkey Point property. No "travel corridors" for terrestrial game species cross the property; however, waterfowl likely use the industrial wastewater facility and other wetlands on the property during migration. American crocodiles use the canals as travel corridors to move throughout the plant property and possibly into the nearby mangrove swamps and marshes.

Important habitats, as defined under NUREG-1555, include wildlife refuges, sanctuaries, or preserves, habitats identified by federal or state agencies as rare or to be protected, wetlands, floodplains, other resources specifically protected by federal or state regulation, or land areas identified as critical habitat for threatened or endangered species. Much of the Turkey Point plant property, particularly the industrial wastewater facility, is classified as critical habitat for the crocodile (Figure 2.4-4) and segments of the access roads and transmission corridors could also have this classification. Locations of other critical habitats were discussed within their species descriptions in Subsection 2.4.1.2.

The mangrove forests of South Florida are a vital component of the estuarine and marine environment in this region and thus mangrove areas, especially red mangrove (*Rhizophora mangle*), should be considered important as an indicator habitat of the south Florida region. Mangroves are plants that are highly adaptive to the extreme conditions associated with shorelines habitats, including soft sediments (prop roots), high salinities (adaptive root membranes), and oxygen-poor soils (prop roots). These forests provide a detrital base for organic food webs and significant habitat for arboreal, intertidal and subtidal organisms, including shellfish, crustaceans, fish, and birds. Some of the species that are highly dependent on mangrove systems are mangrove rivulus (*Rivulus marmoratus*), reddish egrets, mangrove cuckoos (*Coccoyzus minor*) and white-crowned pigeons. The majority of mangroves within the project construction areas are on lands disturbed and previously impacted by the construction and operation of the Turkey Point complex and isolated from Biscayne Bay; however, they likely still provide structural habitat for mangrove community wildlife.

The Everglades Mitigation Bank (EMB) contains approximately 13,000 acres of relatively undisturbed freshwater and estuarine wetlands west and south of the industrial wastewater facility (Figure 2.4-1). This land is also owned and managed by FPL and it operates as a commercial mitigation bank with wetland habitat credits that can be purchased to offset regional wetland impacts. The EMB contains the following vegetative habitats: sawgrass marsh, wet prairie, hypersaline mangrove, tidal mangrove, coastal band mangrove, and coastal ridge mangrove. Many of these habitats contain distinctive “tree island” habitats embedded within them. The EMB is home to 14 species of amphibians, 39 species of reptiles, 14 species of terrestrial mammals, and approximately 150 species of birds (FPL 2008a).

The 181,500-acre Biscayne National Park lies east and north of the Turkey Point plant property. The park preserves mangrove wetlands, extensive open water habitats (Biscayne Bay), the northernmost of the Florida Keys, and coral reef habitat (NPS 2006).

The Crocodile Lake National Wildlife Refuge is a 6600-acre facility located 10 miles south of the Turkey Point plant property on Key Largo in Monroe County. Its primary function is to create refuges for crocodiles and other wildlife associated with mangrove/keys habitats (USFWS 2008b).

The ENP occupies over 1.5 million acres in Miami-Dade and Monroe Counties and its eastern boundary is located approximately 10 miles southwest of the Turkey Point plant property. The park includes most of Florida Bay and is undergoing extensive restoration efforts to repair historical impacts to the system’s hydrology.

2.4.2 AQUATIC ECOLOGY

The primary aquatic habitat found on the Turkey Point plant property is the 5900-acre industrial wastewater facility. The industrial wastewater facility encompasses the Units 6 & 7 plant area. There is also an interceptor ditch along the northwest and west sides of the industrial wastewater facility. To restrict the inland movement of groundwater, water from the interceptor ditch is pumped back into the industrial wastewater facility.

Other aquatic habitats adjacent to the Turkey Point plant property include Lower Biscayne Bay, Card Sound, and the ENP. The proposed transmission lines, reclaimed water pipelines, and road upgrades may affect aquatic species in wetlands, drainage canals, and other man-made channels. Subsection 2.4.2.1 describes the aquatic communities of each of these aquatic habitats.

2.4.2.1 Aquatic Communities

The following subsections include descriptions of important aquatic resources at the Units 6 & 7 plant area, the Turkey Point plant property, and surrounding areas. These descriptions include information related to the abundance of important species found and the value of the habitats present.

2.4.2.1.1 Turkey Point Plant Property

The surface water habitats on the Units 6 & 7 plant area include hypersaline mudflats, remnant canals, channels, dwarf mangrove wetlands, and open water. The Units 6 & 7 plant area and the adjacent laydown area are largely wetland habitats (approximately 272 acres) (Figure 2.4-2). All of these habitats support only a limited number of aquatic species because of the harsh conditions of water level fluctuations, high water temperatures, and high salinities. Specific FLUCCS land use classes are outlined in Table 2.2-1.

Wetlands within the Units 6 & 7 plant area are reduced in functional value because of their use as part of the industrial wastewater facility. The altered hydrology, soils, salinity, and temperature reduce the functional value of mangrove systems when compared to undisturbed tidal mangroves of Biscayne Bay. Wetland functional value is influenced by the surrounding landscape characteristics, specifically the existing units, the extensive cooling canals, and the lack of natural tidal inundation.

The industrial wastewater facility supports a variety of aquatic species typical of a shallow, subtropical, hypersaline environment, including phytoplankton, zooplankton, marine algae, rooted plants, crabs, and estuarine fish (Table 2.4-5). The most abundant fish in the industrial wastewater facility are killifish (Family Cyprinodontidae) and live-bearers. FPL employees have also reported seeing game species, such as the common snook (*Centropomus undecimalis*) and tarpon (*Megalops atlanticus*), in the industrial wastewater facility. Sampling of large fish in the cooling canals is not feasible because sampling gear could easily trap young crocodiles. The larger game fish species, such as tarpon, can be long-lived (up to 78 years); individuals in the cooling canals are likely older individuals that occurred there in 1973 when the canals were isolated from Biscayne Bay. They may persist in the cooling canals until the end of their natural life spans without reproducing. It is plausible, though undocumented, that small numbers of other gamefish species occasionally enter the cooling canals of the industrial wastewater facility as larvae carried by hurricane storm surge. For example, Hurricane Andrew carried a storm surge between 8 and 9 feet at Turkey Point. (Andrews et al. 2001). Although recreationally important in other areas, none of the fish or other marine life in the industrial wastewater facility is available for recreational or commercial fishing. However, fish and crabs life in the industrial wastewater facility support a variety of wading birds and a resident population of the American crocodile.

Within southern Biscayne Bay and Card Sound, there are 11 aquatic species that are protected under the Endangered Species Act or are candidates for listing. Of these, 10 are found in Biscayne Bay and Card Sound, but are not known or expected to be in the industrial wastewater facility. These are Johnson's seagrass *(Halophila johnsonii),* the mangrove rivulus *(Rivulus marmoratus)*, the small-toothed sawfish *(Pristis pectinata),* five species of sea turtle, described in Subsection 2.4.1.1, the American alligator *(Alligator mississippiensis),* and the Florida manatee (Table 2.4-6). Johnson's seagrass occurs along the Florida coast from Sebastian Inlet to central Biscayne Bay at Virginia Key, Key Biscayne. This seagrass is not known to occur as far south as the Turkey Point plant property. The mangrove rivulus is a fish that inhabits crab burrows in mangrove areas, and it could be present in mangrove areas fringing the plant site, but is unlikely to be present in the industrial wastewater facility due to lack of habitat. The small-toothed sawfish inhabits inshore bars, seagrass beds, and mangrove areas, and is unlikely to exist in the industrial wastewater facility due to lack of habitat. The sea turtles are found in marine habitats that open to the sea, such as Biscayne Bay and Card Sound, but the industrial wastewater facility is not a suitable habitat, and the shoreline adjacent to the plant property lacks the beach habitats preferred by sea turtles for nesting. The industrial wastewater facility is not connected to Biscayne Bay.

The approximately 44-acre wetland area for the FPL reclaimed water treatment facility is dominated by sawgrass with scattered dwarf mangroves. This area is assumed to contain aquatic species typical of disturbed dwarf mangrove habitat. Historical tidal connection to this area has been interrupted by construction and operation of the existing units and the industrial wastewater facility. Aquatic organisms existing in the area in November 2007 are presented in Table 2.4-5.

Radial collector wells would be constructed on approximately 3 acres of land classified as fill area. As described in Section 2.2, the radial collector wells would include laterals extending underground offsite from an onsite caisson at a depth of approximately 25 to 40 feet below the bottom of Biscayne Bay. Wildlife species existing near the radial collector wells and associated pipeline corridor would be similar to those observed on the Turkey Point plant property.

The roadway improvements would involve widening of existing paved roads and paving existing unpaved roads. In addition, intersection improvements at six locations would be made to accommodate peak construction traffic. The roadway improvements are about 10.75 miles in length, of which about 5.5 miles would be on FPL property. Aquatic habitats potentially affected by roadway improvements include canals, freshwater marshes, and mangroves. Other land use types are illustrated in Table 2.2-7. The new 4-lane roadway planned for SW 359th Street would run along the northern edge of the industrial wastewater facility. Construction of this road would be separated from the cooling canals of the industrial wastewater facility by the existing berms as well as construction buffers. Canals occur adjacent to the roadway rights-of-way associated with SW 344th Street/Palm Drive and SW 328th Street/N. Canal Drive. In-stream vegetation is minimal within the man-made canals adjacent to existing roadways, due to the steep slopes and minimal littoral zone. These canals provide habitat for common freshwater forage fishes native to south Florida, as well as for nonindigenous fishes commonly inhabiting canals of Miami-Dade County. Areas of mangroves occur adjacent to SW 359th Street near the L-31 Canal.

Fish were surveyed during Summer 2009 in seven areas that would be potentially impacted by construction of Units 6 & 7. These sample areas included the two remnant canals on the plant area, the dead-end canal (laydown area), pools within the mangrove areas (nuclear administration building, training building, and parking area), wetlands adjacent to SW 344th Street/Palm Drive (in the area of the FPL reclaimed water treatment facility), a portion of the return canal, shallow flats in the east-central part of the nuclear island, and two locations along the cooling canals of the industrial wastewater facility (see Figure 2.4-3b).

Fish were collected using (8-foot diameter) cast nets, a 20-foot-long minnow seine, and standard "Gee" type minnow traps. All fish collected were hardy species common in estuarine habitats in south Florida. No rare, unusual, sensitive, or protected species were collected. One additional species, the Atlantic needlefish (Strongylura marina), was observed in the return canal but not captured. The Atlantic needlefish is a common inhabitant of coastal waters from New England to the Florida Keys and west to Mexico.

2.4.2.1.2 Offsite Areas

The Turkey Point plant property is adjacent to mangroves that are tidally inundated with waters from Biscayne Bay, a shallow, subtropical bay supporting seagrasses, sponges, coral reefs, and a variety of marine life. Outside of the plant property, dominant aquatic surface water bodies include Biscayne Bay, Card Sound, and the approximately 13,000-acre EMB.

Much of the land surrounding the Turkey Point plant property is managed for environmental conservation purposes by government agencies. Biscayne National Park and the Biscayne Bay Aquatic Preserve are located northeast, east, and southeast of the plant property. The ENP is located approximately 10 miles southwest of the Turkey Point plant property. The FPL-owned EMB is situated to the southwest of the Turkey Point plant property adjacent to the ENP to the west and Biscayne Bay and Card Sound to the east.

2.4.2.1.2.1 Offsite Mangrove Tidal Flats

Mangrove tidal flats are generally described as a coastal community composed of red mangrove and/or black mangrove, which are present in pure or predominant stands. Most of the area within the undeveloped areas and surrounding the existing units is classified as dwarf red mangrove flats, established within the shallow, tidally flushed area adjacent to Biscayne Bay and Card Sound. The dwarf mangrove tidal flat community contains mangroves less than 24 inches high, stunted in response to decreased nutrient availability and increased salinity. Most of the mangrove community north of the existing units experiences sheet flow-type flushing of tidal waters, and exhibits more saline conditions with decreased nitrogen and phosphorus available for plant uptake. Where tidal creeks cut through the dwarf mangrove flat, the adjacent mangroves are up to 20 feet high as a result of exposure to the nutrient-rich tidal creek water with lower salinities.

The mangrove tidal flats are inundated with approximately 1 to 6 inches of hypersaline water in the form of sheet flow. The Southeast Fisheries Science Center of the National Marine Fisheries Service (NMFS) in Miami is conducting baseline surveys in the area to provide a context in which to study the effects of the Comprehensive Everglades Restoration Plan. The study area includes the western margins of central and southern Biscayne Bay, Card Sound, and Barnes Sound, which form a semi-continuous, 30-mile stretch of mangrove-lined shoreline that is interspersed with natural creeks, artificial channels, and freshwater canal mouths. Mangroves immediately adjacent to the site were included in a study of the abundance and size distribution of three species of fish: gray snapper (*Lutjanus griseus*), great barracuda (*Sphyraena barracuda*), and goldspotted killifish (*Floridichthys carpio*) (Serafy et al. 2007).

Serafy et al. (2007) showed that fish occurrence in this 30-mile stretch of red mangrove varies according to the latitude, season, species, and abundance metric being evaluated. The shoreline serves to varying degrees as habitat for mature and immature gray snapper, and mostly immature great barracuda. Conversely, the goldspotted killifish observed in the coastal mangrove habitat were almost exclusively adults (Serafy et al. 2007).

2.4.2.1.2.2 Biscayne Bay/Card Sound

Biscayne Bay is a shallow subtropical saline lagoon located on the southeast coast of Florida. The eastern boundary of Biscayne Bay is composed of barrier islands that eventually become part of the Florida Keys. The western shore is the Florida mainland. Biscayne Bay is connected to the Atlantic Ocean by several channels and cuts, some natural and some man-made. Major tributaries are (north to south) Arch Creek, Biscayne Canal, Little River, Miami River, Coral Gables Waterway, Snapper Creek Canal, Black Creek, Goulds Canal, North Canal, Florida City Canal, and Model Land Canal.

Biscayne Bay was formed during the Holocene Period (approximately 12,000 years ago) as rising sea level filled a limestone depression. It is not a drowned river valley like most estuaries. Unlike most other estuaries, Biscayne Bay does not receive a sediment load from tributary rivers. Biscayne Bay can be divided into three areas: North Bay, Central Bay, and South Bay. The

Atlantic Intracoastal Waterway traverses the western portion of Biscayne Bay and Card Sound, and a barge trench is maintained from the Intracoastal Waterway to the existing units.

The Turkey Point plant property is located on South Bay (also identified as Lower Biscayne Bay), which is generally undeveloped and fringed by mangrove wetlands. The main canals draining into this portion of Biscayne Bay are Black Creek, Princeton Canal, Military Canal, Mowery Canal, and Model Land Canal. Ocean exchange is restricted to the tidal creeks between the islands of the northern portion of the Florida Keys.

South Bay is approximately 100 square miles (64,000 acres) in area. The average depth is on the order of 5 feet at mean low water, with a maximum depth of 13 feet. The volume at mean low water is on the order of 1.5E10 cubic feet. Mean tide is 1.65 feet on the mainland shore and 1.55 feet on Elliott Key (eastern side). Salinities vary widely, ranging from 24 to 44 ppt, depending on the amount of rainfall and surface drainage reaching the coastal zone. The vertical salinity gradient in Biscayne Bay is relatively low, and the water can be considered vertically homogeneous. Natural water temperatures range from 59°F to 92°F at the surface, with little or no stratification.

Biscayne National Park was first established in 1968 as a national monument and was expanded in 1980 to approximately 173,000 acres of water, coastal lands, and 42 islands. Boating is the most popular activity in the park, and recreational and commercial fishing are allowed. Other recreational activities include snorkeling, diving, camping, picnicking, and hiking.

A portion of Biscayne Bay Aquatic Preserve is located approximately one-half mile to the east of the Units 6 & 7 plant area (Figure 2.4-1). The preserve is a shallow, subtropical lagoon consisting of three separate areas of Biscayne Bay. The northern part of the preserve is just south of Cape Florida on the east, and south of Chicken Key on the west. The southern portion of the preserve is in Card Sound. These areas of the preserve are separated by Biscayne National Park. The preserve is approximately 69,000 acres of submerged state land that has been designated as an Outstanding Florida Water, defined as waters worthy of special protection because of their natural attributes. The Florida Department of Environmental Protection, Office of Coastal and Aquatic Managed Areas, manages the preserve. The preserve offers recreational and commercial in-water activities, including power boating, sailboating, canoeing, sculling, waterskiing, jet skiing, hang gliding, swimming, windsurfing, snorkeling, diving, and fishing.

Aquatic Communities of Biscayne Bay/Card Sound

Important communities in Biscayne Bay and Card Sound include the mangrove forest on its eastern edge, and seagrasses, which are found primarily in Central and South Bays. The mangrove forest is one of the longest continuous stretches of mangroves remaining on the east coast of Florida. The lush seagrass beds provide food and refuge for approximately 70 percent of the area's recreationally and commercially important marine species. Seagrass beds are also a food resource for sea turtles and the Florida manatee. Important seagrass species are shoal grass, turtle grass, and manatee grass. Biscayne Bay and Card Sound are nursery areas for the spiny lobster *(Panulirus argus),* and the area from Cape Florida south through Card Sound is designated a Lobster Sanctuary by the State of Florida. Highly desired game fish in Biscayne Bay and Card Sound include tarpon *(Megalops atlanticus),* snook, red drum *(Sciaenops ocellatus),* permit (Trachinotus falcatus), and sea trout (Cynoscion spp.).

Studies were conducted in Biscayne Bay and Card Sound adjacent to area for Units 3 & 4 in the early 1970s (AEC 1972). Fish and invertebrate sampling conducted in the red mangrove community along the shoreline of Biscayne Bay resulted in over 50 species of fish, dominated by gray snapper, mullet (*Mugil* spp.), and yellowfin mojarra (*Gerres cinereus*). Five species of invertebrates were collected, with 90 percent represented by the blue crab (*Callinectes sapidus*).

Baseline Aquatic Biological Characterization Study

In March 2008, a one-year Baseline Aquatic Biological Characterization Study in Card Sound Canal was initiated adjacent to the Units 6 & 7 plant area and in nearshore waters of Card Sound. The sampling program includes bi-weekly trawling for juvenile and adult fish and shellfish and netting for fish and shellfish eggs and larvae at five stations (two within Card Sound Canal and three in the nearshore area of Card Sound near the mouth of the canal). Results are summarized below for the first three quarters of sampling and for the 12-month period overall.

<u>Trawl Samples</u>

In Spring 2008, species richness was twice as high at Card Sound stations as at the two Card Sound Canal stations. Mojarra (*Eustinostomus* spp.) and pink shrimp (*Farfantepenaeus* duorarum) comprised over 90% of the total catch at Card Sound Canal stations. A greater variety of fish and invertebrates were caught at Card Sound stations. Common fish included mojarra, grunts (*Haemulon* spp.), and pinfish (*Lagodon rhomboides*). Numerically abundant invertebrates in Card Sound trawls included penaeid shrimp (*Farfantepenaeus* and *Litopenaeus* spp.), green sea urchin (*Lytechnius variegates*), and mud crabs (*Xanthoidea*).

In Summer 2008 trawl samples, species richness was more than twice as high at the Card Sound stations than at the two Card Sound Canal stations. Three taxa (mojarra, pink shrimp, and bivalves) comprised 80% of the total catch at the Card Sound Canal stations, whereas 15 taxa accounted for 77% of the catch in Card Sound. Common fish included mojarra, pinfish, bluestriped grunts (*Haemulon sciurus*), and fringed pipefish (*Anarchopterus criniger*). Numerically abundant invertebrates in Card Sound trawls included sea urchins, pink shrimp, bivalves, mud crabs, gastropods, hermit crabs (*Paguroidea*), brittle stars (*Ophiuroidea*), and caridean shrimp.

In Fall 2008, trawl samples, species richness was more than twenty times higher at the Card Sound stations than at the two Card Sound Canal stations. Bivalves comprised 98% of the total catch at the Card Sound Canal stations, whereas 13 taxa accounted for 76% of the catch in Card Sound. Common fishes included pinfish, fringed pipefish, bluestriped grunt, white grunt (*Haemulon plumierii*), and silver jenny (*Eucinostomus gula*). Numerically abundant invertebrates included mud crabs, pink shrimp, hermit crabs, sea urchins, gastropods, bivalves, brittle stars, and caridean shrimp.

A total of 125 taxa of fish and invertebrates were collected during trawl sampling. Fourteen taxa accounted for more than 75 percent of all specimens collected. Commercially-important penaeid shrimp, primarily pink shrimp, accounted for the largest percentage (16.7 percent) of all specimens captured by trawl over the 12-month monitoring period. The most abundant fish species included pinfish, mojarras, and grunts. On average, more than twice as many specimens were collected at each station at night than during the day; nearly all of the penaeid shrimp were captured at night. More than twice as many taxa were collected, and catch per unit effort was four times higher, at Card Sound Stations than at Card Sound Canal Stations. No clear-cut seasonal trends in distribution or dominant fish and shellfish taxa were apparent.

Plankton Samples

Plankton samples were sorted and specimens assigned to one of four categories: fish eggs, fish larvae (ichthyoplankton), commercially important (CI) meroplankton, and non-commercially important (NCI) meroplankton). The CI meroplankton are represented primarily by decapod crustaceans with commercial value, such as edible shrimps (penaeid species), lobster, blue crabs, and stone crabs, but also include some mollusks (e.g., clams, oysters, squid, etc.) and several other organisms used as bait or in medical research (e.g., mole crabs, horseshoe crabs, and mantis shrimps). The NCI taxa represent a variety of other decapod crustaceans, such as grass shrimp, hermit crabs, and mud crabs (*Xanthidae*).

In Spring 2008, eggs were 3.5 times more abundant in Card Sound Canal samples than in Card Sound samples. Both areas were dominated by unidentified eggs and clupeid (herrings and sardines) eggs. Unidentified eggs were those that contained no embryo, were damaged, or could not be assigned to an egg complex based on observed characteristics. Nearly six times as many fish larvae were collected at the Card Sound Canal stations as at the Card Sound stations (per unit volume of water filtered). Both the Card Sound Canal and Card Sound samples were dominated by a few groups of ichthyoplankton (gobies, sleepers, herring, shad, sardines, and menhaden). In addition, Card Sound stations contained labrisomid blennies and flag and tube blennies. CI meroplankton were not abundant in spring samples (on average, fewer 3000 individuals per million gallons of water filtered for all stations and photoperiods combined). Samples from Card Sound Canal Stations contained almost exclusively stone crab and blue crab larvae (98% combined). Card Sound stations were dominated by blue crabs and mantis shrimp, with several other taxa also contributing substantially to the catch. NCI meroplankton were more abundant than CI meroplankton at all stations; overall abundances were four times greater in Card Sound Canal than in Card Sound. Brachyuran crabs and caridean shrimp dominated the NCI catch at all stations.

In Summer 2008, egg samples were again predominately unidentified or clupeid eggs. Fish larvae were 3.7 times more abundant in Card Sound Canal samples than in Card Sound samples. Card Sound Canal stations were dominated by larvae of herring, shad, sardines, menhaden, gobies, and sleepers, while Card Sound Stations were dominated by gobies, silverside (*Atherinomorus stipes*), labrisomid blennies, herring, shad, sardines, and menhaden. CI meroplankton were not abundant in general. Samples from Card Sound Canal Stations contained almost exclusively stone crab and blue crab larvae (99% combined). Card Sound stations were dominated by blue crabs, stone crabs, and mantis shrimp, with several other taxa also contributing substantially to the catch. The abundance of CI meroplankton for all taxa combined was almost three times higher at the Card Sound Canal stations than the Card Sound stations. As in the Spring 2008 samples, NCI meroplankton were more abundant than CI meroplankton at all stations; overall abundances were nine times greater in Card Sound Canal than in Card Sound. Brachyuran crabs and caridean shrimp dominated the NCI catch at all stations.

In Fall 2008, samples of eggs and ichthyoplankton showed a reversal of abundances compared to previous seasons. Eggs were 40% more abundant in Card Sound than in the Card Sound Canal. As in previous seasons, however, unidentified eggs dominated all samples. Fish larvae were 1.2 times more abundant in Card Sound samples than in Card Sound Canal samples. Card Sound stations were dominated by larvae of chaenopsid blennies, gobies, labrisomid blennies, and dragonets (*Diplogrammus pauciradiatus*). Card Sound Canal stations were dominated by larvae of anchovies, gobies, sleepers, and porgies (*Sparidae*). Relatively few CI meroplankton were collected in Fall 2008. The abundance of CI meroplankton for all taxa combined was about 40% higher at the Card Sound Canal stations than the Card Sound stations. Stone crab and blue crab larvae made up 95% of the CI catch in the Card Sound Canal. Card Sound stations were dominated by stone crabs, blue crabs, mantis shrimp, and brown shrimp. As in the Spring and Summer 2008, samples, NCI meroplankton were more abundant than CI meroplankton at all stations; overall abundances were twice as high in Card Sound Canal than in Card Sound. Brachyuran crabs and caridean shrimp dominated the NCI catch at all stations.

The majority of fish eggs (57 percent) could not be assigned to a particular family or group of families because they contained no discernable embryo or were damaged. The vast majority of those that could be identified were in the herring family. More eggs were collected during the night than during the day, and more than twice as many eggs per cubic meter were collected in the Card Sound Canal than in Card Sound. Egg densities were greatest in the spring and summer.

Of the 51 taxa of ichthyoplankton identified during the 12-month monitoring period, herrings, gobies, sleepers, and blennies were dominant. More ichthyoplankton were collected during the night than during the day, and more than four times as many ichthyoplankton were collected per cubic meter in the Card Sound Canal than in Card Sound. Ichthyoplankton densities peaked in April, May, and June, then declined through the late summer and into fall. Abundance trends were similar at Card Sound Canal and Card Sound stations.

During the baseline sampling year, 23 taxa of meroplankton were collected. Nighttime samples had an average of about 25 percent more meroplankton than day samples. Densities in Card Sound Canal samples were more than four times greater than in Card Sound samples. Nine commercially important shellfish taxa were identified; most were blue crab and stone crab larvae. Commercially important meroplankton made up only 2 percent of the combined samples. Densities of commercially important taxa were low (0.442 per cubic meter) compared with overall meroplankton catches (19.899 per cubic meter). Commercially important meroplankton were equally abundant in daytime and nighttime samples, but were 45 percent more abundant in the Card Sound Canal than in Card Sound. Commercially important meroplankton were most abundant in the spring and summer. Abundance declined rapidly in September and remained low through the following March.

2.4.2.1.2.3 Everglades Mitigation Bank

The EMB contains 13,000 acres of relatively undisturbed freshwater and estuarine wetlands, including sawgrass marsh, wet prairie, herbaceous flats, dwarf mangrove, scrub mangrove, coastal band mangroves, coastal ridge mangroves, and disturbed areas that support the exotic species Australian pine and Brazilian pepper. FPL manages the EMB to maintain functioning wetland habitat that may be purchased as mitigation credits to offset wetland impacts within the bank's service area.

2.4.2.2 Important Species of Biscayne Bay and Card Sound

NOAA’s (National Oceanographic and Atmospheric Administration) Estuarine Living Marine Resources program was developed to provide a consistent database of the distribution, abundance, and life history characteristics of important fishes and invertebrates in U.S. estuaries. Four criteria were used to select the 44 species included in the database: (1) commercial value, (2) recreational value, (3) indicator of environmental stress, and (4) ecological value (Nelson et al. Oct 1991). These criteria are similar to those used to identify important species in NUREG-1555.

Because the Estuarine Living Marine Resources program covered 20 estuaries throughout the southeastern United States, the selected species list may not adequately represent the south Florida estuarine fauna, which includes species from the tropical Caribbean biogeographic province (Nelson et al. Oct 1991). However, of the 30 fish species and 10 invertebrate species that were evaluated by NOAA, 12 fish and 6 invertebrates were common, abundant, or highly abundant in Biscayne Bay, as shown in Table 2.4-7.

2.4.2.3 Other Important Species

Rare species include species listed by the USFWS or the NMFS as threatened or endangered species proposed for listing by these agencies, species that are candidates for listing by these agencies, and species that are listed as threatened or endangered by the state in which the proposed facilities are located. Although diadromous (migratory) fish are not one of the groups designated by the NRC as "important," they are considered in the impacts assessment to the extent warranted by their presence in the vicinity (See Subsection 2.4.2.3.1.1).

2.4.2.3.1 Rare/Sensitive Species

Construction and operation of Units 6 & 7 could potentially impact populations of important aquatic species in habitats adjacent to the Turkey Point plant property, including lower Biscayne Bay/Card Sound. Plant and animal species designated by the USFWS, the Florida Fish and Wildlife Conservation Commission or the Florida Department of Agriculture and Consumer Services as endangered, threatened, species of special concern, commercially exploited, or under review, are included in this category. Construction and operation of Units 6 & 7 would result in no impacts to rare or sensitive aquatic species.

Other than the American crocodile, described in Subsection 2.4.1, no listed aquatic or semi-aquatic species occur within the plant property. A number of federal- and state-listed plants and animals are associated or potentially associated with the area surrounding the developed portions of the Turkey Point plant property, including two fish: the mangrove rivulus and the smalltooth sawfish (NMFS 2008d) (Table 2.4-6).

Mangrove Rivulus

The mangrove rivulus is a state and federal species of special concern. It was not reported to occur on the Turkey Point plant property, but is known to occur in the vicinity where suitable habitat exists. Its range closely parallels that of the range of the red mangrove, the preferred habitat of the mangrove rivulus. The rivulus is found in the Caribbean and Central America, and ranges as far north as Florida, where it is locally rare (FMNH 2008a). The mangrove rivulus is primarily a saltwater or brackish water species, with limited occurrence in freshwater. It can tolerate salinities from 0–68 ppt. Within the Everglades and along Florida's west coast, this fish occurs in stagnant, seasonal ponds and sloughs as well as in mosquito ditches within mangrove habitats. Along the east coast of Florida, it occurs in elevated marsh habitats above the intertidal zone, often within the burrows of the great land crab (*Cardisoma guanhumi*). This preferred microhabitat may provide shelter from cool winter temperatures, allowing for a more northerly distribution than would otherwise be possible. Great land crab burrows also provide areas of refuge during the dry season, when seasonal pools of water dry up. The mangrove rivulus is able to survive in moist detritus without water for up to 60 days. This fish has been observed slithering and flipping across land during the rainy season to reach pools of water or crab burrows containing water (FMNH 2008a).

This carnivorous fish feeds heavily on terrestrial and aquatic invertebrates when its habitat becomes flooded. The mangrove rivulus eats ants and flying insects as well as aquatic invertebrates such as polychaete worms, gastropods, mollusks, and mosquito larvae. The mangrove rivulus has been observed jumping out of the water to capture termites, returning to the water to swallow its prey. It may also be cannibalistic, feeding on other mangrove rivulus, while living in crab burrows containing very limited food resources (FMNH 2008a).

Predators include other fish and wood storks, as well as possibly the Atlantic saltmarsh snake which is often found in crab burrows containing mangrove rivulus (FMNH 2008a).

The mangrove rivulus was designated a species of concern in Florida by NOAA in 1997. The species is extremely vulnerable to habitat modification and fragmentation, environmental alteration, and human development/encroachment (NMFS Nov 2007).

Smalltooth Sawfish

The federally endangered smalltooth sawfish has been observed in Biscayne Bay and the Biscayne Bay Aquatic Preserve (NMFS 2006). Although habitat destruction and overfishing have succeeded in eradicating the smalltooth sawfish from most of its former range, it survives in small pockets, notably in south Florida (FMNH 2008b). Loss of the mangrove habitat that juveniles rely on is cited as one of the primary reasons for listing the species as endangered (NMFS 2006). The U.S. distinct population segment of the smalltooth sawfish was listed as endangered by the NMFS in 2003 (FR Apr 2003), and is currently undergoing a 5-year review by the NMFS to ensure that the listing classification is accurate (FR May 2008).

This sawfish primarily occurs in estuarine and coastal habitats such as bays, lagoons, and rivers. It does at times occur in deeper waters, however, and may make crossings to offshore islands. It can tolerate freshwater. When foraging, the smalltooth sawfish swings its saw from side to side, impaling prey fishes on the rostral teeth. The sawfish then scrapes the captured prey off against the substrate and consumes it. The saw is also used to disturb muddy bottoms in search of small prey items, including benthic invertebrates such as crustaceans. Sawfishes are ovoviviparous, producing embryos that mature internally and are nourished by a yolk sac. Gestation is believed to last a year, with 15–20 pups born per litter (FMNH 2008b).

2.4.2.3.1.1 Diadromous Species

No anadromous fish exist in surface water on the Turkey Point plant property, and no major rivers flow into Biscayne Bay or Card Sound. True anadromous species in the south Atlantic Ocean (e.g., blueback herring, American shad, and striped bass) tend to spawn in major rivers flowing into the Atlantic Ocean further north; none of these rivers occurs much south of the St. Johns River in northern Florida (Nelson et al. Oct 1991). One migratory diadromous fish species, the American eel, is reported to occur in Biscayne Bay (Nelson et al. Oct 1991). Adults, juveniles and larvae are common in both low and high salinity portions of the bay (see Table 2.4-7). Because Biscayne Bay is not fed by any river, the eel does not use the bay to access inland waters, as is its habit in other estuaries.

The American eel occurs in rivers and streams along the east coast of the U.S. from Maine to Florida. It occurs throughout most of Florida in both fresh and brackish waters and in Atlantic and Gulf of Mexico drainages. The American eel is primarily riverine but does occur in ponds and lakes, especially oriented to structure and flow. Recent reports have raised concerns over the status of the American eel stock and have urged increased protection (FWC 2008a). In 1999, the South Atlantic Fisheries Management Council (SAFMC) developed a Fishery Management Plan for the American eel, which is an interstate cooperative effort to protect and enhance the Atlantic stock of American eel in the United States while providing for a sustainable harvest of the species. The Florida Fish and Wildlife Conservation Commission monitored young-of-year and adult yellow eels in northeast Florida waterways.

In response to a petition received in November 2004, the USFWS, on July 6, 2005, announced in a 90-day finding that it was initiating a status review to determine if listing the American eel was warranted (FR Jul 2005). The description of population status indicated that population declines have been most dramatic in Canada and New England and populations may be stable in the southeastern United States. On February 2, 2007, USFWS published its findings on a Petition to List the American Eel (FR Feb 2007). After a thorough review of all available scientific information, the USFWS found that listing the American eel as either threatened or endangered was not warranted.

2.4.2.3.2 Nuisance Species

Literature was surveyed for information on the presence of nuisance species on the Turkey Point plant property or in the vicinity of the property that could create biofouling problems in cooling water systems or cause “other significant problems.”

South Florida is host to a large variety of nonindigenous freshwater aquatic species, more than any other drainage in the state; fish, amphibians, reptiles, crustaceans, mollusks, and plants have been introduced, although not all have established reproducing populations (USGS 2008).

The effects of many of the nonindigenous species have not been well documented (Courtenay 1997). However, some nonindigenous species are clearly known to cause economic or ecological harm. Among the known nuisance species in the vicinity of the Turkey Point plant property is the Asiatic clam (*Corbicula fluminea*) (USGS 2008).

The Asiatic clam is a problematic invasive mollusk from southeastern Asia. It is a small bivalve that is typically found at high densities and has a relatively high growth rate. Because of its tolerance of a wide variety of aquatic conditions and its high reproductive rate, it has developed into a pest that clogs ditches and interferes with pipes and heat exchangers of power plants. The Asiatic clam is primarily a freshwater species that tolerates, but does not thrive in, brackish water (Warren 1997). The Asiatic clam is well established in south Florida (USGS 2008). The Asiatic clam has not been recognized as a nuisance for the existing units.

2.4.2.4 Habitat Importance

Many marine fish and estuarine fishes that are federally managed by the SAFMC and NMFS rely on coastal bays during part of their lives. The Sustainable Fisheries Act of 1996, identifying the contribution of habitat loss and degradation on fishery declines, amended the Magnuson-Stevens Act to create a program to protect essential fish habitat. The statute defined essential fish habitat as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity” (Connolly 2002). A description of essential fish habitat is in 50 CFR 600.10 of the regulations implementing the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act; P.L. 104–297). The SAFMC and NMFS are responsible for designating essential fish habitat for each life stage of federally managed marine fish species.

In addition, the NMFS developed regulations (50 CFR Part 600 Subpart J; 62 FR 665531) to guide Fisheries Management Councils in the implementation of the essential fish habitat provisions. The essential fish habitat regulations encourage councils to identify habitat areas of particular concern within areas designated as essential fish habitat to focus conservation priorities on specific habitat areas that play a particularly important role in the life cycles of federally managed fish species. The intent of the NMFS in encouraging the designation of habitat areas of particular concern is to help focus conservation efforts on localized areas that are vulnerable to degradation or especially important ecologically. Habitat areas of particular concern should be subsets of the total area necessary to support healthy stocks of fish throughout all of their life stages. Healthy populations of fish require not only the relatively small habitats identified as habitat areas of particular concern, but also other suitable areas that provide habitat functions that support larger numbers of fish needed to support sustainable fisheries and a healthy ecosystem (NMFS 2001).

The SAFMC has designated portions of Biscayne Bay and Card Sound essential fish habitat for several groups of managed species, including snapper-grouper, coastal migratory pelagics, highly migratory species, penaeid shrimp, red drum, and spiny lobster. Each of these is addressed below.

2.4.2.4.1 Snapper-Grouper Fishery Management Plan

Ten families of fishes containing 73 species are managed under the snapper grouper plan (NMFS 2008a). As coastal inlets, all of Biscayne Bay and Card Sound meet the criteria for essential fish habitat and habitat areas of particular concern. Areas within the coastal inlets that are designated habitat areas of particular concern for species in the snapper-grouper management unit include near shore hard bottom areas, mangrove habitat, oyster/shell habitat, and seagrass habitat along the western edges of these water bodies (NMFS 2008b). During a 2-year study of recreational fishing in Biscayne Bay in the early 1980s, the gray or mangrove snapper was the most important finfish species, by weight, harvested recreationally (Berkeley 1983).

As part of designating habitat areas of particular concern for the snapper-grouper management unit, NMFS provided a generalized profile of the gray snapper, which is presented below (NMFS 2008c). One of the most commonly caught marine fishes in Florida, the gray snapper exists in marine and estuarine waters from North Carolina and Bermuda through Brazil. Spawning activity occurs offshore and peaks during the summer and early fall. Eggs and larvae are planktonic and occur offshore. Flexion of the caudal fin occurs at 4.2 millimeters. Planktonic larval duration is estimated to range from at least 25 to 40 days, with a mean of 33 days post-fertilization based on otolith microstructure. Settlement sizes range from approximately 10 to 20 millimeters. Larvae appear competent to settle at ages from approximately 3 to 5 weeks. Maturity is reached at approximately 200 millimeters total length, probably during the third year. Gray snappers reach a maximum length of 720 millimeters and a maximum age of 10 years (NMFS 2008c).

In contrast to most snapper species, there is substantial literature on habitat use in juvenile stages of gray snapper, mostly from south or central Florida. Settlement stages and early juveniles primarily use grass beds before migrating to hard structures in deeper waters with growth.

Based on reviews of 40 years of surveys, and new sampling in the Biscayne Bay area, newly settled stages of gray snapper commonly existed in grass beds, were consistently absent from mangrove and hard bottom habitats, and were uncommon or rare from all habitats exceeding 5 meters deep. Early juvenile stages (2.5 to 7.0 centimeters) were more widely distributed, particularly on the habitat scale, existing among a variety of hard structures as well as mangroves and grass beds. The absence of newly settled life stages of gray snapper from hard bottom and mangrove habitats may result from the older resident fauna and more concentrated predation pressures in these habitats (NMFS 2008c).

In summary, early stages of gray snapper exist in estuaries and shallow marine areas. Bottom types of high value include seagrass flats (*Thalassia, Syringodium,* and *Halodule*); soft marl bottoms, fine marl mud with shell and rock outcrops; mangrove roots; hard bottom structures; and shallow basins with seagrasses adjacent to mud banks (NMFS 2008c).

2.4.2.4.2 Coastal Migratory Pelagic Fishery Management Plan

Areas designated as essential fish habitat for coastal migratory pelagic fishes in the vicinity of the Turkey Point plant property include nearshore hard bottom south of Cape Canaveral and Atlantic coast estuaries with high numbers of Spanish mackerel and cobia based on the Estuarine Living Marine Resources program abundance data (NMFS 2008d). According to the Fish and Wildlife Research Institute and SAFMC internet map service for displaying essential fish habitat, only a small area of Biscayne Bay is considered essential fish habitat. No habitat areas of particular concern have been designated for this management group. The Estuarine Living Marine Resources data show that Spanish mackerel do exist in Biscayne Bay, but are not considered abundant (Table 2.4-7). During a 2-year study of fishing in Biscayne Bay in the early 1980s, low catches of Spanish mackerel were reported in Biscayne Bay (Berkeley 1983). Biscayne Bay is not included on the list of estuaries considered as essential fish habitat. A limited amount of habitat exists, but due to the pelagic nature of these species, their presence near Turkey Point is unlikely.

2.4.2.4.3 Penaeid Shrimp Fishery Management Plan

For penaeid (brown, white, and pink) shrimp, essential fish habitat in the vicinity of the Turkey Point plant property includes inshore estuarine nursery areas such as tidal freshwater, estuarine, and marine emergent wetlands; tidal palustrine forested areas; mangroves; tidal freshwater, estuarine, and marine submerged aquatic vegetation (e.g., seagrass); and subtidal and intertidal nonvegetated flats. This applies from North Carolina through the Florida Keys (NMFS 2008e). All of Biscayne Bay and Card Sound meet the criteria for essential fish habitat and habitat areas of particular concern for penaeid shrimp. The western vegetated edges of Lower Biscayne Bay and Card Sound are of particular importance.

Of the three species, only the pink shrimp is highly abundant in Biscayne Bay. The other two species are considered rare (Nelson et al. Oct 1991). In a 2-year survey of recreational fishing in Biscayne Bay conducted in the early 1980s, pink shrimp was the single most important species harvested (by weight) accounting for 29 percent of the total recreational harvest from Biscayne Bay (Berkeley 1983). Shrimp were most abundant at seagrass stations along the western side of the bay. In South Bay, they were most abundant during fall and winter, but in North Bay they were most abundant in summer (Berkeley 1983).

Offshore water also serves as habitat for larval and postlarval shrimp. These shrimp are planktonic and feed on zooplankton in the water column. Shrimp enter the inshore habitat as postlarvae and maintain a benthic existence (NMFS 2008e).

2.4.2.4.4 Red Drum Fishery Management Plan

For red drum, essential fish habitat includes all the following habitats to a depth of 50 meters offshore (FWC 2008b):

- Tidal freshwater
- Estuarine emergent vegetated wetlands (flooded salt marshes, brackish marsh, and tidal creeks)
- Estuarine scrub/shrub (mangrove fringe)
- Submerged rooted vascular plants (sea grasses)
- Oyster reefs and shell banks
- Unconsolidated bottom (soft sediments)
- Ocean high salinity surf zones
- Artificial reefs

The area covered includes Virginia through the Florida Keys.

The red drum is distributed along the Atlantic coast, in the ocean and estuarine areas in relation to their stage of maturity. Juvenile red drum use the shallow backwaters of estuaries as nursery areas and remain there until they move to deeper water portions of the estuary associated with river mouths, oyster bars, and front beaches. Estuarine wetlands are especially important to larval red drum. The types of estuarine systems vary along the Atlantic and subsequently, the preferred juvenile habitat also varies with distribution. Young red drum are found in quiet, shallow, protected waters with grassy or slightly muddy bottoms. Shallow bay bottoms or oyster reef substrates are preferred by subadult and adult red drum. Adult red drum use the oceanic system, which is the area of the Atlantic ocean from the beachfront seaward. Large red drum are thought to migrate along the Atlantic coast and are subjected to man's alterations of the natural system. Nearshore artificial reefs along the Atlantic are also known to attract red drum as they make their spring and fall migrations. In the fall and spring, red drum concentrate around inlets, shoals, capes, and from the surf zone to several miles offshore (FWC 2008b).

Areas that meet the criteria for essential fish habitat-habitat areas of particular concern for red drum include all coastal inlets, all state-designated nursery habitats of particular importance to red drum; documented sites of spawning aggregations described in the habitat plan; other spawning areas identified in the future; and habitats identified for submerged aquatic vegetation (FWC 2008b).

2.4.2.4.5 Spiny Lobster Fishery Management Plan

Essential fish habitat for spiny lobster includes (SAFMC 1998):

- Nearshore shelf/oceanic waters
- Shallow subtidal bottom
- Seagrass habitat
- Unconsolidated bottom (soft sediments)
- Coral and live/hard bottom habitat
- Sponges
- Algal communities (*Laurencia*)
- Mangrove habitat (prop roots)

Essential fish habitat-habitat areas of particular concern for spiny lobster include Florida Bay, Biscayne Bay, and Card Sound (SAFMC 1998).

Spiny lobster begin their existence in the Florida Keys as larvae that arrive on oceanic currents. As planktonic larvae, they pass through 11 life stages in more than 6 months. They then metamorphose into a transitional swimming stage that is found along Florida's southeast coast year-round. They travel through channels between the Keys and enter nursery areas in Florida Bay and the Gulf, where they preferentially settle into clumps of red alga. In 7 to 9 days, they metamorphose into juveniles and take a solitary residence in the algal clumps for 2 to 3 months. When juvenile spiny lobster reach a carapace length of 15 to 16 millimeters, they leave the algal clumps and reside individually within rocky holes, crevices, coral, and sponges. They remain solitary until carapace length reaches approximately 25 to 35 millimeters, when they begin congregating in rocky dens. They remain in these nurseries for 15 months to 3 years (NMFS 2008f).

Adult lobsters move to deeper waters in the coral reef environment, where they occupy dens or holes during daylight hours. They are nocturnal feeders and predominantly prey on mollusks and crustacea, including hermit crabs and conch. Adults move to the offshore reef to spawn, and larvae are swept up the east coast by the Florida current (NMFS 2008f).

In addition to providing essential fish habitat and habitat areas of particular concern for the federally managed species listed above, Biscayne Bay and Card Sound provide nursery and rearing habitat for other important estuarine species (listed in Table 2.4-7), as well as for non-harvested forage species that support the harvested species.

2.4.2.4.6 Highly Migratory Species (Sharks and Skates) Fishery Management Plan

In addition, NMFS is in the process of reviewing and updating essential fish habitat for highly migratory species, including sharks (NMFS 2008g). Essential fish habitat regulations call for a comprehensive review of all essential fish habitat information, and this amendment constitutes the comprehensive review and proposed update of essential fish habitat for all highly migratory species (HMS). New information on the biology, distribution, habitat requirements, life history characteristics, migratory patterns, spawning, pupping, and nursery areas of Atlantic HMS were taken into consideration when updating essential fish habitat in this amendment. The proposed updated Fishery Management Plan designates coastal areas of Biscayne Bay and Card Sound as essential fish habitat for various life stages of sharks, including several large coastal sharks (three species of hammerhead shark (*Sphyrna zygaena, S. lewini, and S. mokarran*), nurse shark (*Ginglymostoma cirratum*), bull shark (*Carcharhinus leucas*), Caribbean reef shark (*C. perezi*), dusky shark (*C. obscurus*), lemon shark (*Negaprion brevirostris*), sandbar shark (*C. plumbeus*), silky shark (*C. falciformis*), spinner shark (*C. brevipinna*), and tiger shark (*Galeocerdo cuvier*) and one small coastal shark, the bonnethead (*Sphyrna tiburo*).

2.4.2.5 Preexisting Environmental Stresses

Much of the preexisting stress to habitats on the Turkey Point plant property and in the area immediately surrounding the property is the result of past development activity. The natural topography, soils, and hydrology of areas adjacent to the property have been altered as a result of the construction of existing units, the support facilities, and the industrial wastewater facility. Units 3 & 4 were constructed on mangrove-covered tidal flats. Natural surface water drainage features have been modified through road building and the industrial wastewater facility.

Mangrove heads along historical tidal creek channels within the surrounding mudflats have also been stressed by development as well as by natural causes. The historical tidal connections to Biscayne Bay were severed during construction of the industrial wastewater facility, which has resulted in hypersaline conditions, altered hydrology, and elevated temperatures. Whereas undisturbed tidal creeks of Biscayne Bay typically contain dense mangrove growth along the entire creek channel, the channels within the Units 6 & 7 plant area contain sparse pockets of mangroves, likely a result of stress caused by the hypersaline conditions and drastic fluctuations in water levels. Mangroves in the vicinity have not fully recovered in health or extent from a severe freeze in 1989 and Hurricane Andrew in 1992.

The industrial wastewater facility is not considered a natural habitat, and, therefore, some environmental stress is to be expected. The cooling canals of the industrial wastewater facility contain hypersaline water (approximately 40 to 50 ppt), shallow depths (approximately 3 feet), and maximum temperatures between 95°F to 100°F. The biotic community is restricted to those species that can survive under the limiting conditions of salinity, temperature, and depth. The predominant aquatic vegetation is widgeon grass and the dominant fish are forage fish. Predatory fish, including snook and tarpon, have been observed in the industrial wastewater facility, although the environmental conditions are not conducive to successful reproduction for these fish.

Within Biscayne Bay and Card Sound, preexisting stresses are more difficult to evaluate. Nearly all the nearshore habitat in these coastal waters is protected; however, anthropogenic effects are still evident. Basins in southern Biscayne Bay, including Card Sound, have been the focus of much attention in recent times because of the persistent algal bloom that developed in this region during autumn 2005. An increase in green macro-algae in this region during the late 1990s and early part of this decade is notable, because it could indicate chronic nutrient enrichment that could have played some role in the current phytoplankton bloom (SFWMD & FDEP Mar 2008).

2.4.2.6 Reclaimed Water Pipelines Aquatic Resources

The reclaimed water pipeline corridor would extend approximately 9 miles between the SDWWTP and the FPL reclaimed water treatment facility. For about 6.5 miles of their length, the pipelines would be collocated with the existing Clear Sky-to-Davis transmission line right-of-way and adjacent road and canal rights-of-way. Land use includes wetland, marsh, and swamp habitats (Table 2.2-6) (Section 2.2). The pipelines would be generally underground. Aquatic invertebrates and fishes typical of the area exist in canals and wetlands crossed by this pipeline corridor; however, no areas designated by the USFWS as critical habitat for endangered or threatened aquatic invertebrate or fish species occur in Miami-Dade County.

2.4.2.7 Radial Collector Wells and Pipelines Aquatic Resources

Radial collector wells installed beneath Biscayne Bay would also provide an alternate source of makeup water for the new units. The four wells would be located within three acres of fill area on the northern edge of Turkey Point. Habitats adjacent to the filled lands include coastal mangroves and Biscayne Bay. The radial collector well laterals would be installed horizontally at a depth of approximately 25 to 40 feet below the bottom of Biscayne Bay. Water would flow into the laterals and flow by head force to the collection caisson located onshore where the water would be pumped via one or more pipelines to Units 6 & 7. Pipelines would occupy land classified as streams and waterways/canals, mangrove swamps and fill area. Construction laydown areas would potentially impact approximately 3 acres of fill areas.

Construction of the radial collector wells would not affect aquatic resources in the vicinity. The only important aquatic species is the mangrove rivulus, a state and federal species of special concern (described in Subsection 2.4.2.3.1) that is associated with red mangrove communities. Red mangroves exist in the general vicinity of the construction area. Because this species is closely tied to the distribution of red mangrove, any activity that removes red mangrove could have a potential impact on this fish. However, construction of the radial collector wells would not impact red mangroves because the wells would be located within three acres of previously filled lands on the northern edge of Turkey Point. No presently undisturbed mangrove habitat would be affected by well construction. Areas of temporary mangrove impacts resulting from radial collector well delivery pipeline installation would be restored through replacement of excavated wetland soils to original grade, facilitating natural reestablishment of the vegetative community. Environmental best management practices would reduce the amount of erosion and sedimentation associated with construction, and would limit impacts to aquatic communities in down-gradient water bodies. Because the well laterals would be drilled beneath Biscayne Bay, and surface water and sediment would not be disturbed, no increases in turbidity or sedimentation would result.

Benthic macroinvertebrates were sampled and seagrasses were surveyed from Biscayne Bay near the Turkey Point peninsula in March 2009. Sediment samples collected from 250 to 750 feet offshore in 3 feet of water were passed through a 0.5 mm sieve to collect macroinvertebrates. The majority of the 123 taxa identified from the Biscayne Bay samples were polychaetes and crustaceans. Abundance, species richness, and diversity were greatest at the station nearest to the shore.

Seagrasses were surveyed in approximately 49-hectares around the Turkey Point peninsula. Essentially the entire survey area was found to contain turtle grass or shoal grass. Turtle grass coverage was densest immediately surrounding the peninsula, but densities were variable. Shoal grass was less widespread, occurring most often in shallow waters along or near the peninsula shoreline. The two species often co-occurred, but shoal grass was absent at many sampling locations.

2.4.2.8 Aquatic Resources Along Transmission Corridors

Existing transmission lines generally pass through typical habitats associated with the coastal plain region of southeast Florida: wetlands, agricultural fields, pasture/rangeland, and residential/developed lands. A full listing of land uses within the transmission corridors can be found in Table 2.2-3. The proposed transmission lines extend from Clear Sky to Levee, Clear Sky to

Pennsuco, Clear Sky to Miami (via Davis substation) through a variety of urban, agricultural, range, and wetlands habitats (see Figure 2.2-5).

Wetland land cover percentages along the 43-mile-long Clear Sky-to-Levee line are listed in Table 2.2-3. This line would cross the eastern expansion of the ENP (Figure 2.2-5). An alternative route is relocated eastward to run along the border of the ENP rather than through the park.

The Levee-to-Pennsuco corridor would cross a variety of land cover types (Table 2.2-3).

The approximately 19-mile-long Clear Sky-to-Davis line would be built within an existing corridor (Figure 2.2-5), the percentages of and types of wetland land classes are shown in Table 2.2-3. No towers would be built within water bodies. The lines would span the water bodies.

The approximately 18-mile-long Davis-to-Miami line would largely be built within an existing corridor (Figure 2.2-5), of which there are no wetlands present (Table 2.2-3).

The only special-status fish species in Miami-Dade County that potentially could occur along the proposed transmission corridors is the mangrove rivulus, although the corridors would not include ideal habitat (mangrove) for the fish. Other special-status species might exist in the aquatic and wetland habitats crossed by the proposed corridors.

2.4.2.9 Roadway Improvements

Wetlands and terrestrial habitats affected by the roadway improvements are described in Subsection 2.4.1. Aquatic habitats potentially affected by roadway improvements are described below.

Canals occur adjacent to the roadway right-of-ways associated with SW 344th Street/Palm Drive and SW 328th Street/N. Canal Drive. In-stream vegetation is minimal within the man-made canals adjacent to existing roadways, due to the steep slopes and minimal littoral zone. These canals provide habitat for common freshwater forage fishes native to south Florida, such as mosquitofish (*Gambusia holbrooki*), sailfin molly (*Poecilia latipinna*), least killifish (*Heterandria formosa*), sunfish (*Lepomis spp.*), and gar (*Lepisosteus spp.*). Nonindigenous fishes commonly inhabiting canals of Miami-Dade County include peacock bass (*Cichla ocellaris*), spotted tilapia (*Tilapia mariae*), blue tilapia (*Oreochromis aureus*), Mayan cichlid (*Cichlasoma urophthalmus*), jaguar guapote (*Cichlasoma managuense*), and oscar (*Astronotus ocellatus*).

Areas of mangroves occur adjacent to SW 359th Street near the L-31 Canal. These areas are dominated by a mixture of red mangrove (*Rhizophora mangle*) and black mangrove (*Avicennia germinans*), along with several other plant species.

Section 2.4 References

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Table 2.4-1 (Sheet 1 of 4)
Avifauna Observed on/near the Turkey Point Plant Property and Along Existing/Proposed Transmission Corridors

Common Name	Scientific Name	General Habitat[a]	FES[b]	DERM[b]	Surv1[b]	Surv2[b]	Winter'09[c]
Sharp-shinned hawk	*Accipiter striatus*	C	Y	—	—	—	—
Common myna	*Acridotheres tristis*	F	—	—	—	Y	—
Spotted sandpiper	*Actitis macularia*	C	Y	Y	Y	Y	—
Red-winged blackbird	*Agelaius phoenicius*	M, C	Y	—	Y	Y	C
Roseate spoonbill	*Ajaia ajaja*	M, C, T	—	—	Y	Y	—
Anhinga	*Anhinga anhinga*	C, T	—	—	—	Y	U
Great egret	*Ardea albus*	M, T	Y	Y	Y	Y	C
Great blue heron	*Ardea herodias*	M, C, T	Y	—	Y	Y	C
Florida burrowing owl[d]	*Athene cunicularia floridana*	C	—	—	—	—	—
Great horned owl	*Bubo virginianus*	M	—	Y	Y	—	—
Cattle egret	*Bubulcus ibis*	M, F, C	Y	—	—	—	—
Red shouldered hawk	*Buteo lineatus*	C, T	Y	—	Y	—	—
Broad-winged hawk	*Buteo platypterus*	T	—	—	—	Y	—
Green heron	*Butorides virescens*	M, T	Y	Y	Y	Y	U
Sanderling	*Calidris alba*	C	—	Y	Y	—	—
Red knot	*Calidris canutus*	C	—	—	—	—	U
Western sandpiper	*Calidris maurii*	C	—	Y	Y	—	U
Least sandpiper	*Calidris minutilla*	C	—	Y	Y	—	U
Chuck-will's-widow	*Caprimulgus carolineusis*	C	—	—	—	Y	—
Northern cardinal	*Cardinalis cardinalis*	C, T	Y	—	—	Y	U
Willet	*Catoptrophorus semipalmatus*	C	—	—	Y	—	C
Turkey vulture	*Cathartes aura*	C, T	Y	—	—	Y	C
Belted kingfisher	*Ceryle alcyon*	C, T	Y	Y	Y	Y	U
Semipalmated Plover	*Charadrius semipalmatus*	C	—	Y	Y	—	U
Killdeer	*Charadrius vociferous*	F, C	Y	Y	Y	Y	C

Table 2.4-1 (Sheet 2 of 4)
Avifauna Observed on/near the Turkey Point Plant Property and Along Existing/Proposed Transmission Corridors

Common Name	Scientific Name	General Habitat[a]	FES[b]	DERM[b]	Surv1[b]	Surv2[b]	Winter'09[c]
Wilson's plover	*Charadrius wilsonia*	C	—	Y	Y	—	—
Common nighthawk	*Chordeiles minor*	M, C	—	Y	Y	Y	—
Northern harrier	*Circus cyaneus*	C	—	—	—	—	U
Yellow-billed cuckoo	*Coccyzus americanus*	C	—	—	Y	—	—
Mangrove cuckoo	*Coccyzus minor*	C, M	—	—	—	Y	—
Northern flicker	*Colaptes auratus*	C	Y	—	—	—	U
White-crowned pigeon	*Columba leucocephala*	C, T	—	Y	Y	—	—
Rock dove	*Columba livia*	F	—	—	—	Y	—
Common ground-dove	*Columbina passerine*	C	—	—	—	Y	C
Black vulture	*Coragyps atratus*	M, F, C	Y	—	Y	—	—
Fish crow	*Corvus ossifragus*	C	Y	—	—	—	—
Blue jay	*Cyanocitta cristata*	M	—	—	—	—	—
Prairie warbler	*Dendroica discolor*	C	—	Y	Y	—	U
Palm warbler	*Dendroica palmarum*	M,C	—	—	—	Y	C
Pileated woodpecker	*Dryocopus pileatus*	C	Y	—	—	—	—
Gray catbird	*Dumetella carolinensis*	C, M	Y	—	—	Y	—
Little blue heron	*Egretta caerulea*	M, C, T	Y	—	Y	Y	C
Reddish egret	*Egretta rufescens*	C, M	—	Y	Y	Y	U
Snowy egret	*Egretta thula*	M, C, T	Y	—	Y	Y	C
Tricolor heron	*Egretta tricolor*	M, C, T	—	Y	Y	Y	C
Swallow-tailed kite	*Elanoides forficatus*	T	—	—	—	Y	—
White ibis	*Eudocimus albus*	M, C, T	Y	—	Y	Y	A
Rusty blackbird	*Euphagus carolinus*	C	Y	—	—	—	—
Kestrel	*Falco sparverius*	C, T	Y	—	—	—	U
Magnificent frigatebird	*Fregata magnificens*	M	Y	—	—	—	—
Wilson's snipe	*Gallinago delicata*	C	Y	—	—	—	—

Table 2.4-1 (Sheet 3 of 4)
Avifauna Observed on/near the Turkey Point Plant Property and Along Existing/Proposed Transmission Corridors

Common Name	Scientific Name	General Habitat[a]	FES[b]	DERM[b]	Surv1[b]	Surv2[b]	Winter'09[c]
Bald eagle	*Haliaeetus leucocephalus*	M, T	Y	—	—	Y	—
Black-necked stilt	*Himantopus mexicanus*	C	—	Y	Y	—	—
Barn swallow	*Hirundo rustica*	C	—	Y	Y	—	—
Loggerhead shrike	*Lanius ludovicianus*	C, T	—	—	—	Y	C
Herring gull	*Larus argentatus*	C, M	Y	—	—	—	—
Laughing gull	*Larus atricilla*	C, M	Y	—	—	—	—
Short-billed dowitcher	*Limnodromus griseus*	C	—	Y	Y	—	—
Red-bellied woodpecker	*Melanerpes carolinus*	M	—	—	—	—	—
Red-breasted merganser	*Mergus serrator*	C	Y	—	—	—	—
Mockingbird	*Mimus polyglottis*	C, F, M, T	Y	—	Y	Y	C
Wood stork	*Mycteria americana*	M, C, T	Y	—	Y	—	—
Great crested flycatcher	*Myiarchus crinitus*	M	Y	—	—	—	—
Long-billed curlew	*Numanius americanus*	C	—	Y	Y	—	—
Whimbrel	*Numanius phaeopus*	C	—	Y	Y	—	—
Osprey	*Pandion haliaetus*	C	—	—	—	—	U
Savannah sparrow	*Passerculus sandwichensis*	C	—	—	—	—	C
White pelican	*Pelecanus erythrorhynchos*	M, C	—	—	Y	Y	C
Brown pelican	*Pelecanus occidentalis*	T	—	—	—	Y	—
Double-crested cormorant	*Phalacrocorax auritus*	C, M	—	Y	Y	Y	A
Greater flamingo	*Phoenicopterus rubber*	C	—	Y	—	—	—
Black-bellied plover	*Pluvialis squatarola*	C	—	Y	Y	—	—
Blue-gray gnatcatcher	*Polioptila caerulea*	C	—	Y	Y	—	—
Cliff swallow	*Pterocheilidan pyrrhonota*	C	—	Y	Y	—	—
Boat-tailed grackle	*Quiscalus major*	M, C	Y	—	—	—	U
Common grackle	*Quiscalus quiscala*	C	—	—	—	—	U
American avocet	*Recurvirostra americana*	C	—	Y	Y	—	—

Table 2.4-1 (Sheet 4 of 4)
Avifauna Observed on/near the Turkey Point Plant Property and Along Existing/Proposed Transmission Corridors

Common Name	Scientific Name	General Habitat[(a)]	FES[(b)]	DERM[(b)]	Surv1[(b)]	Surv2[(b)]	Winter'09[(c)]
Bank swallow	*Riparia riparia*	C	—	—	Y	—	—
Everglades snail kite	*Rostrhamus sociabilis p.*	T	—	—	—	Y	—
American redstart	*Setophaga ruticilla*	M	—	—	—	Y	—
Yellow-bellied sapsucker	*Sphyrapicus varius*	C	Y	—	—	—	—
Least tern	*Sterna antillarum*	C, T	—	Y	Y	Y	—
Common tern	*Sterna hirundo*	C, M	Y	—	—	—	—
Royal tern	*Sterna maxima*	C	—	—	Y	—	—
European starling	*Sturnus vulgaris*	F	—	—	—	Y	C
Lesser yellowlegs	*Tringa flavipes*	C	—	Y	Y	—	—
Greater yellowlegs	*Tringa melanoleuca*	C	—	Y	Y	Y	C
Solitary sandpiper	*Tringa solitaria*	C	—	Y	Y	—	—
American robin	*Turdus migratorius*	M	Y	—	—	—	—
Mourning dove	*Zenaida macroura*	C, F, M, T	—	—	—	Y	U

(a) Habitat categories include: C — cooling canal area, F — facilities area, M — mangrove area[8], T — transmission corridor.
(b) Avian surveys within the Turkey Point plant property prior to the seasonal surveys:
FES: surveys of the canal area, mangrove areas (E of canals) in 1972–1973.
DERM: surveys of the plant area on August 29, 2007, by Miami–Dade County Dept. Environmental Resources Mgmt.
Surv1: surveys of the Units 6&7 and construction staging areas in November, 2007, and June, 2008.
Surv2: reconnaissance of the general facility, cooling canals, and transmission corridors in May 2008, and during other wildlife surveys in April 2009 (does not including the seasonal avian surveys).
(c) During the late winter 2009 avian surveys, species were classified by their relative abundance: A = abundant (> 50 individuals observed), C = common (10 — 50 observed), U = uncommon (< 10 observed).
(d) Florida burrowing owls were not observed during the surveys described in footnotes b and c. A single Florida burrowing owl was observed on October 18, 2010, on a dirt road in the southern portion of the industrial wastewater facility.

Table 2.4-2
Wildlife Observed on/near the Turkey Point Plant Property and Along the Existing/ Proposed Transmission Corridors

Common Name	Scientific Name	General Habitat[(a)]	Early Surveys[(b)]	April 2009 Surveys
Mammals				
Virginia opossum	*Didelphus virginiana*	M, T	—	Y
White-tailed deer	*Odocoileus virginiana*	M, T	—	Y
Rice rat	*Oryzomys palustris*	C, M	Y	—
Cotton mouse	*Peromyscus gossypinus*	M	Y	—
Raccoon	*Procyon lotor*	C, F, M, T	—	Y
Black rat	*Rattus rattus*	C, M	—	Y
Cotton rat	*Sigmodon hispidus*	C	—	Y
Marsh rabbit	*Silvilagus palustris*	C, T	Y	Y
Eastern cottontail	*Silvilagus floridanus*	C, M	Y	—
Reptiles				
Carolina anole	*Anolis carolinensis*	C, M, T	Y	—
Key West anole	*Anolis sagrei stejnegeri*	C, M	Y	—
Cuban brown anole	*Anolis sagrei*	C, F, M	—	Y
Florida softshell turtle	*Apalone ferox*	M	—	Y
Southern black racer	*Coluber constrictor priapus*	C, M	Y	Y
American crocodile	*Crocodylus acutus*	C, M	Y	Y
Eastern diamondback rattlesnake	*Crotalus adamanteus*	C, M, T	Y	—
Eastern indigo snake[(c)]	*Drymarchon corais couperi*	S, T	—	—
Mediterranean gecko	*Hemidactylus turcicus*	M	—	Y
Green iguana	*Iguana iguana*	C	—	Y
Mangrove salt marsh snake	*Nerodia clarkii compressicauda*	M	Y	Y
Florida water snake	*Nerodia fasciata pictiventris*	M	—	Y
Rough green snake	*Opheodrys aestivus*	C	—	Y
Amphibians				
Florida cricket frog	*Acris gryllus dorsalis*	C, M	Y	—
Southern toad	*Bufo terrestris*	C, T	—	Y
Greenhouse frog	*Eleutherodactylus planirostris*	M	—	Y
Green tree frog	*Hyla cinerea*	C, M, T	Y	—
Little grass frog	*Hlya ocularis*	C, M, T	Y	—
Squirrel tree frog	*Hyla squirella*	C, M, T	Y	—
Florida chorus frog	*Pseudacris nigrita verrucosa*	C, M	Y	—
Bullfrog	*Rana catesbeiana*	C, M, T	Y	—
Southern leopard frog	*Rana utricularia*	M, T	—	Y

(a) General habitat categories: C = industrial wastewater facility (including proposed construction site); F = existing facilities (Units 1–5); M = mangrove swamp; and T = transmission corridors; and S = south of the industrial wastewater facility.
(b) Observation recorded in AEC 1972, and reconnaissance in 2003 and 2008.
(c) Observations recorded south of industrial wastewater facility in 2004, 2008, 2009, 2010, 2011; observations recorded along transmission corridor in 2011. Indigo snakes were not observed during the surveys described in footnote b.

Table 2.4-3 (Sheet 1 of 6)
Protected Species In Miami-Dade County

Common Name	Scientific Name	Federal Status[(a)]	State Status[(a)]
Amphibians			
Gopher frog	*Rana capito*	—	S
Birds			
Roseate spoonbill	*Ajaia ajaja*	—	S
Cape Sable seaside sparrow	*Ammodramus maritimus mirabilis*	E	E
Limpkin	*Aramus guarauna*	—	S
Florida burrowing owl	*Athene cunicularia floridana*	—	S
Piping plover	*Charadrius melodus*	T	T
Little blue heron	*Egretta caerulea*	—	S
Reddish egret	*Egretta rufescens*	—	S
Snowy egret	*Egretta thula*	—	S
Tricolored heron	*Egretta tricolor*	—	S
White ibis	*Eudocimus albus*	—	S
Peregrine falcon	*Falco peregrinus anatum*	DL	E
American kestrel	*Falco sparverius paulus*	—	T
Florida sandhill crane	*Grus canadensis pratensis*	—	T
American oystercatcher	*Haematopus palliates*	—	S
Bald eagle	*Haliaeetus leucocephalus*	DL	T
Wood stork	*Mycteria Americana*	E	E
White-crowned pigeon	*Patagioenas leucocephala*	—	S
Brown pelican	*Pelecanus occidentalis*	—	S
Snail kite	*Rostrhamus sociabilis plumbeus*	E	E
Black skimmer	*Rynchops niger*	—	S
Least tern	*Sterna antillarum*	—	T
Fish			
Mangrove rivulus	*Rivulus marmoratus*	S	S
Invertebrates			
Florida leafwing (butterfly)	*Anaea troglodyta floridalis*	C	—
Miami blue (butterfly)	*Cyclargus thomasi bethunebakeri*	C	E
Stock Island tree snail	*Orthalicus reses reses*	T	E
Schaus' swallowtail (butterfly)	*Papilio aristodemus ponceanus*	E	E
Bartram's scrub-hairstreak (butterfly)	*Strymon acis bartami*	C	—

Table 2.4-3 (Sheet 2 of 6)
Protected Species In Miami-Dade County

Common Name	Scientific Name	Federal Status[(a)]	State Status[(a)]
Mammals			
Florida bonneted bat	*Eumops floridanus*	—	E
Southern mink	*Neovison vison*	—	T
Florida mouse	*Podomys floridanus*	—	S
Florida panther	*Puma concolor coryi*	E	E
Florida manatee	*Trichechus latirostris*	E	E
Florida black bear	*Ursus americanus floridanus*	—	T
Plants			
Golden leather fern	*Acrostichum aureum*	—	T
Fragrant maidenhair fern	*Adiantum melanoleucum*	—	E
Brittle maidenhair fern	*Adiantum tenerum*	—	E
Meadow jointvetch	*Aeschynomene pratensis*	—	E
Bracted colic-root	*Aletris bracteata*	—	E
Everglades leaf lace	*Alvaradoa amorphoides*	—	E
Crenulate lead-plant	*Amorpha herbacea var. crenulata*	E	E
Wright's anemia	*Anemia wrightii*	—	E
Sea lavender	*Argusia gnaphalodes*	—	E
Blodgett's wild-mercury	*Argythamnia blodgettii*	C	E
Dutchman's pipe	*Aristolochia pentandra*	—	E
American toothed spleenwort	*Asplenium dentatum*	—	E
American bird's nest fern	*Asplenium serratum*	—	E
Modest spleenwort	*Asplenium verecundum*	—	E
Rockland orchid	*Basiphyllaea corallicola*	—	E
Costa Rican ladies'-tresses	*Beloglottis costaricensis*	—	E
Smooth strongbark	*Bourreria cassinifolia*	—	E
Spider orchid	*Brassia caudate*	—	E
Florida brickell-bush	*Brickellia mosieri*	C	E
Locustberry	*Byrsonima lucida*	—	T
Myrtle-of-the-river	*Calyptranthes zuzygium*	—	E
Narrow-leaved strap fern	*Campyloneurum angustifolium*	—	E
Powdery catopsis	*Catopsis berteroniana*	—	E
Many-flowered catopsis	*Catopsis floribunda*	—	E
Hairy deltoid spurge	*Chamaesyce deltoidea ssp. adhaerens*	E	E
Deltoid spurge	*Chamaesyce deltoidea ssp.deltoidea*	E	E

Table 2.4-3 (Sheet 3 of 6)
Protected Species In Miami-Dade County

Common Name	Scientific Name	Federal Status[(a)]	State Status[(a)]
Pinelands spurge	*Chamaesyce deltoidea ssp.pinetorum*	C	E
Garber's spurge	*Chamaesyce garberi*	T	E
Porter's broad-leaved spurge	*Chamaesyce porteriana*	—	E
Silver palm	*Coccothrinax argentata*	—	T
Cuban snake-bark	*Colubrina cubensis var. floridana*	—	E
Christmas berry	*Crossopetalum ilicifolium*	—	T
Rhacoma	*Crossopetalum rhacoma*	—	T
Florida tree fern	*Ctenitis sloanei*	—	E
Tall neottia	*Cyclopogon elatus*	—	E
Cowhorn orchid	*Cyrtopodium punctatum*	—	E
Florida prairie clover	*Dalea carthagenensis var. floridana*	C	E
Few-flowered fingergrass	*Digitaria pauciflora*	C	E
Milkbark	*Drypetes diversifolia*	—	E
Spurred neottia	*Eltroplectris calcarata*	—	E
Dollar orchid	*Encyclia boothiana var. erythronioides*	—	E
Clamshell orchid	*Encyclia cochleata var. triandra*	—	E
Night-scented orchid	*Epidendrum nocturnum*	—	E
Coker's beach creeper	*Ernodea cokeri*	—	E
Tropical ironwood	*Eugenia confusa*	—	E
Red stopper	*Eugenia rhombea*	—	E
Villose fennel	*Eupatorium villosum*	—	E
Rockland painted-leaf	*Euphorbia pinetorum*	—	E
Small's milkpea	*Galactia smallii*	E	E
Two-keeled helmet orchid	*Galeandra bicarinata*	—	E
Coastal vervain	*Glandularia maritime*	—	E
Sheathing govenia	*Govenia floridana*	—	E
Lignum-vitae	*Guaiacum sanctum*	—	E
Fakahatchee guzmania	*Guzmania monostachia*	—	E
Johnson's seagrass	*Halophila johnsonii*	T	—
Simpson's prickly apple	*Harrisia simpsonii*	—	E
Manchineel	*Hippomane mancinella*	—	E
White ironwood	*Hypelate trifoliate*	—	E
Krug's holly	*Ilex krugiana*	—	T
Wild potato morning glory	*Ipomoea microdactyla*	—	E

Table 2.4-3 (Sheet 4 of 6)
Protected Species In Miami-Dade County

Common Name	Scientific Name	Federal Status[(a)]	State Status[(a)]
Rocklands morning glory	*Ipomoea tenussima*	—	E
Pineland jacquemontia	*Jacquemontia curtissii*	—	T
Skyblue clustervine	*Jacquemontia pentanthos*	—	E
Beach jacquemontia	*Jacquemontia reclinata*	E	E
Joewood	*Jacquinia keyensis*	—	T
Small-headed lantana	*Lantana canescens*	—	E
Florida lantana	*Lantana depressa var. depressa*	—	E
Atlantic coast Florida lantana	*Lantana depressa var. floridana*	—	E
Ghost plant	*Leiphaimos parasitica*	—	E
Gulf licaria	*Licaria triandra*	—	E
Sand flax	*Linum arenicola*	C	E
Carter’s small-flowered flax	*Linum carteri var. carteri*	C	E
Carter’s large-flowered flax	*Linum carteri var. smallii*	—	E
Holly vine fern	*Lomariopsis kunzeana*	—	E
Climbing vine fern	*Microgramma heterophylla*	—	E
Wedgelet fern	*Odontosoria clavata*	—	E
Burrowing four-o’clock	*Okenia hypogaea*	—	E
Florida dancinglady orchid	*Oncidium floridanum*	—	E
Hand fern	*Ophioglossum palmatum*	—	E
Florida semaphore cactus	*Opuntia corallicola*	C	E
White passionflower	*Passiflora multiflora*	—	E
Everglades Key passionflower	*Passiflora sexflora*	—	E
Mangrove mallow	*Pavonia paludicola*	—	E
Blunt-leaved peperomia	*Peperomia obtusifolia*	—	E
Mahogony mistletoe	*Phoradendron rubrum*	—	E
Bitter bush	*Picramnia pentandra*	—	E
Tiny polygala	*Polygala smallii*	E	E
Ghost orchid	*Polyrrhiza lindenii*	—	E
Britton’s shadow-witch	*Ponthieva brittoniae*	—	E
Small-flowered prescotia	*Prescotia oligantha*	—	E
West Indian cherry	*Prunus myrtifolia*	—	T
Florida cherry-palm	*Pseudophoenix sargentii*	—	E
Mangrove berry	*Psidium longipes*	—	T
Bahama wild coffee	*Psychotria ligustrifolia*	—	E

Table 2.4-3 (Sheet 5 of 6)
Protected Species In Miami-Dade County

Common Name	Scientific Name	Federal Status(a)	State Status(a)
Bahama brake	*Pteris bahamensis*	—	T
Giant orchid	*Pteroglossaspis ecristata*	—	T
Florida royal palm	*Roystonea elata*	—	E
Bahama sachsia	*Sachsia polycephala*	—	T
Fahkahatchee ladies'-tresses	*Sacoila lanceolata var. paludicola*	—	T
Ray fern	*Schizaea pennula*	—	E
Havana skullcap	*Scutellaria havanensis*	—	E
Eaton's spikemoss	*Selaginella eatonii*	—	E
Green ladies'-tresses	*Spiranthes polyantha*	—	E
Southern ladies'-tresses	*Spiranthes torta*	—	E
Pineland pencil flower	*Stylosanthes calcicola*	—	E
West Indies mahogany	*Swietenia mahagoni*	—	T
Least halberd fern	*Tectaria fimbriata*	—	E
Devil's shoestring	*Tephrosia angustissima var. angustissima*	—	E
Rockland hoary-pea	*Tephrosia angustissima var. corallicola*	—	E
Coastal hoary-pea	*Tephrosia angustissima var. curtissii*	—	E
Creeping maiden fern	*Thelypteris reptans*	—	E
Stiff-leaved maiden fern	*Thelypteris sclerophylla*	—	E
Toothed maiden fern	*Thelypteris serrata*	—	E
Brittle thatch palm	*Thrinax morrisii*	—	E
Florida thatch palm	*Thrinax radiate*	—	E
Banded wild-pine	*Tillandsia flexuosa*	—	T
Pineland noseburn	*Tragia saxicola*	—	T
Lamarck's trema	*Trema lamarckianum*	—	E
Kraus' bristle fern	*Trichomanes krausii*	—	E
Florida filmy fern	*Trichomanes punctatum ssp. floridanum*	—	E
Florida gama grass	*Tripsacum floridanum*	—	T
Young-palm orchid	*Tropidia polystachya*	—	E
Worm-vine orchid	*Vanilla barbellata*	—	E
Leafy vanilla	*Vanilla phaeantha*	—	E
Biscayne prickly ash	*Zanthoxylum coriaceum*	—	E
Rain lily	*Zephyranthes simsonii*	—	T
Reptiles			
American alligator	*Alligator mississippiensis*	SAT	S

**Table 2.4-3 (Sheet 6 of 6)
Protected Species In Miami-Dade County**

Common Name	Scientific Name	Federal Status[(a)]	State Status[(a)]
Loggerhead sea turtle	*Caretta caretta*	T	T
Green sea turtle	*Chelonia mydas*	E	E
American crocodile	*Crocodylus acutus*	T	E
Leatherback sea turtle	*Dermochelys coriacea*	E	E
Eastern indigo snake	*Drymarchon corais couperi*	T	T
Hawksbill sea turtle	*Eretmochelys imbricate*	E	E
Gopher tortoise	*Gopherus polyphemus*	—	T
Florida pine snake	*Pituophis melanoleucus mugitus*	—	S
Rim Rock crowned snake	*Tantilla oolitica*	—	T

(a) E = Endangered; T = Threatened; C = Candidate; — = Not listed; DL = Delisted taxon, recovered, monitored for first five years post delisting; SAT = Similarity of appearance – threatened; S = Species of special concern.
Sources: FNAI 2008, USFWS 2008a

Table 2.4-4
Listed Plants Observed Within the Transmission Corridors Associated With Units 6 & 7

Common Name	Scientific Name	Federal[(a)]	State[(a)]
Golden leather fern	*Acrostichum aureum*	—	LT
Pineland-allamanda	*Angadenia berteroi*	—	LT
Pinepink	*Bletia purpurea*	—	LT
Mosier's false boneset	*Brickellia mosieri*	C	LE
Locustberry	*Byrsonema lucida*	—	LT
White sunbonnets	*Chaptalia albicans*	—	LT
Pineland deltoid spurge	*Chamaesyce deltoidea ssp. pinetorum*	C	LE
Florida silver palm	*Coccothrinax argentata*	—	LT
Quailberry	*Crossopetalum ilicifolium*	—	LT
Blodgett's swallowwort	*Cynanchum blodgettii*	—	LT
Krug's holly	*Ilex krugiana*	—	LT
Rockland morningglory	*Ipomoeae tenuissima*	—	LE
Pineland clustervine	*Jacquemontia curtissii*	—	LT
Skyblue clustervine	*Jacquemontia pentanthos*	—	LE
Shrub eupatorium	*Koanophyllon villosum*	—	LE
Pineland lantana	*Lantana depressa var. depressa*	—	LE
Ghost plant	*Leiphaimos parasitica*	—	LE
Sand flax	*Linum arenicola*	C	LE
Carter's large-flowered flax	*Linum carteri var. smallii*	—	LE
Pineland blackanthers	*Melanthera parvifolia*	—	LT
Southern fogfruit	*Phyla stoechadifolia*	—	LE
Pineland poinsettia	*Poinsettia pinetorum*	—	LE
Bahama ladder brake	*Pteris bahamensis*	—	LT
Small-leaf snoutbean	*Rhynchosia parvifolia*	—	LT
Bahama sachsia	*Sachsia polycephala*	—	LT
Bahama senna	*Senna mexicana var. chapmanii*	—	LT
Mullein nightshade	*Solanum donianum*	—	LT
Everglade Keys false buttonweed	*Spermacoce terminalis*	—	LT
West Indian lilac	*Tetrazygia bicolor*	—	LT
Abrupt-tip maiden fern	*Thelypteris augescens*	—	LT
Twisted wildpine	*Tillandsia balbisiana*	—	LT
Banded wildpine	*Tillandsia flexuosa*	—	LT
Giant wildpine	*Tillandsia utricularia*	—	LE
Pineland noseburn	*Tragia saxicola*	—	LT
West indian trema	*Trema lamarckianum*	—	LE
Florida gamagrass	*Tripsacum floridanum*	—	LT

(a) Regulatory status: C = Federal candidate, LE = State endangered, LT = State threatened, and — = Not listed
Source: (FNAI 2008).

Table 2.4-5
Aquatic Species Documented On the Turkey Point Plant Property (November 2007)

Common Name	Scientific Name
Submerged Aquatic Vegetation	
Mermaid's wineglass (green algae)	*Acetabularia* sp.
Green algae	*Batophora* sp.
Green algae	*Caulerpa* sp.
Widgeon grass	*Ruppia maritima*
Mollusks	
Lightning whelk	*Busycon contrarium*
Ivory cerith	*Cerithium eburneum*
Lister's tree oyster	*Isognomon radiatus*
Flat tree oyster	*Isognomon alatus*
Giant rams horn	*Marisa cornuarietis*
Eastern Melampus	*Melampus bidentatus*
Florida crown conch	*Melongena corona*
Unidentified species of *Tellin*	*Tellin* sp.
Crustaceans	
Great land crab	*Cardisoma guanhumi*
Fiddler crab	*Uca* sp.
Fish	
Sheepshead minnow	*Cyprinodon variegatus*
Unidentified species of Killifish	*Fundulus* sp.
Mosquitofish	*Gambusia* sp.
Mullet	*Mugil* sp.
Sailfin molly	*Poecilia latipinna*
Needlefish	*Strongylura* sp.
Tarpon	*Megalops atlanticus*

Table 2.4-6
Federally Listed and Florida State-Listed Aquatic Species Potentially Existing in Miami-Dade and Monroe Counties

Common Name	Scientific Name	Federal Status[(a)]	State Status[(a)]
Johnson's seagrass	*Halophila johnsonli*	T	—
mangrove rivulus	*Rivulus marmoratus*	SOC	S
small-toothed sawfish	*Pristis pectinata*	C	—
common snook	*Centropomus undecimalis*	—	S
green sea turtle	*Chelonia mydas*	E	E
hawksbill sea turtle	*Erytmochelys imbricata*	E	E
leatherback sea turtle	*Dermochelys coriacea*	E	E
Kemp's ridley sea turtle	*Lepidochelys kempi*	E	E
loggerhead sea turtle	*Caretta caretta*	T	T
Florida manatee	*Trichechus latirostris*	E	E
American alligator	*Alligator mississippiensis*	T (S/A)	S
American crocodile	*Crocodylus acutus*	T	E

(a) E = Endangered; T = Threatened; T(S/A) = Threatened due to similarity of appearance; C = Candidate for federal listing; S = Florida species of special concern; SOC = NOAA species of concern; — = No listing.

Table 2.4-7 (Sheet 1 of 3)
Relative Abundance of Life Stages of Important Estuarine Organisms in Biscayne Bay

Species	Life Stage	Relative Abundance in Salinity Zones	
		Mixing (0.5 – 25 ppt)	Seawater (>25 ppt)
American Oyster *Crassostrea virginica*	Adult	Common	Common
	Spawning adults	Common	Common
	Juveniles	Common	Common
	Larvae	Common	Common
	Eggs	Common	Common
Bay scallop *Argopecten irradians*	Adult		Common
	Spawning adults		Common
	Juveniles		Common
	Larvae		Common
	Eggs		Common
Hard clam *Mercenaria* sp.	Adult	Common	Common
	Spawning adults	Common	Common
	Juveniles	Common	Common
	Larvae	Common	Common
	Eggs	Common	Common
Pink shrimp *Furfantepenaeus duorarum*	Adult		
	Spawning adults		
	Juveniles	Highly Abundant	Highly Abundant
	Larvae	Highly Abundant	Highly Abundant
	Eggs		
Grass shrimp *Palaemonetes pugio*	Adult	Common	Common
	Spawning adults	Common	Common
	Juveniles	Common	Common
	Larvae	Common	Common
	Eggs	Common	Common
Blue crab *Callinectes sapidus*	Adult	Highly Abundant	Abundant
	Mating adults	Abundant	Common
	Juveniles	Highly Abundant	Abundant
	Larvae	Abundant	Abundant
	Eggs	Abundant	Abundant
Ladyfish *Elops saurus*	Adult	Common	Common
	Spawning adults		
	Juveniles	Common	Common
	Larvae	Common	Common
	Eggs		

Table 2.4-7 (Sheet 2 of 3)
Relative Abundance of Life Stages of Important Estuarine Organisms in Biscayne Bay

Species	Life Stage	Relative Abundance in Salinity Zones	
		Mixing (0.5 – 25 ppt)	Seawater (>25 ppt)
American Eel *Anguilla rostrata*	Adults (silver eel)	Common	Common
	Spawning adults		
	Juveniles (elvers, yellow eels)	Common	Common
	Larvae (glass eel, leptocephali)	Common	Common
	Eggs		
Bay anchovy *Anchoa mitchelli*	Adult	Highly Abundant	Highly Abundant
	Spawning adults	Highly Abundant	Highly Abundant
	Juveniles	Highly Abundant	Highly Abundant
	Larvae	Highly Abundant	Highly Abundant
	Eggs	Highly Abundant	Highly Abundant
Sheepshead minnow *Cyprinodon variegatus*	Adult	Common	Common
	Spawning adults	Common	Common
	Juveniles	Common	Common
	Larvae	Common	Common
	Eggs	Common	Common
Atlantic silversides *Menidia* spp.	Adult	Common	Common
	Spawning adults		
	Juveniles	Common	Common
	Larvae		
	Eggs		
Gray snapper *Lutjanus griseus*	Adult	Highly abundant	Highly abundant
	Spawning adults		
	Juveniles	Highly abundant	Highly abundant
	Larvae	Abundant	Highly abundant
	Eggs		
Pinfish *Lagodon rhomboides*	Adult	Highly abundant	Highly abundant
	Spawning adults		
	Juveniles	Highly abundant	Highly abundant
	Larvae	Highly abundant	Highly abundant
	Eggs		
Spotted seatrout *Cynoscion nebulosus*	Adult	Common	Common
	Spawning adults		Common
	Juveniles	Common	Common
	Larvae	Common	Common
	Eggs		Common

Table 2.4-7 (Sheet 3 of 3)
Relative Abundance of Life Stages of Important Estuarine Organisms in Biscayne Bay

Species	Life Stage	Relative Abundance in Salinity Zones	
		Mixing (0.5 – 25 ppt)	Seawater (>25 ppt)
Spot *Leiostomus xanthurus*	Adult	Common	Common
	Spawning adults		
	Juveniles	Common	Common
	Larvae	Common	Common
	Eggs		
Striped mullet *Mugil cephalus*	Adult	Common	Common
	Spawning adults		
	Juveniles	Common	Common
	Larvae	Common	Common
	Eggs		
Spanish mackerel *Scomberomorus maculatus*	Adult	Common	Common
	Spawning adults		
	Juveniles	Common	Common
	Larvae		Common
	Eggs		
Gulf flounder *Paralichthys albigutta*	Adult	Common	Common
	Spawning adults		Common
	Juveniles	Common	Common
	Larvae	Common	Common
	Eggs		

Source: (Nelson et al. 1991)
Notes:
Mixing Zone = Waters with intermediate salinity, from nearly fresh to almost seawater
Seawater Zone = Waters with at least 25 ppt salinity
Common = Frequently encountered but not in large numbers; does not imply a uniform distribution throughout the salinity zone
Highly Abundant = Often encountered in substantial numbers relative to other species
Abundant = Numerically dominant relative to other species
Blank cell = Absent

Figure 2.4-1 Landscape Features Near Turkey Point Facility

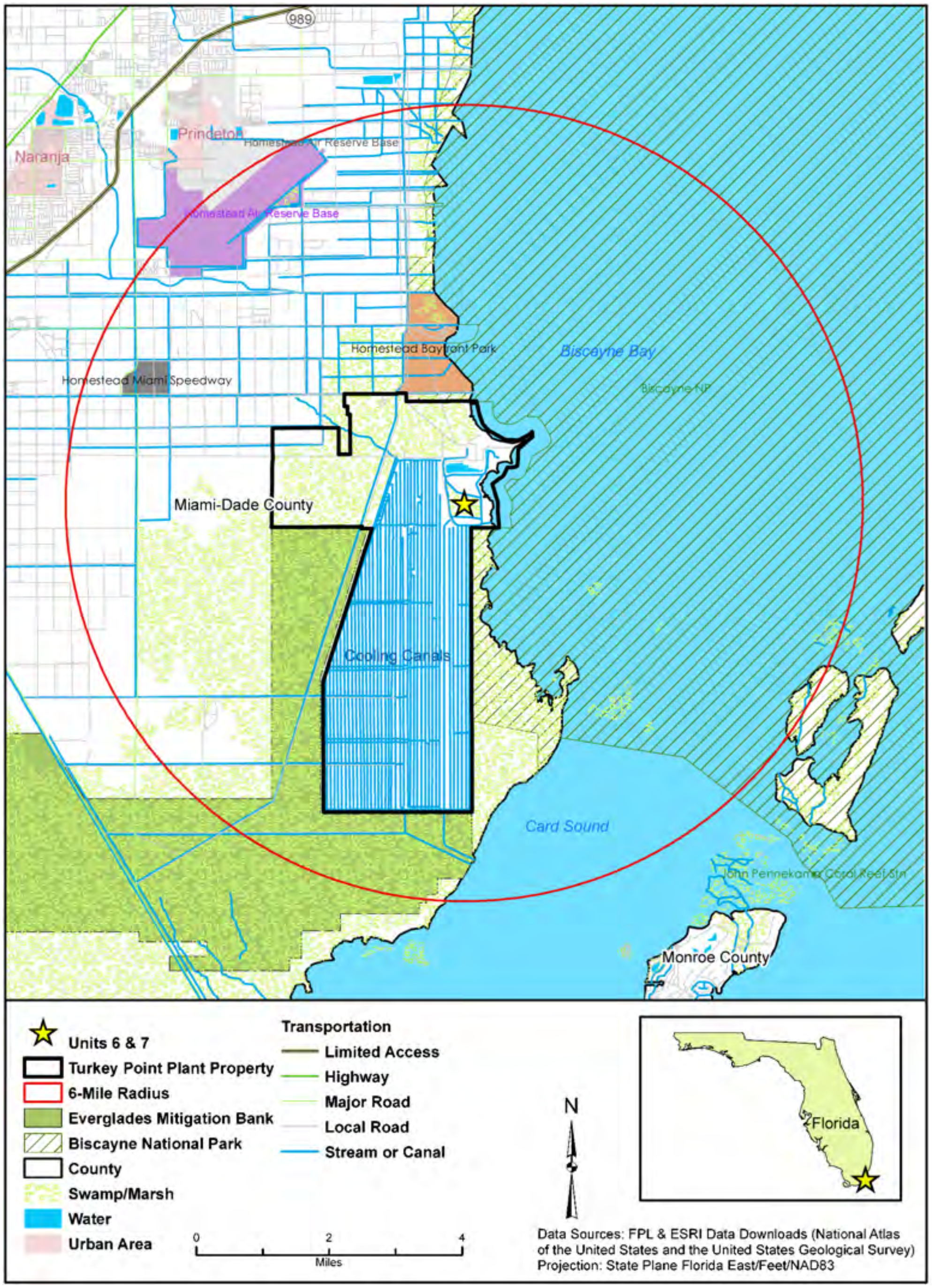


Figure 2.4-2 Habitat Classification at Units 6 and 7

Figure 2.4-3a Locations of Recent Wildlife and Fish Surveys on the Turkey Point Plant Property

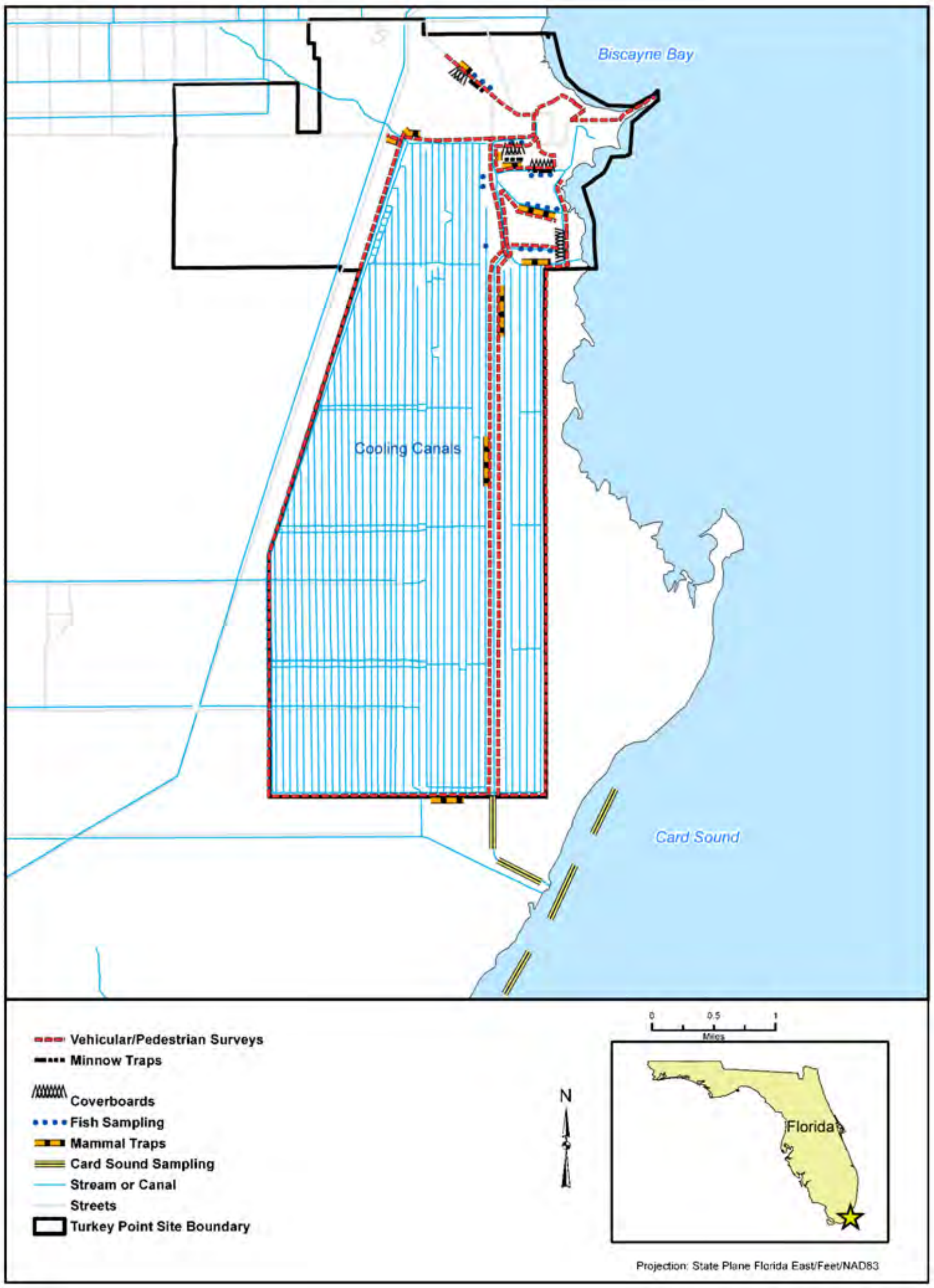


Figure 2.4-3b Locations of Additional Fish Surveys on the Turkey Point Plant Property

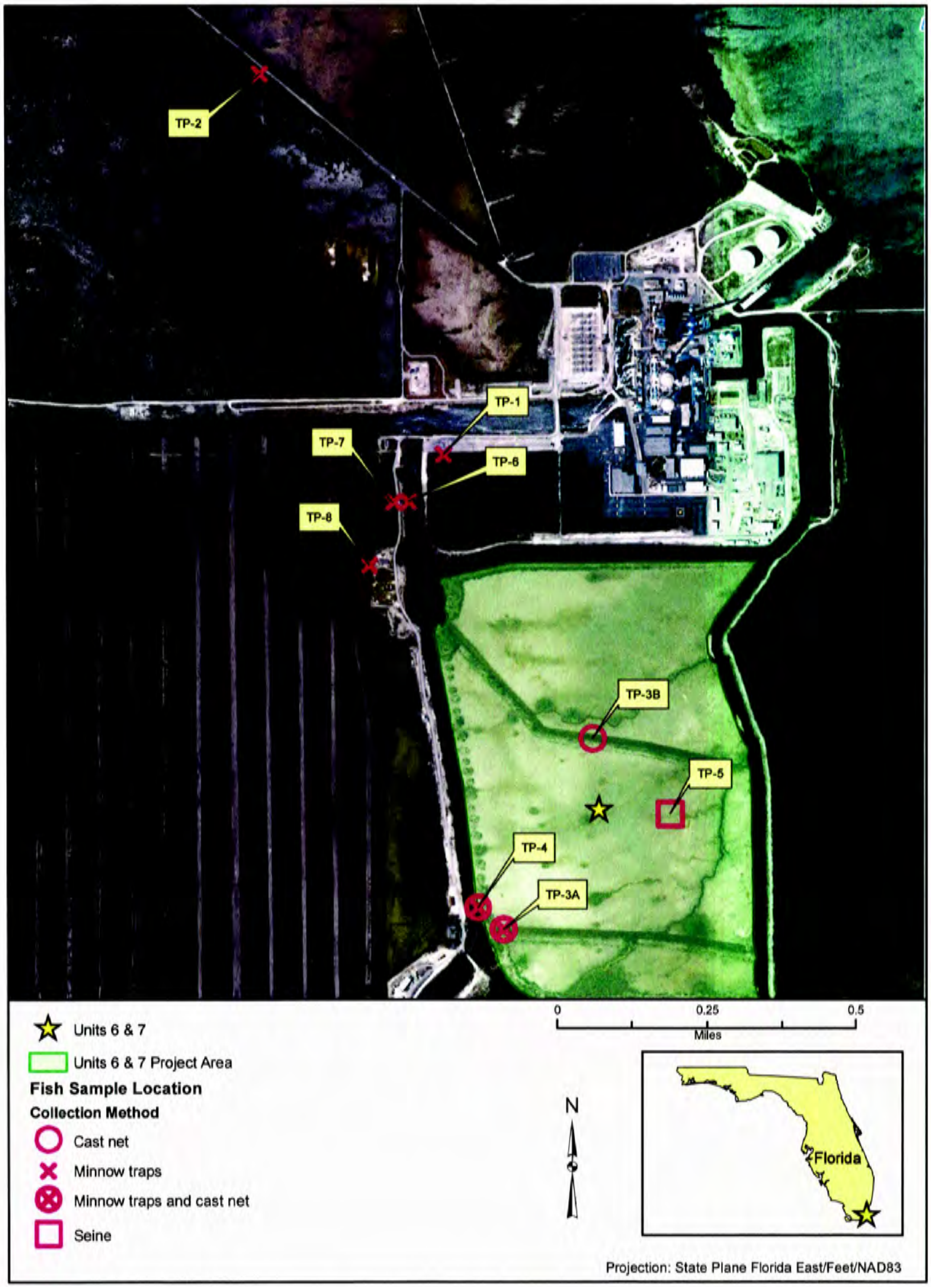


Figure 2.4-4 Designated Critical Habitats Within 50 Miles of the Turkey Point Facility

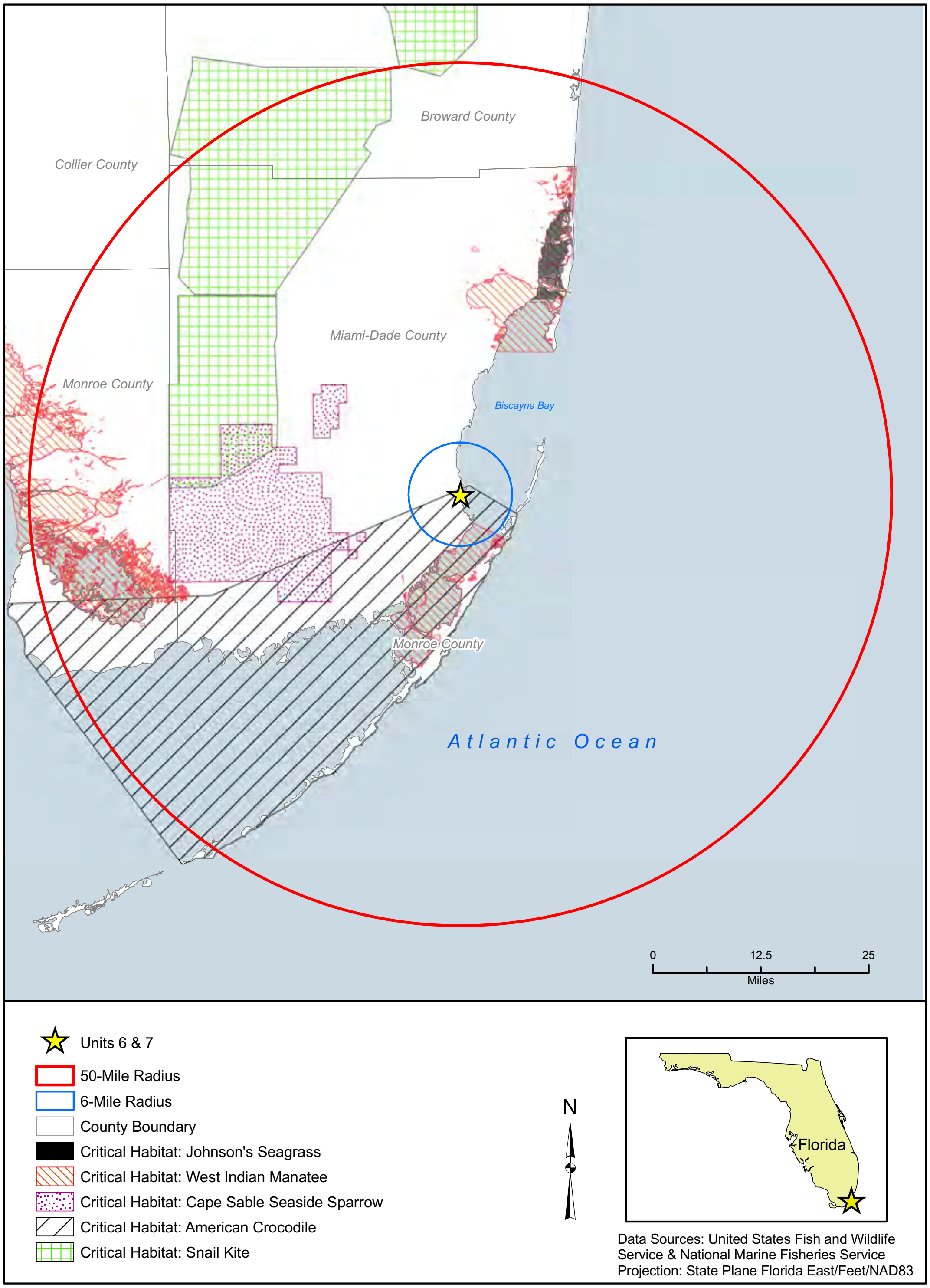
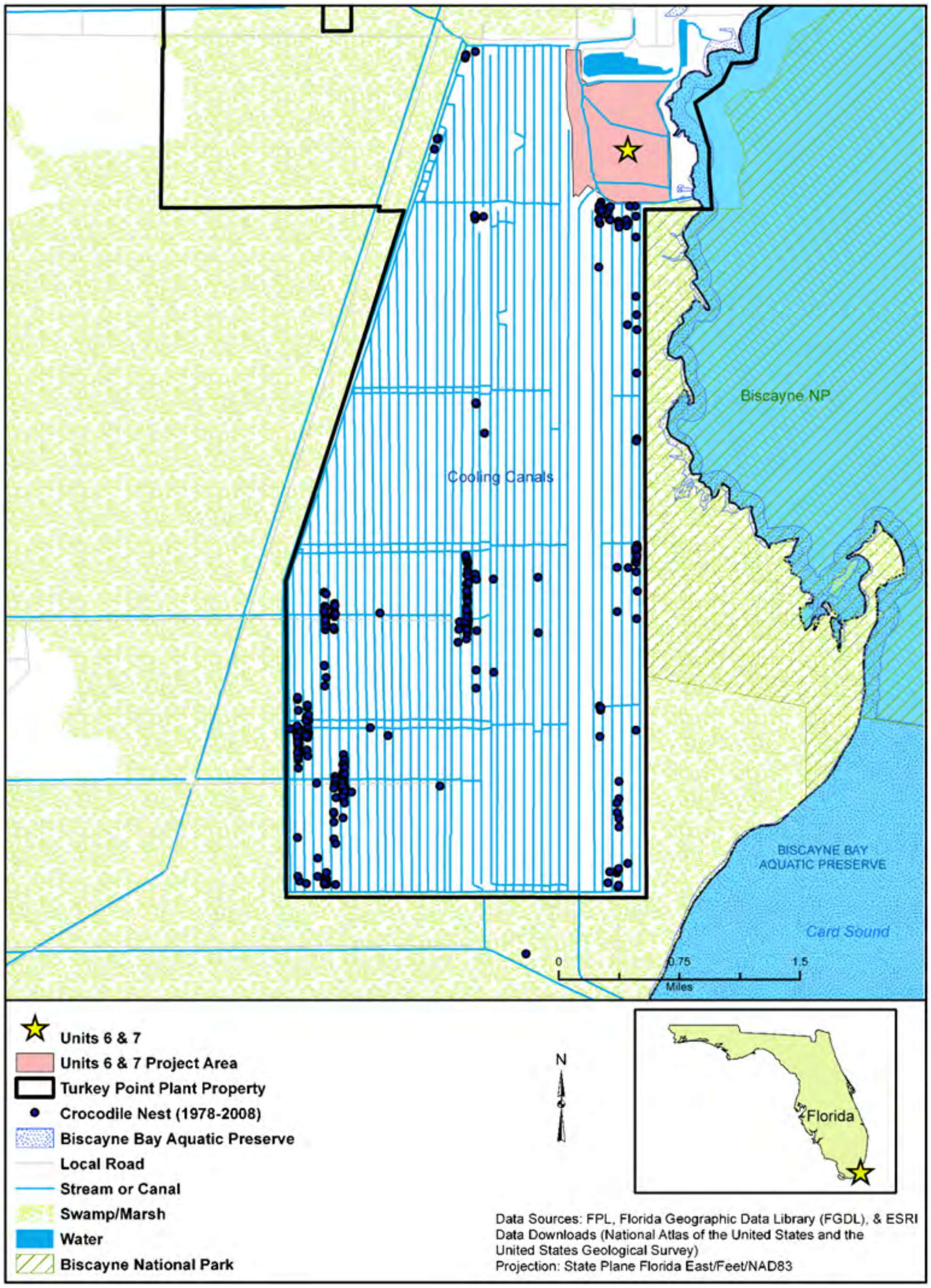


Figure 2.4-5 Crocodile Nest Locations



SECTION 2.5: SOCIOECONOMICS

SECTION 2.5 LIST OF TABLES

SECTION 2.5 LIST OF TABLES (CONT.)

SECTION 2.5 LIST OF TABLES (CONT.)

SECTION 2.5 LIST OF FIGURES

SECTION 2.5 LIST OF FIGURES (CONT.)

2.5 SOCIOECONOMICS

This section describes the socioeconomic resources that have the potential to be impacted by the construction and operation of Units 6 & 7. This section is divided into four subsections: demography, community characteristics, historic properties, and environmental justice. These subsections include descriptions of spatial and temporal considerations, where appropriate. For purposes of socioeconomic analysis, regional socioeconomic data has been collected and analyzed to determine the appropriate socioeconomic region of influence (ROI).

In order to determine the counties that could potentially be impacted by the construction and operation of new Units 6 & 7, several characteristics of each county whose boundaries are at least partially within a 50-mile radius were reviewed. Those counties are Broward, Collier, Miami-Dade and Monroe. All of Miami-Dade County is within the 50-mile radius and the majority (64 percent) of Monroe County is within the 50-mile radius. A smaller portion, 37 percent, of Broward County and a very small portion, less than 3 percent, of Collier County lie within the 50-mile radius. For each of the four counties, several characteristics were examined:

- Percentage of current Turkey Point workforce that reside in the county
- Population size and density of the county
- Number of residents of the population center within the county and the center's driving distance from the Turkey Point plant property
- Mean travel time to work (in minutes) for the county
- Total employment for the county
- Construction employment for the county
- Worker commuting patterns of residents in the county

The population data in this section was updated to reflect the American Community Survey Estimates for 2005-2009. The population projections in Table 2.5-1 and FSAR Subsection 2.1.3, however, used the 2010 Census dataset in order to be consistent with the base population utilized by the Florida Office of Economic Development and Research for the state projected population growth between 2010 and 2030. The 2010 Census dataset was also used in FSAR Subsection 2.1.3 to calculate the same base growth rate multiplier as the state, so that the population projections would be consistent with those projected by the state through 2030.

Miami-Dade County

Miami-Dade County is the host county for new Units 6 & 7. In 2005-2009, Miami-Dade County had an estimated population of approximately 2.5 million (USCB 2010c). The County's 2000 population density of 1158 persons per square mile was approximately 15 times the national average of 80 and 4 times the average of Florida of 296 persons per square mile (USCB 2009c). The county's largest population center is Miami which had an estimated population of 418,480 in 2005-2009 (USCB 2010c). The Turkey Point plant property is located approximately 25 miles south of Miami. The driving distance from many other residential clusters in the county to Turkey Point is shorter, when compared to the driving distance from populated areas in other counties within the 50-mile region. In 2005-2009, the county's mean travel time to work was 29.9 minutes (USCB 2010a). More than 90 percent of Miami-Dade County residents who travel to work are employed within the county. Of workers employed at a site within the Miami-Dade County, 86 percent were residents of the county (Table 2.5-6). The majority, 83.3 percent, of the current Turkey Point workforce resides in Miami-Dade County (Table 2.5-3).

Miami-Dade County has a large construction workforce. In 2009, Miami-Dade County's total employment was 1,369,128. Of that total, construction employment was 64,702 (Table 2.5-8).

Miami-Dade County would be the major recipient of property tax revenues from new Units 6 & 7.

It was determined that because of the large population base, the large construction work force, the reasonable commuting distance, the established residence-to-work site commuting patterns in south Florida, and the propensity of workers that live in the county, Miami-Dade County could potentially experience socioeconomic impacts.

Broward County

Broward County is where 6.4 percent of the current Turkey Point workers reside (Table 2.5-3). The county's population center, Fort Lauderdale is outside the 50-mile radius. The mean commute time to work in the county was 26.9 minutes in 2005-2009 (USCB 2010a). The majority, 76 percent, of the working residents of Broward County who commute to a work site, travel to a site within Broward County; approximately 15 percent of Broward County residents who commute to work travel to a work site in Miami-Dade County. If the percentage of the new construction workers that choose to live in Broward County were similar to the percentage of current workers that call the county home (Table 2.5-3), the large 2005-2009 population base of the county, 1,759,132 (USCB 2010c), then the new workers and family members would represent less than 0.02 percent of the population. Given the small number of current Turkey Point workers residing in Broward County, the resident workers commuting patterns, and short mean commute time, Broward County is not included in the socioeconomic ROI for Units 6 & 7.

Monroe County

Monroe County contains the islands of the Florida Keys, a portion of the Everglades National Park, and the Big Cypress National Preserve. In 2005-2009, Monroe County had a population of 74,024 (USCB 2010c), 7.0 percent fewer residents than in 2000 (USCB 2009b). The county's largest population center, Key West, with a 2005-2009 population of 22,914 (USCB 2010c), is an estimated 128 driving miles from Turkey Point. In 2000, 95.4 percent of Monroe County residents who traveled to a work place, commuted to a work site within Monroe County. Less than 3 percent of the resident workers traveled to Miami-Dade County for employment. Less than 5 percent of the current Turkey Point work force resides in Monroe County (Table 2.5-3). Thus, Monroe County is not included in the socioeconomic ROI for Units 6 & 7.

Collier County

Only a very small portion of Collier County is within a 50-mile radius of Turkey Point. The county population center, Naples, is more than 100 miles from the site. Of the current employees of Turkey Point, only 1 employee lives in Collier County (Table 2.5-3). Thus, Collier County is not included in the socioeconomic ROI for Units 6 & 7.

Region of Interest

Based on this analysis, the socioeconomic ROI for Units 6 & 7 was determined to be Miami-Dade County. Miami-Dade County would be the only county likely to potentially experience socioeconomic impacts. However, to comply with NUREG 1555 in the description of certain resources in the 50-mile radius, a description of those resources in counties partially contained within the 50-mile radius of the Units 6 & 7 plant area was included where appropriate. Those counties are Broward, Collier, and Monroe.

2.5.1 DEMOGRAPHY

This subsection describes the following demographic characteristics: population data by sector, population data by political jurisdiction, and transient populations. Information specific to low-income and minority populations along with migrant populations is characterized in Subsection 2.5.4.

2.5.1.1 Population Data by Sector

The population surrounding the Turkey Point plant property, within 50 miles, was based on 2010 United States Census Bureau (USCB) decennial census data. The population was shown in 10 concentric rings at 0 to 1 mile, 1 to 2 miles, 2 to 3 miles, 3 to 4 miles, 4 to 5 miles, 5 to 10 miles, 10 to 20 miles, 20 to 30 miles, 30 to 40 miles, and 40 to 50 miles from the new units, and 16 directional sectors, each sector consisting of 22.5 degrees (Figure 2.5-2). The populations for years 2020 through 2090 have been projected by calculating a growth rate using state population projections (by county) as the base in 10-year increments (Table 2.5-1). The growth rate was calculated using this exponential growth rate formula $P_2 = P_1 \times e^{(rxn)}$, where P_2 is the projected population, P_1 is the initial population, r is the growth rate and n is the number of years. This period covers the construction and operation through the first 40 years plus 20 years of license renewal for both units.

The resident population distribution within 10 miles and up to 50 miles was computed by overlaying the 2010 census block group point data on the grids shown in Figures 2.5-1 and 2.5-2 and summing the populations of the census block points in each sector/radius. Population projections to year 2030 were obtained from the Office of Economic and Demographic Research of the Florida Legislature and used to calculate an exponential growth rate for each county within 50 miles (EDR 2011). The growth rate for each county was then used to project future populations (within each sector and radius, taking into account the percent of each sector in a particular county). The population distributions (including transient population to the 10-mile radius) and related information were tabulated for all radial distances within each of the 16 sectors. The current population within 50 miles is that shown for the year 2010.

2.5.1.2 Population Data by Political Jurisdiction

Population data by political jurisdiction to facilitate analyses has also been included. The area defined by a 50-mile radius from the midpoint between the new units (Figure 2.5-2) includes all or portions of four counties in south Florida (Table 2.5-2 and Figure 2.5-2): Miami-Dade, Monroe, Broward and Collier. Miami-Dade County is entirely in the 50-mile radius. Most of Monroe County also lies within the area, while only a small portion of Broward County and Collier County are within 50 miles (Table 2.5-2).

The Turkey Point plant property is approximately 25 miles south of Miami, Florida, and 8 miles east of Florida City, Florida, and 9 miles southeast of Homestead, Florida. The Turkey Point plant property is located in an unincorporated portion of Miami-Dade County. The closest population centers are the cities of Homestead and Florida City (Figure 2.5-1). Homestead had a 2000 population of 31,909 (USCB 2008) and a 2005-2009 population estimate of 55,036 (USCB 2010c). Florida City had a 2000 population of 7843 (USCB 2008) and a 2005-2009 population estimate of 9808 (USCB 2010c). The Homestead and Florida City area is also the residence of the largest concentration of current Turkey Point employees. Table 2.5-3 presents the residential distribution patterns of the current Turkey Point employees.

The 50-mile vicinity includes a major portion of the Miami-Fort Lauderdale-Pompano Beach, Florida Metropolitan Statistical Area; portions of the Naples-Marco Island, Florida Metropolitan Statistical Area; and portions of the Key West, Florida Micropolitan Statistical Area.

- The Miami-Fort Lauderdale-Pompano Beach, Florida, Metropolitan Statistical Area had a 2000 population of 5,007,992. From 2000 to 2005-2009, the population grew 9.5 percent. The 2005-2009 population estimate was 5,484,777.
- The Naples-Marco Island, Florida, Metropolitan Statistical Area had a 2000 population of 251,377. From 2000 to 2005-2009, the population grew 24.6 percent. The 2005-2009 population estimate was 313,165.
- The Key West, Florida, Micropolitan Statistical Area had a 2000 population of 79,589. From 2000 to 2005-2009, the population decreased 7.0 percent. The 2005-2009 population estimate was 74,024 (USCB 2010c).

The Naples-Marco Island, Florida, Metropolitan Statistical Area shares the same boundary as Collier County, Florida, and the Key West-Marathon, Florida, Micropolitan Statistical Area shares the same boundary as Monroe County, Florida.

Table 2.5-4 presents historical and projected population and growth rate data for the ROI (Miami-Dade County). For the purpose of comparison, population data for Florida is included in this table. From 1990 to 2000, the population of the ROI grew at an average annual rate of 1.53 percent. For the same period, Florida population grew at an average annual rate of 2.14 percent.

The population projections were completed using four extrapolation techniques and three different historical base periods. The four techniques were:

- Linear – the population changes by the same number of persons in each future year as the average annual change during the base period.
- Exponential – the population changes at the same percentage rate in each future year as the average annual rate during the base period.
- Share of growth – each county's share of state population growth in the future is the same as its share during the base period.
- Shift share – each county's share of the state population changes by the same annual amount in the future as the average annual change during the base period.

For the linear and share-of-growth techniques, base periods of five, ten, and fifteen years were used, yielding three sets of projections for each technique. For the exponential and shift-share techniques, a single base period of ten years was used, yielding one set of projections for each technique.

The starting point for each county's projection was the population estimate produced by the Bureau of Economic and Business Research for April 1, 2006. These estimates are based on 2000 Census counts and a variety of data and techniques showing population changes since 2000. The techniques described above provided eight projections for each county for each projection year (2010, 2015, 2020, 2025, and 2030). In order to moderate the effects of extreme projections, the highest and lowest projections for each county were excluded. The medium projection was then calculated by taking an average of the six remaining projections and adjusting the sum of the county projections to be consistent with the total population change implied by the state projections for each projection interval.

Between 2010 and 2030, the latest year for which data is provided, the average annual growth rates of the ROI and Florida are projected to slow. By 2030, the ROI is projected to slow to 0.81 percent annual growth rate (Table 2.5-4).

Florida has experienced a boom-bust economy over the last decade. From 2000 to 2006, a healthy national economy, strong state-wide real estate markets, and accelerating construction fueled Florida's population growth. Florida's population has increased at an average of about 340,000 people per year.(USCB 2009b)

In 2007, the national housing market and economy began to decline. In Florida, the phenomenon was magnified. As a result, there was a slowing in the population growth to about 149,800 persons per year from 2006 to 2009 (USCB 2009b). However, projections indicate that Florida's population is expected to return to more moderate growth levels of about 252,500 persons per year from 2010 to 2020 and about 255,100 persons per year from 2020 to 2030 (Table 2.5-4).

Table 2.5-5 lists the age distributions of the populations in the ROI, in 2005–2009, and compares them to the age distribution of the population in Florida.

2.5.1.3 Transient Populations

Regulatory Guide 4.7, Section C.4 defines transient populations as people (other than those just passing through the area) who work, reside part-time, or engage in recreational activities in a given area, but are not permanent residents of the area.[1] Under this definition, transients include people in:

- Workplaces
- Places where people reside part-time, such as hotels and motels and seasonal housing

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1. People living in institutional settings such as correctional institutions and nursing homes, and noninstitutional settings such as college dormitories and military quarters are considered, by the USCB, as permanent residents and are included in the decennial census.

- Recreational areas or at special events

Transient information is presented in two formats: quantitatively within the 0- to 10-mile radius and qualitatively within the 10- to 50-mile radius. The transient population within 10 miles was estimated to be 40,521 based on major employers, overnight accommodations including hotels, motels, and seasonal housing, and major recreational areas and marinas.

These transient populations are included in Table 2.5-1 for values within the 0–10 mile radius. Transients within the 10- to 50-mile radius are not included in Table 2.5-1 because of a large amount of uncertainty associated with quantifying the transient population to 50 miles. This is because the 50-mile radius encompasses all or portions of four south Florida counties and all or portions of two major metropolitan areas that are popular vacation destinations for both U.S. and international tourists. Because of this uncertainty, the transient population was not keyed to sectors or projected for future years. However, a qualitative description is presented in this section and throughout Section 2.5.

A method for determining the number of transient workers entering an area is to analyze worker flows in and out of counties. The USCB tracks this data. Table 2.5-6 identifies the number of workers that traveled to a work site in Miami-Dade County for work in 2000. (More current inter-county work flows are not available from the USCB.) ROI transients include workers who reside outside the ROI, but traveled to a worksite in the ROI. According to the data in Table 2.5-6, 116,562 workers commuted from an area outside the ROI to a worksite in the ROI for work in 2000. Migrant populations are addressed in Subsection 2.5.4.2.

Within Miami-Dade County, in late 2011, there were approximately 361 hotels and motels with about 47,642 rooms (Table 2.5-35). Because of the seasonal variation in the number of visitors, the occupancy rates vary. In 2010, there were 38,302 vacant housing units in the ROI that were designated as seasonal, recreational, or occasional use (USCB 2010d). Housing in the ROI is reviewed in detail in Subsection 2.5.2.6.

Recreational facilities and special events in the 50-mile radius, which may affect the number of transients, are addressed in Subsection 2.5.2.5.

2.5.1.4 Turkey Point Units 3 & 4 Workforce

As reported in Section 5.11, currently there are 977 operation workers that support the operation of Units 1 through 5. Also, Units 3 & 4 are both on 18-month refueling cycles and, during each refueling event, an additional 600–1000 outage workers join the current operation workforce for a period of 25 to 35 days.

2.5.2 COMMUNITY CHARACTERISTICS

Units 6 & 7 would be located on the Turkey Point plant property, adjacent to Units 3 & 4. The Turkey Point plant property is located in Miami-Dade County, Florida, south of the city of Miami on the Atlantic coast. Based on an analysis of the residence location of current Turkey Point workers, regional demographics and labor markets, and intercounty worker commuting patterns, it has been determined that the construction and operation of the new units has the potential to impact socioeconomic variables (employment, population, income, housing, infrastructure, and community services) in only one county, Miami-Dade County. Therefore, that county is considered as the socioeconomic ROI. This section addresses the following community characteristics for the Miami-Dade County: economy, transportation taxes, land use, aesthetics and recreation, housing, public services, community infrastructure, and education. The aesthetics and recreation section contains data for the 50-mile radius because most of potential socioeconomic impacts to this resource may be experienced within that area.

2.5.2.1 Economy

Miami-Dade County is a consolidated government that includes the city of Miami. As noted in Subsection 2.5.1.2, Miami-Dade County is part of the Miami-Fort Lauderdale-Pompano Beach, Florida Metropolitan Statistical Area, which also includes Broward and Palm Beach Counties to the north. Miami-Dade County alone comprises of the Miami-Miami Beach-Kendall Metropolitan Division within the larger MSA (OMB Nov 2008). Principal cities in Miami-Dade County include Miami, Hialeah, Miami Beach, North Miami, Coral Gables, and Homestead. Another population center near Turkey Point is Florida City. Key Largo, located on the Florida Keys in Monroe County, is approximately 30 miles south of Florida City along U.S. Highway 1.

Miami-Dade County includes highly urbanized and suburban areas surrounding the city of Miami along the Atlantic Coast, rural agricultural areas further south, and the Everglades areas, including Everglades National Park, in the western half of the county. Near Turkey Point, the non-wetland area centered around the Homestead and Florida City area is primarily agricultural. The region’s tropical climate allows the winter production of green beans, tomatoes, strawberries, and squash for distribution throughout the United States, as well as year-round production of tropical fruits and vegetables such as avocados, passion fruit, malanga, and boniato. Another sector of the industry is Asian specialties such as Thai guava, Thai basil, Thai eggplant, lemon grass, bitter melon and various herbs and spices (MDCAM 2008).

Table 2.5-7 details labor force, employment, and unemployment trends in Miami-Dade County from 2001 to 2011, as reported by the U.S. Bureau of Labor Statistics (BLS). In 2011, the Miami-Dade County labor force totaled 1.3 million people, representing 14.1 percent of the total Florida labor force. The Miami-Dade County labor force grew at an average annual rate of approximately 1.7 percent between 2001 and 2010. The population increased during that period by an average annual rate of 1.0 percent, suggesting that a substantial portion of the population increase is from persons outside of the working age (i.e., children and the elderly or retired), and perhaps that there is a lower labor participation rate among those within the working age group (e.g., mothers staying at home rather than joining the work force). The size of the state's labor force was essentially flat over the same period, reflecting faster growth in other Florida counties than in Miami-Dade County. In 2011, 156,562 people in Miami-Dade County were unemployed. The 2011 average annual unemployment rate in the Miami-Dade County was 12.0 percent, compared to 10.6 percent for Florida and 8.9 percent for the United States (BLS 2012a). BLS data about the economy, including labor force information and unemployment rates, is not available for geographical areas smaller than the county level.

The U.S. Bureau of Economic Analysis (BEA) reports employment data broken out by industrial sector (as defined by the North American Industrial Classification System, or NAICS). The latest year for which BEA's data is published is 2009. As of 2009 in Miami-Dade County, in the nonfarm employment category, the services sector was the largest source of employment, accounting for 48.7 percent of jobs, slightly higher than Florida. The retail sector accounted for 9.9 percent of jobs, while the finance, insurance, and real estate sector provided 9.7 percent of the jobs, and local government provided 8.4 percent of jobs in Miami-Dade County. Construction provided 4.7 percent of the positions. These trends are fairly typical for a diversified urban economy. Table 2.5-8 summarizes employment by industry sectors for Miami-Dade County and Florida, while Figures 2.5-3 and 2.5-4 illustrate employment by industry sector in Miami-Dade County and in Florida, respectively.

Total employment in Miami-Dade County grew by an average of 0.5 percent annually between 2001 and 2009, with the highest absolute (number of new jobs) employment growth in health care and social assistance, 38,501 jobs; other services, except public administration, 22,557 jobs; and real estate and rental and leasing, 16,075 jobs. These trends reflect a period of higher-than-average home building and other growth in certain parts of Florida and in Miami-Dade County. This situation resulted in part from Florida's climate amenities and increased attraction for retirees, and in part from the increased availability of home mortgages to a wider segment of the population. These trends were prevalent over the past several years, and have only recently halted due to the recent economic downturn. Sectors experiencing declining employment were led by manufacturing with a loss of 22,465 jobs; positions in information services which declined by 13,709; and administrative and waste management services which lost 6962 jobs. During the same period, Florida's employment grew by an annual average rate of 1.0 percent, led by healthcare and social assistance, real estate and rental and leasing, and finance and insurance. Table 2.5-9 presents detailed employment trends by industry sector for Miami-Dade County and Florida.

Table 2.5-10 lists the Miami-Dade County major employers by the number of employees. The five largest public employers are Miami-Dade Schools, Miami-Dade County government, the federal government, Florida state government, and Jackson Health System, while the five largest private employers are the University of Miami, Baptist Health South Florida, Publix Super Markets (a grocery chain), American Airlines, and Precision Response Corporation (marketing services).

In its Quarterly Census of Employment and Wages, the BLS collects employment and wage data by industrial sectors; the information is classified by the nature of a firm's business or an organization's activities. The year 2010 is the latest year for which final data is available. Table 2.5-11 presents employment trends for 2001 to 2010 for total workers in all nongovernment industry sectors, construction, heavy and civil engineering construction, utilities, and nuclear electric power generation. (Note that utilities data were not disclosed for 2001 for Miami-Dade County, and nuclear electric power generation data were not disclosed for any years for Florida or Miami-Dade County.[1])

Table 2.5-11 shows that construction employment dropped at similar rates nationally, in Florida, and in Miami-Dade County. This employment contraction also occurred, to a generally lesser degree, in the specialized heavy and civil engineering construction sector. Florida lost 3.0 percent of the jobs in the field, while Miami-Dade County fared better, losing only 0.3 percent of the positions. Employment in the utilities sector also declined during this period. Although employment data were not disclosed for either Florida or Miami-Dade County for the nuclear electrical power generation sector, national employment in the industry grew at a very modest 1.7 percent during the decade.

Table 2.5-12 shows average annual wage (not adjusted for inflation) trends from 2001 to 2010 for the same industrial sectors described above. Although employment dropped in all industrial sectors, in construction and in heavy and civil engineering construction nationally, in Florida and in Miami-Dade County, average annual wages rose about 3 percent in all industrial sectors, construction, heavy and civil engineering construction, and utilities in all three geographical areas. Average annual wages also rose in the study period at a faster rate in the nuclear electrical power generation field than the other analyzed sectors. Figure 2.5-5 compares wage trends in heavy and civil engineering construction for Miami-Dade County, the state of Florida, and the United States.

The Florida Agency for Workforce Innovation (FAWI) collects data by industrial sector and occupational category, and has projected employment levels for 2019 for each category. Table 2.5-13 shows 2011 employment totals for all industries in the construction sector, to include the heavy and civil engineering construction sectors and construction occupational categories. It

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1. Area data may not be disclosed when data does not meet BLS or state agency disclosure standards regarding confidentiality or data quality (BLS 2012c). For example, if there are few firms in an area, data users could determine or approximate a firm's total payroll, hours worked, and other information that a firm may not want known to its competitors.

also reflects projected employment for 2019, the anticipated average annual change, and average hourly wages (for the occupational categories only). The table shows that the state has projected very slow growth in these sectors and occupations.

Per capita personal income provides a useful income comparison among regions. The BEA calculates per capita personal income by dividing the total personal income in an area by the area’s population. In 2009 (the latest year for which the BEA provides data), the per capita personal income in Florida was $38,965, $670 less than the per capita personal income for the United States. The per capita personal income in Miami-Dade County in 2009 was $36,357, which represented 91.7 percent of the United States and 93.3 percent of Florida per capita personal income. As shown in Table 2.5-14, per capita personal income in Miami-Dade County grew by an average annual rate of 3.8 percent between 2001 and 2009 (not adjusted for inflation), showing stronger growth than Florida (3.4 percent) and the United States (3.1 percent) (BEA 2011b). Figure 2.5-6 illustrates income trends in Miami-Dade County, the state of Florida, and the United States.

2.5.2.2 Transportation

Miami-Dade County has an extensive roadway infrastructure including U.S. and interstate highways, multilane divided state highways, and local streets. The County operates public transportation services including rail, and express and local bus. Rail freight service in Miami-Dade County is provided by CSX. Rail passenger service is provided by Amtrak and TRI Rail. The County has public airports, heliports, and a seaplane base; a seaport for commercial freight and passenger service; and an intermodal transportation hub for air, rail, and ship. The County is also served by private airstrips, heliports (including the FPL corporate and Turkey Point heliports), and seaplane bases. The following subsections describe the transportation infrastructure.

2.5.2.2.1 Roads and Highways

The major federal highways in Miami-Dade County are U.S. Highway 1, which bisects the county from north to south and continues to the Florida Keys, and Interstates 75 and 95, which run north-south and terminate in Miami. These U.S. highways and interstates are shown on Figure 2.5-7.

Two major state highways in the County are Florida's Turnpike and SR 997. Florida's Turnpike is a multilane divided toll road that connects Interstate 75 in Central Florida to U.S. Highway 1 at Homestead/ Florida City. SR 997 (also known as Krome Avenue) runs from the Homestead area to its intersection with U.S. Highway 27 just south of the Broward County/ Miami-Dade County line, skirting the western Miami metropolitan area. These highways are shown on Figures 2.5-7 and 2.5-8a.

The existing access road for Turkey Point is SW 344th Street/Palm Drive, which runs east-west. Workers from the west, northwest, north and south can access the west end of Palm Drive from U.S. Highway 1, Krome Avenue or Florida's Turnpike. Workers from the north can also access Palm Drive by traveling south on SW 137th Avenue/Tallahassee Road or SW 117th Avenue, a street east of Tallahassee Road.

SW 328th Street/North Canal Drive runs east-west several blocks north of Palm Drive, and also can be accessed from Krome Avenue, U.S. Highway 1 or Florida's Turnpike. North Canal Drive intersects with Tallahassee Road, north of Tallahassee Road's intersection with Palm Drive, and therefore provides an alternative access to Turkey Point from the west for part of the commute. Tallahassee Road, North Canal Drive and Palm Drive are 4-lane roads for at least part of their distances and are classified as rural major collectors (Table 2.5-15), designed for travel at lower speeds and shorter distances than arterials which provide the highest level of speed and mobility. Florida considers rural major collectors to be any road that connects major or minor thoroughfares, or connects a major thoroughfare with a concentrated land use (FDOT 2003).

Both the Florida Department of Transportation and Miami-Dade County monitor traffic in the Homestead/ Florida City area, mostly at intersections of the major highways with major surface streets (Figure 2.5-8a and Tables 2.5-16 and 2.5-17). The major roads support much greater traffic volumes than local streets. Average traffic counts do not provide information on the range of traffic volumes. When analyzing traffic in Florida, consideration must be given to the seasonality of many residents. The Bureau of Economic and Business Research, Warrington College of Business Administration, University of Florida has compiled a series of research papers on the impact of seasonal residents to Florida (Galvez, 1997). Florida has approximately 1 million seasonal residents in January and approximately 170,000 in late summer (Nova Southeastern University 2009). Forty-one percent of the seasonal residents can be found in the southwest counties and 35 percent in the 10 southeastern counties, including Miami-Dade (Galvez, 1997).

Evacuation Routes

The severe weather evacuation routes in the Homestead and Florida City area are U.S. Highway 1, Florida's Turnpike, SR 997, and Card Sound Road (FDEM 2007). These routes are shown on Figure 2.5-8a.

Special Events Affecting Local Traffic

In addition to seasonal population fluxes, the level of traffic on the local roads described above would be impacted by events at the Homestead Miami Speedway. The Speedway operates 280 days a year, and hosts events sponsored by all six of America's premier motorsport championships. Many of its activities are not national events, such as Porsche/BMW Owners

Club meetings, SCCA Drivers School, VanEpps Teen Driving programs, and amateur formula, automobile and motorcycle races. The track has parking for 30,000 cars and 1300 RVs. The speedway lies at the intersection of SW 344th Street/Palm Drive and SW 137th Avenue/ Tallahassee Road. See Subsections 2.2.1.2 and 2.5.2.5 for additional details on this venue.

2.5.2.2.2 Public Transportation

Miami-Dade County operates public transportation services including rail, express bus, and local buses with multiple stops. The rail service has 22 stations and serves Miami. There are approximately 100 bus routes that serve a larger area. Bus routes that serve Homestead and Florida City are local with multiple stops, and express buses that link the area with Miami that have only a few stops. Buses use exclusive highway lanes called the busway, which ensures that they are not slowed by traffic congestion. The express route terminates at SW 344th Street/Palm Drive. The originating station (Dadeland South) has 1260 parking spaces (MDC 2009), and there are five “Park & Ride” parking lots located along the express route at SW 152th, SW 168th, SW 200th, SW 244th, and SW 296th Streets. Plans are being developed for a future Park & Ride lot at SW 344th Street/Palm Drive. (MDC 2008a)

In addition to this public bus transportation infrastructure, the TRI-Rail commuter train provides service to Miami International Airport and Fort Lauderdale/Hollywood International Airport. Connecting bus services to the portions of Miami-Dade County served by bus routes are available from TRI-Rail stations. (SFRTA 2008)

Miami-Dade County is constructing a ground transportation hub next to Miami International Airport—the Miami Intermodal Center. The anticipated opening date is 2011. Miami Central Station is to be one of the major facilities within the Miami Intermodal Center. Miami Central Station is to be situated between NW 25th Street on the north, NW 37th Avenue on the east, NW 21st Street on the south, and NW 38th Court on the west. The facility is designed to accommodate various transportation connections, thereby providing connectivity between various modes of transportation. The facility will feature grade level tracks for TRI-Rail, Metrorail, and Amtrak rail service. Bus depots will be provided for Greyhound, Miami-Dade Metrobus, and intra-city buses. Space will be provided for courtesy buses, shuttles, and taxis currently serving Miami International Airport. (FDOT 2008a)

2.5.2.2.3 Rail Service

Rail passenger service is provided to Miami by Amtrak and TRI-Rail; both have service to connecting rail lines across the United States (Amtrak 2008, SFRTA 2008). Neither rail service travels to locations south of Miami.

Rail freight service in Miami-Dade County is provided by CSX operating Class 1 rail lines (FDOT 2006). The CSX line services the Port of Miami and has an intermodal terminal in Miami

(CSX 2008). The rail line is shown in Figure 2.5-7. The rail line terminates in Homestead. The nearest rail crossing to Turkey Point is at SW 320th Street and is approximately 11 roadway miles to the plant entrance.

2.5.2.2.4 Air Transportation

Miami-Dade County has air transportation infrastructure including airports, airstrips, heliports, and a seaplane base.

The county operates five airports: Miami International, a major commercial airport in Miami, Kendall-Tamiami Executive Airport in Kendall, Dade-Collier Training and Transition Airport in Collier and Miami-Dade County. Also operated by the county are Opa-Locka Airport and Homestead General Aviation Airport (Miami-Dade Aviation Department 2008). Homestead is also host to the Homestead Air Reserve Base (U.S. Air Force 2008), which is the closest airport to Turkey Point. Another major commercial airport is located within 50 miles of Turkey Point in Broward County, the Fort Lauderdale/Hollywood International Airport. Also within 50 miles is Broward County's North Perry Airport. The location of these airports is shown in Figure 2.5-7. In addition, the county has several private airstrips including Burr's Airstrip 16 miles southwest of Miami and Lindbergh's Landing Airstrip 20 southwest of Miami (FDOT 2008b).

Miami-Dade has many privately owned heliports, including the FPL Helistop and the FPL Turkey Point Heliport (FDOT 2008b).

Rounding out the variety of air transportation infrastructure in Miami-Dade County is the Miami Seaplane Base. The facility lies on Watson Island near the southern tip of the Miami Beach peninsula (CFASPP 2007).

2.5.2.2.5 Deep Sea Ports

Deep sea ports are located in Miami-Dade County and the adjacent counties of Broward County to the north and Monroe County to the southwest. The Port of Miami is in Miami and is shown on Figure 2.5-7. The Port of Key West is in Key West in Monroe County and Port Everglades is in Fort Lauderdale in Broward County (FDOT 2008e). The Port of Miami offers passenger and freight services (MDC 2008b).

2.5.2.2.6 Atlantic Intracoastal Waterway

The Atlantic Intracoastal Waterway traverses the eastern coastline of Florida and intersects with the Port of Miami, as shown on Figure 2.5-7. The existing equipment barge unloading area at Turkey Point is accessed via the waterway to receive shipments of oil and equipment.

2.5.2.3 Taxes

Several tax revenue categories would be affected by the construction and operation of Units 6 & 7. These include corporate taxes on company profits, sales and use taxes on construction- and operations-related purchases and on the purchases made by project-related workers; property taxes related to the construction and operation of the units; and property taxes paid by incoming workers. The following subsections describe each type of tax and its application in the ROI (Miami-Dade County) and the state of Florida, and presents revenues and expenditures by category for local jurisdictions.

As shown in Table 2.5-18, the state of Florida's general revenues were $25.5 billion in 2011, while total tax revenues were $32.4 billion. Figure 2.5-9 illustrates Florida's revenues by source.

2.5.2.3.1 Personal and Corporate Income Taxes

Florida does not have a personal income tax (FDOR 2012d).

Corporations and artificial entities that conduct business, or earn or receive income in Florida, including out-of-state corporations, must file a Florida corporate income tax return unless specifically exempt. According to the Florida Department of Revenue web site, Florida's corporate income tax liability is computed using federal taxable income, modified by certain Florida adjustments, to determine adjusted federal income. A corporation doing business both within and outside of Florida may apportion its total income to Florida using a three-factor formula, which is a weighted average, designating 25 percent each to factors for property and payroll, and 50 percent to sales. Nonbusiness income allocated to Florida is added to the Florida portion of adjusted federal income. An exemption of $50,000, for tax years beginning on or after 1/1/2013, is subtracted to arrive at Florida net income, which is multiplied by 5.5 percent to compute the tax (FDOR 2012b).

Florida Statute §220.131 allows certain affiliated groups of corporations to elect to participate in the filing of a consolidated corporate income tax return. FPL is part of an affiliated group of corporations that has made this election. Under a consolidated Florida corporate income tax return the federal taxable income of the combined group is the same as the federal taxable income included in the affiliated groups consolidated federal tax return. The Florida adjustments, apportionment factor, and nonbusiness income allocations are all made on a consolidated basis and one exemption is available to the consolidated group. The resulting Florida net income is then multiplied by 5.5 percent to compute the tax.

In 2011[1], corporate income and excise tax accounted for 5.8 percent of the state's total tax revenues (Table 2.5-18).

2.5.2.3.2 Sales and Use Taxes

Florida imposes a state sales tax of 6 percent on the sale or rental of tangible personal property, certain services, admissions, and the rental or lease of real property and transient living accommodations. In addition, Florida law allows counties to levy discretionary sales surtaxes for various purposes, such as transit systems, infrastructure, indigent care, or health services. The eligibility for imposing a surtax differs by the type of tax. The authorized amounts also vary, but range from 0.5 to 1.5 percent. Generally, only the first $5000 of a single purchase is subject to the discretionary tax. Counties may also impose local option taxes on fuel, food and beverages, and tourism-related items (FDOR 2012d). Miami-Dade County imposes a 1 percent discretionary sales surtax in addition to the state sales tax (FDOR 2012a).

A dealer who sells and delivers taxable merchandise or taxable services is required to collect the surtax at the rate imposed in the county where the merchandise or service is delivered. For motor vehicle and mobile home sales, the applicable surtax rate is for the county where the vehicle or mobile home will be registered. Only the first $5000 of a single sale of tangible personal property is subject to discretionary sales surtax if the property is sold as a single item, in bulk, as a working unit, or as part of a working unit. The $5000 limit does not apply to commercial rentals, transient rentals, or services (FDOR 2012d).

Florida also imposes a 6 percent tax on out-of-state purchases imported into the state. The tax applies to all items purchased outside of Florida that would have been subject to tax if purchased in the state. Examples of such taxable purchases include purchases made by mail order, furniture delivered from dealers located in another state, and computer equipment delivered by common carrier. Items purchased and used in another state for at least 6 months before being brought into Florida are not subject to the tax. Additionally, Florida allows a credit for a lawfully imposed sales tax paid in another state (FDOR 2012d).

General grocery items are exempt from sales tax. This exemption does not apply to candies, soft drinks, alcoholic or malt beverages, food or drinks prepared on the sellers' premises and sold for immediate consumption, or food or drink sold by restaurants, hotels, amusement parks, racetracks, taverns, stadiums, theaters, or similar places of business. Prescription and common household medicines, prosthetic and orthopedic devices, hearing aids, eyeglasses, and dentures are examples of other items also exempt from sales tax (FDOR 2012f).

1. State and county fiscal years begin on July 1 and end on June 30. By convention, the fiscal year is referred to by the ending year, i.e., FY 2010-2011, or simply 2011.

In 2011, sales and use taxes accounted for 59.8 percent of Florida's tax revenues (Table 2.5-18).

2.5.2.3.3 Other Taxes on Sales and Services

Communications Services Tax

In 2001, Florida restructured taxes on telecommunications, cable, direct-to-home satellite, and related services. The law replaced and consolidated several different state and local taxes with a single tax comprised of two parts: the Florida communications services tax and the local communications services tax. Communications services include telecommunications, cable, direct-to-home satellite, and related services. This definition includes voice, data, audio, video, or any other information or signals, including cable services, transmitted by any medium. (FDOR 2012c)

The Florida Department of Revenue’s web site provides some examples of services subject to the tax: local, long-distance, and toll telephone; cable television; direct-to-home satellite; mobile communications, including detailed billing charges, private line services, pager, and beeper services; telephone charges made by a hotel or motel; facsimiles, when not provided in the course of professional or advertising service; and telex, telegram, and teletype services. Governments, religious institutions, and certain nonprofit organizations are exempt from this tax. Residential telephone service is exempt from the state portion of the communications services tax. This service is subject to the state gross receipts and local portions of the tax. Mobile telephone, cable, and direct-to-home satellite services are fully taxable, even if provided to a residence (FDOR 2012c).

In 2011, communications services taxes accounted for 7.1 percent of the state’s tax revenues (Table 2.5-18).

Documentary Stamp Tax

Florida levies a documentary stamp tax on deeds, bonds, notes, written obligations to pay money, mortgages, liens, and other evidences of indebtedness. According to the FDOR web site, the tax rate for documents that transfer an interest in real property is $0.70 per $100 (or portion thereof) of the total consideration paid, or to be paid, for the transfer. An exception is Miami-Dade County, where the rate is $0.60 per $100 (or portion thereof) when the property is a single-family residence. If the Miami-Dade property is anything other than a single-family residence, the tax rate is $0.60 plus $0.45 surtax per $100 (or portion thereof) (FDOR 2012e).

Examples of documents that may transfer interest in real property include:

- Warranty deeds

- Quit claim deeds
- Contracts for timber, gas, oil, or mineral rights
- Easements
- Contracts or agreements for deed
- Assignments of contract or agreement for deed
- Assignments of leasehold interest
- Assignments of beneficial interest in a trust
- Deeds in lieu of foreclosure

“Consideration” generally consists of:

- Money paid or to be paid
- Discharge of an obligation, mortgage or other lien encumbering the property
- Exchange of property
- Any other monetary consideration or consideration that has value.

In 2011, the documentary stamp tax accounted for 3.6 percent of the state’s tax revenues (Table 2.5-18).

2.5.2.3.4 Property Taxes — County, School District, and Special Districts

Under Florida law, both real property (land and permanent buildings) and tangible personal property (primarily business equipment) are subject to property tax. Property taxes are administered by local governments. Homeowners may be entitled to receive a homestead exemption on real property tax. The owner of taxable tangible personal property is required to file an annual tax return with the county property appraiser by April 1 of each year. Taxable tangible personal property includes machinery and equipment and other items that are used for business purposes.

FPL pays property taxes to Miami-Dade County and the Miami-Dade school district. Table 2.5-18 presents information from 2000 to 2011 on the total assessed value of the three fossil units and the two nuclear units, and the total tax paid to the county and the school district. In 2011, taxes were $6.7 million on the nuclear units and $9.2 million on the fossil units, for a total of $15.9 million. The county received 55 percent of this tax, while the school district received 45 percent of the tax revenue.

FPL also pays personal property taxes for the existing units to Miami-Dade County, the Miami-Dade school district, and several special taxing districts. These include the Florida Inland Navigation District, the South Florida Water Management District, the Everglades Construction Project and the Children's Trust Authority. Table 2.5-20 provides the 2011 millage rate, taxable value, and taxes levied by each taxing entity. In 2011, FPL was levied $15.3 million in tangible personal property taxes on its properties at Turkey Point.

2.5.2.3.5 School Districts

In Florida, each of its 67 counties comprises a single school district (FDOE 2008). Therefore, the Miami-Dade school district includes all of the schools within the ROI. The Miami-Dade School District and Miami-Dade County government are separate entities.

Like many states, Florida seeks to ensure that all students in the state receive comparable educational opportunities, regardless of the relative wealth of each student's school district, and has established a funding equalization process to accomplish this goal. "In 1973, the Florida Legislature enacted the Florida Education Finance Program (FEFP) and established the state policy on equalized funding to guarantee to each student in the Florida public education system the availability of programs and services appropriate to his or her educational needs that are substantially equal to those available to any similar student notwithstanding geographic differences and varying local economic factors (FSBA 2012)." The FEFP is the primary mechanism for funding the operating costs of Florida school districts. Funding is based on the number of full-time equivalent students, and considers variations in several factors when determining funding for each district. A detailed description of the FEFP equation used to determine school district allocations is found at the Florida School Board Association website (FSBA 2012).

School funding comes primarily from local, state, and federal government sources. Local funding is from property taxes on properties located within the school district. State funding is by legislative appropriation, with the major source of revenue being the state sales tax. Federal funding is coordinated by the Florida Department of Education. School districts receive funds from the federal government directly and through the state as an administering agency, and may receive funds under a variety of programs from agencies such as the Department of Labor, Veterans Administration, Department of Interior, Department of Education, Department of Defense, and Department of Agriculture. Table 2.5-21 shows the Miami-Dade School District's revenues by source for the 2000–2001 to 2009–2010 school years. As the table shows, over this

10-year period, the state contribution has steadily declined from 53.4 percent to 28.2 percent, while the local portion has risen from 37.2 percent to 54.0 percent. The change in contribution proportions between state and local funding is a result of legislative action in 2004 that changed the funding formula for large school districts such as the Miami-Dade School District (Iatarola 2004). As a result, the state contribution declined and local contributions increased to make up the difference. The federal contribution has also risen, from 9.5 percent to 17.9 percent. In the 2009–2010 school year, Miami-Dade schools had total revenues of $3.5 billion. Figure 2.5-10 illustrates these trends.

2.5.2.3.6 Local Revenues and Expenditures

Over 83 percent of the current Turkey Plant employees live in Miami-Dade County, which is the ROI. The county's extensive retail opportunities ensure that Turkey Point Plant workers would purchase a large portion of their goods and services within the county. Therefore, Miami-Dade is the county most affected by project and worker expenditures and subsequent sales tax collections. Neither the city of Homestead nor Florida City, home to 43 percent of current Turkey Point plant employees, imposes a local sales tax, but both levy a tax on real and personal property. Local revenues and expenditures by Miami-Dade County and the cities of Homestead and Florida City are briefly described below.

Miami-Dade County

As shown in Table 2.5-22, in 2011, Miami-Dade County government had $1.3 billion in total revenues. The county received 76.4 percent of its revenues from ad valorem (property) taxes, 5.1 percent from gas taxes, and 4.5 percent from sales taxes. Figure 2.5-11 illustrates the proportion from each revenue source. (As noted previously, the Miami-Dade school district is a separate taxing entity.)

The county's expenditures for 2011 totaled $1.2 billion, as shown in Table 2.5-22. Public safety was the largest expenditure, accounting for 43.2 percent. Health and human services accounted for 15.2 percent, general government for 14.7 percent, and transportation for 14.1 percent. Figure 2.5-12 shows the expense breakout.

City of Homestead

Table 2.5-23 presents 2001 through 2010 revenues and expenditures for the city of Homestead. In 2010, the city had total revenues of $58.5 million and expenditures of $54.5 million, resulting in a surplus of $4.1 million, substantially more than the previous year's surplus of $600,000. Figure 2.5-13 illustrates the changes in revenues, expenditures, and the total tax levy from 2001 to 2010, and shows that all have grown substantially since 2002. Revenues and expenditures dropped in 2007 and 2008 from 2006 levels.

In 2010, 37.8 percent of Homestead's revenues were from property taxes, with 33.9 percent coming from intergovernmental sources with 2.6 percent from licenses and permits. Figure 2.5-14 illustrates the proportion from each revenue source.

Public safety was Homestead's largest expenditure in 2010, accounting for 47.2 percent of the total. General government accounted for 22.8 percent, capital outlay for 15.5 percent, and parks and recreation for 7.2 percent. Figure 2.5-15 outlines the expense breakout.

Table 2.5-24 presents the assessed value of Homestead's real and personal property from 2001 to 2010, along with the total tax levy for each year. The assessed value of real property increased by more than fivefold (not adjusted for inflation) over that decade, while the amount of total tax levy more than quadrupled.

Table 2.5-25 shows the history of millage rates over that decade. Rates for the city of Homestead, the school district, the county, and the state have declined somewhat, while the special district millages have fluctuated. Overall, the total property tax rate for Homestead property owners has declined from 26.2640 (dollars per $1000 of taxable property value) to 23.1774.

City of Florida City

Table 2.5-26 presents 1998 through 2007 revenues and expenditures for the city of Florida City. In 2007, the city had total revenues of $14.7 million and expenditures of $11.6 million, resulting in a surplus of $3.1 million, slightly less than the previous year's surplus of $3.2 million. Figure 2.5-16 illustrates the revenues and expenditures over the past decade, along with the total tax levy (values are not adjusted for inflation). Since 2001, both revenues and expenditures have generally grown, although they declined between 2003 through 2004, 2004 through 2005, and 2006 through 2007. The surplus of revenue over expenditures has gradually increased during most years. The total tax levy grew steadily, increasing at a faster rate between 2004 and 2006, but increasing only slightly between 2006 and 2007.

In 2007, 41.5 percent of Florida City's revenues were from taxes, 20.6 percent came from charges for services, and 13.2 percent came from intergovernmental sources. Figure 2.5-17 illustrates the proportion from each revenue source.

General government was Florida City's largest expenditure in 2007, accounting for 34.2 percent of the total. Public safety accounted for 22.1 percent, capital outlays for 20.2 percent, public works for 19.0 percent, and parks and recreation for 3.4 percent. Figure 2.5-18 illustrates the breakout of expenses.

Table 2.5-27 presents the assessed value of Florida City's real and personal property from 1998 to 2007, along with the total tax levy for each year. The assessed value of real property more than quadrupled (not adjusted for inflation) over that decade, while the amount of total tax levy increased by about fivefold.

Table 2.5-28 shows the history of millage rates over that decade. Rates for the city of Florida City have increased, while the school district, the county, and the state have declined and special district millages have fluctuated. Overall, the total property tax rate for Florida City property owners has declined from 28.8620 (dollars per $1000 of taxable property value) to 27.1998.

2.5.2.4 Land Use

The Turkey Point plant property is located in southeastern Miami-Dade County and consists of approximately 9400 acres of land. It is located approximately 4.5 miles east of the southeastern municipal limits of Homestead, adjacent to Biscayne Bay and Card Sound. Homestead is the closest population center of 25,000 or more. As shown in Table 2.5-3, 43 percent of FPL's current workforce resides in the Homestead and Florida City area. Based on the percentage of the existing workforce that lives in Homestead and Florida City, this area is described in addition to Miami-Dade County. Section 2.2 provides tables and maps displaying land use categories and breakdowns for the Turkey Point plant property, vicinity, and the 50-mile radius.

Laws adopted during the 1984–86 period established Florida's growth management system, including the adoption of a state comprehensive plan. This system requires regional planning councils to prepare and adopt comprehensive regional policy plans. Amendments mandated that specific level-of-service standards for traffic, mass transit, parks, water, sewer, solid waste, and drainage be included in local comprehensive plans and that no development orders can be issued when the adopted levels of service would not be met (MDC 2006). Chapter 163 of the Florida Statutes requires consistency between the local plan, the applicable regional plan, and the state comprehensive plan, and all development regulations and orders must be consistent with the adopted local comprehensive plan (FDCA 2008a, FDCA 2008b, and MDC 2006).

2.5.2.4.1 Florida's State Comprehensive Plan

Chapter 187 of Title XIII of the Florida Statutes is the state of Florida's designated comprehensive plan. The plan provides long-range policy guidance for the orderly social, economic, and physical growth of the state and is reviewed biennially by the state legislature.

The comprehensive plan encourages the centralization of commercial, governmental, retail, residential, and cultural activities within downtown areas and promotes directing development to those areas that have in place, or have agreements to provide, the land and water resources, fiscal abilities, and service capacity to accommodate growth in an environmentally acceptable manner.

2.5.2.4.2 South Florida Regional Planning District

The South Florida Regional Planning Council has regional planning responsibilities for Broward, Miami-Dade, and Monroe Counties (SFRPC 2004), while the Southwest Florida Regional Planning Council is responsible for Collier County and five other counties (SWFRPC 2004). State legislation passed in 1993 recognized that the regional planning council is Florida's only multipurpose regional entity that is in a position to plan for and coordinate intergovernmental solutions to growth-related problems on greater-than-local issues. This legislation requires each regional planning council to develop and periodically update a strategic regional policy plan (SFRPC 2004).

2.5.2.4.3 Miami-Dade County

Miami-Dade County has more than 2420 square miles of land and water, of which almost 510 square miles have been developed for urban uses. The land use portion of the Miami-Dade County Comprehensive Development Master Plan (CDMP) includes a map for 2015–2025 which shows recommended land uses by major categories. Each of these categories is interpreted locally through zoning designations (MDC 2006).

Miami-Dade County covers a land area of 1946 square miles (1,245,440 acres). In 2007, approximately 5 percent of the land area of Miami-Dade County consisted of farms and ranches (Subsection 2.2.3). There are 281,172 acres of urban or built up land, 98,200 acres of agricultural land, 16,094 acres of rangeland, 61,069 acres of upland forest, 20,088 acres of water, 837,446 acres of wetland, and 3881 acres of barren land.

The Miami-Dade County CDMP provides broad parameters for the county government to do detailed land use planning and zoning activities (MDC 2006). The CDMP applies to incorporated and unincorporated areas, addressing primarily the unincorporated areas and the county’s jurisdictional responsibilities in the 35 municipalities. The CDMP cannot supersede authority of incorporated municipalities to exercise all powers relating solely to their local affairs, provided that four fundamental growth management components of the CDMP serve as minimum standards for zoning, service, and regulation to be implemented through all municipal comprehensive plans and land development regulations (MDC 2006). The four fundamental growth management components are:

1. The urban development boundary, urban expansion area boundaries, and the CDMP provisions that prescribe allowable land uses and public services and facilities outside the urban development boundary.

2. The Policies for Development of Urban Centers contained in the text of the land use element.

3. The Population Estimates and Distributions as mapped in the land use element.

4. Policies require the county to maintain and use its authority as provided by the Miami-Dade County Charter to maintain, site, construct and operate public facilities in incorporated and unincorporated areas of the county.

The plan encourages development in a contiguous pattern centered around a network of high-intensity urban centers well-connected by multimodal, intra-urban transportation facilities and in locations that optimize efficiency in public service delivery and conservation of valuable natural resources (MDC 2006).

Miami-Dade County zoning code mandates that the county must plan for and manage its population growth and provide the best possible distribution of land uses, by type and density, to meet the needs of the present and future resident and tourist populations in a manner that would maintain or improve the quality of the environment (Miami-Dade Code 2008). It also regulates the subdivision of land in both the incorporated and unincorporated areas of the county (Miami-Dade Code 2008).

2.5.2.4.4 City of Homestead

Homestead is the closest incorporated municipality with a population of 25,000 or more (Section 2.1). The city of Homestead is entirely surrounded by unincorporated Miami-Dade County, except for a common border with Florida City to the south and west. Homestead is comprised of approximately 15 square miles (Homestead EAR 2007). Homestead has 4755 acres of developed land and 4914 acres of undeveloped (vacant) land. Specifically, the city has 690 acres of land under construction zoned for residential purposes, 83 acres under construction for commercial uses, and 424 acres of open land.

There are currently 5525 acres of urban or built up land, 2241 acres of agricultural land, 440 acres of rangeland, 138 acres of upland forest, 400 acres of water, 250 acres of wetland, and 160 acres of transportation, communications, and utilities.

Homestead's comprehensive plan is intended to provide effective, long-term future direction for redevelopment and new growth (Homestead CP 2005). The city also has neighborhood development and redevelopment plans.

The Homestead comprehensive plan is organized into ten plan elements and six sub-elements, including the future land use map contained in the future land use element. This comprehensive plan was approved by the Homestead city council for transmittal to the Florida Department of Community Affairs on September 5, 2000 (Homestead CP 2005).

Homestead has established an official zoning ordinance. One purpose of the ordinance is to conserve the value of buildings and encourage the most appropriate use of land within the incorporated area by designating specific uses of land, such as various residential and commercial designations (Homestead Code 2008). Homestead has undeveloped land designated for planned unit developments, which allows mixed uses including residential and commercial (Homestead Code 2008). In addition, mobile home parks are only permitted in areas zoned as residential mobile home (RMH), which total 88 acres in Homestead (Homestead Code 2008).

2.5.2.4.5 City of Florida City

Florida City is 8 miles west of the Turkey Point plant property (Section 2.1). It is bordered by unincorporated Miami-Dade County to the west and south, and shares a common border with Homestead to the north and east. Florida City consists of approximately 3.2 square miles. In 2005, there were 1126 acres of developed land and 837 acres of undeveloped or vacant land (Florida City EAR 2006). Specifically, the city has 66 acres of land under construction zoned for residential purposes, 6 acres under construction for commercial uses, and 255 acres of open land.

There are currently 1473 acres of urban or built up land, 266 acres of agricultural land, 60 acres of rangeland, 64 acres of upland forest, 47 acres of water, 95 acres of wetland, and 57 acres of transportation, communications, and utilities.

Florida City uses comprehensive planning as a means to direct development and redevelopment in a positive manner such that the community benefits and service levels are maximized. (Florida City EAR 2006). The city's comprehensive plan was adopted in 1991 with an evaluation and appraisal report completed in 1996. Another evaluation and appraisal report was completed in 2005 (Florida City EAR 2006).

Florida City has established zoning ordinances. One purpose of the ordinances is to encourage the most appropriate and convenient use of land in accordance with the adopted Comprehensive Development Master Plan and in the public interest (FCC 2008). Florida City has subdivision zoning codes that are intended to aid in coordinating land development in the community and to assist with implementing the master plan. (FCC 2008). In addition, mobile home parks are only permitted in areas zoned as R-T, which total 40 acres in Florida City (FCC 2008).

2.5.2.5 Aesthetics and Recreation

This subsection characterizes the visual aesthetics and recreational facilities and opportunities in the 50-mile region. Other aesthetics variables, including noise, odors, and vibrations, are discussed in Subsection 4.4.1.

2.5.2.5.1 Aesthetics

The Turkey Point plant property lies in an unincorporated area in Miami-Dade County, Florida, approximately 8 miles east of Florida City and 4.5 miles east of the southeastern municipal limits of Homestead. The Units 6 & 7 plant area is currently at an elevation of approximately –2.4 to 0.8 feet (NAVD 88). The topography of the area consists of flat mud lands and lies within the Floridian plateau. The Units 1 & 2 emissions stacks are the tallest structures on the property, approximately 400 feet tall.

There are some sensitive visual resources in the vicinity (within 6 miles) of the plant property. There are residential neighborhoods in Homestead. A portion of Biscayne National Park, including the visitor’s center, lies within 6 miles to the east. There is a municipally-owned recreational area in the plant area vicinity, Homestead Bayfront Park. In addition, a privately owned recreational venue, Homestead Miami Speedway, is approximately 5 miles northwest of the plant property. Although the topography surrounding the plant property is relatively flat and sparsely populated with trees, there is sufficient vegetation to screen the existing units from area roadways and recreational areas on land.

SW 344th Street/Palm Drive and SW 328th Street/N. Canal Street provide the best opportunity for the public to view the existing units from roadways. However, trees and scrub growth aid in screening the units, including the emissions stacks, from area roadways. Because of the vegetation, the existing units and emission stacks are not visible from most points in Biscayne National Park and Homestead Bayfront Park. The emission stacks may be visible from some upper level seats in the grand stand at the Homestead-Miami Speedway. The existing units are fully visible from Biscayne Bay.

Beyond the six mile radius, on land, the existing units are not visible and, therefore, have no visual aesthetics considerations. Over the waters in Biscayne Bay however, the units can be clearly seen. There are no facility-generated noises, odors, or vibrations experienced outside the boundaries of the plant property, and hence, no recreational venue in the vicinity, ROI, or fifty-mile region, is affected by these aesthetic variables.

2.5.2.5.2 Recreation

Public and private recreational opportunities and facilities abound in the region. The metropolitan character of south Florida, including Miami-Dade and Broward Counties, means there is a wide range of leisure choices. In addition, the area is a major recreation tourist destination. Monroe County, a portion of which is also within the region (Figure 2.1-4), is famous as the home of the Florida Keys. Recreational opportunities in the region include, but are not limited to, festivals, specialized tourist attractions (zoos, botanical gardens, art and cultural museums, etc), spectator sports, participatory sports, beaches, and parks. Select recreational opportunities in the region and more specifically in the cities of Homestead and Florida City are discussed below. Recreational areas in the vicinity are shown on Figure 2.5-19. Select recreational venues in the 50-mile radius are shown on Figure 2.5-20.

Festivals — The Region

Large and small municipalities and special interest organizations in the region host countless festivals throughout the year. Many reflect the region's rich cultural heritage. Among the two largest festivals in the region are the Italian Renaissance Festival in Miami, which drew 80,000 attendees in 2008 (SFS-S 2009) and the Orange Bowl Festival, also in Miami, which centers around the Orange Bowl football game on New Year's night.

Festivals — Homestead and Florida City

There are three major festivals in the Homestead and Florida City area. The Homestead Rodeo, "It's more than a sport … It's a lifestyle", is held each January. The 60th annual Rodeo in 2009 had approximately 27,500 spectators. The Annual Super Chili Bowl Cook-Off and Outhouse Race is held each February and draws about 2000 participants. The Dade County Farm Bureau Annual Barbeque and "Fun" Raiser is held in April and draws 1200 participants.

Specialized Attractions — The Region

The region has several popular specialized attractions that provide a recreational outlet. Among the more popular attractions, in terms of attendance, is the Miami Seaquarium which has more than 300,000 guests a year and the Miami MetroZoo with 750,000 visitors a year. The region also has the largest botanical garden in the continental United States, the Fairchild Tropical Garden, in Coral Gables.

There are many venues for concerts and theatrical performances in the region. There are also large libraries, historical museums, memorials, and several regional museums and galleries which reflect the varied culture of the region.

Specialized Attractions — Homestead and Florida City

Homestead has several popular specialized attractions that provide recreational opportunities. The Everglades Alligator Farm in Homestead is home to almost 3000 alligators as well as local and exotic snakes. Homestead is also the home of the Fruit and Spice Park, the only one of its kind in the USA which features over 500 varieties of fruits, herbs, spices, and nuts (DoT 2008). In addition, Coral Castle is a park that consists of over 1,100 tons of carved coral rock built by one man over a thirty-year period. Also known as Rock Gate, Coral Castle is listed on the National Register of Historic Places (AM 2009).

Recreational Sports for the Spectator — The Region

The region offers a variety of spectator sports at both the professional and collegiate level. The Miami Dolphins of the National Football League play their home games in Sunlife Stadium (aka Pro Player Dolphin Stadium, Miami Gardens Stadium) which is also home to the University of Miami Hurricanes. The stadium seats 75,540 for football and soccer and 38,560 for baseball (DS 2009). The American Airlines Arena houses the professional basketball team, the Miami Heat. The arena seats approximately 20,000 for basketball (AAA 2009). The Florida Panthers of the National Hockey League play at the BankAtlantic Center, which seats 19,250 (FPT 2009). The Florida International University Golden Panthers play at the Golden Panther Arena which has seating capacity of approximately 5000 (FIU 2009). The Miami Marlins major league baseball team is now playing at the new Marlins Park, a natural grass playing field with 37,000 seats (MM 2012).

Popular spectator sports in the area are horse and auto racing. Calder Race Course in Miami offers thoroughbred racing. Calder Race Course had a 2006 track attendance of 690,270. Other spectator sports include golf tournaments, greyhound races, horse shows, regattas, soccer matches, and tennis tournaments.

Recreational Sports for the Spectator — Homestead and Florida City

One of the region’s major sporting events is the Grand Prix of Miami, which draws an estimated 85,000 over three days (Miami Today 2003) is held at the Homestead Miami Speedway in Homestead. The Speedway is approximately 5 miles from the Units 6 & 7 plant area. The grandstand seats 65,000 spectators. The Speedway hosts race car and motorcycle events throughout the year (HMS 2008).

Recreational Sports for the Participant — The Region

A complete range of outdoor sports activities is available year-round in the region at numerous public and private facilities. Within the region, Miami-Dade County offers more than 20 public golf courses. Nearly 500 tennis courts for day and evening play are located in many parks and recreation areas throughout the region; in addition, most hotels have their own tennis facilities. There are opportunities to participate in water sports including scuba and skin diving, snorkeling, windsurfing, waterskiing, and recreational boating in the region’s lakes, rivers and in Biscayne Bay. Fishing is popular. A fresh water fishing license is required for anyone between the ages of 15 and 65 years. No license is required for salt water fishing, but minimum size and bag limits apply (FWC 2008). In addition, there are many opportunities for camping.

The Florida Keys are also known for sport fishing (fishing tournaments and angling opportunities), boating, sailing, kayaking, and ecotours (FK 2009).

Recreational Sports for the Participant — Homestead and Florida City

Participatory recreational opportunities in the Homestead and Florida City area are available in the area's two dozen municipal parks. These parks are described below in "Parks-Homestead and Florida City."

Beaches — The Region

There are 21 public beaches in Miami-Dade County alone. There are five public beaches in Broward County. Virtually all of the residents of Monroe County within the region live in the Keys and have ocean access. There are five public beaches in Monroe County that are within the 50-mile region. (CTG 2009)

Beaches — Homestead and Florida City

Homestead Bayfront Park has a public beach. The park offers picnic tables and barbeque grills, shelters, food/drink concession stands, restrooms and showers, and fishing (CTG 2009). The Homestead Bayfront Park is located next to Biscayne National Park which offers a beach, fishing, picnic areas, and a playground (FNAI 2008). The Biscayne National Park entrance is approximately 3 miles north of the plant property.

Parks (National, National Wildlife Refuges, and State Parks) — The Region

There are eight federal, state, and privately managed, wildlife management areas, preserves, national wildlife refuges, and sanctuaries within 50 miles of Units 6 & 7 (Figure 2.5-20). Tables 2.5-29 and 2.5-30 list locations, acreages, and other information for these facilities located within the 50-mile region.

Big Cypress National Preserve consists of 720,561 acres of swamp (FNAI 2008). The park offers hiking, hunting, and off-road vehicle use. Everglades National Park is primarily comprised of internationally important wetlands that are home to rare and endangered species such as the American crocodile, Florida panther, and West Indian manatee (NPS 2008b). The park covers 1,508,533 acres (FNAI 2008). In August 2010, the South Florida Water Management District took ownership of 26,800 acres of land formerly owned by United States Sugar Corporation and preserved the option to acquire 153,200 acres of additional land (SFWMD 2011). Also, the National Park Service is evaluating the possible acquisition of 320 acres within the park "expansion area" (The Everglades National Park Protection and Expansion Act of 1989) from FPL (NPS 2011). Recreational opportunities in the park include camping, hiking, boating, and wildlife viewing.

There are 11 state parks within 50 miles of Turkey Point. These parks offer an array of activities such as camping, fishing, hiking, wildlife viewing, scuba diving, snorkeling, boating, picnicking, and historic lighthouse tours. Table 2.5-30 lists the park's distance from Units 6 & 7 to the various state parks and other information.

Among the more visited parks managed by the state or the U.S. Park Service in the region are Bill Baggs Cape Florida State Park, John Pennekamp Coral Reef State Park, John U. Lloyd Beach State Park, Oleta River State Park, Big Cypress National Preserve, and Everglades National Park. Bill Baggs Cape Florida State Park is the home of the oldest standing structure in Miami-Dade County, a lighthouse. Visitors come to the park to sunbathe, swim, bike, kayak, fish and picnic on over a mile of Atlantic beachfront. (FPS 2008). John Pennekamp Coral Reef State Park near Key Largo in the Florida Keys has the only living coral reef in the United States. Visitors to the park can swim, snorkel, surf fish, canoe, and scuba dive (FPS 2008).

Parks (National, National Wildlife Refuges, and State Parks) — Homestead and Florida City

The Biscayne National Park visitor's center is approximately 3 miles north of Units 6 & 7. Biscayne National Park protects a "rare combination of aquamarine waters, emerald islands, and fish-bejeweled coral reefs" (NPS 2008a). It covers an area of approximately 173,000 acres, 95 percent of which is water (FNAI 2008). Visitors can view wildlife, snorkel, scuba dive, canoe, camp, hike, and fish.

There are no state-owned recreational properties within 6 miles of the Units 6 & 7 plant area.

Parks (County, Local, Municipal) — The Region

There are over 400 county and local parks within the 50-mile region. Among the recreational activities that can be pursued in many of the parks are picnicking, canoeing, boating, hiking, camping, fishing, swimming, basketball, softball, handball, racquetball, and bike trails.

Parks (County, Local, Municipal) — Homestead and Florida City

The city of Homestead has 16 community, municipal, neighborhood, or special use parks (CHF 2012) and Florida City has 5 city parks (Iler Planning Group 2005). Among the recreational activities that can be pursued in many of the parks are picnicking, canoeing, boating, hiking, camping, fishing, swimming, basketball, softball, handball, racquetball, and bike trails.

2.5.2.6 Housing

Within Miami-Dade County, residential areas are found in cities, towns, smaller communities, and in the unincorporated portions of the county. Most of the housing is concentrated in the municipalities throughout the county, including the Homestead and Florida City area. The residential distribution of current Turkey Point employees is presented in Subsection 2.5.1 and Table 2.5-3. Approximately 43 percent of the current Turkey Point workers live in the Homestead and Florida City area. An additional 40 percent of the current workforce lives outside the

Homestead and Florida City area, but within Miami-Dade County, primarily in Miami. The ROI is densely populated and residential clusters abound in the many incorporated and unincorporated communities.

2.5.2.6.1 Permanent Housing

Table 2.5-31 provides information about housing units and housing characteristics for Miami-Dade County for 2000 and 2005-2009. In 2005-2009, there were 962,935 total housing units in the ROI, an increase of 13 percent or 110,657 units since 2000. Of the occupied units in 2005-2009, 482,841 (58 percent) were owner-occupied and 345,090 (42 percent) were renter-occupied. For the ROI in 2005-2009, the vacancy rate of the owner-occupied units was 3.7 percent, and the vacancy rate for the renter-occupied units was 8.0 percent. Rental units include housing such as single-family units, multifamily units, apartments, or mobile homes that, if occupied are not owner-occupied, and if vacant are “for rent.” In 2009, 368,533 single-family homes were located in Miami-Dade County. The mean construction date of these units is 1973. A large concentration of condominiums, 345,654 units (22 percent of the state of Florida) was located in Miami-Dade County in 2009 (UF 2010).

Of the 852,278 total units within the ROI in 2000, approximately 9 percent (75,504 units) were vacant (USCB 2008). However, of the 962,935 total units within the ROI in 2005-2009, 14 percent (135,004 units) were vacant. In 2009, 42 percent of the condominiums in Miami-Dade County were owner-occupied (UF 2010).

Of the occupied units, approximately 42 percent were rental units in 2005-2009, the same percentage as in 2000. In 2000, the majority of rental units in the ROI had a monthly rental rate below $750 with a median rent of $647 per month. The median monthly rate increased to $965 in 2005-2009 (dollars are not adjusted for inflation). Of the 852,278 housing units in Miami-Dade County in 2000, 15,338 were mobile homes, approximately 1.8 percent of the county’s housing units (USCB 2000b). Within Miami-Dade County in 2005-2009, there were 15,085 mobile homes. This is a 1.6 percent decrease in the number of mobile homes since 2000.

Housing characteristics in the Homestead and Florida City area are detailed in Table 2.5-32. In 2005-2009, 23,994 housing units were located in the Homestead and Florida City area. Approximately 17 percent (4,046) of these units were vacant. Approximately 57 percent of the occupied units are rental units. In August 1992, Hurricane Andrew hit Miami-Dade County, devastating areas in the southern portion of the county, particularly the Homestead and Florida City area. In 2000, there were 335 mobile homes in the Homestead and Florida City area; however, in 1990, there were 929 mobile homes in this same area, indicating a decrease of 64 percent of the mobile home stock in the decade that experienced Hurricane Andrew (USCB 1990).

There were 12,637 building permits for privately owned residential units (single and multifamily units) were issued in the Homestead and Florida City area from 2001 to 2010, nearly doubling the area's 2000 total housing inventory. There were 128,120 permits issued in Miami-Dade County for 2001–2010 (Table 2.5-33).

The median value of homes in Miami-Dade County increased from 2000 to 2005-2009. In 2005-2009, the largest portion of the owner-occupied housing inventory in Miami-Dade County was valued in the range of $300,000 to $499,999. In 2005-2009, approximately 28 percent of the owner-occupied housing in the county was valued at less than $199,999 (USCB 2000b). In 2000, the median value of an owner-occupied house was $124,000 (USCB 2010b). In 2005-2009, the median value of an owner-occupied house was $277,200 (USCB 2010b). This is an increase of 124 percent for the 2000 to 2005-2009 period.

The median value for an owner-occupied home in Homestead was $88,200 in 2000, and the median value for a owner-occupied home in Florida City was $70,200 (USCB 2000b). As shown in Table 2.5-32, the median value of an owner-occupied house was $216,500 in Homestead and $171,300 in Florida City in 2005-2009. These values reflect an increase of 145 percent and 144 percent respectively of the 2000 values.

2.5.2.6.2 Seasonal Housing

The U.S. Census Bureau defines seasonal housing as a housing unit held for occupancy only during limited portions of the year; such as a weekend home, winter residences, beach cottage, ski cabin, or a time-share condominium.

In 2010, there were 38,302 housing units for seasonal, recreational, or occasional use in Miami-Dade County (Table 2.5-31). Seasonal housing is a part of an area's "vacant housing." Of those housing units for seasonal, recreational, or occasional use in the ROI, 175 were in the Homestead and Florida City area (Table 2.5-32).

2.5.2.6.3 Recreational Vehicle Parks with Hookups

There are at least nine recreational vehicle parks or campgrounds in Miami-Dade County. These identified parks and campgrounds have 1587 spaces with full hookups for private recreational vehicles in the ROI. Approximately 68 percent of these spaces are in the Homestead and Florida City area (Table 2.5-34). Because most of the recreational vehicle parks are privately owned, the average yearly capacity was not available.

2.5.2.6.4 Hotels and Motels

In 2011, there were approximately 361 hotels/motels with 47,642 rooms available in the ROI (Table 2.5-35). In the South Dade region, which includes the Homestead and Florida City area, 27 hotels/motels with approximately 1928 rooms were available in 2011.

Because many areas of Miami-Dade County are tourist attractions, the room rates and the occupancy rates vary in different regions of the county during different seasons of the year. The room rates in December 2011 ranged from $75.76 per night in South Dade to $206.54 per night in Miami Beach (GMCVB 2012).

2.5.2.7 Public Services and Community Infrastructure

Public services and community infrastructure include public water supply and wastewater treatment systems, law enforcement and fire departments, medical facilities, and schools. Schools are described in Subsection 2.5.2.8. The other services and infrastructures are described below.

2.5.2.7.1 Public Water Supply and Wastewater Treatment Systems

As described in Subsection 2.5.2, the ROI consist of Miami-Dade County. Since 43 percent of the current Turkey Point workforce reside in the Homestead and Florida City area, the description of public services and community infrastructure details this area in addition to the ROI. Table 2.5-36 details major public water suppliers in the county, their rated capacities, and their daily average annual flow measured in 2005. Table 2.5-38 details wastewater treatment facilities in the county. The public water suppliers and the wastewater treatment facilities in the Homestead and Florida City area are included in the table. Currently, there is sufficient water supply for peak demand in all of the major water supply facilities and in most of the wastewater treatment facilities. The water supply facilities that serve the Homestead and Florida City area have excess production capacity, as does the wastewater facility that serves Florida City.

2.5.2.7.1.1 Public Water Supply

The Florida Department of Environmental Protection (FDEP) is involved in managing the quality and quantity of water through its relationship with the state's five water management districts; Northwest Florida Water Management District, Suwannee River Water Management District, St. Johns River Water Management District, South Florida Water Management District (SFWMD), and Southwest Florida Water Management District (FDEP 2008) (Figure 2.5-21).

The South Florida Water Management District (SFWMD) is a regional governmental agency that oversees the water resources in the southern half of Florida, covering 16 counties from Orlando to the Florida Keys and serving a population of 7.5 million residents. It is the largest of Florida's five water management districts and is responsible for water supply planning for each region within its jurisdiction. SFWMD's mission is to manage and protect water resources of the region by balancing and improving water quality, flood control, natural systems and water supply.

The SFWMD serves local governments by supporting efforts to safeguard existing natural resources and meet future water demands through one of the four water supply planning areas. The four water supply planning areas are the Upper East Coast, the Lower East Coast, the Lower West Coast, and the Kissimmee Basin. The planning areas are generally defined by the drainage divides of major surface water systems in South Florida. The Lower East Coast (LEC) Planning Area of the SFWMD encompasses approximately 6100 square miles that includes all of Miami-Dade, Broward and Palm Beach Counties, most of Monroe County, and the eastern portions of Hendry and Collier Counties. The SFWMD, through the LEC planning area, provides regional oversight to these specific counties for water demand projections, assessment of existing and projected resource conditions, and formulation of strategies to meet urban, agricultural and environmental water needs (SFWMD 2005).

Miami-Dade County is one of ten counties in the LEC planning area. Miami-Dade County's water is provided by five suppliers: the Miami-Dade Water and Sewer Department, the city of North Miami, the city of North Miami Beach, the city of Homestead and the city of Florida City. The Miami-Dade Water and Sewer Department (MDWASD) provides drinking water to approximately two million customers in Miami-Dade County (Figure 2.5-22) and draws drinking water from the Biscayne Aquifer. The MDWASD is composed of three water treatment facilities: the Hialeah-Preston Water and Sewer Department (WASD), serving the northern part of Miami-Dade County, the Alexander Orr, Jr. WASD, serving the central and portions of the southern part of Miami-Dade County and the South Dade WASD, serving the southern part of Miami-Dade County. The MDWASD has plans for the construction and operation of the South Miami Heights (SMH) Water Treatment Plant in the South Dade area, which is scheduled to come online in 2012. The MDWASD has a 20 year water use permit issued by the SFWMD which limits its annual allocation to 149,106 million gallons and its monthly maximum allocation to 13,047 million gallons (SFWMD 2010). These allocations are further limited by a wellfield operational plan, described in Limiting Condition 27 of the water use permit (MDWASD 2008).

The city of North Miami supplies water within its municipal boundary as well as outside of its municipal boundary to certain northern parts of unincorporated Miami-Dade County. The city of North Miami Beach supplies water within its municipal boundary as well as outside its municipal boundaries to certain northern parts of unincorporated Miami-Dade County. The city of Homestead provides water within its municipal boundary and for a portion of unincorporated Miami-Dade County, including the Redavo development, from 6 city-owned withdrawal wells. The city of Homestead also has an agreement with the MDWASD to provide some water service within portions of Homestead municipal boundary. Florida City also provides water to portions of unincorporated Miami-Dade County as a water supplier. Florida City provides water service within its incorporated boundaries from 4 production wells (MDWASD 2008).

In 2007, the total daily average demand of water supplied by these five major suppliers in Miami-Dade County was 398.03 million gallons per day (MGD) or 74.74 percent of total capacity (Table 2.5-36).

Demand, Supply, Additional Water Needs, and Water Management Strategies

In 2005, the SFWMD analyzed projected use by type. In this study, the county's total water demand was projected to increase by 33 percent, from 526.22 mgd in 2005 to 699.9 mgd in 2025 (Table 2.5-37). Thermoelectric power use accounted for the largest increase of projected demand through 2025. Municipal demand was projected to experience an increase by approximately 27 percent over the same period, from 380.92 mgd to 483.10 mgd. Agricultural irrigation self-supplied demand was expected to decline by 2.70 percent, from 92.7 mgd to 90.2 mgd. Thermoelectric power self supplied demand will increase 3224 percent from 2.1 mgd to 69.8 mgd (SFWMD 2005).

The two water systems in the Homestead and Florida City area currently have a combined facility capacity of 20.90 mgd. The total population served by both Homestead and Florida City water systems is estimated to increase from 57,951 in 2005 to 110,278 in 2025 (SFWMD 2005). This would be an estimated 90 percent increase in population since 2005. The projected water demands in 2025 for both the Homestead and Florida water systems are estimated to exceed the current rated capacity of these systems. The projected finished water demand in 2025 for the Homestead water system would be 122 percent of the current rated capacity. The projected finished water demand in 2025 for the Florida City water system would be 104 percent of the current rated capacity (SFWMD 2005).

The major water supply source for all of the existing water treatment systems in Miami-Dade County is from the surficial (also known as Biscayne) and Floridan aquifers (MDWASD 2008). While the Biscayne aquifer is highly productive with high-quality freshwater in some areas of the county (in the vicinity of the Turkey Point plant property, the water is saline, see Subsection 2.3.3), it is generally shallow, located within 200 feet of ground surface, and is connected to surface water systems, including canals, lakes, and wetlands (SFWMD 2005).

Groundwater from the Floridan aquifer is used to blend brackish and fresh water at water treatment plants in order to extend the water supply. Alexander Orr water treatment plant is currently using this process. Blending of groundwater from the Floridan aquifer is also proposed at the Hialeah Preston water treatment plant. The design capacity of the Hialeah Preston Upper Floridan aquifer wells is 12.50 mgd with a total designed installed capacity of 295 mgd, and is proposed to be operational by 2010 (MDWASD 2008).

The SFWMD, local governments, and utilities have been working closely with the Florida Department of Community Affairs to project water demands and propose viable alternative water supply projects. Water management strategies for the Miami-Dade county plan include, but are not limited to, a more coordinated use of conservation and alternative water supply projects, such as reverse osmosis plants, and reclaimed water systems. In total, these strategies could provide 98.3 mgd of additional water supply to Miami-Dade County by the year 2025, at a total capital cost of approximately $989,460,000 (SFWMD 2005).

In 2010, the SFWMD approved the renewal and modification of a water use permit for the public water supply for the MDWASD service area serving 2,787,451 persons in the year 2030. Modifications were recommended for several well fields and the delay of timelines for two projects (Hialeah Reverse Osmosis plant and South Miami Heights WTP). Also included were allocation changes to decrease the yearly raw water supply system allocation from 152,741 million gallons to 149,106 million gallons to meet the water supply needs through 2030.

2.5.2.7.1.2 Wastewater Treatment Systems

Wastewater is the spent or used water from homes, communities, farms, and businesses. Wastewater includes both domestic sewage and industrial waste from manufacturing sources. Wastewater treatment in the region is provided by local jurisdictions and primarily regulated by the FDEP. Wastewater treatment capacity depends on two factors: water supply and the availability of infrastructure. There is currently excess capacity in most of the wastewater treatment systems within Miami-Dade County.

Capacity for Wastewater Treatment

Table 2.5-38 details public wastewater treatment facilities located within the ROI, the average annual flow rates reported for May 2007 through April 2008, the permitted capacity, and their flow as a percent of the design capacity.

Infrastructure for Wastewater Treatment

In the event that capacity limits may be approached or exceeded, Florida Administrative Code Section 62-600.405 directs that:

> "When the three-month average daily flow for the most recent three consecutive months exceeds 50 percent of the permitted capacity of the treatment plant or reuse and disposal systems, the permittee shall submit to the Department a capacity analysis report. [Section 62-600.405(3)]"

An evaluation of the data listed in Table 2.5-38 indicates that the wastewater systems for the city of Homestead, MDWASD South District, MDWASD North District, and MDWASD Central District are in excess of the 50 percent flow value described above.

Currently, Homestead wastewater treatment plant uses the MDWASD system as backup and excess flows are diverted to the county wastewater treatment facilities. These excess flows are included in the South District water treatment plant flows reports.

The wastewater treatment facility for Homestead currently shows 102 percent capacity; however, the city's proposed 10-Year Water Supply Facilities Work Plan identifies and details the construction of a 3.45 mgd high level disinfectant wastewater treatment plant upgrade. The proposed expanded wastewater treatment plant will have the capacity to handle 9.45 mgd, which will provide enough capacity through at least 2030.

The wastewater created in Miami-Dade County is either treated at the public wastewater treatment facilities listed in Table 2.5-38, or is handled by privately owned and operated septic systems. These septic systems are likely to be found in unincorporated areas of Miami-Dade County.

MDWASD handles Florida City's wastewater and they are currently below the design capacity. Capacity modifications are the responsibility of MDWASD.

2.5.2.7.2 Law Enforcement, Fire, and Emergency Management

Law Enforcement

The Miami-Dade County police department serves the entire county including all the municipalities. However, each incorporated city is also served by their own police department as in Homestead and Florida City under the Miami-Dade County Police Department.

In 2010, 2980 officers were employed in the Miami-Dade County Police Department. Law enforcement in the Homestead and Florida City area is served through the Miami-Dade County Police Department.

In 2010, 135 officers were employed in the Homestead and Florida City areas police departments. Table 2.5-39 summarizes the number of law enforcement personnel in Miami-Dade County, Homestead, and Florida City.

Fire

Table 2.5-40 provides fire protection personnel data for the departments in Miami-Dade County as of 2010. All of the firefighters in these departments, with the exception of those serving the Everglades National Park, are active, career firefighters.

The Homestead and Florida City area is served by the Miami-Dade County Fire and Rescue. As of 2010, approximately 2070 firefighters were active throughout 65 fire stations located in the Homestead and Florida City service area.

The public protection classification system is a national system used by the insurance services office to reflect a community's local fire protection for property insurance rating purposes. The insurance services office is an advisory organization that serves the property and casualty insurance industry by providing inspection services, insurance coverage for development, and statistical services. The public fire protection of a city, town, or area is graded using the insurance services office fire suppression rating schedule. The insurance services office classifies communities from 1 (the most preferred) to 10 (the least preferred). Communities are graded on water distribution, fire department equipment and manpower, and fire alarm facilities, among other things. The overall public protection classification rating for Miami-Dade County is 4. The overall public protection classification for Homestead and Florida City was 4.

2.5.2.7.3 Medical

Table 2.5-41 presents hospital use data in Miami-Dade County. Miami-Dade County has 10,497 physicians (AMA 2011), 31 hospitals, 8420 staffed beds, and a hospital census (the average number of in-patients receiving care each day) of 4010 (AHA 2006).

A majority (23) of the hospitals located within the ROI are classified as "General and Surgical" hospitals. Three hospitals are listed as certified trauma centers (Shands at University of Florida, Jackson Memorial Hospital, and Miami Children's Hospital). Four hospitals are listed as rehabilitation, while two are long-term acute care, one is children's general, one is eye, ear, nose and throat, and one other specialty hospital.

2.5.2.8 Education

2.5.2.8.1 Public Schools — Pre-Kindergarten through 12

This subsection describes the enrollment, capacity, and facilities of public schools in the ROI. The state of Florida divides the school districts by county. The Miami-Dade County Public School District (M-DCPS) covers all of the ROI and is ranked fourth largest in student population among school districts in the United States (M-DCPS 2011a). M-DCPS is further divided into five regional centers and nine districts. The Homestead and Florida City area is a part of District IX.

The Florida Legislature enacted the FEFP and equalized funding to guarantee each student receives the same programs and services regardless of geographical and local economic differences. Subsection 2.5.2.3 describes school revenue sources and other fiscal issues.

Miami-Dade County Public School District

The M-DCPS has a total of 435 schools (M-DCPS 2011a). There are 213 elementary schools, 79 middle schools, 46 K-8 schools, 68 high schools, 24 alternate or special schools, and 5 combined schools (M-DCPS 2011a). For the school year 2010-2011, M-DCPS had a kindergarten through Grade 12 total enrollment of 347,133 students. This is an approximately 4 percent decrease from the 2005-2006 school enrollments. Student enrollment has consistently decreased since 2001-2002 with the exception of 2009-2010 when there was a very small increase from 2008-2009 (M-DCPS 2011a). In the school year 2006-2007, the district relied on 2193 portable units to handle excess student enrollment (M-DCPS 2007). The district has construction and expansion projects underway for an additional 13,746 student stations to accommodate enrollment with a completion date of 2015-2016. Table 2.5-42 lists the various projects and capacities. Of the student population in M-DCPS, 91.4 percent are racial and/or ethnic minorities. Students enrolled in the English for Speakers of Other Languages Program totaled 62,838 (18.1 percent of the 2010-2011 enrollments) (M-DCPS 2011a).

All publicly funded Florida pre-kindergarten through Grade 12 schools are required to meet Florida Department of Education (FDOE)-mandated average student class size. The mandated class sizes vary depending on the grade level: Pre-kindergarten through grade 3 = 18 students, Grades 4 through 8 = 22 students, and Grades 9 through 12 = 25 students by the 2010-2011 school year (FDOE 2002). The M-DCPS class size for the 2010–2011 school year for kindergarten through Grade 3 was 13.9, Grades 4 through 8 was 16.6, and Grades 9 through 12 was 20.2 (FDOE 2012). Therefore, M-DCPS met the state-mandated average classroom size for all grades.

Homestead and Florida City Area

Approximately 43 percent of the current Turkey Point workforce resides within the Homestead and Florida City area. Therefore, special focus has been given to the schools within District IX which includes the Homestead and Florida City area. District IX has 76 schools. For the 2010-2011 year, the public schools in the Homestead and Florida City area had an enrollment of 55,860 students (M-DCPS 2011a). Recent initiatives within the Miami Dade County Public School system have eliminated overcrowding in the Homestead and Florida City area (M-DCPS 2008).

2.5.2.8.2 Private Schools – Pre-Kindergarten through 12

Miami-Dade County

In the 2009-2010 school year, Miami-Dade County had a total of 301 private schools (NCES 2012b), which includes all grade levels from pre-kindergarten through 12. In that same school year, the private schools in Miami-Dade county had a total enrollment of 61,161 (NCES 2012b). Capacity levels are not available.

Homestead and Florida City

In the 2009-2010 school year, the Homestead and Florida City area had a total of 16 private schools (NCES 2012b), which include all grade levels from pre-kindergarten through 12. In the same school year, the private schools in the Homestead and Florida City area had a total enrollment of 2263 (NCES 2012b). Capacity levels are not available.

2.5.2.8.3 Post-Secondary Institutions

There are 12 colleges or universities that are accredited by the Southern Association of Colleges and Schools (SACS) to award various certificates and degrees ranging from associate to doctoral. There are also a large number of vocational schools that offer professional and paraprofessional training within 50 miles of Units 6 & 7. Table 2.5-43 lists the colleges' distance from Homestead, type of college, awards offered, and the 2007 student enrollment.

2.5.3 HISTORIC PROPERTIES

2.5.3.1 Applicable Federal, State, and Local Historic Preservation Regulations

Because the NRC, a federal agency, would issue the combined licenses for Units 6 & 7, the project is subject to review and consultation under the *National Historic Preservation Act* (16 U.S.C. § 470 et seq.). In particular, Section 106 of the Act applies, along with the section's implementing regulations, 36 CFR Part 800, which direct the lead federal agency to consider the potential effects of proposed projects on historic properties and to enact measures to avoid, reduce, or mitigate those effects. This regulation applies to historic properties, which are those cultural resources determined potentially eligible or eligible for listing on the National Register of Historic Places.

The state of Florida's Statutes, Title XVIII, Chapter 267, *Historical Resources*, provides Florida's state policy regarding historical resources, and outlines the role of the Division of Historical Resources. Florida Statutes, Title XLVI, Chapter 872, *Offenses Concerning Dead Bodies and Graves*, Section 5, *Unmarked Human Burials*, addresses the protection and treatment of human remains and associated burial artifacts found on public or private lands, including submerged lands.

The *Metropolitan Miami-Dade County Historic Preservation Ordinance* (Miami-Dade County Ordinance 81-13 Chapter 16-A) was adopted to ensure the protection, enhancement, and perpetuation of properties of historical, cultural, archaeological, paleontological, aesthetic, and architectural merit that represent distinctive elements of the county's cultural, social, economic, political, scientific, religious, prehistoric, and architectural history. It applies to all incorporated and unincorporated parts of the county, except for municipalities that enact their own ordinance that is at least as prescriptive as the county ordinance. The ordinance establishes the Miami-Dade

County, Office of Planning and Zoning, Office of Historic Preservation and its Historic Preservation Board. The board designates important properties and archaeological and paleontological zones, and if projects are proposed that will affect those properties or zones, the project cannot go forward without a board-issued certificate of appropriateness or certificate to dig.

The city of Homestead is the only certified local government with an historic preservation ordinance in the project area. The city of Homestead enacted its own *Historic Preservation Ordinance* 2005-11-37. Very similar to the county ordinance, the Homestead ordinance establishes the Homestead Historic Preservation Board, which designates historical, archaeological, or architectural properties of merit and issues certificates of appropriateness for any projects that could affect designated properties.

2.5.3.2 Consultation with the Florida Division of Historical Resources

FPL initiated consultation by letter with the Florida Division of Historical Resources, the executive director of which is the State Historic Preservation Officer (SHPO), for the proposed project. FPL has submitted survey reports and work plans to the SHPO (FPL 2009a, FPL 2009b, FPL 2009c, and FPL 2009d) for consultation on the Site and associated non-linear facilities, as detailed in Subsection 2.5.3.3.1, and received concurrence from the SHPO on the recommendations made by FPL in the work plans. FPL will continue consultation with the SHPO in accordance with Section 106 of the National Historic Preservation Act for the offsite linear facilities, as described in Subsection 2.5.3.3.2. Results of continued SHPO consultation, including reports of surveys and investigations, and all original and current correspondence between FPL and SHPO is contained in Appendix 2.5A. Future correspondence will be provided to the NRC.

2.5.3.3 Cultural Resource Reports and Work Plans

FPL has prepared and submitted several reports and work plans to the SHPO, including the following:

- *Cultural Resource Assessment Survey for the Turkey Point Units 6 & 7 Site, Associated Non-Linear Facilities, and Spoils Area on Plant Property* (FPL 2009a).
- *Cultural Resource Assessment Survey Work Plan for the Turkey Point Units 6 & 7 Site and Associated Non-Linear Facilities* (FPL 2009b).
- *Preliminary Cultural Resources Report for the Turkey Point Units 6 & 7 Associated Linear Facilities* (FPL 2009c).
- *Cultural Resource Assessment Survey Work Plan for the Turkey Point Units 6 & 7 Associated Linear Facilities* (FPL 2009d).

All cultural resource work plans and reports were conducted and prepared by personnel who meet or exceed the professional qualifications as stipulated in the *Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation* (36 CFR Part 61) (48FR44716-44742).

The results of these reports, contents of the work plans, recommendations for further work, and SHPO correspondence are discussed in the following paragraphs.

2.5.3.3.1 Units 6 & 7 Site and Associated Non-Linear Facilities

A Cultural Resource Assessment Survey (FPL 2009a) of the Site and associated non-linear facilities was prepared by FPL and submitted in June 2009 as part of the Turkey Point Units 6 & 7 Site Certification Application (FPL 2009e). This survey addressed the potential for historic properties within the following potentially impacted areas:

- Turkey Point Units 6 & 7 Site
- Nuclear Administration Building, Training Building and Parking Area
- Radial Collector Wells
- FPL Reclaimed Water Treatment Facility and Delivery Pipelines to the Plant Area
- FPL-Owned Fill Source
- Equipment Barge Unloading Area
- Heavy Haul Road on Plant Property
- Spoils Areas on Plant Property

The locations of these areas are depicted in Figure 3.9-1.

The Areas of Potential Effects (APEs) for the historic resources survey considered direct as well as secondary or indirect effects. The APE for direct effects included areas within the footprints of the Site and associated non-linear facilities. The APE for potential indirect effects is defined as the area within which potential visual, audible, or atmospheric impacts from the improvements could be observed. The highest proposed structure will be 400 feet tall, which will not exceed the current height of the structures associated with the existing units. Also considered is the relatively flat topography and the undeveloped character of the surrounding area. Based on these factors, an indirect effects APE of one-half mile from the proposed site was recommended.

The survey (FPL 2009a) included a review of Pre-Contact and Historic cultural history; an environmental overview; a description of land use history, including research from Government Land Office historic plat maps and historic aerial photographs of the area; and the results of background research into previously recorded cultural resources. The background research included a search of the Florida Master Site File and review of Miami-Dade County and local inventories. No previously recorded properties or locally-designated sites are located within or adjacent to (within 100 feet) of the APEs, and research determined that, prior to 1963, the area surrounding the site was undeveloped.

A pedestrian survey and subsurface shovel testing were conducted during the months of October 2008, December 2008, March 2009, and April 2009. A total of 21 shovel tests were judgmentally excavated in the following areas: two within the Site, four within the radial collector well area, five within the FPL reclaimed water treatment facility area, and 10 within the FPL-owned fill source area. These subsurface tests resulted in stratigraphic sequences consistent with land modification, disturbance, and inundation. No artifacts, features, or cultural material were identified in any of the shovel tests conducted during the survey. The field investigations confirmed that the locations of the Site and associated non-linear facilities have a low probability for archaeological sites. The results of the field investigations are detailed below.

Site

The area along the southern edge of the Site was examined to determine whether any remnants of a possible hammock, as suggested by the historic plat map, existed. The survey confirmed that this area consisted of a spoil pile from the canal bordering the property to the south. An area of slightly higher elevation on the spoil pile appeared to be in the approximate location of the possible hammock. A shovel test was excavated in that location and revealed that the strata consisted of 30 cm of spoil overlying black peat. Water was encountered at 60 cm below the surface. A second shovel test was excavated to the north of the spoil pile in an area containing mangroves. This shovel test consisted of brown muck and water, which was evident at the surface. The remainder of the Site consisted of mudflats, some of which were too low or unstable to walk on or through. The mudflats are frequently inundated and have been impacted by flooding and hurricanes over the years.

Nuclear Administration Building, Training Building and Parking Area

The nuclear administration building, training building and parking area are located within the plant property in an area dominated by mangrove and coastal plain willow. This area is considered to have a low probability for archaeological sites. Given the wet environmental conditions, the results of the survey, and the lack of previously recorded sites within or adjacent to the Turkey Point plant property and the Everglades Mitigation Bank, subsurface testing was not deemed necessary.

Radial Collector Wells

Four test excavations conducted within the radial collector well corridor demonstrated an average 40 cm deposit of limestone fill before the shovel test was inundated with groundwater, indicating that this area is man-made land.

FPL Reclaimed Water Treatment Facility and Delivery Pipelines to the Plant Area

The area proposed for the FPL reclaimed water treatment facility consisted of dwarf mangroves and sawgrass with clusters of Australian pines. One of the Australian pine clusters was tested and showed a black muck to a depth of about 40 cm underlain by water. A line of five shovel tests was placed running along the northern area resulting in a white-ashy muck to a grayish brown colored muck and water was encountered very close to the surface.

The delivery pipeline to the plant follows an existing access road south of the facility; crosses fill areas and roadways and goes underneath the existing discharge canal before ending at the southwest portion of the Site. This area is considered to have a low probability for archaeological sites. Given the existing conditions, the results of the survey, and the lack of previously recorded sites within or adjacent to the Turkey Point plant property and the Everglades Mitigation Bank, subsurface testing was not deemed necessary.

FPL-Owned Fill Source

Archaeological testing within the FPL-owned fill source revealed gray brown loamy clay, which ranged in depth from approximately 10 to 30 cm below the surface, over limerock. No archaeological material was identified.

Equipment Barge Unloading Area

The equipment barge unloading area is located within the plant property to the north of the Site in land currently classified as electric power facilities. A portion of the existing barge unloading area will be expanded. This area is considered to have a low probability for archaeological sites. Given the existing conditions, the results of the survey, and the lack of previously recorded sites within or adjacent to the Turkey Point plant property and the Everglades Mitigation Bank, subsurface testing was not deemed necessary.

Heavy Haul Road on Plant Property

The heavy haul road is an existing heavy haul road located within the plant property. The only improvements will be to improve the road for additional weight. This area is considered to have a low probability for archaeological sites. Given the existing conditions and the lack of proposed ground disturbance, no subsurface testing was deemed necessary.

Spoils Areas on Plant Property

Spoils generated from de-mucking the Site will be deposited onto existing spoils berms adjacent to the Grand Canal (main return canal) and the southern boundary of the industrial wastewater facility. The existing berms consist of limestone taken from the adjacent canals. This area is considered to have a low probability for archaeological sites. Given the existing conditions and the lack of proposed ground disturbance, subsurface testing was not deemed necessary.

A Cultural Resource Assessment Survey Work Plan (FPL 2009b) was submitted to SHPO in June 2009 that summarized the results of the *Cultural Resource Assessment Survey* (FPL 2009a). Based on the results of the survey, which included both historical research and field survey, the recommendation that no further field investigations or research are needed for these construction areas was proposed to SHPO. Additional recommendations included continued coordination with the Miami-Dade County Office of Historic and Archaeological Resources, consultation with five federally recognized tribes (see Subsection 2.5.3.4) regarding the results of the archaeological field assessment, and development of an Unanticipated Finds Plan and associated Contractor Training Program.

SHPO concurred with the recommendations of the Work Plan in July 2009 (FDOS Jul 2009a). The letter of concurrence has been attached as Appendix 2.5A. FPL will implement the Work Plan recommendations prior to construction on the site and associated non-linear facilities.

2.5.3.3.2 Units 6 & 7 Associated Linear Facilities

A Preliminary Cultural Resources Report for the Turkey Point Units 6 & 7 Associated Linear Facilities (FPL 2009c) was prepared by FPL and submitted in June 2009 as part of the Turkey Point Units 6 & 7 Site Certification Application (FPL 2009e). This survey addressed the potential for historic properties within the following potentially impacted areas:

- New transmission lines going north and west from the Clear Sky substation (the East Preferred Corridor and West Preferred/Secondary Corridors) and the Levee substation expansions.
- Reclaimed water delivery pipelines from the MDWASD South District Wastewater Treatment Plant to the FPL reclaimed water treatment facility (reclaimed water delivery pipelines).
- Access roads and bridges to Units 6 & 7 (access roads and bridges).
- Potable water pipelines from MDWASD potable water transmission main to Units 6 & 7 (potable water pipelines).

The locations of these areas are depicted in Figures 2.2-5 (transmission and reclaimed water corridors) and 3.9-1.

The Preliminary Cultural Resources Report (FPL 2009c) researched a direct effects APE of 100 feet from the associated linear facilities to identify any previously recorded archaeological sites. An indirect APE for potential visual effects is defined as the area within which the improvements could be observed. For this preliminary report, the indirect APE was defined as 500 feet from the associated linear facilities to identify any previously recorded historic structures, resource groups, bridges, and cemeteries. No previously recorded resources were located within the direct or indirect APEs for the reclaimed water delivery pipeline, potable water pipelines, access roads, or bridges. For the West Preferred/Secondary corridors, three previously recorded archaeological sites are located with the direct APE and three resource groups (a trail, a canal, and a railway) cross the corridors. Also, two historic structures are located between 100 and 500 feet of the corridors. For the East Preferred Corridor, the direct APE contains two archaeological sites, 82 historic structures, 12 resource groups, and one historic bridge. The indirect APE includes an additional 109 historic structures, one resource group, and one historic bridge.

Based on the results of the *Preliminary Cultural Resources Report* (FPL 2009c), a *Cultural Resource Assessment Survey Work Plan* (FPL 2009d) was prepared by FPL and submitted to SHPO for their review and concurrence with the recommendation for further surveys and investigations. The areas considered include the western and eastern transmission lines, the reclaimed water and potable water pipelines, and the access roads and bridges. The APE for direct effects would be the construction corridors for the transmission lines, the reclaimed water and potable water pipelines, access road rights-of-way, and any associated staging or laydown areas. Only the transmission lines would have an indirect APE because the other work areas would be at or below the ground surface. This indirect APE for the transmission lines would be determined in consultation with the SHPO after conduct of a reconnaissance visual survey. The SHPO agreed (FDOS Jul 2009b) with the recommendation proposed in the Work Plan (FDEP 2009d). The SHPO response is included in Appendix 2.5A.

Specific recommendations for offsite linear facilities with which the SHPO concurred include the following:

Archaeological and Historic Survey and Identification Plan for Access Roads and Bridges

- Historic access roads and bridges will be surveyed prior to construction.
- No archaeological survey will be necessary for existing roads with no proposed widening.
- Visual surveys of all roads will be conducted to identify areas of high archaeological probability within new roads or areas of road widening.

- Standard archaeological surveys will be conducted in areas of high archaeological potential. Testing will be conducted at 25-meter intervals within the APE.

Archaeological Survey and Identification Plan for the Transmission Line Corridors, the Reclaimed Water Delivery Pipelines and the Potable Water Pipelines

- Surveys will be conducted prior to construction.
- The APE for archaeological survey will be confined to the construction corridor and associated staging areas.
- Visual surveys will be conducted of the APE to refine areas of high archaeological probability.
- All previously recorded archaeological sites within the APE will be field verified and re-evaluated. Updated Florida Master Site File (FMSF) forms will be completed for each previously recorded site.
- A reconnaissance level survey will be conducted for previously surveyed areas that do not meet current professional standards. In areas that have not been previously surveyed, a standard archaeological survey will be conducted of high and moderate probability zones. Testing will be conducted at 25-meter and 50-meter intervals respectively, with judgmental testing of low probability zones. Shovel testing will be confined to the APE.

Historic Resource Survey and Identification Plan for the Transmission Line Corridors, the Reclaimed Water Delivery Pipelines, and Potable Water Pipelines

- Surveys will be conducted prior to construction.
- A standard historic resource survey will be conducted to identify resources in areas that have not been previously surveyed. FMSF forms will be completed for newly identified resources.
- All previously recorded historic districts and individual resources in the APE will be field verified. Each individual building or structure within the boundaries of a previously recorded historic district will not be field verified. Updated FMSF forms will be completed only if substantial changes have occurred since a resource's initial recording, including: demolition, change in National Register status, and change in original massing.
- The boundaries of both previously recorded and newly identified historic districts will be noted and recorded on FMSF forms. Individual buildings within the historic district will not be recorded.

- A reconnaissance level historic resource survey will be conducted of the APE for indirect impacts of the transmission line corridors. This APE will be determined in consultation with the SHPO's office.

Other recommendations with which the SHPO concurred include continual tribal coordination and the development of an Unanticipated Finds Plan and Contractor Training for the non-linear facilities prior to construction. FPL will implement the Work Plan recommendations prior to construction of the associated linear facilities. When field investigations have been completed, a report of the results will be submitted, along with recommendations on effects to historic properties, to the SHPO for consultation under Section 106 of the NHPA. The report, recommendations on effect, and the SHPO's response will be provided to the NRC.

2.5.3.4 Native American Consultation

Five federally-recognized tribes with cultural affiliation to Florida have been notified about the Units 6 & 7 project. These tribes include: Miccosukee Tribe of Indians of Florida, the Seminole Tribe of Florida, the Muskogee Creek Indians, the Poarch Band of Creek Indians, and the Seminole Nation of Oklahoma. A meeting was held by FPL with the land management of the Miccosukee Tribe on January 9, 2009 to discuss the project. The Miccosukee Tribe of Indians of Florida and the Seminole Tribe of Florida have reservations in the State of Florida. Consultations will be held with these five tribes regarding the results of any archaeological field investigations conducted for the project. Letters and responses received from the tribes have been included in Appendix 2.5A.

2.5.3.5 Significant Cultural Resources within 10 Miles

There are seven types of designations in the project region of interest to recognize and protect significant historic and prehistoric properties; two are federal, three are state, and two are local designations. The National Park Service designates areas as National Historic Landmarks and lists properties on the National Register of Historic Places. The Florida Division of Historical Resources offers three designations: State Archeological Landmark, Florida Heritage Site, and Florida Heritage Landmark. In addition, the Miami-Dade County Historic Preservation Board and the Homestead Historic Preservation Board each maintain a listing of significant cultural resources within their respective jurisdictions.

A search of records maintained by the National Park Service, Florida Division of Historical Resources, Miami-Dade County, and city of Homestead was conducted to identify significant cultural resources located within 10 miles of Units 6 & 7. The research identified 290 individual resources and five resource groups in the search area. These resources are summarized below, and are listed with details in Tables 2.5-44 through 2.5-47.

Within the search area are 22 archaeological sites, most are located in Key Largo and Elliott Key. None are located within the Turkey Point plant property. The sites date to both prehistoric and historic periods, and include middens, refuse dumps, road segments, artifact scatters, and habitations. One site is listed on the National Register of Historic Places and one site is listed by the Miami-Dade Historic Preservation Board.

Two historic cemeteries are located within the 10-mile search area. One is in Naranja and one in Miami. Both date to the early 20th century and the latter is listed by the Miami-Dade Historic Preservation Board.

The search area contains 266 recorded historic period structures, of which 34 have been designated as destroyed (likely by hurricanes). These resources are found mostly in Homestead, followed by Florida City and South Dade County. The other towns with historic structures in the search area are Goulds, Leisure City, Miami, Modello, and Naranja. None are located within the Turkey Point plant property. Most of the historic structures are residences, though public and commercial buildings are also represented. Nine of the structures are listed on the National Register of Historic Places, while 19 have been designated as significant by the Miami-Dade Historic Preservation Board and 8 have been designated by the Homestead Historic Preservation Board.

There are five resource groupings within the 10-mile search area. One is an archaeological district located offshore on Islandia. This district contains both prehistoric and historic resources and is listed on the National Register of Historic Places. Another is an historic district located in Goulds. It is listed by the Miami-Dade Historic Preservation Board, but has not been evaluated for National Register of Historic Places eligibility. Two other historic districts, located in Homestead and in Key Largo, are both listed on the National Register of Historic Places. Finally, there is a railway located in Miami that has not been evaluated for listing.

2.5.3.6 Significant Cultural Resources within 1.2 Miles of Offsite Areas

A search of records maintained by the National Park Service, Florida Division of Historical Resources, Miami-Dade County, and city of Homestead was conducted to identify significant cultural resources located within 1.2 miles of the transmission lines, substations, and reclaimed water pipelines. The research identified 178 individual resources and five resource groups in the search area. These resources are summarized below, and are listed with details in Tables 2.5-48 through 2.5-51.

Within the search area are 58 archaeological sites, six of which have been destroyed since recording. Most of the sites are in the search area surrounding the northern portion of the proposed transmission lines, in unincorporated Dade County west of the developed metropolitan area from Everglades National Park north to the area around Pennsuco substation. Other locations include Alladin City, Florida City, Goulds, Hialeah, Hialeah Gardens, Homestead, Medley, Miami, and Pennsuco. The sites date to both prehistoric and historic periods, and include campsites, roads, habitations, artifact scatters, middens, burials, a quarry, and a mound. None are listed on the National Register of Historic Places; however, nine sites are listed by the Miami-Dade Historic Preservation Board.

The northern-most portion of the eastern transmission line corridor is located within the North Bank and West Bank Archaeological Zones designated by the City of Miami. The same portion of the eastern transmission line corridor is also located less than 500 feet west of the City of Miami's South Bank Archaeological Zone.

Only one historic cemetery is located within the 1.2-mile search area. It is an African-American cemetery located in Miami. It dates to the early 20th century and is listed by the Miami-Dade Historic Preservation Board.

The search area contains 303 recorded historic period structures, of which one has been designated as destroyed (likely by hurricanes). These resources are found mostly in the search areas surrounding the northern half of the proposed Turkey Point-to-Davis transmission line, along the Davis-to-Miami line, and in unincorporated Dade County west of Florida City and Homestead. The other places with historic structures in the search area are Florida City, Goulds, Homestead, Longview, Medley, Miami, and Pennsuco. Most of the historic structures are residences, though public and commercial buildings are also represented. Four of the structures are listed on the National Register of Historic Places, while 21 have been designated as significant by the Miami-Dade Historic Preservation Board.

There are 16 resource groupings within the 1.2-mile search area. Ten of the groupings are linear resources, mostly roads, which extend through multiple towns. Five groupings are districts and one grouping is a multiple property submission. Seven of the resource groups have been determined potentially eligible for listing on the National Register of Historic Places. Two resource groups are listed on the Register: the Calle Ocho and the MacFarlane Homestead Historic District.

2.5.4 ENVIRONMENTAL JUSTICE

2.5.4.1 Methodology

Environmental justice is defined as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies (U.S. EPA 2008). Concern that minority and/or low-income populations might be bearing a disproportionate share of adverse health and environmental impacts led to Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations.*

This order directs federal agencies to make environmental justice part of their mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and low income populations (EO 1994). The Council on Environmental Quality has provided guidance for addressing environmental justice (CEQ 1997). The NRC has also issued guidance on environmental justice analysis in *Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issue*s. NRC guidance was used to determine the minority and low-income composition in the environmental impact area.

The NRC concluded that a 50-mile radius could reasonably be expected to contain the area of potential impact and that the state was appropriate as the geographic area for comparative analysis. The NRC methodology identifies minority and low-income populations within the 50-mile region and then determines if these populations could receive disproportionately high adverse impacts from the proposed action. This approach was adopted for identifying the minority and low-income populations and associated impacts that could be caused by the proposed action. While this section identifies the locations of minority and low income populations in the area surrounding the plant property, the potential adverse impacts to these groups from construction and operation are identified and described in Chapters 4 and 5, respectively.

The ArcGIS®[1] 10.0 software was used with 2005-2009 American Community Survey (ACS) data to determine minority and low-income populations by block group within 50 miles of Units 6 & 7 (i.e., the environmental impact area), which is located in Miami-Dade County. A census block group is a geographic unit used by the USCB, hierarchically between the census tract and census block. A block group generally contains 600 to 3000 people. For the environmental justice analysis of Units 6 & 7, a block group in the analysis set was included if any part of its area fell within 50 miles. There are 1627 block groups that meet this criterion (Table 2.5-52). Consistent with the NRC guidance, the geographic area for comparative analysis was defined as the state of Florida.

2.5.4.2 Minority Populations

The NRC *Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues* defines minority categories as: American Indian/Alaskan Native races, Asian race, Native Hawaiian/Other Pacific Islander races, Black races, and Hispanic ethnicity. Additionally, the guidance states that “Other” race may be considered a separate category and requires that the multiracial and aggregate racial minority categories be analyzed separately. The

1. ArcGis is a registered trademark of Environmental Systems Research Institute, Inc.

guidance also indicates that a significant minority population exists if either of two conditions is met:

- The minority population of a block group or environmental impact area exceeds 50 percent.
- The minority population of a block group or environmental impact area is a significantly greater proportion than the minority population in the geographic comparison area. “Significantly greater” is defined as at least 20 percentage points.

Each minority group’s proportion of each of the 1627 block groups was calculated in the 50-mile radius using 2005-2009 ACS data, and each minority group’s proportion of the population in the state of Florida was also calculated. If the percentage of any minority population in a block group exceeded 50 percent of the total population in that block group, or if it surpassed the state’s percentage for that minority category by 20 percentage points or more, that block group qualified as containing a “significant” minority population. Some block groups contained more than one significant minority population.

For this analysis, Florida was the geographic comparison area. According to 2005-2009 ACS census data for the state of Florida (Table 2.5-52), 15.4 percent of the state’s population is Black, 0.3 percent is American Indian/Alaska Native, 2.3 percent is Asian, 0.05 percent is Native Hawaiian/Other Pacific Islander, 3.6 percent is Other, 1.8 percent is multiracial (two or more races), and 20.6 percent of the state’s population is of Hispanic ethnicity. Persons of Hispanic ethnicity may be of any race.

Table 2.5-52 provides the block group analysis results and Figures 2.5-24 through 2.5-30 show the locations of block groups with significant minority populations. There are 411 block groups within 50 miles of Units 6 & 7 with a significant Black population. Units 6 & 7 lie within the closest block group (Figure 2.5-24). Of these 411 block groups, 92 are in Broward County (more than 36 miles from the plant area) and the remaining 319 are in Miami-Dade County.

There is only one block group with a significant American Indian or Alaskan Native population within 50 miles of Units 6 & 7. It is in Broward County, approximately 42 miles north-northeast, adjacent to the Hollywood Indian Reservation. The Hollywood Reservation is one of six reservations of the Seminole Tribe of Florida. As the Seminole Tribe of Florida Headquarters, the reservation offers many commercial enterprises including a restaurant, casinos, and a museum.

Four Miccosukee Indian Reservations--Tamiami Trail (Miami-Dade County), Alligator Alley (Broward County), and two at Krome Avenue (Miami-Dade County)--also lie within 50 miles. There are over 640 people enrolled in the Miccosukee Tribe. The Tamiami Trail Reservation, which consists of four parcels of land, is 40 miles west of Miami and is presently the site of most tribal operations and the center of the Miccosukee Indian population. One parcel is under a

50-year use permit from the National Park Service, which expires on January 24, 2014. The other three parcels were originally dedicated to the Miccosukee by the state of Florida and have since acquired federal reservation status. These areas are used for commercial development. The tribe also has a perpetual lease from the state of Florida for 189,000 acres, which is part of the South Florida Water Management District's Conservation Area 3A South. The tribe is allowed to use this land for hunting, fishing, frogging, subsistence agriculture, and to carry on the traditional Miccosukee way of life. Alligator Alley is the largest of the Miccosukee Tribe's reservations, comprising approximately 75,000 acres. This land consists of 20,000 acres with potential for development and 55,000 acres of wetlands. The reservation contains a modern service station plaza, a police substation, and 13,000 acres of land that is leased for cattle grazing. There are two reservations located at the intersection of Krome Avenue and Tamiami Trail. One (25 acres) is the site of the Miccosukee Indian gaming facility and the Miccosukee resort and convention center. The second reservation area (less than 1 acre) is the site of the Miccosukee tobacco shop (Miccosukee Tribe of Indians of Florida 2012).

Figure 2.5-25 shows the locations of the single American Indian or Alaskan Native block group, the Hollywood Indian Reservation, and the Miccosukee Indian Reservations.

There are six block groups with a significant Asian minority population, all within Miami-Dade County. The closest of these is approximately 22 miles north of Units 6 & 7. Figure 2.5-26 shows the locations of these block groups. There are 22 block groups with a significant *Other* races population. The closest is approximately 15 miles north-northeast of Units 6 & 7. The locations of these block groups are shown on Figure 2.5-27. Two block groups within 50 miles have significant multiracial minority populations, both are in Miami-Dade County. The closest of these is approximately 10 miles north-northwest of Units 6 & 7. These block groups' locations are shown on Figure 2.5-28. Within the 50-mile radius, 443 block groups contain significant aggregate minority racial populations (Figure 2.5-29). The closest of these is the block group containing the Turkey Point plant property.

There are 843 block groups (58 in Broward County, 783 in Miami-Dade County, and 2 in Monroe County) that contain significant Hispanic ethnicity minority populations (Figure 2.5-30).

Seasonal, agricultural (migrant) workers may make up a portion of the minority population within 50 miles. While migrant worker populations are not available from USCB, the U.S. Department of Agriculture has collected information on farms that employ migrant labor. Farms in the following Florida counties, which fall wholly or partially within the 50-mile radius, employ migrant labor: Broward (24 farms), Collier (31), and Miami-Dade (234). There are no farms in Monroe County that employ migrant labor (USDA 2007).

2.5.4.3 Low-Income Populations

The NRC guidance defines low-income households based on statistical poverty thresholds. A block group is considered low income if either of the following two conditions is met:

- The low-income population of a block group or environmental impact area exceeds 50 percent.
- The low-income population of a block group or environmental impact area is a significantly greater proportion than the low income population in the geographic comparison area. “Significantly greater” is defined as at least 20 percentage points.

The proportion of low-income households was calculated in each block group within 50 miles relative to the total households in that block group. For this analysis, Florida is the geographic comparison area. For the state of Florida as a whole, it was determined that 12.5 percent of households are low income (Table 2.5-52). Within 50 miles of Units 6 & 7, 231 block groups have a significant low-income population. Table 2.5-52 identifies and Figure 2.5-31 locates the significant low-income block groups, 212 of which are in Miami-Dade County and 19 in Broward County. There are no significant low-income block groups in Collier or Monroe County.

2.5.4.4 Potential for Disproportionate Impacts

Local government officials, staff of social welfare agencies, and the Miccosukee Indian Tribe were contacted concerning unusual resource dependencies or practices or health conditions that could result in potentially disproportionate impacts to minority and low-income populations. Contacts with multiple government entities in Miami-Dade County were attempted.

Many agencies had no information concerning activities and health issues of minority populations. Interviews were conducted with the Community Action Agency, Miami-Dade Office of Community Advocacy, Miami-Dade County Community and Economic Development, Countywide Healthcare Planning, Metro Miami Action Plan Trust, and the Miami-Dade Black Advisory Board. No agency reported dependencies or practices, such as subsistence agriculture, hunting, or fishing, or preexisting health conditions through which the populations could be disproportionately or adversely affected by the proposed project. Several agencies alluded to the extreme urban nature of the study area and implied that there was no possibility of any subsistence activity on the part of any group.

Contact with the Miccosukee Indian Tribe reported that the Indians residing in the reservation within the 50-mile radius do not depend on hunting, fishing, or gardening for subsistence. The Miccosukee Tribe does lease land from the SFWMD for hunting, fishing, frogging, agriculture, and to carry on the traditional Miccosukee way of life. However, most tribal members rely on modern means to meet their food needs.

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Table 2.5-1 (Sheet 1 of 3)
Current Population and Projections, by Sector, to 2090

		Radii/Assistance (miles)																		
Sectors		0–1	1–2	0–2 Cumulative	2–3	0–3 Cumulative	3–4	0–4 Cumulative	4–5	0–5 Cumulative	5–10	0–10 Cumulative	10–20	0–20 Cumulative	20–30	0–30 Cumulative	30–40	0–40 Cumulative	40–50	0–50 Cumulative
N	2010	1,467	0	1,467	2,400	3,867	0	3,867	0	3,867	22,777	26,644	214,391	241,035	489,271	730,306	581,457	1,311,763	497,103	1,808,866
	2020	1,596	0	1,596	2,610	4,206	0	4,206	0	4,206	24,771	28,977	233,163	262,140	532,113	794,253	625,294	1,419,547	520,458	1,940,005
	2030	1,735	0	1,735	2,839	4,574	0	4,574	0	4,574	26,940	31,514	253,580	285,094	578,706	863,800	672,637	1,536,437	544,911	2,081,348
	2040	1,887	0	1,887	3,088	4,975	0	4,975	0	4,975	29,299	34,274	275,784	310,058	629,379	939,437	723,777	1,663,214	570,512	2,233,726
	2050	2,053	0	2,053	3,358	5,411	0	5,411	0	5,411	31,865	37,276	299,932	337,208	684,488	1,021,696	779,031	1,800,727	597,316	2,398,043
	2060	2,232	0	2,232	3,652	5,884	0	5,884	0	5,884	34,655	40,539	326,195	366,734	744,424	1,111,158	838,741	1,949,899	625,380	2,575,279
	2070	2,428	0	2,428	3,972	6,400	0	6,400	0	6,400	37,690	44,090	354,757	398,847	809,607	1,208,454	903,280	2,111,734	654,762	2,766,496
	2080	2,640	0	2,640	4,319	6,959	0	6,959	0	6,959	40,990	47,949	385,820	433,769	880,498	1,314,267	973,052	2,287,319	685,524	2,972,843
	2090	2,872	0	2,872	4,698	7,570	0	7,570	0	7,570	44,579	52,149	419,603	471,752	957,596	1,429,348	1,048,495	2,477,843	717,732	3,195,575
NNE	2010	0	0	0	0	0	0	0	0	0	0	0	5,688	5,688	423,532	429,220	420,970	850,190	209,467	1,059,657
	2020	0	0	0	0	0	0	0	0	0	0	0	6,186	6,186	460,618	466,804	456,688	923,492	219,322	1,142,814
	2030	0	0	0	0	0	0	0	0	0	0	0	6,728	6,728	500,950	507,678	495,480	1,003,158	229,642	1,232,800
	2040	0	0	0	0	0	0	0	0	0	0	0	7,317	7,317	544,815	552,132	537,613	1,089,745	240,447	1,330,192
	2050	0	0	0	0	0	0	0	0	0	0	0	7,958	7,958	592,520	600,478	583,375	1,183,853	251,762	1,435,615
	2060	0	0	0	0	0	0	0	0	0	0	0	8,654	8,654	644,402	653,056	633,084	1,286,140	263,610	1,549,750
	2070	0	0	0	0	0	0	0	0	0	0	0	9,412	9,412	700,828	710,240	687,080	1,397,320	276,016	1,673,336
	2080	0	0	0	0	0	0	0	0	0	0	0	10,236	10,236	762,193	772,429	745,737	1,518,166	289,007	1,807,173
	2090	0	0	0	0	0	0	0	0	0	0	0	11,133	11,133	828,933	840,066	809,459	1,649,525	302,611	1,952,136
NE	2010	0	0	0	0	0	0	0	0	0	0	0	15	15	0	15	0	15	0	15
	2020	0	0	0	0	0	0	0	0	0	0	0	17	17	0	17	0	17	0	17
	2030	0	0	0	0	0	0	0	0	0	0	0	18	18	0	18	0	18	0	18
	2040	0	0	0	0	0	0	0	0	0	0	0	20	20	0	20	0	20	0	20
	2050	0	0	0	0	0	0	0	0	0	0	0	21	21	0	21	0	21	0	21
	2060	0	0	0	0	0	0	0	0	0	0	0	23	23	0	23	0	23	0	23
	2070	0	0	0	0	0	0	0	0	0	0	0	25	25	0	25	0	25	0	25
	2080	0	0	0	0	0	0	0	0	0	0	0	27	27	0	27	0	27	0	27
	2090	0	0	0	0	0	0	0	0	0	0	0	30	30	0	30	0	30	0	30
ENE	2010	0	0	0	0	0	0	0	0	0	3	3	0	3	0	3	0	3	0	3
	2020	0	0	0	0	0	0	0	0	0	3	3	0	3	0	3	0	3	0	3
	2030	0	0	0	0	0	0	0	0	0	4	4	0	4	0	4	0	4	0	4
	2040	0	0	0	0	0	0	0	0	0	4	4	0	4	0	4	0	4	0	4
	2050	0	0	0	0	0	0	0	0	0	4	4	0	4	0	4	0	4	0	4
	2060	0	0	0	0	0	0	0	0	0	5	5	0	5	0	5	0	5	0	5
	2070	0	0	0	0	0	0	0	0	0	5	5	0	5	0	5	0	5	0	5
	2080	0	0	0	0	0	0	0	0	0	5	5	0	5	0	5	0	5	0	5
	2090	0	0	0	0	0	0	0	0	0	6	6	0	6	0	6	0	6	0	6
E	2010	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2020	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2030	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2040	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2050	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2060	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2070	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2080	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2090	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ESE	2010	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2020	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2030	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2040	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2050	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2060	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2070	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2080	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2090	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SE	2010	0	0	0	0	0	0	0	0	0	49	49	0	49	0	49	0	49	0	49
	2020	0	0	0	0	0	0	0	0	0	52	52	0	52	0	52	0	52	0	52
	2030	0	0	0	0	0	0	0	0	0	56	56	0	56	0	56	0	56	0	56
	2040	0	0	0	0	0	0	0	0	0	59	59	0	59	0	59	0	59	0	59

Table 2.5-1 (Sheet 2 of 3)
Current Population and Projections, by Sector, to 2090

		Radii/Assistance (miles)																		
Sectors		0–1	1–2	0–2 Cumulative	2–3	0–3 Cumulative	3–4	0–4 Cumulative	4–5	0–5 Cumulative	5–10	0–10 Cumulative	10–20	0–20 Cumulative	20–30	0–30 Cumulative	30–40	0–40 Cumulative	40–50	0–50 Cumulative
	2050	0	0	0	0	0	0	0	0	0	63	63	0	63	0	63	0	63	0	63
	2060	0	0	0	0	0	0	0	0	0	68	68	0	68	0	68	0	68	0	68
	2070	0	0	0	0	0	0	0	0	0	73	73	0	73	0	73	0	73	0	73
	2080	0	0	0	0	0	0	0	0	0	78	78	0	78	0	78	0	78	0	78
	2090	0	0	0	0	0	0	0	0	0	84	84	0	84	0	84	0	84	0	84
SSE	**2010**	0	0	0	0	0	0	0	0	0	8,355	8,355	0	8,355	0	8,355	0	8,355	0	8,355
	2020	0	0	0	0	0	0	0	0	0	8,135	8,135	0	8,135	0	8,135	0	8,135	0	8,135
	2030	0	0	0	0	0	0	0	0	0	7,920	7,920	0	7,920	0	7,920	0	7,920	0	7,920
	2040	0	0	0	0	0	0	0	0	0	7,712	7,712	0	7,712	0	7,712	0	7,712	0	7,712
	2050	0	0	0	0	0	0	0	0	0	7,509	7,509	0	7,509	0	7,509	0	7,509	0	7,509
	2060	0	0	0	0	0	0	0	0	0	7,311	7,311	0	7,311	0	7,311	0	7,311	0	7,311
	2070	0	0	0	0	0	0	0	0	0	7,118	7,118	0	7,118	0	7,118	0	7,118	0	7,118
	2080	0	0	0	0	0	0	0	0	0	6,931	6,931	0	6,931	0	6,931	0	6,931	0	6,931
	2090	0	0	0	0	0	0	0	0	0	6,748	6,748	0	6,748	0	6,748	0	6,748	0	6,748
S	**2010**	0	0	0	0	0	0	0	0	0	61	61	2,165	2,226	23	2,249	0	2,249	0	2,249
	2020	0	0	0	0	0	0	0	0	0	62	62	2,108	2,170	22	2,192	0	2,192	0	2,192
	2030	0	0	0	0	0	0	0	0	0	63	63	2,052	2,115	22	2,137	0	2,137	0	2,137
	2040	0	0	0	0	0	0	0	0	0	65	65	1,998	2,063	21	2,084	0	2,084	0	2,084
	2050	0	0	0	0	0	0	0	0	0	66	66	1,946	2,012	21	2,033	0	2,033	0	2,033
	2060	0	0	0	0	0	0	0	0	0	68	68	1,894	1,962	20	1,982	0	1,982	0	1,982
	2070	0	0	0	0	0	0	0	0	0	71	71	1,844	1,915	20	1,935	0	1,935	0	1,935
	2080	0	0	0	0	0	0	0	0	0	73	73	1,796	1,869	19	1,888	0	1,888	0	1,888
	2090	0	0	0	0	0	0	0	0	0	76	76	1,749	1,825	19	1,844	0	1,844	0	1,844
SSW	**2010**	0	0	0	0	0	0	0	0	0	6	6	225	231	9,407	9,638	5,957	15,595	1,106	16,701
	2020	0	0	0	0	0	0	0	0	0	7	7	237	244	9,159	9,403	5,800	15,203	1,077	16,280
	2030	0	0	0	0	0	0	0	0	0	7	7	250	257	8,918	9,175	5,647	14,822	1,049	15,871
	2040	0	0	0	0	0	0	0	0	0	8	8	264	272	8,683	8,955	5,498	14,453	1,021	15,474
	2050	0	0	0	0	0	0	0	0	0	8	8	280	288	8,454	8,742	5,354	14,096	994	15,090
	2060	0	0	0	0	0	0	0	0	0	9	9	298	307	8,231	8,538	5,212	13,750	968	14,718
	2070	0	0	0	0	0	0	0	0	0	10	10	317	327	8,014	8,341	5,075	13,416	942	14,358
	2080	0	0	0	0	0	0	0	0	0	11	11	338	349	7,803	8,152	4,941	13,093	917	14,010
	2090	0	0	0	0	0	0	0	0	0	12	12	361	373	7,598	7,971	4,811	12,782	893	13,675
SW	**2010**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	15
	2020	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	15
	2030	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	14
	2040	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	14
	2050	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	13
	2060	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	13
	2070	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	13
	2080	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	12
	2090	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	12
WSW	**2010**	0	0	0	0	0	0	0	0	0	106	106	230	336	21	357	0	357	3	360
	2020	0	0	0	0	0	0	0	0	0	115	115	250	365	23	388	0	388	3	391
	2030	0	0	0	0	0	0	0	0	0	125	125	272	397	25	422	0	422	3	425
	2040	0	0	0	0	0	0	0	0	0	136	136	296	432	27	459	0	459	3	462
	2050	0	0	0	0	0	0	0	0	0	148	148	322	470	29	499	0	499	3	502
	2060	0	0	0	0	0	0	0	0	0	161	161	350	511	32	543	0	543	3	546
	2070	0	0	0	0	0	0	0	0	0	175	175	381	556	35	591	0	591	3	594
	2080	0	0	0	0	0	0	0	0	0	191	191	414	605	38	643	0	643	2	645
	2090	0	0	0	0	0	0	0	0	0	207	207	450	657	41	698	0	698	2	700
W	**2010**	0	0	0	0	0	0	0	0	0	19,609	19,609	6,175	25,784	0	25,784	0	25,784	0	25,784
	2020	0	0	0	0	0	0	0	0	0	21,326	21,326	6,716	28,042	0	28,042	0	28,042	0	28,042
	2030	0	0	0	0	0	0	0	0	0	23,193	23,193	7,304	30,497	0	30,497	0	30,497	0	30,497
	2040	0	0	0	0	0	0	0	0	0	25,224	25,224	7,943	33,167	0	33,167	0	33,167	0	33,167
	2050	0	0	0	0	0	0	0	0	0	27,433	27,433	8,639	36,072	0	36,072	0	36,072	0	36,072
	2060	0	0	0	0	0	0	0	0	0	29,835	29,835	9,395	39,230	0	39,230	0	39,230	0	39,230
	2070	0	0	0	0	0	0	0	0	0	32,447	32,447	10,218	42,665	0	42,665	0	42,665	0	42,665
	2080	0	0	0	0	0	0	0	0	0	35,289	35,289	11,113	46,402	0	46,402	0	46,402	0	46,402
	2090	0	0	0	0	0	0	0	0	0	38,378	38,378	12,086	50,464	0	50,464	0	50,464	0	50,464
WNW	**2010**	0	0	0	0	0	0	0	0	0	62,316	62,316	20,753	83,069	0	83,069	6	83,075	6	83,081

Table 2.5-1 (Sheet 3 of 3)
Current Population and Projections, by Sector, to 2090

		Radii/Assistance (miles)																		
Sectors		0–1	1–2	0–2 Cumulative	2–3	0–3 Cumulative	3–4	0–4 Cumulative	4–5	0–5 Cumulative	5–10	0–10 Cumulative	10–20	0–20 Cumulative	20–30	0–30 Cumulative	30–40	0–40 Cumulative	40–50	0–50 Cumulative
	2020	0	0	0	0	0	0	0	0	0	67,773	67,773	22,570	90,343	0	90,343	6	90,349	6	90,355
	2030	0	0	0	0	0	0	0	0	0	73,707	73,707	24,546	98,253	0	98,253	7	98,260	6	98,266
	2040	0	0	0	0	0	0	0	0	0	80,161	80,161	26,696	106,857	0	106,857	7	106,864	6	106,870
	2050	0	0	0	0	0	0	0	0	0	87,180	87,180	29,033	116,213	0	116,213	7	116,220	6	116,226
	2060	0	0	0	0	0	0	0	0	0	94,814	94,814	31,576	126,390	0	126,390	8	126,398	5	126,403
	2070	0	0	0	0	0	0	0	0	0	103,116	103,116	34,340	137,456	0	137,456	8	137,464	5	137,469
	2080	0	0	0	0	0	0	0	0	0	112,145	112,145	37,347	149,492	0	149,492	9	149,501	5	149,506
	2090	0	0	0	0	0	0	0	0	0	121,964	121,964	40,618	162,582	0	162,582	9	162,591	5	162,596
NW	**2010**	0	0	0	0	0	4	4	4	8	44,445	44,453	10,937	55,390	40	55,430	407	55,837	11	55,848
	2020	0	0	0	0	0	4	4	4	8	48,337	48,345	11,895	60,240	44	60,284	443	60,727	12	60,739
	2030	0	0	0	0	0	5	5	5	10	52,569	52,579	12,936	65,515	47	65,562	481	66,043	13	66,056
	2040	0	0	0	0	0	5	5	5	10	57,172	57,182	14,069	71,251	51	71,302	524	71,826	15	71,841
	2050	0	0	0	0	0	6	6	6	12	62,178	62,190	15,301	77,491	56	77,547	569	78,116	17	78,133
	2060	0	0	0	0	0	6	6	6	12	67,623	67,635	16,641	84,276	61	84,337	619	84,956	19	84,975
	2070	0	0	0	0	0	7	7	7	14	73,544	73,558	18,098	91,656	66	91,722	673	92,395	21	92,416
	2080	0	0	0	0	0	7	7	7	14	79,984	79,998	19,682	99,680	72	99,752	732	100,484	23	100,507
	2090	0	0	0	0	0	8	8	8	16	86,987	87,003	21,406	108,409	78	108,487	797	109,284	26	109,310
NNW	**2010**	0	0	0	6	6	0	6	0	6	30,986	30,992	245,476	276,468	127,205	403,673	80	403,753	20	403,773
	2020	0	0	0	7	7	0	7	0	7	33,699	33,706	266,970	300,676	138,343	439,019	87	439,106	21	439,127
	2030	0	0	0	7	7	0	7	0	7	36,650	36,657	290,347	327,004	150,457	477,461	94	477,555	22	477,577
	2040	0	0	0	8	8	0	8	0	8	39,859	39,867	315,770	355,637	163,631	519,268	102	519,370	23	519,393
	2050	0	0	0	8	8	0	8	0	8	43,349	43,357	343,420	386,777	177,959	564,736	110	564,846	24	564,870
	2060	0	0	0	9	9	0	9	0	9	47,145	47,154	373,490	420,644	193,542	614,186	120	614,306	26	614,332
	2070	0	0	0	10	10	0	10	0	10	51,273	51,283	406,194	457,477	210,489	667,966	130	668,096	27	668,123
	2080	0	0	0	11	11	0	11	0	11	55,763	55,774	441,761	497,535	228,920	726,455	141	726,596	28	726,624
	2090	0	0	0	12	12	0	12	0	12	60,646	60,658	480,443	541,101	248,964	790,065	153	790,218	30	790,248
TOTAL	**2010**	1,467	0	1,467	2,406	3,873	4	3,877	4	3,881	188,713	192,594	506,055	698,649	1,049,499	1,748,148	1,008,877	2,757,025	707,731	3,464,756
	2020	1,596	0	1,596	2,617	4,213	4	4,217	4	4,221	204,280	208,501	550,112	758,613	1,140,322	1,898,935	1,088,318	2,987,253	740,914	3,728,167
	2030	1,735	0	1,735	2,846	4,581	5	4,586	5	4,591	221,234	225,825	598,033	823,858	1,239,125	2,062,983	1,174,346	3,237,329	775,660	4,012,989
	2040	1,887	0	1,887	3,096	4,983	5	4,988	5	4,993	239,699	244,692	650,157	894,849	1,346,607	2,241,456	1,267,521	3,508,977	812,041	4,321,018
	2050	2,053	0	2,053	3,366	5,419	6	5,425	6	5,431	259,803	265,234	706,852	972,086	1,463,527	2,435,613	1,368,446	3,804,059	850,135	4,654,194
	2060	2,232	0	2,232	3,661	5,893	6	5,899	6	5,905	281,694	287,599	768,516	1,056,115	1,590,712	2,646,827	1,477,784	4,124,611	890,024	5,014,635
	2070	2,428	0	2,428	3,982	6,410	7	6,417	7	6,424	305,522	311,946	835,586	1,147,532	1,729,059	2,876,591	1,596,246	4,472,837	931,789	5,404,626
	2080	2,640	0	2,640	4,330	6,970	7	6,977	7	6,984	331,460	338,444	908,534	1,246,978	1,879,543	3,126,521	1,724,612	4,851,133	975,518	5,826,651
	2090	2,872	0	2,872	4,710	7,582	8	7,590	8	7,598	359,687	367,285	987,879	1,355,164	2,043,229	3,398,393	1,863,724	5,262,117	1,021,311	6,283,428

Table 2.5-2
Counties Completely or Partially within the 50-Mile Region

Broward[(a)]
Collier[(a)]
Miami-Dade
Monroe

Source: Figure 2.5-2

(a) Less than approximately 50% of the land area of this county falls within the 50-mile radius.

Table 2.5-3
Residential Distribution of Current Turkey Point Employees

County	City	Number of Turkey Point Employees in Residence	Percentage of Total Turkey Point Employees	2005–2009 City or County Population[(a)]	Percentage of Population
Miami-Dade County		814	83.3	2,457,044	0.03
	Homestead	391	40.0	55,036	0.71
	Miami	380	38.9	418,480	0.09
	Florida City	27	2.8	9,808	0.28
	Other	16	1.6	N/A	N/A
Broward County		63	6.4	1,759,132	<0.01
Collier County		1	0.1	313,165	<0.01
Monroe County		47	4.8	74,024	0.06
Other Florida Counties		35	3.6	N/A	N/A
Other States		17	1.7	N/A	N/A
Total		977	100		

(a) Source: USCB 2010c
N/A — Not Applicable

Table 2.5-4
Population Data, Miami-Dade County and Florida, 1970 to 2030

	Miami-Dade County		Florida	
Year	Population	Average Annual Growth Rate	Population	Average Annual Growth Rate
1970[(a)]	1,267,792	N/A	6,789,447	N/A
1980[(a)]	1,625,509	2.52%	9,746,961	3.68%
1990[(a)]	1,937,194	1.77%	12,938,071	2.87%
2000[(a)]	2,253,779	1.53%	15,982,824	2.14%
2010[(b)]	2,496,435	1.03%	18,801,310	1.64%
2020[(b)]	2,722,889	0.87%	21,326,797	1.27%
2030[(b)]	2,952,762	0.81%	23,877,889	1.14%

(a) Source: EDR 2007
(b) Source: EDR 2012
N/A — Not Available

Table 2.5-5
Population Distribution by Age, Miami-Dade County and Florida, 2005-2009

	Miami-Dade County		Florida	
	Number	Percent	Number	Percent
Total population	2,457,044	—	18,222,420	—
Under 5 years	168,911	6.9	1,145,667	6.3
5 to 9 years	148,782	6.1	1,066,621	5.9
10 to 14 years	158,984	6.5	1,131,018	6.2
15 to 19 years	164,314	6.7	1,170,393	6.4
20 to 24 years	164,466	6.7	1,176,441	6.5
25 to 34 years	345,564	14.1	2,291,105	12.6
35 to 44 years	369,276	15.0	2,517,243	13.8
45 to 54 years	338,765	13.8	2,564,133	14.1
55 to 59 years	134,244	5.5	1,098,387	6.0
60 to 64 years	116,790	4.8	990,442	5.4
65 to 74 years	171,735	7.0	1,479,365	8.1
75 to 84 years	125,060	5.1	1,162,247	6.4
85 years and over	50,153	2.0	429,358	2.4
Median age (years)	37.2	N/A	39.7	N/A

Source: USCB 2010c
N/A — Not Applicable

Table 2.5-6
Worker Flows, 2000

Residence County	Number of Workers that Commute to Work in Residence County	Number of Workers Traveling to Miami-Dade County for Work	Corresponding Percentage of the Miami-Dade County Workforce
Broward	565,812	115,044	12.03
Collier	95,020	332	0.03
Monroe	39,721	1,186	0.12
Miami-Dade (ROI)	823,642	N/A	86.11
Total In-Migrating Workers		116,562	12.19
Total Workforce in Miami-Dade County		956,458	100.00

	Number of Workers in County	Number of Workers Residing in Miami-Dade County but Traveling into Surrounding Counties for Work	Corresponding Percentage of Corresponding County's Workforce
Broward	670,271	60,096	8.97
Collier	113,038	399	0.35
Monroe	43,946	2,821	6.42

Source: USCB 2003
N/A — Not Applicable

Table 2.5-7
Employment Trends, Miami-Dade County and Comparison Areas, 2001 to 2011

	Labor Force			Employed			Unemployed			Unemployment Rate		
	2001	2005	2011	2001	2005	2011	2001	2005	2011	2001	2005	2011
USA[(a)]	143,734,000	149,320,000	153,617,000	136,933,000	141,730,000	139,869,000	6,801,000	7,591,000	13,747,000	4.7%	5.1%	8.9%
Florida[(b)]	7,998,062	8,635,032	9,233,765	7,624,718	8,305,281	8,251,332	373,344	329,751	982,433	4.7%	3.8%	10.6%
Miami-Dade County[(b)]	1,098,226	1,123,472	1,303,385	1,031,747	1,071,853	1,146,823	66,479	51,619	156,562	6.1%	4.6%	12.0%
Miami-Dade County as % of Florida	13.7%	13.0%	14.1%	13.5%	12.9%	13.9%	17.8%	15.7%	15.9%	N/A	N/A	N/A

(a) Source: BLS 2012a
(b) Source: BL 2012b
N/A — Not Applicable

Table 2.5-8
Employment by Industry Sector Summary, Miami-Dade County and Florida, 2009

Industry Sector	ROI — Miami Dade County		Florida	
	Employment	Percent of Total	Employment	Percent of Total
Total Employment	1,369,128	100.0	9,840,243	100.0
Farm/Forestry & Fishing	9,108	0.7	142,280	1.4
Mining & Utilities	4,812	0.4	50,666	0.5
Construction	64,702	4.7	564,324	5.7
Manufacturing	42,080	3.1	349,030	3.5
Wholesale Trade	75,705	5.5	357,169	3.6
Retail Trade	136,000	9.9	1,081,224	11.0
Transportation and Warehousing	77,866	5.7	293,722	3.0
Finance, Insurance, and Real Estate[(a)]	133,257	9.7	1,108,039	11.3
Services[(b)]	667,435	48.7	4,689,764	47.7
Federal and State Government[(c)]	43,695	3.2	443,044	4.5
Local Government	114,468	8.4	760,981	7.7

(a) “Finance, Insurance and Real Estate” includes the following sectors: finance and insurance; and real estate and rental and leasing.
(b) "Services" includes the following sectors: information; professional and technical services; management of companies and enterprises; administrative and waste services; educational services; health care and social assistance; arts, entertainment, and recreation; accommodations and food services; and other services except public administration.
(c) "Federal and State Government" includes the following sectors: federal civilian; federal military; and state government.
Source: BEA 2011a

Table 2.5-9
Employment Trends by Industry Sectors, Miami-Dade County and Florida, 2001 to 2009

	Miami-Dade County			Florida		
Description	**2001**	**2009**	**Average Annual Change**	**2001**	**2009**	**Average Annual Change**
Total employment	1,302,652	1,369,128	0.5%	8,917,152	9,840,243	1.0%
Wage and salary employment	1,090,997	1,038,010	-0.5%	7,473,473	7,632,084	0.2%
Proprietors employment	211,655	331,118	4.6%	1,443,679	2,208,159	4.3%
Farm proprietors employment	1,828	1,821	0.0%	41,702	39,108	-0.6%
Nonfarm proprietors employment	209,827	329,297	4.6%	1,401,977	2,169,051	4.5%
Farm employment	7,465	6,585	-1.2%	95,766	80,574	-1.7%
Nonfarm employment	1,295,187	1,362,543	0.5%	8,821,386	9,759,669	1.0%
Private employment	1,139,623	1,204,380	0.6%	7,709,225	8,555,644	1.0%
Forestry, fishing, and related activities	3,497	2,523	-3.2%	64,009	61,706	-0.4%
Mining	740	1,160	4.6%	13,237	24,909	6.5%
Utilities	(ND)	3,652	N/A	28,963	25,757	-1.2%
Construction	61,445	64,702	0.5%	582,475	564,324	-0.3%
Manufacturing	64,545	42,080	-4.2%	451,304	349,030	-2.5%
Wholesale trade	75,339	75,705	0.0%	343,372	357,169	0.4%
Retail trade	141,661	136,000	-0.4%	1,077,002	1,081,224	0.0%
Transportation and warehousing	(ND)	77,866	N/A	286,317	293,722	0.3%
Information	36,938	23,229	-4.5%	213,331	176,056	-1.9%
Finance and insurance	59,617	71,201	1.8%	440,788	573,384	2.7%
Real estate and rental and leasing	45,981	62,056	3.0%	344,523	534,655	4.5%
Professional, scientific, and technical services	87,650	89,576	0.2%	533,954	659,989	2.1%
Management of companies and enterprises	6,587	10,615	4.9%	63,532	88,747	3.4%
Administrative and waste management services	108,960	101,998	-0.7%	836,220	764,108	-0.9%
Educational services	27,707	36,020	2.7%	118,468	183,120	4.5%
Health care and social assistance	117,505	156,006	2.9%	839,090	1,078,551	2.5%
Arts, entertainment, and recreation	20,882	25,405	2.0%	234,882	286,867	2.0%
Accommodation and food services	86,659	97,352	1.2%	660,634	775,734	1.6%
Other services, except public administration	104,677	127,234	2.0%	577,124	676,592	1.6%
Government and government enterprises	155,564	158,163	0.2%	1,112,161	1,204,025	0.8%
Federal, civilian	18,135	19,895	0.9%	118,673	132,904	1.1%
Military	7,375	7,341	0.0%	105,111	99,415	-0.6%
State and local	130,054	130,927	0.1%	888,377	971,706	0.9%
State government	20,733	16,459	-2.3%	219,277	210,725	-0.4%
Local government	109,321	114,468	0.5%	669,100	760,981	1.3%

(ND) As reported by the U. S. Bureau of Economic Analysis, "not shown to avoid disclosure of confidential information, but the estimate for this item is included in the totals." For this reason, sums may not total as shown, and the average annual percent change could not be calculated for the 8-year period.
Source: BEA 2011a
NA — Not Available

Table 2.5-10
Major Employers, Miami-Dade County, 2009

Company	Number of Employees
Top Private Employers	
University of Miami	16,000
Baptist Health South Florida	13,376
Publix Super Markets	10,800
American Airlines	9,000
Precision Response Corporation	5,000
Florida Power & Light Company	3,840
Carnival Cruise Lines	3,500
Winn-Dixie Stores	3,400
AT&T	3,100
Mount Sinai Medical Center	3,000
Miami Children's Hospital	2,800
Sedanos Supermarkets	2,500
Wachovia, A Wells Fargo Co.	2,179
Assurant Solutions	2,100
Bank of America	2,000
Royal Caribbean International/Celebrity Cruises	1,880
Beckman Coulter Corp.	1,400
United Parcel Service	1,150
Federal Express	1,134
Eulen America	1,000
Top Public Employers	
Miami-Dade County Public Schools	48,571
Miami-Dade County	29,000
Federal Government	19,500
Florida State Government	17,100
Jackson Health System	12,571
Florida International University	8,000
Miami-Dade College	6,200
City of Miami	4,309
Homestead AFB	2,700
Miami V A Healthcare System	2,385
City of Miami Beach	1,950
City of Hialeah	1,700
U.S. Southern Command	1,600

Source: BC 2009

Table 2.5-11
Average Annual Employment by Sector, Miami-Dade County and Comparison Areas, 2001 to 2010

[(a)]Sector/Area	2001	2005	2010	Average Annual Growth 2001 to 2010
Total, All Industry Sectors				
United States	109,304,802	110,611,016	106,201,232	-0.3%
Florida	6,153,547	6,694,864	6,044,806	-0.2%
Miami-Dade County	847,368	848,754	803,654	-0.6%
MDC, of Florida, all sectors	13.8%	12.7%	13.3%	
Sector 23, Construction Sector				
United States	6,773,512	7,269,317	5,489,499	-2.3%
Florida	420,783	580,051	347,106	-2.1%
Miami-Dade County	38,353	45,792	31,395	-2.2%
MDC, Sector 23 of all MDC sectors	4.5%	5.4%	3.9%	
Sector 237, Heavy and Civil Engineering Construction Sector				
United States	950,385	931,031	811,123	-1.7%
Florida	65,450	70,258	49,742	-3.0%
Miami-Dade County	5,256	6,035	5,401	0.3%
MDC Sector 237 of MDC sector 23	13.7%	13.2%	17.2%	
Sector 22, Utilities				
United States	599,899	550,593	551,287	-0.9%
Florida	27,811	24,219	22,540	-2.3%
Miami-Dade County[(b)]	(ND)	2,999	2,991	N/A
MDC Sector 22, of all MDC sectors	N/A	0.4%	0.4%	
Sector 221113, Nuclear Electric Power Generation[(c)]				
United States	45,312	52,331	52,582	1.7%

(a) Information reflects privately owned firms and establishments of all sizes.
(b) Sector 22 information is not disclosed for Miami-Dade County 2001.
(c) Source: BLS 2012c.
(ND) — As reported by Bureau of Labor Statistics, "Not disclosable-data do not meet BLS or state agency disclosure standards."
N/A — Not Available

Table 2.5-12
Average Annual Wages, Miami-Dade County and Comparison Areas, 2001 to 2010

[(a)]Sector/Area	2001	2005	2010	Average Annual Growth 2001 to 2010
Total, All Industry Sectors				
United States	$36,157	$40,505	$46,455	2.8%
Florida	$31,038	$36,096	$40,562	3.0%
Miami-Dade County	$33,640	$39,222	$44,042	3.0%
Sector 23, Construction Sector				
United States	$38,412	$42,100	$49,597	2.9%
Florida	$33,602	$38,297	$41,075	2.3%
Miami-Dade County	$34,755	$42,382	$45,976	3.2%
Sector 237, Heavy and Civil Engineering Construction Sector				
United States	$43,099	$49,399	$58,952	3.5%
Florida	$38,094	$45,313	$49,278	2.9%
Miami-Dade County	$41,408	$54,108	$58,662	3.9%
Sector 22, Utilities				
United States	$65,561	$75,208	$86,791	3.2%
Florida	$59,507	$66,927	$76,463	2.8%
Miami-Dade County[(b)]	(ND)	$79,881	$84,479	N/A
Sector 221113, Nuclear Electric Power Generation[(c)]				
United States	$74,294	$91,732	$109,901	4.4%

(a) Information reflects privately owned firms and establishments of all sizes.
(b) Sector 22 information is not disclosed for Miami-Dade County 2001.
(c) Information was not disclosed for Florida or Miami-Dade County for NAICS 221113, Nuclear Electric Power Generation.
Source: BLS 2012d
(ND) — As reported by Bureau of Labor Statistics, "Not disclosable-data do not meet BLS or state agency disclosure standards."
N/A — Not Available

Table 2.5-13
Industry and Occupation Employment Forecasts, Miami-Dade County, 2011 to 2019

Industry Sector/Occupational Title	Estimated Employment 2011	Projected Employment 2019	Average Annual Percent Change	2011 Average Hourly Wage
Industry Sector[(a)]				
Total, All Industries	1,074,873	1,163,250	1.03	N/A
Construction (NAICS 23)	31,221	38,264	2.82	N/A
Heavy and Civil Engineering Construction (NAICS 237)	5,515	6,061	1.24	N/A
Occupational Title[(b)]				
Construction and Extraction Occupations	32,976	38,645	2.15	N/A
First-Line Superv. of Construction and Extraction Workers	4,283	5,156	2.55	$28.74
Construction Trades Workers	23,442	27,275	2.04	N/A
Brick Masons and Block Masons	273	311	1.74	$21.40
Carpenters	4,634	5,307	1.82	$16.95
Floor Layers, Except Carpet, Wood, and Hard Tiles	83	95	1.81	$18.80
Tile and Marble Setters	341	433	3.37	$12.51
Cement Masons and Concrete Finishers	340	412	2.65	$16.08
Construction Laborers	5,366	6,464	2.56	$13.14
Operating Engineers/Construction Equipment Operators	1,507	1,731	1.86	$19.80
Drywall and Ceiling Tile Installers	422	540	3.50	$17.19
Electricians	3,160	3,571	1.63	$21.24
Glaziers	348	409	2.19	$19.52
Painters, Construction and Maintenance	2,097	2,341	1.45	$17.33
Plumbers, Pipefitters, and Steamfitters	2,188	2,477	1.65	$21.56
Roofers	639	748	2.13	$16.42
Sheet Metal Workers	399	443	1.38	$17.61
Structural Iron and Steel Workers	288	355	2.91	$16.02
Helpers – Construction Trades	2,113	2,561	2.65	N/A
Helpers – Carpenters	272	355	3.81	$12.61
Helpers – Electricians	835	1,026	2.86	$12.23
Helpers – Plumbers, Pipefitters, and Steamfitters	552	665	2.56	$12.78
Other Construction and Related Workers	2,869	3,381	2.23	N/A
Construction and Building Inspectors	1,088	1,367	3.21	$29.33
Construction and Related Workers, All Other	1,134	1,299	1.82	$18.66

(a) Source: FAWI 2011a.
(b) Source: FAWI 2011b.
N/A — Not Available

Table 2.5-14
Per Capita Personal Income, Miami-Dade County and Comparison Areas, 2001 to 2009

Area	2001	2005	2009	Average Annual Change 2001 to 2009
United States	$31,145	$35,424	$39,635	3.1%
Florida	$29,809	$35,605	$38,965	3.4%
Florida as percentage of United States	95.7%	100.5%	98.3%	N/A
Miami-Dade County	$27,041	$32,057	$36,357	3.8%
Miami-Dade County PCI as Percentage of Florida	90.7%	90.0%	93.3%	N/A
Miami-Dade County PCI as Percentage of United States	86.8%	90.5%	91.7%	N/A

Source: BEA 2011b
N/A — Not Applicable
PCI — Per Capita Income

Table 2.5-15
Roadway Functional Classes for Roadways near Turkey Point

Roadway	Functional Class
SW 344th Street/Palm Drive W of US Highway 1	Urban — Minor Arterial
SW 344th Street/Palm Drive E of Tallahassee Road	Rural — Major Collector
SW 328th Street/N. Canal Drive	Rural — Major Collector
SW 312th Street/Campbell Drive	Urban — Major Collector
SW 360th Street/ Lucille Drive	Not included in FDOT Functional Class listing, rural 2-lane
SW 117th Avenue	Not included in FDOT Functional Class listing, rural 2-lane between SW 328 Street and SW 344 Street
SW 137th Avenue/Tallahassee Road	Rural — Major Collector
US Highway 1	Urban — Principal Arterial - Other
Florida's Turnpike	Urban — Principal Arterial – Other Freeways and Expressways
SR 997	Urban — Principal Arterial - Other

Source: FDOT 2008c, 2008d
Shaded: Roadways are primary access roads to Turkey Point, east of U.S. Highway 1.

Table 2.5-16
Annual Average Daily Traffic (AADT) for Roadways near Turkey Point

Station	Location	2007 AADT	Forecasted 2012 AADT	Forecasted 2015 AADT	Forecasted 2016 AADT	Forecasted 2017 AADT
872548	Florida City — SW 344th St/Palm Drive 100 ft E of SR 997	19,800	22,500	Not reported	Not reported	Not reported
870084	Florida City — SW 344th St/Palm Drive 200 ft W of SW 2 Ave.	24,000	30,000	33,600	34,800	36,000
870043	Homestead — SR 997/ Krome Ave. 200 ft S of SW 296th St/Avocado Dr.	17,600	20,800	22,800	23,400	24,100
875017	Homestead — SR 997/ Krome Ave. 200 ft S of NE/ NW 8th St	16,500	18,600	19,800	20,300	20,700
870131	Homestead — SR 997 200 ft. S of SE 8th Street	12,200	13,400	14,100	14,400	14,600
870544	Homestead — U.S. Highway 1 100 ft. N of SW 328th Street	30,000	35,900	39,400	40,600	41,700
870545	US 5/U.S. Highway 1 100 ft. N of SW 308th St	31,500	36,000	38,700	39,600	40,500
972259	Florida's Turnpike between U.S. Highway 1 and SW 312nd Street	59,700	Not reported	Not reported	Not reported	Not reported
972262	Florida's Turnpike N. of SW 162nd Ave. Bridge	34.100	43,100	48,400	50,200	52,000
870518	SR 997/Krome Ave, 400 ft. NW SR 5/U.S. Highway 1	8,800	10,900	12,100	12,600	13,000
870543	SR 5/US Highway 1, 2,500 ft. S of SW 344th St/ Palm Drive	27,000	30,900	33,300	34,100	34,900

Source: FDOT 2008d
Shaded: Roadway is primary access roads to Turkey Point, east of U.S. Highway 1.

Table 2.5-17
Traffic Counts for Turkey Point Access Roads

Miami-Dade County Traffic Count Station	Location	Peak Hour Capacity[(a)]	Peak Hour Trips[(b)]	Available Peak Hour Capacity
9956	Palm Drive west of Tallahassee Road	3,030	231	2,799
9952	N. Canal Street west of Tallahassee Road	2,600	254	2,346
9944	SW 312th Street /Campbell Drive east of Florida's Turnpike	3,350	2,061	1,289

(a) Maximum level of service capacity.
(b) Existing traffic volumes plus peak hour trips associated with approved, but not built, developments.
Source: MDC 2008c
Shaded: Roadways are primary access roads to Turkey Point, east of U.S. Highway 1.

Table 2.5-18
Florida - Revenue Collection Summary
Five Year Comparison of DOR Administered Tax Collections
FY 2006/2007 through FY 2010/2011 ($ Millions)

General Revenue Sources	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	Percent of Total Taxes, 2010-2011
Sales and Use Tax	22,854.6	21,518.0	19,227.7	18,537.0	19,352.98	59.8
Communications Services Tax	2,420.8	2,507.2	2,516.9	2,419.2	2,307.05	7.1
Corporate Income and Excise Tax	2,442.5	2,211.8	1,836.6	1,793.2	1,869.87	5.8
Documentary Stamp Tax	3,064.5	1,977.5	1,128.4	1,093.6	1,176.82	3.6
Insurance Premium Tax	785.9	714.7	651.3	667.8	698.11	2.2
Intangible Tax B & D (annual)	40.0	2.1	0.8	0.7	0.32	0.0
Intangible Tax C	726.7	436.5	199.9	158.9	162.47	0.5
Estate Tax	43.4	12.2	4.8	3.3	1.12	0.0
Severance Tax – Oil & Gas	9.4	12.8	8.0	3.9	10.06	0.0
Severance Tax – Solid Mineral	36.5	43.2	73.3	67.1	48.96	0.2
Audit Clearing Account	129.2	107.3	123.0	116.7	165.57	0.5
Warrant Clearing Account	0.5	0.4	0.1	0.0	0.00	0.0
GR Sources – Refunds	-360.5	-460.9	-596.8	-536.5	-319.70	-1.0
Subtotal - General Revenues	**32,218.7**	**29,082.8**	**25,173.8**	**24,324.9**	**25,473.62**	
Other Tax Sources						
Governmental Leasehold Tax	0.5	0.4	0.7	0.9	0.95	0.0
Fuel-Related Taxes and Fees	3,167.9	3,392.0	3,287.0	3,330.1	3,335.68	10.3
Gross Receipts Tax – Utility	603.1	648.3	653.2	660.0	639.45	2.0
Solid Waste Return Taxes	185.7	187.6	166.1	160.8	172.88	0.5
Warranty Fee (Lemon Law)	2.3	2.1	1.5	1.3	1.62	0.0
Lakebelt Mitigation	4.5	5.0	4.5	4.3	4.67	0.0
Lakebelt Plant Upgrade Fee	2.8	5.4	3.4	2.7	2.86	0.0
Clerk of Court – DOR	152.6	169.6	287.8	198.9	190.70	0.6
Clerk of Court – Other Agencies	149.1	153.2	174.8	1,027.1	831.78	2.6
Miscellaneous	2.1	5.4	3.9	9.2	66.05	0.2
Other Sources – Refunds	-52.0	-54.7	-61.1	-59.5	-63.00	-0.2
Unemployment Tax	1,047.4	885.8	900.7	1,184.2	1,699.24	5.3
Subtotal – Other Tax Sources	**5,525.7**	**5,400.0**	**5,422.6**	**6,520.0**	**6,882.87**	21.3
Total DOR Administered Taxes	**37,719.1**	**34,482.8**	**30,596.4**	**30,844.9**	**32,356.50**	100.0
Annual Percent Change	-3.4%	-8.6%	-11.3%	0.8%	4.9%	
Growth over 5 years					**-14.2%**	

Note: Values displayed as presented in the referenced source; values may not reflect sum of the subtotals.
Source: FDOR 2011: 2011 Annual Report (pg 27)

Table 2.5-19
Turkey Point Plant Property Taxes, 2000 to 2011
Miami-Dade County School District and Miami-Dade Schools

Tax Year	Plant	Total Assessed Value(a)	Total Tax Paid(b)	Miami-Dade School Tax	Percent of Total	Miami-Dade County Tax(c)	Percent of Total
2000	Turkey Point Fossil	$83,354,423	$1,785,093	$769,555	43%	$1,015,538	57%
2000	Turkey Point Nuclear	455,558,527	9,756,105	4,205,862	43%	5,550,243	57%
	Subtotal, 2000	**$538,912,950**	**$11,541,198**	**$4,975,417**	**43%**	**$6,565,781**	**57%**
2001	Turkey Point Fossil	$65,987,617	$1,395,335	$593,952	43%	$801,383	57%
2001	Turkey Point Nuclear	458,099,013	9,686,689	4,123,331	43%	5,563,358	57%
	Subtotal, 2001	**$524,086,630**	**$11,082,024**	**$4,717,283**	**43%**	**$6,364,741**	**57%**
2002	Turkey Point Fossil	$64,338,341	$1,350,211	$571,448	42%	$778,763	58%
2002	Turkey Point Nuclear	465,339,535	9,765,662	4,133,109	42%	5,632,553	58%
	Subtotal, 2002	**$529,677,876**	**$11,115,873**	**$4,704,557**	**42%**	**$6,411,316**	**58%**
2003	Turkey Point Fossil	$43,511,650	$926,496	$380,118	41%	$546,378	59%
2003	Turkey Point Nuclear	278,710,476	5,934,900	2,434,815	41%	3,500,085	59%
	Subtotal, 2003	**$322,222,126**	**$6,861,396**	**$2,814,933**	**41%**	**$4,046,463**	**59%**
2004	Turkey Point Fossil	$39,894,027	$830,306	$332,693	40%	$497,613	60%
2004	Turkey Point Nuclear	284,916,696	5,930,132	2,376,041	40%	3,554,091	60%
	Subtotal, 2004	**$324,810,723**	**$6,760,438**	**$2,708,734**	**40%**	**$4,051,704**	**60%**
2005	Turkey Point Fossil	$71,888,527	$1,471,098	$582,332	40%	$888,766	60%
2005	Turkey Point Nuclear	527,182,524	10,788,052	4,270,431	40%	6,517,621	60%
	Subtotal, 2005	**$599,071,051**	**$12,259,150**	**$4,852,763**	**40%**	**$7,406,387**	**60%**
2006	Turkey Point Fossil	$74,247,918	$1,478,788	$577,708	39%	$901,080	61%
2006	Turkey Point Nuclear	606,102,816	12,071,689	4,715,965	39%	7,355,724	61%
	Subtotal, 2006	**$680,350,734**	**$13,550,477**	**$5,293,673**	**39%**	**$8,256,804**	**61%**
2007	Turkey Point Fossil	$47,437,549	$845,583	$361,952	43%	$483,631	57%
2007	Turkey Point Nuclear	387,242,701	6,902,670	2,954,689	43%	3,947,981	57%
	Subtotal, 2007	**$434,680,250**	**$7,748,253**	**$3,316,641**	**43%**	**$4,431,612**	**57%**
2008	Turkey Point Fossil	$552,418,545	$9,873,101	$4,146,702	42%	$5,726,399	58%
2008	Turkey Point Nuclear	352,130,695	6,293,456	2,643,252	42%	3,650,204	58%
	Subtotal, 2008	**$904,549,240**	**$16,166,557**	**$6,789,954**	**42%**	**$9,376,603**	**58%**
2009	Turkey Point Fossil	$523,870,631	$9,502,092	$4,180,920	44%	$5,321,172	56%
2009	Turkey Point Nuclear	357,175,158	6,478,529	2,850,553	44%	3,627,976	56%
	Subtotal, 2009	**$881,045,789**	**$15,980,621**	**$7,031,473**	**44%**	**$8,949,148**	**56%**
2010	Turkey Point Fossil	$503,497,020	$9,888,181	$4,153,036	42%	$5,735,145	58%
2010	Turkey Point Nuclear	360,308,464	7,076,100	2,971,962	42%	4,104,138	58%
	Subtotal, 2010	**$863,805,484**	**$16,964,281**	**$7,124,998**	**42%**	**$9,839,283**	**58%**
2011	Turkey Point Fossil	$511,021,255	$9,181,946	$4,131,876	45%	$5,050,070	55%
2011	Turkey Point Nuclear	372,646,453	6,695,650	3,013,043	45%	3,682,608	55%
	Subtotal, 2011	**$883,667,708**	**$15,877,596**	**$7,144,919**	**45%**	**$8,732,678**	**55%**

(a) This column includes both real and TPP assessed values.
(b) This column includes both real and TPP property tax.
(c) Includes County-Wide operating, OCL operating, Library District, Fire-Rescue SFWMD.

Table 2.5-20
FPL Tangible Personal Property Taxes for Turkey Point Units 1-5
Miami-Dade County, Schools, and Special Districts, 2011

Taxing Unit	Millage Rate	Taxable Value	Taxes Levied[(a)]
Miami-Dade Schools			
School Board Operating	7.7650	$819,313,485	$6,361,969
School Board Debt Service	0.2400	$819,313,485	$196,635
Subtotal			$6,558,604
State and Others			
Florida Inland Navigation District	0.0345	$819,313,485	$28,267
South Florida Water Mgmt District	0.3739	$819,313,485	$306,341
Everglades Construction Project	0.0624	$819,313,485	$51,126
Children's Trust Authority	0.5000	$819,313,485	$409,656
Subtotal			$795,390
Miami-Dade County			
County Wide Operating	4.8050	$819,313,485	$3,936,802
County Wide Debt Service	0.2850	$819,313,485	$233,505
Unincorporated Operating	2.0083	$819,313,485	$1,645,428
Library District	0.1795	$819,313,485	$147,068
Fire Rescue Operating	2.4496	$819,313,485	$2,006,990
Fire Rescue Debt Service	0.0131	$819,313,485	$10,732
Subtotal			$7,980,525
Total			**$15,334,519**

(a) Values reflect taxes levied; FPL paid taxes prior to November 30, 2011 and secured a 4 percent reduction in taxes due.

Table 2.5-21
Miami-Dade Schools Revenues by Source (Dollars), FY 2000–2001 to 2009–2010

	Federal	State	Local	Total Revenues
2000-2001	268,150,714	1,512,439,113	1,054,286,298	2,834,876,125
2001-2002	289,012,907	1,421,376,456	1,109,624,023	2,820,013,386
2002-2003	340,707,795	1,398,807,944	1,170,145,397	2,909,661,136
2003-2004	383,660,896	1,513,259,169	1,281,405,099	3,178,325,164
2004-2005	409,209,373	1,542,761,004	1,430,246,807	3,382,217,184
2005-2006	401,736,168	1,473,040,327	1,605,092,982	3,479,869,477
2006-2007	440,366,731	1,463,821,921	1,838,092,952	3,742,281,604
2007-2008	434,301,957	1,431,106,534	2,024,188,466	3,889,596,957
2008-2009	455,555,278	1,080,904,568	2,045,069,733	3,581,529,579
2009-2010	625,946,741	987,315,968	1,890,151,904	3,503,414,614
As % of Total				
	Federal	**State**	**Local**	**Total**
2000-2001	9.5%	53.4%	37.2%	100.0%
2001-2002	10.2%	50.4%	39.3%	100.0%
2002-2003	11.7%	48.1%	40.2%	100.0%
2003-2004	12.1%	47.6%	40.3%	100.0%
2004-2005	12.1%	45.6%	42.3%	100.0%
2005-2006	11.5%	42.3%	46.1%	100.0%
2006-2007	11.8%	39.1%	49.1%	100.0%
2007-2008	11.2%	36.8%	52.0%	100.0%
2008-2009	12.7%	30.2%	57.1%	100.0%
2009-2010	17.9%	28.2%	54.0%	100.0%

Note: Subtotals may not sum to presented totals because of rounding.
Sources: FDOE 2002; FDOE 2004; FDOE 2005; FDOE 2006; FDOE 2007a; FDOE 2007b; FDOE 2008; FDOE 2009: FDOE 2010; FDOE 2011.

Table 2.5-22
Miami-Dade County Revenues and Expenses, 2011 (Thousands of Dollars)

	2011 Actual	2012 Forecast	2013 Forecast	2014 Forecast	2015 Forecast	2016 Forecast
Revenues						
Property Tax	$976,737	$853,434	$853,424	$879,008	$905,361	$932,504
Gas Tax	$64,600	$65,389	$66,370	$67,366	$68,376	$69,402
Carryover	$61,121	$99,915	$21,568	$0	$0	$0
Interest	$1,263	$2,470	$2,470	$2,544	$2,620	$2,699
State Revenue Sharing	$28,747	$30,572	$31,489	$32,433	$33,406	$34,409
Limited Term Revenues	$25,133	$25,000	$0	$0	$0	$0
Administrative Reimb.	$42,343	$31,401	$31,715	$32,032	$32,352	$32,676
Sales Tax	$57,559	$58,702	$60,463	$62,277	$64,145	$66,070
Other	$20,571	$14,562	$14,780	$15,002	$15,227	$15,456
Total Revenues	$1,278,074	$1,181,445	$1,082,279	$1,090,663	$1,121,489	$1,153,215
Expenses						
Public Safety	$509,204	$488,336	$500,915	$528,004	$542,329	$563,019
Policy Formulation	$31,527	$28,343	$28,489	$29,483	$30,289	$31,461
Transportation	$166,165	$168,497	$174,046	$216,290	$226,847	$234,421
Recreation and Culture	$59,421	$47,315	$47,541	$48,892	$50,003	$51,600
Neighborhood and Infrastructure	$9,279	$8,517	$8,565	$8,857	$9,096	$9,440
Economic Development	$49,198	$41,854	$41,873	$43,146	$44,429	$45,796
Health & Human Services	$179,596	$189,463	$193,368	$196,429	$201,885	$207,934
General Government	$173,768	$187,552	$172,553	$180,659	$212,864	$227,253
Total Expenses	$1,178,158	$1,159,877	$1,167,350	$1,251,760	$1,317,742	$1,370,924
Surplus/Funding Gaps	$99,916	$21,568	($85,071)	($161,097)	($196,253)	($217,709)

Note: All values were entered from the source and were not calculated.
Source: MDC 2012

Table 2.5-23
City of Homestead, Florida, Revenues and Expenditures, 2001 to 2010

Fiscal Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Revenues										
Taxes	$9,067,706	$10,526,894	$11,452,540	$10,394,172	$12,983,777	$17,883,162	$22,801,735	$23,572,143	$24,582,143	$22,150,021
Licenses and permits	1,038,177	1,399,721	3,681,426	7,319,860	9,874,796	7,115,937	6,843,013	2,092,160	1,134,500	1,502,317
Intergovernmental	5,673,791	4,804,512	5,871,505	10,125,061	14,449,612	25,682,205	13,402,273	13,352,446	22,449,188	19,833,928
Charges for services	222,995	427,786	812,168	682,823	1,761,002	821,636	1,053,153	1,424,963	716,941	492,969
Fines and forfeitures	5,540,240	3,171,116	3,379,188	1,839,569	1,858,985	1,579,083	1,023,917	1,237,766	4,675,874	2,449,746
Investment income	539,903	391,594	582,542	485,883	958,572	1,873,176	2,153,768	1,608,681	1,766,610	1,897,670
Payment in lieu of taxes	510,000	510,000	510,000	510,000	735,000	735,000	738,800	738,800	738,800	738,800
Other revenues	4,246,688	3,547,826	4,717,819	4,305,843	3,366,325	3,281,295	3,812,819	7,863,335	7,304,237	9,475,586
Total revenues	26,839,500	24,779,449	31,007,188	35,663,211	45,988,069	58,971,494	51,829,478	51,890,294	63,368,293	58,541,037
Expenditures										
General government	5,583,705	6,920,475	6,203,405	7,757,725	10,362,703	15,968,715	12,540,349	12,461,323	11,438,655	12,433,496
Public safety	12,304,539	10,820,422	14,230,606	14,079,160	17,251,305	24,844,565	23,144,728	24,879,553	27,066,693	25,744,339
Public works	608,594	728,869	833,282	1,217,976	1,544,222	2,091,683	2,365,714	2,048,259	2,658,300	1,697,207
Parks and recreation	2,213,556	2,805,187	4,936,101	3,426,868	3,819,015	5,165,915	5,106,593	4,095,683	4,511,005	3,943,597
Capital outlay	1,947,353	1,773,427	2,342,217	4,620,898	6,141,460	11,843,770	10,542,159	8,861,472	14,666,466	8,463,578
Debt service:										
Principal	1,538,187	1,433,221	1,289,535	539,203	924,203	2,179,203	1,759,203	1,644,203	1,644,203	1,644,203
Interest mid fiscal charges	1,318,449	1,076,770	1,856,070	874,130	804,159	892,828	674,278	709,328	782,412	559,104
Total expenditures	25,514,383	25,558,371	31,691,216	32,515,960	40,847,067	62,986,679	56,133,024	54,699,821	62,767,734	54,485,524
Excess of revenues over (under) expenditures	1,325,117	(778,922)	(684,028)	3,147,251	5,141,002	(4,015,185)	(4,303,546)	(2,809,527)	600,559	4,055,513
Other financing sources (uses):										
Transfer in	4,458,820	6,745,663	4,924,889	4,711,383	5,050,024	5,280,740	6,445,577	17,813,998	657,243	662,192
Transfer out	(582,467)	(1,780,801)	(1,439,761)	(1,841,050)	(1,410,935)	(2,422,456)	(901,544)	(717,704)	(630,703)	(952,194)
Other financing source	—	—	952,419	352,550	—	1,200,000	—	—	—	—
Total other financing sources (uses)	3,876,353	4,964,862	4,437,547	3,222,883	3,639,089	4,058,284	5,544,033	17,096,294	26,540	(290,002)
Net change in fund balances	5,201,470	4,185,940	3,753,519	6,370,134	8,780,091	43,099	1,240,487	14,286,767	627,099	3,765,511
Debt services as a percentage of noncapital expenditures	12.12%	10.55%	10.61%	4.82%	4.87%	5.89%	5.11%	5.08%	5.18%	4.78%

Note 1: Values are not adjusted for inflation.
Note 2: City of Homestead CAFR for fiscal years ending September 30, 2001 through September 30, 2010
Source: CHF 2011

Table 2.5-24
City of Homestead Assessed Value and Estimated Actual Value of Taxable Property, 2001 to 2010 (Dollars in Thousands)

Fiscal Year	Real Property Assessed Value	Personal Property Assessed Value	Total Taxable Assessed Value	Valuation Adjustments	Total Direct Tax Rate	Estimated Actual Taxable Value	Assessed Value as % of Estimated
2001	535,512	90,363	625,875	(19,801)	8.5000	606,074	97
2002	609,955	80,156	690,011	(16,632)	8.5000	673,379	98
2003	663,610	79,307	742,917	(23,445)	8.5000	719,472	97
2004	807,659	84,096	891,755	(37,645)	8.2500	854,110	96
2005	1,121,336	84,435	1,205,771	(42,778)	7.7500	1,162,993	96
2006	1,736,246	83,296	1,819,542	68,326	6.7500	1,887,868	104
2007	2,809,561	108,324	2,917,885	(7,886)	6.2500	2,909,999	100
2008	3,690,990	112,797	3,803,787	-160,333	5.1585	3,643,454	96
2009	3,854,307	110,531	3,964,838	-206,460	5.3410	3,758,378	95
2010	2,876,330	110,037	2,986,367	N/A	6.2917	2,986,367	N/A

Source: CHF 2011
N/A — Not Available

Table 2.5-25
City of Homestead Property Tax Rates
Direct and Overlapping Governments, 1999 to 2010

Fiscal Year	City of Homestead Direct Rates		Overlapping Rates				Total Millage
	Operating Millage	Total City Millage	School District Millage	State Millage	Miami-Dade County	Special District Millage	
1999	8.5000	8.5000	10.1600	0.7440	6.8600	3.1980	26.2640
2000	8.5000	8.5000	9.6440	0.7410	9.6980	N/A	28.5830
2001	8.5000	8.5000	9.6170	0.7380	6.4030	3.1030	28.3610
2002	8.5000	8.5000	9.3760	0.7355	6.2650	3.2030	28.0795
2003	8.5000	8.5000	9.2520	0.7355	6.2790	3.1470	27.9135
2004	8.2500	8.2500	9.1000	0.7355	6.2540	3.6470	27.9865
2005	7.7500	7.7500	8.6870	0.7355	6.2200	3.5912	26.9837
2006	6.7500	6.7500	8.4380	0.7355	6.1200	3.5758	25.6193
2007	6.2500	6.2500	8.1050	0.7355	5.9000	3.5593	24.5498
2008	5.1585	5.1585	7.0948	0.6585	4.8646	3.0552	21.6848
2009	5.3410	5.3410	7.7970	0.6585	5.1229	3.0305	21.9499
2010	6.2917	6.2917	7.9950	0.6585	5.1229	3.1093	23.1774

Source: CHF 2011
N/A — Not Available

Table 2.5-26
City of Florida City, Florida, Revenues and Expenditures, 1998–2007[(a)]

Fiscal Year:	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Revenues										
Taxes	1,743,321	1,913,387	2,007,569	2,347,976	2,866,283	3,048,194	3,318,362	3,704,135	4,712,751	6,083,020
Intergovernmental	3,400,593	3,359,370	3,401,390	3,702,841	5,293,461	6,157,460	1,596,708	1,886,441	1,860,483	1,938,026
Charges for services	867,039	2,170,488	2,253,455	2,760,624	3,218,026	3,717,208	2,128,659	2,621,528	2,907,724	3,013,128
Program income	830,659	129,578	236,679	50,974	24,745	15,530	6,415	68,841	11,467	6,751
Interest	225,802	161,365	156,138	143,832	140,601	174,075	218,875	87,033	387,365	823,122
Impact fees	0	423,134	244,797	180,266	120,469	154,791	495,137	254,765	591,756	256,263
Licenses and permits	213,200	361,415	228,565	343,830	243,856	320,698	809,898	523,472	771,320	645,951
Donations	64,467	11,285	56,450	19,325	7,011	15,550	10,725	2,328	1,900	20,535
Confiscated property	14,786	13,569	6,449	15,451	6,990	7,826	11,477	17,027	8,589	10,551
Public safety	26,774	16,146	0	0	0	0	0	0	0	0
Fines and forfeitures	0	0	23,280	28,831	17,487	22,087	35,321	362,025	70,770	38,589
Grants	0	0	0	0	0	0	3,379,924	2,178,292	4,268,564	1,638,886
Other revenues	186,451	167,951	345,153	329,085	334,763	288,351	415,755	226,218	453,479	175,872
Total revenues	7,573,092	8,727,688	8,959,925	9,923,035	12,273,692	13,921,770	12,427,256	11,932,105	16,046,168	14,650,694
Expenditures										
General government	4,927,434	5,072,683	6,206,941	5,828,041	7,304,899	8,759,836	4,992,062	4,387,909	6,263,248	3,959,431
Public safety	1,304,263	1,596,194	1,752,545	1,644,892	1,587,478	1,664,272	1,809,718	1,868,060	2,411,032	2,559,295
Public works	1,176,822	1,159,669	1,258,117	1,368,100	1,536,536	1,699,657	1,815,524	1,848,024	2,078,063	2,200,313
Parks and recreation	139,979	153,960	176,205	162,108	182,413	229,592	266,312	245,119	413,403	392,531
Capital outlay	787,763	44,404	143,952	87,934	35,135	63,703	1,843,754	1,381,943	1,464,536	2,332,956
Debt Service										
Principal	0	48,700	47,095	45,440	42,345	41,388	0	87,108	180,301	115,882
Interest	0	32,100	33,100	34,100	39,270	38,700	0	0	0	0
Total expenditures	8,336,261	8,107,710	9,617,955	9,170,615	10,728,076	12,497,148	10,727,370	9,818,163	12,810,583	11,560,408
Excess of revenues over (under) expenditures	(763,169)	619,978	(658,030)	752,420	1,545,616	1,424,622	1,699,886	2,113,942	3,235,585	3,090,286

(a) Values are not adjusted for inflation.
Source: CFCF May 2008

Table 2.5-27
City of Florida City Assessed Value and Estimated Actual Value of Taxable Property 1998–2007 (Dollars in Thousands)[a]

Fiscal Year	Real Property Assessed Value	Personal Property Assessed Value	Less Tax Exempt Property	Total Taxable Assessed Value	Estimated Actual Taxable Value	Total Tax Levy
1998	152,240	21,262	20,344	153,158	204,391	1,079,547
1999	168,647	21,030	28,988	160,689	225,229	1,276,772
2000	190,151	24,982	29,448	185,685	251,504	1,563,805
2001	225,434	26,337	35,030	216,741	293,021	1,931,973
2002	238,528	23,964	38,208	224,284	310,708	2,006,105
2003	266,852	25,507	40,284	252,075	342,489	2,222,409
2004	308,595	26,261	45,403	289,453	405,519	2,562,967
2005	396,474	33,975	62,710	367,739	459,651	3,528,894
2006	549,218	37,010	65,093	521,135	641,289	5,201,929
2007	702,348	39,434	72,027	669,755	812,637	5,579,344

(a) Values are not adjusted for inflation.
Source: CFCF May 2008

Table 2.5-28
City of Florida City Property Tax Rates
Direct and Overlapping Governments, 1998–2007

Fiscal Year	City of Florida City Direct Rates		Overlapping Rates				Total Millage
	Operating Millage	Total City Millage	School District Millage	State Millage	Miami-Dade County	Special District Millage	
1998	7.9000	7.9000	10.1600	0.7440	6.8600	3.1980	28.8620
1999	7.9000	7.9000	9.6440	0.7410	6.6250	3.0730	27.9830
2000	8.4000	8.4000	9.6170	0.7380	6.4030	3.1030	28.2610
2001	8.9000	8.9000	9.3760	0.7355	6.2650	3.2030	28.4795
2002	8.9000	8.9000	9.2520	0.7355	6.2790	3.1470	28.3135
2003	8.9000	8.9000	9.1000	0.7355	6.2540	3.6470	28.6365
2004	8.9000	8.9000	8.6870	0.7355	6.2200	3.5912	28.1337
2005	8.9000	8.9000	8.4380	0.7355	6.1200	3.5758	27.7693
2006	8.9000	8.9000	8.1050	0.7355	5.9000	3.5593	27.1998
2007	8.9000	8.9000	8.1050	0.7355	5.9000	3.5593	27.1998

Source: CFCF May 2008

Table 2.5-29
Wildlife Management Areas, National Wildlife Refuges, and Preserves[(a)] within 50 Miles of Turkey Point

Name	Management Agency	County	Acres	Annual Visitors	Capacity	Distance to the Plant Area (miles)
Big Cypress National Preserve	U.S. National Park Service	Broward, Collier, Miami-Dade, and Monroe	720,561	822,864	N/A	44
Biscayne National Park	U.S. National Park Service	Miami-Dade	172,971	517,442	N/A	Adjacent to the plant property[(b)]
Cross Key	The Nature Conservancy	Monroe	124	N/A	N/A	15
Crocodile Lake National Wildlife Refuge	U.S. Fish and Wildlife Service	Monroe	6,692	N/A	N/A	12
Everglades National Park	U.S. National Park Service	Collier, Miami-Dade, and Monroe	1,508,533	1,074,764	N/A	29
Florida Keys Wildlife and Environmental Area	Florida Fish and Wildlife Conservation Commission	Monroe	3,089	N/A	N/A	31
Mary Krome Bird Refuge	Florida Audubon Society, Inc.	Mami-Dade	2	N/A	N/A	10
Tarpon Basin	The Nature Conservancy	Monroe	598	N/A	N/A	21
ROI Total			2,412,570			

(a) Only wildlife management areas, national wildlife refuges, and preserves that are open to the public are listed.
(b) Park's visitor center is 3 miles from Units 6 & 7.
N/A — Not Available
Source: NPS 2008c, FNAI 2008

Table 2.5-30
State Parks within 50 Miles of Turkey Point

Name	County	Acres	Annual Visitors 2007–2008	Daily Capacity 2007–2008	Distance to the site (miles)
Bill Baggs Cape Florida State Park	Miami-Dade	432	893,543	6,560	20
Curry Hammock State Park	Monroe	1,000	60,544	NA	26
Dagny Johnson Key Largo Hammock Botanical State Park	Monroe	2,421	11,372	140	12
Indian Key Historic State Park	Monroe	110	18,295	50	43
John Pennekamp Coral Reef State Park	Monroe	63,836	878,939	2,225	17
John U. Lloyd Beach State Park	Broward	311	495,609	12,600	47
Lignumvitae Key Botanical State Park	Monroe	10,818	23,416	50	42
Oleta River State Park	Miami-Dade	1,033	357,178	6,902	36
San Pedro Underwater Archaeological Preserve State Park	Monroe	644	712	60	45
The Barnacle Historic State Park	Miami-Dade	10	31,545	160	21
Windley Key Fossil Reef Geological State Park	Monroe	32	11,087	400	36
ROI Total		80,647	2,721,696	29,147	

Sources: FNAI 2008

Table 2.5-31
Residential Housing, Miami-Dade County, 2000 to 2005–2009

	Total Housing Units	Occupied Units	Owner-occupied Units	Vacancy Rate, Owner-occupied Units	Median Value of Owner-occupied	Renter Occupied Units	Vacancy Rate, Rental Units	Median Monthly Rental	Vacant Units	Seasonal, Recreational, and Occasional Use (Vacant Units)	Mobile Homes
2000	852,278	776,774	449,325	2.1%	$124,000	327,449	5.7%	$647	75,504	29,587	15,338
2005-2009	962,935	827,931	482,841	3.7%	$277,200	345,090	8.0%	$965	135,004	38,302	15,085
Change 2000 to 2005-2009	13.0%	6.6%	7.5%	N/A	123.5%	5.4%	N/A	49.1%	78.8%	29.5%	-1.6%

Sources: USCB 2000a and 2000b, USCB 2010b, and USCB 2010d
N/A — Not Applicable

Table 2.5-32
Residential Housing, Homestead and Florida City Area, 2005-2009

	Total Housing Units	Occupied Units	Owner-Occupied Units	Vacancy Rate of Owner Occupied Units	Median Value of Owner Occupied Units	Renter Occupied Units	Vacancy Rate of Rental Units	Median Monthly Rent	Vacant Units	Seasonal, Recreational, Occasional Use (Vacant Units)	Mobile Homes
Homestead	20,875	17,239	7,594	10.7%	$216,500	9,645	11.0%	$928	3,636	164	599
Florida City	3,119	2,709	946	2.7%	$171,300	1,763	11.5%	$828	410	11	12
Total Homestead/ Florida City Area	23,994	19,948	8,540	N/A	N/A	11,408	N/A	N/A	4,046	175	611

Note: Data reflect numbers from years 2005-2009, except for "Seasonal, recreational, occasional use" which is 2010 data.
Sources: USCB 2010b and USCB 2010d
N/A — Not Applicable

Table 2.5-33
Residential Building Permits Issued, Miami-Dade County, Homestead, and Florida City, 2001 to 2011

Year	Miami-Dade County	Homestead	Florida City	Total, Homestead and Florida City Area
2001[(a)]	13,996	491	13	504
2002[(a)]	14,606	300	39	339
2003[(a)]	15,533	1,565	174	1,739
2004[(a)]	22,856	2,719	242	2,961
2005[(a)]	26,120	3,798	233	4,031
2006[(a)]	20,017	1,653	143	1,796
2007[(a)]	8,082	709	148	857
2008[(a)]	2,569	41	2	43
2009[(b)]	1,133	107	4	111
2010[(b)]	3,208	158	98	256
2011[(b)]	2,635	N/A	N/A	N/A
Total (2001 to 2010)	128,120	11,541	1,096	12,637

(a) USCB 2009a
(b) USCB 2012a
N/A — Not Available

Table 2.5-34
Recreational Vehicle Parks, Miami-Dade County, 2012

RV Park[(a)]	Location	Number of RV Sites	Number of Sites with Full Hookups
Everglades National Park (Long Pine Key)[(b)]	Homestead	108	0
Florida City Campsite (City Park)[(c)]	Florida City	310	253
Goldcoaster Mobile Home and RV Resort[(c)]	Homestead	90	90
Larry & Penny Thompson Park & Campground[(c)]	Miami	240	240
Miami Everglades Campground[(d)]	Miami	300	252
Pine Isle Mobile Home Park[(c)]	Homestead	257	257
The Boardwalk[(c)]	Homestead	130	130
Gator Park[(c)]	Miami	60	15
Southern Comfort[(e)]	Florida City	356	350
Total	N/A	1851	1587

(a) Rates generally range from $30 -$60 per night for 2 people or per vehicle.
(b) Source: NPS 2009.
(c) Source: Woodall's 2012.
(d) Source: TLD 2012.
(e) Source: RVP 2012.
N/A — Not Applicable

Table 2.5-35
Hotel/Motel Data, Miami-Dade County, 2011

City/Town/Place	Number of (Hotel/Motel) Units[(a)]	Rooms Available	Room Nights Available (unoccupied)[(b)]	Average Room Rate[(c)]	Occupancy Rate[(c)]
Airport/Civic Center	61	10,698	1,979	$98.65	81.5%
Aventura/Sunny Isle	15	2,670	724	$166.04	72.9%
Central Dade	18	2,034	572	$101.21	71.9%
Coral Gables	15	1,677	428	$129.46	74.5%
Downtown/Surfside/BalHabor	37	7,285	1,938	$153.08	73.4%
Grove/Key Biscayne	12	1,715	430	$189.41	74.9%
Miami Beach	138	16,599	3,967	$206.54	76.1%
North Dade	38	3,036	777	$76.93	74.4%
South Dade	27	1,928	713	$75.76	63.0%
Miami-Dade County Total	361	47,642	11,528	$150.79	75.8%

(a) Smith Travel Research, from Planning and Research Department, Greater Miami Convention & Visitor's Bureau; this number represents only the hotel/motels that report to the Smith Travel Research.
(b) The number of available rooms multiplied by vacancy rate (1-occupancy rate).
(c) Average 2011 as of October 2011.
Source: GMCVB 2012

Table 2.5-36
Major Public Water Suppliers in Miami-Dade County

Major Suppliers	Service Area Population, 2007	2007 Daily Average Demand (MGD)	Available Facility Capacity (MGD)	Daily Demand as Percent of Capacity, 2007
Total from major suppliers, Miami-Dade County	2,621,700	398.03	532.55	74.74%
Miami-Dade County Water and Sewer Department (WASD)[(a)(b)(c)]	2,250,944	347.81	470.35	73.95%
Florida City[(d)]	15,000	2.33	4.00	58.13%
Homestead[(d)]	71,252	12.47	16.90	73.78%
North Miami[(d)]	97,504	8.50	9.30	91.40%
North Miami Beach[(d)]	187,000	26.93	32.00	84.15%

(a) Table 5-4.
(b) SFWMD 2010.
(c) Includes 20 mgd for South Miami Heights water treatment plant scheduled to come online in 2012.
(d) Chapter 2.6 and footnote to Exhibit C-4.
Source: MDWASD 2008

Table 2.5-37
Miami-Dade County- Projected Water Demands for 2005–2025

Category	2005 (mgd)	2025 (mgd)	Percent change in demand 2005–2025	Percent of overall demand, 2005
Public Water Utility and Domestic Self-Supply	380.92	483.10	26.8	72.39
Commercial/Industrial Self-Supply	41.7	41.7	0.00	7.92
Recreational Self-Supply	8.8	15.1	71.59	1.67
Thermoelectric Power Self-Supply	2.1	69.8	3223.81	0.40
Agricultural Self-Supply	92.7	90.2	-2.70	17.62
Total Water Demand	526.22	699.9	33.01	100.00

Source: SFWMD 2005, Appendix D

Table 2.5-38
Wastewater Treatment Systems in Miami-Dade County

System Name (Facility #)	Plant Capacity[(a)] (mgd)	Annual Average Flow (mgd)	Flow as Percent of Design Capacity
Miami-Dade County			
City of Homestead (FLA013609)	6.0	6.13	102%
MDWASD South District WWTF (FL0042137)	112.5	98.53	88%
MDWASD North District WWTP (FL0032182)	112.5	91.39	81%
Central District WWTP (FLA024805)	143	115	80%

(a) Maximum permitted capacity.

Table 2.5-39
Law Enforcement, Miami-Dade County, Florida City, and Homestead, 2010

Political Jurisdiction	Total Law Enforcement Employees	Total Officers
Miami-Dade County[(a)(b)]	4363	2980
Florida City[(c)]	44	33
Homestead [(c)]	144	102

(a) Excludes employees employed by municipalities within the county.
(b) Source: FBI 2010a.
(c) Source: FBI 2010b.

Table 2.5-40
Fire Protection, Miami-Dade County, 2010

Fire Department Name	City	Department Type	Number Of Stations	Active Firefighters Career	Active Firefighters Volunteer	Active Firefighters Paid per Call
482 SPTG/CEF Fire Department	Homestead ARB	Career	1	54	0	0
Coral Gables Fire & Rescue Department	Coral Gables	Career	3	140	0	0
Everglades National Park Visitor Protection	Homestead	Volunteer	2	0	0	15
Hialeah Fire Department	Hialeah	Career	8	284	0	0
Key Biscayne Fire Rescue	Key Biscayne	Career	1	38	0	0
Miami Beach Fire Department	Miami Beach	Career	4	200	0	0
Miami Fire-Rescue	Miami	Career	14	699	0	0
Miami-Dade Fire Rescue Department	Doral	Career	65	2070	0	0
Totals	-	-	98	3485	0	15

Note: Homestead and Florida City are served by the Miami-Dade Fire Rescue Department.
Source: USFA 2010

Table 2.5-41 (Sheet 1 of 2)
Medical Facilities and Personnel for Miami-Dade County, 2006

Facility Name	Staffed Beds	Admissions[a]	Census[b]	Outpatient Visits[c]	Personnel[c]	Service Classification
Aventura Hospital and Medical Center	390	15,956	246	76,540	892	General & Surgical
Coral Gables Hospital	188	N/A	N/A	N/A	N/A	General & Surgical
Doctors Hospital	148	6,994	105	61,204	740	General & Surgical
Kindred Hospital South Florida – Coral Gables	53	N/A	N/A	N/A	N/A	Other Specialty
Hialeah Hospital	220	N/A	N/A	N/A	N/A	General & Surgical
Palm Springs General Hospital	190	N/A	N/A	N/A	N/A	General & Surgical
Palmetto General Hospital	190	N/A	N/A	N/A	N/A	General & Surgical
Homestead Hospital	116	7,284	86	68,452	631	General & Surgical
Baptist Hospital of Miami	551	N/A	N/A	N/A	N/A	General & Surgical
Bascom Palmer Eye Institute – Anne Bates Leach Eye Hospital	22	174	2	186,118	570	Eye, Ear, Nose & Throat
Cedars Medical Center	350	17,933	301	51,153	1,179	General & Surgical
Healthsouth Rehabilitation Hospital	60	N/A	N/A	N/A	N/A	Rehabilitation
Jackson Memorial Hospital	1,776	66,192	1,472	626,140	11,193	General & Surgical
Jackson South Community Hospital	233	N/A	N/A	N/A	N/A	General & Surgical
Kendall Regional Medical Center	296	16,428	210	80,098	1,217	General & Surgical
Meadowbrook Rehabilitation Hospital of West Gables	60	N/A	N/A	N/A	N/A	Rehabilitation
Mercy Hospital	367	19,790	291	93,699	2,065	General & Surgical
Miami Children's Hospital	252	13,297	195	266,010	2,266	Children's General
Miami Jewish Home and Hospital for the Aged	32	N/A	N/A	N/A	N/A	General & Surgical
North Shore Medical Center	357	N/A	N/A	N/A	N/A	General & Surgical
Pan American Hospital	146	N/A	N/A	N/A	N/A	General & Surgical
Select Specialty Hospital of Miami	40	N/A	N/A	N/A	N/A	Long-Term Acute Care
Sister Emmanual Hospital for Continuing Care	29	N/A	N/A	N/A	N/A	Long-Term Acute Care
South Miami Hospital	324	21,062	233	180,214	1,813	General & Surgical
University of Miami Hospital and Clinics	40	1,428	24	175,234	757	General & Surgical
Veterans Affairs Medical Center	347	6,623	270	542,111	2,402	General & Surgical
Westchester General Hospital	172	5,976	142	22,129	561	General & Surgical
Mount Sinai Medical Center	685	24,319	433	173,691	2,837	General & Surgical
St. Catherine's Rehabilitation Hospital	272	N/A	N/A	N/A	N/A	Rehabilitation

Table 2.5-41 (Sheet 2 of 2)
Medical Facilities and Personnel for Miami-Dade County, 2006

Facility Name	Staffed Beds	Admissions[(a)]	Census[(b)]	Outpatient Visits[(c)]	Personnel[(c)]	Service Classification
Parkway Regional Medical Center	392	N/A	N/A	N/A	N/A	General & Surgical
Larkin Community Hospital	122	N/A	N/A	N/A	N/A	General & Surgical
Total	**8,420**	**223,456**	**4,010**	**2,622,793**	**29,123**	N/A

(a) Total during a recent 12-month period (2005–2006).
(b) Average daily census during a recent 12-month period.
(c) Hospital personnel list does not include doctors that serve patients in the hospital, but are employed by the hospital.

Source: AHA 2006.
N/A — Not Available.

Table 2.5-42
Additional Planned Capacity, Miami-Dade County Public Schools, FY 2011/2012 to FY 2015/2016

Project	School to be Relieved	Fiscal year	Additional Capacity (Student Stations)
Partial Replacement	Southwest Miami Senior High	2013/2014	600
Campus addition	Norman S Edelcup/Sunny Isles Beach K-8	2012/2013	264
Partial Replacement	Southwest Miami Senior High	2015/2016	1,000
Classroom Remodeling	Key Biscayne K-8 Center	2011/2012	90
Campus addition	Norman S Edelcup/Sunny Isles Beach K-8	2014/2015	400
NEW K-8 Center, Hialeah	Location not specified	2014/2015	1,600
NEW K-8 Center, Doral	Location not specified	2013/2014	1,200
NEW K-8 Center, NE Corridor	Location not specified	2015/2016	1,200
iPrepClassroom	Miami Palmetto Senior High	2011/2012	150
iPrepClassroom	Miami Norland Senior High	2011/2012	100
iPrepClassroom	North Miami Beach Senior High	2011/2012	100
Replacement w/ K-8 Center	Frederick Douglass Elementary	2012/2013	800
Addition	Key Biscayne K-8 Center	2013/2014	320
Partial Replacement	Key Biscayne K-8 Center	2015/2016	540
Partial Replacement	Miami Norland Senior High	2013/2014	600
Partial Replacement	Miami Norland Senior High	2015/2016	1,000
Replacement	Miami Park Elementary	2014/2015	500
Partial Replacement	West Homestead Elementary	2013/2014	200
Addition	Glades Middle	2014/2015	600
New Senior	Location not specified	2014/2015	1,800
Partial Replacement	Cutler Ridge Middle	2012/2013	270
PLC Expansion	School Board Administration Complex	2011 to 2015/2016	212
iPrepClassroom	School Board Administration Complex	2012 to 2013/2014	200
Total	—	—	13,746

Source: M-DCPS 2011b

Table 2.5-43
Accredited Post-Secondary Institutions within 50 Miles of Homestead Florida

Name	Location	Distance from Zip (miles)	Type	Lowest/Highest Awards Offered	2009 Student Enrollment
Florida National College–South Campus[a]	Miami	18	Private, for-profit	Less than 1 yr Certificate, Bachelor's Degree	N/A
Saint John Vianney College Seminary	Miami	20	Private, not for-profit	Bachelor's Degree, Post Baccalaureate Certificate	65
Florida International University	Miami	21	Public	Associate's Degree, Doctor's Degree	42,197
Keiser University–Miami	Miami	24	Private, not for-profit	Associate's Degree, Master's Degree	N/A
University of Miami	Coral Gables	24	Private, not for-profit	Less than 1 yr Certificate, Doctor's Degree	15,657
Miami Dade College	Miami	29	Public	Less than 1 yr Certificate, Bachelor's Degree	61,674
Florida National College–Main Campus	Hialeah	30	Private, for-profit	Less than 1 yr Certificate, Bachelor's Degree	2,819
Florida Memorial University	Miami Gardens	33	Private, not for-profit	Bachelor's Degree, Master's Degree	1,891
Saint Thomas University	Miami Gardens	33	Private, not for-profit	Less than 1 yr Certificate, Doctor's Degree	2,469
Barry University	Miami	35	Private, not for-profit	Bachelor's Degree, Doctor's Degree	8,995
Jose Maria Vargas University	Pembroke Pines	38	Private, for-profit	Less than 1 yr Certificate, Master's Degree	N/A
Nova Southeastern University	Fort Lauderdale	44	Private, not for-profit	Associate's Degree, Doctor's Degree	28,741

(a) Student enrollment is included in the Florida National-Main Campus.
Note 1: Accredited by the Commission of Colleges, Southern Association of Colleges and Schools (SACS).
Note 2: Zip code 33030 (Homestead Florida) used to calculate distances.
Sources: NCES 2012a and SACS 2011
N/A — Not Available

Table 2.5-44 (Sheet 1 of 2)
Previously Recorded Archaeological Sites Located Within 10 Miles of Units 6 & 7

Site ID	Site Name	City	County	Description	Human Remains[(a)]	Dates	Ownership	Designation[(b)]	SHPO Eval	Comments
DA00143	Biscayne National Seashore 1	Elliott Key	Dade	Redeposited site (to this location)		Glades I, 1000 B.C.–A.D. 750	Federal		Not evaluated by SHPO	In Biscayne National Park
DA00144	Biscayne National Seashore 2	Elliott Key	Dade	Redeposited site (to this location)		Glades I, 1000 B.C.–A.D. 750	Federal		Not evaluated by SHPO	In Biscayne National Park
DA00147	Biscayne National Seashore 6	Elliott Key	Dade	Prehistoric midden(s)		Glades I, 1000 B.C.–A.D. 750	Federal		Not evaluated by SHPO	In Biscayne National Park
DA00148	Biscayne National Seashore 7	Elliott Key	Dade	Redeposited site (to this location)		American, 1821–present/ Glades, A.D. 750	Federal		Not evaluated by SHPO	In Biscayne National Park
DA00149	Biscayne National Seashore 8	Elliott Key	Dade	Redeposited site (to this location)		Glades I, 1000 B.C.–A.D. 750	Federal		Not evaluated by SHPO	In Biscayne National Park
DA00150	Biscayne National Seashore 9	Elliott Key	Dade	Redeposited site (to this location)		Glades I, 1000 B.C.–A.D. 750/ Spanish-First Period 1513–1599	Federal		Not evaluated by SHPO	In Biscayne National Park
DA00151	Biscayne National Seashore 10	Elliott Key	Dade	Historic refuse/dump		Spanish-First Period 1513–1599 or Second Period 1783–1821	Federal		Not evaluated by SHPO	In Biscayne National Park
DA00152	Biscayne National Seashore 11	Elliott Key	Dade	Artifact scatter-low density		Glades I, 1000 B.C.–A.D. 750	Federal		Not evaluated by SHPO	In Biscayne National Park
DA01031	Black Creek 2	Unincorp Dade County	Dade	Prehistoric midden(s)		Glades, 1000 B.C.–A.D. 1700	Private	Miami-Dade	Not evaluated by SHPO	
DA03439	Totten Key Mound	Unincorp Dade County	Dade	Prehistoric midden(s)		Glades, 1000 B.C.–A.D. 1700	Federal		Not evaluated by SHPO	
DA06451	Goulds Pineland	Goulds	Dade	Building remains/ subsurface features		Twentieth Century American/African-American	State		Not evaluated by SHPO	

Table 2.5-44 (Sheet 2 of 2)
Previously Recorded Archaeological Sites Located Within 10 Miles of Units 6 & 7

Site ID	Site Name	City	County	Description	Human Remains[(a)]	Dates	Ownership	Designation[(b)]	SHPO Eval	Comments
DA06463	Hattie Bauer Hammock	Unincorp Dade County	Dade	Subsurface features are present	Yes	Twentieth Century American	Private		Not evaluated by SHPO	
DA06792	Harden Hammock	Unincorp Dade County	Dade	Habitation (prehistoric)		Glades, 1000 B.C.–A.D. 1700/ Prehistoric	County		Not evaluated by SHPO	
DA06996	Sweeting Homestead	Elliott Key	Dade	Homestead	Yes	Nineteenth & Twentieth Century American	Federal		NRHP listed	
DA07016	Ingraham Highway	Florida City	Dade	Historic road segment		Twentieth Century American	State		Ineligible for NRHP	
DA09990	U.S. 1	Florida City	Dade	Historic road segment		Twentieth Century American	Federal		Ineligible for NRHP	
MO00028	Key Largo 4	Key Largo	Monroe	Prehistoric mound(s)		Not recorded	Unknown		Not evaluated by SHPO	General Vicinity — never located
MO01486	Card Sound Road Intersection	Key Largo	Monroe	Historic road segment		Nineteenth & Twentieth Century American	County		Ineligible for NRHP	
MO01978	Pumpkin Key	Key Largo	Monroe	Prehistoric shell midden		Glades, 1000 B.C.–A.D. 1700	Not recorded		Not evaluated by SHPO	
MO02052	Litman	Key Largo	Monroe	Prehistoric midden(s)/artifact scatter		Glades IIIc, A.D. 1513-Ca.1700	Not recorded		Not evaluated by SHPO	
MO02062	Ocean Reef	Key Largo	Monroe	Prehistoric shell midden		Prehistoric	Not recorded		Not evaluated by SHPO	Based on informants
MO02068	Black Lowe	Key Largo	Monroe	House/Historic Well		Nineteenth & Twentieth Century American	Not recorded		Not evaluated by SHPO	

(a) Blank Entry = No Human Remains Recorded.
(b) Blank Entry = Not Locally Designated.

Summary

22 Archeological Sites identified via Florida Master Site File records
2 Listed with Human Remains found
1 Individually listed National Register property identified
1 Designated by Miami-Dade County Historic Preservation Board
0 Designated by Homestead Historic Preservation Board

Table 2.5-45
Previously Recorded Historic Cemeteries Located Within 10 Miles of Units 6 & 7

Site ID	Site Name	City	County	Description	Year Established	Ownership	Local Designation[(a)]	SHPO Evaluation
DA05893	Palms Memorial Park Cemetery	Naranja	Dade	Multi-ethnic Cemetery	1913	Private-individual		Not evaluated by SHPO
DA06793	Silver Green Cemetery	Miami	Dade	African-American Cemetery	1922	Private-corporate	Miami-Dade	Not evaluated by SHPO

(a) Blank Entry = Not Locally Designated.

Summary

2 Historic Cemeteries identified via Florida Master Site File records
0 Individually listed National Register properties identified
1 Designated by Miami-Dade County Historic Preservation Board
0 Designated by Homestead Historic Preservation Board

Table 2.5-46 (Sheet 1 of 9)
Previously Recorded Historic Structures Located Within 10 Miles of Units 6 & 7

County	Description	Year Built	Ownership	Local Designation[(a)]	SHPO Evaluation
Dade	Masonry Vernacular Commercial	1920	Private	Miami-Dade	NRHP Listed
Dade	Frame Vernacular Residence, now Museum	c 1904	Miami-Dade County	Miami-Dade	NRHP Listed
Dade	Masonry Vernacular Commercial	1936	Private	Homestead	Ineligible for NRHP
Dade	Masonry Vernacular Hotel	1914	Private		Not Evaluated by SHPO
Dade	Mediterranean Revival School	1913	Miami-Dade School Board		NRHP Listed
Dade	Frame Vernacular Hotel	1912	Private	Miami-Dade	Not Evaluated by SHPO
Dade	Residence	c 1920	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	1915	Private		Not Evaluated by SHPO
Dade	Masonry Vernacular Hotel and outbuilding	c 1913	Private	Homestead	Homestead NRHP Historic District
Dade	Commercial	1936	Private		Not Evaluated by SHPO
Dade	Residence	c 1920	Private		Not Evaluated by SHPO
Dade	Residence	1914	Private		Not Evaluated by SHPO
Dade	Masonry Vernacular Bank	c 1922	Private		Homestead HD
Dade	Commercial	1921	City of Homestead		Homestead HD
Dade	Art Deco Theater	c 1940	City of Homestead	Homestead	Potentially Eligible for NRHP
Dade	Bungalow Hotel	1916	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	1938	Private		Not Evaluated by SHPO
Dade	Service station	1926	Private		Not Evaluated by SHPO
Dade	Mediterranean Revival Church	c 1949	Private religious		Ineligible for NRHP
Dade	Frame Vernacular Residence	1904	Florida City	Miami-Dade	Not Evaluated by SHPO
Dade	Mission Commercial	c 1923	Private	Homestead	NRHP Listed
Dade	Residence	1925	Private		Not Evaluated by SHPO
Dade	Residence	c 1915	Private		Not Evaluated by SHPO
Dade	Masonry Vernacular Commercial	c 1924	Private		Ineligible for NRHP
Dade	Residence	1924	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	1916	Private		Not Evaluated by SHPO
Dade	Masonry Vernacular Commercial	1912	Florida City		Not Evaluated by SHPO
Dade	Frame Vernacular Commercial	1911	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	Not recorded	Private		Not Evaluated by SHPO

Table 2.5-46 (Sheet 2 of 9)
Previously Recorded Historic Structures Located Within 10 Miles of Units 6 & 7

County	Description	Year Built	Ownership	Local Designation[(a)]	SHPO Evaluation
Dade	Masonry Vernacular Residence	Not recorded	Private		Not Evaluated by SHPO
Dade	Mediterranean Revival Residence	1919	Private		Not Evaluated by SHPO
Dade	English Tudor Cottage residence	1920	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	1923	Private		Not Evaluated by SHPO
Dade	Civic center/ House of worship	1915	Private		Not Evaluated by SHPO
Dade	Apartment/ Hospital	1921	Private		Not Evaluated by SHPO
Dade	Residence	c 1925	Private		Not Evaluated by SHPO
Dade	Commercial	1938	Miami-Dade County		Not Evaluated by SHPO
Dade	Masonry Vernacular Residence	1923	Private		Not Evaluated by SHPO
Dade	Masonry Vernacular Residence	1930	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	1930	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	1930	Private		Not Evaluated by SHPO
Dade	Residence	c 1915	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	1920	Private		Not Evaluated by SHPO
Dade	Masonry Vernacular Residence	1920	Private		Not Evaluated by SHPO
Dade	Mission Residence	1920	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	1920	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	1937	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	1915	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	1930	Private		Not Evaluated by SHPO
Dade	School	c 1920	Miami-Dade School Board		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	1930	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	1930	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	1930	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	1926	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	1920	Private		Not Evaluated by SHPO
Dade	Masonry Vernacular Residence	c 1920	Private		Not Evaluated by SHPO
Dade	Residence	1909	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	1936	Private		Homestead NRHP Historic District
Dade	Frame Vernacular Residence	1906	Private		Not Evaluated by SHPO

Table 2.5-46 (Sheet 3 of 9)
Previously Recorded Historic Structures Located Within 10 Miles of Units 6 & 7

County	Description	Year Built	Ownership	Local Designation[a]	SHPO Evaluation
Dade	House of worship	1916	Private religious		Not Evaluated by SHPO
Dade	Commercial	1934	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Commercial	1930	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	1938	Private	Miami-Dade	Not Evaluated by SHPO
Dade	Frame Vernacular Residence	1930	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	1915	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	1914	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	1938	Private religious		Not Evaluated by SHPO
Dade	Residence	1925	Private		Not Evaluated by SHPO
Dade	Residence	1912	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	1920	Private		NRHP Listed
Dade	Masonry Vernacular Commercial	1920	Private	Miami-Dade	Potentially Eligible for NRHP
Dade	Frame Vernacular Residence	1925	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	c 1920	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	c 1905	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	1925	Private		Not Evaluated by SHPO
Dade	Mediterranean Revival Apartment	c 1920	Private		Not Evaluated by SHPO
Dade	Masonry Vernacular Commercial	c 1930	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	c 1929	Private		Not Evaluated by SHPO
Dade	Log Outbuilding	c 1914	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	c 1904	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	1930	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	1910	Private		Not Evaluated by SHPO
Dade	Bungalow Residence	1919	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	c 1923	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	Not recorded	Private		Not Evaluated by SHPO
Dade	Masonry Vernacular Residence	1912	Private		Not Evaluated by SHPO
Dade	Bungalow Residence	1911	Private	Miami-Dade	Not Evaluated by SHPO
Dade	Frame Vernacular Residence	1913	Private		Not Evaluated by SHPO
Dade	Masonry Vernacular Residence	c 1920	Private religious		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	1925	Private	Miami-Dade	Not Evaluated by SHPO

Table 2.5-46 (Sheet 4 of 9)
Previously Recorded Historic Structures Located Within 10 Miles of Units 6 & 7

County	Description	Year Built	Ownership	Local Designation[a]	SHPO Evaluation
Dade	Frame Vernacular Residence	c 1930	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	c 1938	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	c 1913	Private		Not Evaluated by SHPO
Dade	Bungalow Residence	c 1920	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	c 1920	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	c 1912	Private		Not Evaluated by SHPO
Dade	Modern Apartment	c 1915	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Commercial	1904	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	c 1930	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	1913	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	1925	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	c 1920	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	c 1913	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	1925	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	c 1923	Private		Not Evaluated by SHPO
Dade	Mediterranean Revival Library	1938	City of Homestead		NRHP Listed
Dade	Masonry Vernacular Commercial	c 1900	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	c 1930	Private	Homestead	Ineligible for NRHP
Dade	Frame Vernacular Residence	c 1921	Private		Ineligible for NRHP
Dade	Frame Vernacular Residence	c 1925	Private		Ineligible for NRHP
Dade	Frame Vernacular Residence	c 1920	Private		Not Evaluated by SHPO
Dade	Bungalow Residence	c 1920	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	c 1920	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	c 1920	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	c 1920	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	c 1920	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	c. 1940	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	c 1930	Private		Not Evaluated by SHPO
Dade	Masonry Vernacular Apartment	c 1939	Private		Ineligible for NRHP
Dade	Masonry Vernacular Residence	c 1940	Private		Ineligible for NRHP
Dade	Frame Vernacular Residence	c 1920	Private		Not Evaluated by SHPO

Table 2.5-46 (Sheet 5 of 9)
Previously Recorded Historic Structures Located Within 10 Miles of Units 6 & 7

County	Description	Year Built	Ownership	Local Designation[a]	SHPO Evaluation
Dade	Frame Vernacular Residence	c 1920	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	c 1920	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	1928	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	1930	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	1939	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	1936	Private		Not Evaluated by SHPO
Dade	Masonry Vernacular Residence	c 1930	Private		Homestead NRHP Historic District
Dade	Frame Vernacular Residence	1926	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Commercial	c 1930	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	c 1920	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	c 1920	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	c 1930	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	c 1920	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	c 1920	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	1920	Private		Not Evaluated by SHPO
Dade	Mission Residence	1926	Private		Not Evaluated by SHPO
Dade	Masonry Vernacular Commercial	c 1940	Private		Ineligible for NRHP
Dade	Masonry Vernacular Residence	c 1920	Private		Not Evaluated by SHPO
Dade	Mission Residence	c 1920	Private		Not Evaluated by SHPO
Dade	Mission Residence	c 1930	Private		Not Evaluated by SHPO
Dade	Spanish Colonial Commercial	1926	Private		NRHP Listed
Dade	Masonry Vernacular Residence	c 1930	Private		Not Evaluated by SHPO
Dade	Mission Residence	1925	Private		Not Evaluated by SHPO
Dade	Mission Residence	1925	Private		Not Evaluated by SHPO
Dade	Mission Residence	c 1920	Private		Not Evaluated by SHPO
Dade	Mission Residence	c 1920	Private		Not Evaluated by SHPO
Dade	Mission Residence	c 1930	Private		Not Evaluated by SHPO
Dade	Mission Residence	c 1930	Private		Not Evaluated by SHPO
Dade	Mission Residence	c 1930	Private		Not Evaluated by SHPO
Dade	Masonry Vernacular Commercial	c 1945	Private		Ineligible for NRHP
Dade	Frame Vernacular Residence	c 1920	Private		Not Evaluated by SHPO

Table 2.5-46 (Sheet 6 of 9)
Previously Recorded Historic Structures Located Within 10 Miles of Units 6 & 7

County	Description	Year Built	Ownership	Local Designation[(a)]	SHPO Evaluation
Dade	Masonry Vernacular Residence	c 1930	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	c 1930	Private		Not Evaluated by SHPO
Dade	Mission Residence	c 1930	Private		Not Evaluated by SHPO
Dade	Masonry Vernacular Commercial	c 1930	Private		Homestead NRHP Historic District
Dade	Masonry Vernacular Commercial	c 1935	Private		Ineligible for NRHP
Dade	Masonry Vernacular Commercial	c 1935	Private		Ineligible for NRHP
Dade	Masonry Vernacular Residence	c 1930	Private		Not Evaluated by SHPO
Dade	Moderne Residence	c 1930	Private		Not Evaluated by SHPO
Dade	Masonry Vernacular Commercial	c 1930	Private		Ineligible for NRHP
Dade	Gothic Revival Temple	1942	Private religious		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	c 1910	Private		Not Evaluated by SHPO
Dade	Mission Apartment	c 1920	Private		Not Evaluated by SHPO
Dade	Armory	c 1940	Federal		Ineligible for NRHP
Dade	Neo-Classical Revival Meetinghouse	c 1947	Private religious		Homestead NRHP Historic District
Dade	Masonry Vernacular Commercial	c 1928	Private		Homestead NRHP Historic District
Dade	Masonry Vernacular Hotel	c 1920	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	c 1921	Private	Miami-Dade	Ineligible for NRHP
Dade	Frame Vernacular Residence	c 1936	Private	Miami-Dade	Ineligible for NRHP
Dade	Moorish Revival Residence	c 1926	Private	Miami-Dade	Ineligible for NRHP
Dade	Mission Residence	c 1930	Private	Miami-Dade	Ineligible for NRHP
Dade	Frame Vernacular Residence	c 1920	Private	Miami-Dade	Ineligible for NRHP
Dade	Frame Vernacular Residence	C1930	Private		Ineligible for NRHP
Dade	Masonry Vernacular Residence	1920	Private		Ineligible for NRHP
Dade	Frame Vernacular Residence	c 1939	Private		Ineligible for NRHP
Dade	Frame Vernacular Residence	c 1929	Private		Ineligible for NRHP
Dade	Frame Vernacular Residence	c 1923	Private		Ineligible for NRHP
Dade	Masonry Vernacular Residence	c 1940	Private		Ineligible for NRHP
Dade	Frame Vernacular Residence	c 1935	Private		Ineligible for NRHP
Dade	Frame Vernacular Residence	c 1930	Private		Ineligible for NRHP
Dade	Frame Vernacular Residence	c 1920	Private		Ineligible for NRHP
Dade	Frame Vernacular Residence	c 1936	Private		Ineligible for NRHP

Table 2.5-46 (Sheet 7 of 9)
Previously Recorded Historic Structures Located Within 10 Miles of Units 6 & 7

County	Description	Year Built	Ownership	Local Designation[(a)]	SHPO Evaluation
Dade	Masonry Vernacular Commercial	c 1930	Private		Ineligible for NRHP
Dade	Frame Vernacular Residence	c 1910	Private		Not Evaluated by SHPO
Dade	Craftsman Residence	c 1925	Private	Miami-Dade	Not Evaluated by SHPO
Dade	Masonry Vernacular Commercial	c 1940	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Residence	c 1915	Private		Not Evaluated by SHPO
Dade	Masonry Vernacular Commercial	c 1930	Private		Not Evaluated by SHPO
Dade	Masonry Vernacular Residence	c 1911	Private	Miami-Dade	Not Evaluated by SHPO
Dade	Masonry Vernacular Commercial	1920	Private		Not Evaluated by SHPO
Dade	Masonry Vernacular Residence	c 1912	Private		Not Evaluated by SHPO
Dade	Masonry Vernacular Commercial	c 1930	Private		Not Evaluated by SHPO
Dade	Frame Vernacular Commercial	c 1925	Private	Miami-Dade	Not Evaluated by SHPO
Dade	Masonry Vernacular Commercial	c 1920	Private	Miami-Dade	Not Evaluated by SHPO
Dade	Frame Vernacular Commercial	c 1920	Private	Miami-Dade	Not Evaluated by SHPO
Dade	Masonry Vernacular Commercial	c 1919	Private	Miami-Dade	Not Evaluated by SHPO
Dade	Masonry Vernacular Hotel	c 1913	Private		Homestead NRHP Historic District
Dade	Wall	c 1935	Miami-Dade County		Ineligible for NRHP
Dade	Masonry Vernacular Residence	c 1941	Private		Ineligible for NRHP
Dade	Masonry Vernacular Commercial	1934	Private		Ineligible for NRHP
Dade	Masonry Vernacular Commercial	c 1914	Private	Homestead	NRHP Listed
Dade	Masonry Vernacular City Hall	c 1917	City of Homestead		NRHP Listed
Dade	Minimal Traditional Residence	c 1932	Private		Ineligible for NRHP
Dade	Masonry Vernacular Commercial	c 1940	Private		Ineligible for NRHP
Dade	Masonry Vernacular Garage	c 1945	Private		Ineligible for NRHP
Dade	Masonry Vernacular Service Station	c 1948	Private		Ineligible for NRHP
Dade	Masonry Vernacular Commercial	c 1948	Private		Ineligible for NRHP
Dade	Masonry Vernacular Commercial	c 1950	Private		Ineligible for NRHP
Dade	Masonry Vernacular Commercial	c 1950	Private	Homestead	Ineligible for NRHP
Dade	Masonry Vernacular Garage	c 1948	Private		Ineligible for NRHP
Dade	Masonry Vernacular Commercial	c 1935	Private		Ineligible for NRHP
Dade	Masonry Vernacular Commercial	c 1950	Private		Ineligible for NRHP
Dade	Masonry Vernacular Commercial	c 1945	Private		Ineligible for NRHP

Table 2.5-46 (Sheet 8 of 9)
Previously Recorded Historic Structures Located Within 10 Miles of Units 6 & 7

County	Description	Year Built	Ownership	Local Designation[a]	SHPO Evaluation
Dade	Masonry Vernacular Commercial	c 1925	Private		Ineligible for NRHP
Dade	Masonry Vernacular Commercial	c 1948	Private		Ineligible for NRHP
Dade	Masonry Vernacular Commercial	c 1920	Private		Homestead NRHP Historic District
Dade	Masonry Vernacular Commercial	c 1947	Private		Ineligible for NRHP
Dade	Masonry Vernacular Meetinghouse (religious)	c 1948	Private	Homestead	Ineligible for NRHP
Dade	Moderne Residence	c 1950	Private		Ineligible for NRHP
Dade	Masonry Vernacular Duplex	c 1948	Private		Ineligible for NRHP
Dade	Masonry Vernacular Residence	c 1948	Private		Ineligible for NRHP
Dade	Masonry Vernacular Bank	c 1948	Private		Homestead NRHP Historic District
Dade	Masonry Vernacular Commercial	c 1951	Private		Ineligible for NRHP
Dade	Masonry Vernacular Duplex	1951	Private		Ineligible for NRHP
Dade	Masonry Vernacular Commercial	1935	Private		Ineligible for NRHP
Dade	Masonry Vernacular Commercial	1940	Private		Homestead NRHP Historic District
Dade	Mediterranean Revival Commercial	1924	Private		Ineligible for NRHP
Dade	Masonry Vernacular Commercial	1924	Private		Ineligible for NRHP
Dade	Masonry Vernacular Commercial	1924	Private		Ineligible for NRHP
Dade	Masonry Vernacular Commercial	1924	Private		Ineligible for NRHP
Dade	Masonry Vernacular Commercial	1924	Private		Homestead NRHP Historic District
Dade	Masonry Vernacular Residence	1930	Private		Ineligible for NRHP
Dade	Masonry Vernacular Commercial	1948	Private		Homestead NRHP Historic District
Dade	Masonry Vernacular Commercial	1935	Private		Homestead NRHP Historic District
Dade	Masonry Vernacular Commercial	1951	Private		Homestead NRHP Historic District
Dade	Masonry Vernacular Commercial	1945	Private		Homestead NRHP Historic District
Dade	Masonry Vernacular Commercial	1924	Private		Ineligible for NRHP
Dade	Moderne Commercial	1948	Private		Ineligible for NRHP
Dade	Frame Vernacular Residence	1930	Private		Ineligible for NRHP
Dade	Masonry Vernacular Residence	1945	Private		Ineligible for NRHP
Dade	Masonry Vernacular Commercial	1940	Private		Homestead NRHP Historic District
Dade	Masonry Vernacular Commercial	1949	Private		Ineligible for NRHP
Dade	Masonry Vernacular Commercial	1935	Private		Ineligible for NRHP
Dade	Masonry Vernacular Commercial & Outbuilding	1948	Private		Homestead NRHP Historic District

Table 2.5-46 (Sheet 9 of 9)
Previously Recorded Historic Structures Located Within 10 Miles of Units 6 & 7

County	Description	Year Built	Ownership	Local Designation[(a)]	SHPO Evaluation
Dade	Masonry Vernacular Commercial	1948	Private		Homestead NRHP Historic District
Dade	Masonry Vernacular Commercial	1948	Private		Ineligible for NRHP
Dade	Masonry Vernacular Commercial	1925	Private		Ineligible for NRHP
Dade	Masonry Vernacular Commercial	1945	Private		Ineligible for NRHP
Dade	Masonry Vernacular Commercial	1948	Private		Ineligible for NRHP
Dade	Masonry Vernacular Commercial	1945	Private		Ineligible for NRHP
Dade	Frame Vernacular Commercial	1925	Private		Ineligible for NRHP
Dade	Masonry Vernacular Lodge	1950	Private		Ineligible for NRHP
Dade	Masonry Vernacular Commercial	1947	Private		Ineligible for NRHP
Dade	Mission Animal Shelter	1930	Private		Ineligible for NRHP
Dade	Masonry Vernacular Power Plant	1925	Private		Ineligible for NRHP
Dade	Masonry Vernacular Commercial	1945	Private		Ineligible for NRHP
Dade	Masonry Vernacular Commercial	1945	Private		Ineligible for NRHP
Dade	Masonry Vernacular Commercial	1934	Private		Ineligible for NRHP
Dade	Gothic Revival Meetinghouse (religious)	1935	Private religious		Ineligible for NRHP
Dade	Masonry Vernacular Commercial	1945	Private		Ineligible for NRHP
Dade	Masonry Vernacular Residence	c 1920	Private		Potentially Eligible for NRHP
Dade	Masonry Vernacular Commercial	1947	Private		Ineligible for NRHP
Dade	Mediterranean Revival Residence	1959	Private		Not Evaluated by SHPO
Dade	Masonry Vernacular Residence	1955	Private		Ineligible for NRHP
Monroe	Frame Vernacular Lodge	1928	Private		Not Evaluated by SHPO

(a) Blank entry = not locally designated.

Table 2.5-47
Previously Recorded Resource Groups Located Within 10 Miles of Units 6 & 7

Site ID	Site Name	City	County	Description	Dates of Significance	Local Designation[a]	SHPO Evaluation
DA03219	Offshore Reefs Archaeological District	Miami	Dade	Archaeological District	Nineteenth century American/Transitional, 1000 B.C.–700 B.C.		NRHP Listed
DA06943	Goulds Historic District	Goulds	Dade	Historical District	Not specified	Miami-Dade	Not evaluated by SHPO
DA10107	F.E.C. Railway	Miami	Dade	Linear Resource	1896-1959		Insufficient information
DA10465	Homestead Historic Downtown District	Homestead	Dade	Historical District	Twentieth century American		NRHP listed
MO00208	John Pennekamp Coral Reef State Park	Key Largo	Monroe	Mixed District	British, 1763–1783/ Nineteenth Century American		NRHP listed

(a) Blank entry = not locally designated.

Summary
5 Resource Groups identified via Florida Master Site File records
3 National Register listed resource groups identified
1 Designated by Miami-Dade County Historic Preservation Board
0 Designated by Homestead Historic Preservation Board

Table 2.5-48 (Sheet 1 of 5)
Previously Recorded Archaeological Sites Within 1.2 Miles of Offsite Areas

Site ID	Site Name	City	County	Description	Human Remains[(a)]	Dates	Ownership	Local Designation[(b)]	SHPO Evaluation	Comment
DA02100	Monkey Jungle	Alladin City	Dade	Paleontological remains/ artifact scatter	Yes	Archaic, 8500 B.C.–1000 B.C.	Private		Not evaluated by SHPO	
DA02102	Refugee Island	Unincorp Dade County	Dade	Prehistoric campsite	Yes	Glades, 1000 B.C.–A.D. 1700	Private		Not evaluated by SHPO	
DA02103	Dade Corners	Unincorp Dade County	Dade	Prehistoric midden(s)		Glades, 1000 B.C.–A.D. 1700	Private		Not evaluated by SHPO	
DA02104	Levee Cut	Unincorp Dade County	Dade	Prehistoric midden(s)	Yes	Glades IIa-b A.D. 750v1100, IIIa A.D. 1200–1400	State	Miami-Dade	Not evaluated by SHPO	
DA02105	Pee Wee Island	Unincorp Dade County	Dade	Prehistoric midden(s)		Glades III, A.D. 1000–1700	Private		Not evaluated by SHPO	
DA02106	Bench Mark Island	Unincorp Dade County	Dade	Prehistoric lithic scatter/quarry		Glades, 1000 B.C.–A.D. 1700	Private		Not evaluated by SHPO	
DA02107	Turnpike Bend	Unincorp Dade County	Dade	Prehistoric midden(s)		Glades, 1000 B.C.–A.D. 1700	Private		Ineligible for NRHP	
DA00035	Collins	Unincorp Dade County	Dade	Prehistoric midden(s)		Glades II, A.D. 750–1200	Private		Not evaluated by SHPO	
DA00040	(No Name)	Hialeah Gardens	Dade	Prehistoric midden(s)		Prehistoric	Private		Potentially eligible for NRHP	
DA00041	Pennsuco	Pennsuco	Dade	Prehistoric midden(s)		Glades I, 1000 B.C.–A.D. 750	Private		Not evaluated by SHPO	
DA00045	Maddens Hammock	Hialeah	Dade	Prehistoric midden(s)/ Mounds	Yes	Glades, 1000 B.C.–A.D. 1700	Private	Miami-Dade	Not evaluated by SHPO	
DA00075	Hialeah 1	Hialeah	Dade	Prehistoric midden(s)		Prehistoric with pottery	Private		Not evaluated by SHPO	

Table 2.5-48 (Sheet 2 of 5)
Previously Recorded Archaeological Sites Within 1.2 Miles of Offsite Areas

Site ID	Site Name	City	County	Description	Human Remains[a]	Dates	Ownership	Local Designation[b]	SHPO Evaluation	Comment
DA00076	Hialeah 2	Hialeah	Dade	Prehistoric midden(s) & artifact scatter		European/ Prehistoric with pottery	Private		Not evaluated by SHPO	Destroyed
DA00077	Hialeah 3	Hialeah	Dade	Prehistoric midden(s)		Prehistoric with pottery	Private		Not evaluated by SHPO	Destroyed
DA00082	Hialeah 4	Hialeah	Dade	Prehistoric burial(s)/ Middens	Yes	Glades, 1000 B.C.–A.D. 1700	Private		Not evaluated by SHPO	Destroyed
DA00085	Black Creek 1	Miami	Dade	Prehistoric midden(s)		Glades II, A.D. 750–1200	Private		Not evaluated by SHPO	
DA00087	Medley 2	Medley	Dade	Prehistoric midden(s)		Deptford, 700 B.C.–300 B.C./ Glades, 1000 B.C.–A.D. 1700	Private		Not evaluated by SHPO	
DA00092	Medley	Medley	Dade	Prehistoric midden(s)		Prehistoric with pottery	Private		Not evaluated by SHPO	
DA00093	Lehigh Portland	Miami	Dade	Prehistoric midden(s)		Prehistoric with pottery	Private	Miami-Dade	Not evaluated by SHPO	
DA00094	Krome, Portland, Bamboo Mound	Unincorp Dade County	Dade	Prehistoric campsite	Yes	Late Archaic 3000–500 B.C./ Glades, 1000 B.C.–A.D. 1700	Private		Not evaluated by SHPO	Destroyed
DA00141	(No Name)	Unincorp Dade County	Dade	Prehistoric midden(s)		Glades, 1000 B.C.–A.D. 1200	Private		Not evaluated by SHPO	
DA00142	Micro Wave Tower	Unincorp Dade County	Dade	Prehistoric midden(s)	Yes	Glades, 1000 B.C.–A.D. 1700	Private		Not evaluated by SHPO	
DA01031	Black Creek 2	Goulds	Dade	Prehistoric midden(s)		Glades, 1000 B.C.–A.D. 1700	Private	Miami-Dade	Not evaluated by SHPO	
DA01043	Beal Smith	Unincorp Dade County	Dade	Prehistoric midden(s)		Glades, 1000 B.C.–A.D. 1700/ Seminole, 1716–present	Private		Not evaluated by SHPO	
DA01052	Prasado	Unincorp Dade County	Dade	Prehistoric midden(s)		Glades, 1000 B.C.–A.D. 1700	Private	Miami-Dade	Not evaluated by SHPO	

Table 2.5-48 (Sheet 3 of 5)
Previously Recorded Archaeological Sites Within 1.2 Miles of Offsite Areas

Site ID	Site Name	City	County	Description	Human Remains(a)	Dates	Ownership	Local Designation(b)	SHPO Evaluation	Comment
DA01058	Cheetums	Unincorp Dade County	Dade	Prehistoric midden(s)		Glades, 1000 B.C.–A.D. 1700	Private		Not evaluated by SHPO	Destroyed
DA01068	Cibi	Unincorp Dade County	Dade	Prehistoric midden(s)	Yes	Glades, 1000 B.C.–A.D. 1700	Private	Miami-Dade	Not evaluated by SHPO	
DA01069	Mendoza	Unincorp Dade County	Dade	Prehistoric midden(s)		Glades, 1000 B.C.–A.D. 1700	Private		Not evaluated by SHPO	
DA01077	Leo	Unincorp Dade County	Dade	Prehistoric habitation & artifact scatter		Glades, 1000 B.C.–A.D. 1700	Private		Not evaluated by SHPO	
DA01078	Diedra	Medley	Dade	Prehistoric habitation		Glades, 1000 B.C.–A.D. 1700	Private		Potentially eligible for NRHP	
DA01085	Coptic Camp	Unincorp Dade County	Dade	Prehistoric midden(s)		Glades, 1000 B.C.–A.D. 1700	Private		Not evaluated by SHPO	
DA02109	Fang Island	Unincorp Dade County	Dade	Prehistoric midden(s)		Glades II & III, A.D. 750–A.D. 1700	Private		Not evaluated by SHPO	
DA02110	Voodoo Island	Unincorp Dade County	Dade	Prehistoric midden(s)		Glades III, A.D. 1000–1700	Private		Not evaluated by SHPO	
DA02111	Bulldozer Cut	Unincorp Dade County	Dade	Prehistoric midden(s)		Glades, 1000 B.C.–A.D. 1700	Private		Not evaluated by SHPO	
DA02113	Cottonmouth Island	Unincorp Dade County	Dade	Prehistoric midden(s)		Glades, 1000 v	Private		Not evaluated by SHPO	
DA02114	Ditch Island	Unincorp Dade County	Dade	Prehistoric burial(s)/ Campsite	Yes	Prehistoric with pottery	Private		Ineligible for NRHP	(b)Recent testing (2008) found no human remains
DA02117	Boat Ramp	Unincorp Dade County	Dade	Prehistoric midden(s)		Glades, 1000 B.C.–A.D. 1700	Private		Not evaluated by SHPO	

Table 2.5-48 (Sheet 4 of 5)
Previously Recorded Archaeological Sites Within 1.2 Miles of Offsite Areas

Site ID	Site Name	City	County	Description	Human Remains[(a)]	Dates	Ownership	Local Designation[(b)]	SHPO Evaluation	Comment
DA02135	Meissner/ Redland Hammock	Homestead	Dade	Paleontological remains/ artifact scatter		Not recorded	Not recorded		Not evaluated by SHPO	
DA02178	(No Name)	Unincorp Dade County	Dade	No field investigation		Not recorded	Not recorded		Not evaluated by SHPO	Recorded based on aerials & maps
DA02182	(No Name)	Unincorp Dade County	Dade	No field investigation		Not recorded	Not recorded		Not evaluated by SHPO	Recorded based on aerials & maps
DA02184	(No Name)	Unincorp Dade County	Dade	No field investigation		Not recorded	Not recorded		Not evaluated by SHPO	Recorded based on aerials & maps
DA02186	(No Name)	Unincorp Dade County	Dade	No field investigation		Not recorded	Not recorded		Not evaluated by SHPO	Recorded based on aerials & maps
DA02188	(No Name)	Unincorp Dade County	Dade	No field investigation		Not recorded	Not recorded		Not evaluated by SHPO	Recorded based on aerials & maps
DA02191	(No Name)	Unincorp Dade County	Dade	No field investigation		Not recorded	Not recorded		Not evaluated by SHPO	Recorded based on aerials & maps
DA02192	(No Name)	Unincorp Dade County	Dade	No field investigation		Not recorded	Not recorded		Not evaluated by SHPO	Recorded based on aerials & maps
DA02223	(No Name)	Unincorp Dade County	Dade	No field investigation		Not recorded	Not recorded		Not evaluated by SHPO	Recorded based on aerials & maps
DA02224	(No Name)	Unincorp Dade County	Dade	No field investigation		Not recorded	Not recorded		Not evaluated by SHPO	Recorded based on aerials & maps
DA03221	Double Island	Medley	Dade	Historic burial(s)/ Prehistoric campsite	Yes	Twentieth Century American	Private	Miami-Dade	Potentially Eligible for NRHP	
DA04737	Black Island Midden	Unincorp Dade County	Dade	Prehistoric campsite	Yes	Glades, 1000 B.C.–A.D. 1700	Private		Not evaluated by SHPO	

Table 2.5-48 (Sheet 5 of 5)
Previously Recorded Archaeological Sites Within 1.2 Miles of Offsite Areas

Site ID	Site Name	City	County	Description	Human Remains[a]	Dates	Ownership	Local Designation[b]	SHPO Evaluation	Comment
DA05128	L and L Site	Unincorp Dade County	Dade	Prehistoric burial(s)/ Campsite	Yes	Glades, 1000 B.C.–A.D. 1700	Private	Miami-Dade	Potentially eligible for NRHP	
DA05131	Bogg	Unincorp Dade County	Dade	Historic burial(s)/ Prehistoric campsite	Yes	Glades, 1000 B.C.–A.D. 1700	Private	Miami-Dade	Potentially eligible for NRHP	
DA06460	Panther North	Unincorp Dade County	Dade	Prehistoric campsite	Yes	Late Archaic, 3000–500 B.C.	Private		Not evaluated by SHPO	
DA06461	Panther South	Unincorp Dade County	Dade	Prehistoric campsite	Yes	Late Archaic, 3000–500 B.C.	Private		Not evaluated by SHPO	
DA06792	Harden Hammock	Goulds	Dade	Prehistoric habitation		Glades, 1000 B.C.–A.D. 1700	County		Not evaluated by SHPO	
DA07016	Ingraham Highway	Florida City	Dade	Historic road segment		Twentieth Century American	State		Ineligible for NRHP	
DA09603	Krome Ave	Unincorp Dade County	Dade	Historic road segment		Twentieth Century American	Federal		Ineligible for NRHP	
DA09990	U.S. 1	Florida City	Dade	Historic road segment		Twentieth Century American	Federal		Ineligible for NRHP	
DA00017	Miami Rock Mound 2	Miami	Dade	Prehistoric Mound		Prehistoric	Unknown		Not evaluated by SHPO	Destroyed

(a) Blank entry = no human remains recorded.
(b) Blank entry = not locally designated.

Summary
58 Archeological Sites identified via Florida Master Site File records
15 listed with Human Remains found
0 Individually listed National Register properties identified
9 designated by Miami-Dade County Historic Preservation Board
0 designated by Homestead Historic Preservation Board

Table 2.5-49
Previously Recorded Historic Cemeteries Within 1.2 Miles of Offsite Areas

Site ID	Site Name	City	County	Description	Year Established	Ownership	Local Designation	SHPO Evaluation
DA06793	Silver Green Cemetery	Miami	Dade	African-American Cemetery	1922	Private-corporate	Miami-Dade	Not Evaluated by SHPO

Summary

1 Historic Cemetery identified via Florida Master Site File records
0 Individually listed National Register properties identified
1 Designated by Miami-Dade County Historic Preservation Board
0 Designated by Homestead Historic Preservation Board

Table 2.5-50 (Sheet 1 of 15)
Previously Recorded Historic Structures Within 1.2 Miles of Offsite Areas

Site ID	Site Name	Address	Destroyed	City	Description	Year Built	Ownership	Local Designation[(a)]	SHPO Evaluation
DA00164	Graham Dairy House	10721 Us 27	No	Pennsuco	Masonry Vernacular Residence	1924	Private	Miami-Dade	Potentially eligible for NRHP
8DA279	Holsum Bakery Building	5750 S Dixie Highway							Not Evaluated
8DA429	152 SW 20 Road	152 SW 20 Road							Not Evaluated
8DA430	100 SW 21 Road	100 SW 21 Road							Not Evaluated
8DA431A	Vizcaya Farm Building 1	50 SW 32nd Road							Not Evaluated
8DA431B	Vizcaya Farm Building 2	50 SW 32nd Road							Not Evaluated
8DA431C	Vizcaya Farm Building 3	50 SW 32nd Road							Not Evaluated
8DA431D	Vizcaya Farm Building 4	50 SW 32nd Road							Not Evaluated
8DA431E	Vizcaya Farm Building 5	50 SW 32nd Road							Not Evaluated
8DA431F	Viscaya Farm Building 6								Not Evaluated
8DA431G	Vizcaya Farm Building 7	50 SW 32nd Road							Not Evaluated
8DA431H	Vizcaya Farm Building 8	50 SW 32nd Road							Not Evaluated
8DA433	5900 S Dixie Highway	5900-5910 S Dixie Highway							Potentially Eligible
8DA434	5904 S Dixie Highway	5904 S Dixie Highway							Potentially Eligible
8DA437	5900 Sunset Drive	5900 Sunset Drive							Potentially Eligible
8DA439	914 SW 1st Avenue	914 SW 1st Avenue							Not Evaluated
8DA440	921 SW 1st Avenue	921 SW 1st Avenue							Not Evaluated
8DA442	1013-1015 SW 1st Avenue	1013-1015 SW 1st Avenue							Not Evaluated

**Table 2.5-50 (Sheet 2 of 15)
Previously Recorded Historic Structures Within 1.2 Miles of Offsite Areas**

Site ID	Site Name	Address	Destroyed	City	Description	Year Built	Ownership	Local Designation[(a)]	SHPO Evaluation
8DA443	Shipyard Corporation	615 SW 2nd Avenue							Potentially Eligible
8DA447	123 SW 10th Street	123 SW 10th Street							Not Evaluated
8DA448	120 SW 20 Road	120 SW 20 Road							Not Evaluated
8DA449	105 SW 20 Road	105 SW 20 Road							Not Evaluated
8DA450	51 SW 19th Road	51 SW 19th Road							Not Evaluated
8DA451	50 SW 19th Road	50 SW 19th Road							Not Evaluated
8DA452	76 SW 18th Terrace	76 SW 18th Terrace							Not Evaluated
8DA456	Woodside Apartments	2460 SW 16 Court							Not Evaluated
8DA457	53 SW 14th Street	53 SW 14th Street							Not Evaluated
8DA459	70 SW 12th Street	70 SW 12th Street							Not Evaluated
8DA460	67 SW 12th Street	67 SW 12th Street							Not Evaluated
8DA461	60 SW 12th Street	60 SW 12th Street							Not Evaluated
8DA462	52 SW 12th Street	52 SW 12th Street							Not Evaluated
8DA463	911 SW 1st Avenue	911 SW 1st Avenue							Not Evaluated
8DA464	908 SW 1st Avenue	908 SW 1st Avenue							Not Evaluated
8DA465	903 SW 1st Avenue	903 SW 1st Avenue							Not Evaluated
8DA469	35 SW 9th Street	35 SW 9th Street							Not Evaluated
8DA470	104 SW 9th Street	104 SW 9th Street							Not Evaluated
8DA471	118 SW 9th Street	118 SW 9th Street							Not Evaluated
8DA472	118 SW 9th Street Rear	118 SW 9th Street Rear							Not Evaluated
8DA473	120 SW 9th Street	120 SW 9th Street							Not Evaluated
8DA474	126 SW 9th Street	126 SW 9th Street							Not Evaluated
8DA475	128 SW 9th Street	128 SW 9th Street							Not Evaluated
8DA483	FEC Railway Freight House	400 SW 1st Avenue							Not Evaluated
8DA484	916 SW 1st Avenue	916 SW 1st Avenue							Not Evaluated
8DA485	940 SW 1st Avenue	940 SW 1st Avenue							Not Evaluated

Table 2.5-50 (Sheet 3 of 15)
Previously Recorded Historic Structures Within 1.2 Miles of Offsite Areas

Site ID	Site Name	Address	Destroyed	City	Description	Year Built	Ownership	Local Designation[(a)]	SHPO Evaluation
8DA486	3435 SW 1st Avenue	3435 SW 1st Avenue							Not Evaluated
8DA488	37 SW 7th Street	37 SW 7th Street							Not Evaluated
8DA489	44 SW 7th Street	44 SW 7th Street							Not Evaluated
8DA490	54 SW 7th Street	54 SW 7th Street							Not Evaluated
8DA492	79 SW 12th Street	79 SW 12th Street							Not Evaluated
8DA493	84 SW 13th Street	84 SW 13th Street							Not Evaluated
8DA495	60 SW 18th Road	60 SW 18th Road							Not Evaluated
8DA496	74 SW 18th Terrace	74 SW 18th Terrace							Not Evaluated
8DA497	826 SW 1st Avenue	826 SW 1st Avenue							Not Evaluated
8DA498	145 SW 21st Road	145 SW 21st Road							Not Evaluated
8DA500	1770 SW 24th Terrace	1770 SW 24th Terrace							Not Evaluated
8DA501	1780 SW 24th Terrace	1780 SW 24th Terrace							Not Evaluated
8DA502	1868 SW 25th Terrace								Not Evaluated
8DA505	46 SW 12th Street	46 SW 12th Street							Not Evaluated
8DA513	87 SW 11th Street	87 SW 11th Street							Not Evaluated
8DA514	68 SW 11th Street	68 SW 11th Street							Not Evaluated
8DA515	59 SW 11th Street	59 SW 11th Street							Not Evaluated
8DA516	52 SW 11th Street	52 SW 11th Street							Not Evaluated
8DA517	Brickell Plaza Hotel	44 SW 11th Street							Not Evaluated
8DA518	2420 SW 16th Court	2420 SW 16th Court							Not Evaluated
8DA519	87 SW 18th Road	87 SW 18th Road							Not Evaluated
8DA521	2598 Taluga Drive	2598 Taluga Drive							Not Evaluated
8DA523	Miami First United Methodist Church								Not Evaluated
8DA524	2892 S W 32 Court	2892 S W 32 Court							Not Evaluated
8DA530	2912 Bridgeport Avenue	2912 Bridgeport Avenue							Not Evaluated

Table 2.5-50 (Sheet 4 of 15)
Previously Recorded Historic Structures Within 1.2 Miles of Offsite Areas

Site ID	Site Name	Address	Destroyed	City	Description	Year Built	Ownership	Local Designation[(a)]	SHPO Evaluation
8DA533	Marion Villa	45 SW 12th Street							Not Evaluated
8DA1086	Simpson Park	85 SW 17th Road							Not Evaluated
8DA1180	Columbus Group	637 S Miami Avenue							Not Evaluated
8DA1181	650 S Miami Avenue	650 S Miami Avenue							Not Evaluated
8DA1184	Fire Station No. 4	1000 S. Miami Avenue							NRHP–listed
8DA1186	Burkhart, House and Office	1150 S Miami Avenue							Not Evaluated
8DA1187	1326 S Miami Avenue	1326 S Miami Avenue							Not Evaluated
8DA1188	1525 S Miami Avenue	1525 S Miami Avenue							Not Evaluated
8DA1190	2000 S Miami Avenue	2000 S Miami Avenue							Not Evaluated
8DA1191	2238 S Miami Avenue	2238 S Miami Avenue							Not Evaluated
8DA1192	2300 S Miami Avenue	2300 S Miami Avenue							Not Evaluated
8DA1193	2500 S Miami Avenue	2500 S Miami Avenue							Not Evaluated
8DA1243	936 SW 1st Avenue	936 SW 1st Avenue							Not Evaluated
8DA1246	1345 SW 1st Avenue	1345 SW 1st Avenue							Not Evaluated
8DA1284	400 SW 2nd Avenue	400 SW 2nd Avenue							Not Evaluated
8DA1382	Mercy Restaurant	93 SW 8th Street							Not Evaluated
8DA1384	78 SW 7th Street	78 SW 7th Street							Not Evaluated
8DA1393	29 S 9th Street	29 S 9th Street							Not Evaluated
8DA1394	62-62 SW 9th Street	62-62 SW 9th Street							Not Evaluated
8DA1395	70 SW 9th Street	70 SW 9th Street							Not Evaluated
8DA1396	29 SW 9th Street	29 SW 9th Street							Not Evaluated
8DA1397	45-45 ½ SW 10th Street	45-45 ½ SW 10th Street							Not Evaluated

Table 2.5-50 (Sheet 5 of 15)
Previously Recorded Historic Structures Within 1.2 Miles of Offsite Areas

Site ID	Site Name	Address	Destroyed	City	Description	Year Built	Ownership	Local Designation[(a)]	SHPO Evaluation
8DA1399	28 SW 11th Street	28 SW 11th Street							Not Evaluated
8DA1402	60 SW 11th Street	60 SW 11th Street							Not Evaluated
8DA1404	75 SW 11th Street	75 SW 11th Street							Not Evaluated
8DA1405	37 SW 12th Street	37 SW 12th Street							Not Evaluated
8DA1418	Southside School	45 SW 13th Street							NRHP–listed
8DA1419	Terrace Apartments	21 SW 14th Terrace							Not Evaluated
8DA1427	171 SW 14th Street	171 SW 14th Street							Not Evaluated
8DA1429	37 SW 14th Terrace	37 SW 14th Terrace							Not Evaluated
8DA1445	43 SW 18 Road	43 SW 18 Road							Not Evaluated
8DA1450	65 SW 18th Terrace	65 SW 18th Terrace							Not Evaluated
8DA1451	73 SW 18th Terrace	73 SW 18th Terrace							Not Evaluated
8DA1452	70 SW 18th Terrace	70 SW 18th Terrace							Not Evaluated
8DA1454	42 SW 19th Road	42 SW 19th Road							Not Evaluated
8DA1457	73 SW 19th Road	73 SW 19th Road							Not Evaluated
8DA1465	46 SW 20th Road	46 SW 20th Road							Not Evaluated
8DA1487	43 SW 21 Road	43 SW 21 Road							Not Evaluated
8DA1493	38 SW 22 Road	38 SW 22 Road							Not Evaluated
8DA1518	32 SW 23rd Road	32 SW 23rd Road							Not Evaluated
8DA1678	2741 SW 22nd Avenue	2741 SW 22nd Avenue							Not Evaluated
8DA1688	25 SW 27 Road	25 SW 27 Road							Not Evaluated
8DA1691	2497 Abaco Avenue	2497 Abaco Avenue							Not Evaluated
8DA1695	2517 Andros Avenue	2517 Andros Avenue							Not Evaluated
8DA1696	2530 Andros Avenue	2530 Andros Avenue							Not Evaluated
8DA1697	2533 Andros Avenue	2533 Andros Avenue							Not Evaluated
8DA1698	2539 Andros Avenue	2539 Andros Avenue							Not Evaluated

Table 2.5-50 (Sheet 6 of 15)
Previously Recorded Historic Structures Within 1.2 Miles of Offsite Areas

Site ID	Site Name	Address	Destroyed	City	Description	Year Built	Ownership	Local Designation[(a)]	SHPO Evaluation
8DA1699	2544 Andros Avenue	2544 Andros Avenue							Not Evaluated
8DA1807	2823 Coconut Avenue	2823 Coconut Avenue							Not Evaluated
8DA1848	2801 Emathla Street	2801 Emathla Street							Not Evaluated
8DA1894	2830 Jefferson Street	2830 Jefferson Street							Not Evaluated
8DA1895	2924 Jefferson Street	2924 Jefferson Street							Not Evaluated
8DA1909	2911 Lucaya Street	2911 Lucaya Street							Not Evaluated
8DA1959	2825 S Miami Avenue	2825 S Miami Avenue							Not Evaluated
8DA1972	2621 Natoma Street	2621 Natoma Street							Not Evaluated
8DA1973	2630 Natoma Street	2630 Natoma Street							Not Evaluated
8DA1974	2631 Natoma Street	2631 Natoma Street							Not Evaluated
8DA1977	2601 Nocatee Drive	2601 Nocatee Drive							Not Evaluated
8DA1978	146 Oak Street	146 Oak Street							Not Evaluated
8DA2014	2085 Secoffee Street	2085 Secoffee Street							Not Evaluated
8DA2015	2107 Secoffee Street	2107 Secoffee Street							Not Evaluated
8DA2016	2140 Secoffee Street	2140 Secoffee Street							Not Evaluated
8DA2080	1757 Wa-Kee-Na Drive	1757 Wa-Kee-Na Drive							Not Evaluated
8DA2081	1765 Wa-Kee-Na Drive	1765 Wa-Kee-Na Drive							Not Evaluated
8DA2082	1866 Wa-Kee-Na Drive	1866 Wa-Kee-Na Drive							Not Evaluated
8DA2631	635 SW 3rd Avenue	635 SW 3rd Avenue							Not Evaluated
8DA2643	145 SW 8th Street	145 SW 8th Street							Not Evaluated
DA02666	304 S Flagler Avenue	304 S Flagler Ave	Yes	Homestead	Commercial	1936	Private		Not evaluated by SHPO

Table 2.5-50 (Sheet 7 of 15)
Previously Recorded Historic Structures Within 1.2 Miles of Offsite Areas

Site ID	Site Name	Address	Destroyed	City	Description	Year Built	Ownership	Local Designation[a]	SHPO Evaluation
DA02675	425 S Krome Ave	425 S Krome Ave	No	Florida City	Frame Vernacular Residence	1938	Private		Not evaluated by SHPO
DA02685	17 Palm Dr	17 Palm Dr	No	Florida City	Frame Vernacular Residence	1916	Private		Not evaluated by SHPO
DA02686	Florida City Hall	400 W Palm Dr	No	Florida City	Masonry Vernacular Government Offices	1912	Private		Not evaluated by SHPO
DA02687	500 W Palm Dr	500 W Palm Dr	No	Florida City	Frame Vernacular Commercial	1911	Private		Not evaluated by SHPO
DA02688	726 W Palm Dr	726 W Palm Dr	No	Florida City	Frame Vernacular Residence	Not recorded	Private		Not evaluated by SHPO
DA02689	777 W Palm Dr	777 W Palm Dr	No	Florida City	Masonry Vernacular Residence	Not recorded	Private		Not evaluated by SHPO
DA02690	808 W Palm Dr	808 W Palm Dr	No	Florida City	Mediterranean Revival Residence	1919	Private		Not evaluated by SHPO
DA02691	904 W Palm Dr	904 W Palm Dr	No	Florida City	Frame Vernacular Residence	c 1924	Private		Not evaluated by SHPO
DA02692	19905 W Palm Dr	19905 W Palm Dr	No	Longview	Frame Vernacular Residence	1926	Private		Not evaluated by SHPO
DA02701	Edwards House	310 NW 1st St	No	Florida City	Masonry Vernacular Residence	1923	Private	Miami-Dade	Not evaluated by SHPO
DA02702	320 NW 1st St	320 NW 1st St	No	Florida City	Masonry Vernacular Residence	1930	Private		Not evaluated by SHPO
DA02703	321 NW 1st St	321 NW 1st St	No	Florida City	Frame Vernacular Residence	1930	Private		Not evaluated by SHPO
DA02704	328 NW 1st St	328 NW 1st St	No	Florida City	Frame Vernacular Residence	1930	Private		Not evaluated by SHPO
DA02706	237 SW 1st St	237 SW 1st St	No	Florida City	Frame Vernacular Residence	1920	Private		Not evaluated by SHPO
DA02707	246 SW 1st St	246 SW 1st St	No	Florida City	Masonry Vernacular Residence	1920	Private		Not evaluated by SHPO
DA02708	306 SW 1st St	306 SW 1st St	No	Florida City	Mission Residence	1920	Private		Not evaluated by SHPO
DA02709	330 SW 1st St	330 W 1st St	No	Florida City	Frame Vernacular Residence	1920	Private		Not evaluated by SHPO

Table 2.5-50 (Sheet 8 of 15)
Previously Recorded Historic Structures Within 1.2 Miles of Offsite Areas

Site ID	Site Name	Address	Destroyed	City	Description	Year Built	Ownership	Local Designation[(a)]	SHPO Evaluation
DA02710	345 SW 1st St	345 SW 1st St	No	Florida City	Frame Vernacular Residence	1937	Private		Not evaluated by SHPO
DA02711	406 SW 1st St	406 SW 1st St	No	Florida City	Frame Vernacular Residence	1915	Private		Not evaluated by SHPO
DA02712	430 SW 1st St	430 SW 1st St	No	Florida City	Frame Vernacular Residence	1930	Private		Not evaluated by SHPO
DA02718	146 NW 3rd Ave	146 NW 3rd Ave	No	Florida City	Frame Vernacular Residence	1930	Private		Not evaluated by SHPO
DA02720	246 SW 3rd Ave	246 SW 3rd Ave	No	Florida City	Frame Vernacular Residence	1920	Private		Not evaluated by SHPO
DA02751	19470 SW 320th St	19470 SW 320th St	No	Longview	Frame Vernacular Residence	1931	Private		Not evaluated by SHPO
DA02752	19790 SW 320th St	19790 SW 320th St	No	Longview	Frame Vernacular Residence	Not recorded	Private		Not evaluated by SHPO
DA02753	20255 SW 320th St	20255 SW 320th St	No	Longview	Frame Vernacular Residence	1945	Private		Not evaluated by SHPO
8DA2754	9100 Dadeland Boulevard	9100 Dadeland Boulevard							Not Evaluated
DA02762	Historic Cauley Square	22400 Old Dixie Hwy	No	Goulds	Masonry Vernacular Commercial	1920	Private	Miami-Dade	Potentially eligible for NRHP
DA02767	24005 S Federal Highway	24005 S Federal Highway	No	S. Dade County	Frame Vernacular Residence	c 1920	Private		Not evaluated by SHPO
DA02768	24101 S Dixie Highway	24101 S Dixie Highway	No	S. Dade County	Frame Vernacular Residence	c 1905	Private		Not evaluated by SHPO
DA02769	25501 S Dixie Highway	25501 S Dixie Highway	No	S. Dade County	Frame Vernacular Residence	1925	Private		Not evaluated by SHPO
8DA2773	9830 SW 77th Avenue	9830 SW 77th Avenue							Not Evaluated
8DA2774	9840 SW 77th Avenue	9840 SW 77th Avenue							Not Evaluated
DA02785	21000 SW 127th Ave	21000 Sw 127th Ave	No	S. Dade County	Frame Vernacular Residence	c 1920	Private		Not evaluated by SHPO
DA02786	24700 SW 129th	24700 Sw 129th Ave	No	S. Dade County	Masonry Vernacular Commercial	c 1930	Private		Not evaluated by SHPO

Table 2.5-50 (Sheet 9 of 15)
Previously Recorded Historic Structures Within 1.2 Miles of Offsite Areas

Site ID	Site Name	Address	Destroyed	City	Description	Year Built	Ownership	Local Designation[a]	SHPO Evaluation
DA02788	18200 SW 134th Ave	18200 SW 134th Ave	No	S. Dade County	Frame Vernacular Residence	c 1930	Private		Not evaluated by SHPO
DA02789	20101 SW 134th Ave	20101 SW 134th Ave	No	S. Dade County	Masonry Vernacular Residence	c 1920	Private		Not evaluated by SHPO
DA02790	20379 SW 134th Ave	20379 SW 134th Ave	No	S. Dade County	Frame Vernacular Residence	c 1920	Private		Not evaluated by SHPO
DA02791	25267 SW 134th Ave	25267 SW 134th Ave	No	S. Dade County	Frame Vernacular Residence	c 1929	Private		Not evaluated by SHPO
DA02792	26055 SW 134th Ave	26055 SW 134th Ave	No	S. Dade County	Log Outbuilding	c 1914	Private		Not evaluated by SHPO
DA02794	Drake Lumber Co	SW 137th Ave and SW 248	No	S. Dade County	Frame Vernacular Residence	c 1904	Private		Not evaluated by SHPO
DA02795	25820 SW 137th Ave	25820 SW 137th Ave	No	S. Dade County	Frame Vernacular Residence	1930	Private		Not evaluated by SHPO
DA02796	21690 SW 138th Ave	21690 SW 138th Ave	No	S. Dade County	Frame Vernacular Residence	1910	Private	Miami-Dade	Not evaluated by SHPO
DA02798	23500 SW 142nd Ave	23500 SW 142nd Ave	No	S. Dade County	Frame Vernacular Residence	1911	Private		Not evaluated by SHPO
DA02819	21615 SW 187th Ave	21615 SW 187th Ave	No	S. Dade County	Frame Vernacular Residence	1922	Private		Not evaluated by SHPO
DA02820	21901 SW 187th Ave	21901 SW 187th Ave	No	S. Dade County	Frame Vernacular Residence	c 1920	Private		Not evaluated by SHPO
DA02827	12641 SW 200th St	12641 SW 200th St	No	S. Dade County	Frame Vernacular Residence	1912	Private		Not evaluated by SHPO
DA02828	12505 SW 216th St	12505 SW 216th St	No	S. Dade County	Frame Vernacular Residence	1936	Private		Not evaluated by SHPO
DA02829	Mobley/Wood House	13550 SW 218th St	No	S. Dade County	Frame Vernacular Residence	1910	Private	Miami-Dade	Not evaluated by SHPO
DA02830	Full Gospel Mission	12425 SW 224th St	No	S. Dade County	Masonry Vernacular House of Worship	c 1920	Private religious		Not evaluated by SHPO
DA02831	12490 SW 224th St	12490 SW 224th St	No	S. Dade County	Frame Vernacular Residence	1925	Private	Miami-Dade	Not evaluated by SHPO
DA02832	13280 SW 232nd St	13280 SW 232nd St	No	S. Dade County	Frame Vernacular Residence	c 1930	Private		Not evaluated by SHPO
DA02833	13295 SW 232nd St	13295 SW 232nd St	No	S. Dade County	Frame Vernacular Residence	c 1938	Private		Not evaluated by SHPO
DA02834	13301 SW 232nd St	13301 SW 232nd St	No	S. Dade County	Frame Vernacular Residence	c 1913	Private		Not evaluated by SHPO

Table 2.5-50 (Sheet 10 of 15)
Previously Recorded Historic Structures Within 1.2 Miles of Offsite Areas

Site ID	Site Name	Address	Destroyed	City	Description	Year Built	Ownership	Local Designation[(a)]	SHPO Evaluation
DA02835	13401 SW 232nd St	13401 SW 232nd St	No	S. Dade County	Bungalow Residence	c 1920	Private		Not evaluated by SHPO
DA02836	13460 SW 232nd St	13460 SW 232nd St	No	S. Dade County	Frame Vernacular Residence	c 1920	Private		Not evaluated by SHPO
DA02847	19501 SW 232nd St	19501 SW 232nd St	No	S. Dade County	Frame Vernacular Residence	1925	Private		Not evaluated by SHPO
DA02848	13425 SW 248th St	13425 SW 248th St	No	S. Dade County	Frame Vernacular Commercial	c 1912	Private		Not evaluated by SHPO
DA02849	13610 SW 248th St	13610 SW 248th St	No	S. Dade County	Moderne Apartment	c 1915	Private		Not evaluated by SHPO
DA02850	13620 SW 248th St	13620 SW 248th St	No	S. Dade County	Frame Vernacular Industrial Plant	1904	Private		Not evaluated by SHPO
DA02851	13805 SW 248th St	13805 SW 248th St	No	S. Dade County	Frame Vernacular Residence	c 1930	Private		Not evaluated by SHPO
DA02860	19701 SW 248th St	19701 SW 248th St	No	S. Dade County	Frame Vernacular Residence	1925	Private		Not evaluated by SHPO
DA02862	19500 SW 264th St	19500 SW 264th St	No	S. Dade County	Frame Vernacular Residence	c 1926	Private		Not evaluated by SHPO
DA02863	13317 SW 266th St	13317 SW 266th St	No	S. Dade County	Frame Vernacular Residence	1913	Private		Not evaluated by SHPO
8DA2882	Dorn Building	5900-5904 S Dixie Highway							Not Evaluated
8DA2886	5875-5885 Sunset Drive	5875-5885 Sunset Drive							Not Evaluated
8DA2887	6130 Sunset Drive	6130 Sunset Drive							Potentially Eligible
8DA3067	209 SW 5th Avenue	209 SW 5th Avenue							Not Evaluated
DA03184	Lindgren House	19300 SW 137th Ave	No	Miami	Frame Vernacular Residence	1912	Private	Miami-Dade	Not evaluated by SHPO
8DA3186	43 SW 7th Street	43 SW 7th Street							Not Evaluated
8DA3187	87 SW 9th Street	87 SW 9th Street							Not Evaluated
8DA3704	I&E Greenwald, Steam Engine #1058	3898 Shipping Avenue							NRHP–listed
8DA4585	South Bayshore Drive & South Miami Avenue	South Bayshore Drive & South Miami Avenue							Not Evaluated

Table 2.5-50 (Sheet 11 of 15)
Previously Recorded Historic Structures Within 1.2 Miles of Offsite Areas

Site ID	Site Name	Address	Destroyed	City	Description	Year Built	Ownership	Local Designation[(a)]	SHPO Evaluation
8DA4626	Gulf Gas Station	1492 S Dixie Highway							Not Evaluated
8DA4630	George Washington Carver Elementary	238 Grand Avenue							Not Evaluated
8DA4650	4855 Ponce De Leon Blvd	4855 Ponce De Leon Blvd							Not Evaluated
8DA4667	1722 SW 1 Avenue	1722 SW 1 Avenue							Not Evaluated
8DA4668	3211 SW 1 Avenue	3211 SW 1 Avenue							Not Evaluated
8DA4681	2939 SW 36 Avenue	2939 SW 36 Avenue							Not Evaluated
8DA4683	126 SW 17 Road	126 SW 17 Road							Not Evaluated
8DA4684	157 SW 20 Road	157 SW 20 Road							Not Evaluated
8DA4685	158 SW 20 Road	158 SW 20 Road							Not Evaluated
8DA4686	101 SW 22 Road	101 SW 22 Road							Not Evaluated
8DA4687	148 SW 22 Road	148 SW 22 Road							Not Evaluated
8DA4688	160 SW 22 Road	160 SW 22 Road							Not Evaluated
8DA4690	120 SW 31 Road	120 SW 31 Road							Not Evaluated
8DA4691	168 SW 32 Road	168 SW 32 Road							Not Evaluated
8DA4696	137 SW 10th Street	137 SW 10th Street							Not Evaluated
8DA4706	1038 SW 22 Street	1038 SW 22 Street							Not Evaluated
8DA4710	3382 SW 29 Street	3382 SW 29 Street							Not Evaluated
8DA4721	1712 SW 24th Terrace	1712 SW 24th Terrace							Not Evaluated
8DA4722	1865 SW 25th Terrace	1865 SW 25th Terrace							Not Evaluated
8DA5022	113 Frow Avenue	113 Frow Avenue							Not Evaluated
8DA5023	117-119 Frow Avenue	117-119 Frow Avenue							Not Evaluated
8DA5024	125 Frow Avenue	125 Frow Avenue							Not Evaluated
8DA5608	8370 SW 122 Street	8370 SW 122 Street							Ineligible
8DA6129	5891-93 Sunset Drive	5891-93 Sunset Drive							Potentially Eligible

Table 2.5-50 (Sheet 12 of 15)
Previously Recorded Historic Structures Within 1.2 Miles of Offsite Areas

Site ID	Site Name	Address	Destroyed	City	Description	Year Built	Ownership	Local Designation[(a)]	SHPO Evaluation
8DA6130	5875-81 Sunset Drive	5875-81 Sunset Drive							Ineligible
8DA6131	5843-49 Sunset Drive	5843-49 Sunset Drive							Ineligible
8DA6132	5857 Sunset Drive	5857 Sunset Drive							Ineligible
8DA6500	6101 Sunset Drive	6101 Sunset Drive							Ineligible
8DA6508	South Miami City Hall	6130 Sunset Drive							Ineligible
8DA9986	118 Frow Avenue	118 Frow Avenue							Not Evaluated
8DA9987	123/125 Frow Avenue	123/125 Frow Avenue							Not Evaluated
8DA9988	217 Florida Avenue	217 Florida Avenue							Not Evaluated
8DA9989	134 Florida Avenue	134 Florida Avenue							Not Evaluated
8DA9991	11555 SW 82nd Avenue	11555 SW 82nd Avenue							Not Evaluated
DA03702A	FLA East Coast Railway Locomotive #153	12400 SW 152nd St	No	Miami	Railroad Vehicle	1922	Dade County		NRHP listed
DA05087	Talbott Estate	13390 SW 200th St	No	S. Dade County	Masonry Vernacular Residence	c 1929	Private	Miami-Dade	Not evaluated by SHPO
DA05593	Ogden Residence	22200 Miami Ave	No	Miami	Frame Vernacular Residence	c 1925	Private	Miami-Dade	Ineligible for NRHP
DA05594	Cauley Residence	22215 Miami Ave	No	Miami	Frame Vernacular Residence	c 1930	Private	Miami-Dade	Ineligible for NRHP
DA05595	WC Roberts Residence	22240 Miami Ave	No	Miami	Frame Vernacular Residence	c 1921	Private	Miami-Dade	Ineligible for NRHP
DA05596	Hathaway Residence	22300 Miami Ave	No	Miami	Frame Vernacular Residence	c 1936	Private	Miami-Dade	Ineligible for NRHP
DA05600	Monkey Jungle	14805 SW 216 St	No	Miami	Frame Vernacular Theme park (resort complex)	1946	Private		Ineligible for NRHP
DA05615	Gossman Residence	2225 SW 124 Ave	No	Miami	Moorish Revival Residence	c 1926	Private	Miami-Dade	Ineligible for NRHP
DA05616	Evans Residence	22295 SW 124 Ave	No	Miami	Mission Residence	c 1930	Private	Miami-Dade	Ineligible for NRHP
DA05617	Talbott Residence	22301 SW 124 Ave	No	Miami	Frame Vernacular Residence	c 1920	Private	Miami-Dade	Ineligible for NRHP

Table 2.5-50 (Sheet 13 of 15)
Previously Recorded Historic Structures Within 1.2 Miles of Offsite Areas

Site ID	Site Name	Address	Destroyed	City	Description	Year Built	Ownership	Local Designation[(a)]	SHPO Evaluation
DA05618	22520 SW 134 Ave	22520 SW 134 Ave	No	Miami	Frame Vernacular Residence	c 1927	Private		Ineligible for NRHP
DA05621	Fitzgibbons Residence	22850 SW 134 Ave	No	Miami	Masonry Vernacular Residence	c 1936	Private		Ineligible for NRHP
DA05622	Fitzgibbons Residence (Bldg A)	22850 SW 134 Ave	No	Miami	Masonry Vernacular Residence	c 1936	Private		Ineligible for NRHP
DA05623	16400 SW 137 Ave	16400 SW 137 Ave	No	Miami	Frame Vernacular Residence	c 1924	Private		Ineligible for NRHP
DA05624	25900 SW 137 Ave	25900 SW 137 Ave	No	Miami	Frame Vernacular Residence	c 1930	Private		Ineligible for NRHP
DA05625	Cooper Residence	14204 SW 248th St	No	Miami	Masonry Vernacular Residence	1920	Private		Ineligible for NRHP
DA05627	Wright Residence	19905 SW 147 Ave	No	Miami	Frame Vernacular Residence	c 1910	Private		Ineligible for NRHP
DA05645	Kufeldt Residence	22201 SW 187 Ave	No	Miami	Masonry Vernacular Residence	c 1937	Private		Ineligible for NRHP
DA05648	25250 SW 194 Ave	25250 SW 194 Ave	No	Miami	Frame Vernacular Residence	c 1938	Private		Ineligible for NRHP
DA05649	25190 SW 194 Ave	25190 SW 194 Ave	No	Miami	Frame Vernacular Residence	c 1920	Private		Ineligible for NRHP
DA05650	Barrow Residence	26100 SW 194 Ave	No	Miami	Frame Vernacular Residence	c 1935	Private		Ineligible for NRHP
DA05651	Ingiverson, Pritchett Residence	25600 SW 197 Ave	No	Miami	Frame Vernacular Residence	c 1945	Private		Ineligible for NRHP
DA05652	Petzolt Residence	14000 SW 216 St	No	Miami	Frame Vernacular Residence	c 1910	Private		Ineligible for NRHP
DA05655	Mulkins Residence	19300 SW 256 St	No	Miami	Frame Vernacular Residence	c 1930	Private		Ineligible for NRHP
DA05656	19930 SW 256 St	19930 SW 256 St	No	Miami	Frame Vernacular Residence	c 1928	Private		Ineligible for NRHP
DA05661	19470 SW 264 St	19470 SW 264 St	No	Miami	Frame Vernacular Residence	c 1911	Private		Ineligible for NRHP
DA05663	McCallman Residence	19200 SW 264 St	No	Miami	Frame Vernacular Residence	c 1917	Private		Ineligible for NRHP
DA05664	Silverstein Residence	19380 SW 264 St	No	Miami	Frame Vernacular Residence	c 1926	Private		Ineligible for NRHP
DA05666	Easton Residence	19945 SW 197 Ave	No	Miami	Mission Residence	c 1937	Private		Ineligible for NRHP

Table 2.5-50 (Sheet 14 of 15)
Previously Recorded Historic Structures Within 1.2 Miles of Offsite Areas

Site ID	Site Name	Address	Destroyed	City	Description	Year Built	Ownership	Local Designation[(a)]	SHPO Evaluation
DA05667	Murray Residence	19650 SW 264 St	No	Miami	Frame Vernacular Residence	c 1925	Private		Ineligible for NRHP
DA05668	Baker Residence	20100 SW 264 St	No	Miami	Frame Vernacular Residence	c 1926	Private		Ineligible for NRHP
DA05671	Inst of Food and Agricultural Sciences	18905 SW 280 St	No	Miami	Frame Vernacular Laboratory	c 1931	State University		Ineligible for NRHP
DA05672	19701 SW 280 Street	19701 SW 280 Street	No	Miami	Frame Vernacular Residence	c 1934	Private		Ineligible for NRHP
DA05673	19201 SW 288 Street	19201 SW 288 Street	No	Miami	Frame Vernacular Residence	c 1939	Private		Ineligible for NRHP
DA05674	Redd Residence	19440 SW 296 St	No	Miami	Frame Vernacular Residence	c 1927	Private	Miami-Dade	Ineligible for NRHP
DA05678	Dunn Residence	19570 SW 264 St	No	Miami	Frame Vernacular Residence	c 1926	Private		Ineligible for NRHP
DA05681	28800 SW 192 Ave	28800 SW 192 Ave	No	Miami	Frame Vernacular Residence	c 1937	Private		Ineligible for NRHP
DA05682	Deitz Residence	237 NW 2nd St	No	Florida City	Frame Vernacular Residence	c 1935	Private		Ineligible for NRHP
DA05684	327 SW 2nd St	327 SW 2nd St	No	Miami	Frame Vernacular Residence	c 1930	Private		Ineligible for NRHP
DA05685	Cano Residence	336 SW 3rd St	No	Miami	Frame Vernacular Residence	c 1920	Private		Ineligible for NRHP
DA05904	Country Cottage II	12312 SE 224th St	No	Goulds	Frame Vernacular Commercial	c 1925	Private	Miami-Dade	Not evaluated by SHPO
DA05905	22430 Old Dixie Hwy	22430 Old Dixie Hwy	No	Goulds	Masonry Vernacular Commercial	c 1920	Private	Miami-Dade	Not evaluated by SHPO
DA05906	22420 Old Dixie Hwy	22420 Old Dixie Hwy	No	Goulds	Frame Vernacular Commercial	c 1920	Private	Miami-Dade	Not evaluated by SHPO
DA05907	22400 Old Dixie Hwy	22400 Old Dixie Hwy	No	Goulds	Masonry Vernacular Commercial	c 1919	Private	Miami-Dade	Not evaluated by SHPO
DA06355	27 SW 2nd Ave	27 SW 2nd Ave	No	Florida City	Masonry Vernacular Residence	c 1941	Private		Ineligible for NRHP
DA06356	750 S Krome Ave	750 S Krome Ave	No	Florida City	Masonry Vernacular Bar/ Restaurant	1934	Private		Ineligible for NRHP
DA06458	Naval Air Station, Richmond, FL	15810 SW 129th Ave	No	Miami	Frame Vernacular Military	1942	Federal		Not evaluated by SHPO

Table 2.5-50 (Sheet 15 of 15)
Previously Recorded Historic Structures Within 1.2 Miles of Offsite Areas

Site ID	Site Name	Address	Destroyed	City	Description	Year Built	Ownership	Local Designation[(a)]	SHPO Evaluation
DA06700	275 S Krome Ave	275 S Krome Ave	No	Florida City	Minimal Traditional Residence	c 1932	Private		Ineligible for NRHP
DA07008	36650 SW 192nd Ave	36650 SW 192nd Ave	No	Florida City	Moderne Commercial	1950	Private		Ineligible for NRHP
DA07009	36590 SW 192nd Ave	36590 SW 192nd Ave	No	Florida City	Masonry Vernacular Residence	1949	Private		Ineligible for NRHP
DA07010	36490 SW 192nd Ave	36490 SW 192nd Ave	No	Florida City	Moderne Residence	1947	Private		Ineligible for NRHP
DA07011	Longview School	19225 v 344th St	No	Florida City	Frame Vernacular Education Related	1911	Private		Potentially eligible for NRHP
DA07012	Cuchiella House	778 W Palm Dr	No	Florida City	Masonry Vernacular Residence	c 1920	Private	Miami-Dade	Potentially eligible for NRHP
DA08040	AT&T Pennsuco	11011 NW 177th Ave	No	Pennsuco	Warehouse	c 1956	Private		Ineligible for NRHP
DA09601	17700 SW 8th St	17700 SW 8th St	No	Miami	Masonry Vernacular Commercial	1955	Private		Ineligible for NRHP
DA09900	8130 NW 74th	11825 NW 56th St	No	Medley	Masonry Vernacular Residence	1936	Private		Ineligible for NRHP
DA09901	11825 NW 56th St	8130 NW 74th St	No	Medley	Masonry Vernacular Commercial	1950	Private		Ineligible for NRHP

(a) Blank entry = not locally designated.

All sites are within Miami-Dade County

Summary
120 Historic Structures identified via Florida Master Site File records
1 Listed as "Destroyed"
1 Individually listed National Register property identified
21 Designated by Miami-Dade County Historic Preservation Board
0 Designated by Homestead Historic Preservation Board

Table 2.5-51
Previously Recorded Resource Groups Within 1.2 Miles of Offsite Areas

Site ID	Site Name	City	County	Description	Dates of Significance	Local Designation[(a)]	SHPO Evaluation
DA06943	Goulds Historic District	Goulds	Dade	Historical district	Not specified	Miami-Dade	Not evaluated by SHPO
DA09997	Monkey Jungle	Alladin City	Dade	Mixed district	American, 1821–present		Potentially eligible for NRHP
DA4353	Coral Way State Historic Highway	Multiple	Dade	Linear resource	Historic		Potentially eligible for NRHP
DA4584	Bird Road	Multiple	Dade	Linear resource	Historic		Ineligible for NRHP
DA4585	S. Bayshore Drive/Miami Avenue	Miami	Dade	Linear resource	Historic		Potentially eligible for NRHP
DA4586	Calle Ocho	Multiple	Dade	Linear resource	Historic		NRHP-listed
DA5123	Downtown Miami Multiple Resource Area	Miami	Dade	Multiple property submission	Historic		Potentially eligible for NRHP
DA5583	Macfarlane Homestead Historic District	Coral Gables	Dade	Historical district	Historic		NRHP-listed
DA6486	Sunset Drive		Dade	Linear resource	Historic		Ineligible for NRHP
DA6509	Sunset Drive Historic District		Dade	Historical district	Historic		Potentially eligible for NRHP
DA8039	Miami Roads Neighborhood	Miami	Dade	Historical district	Historic		Not evaluated
DA10107	F.E.C. Railway	Multiple	Dade	Linear resource	Historic		Insufficient info
DA10753	CSX Railroad	Multiple	Dade	Linear resource	Historic		Insufficient info
DA10754	Snapper Creek Canal	Multiple	Dade	Linear resource	Historic		Ineligible for NRHP
DA6453	Tamiami Canal	Multiple	Dade	Linear resource	Historic		Potentially eligible for NRHP
DA6510	Tamiami Trail	Multiple	Dade	Linear resource	Historic		Potentially eligible for NRHP

(a) Blank entry = not locally designated.

Summary

16 Resource Groups identified via Florida Master Site File records
2 National Register listed resource groups identified
1 designated by Miami-Dade County Historic Preservation Board
0 designated by Homestead Historic Preservation Board

Table 2.5-52
County Summary, Block Groups within 50 Miles of the Turkey Point Site with Significant Minority or Low-Income Populations

County	Total Block Groups	Black Block Groups	American Indian or Alaska Native Block Groups	Asian Block Groups	Native Hawaiian or Other Pacific Islander Block Groups	Other Block Groups	Multiracial	Aggregate of Minority Races Block Groups	Hispanic Ethnicity Block Groups	Low-Income Households Block Groups
Broward	367	92	1	0	0	4	0	108	58	19
Collier	1	0	0	0	0	0	0	0	0	0
Miami-Dade	1222	319	0	6	0	18	2	335	783	212
Monroe	37	0	0	0	0	0	0	0	2	0
Total Counties	**1627**	**411**	**1**	**6**	**0**	**22**	**2**	**443**	**843**	**231**
State of Florida Percentages		15.4%	0.3%	2.3%	0.05%	3.6%	1.8%	23.4%	20.6%	12.5%

Source: USCB 2012b

Figure 2.5-1 10-Mile Vicinity with Direction Sectors

Figure 2.5-2 50-Mile Vicinity with Direction Sectors

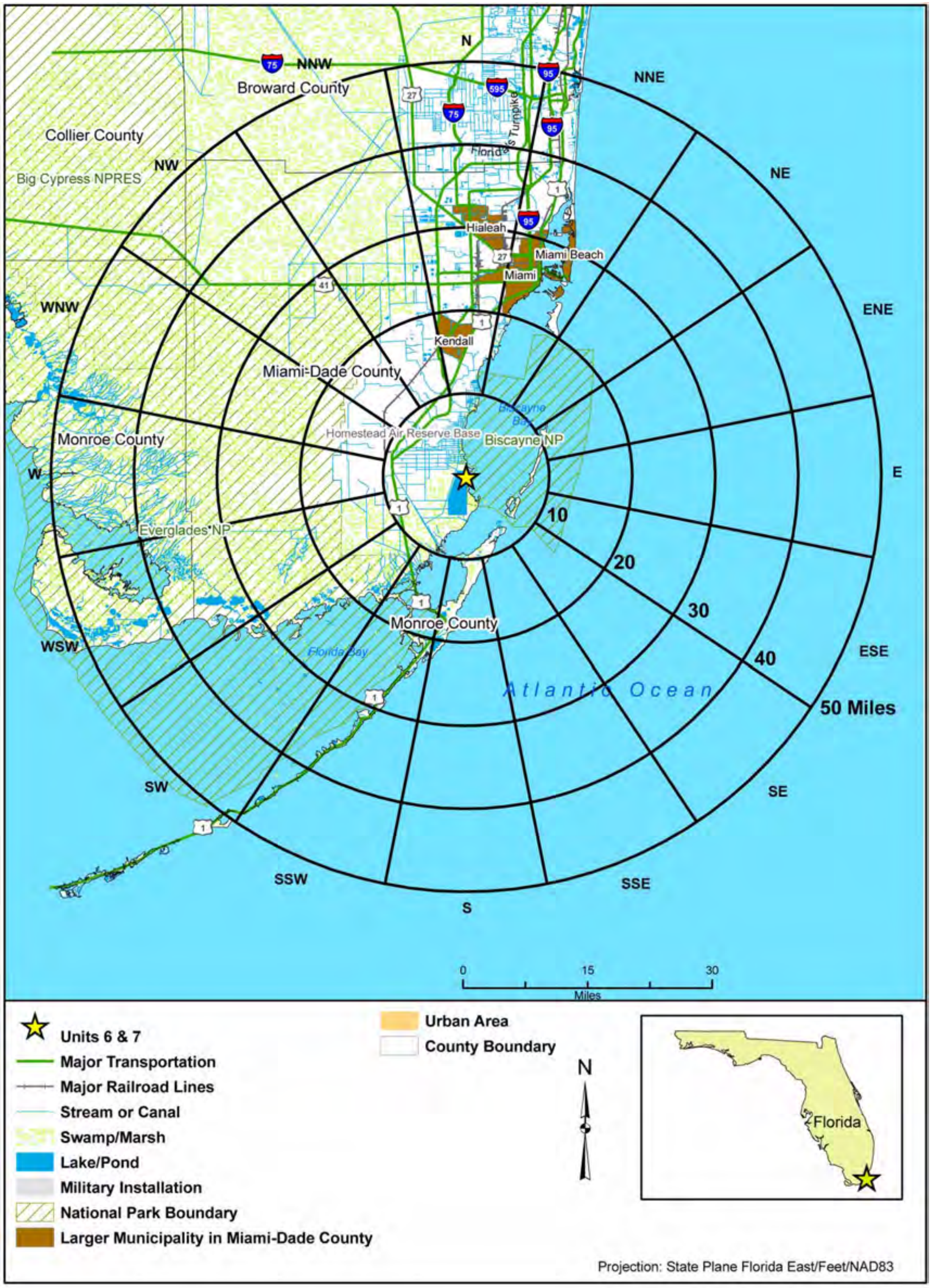
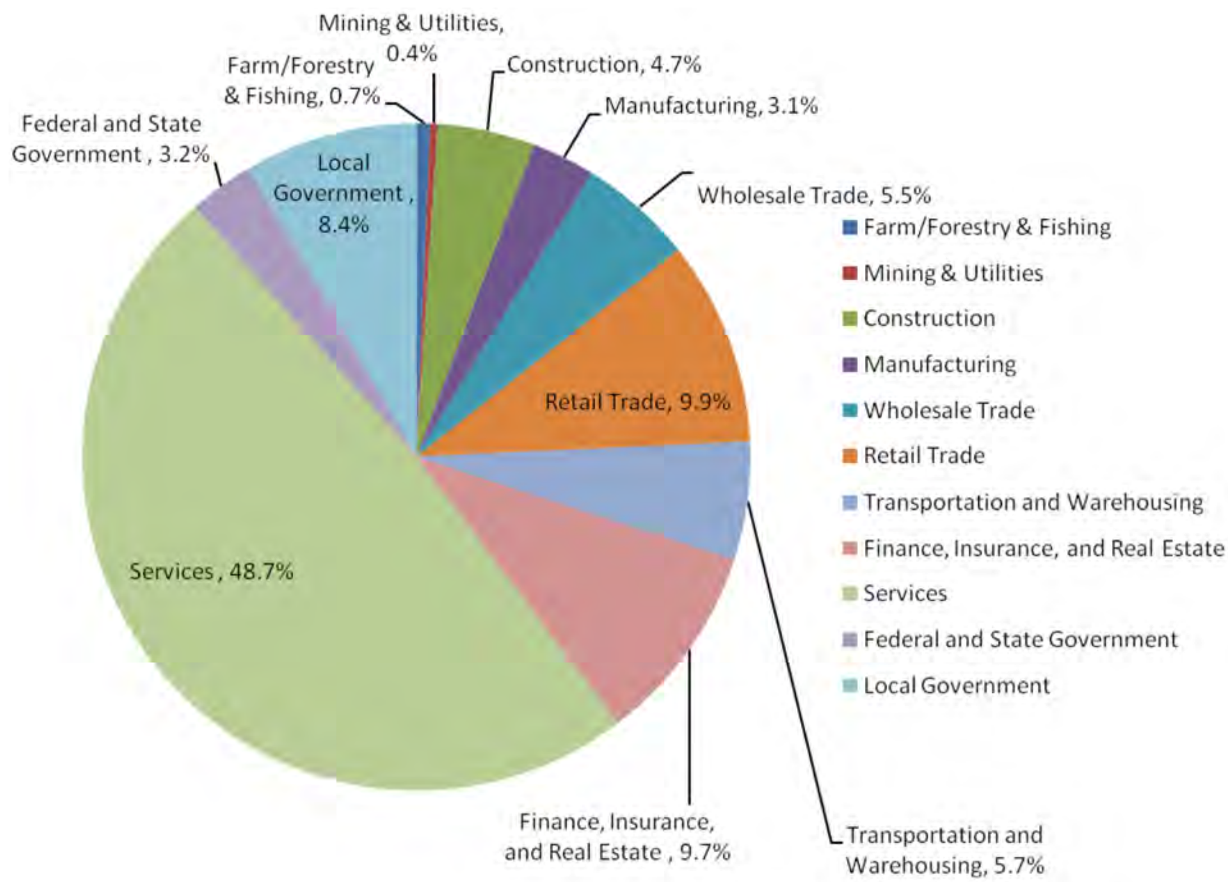
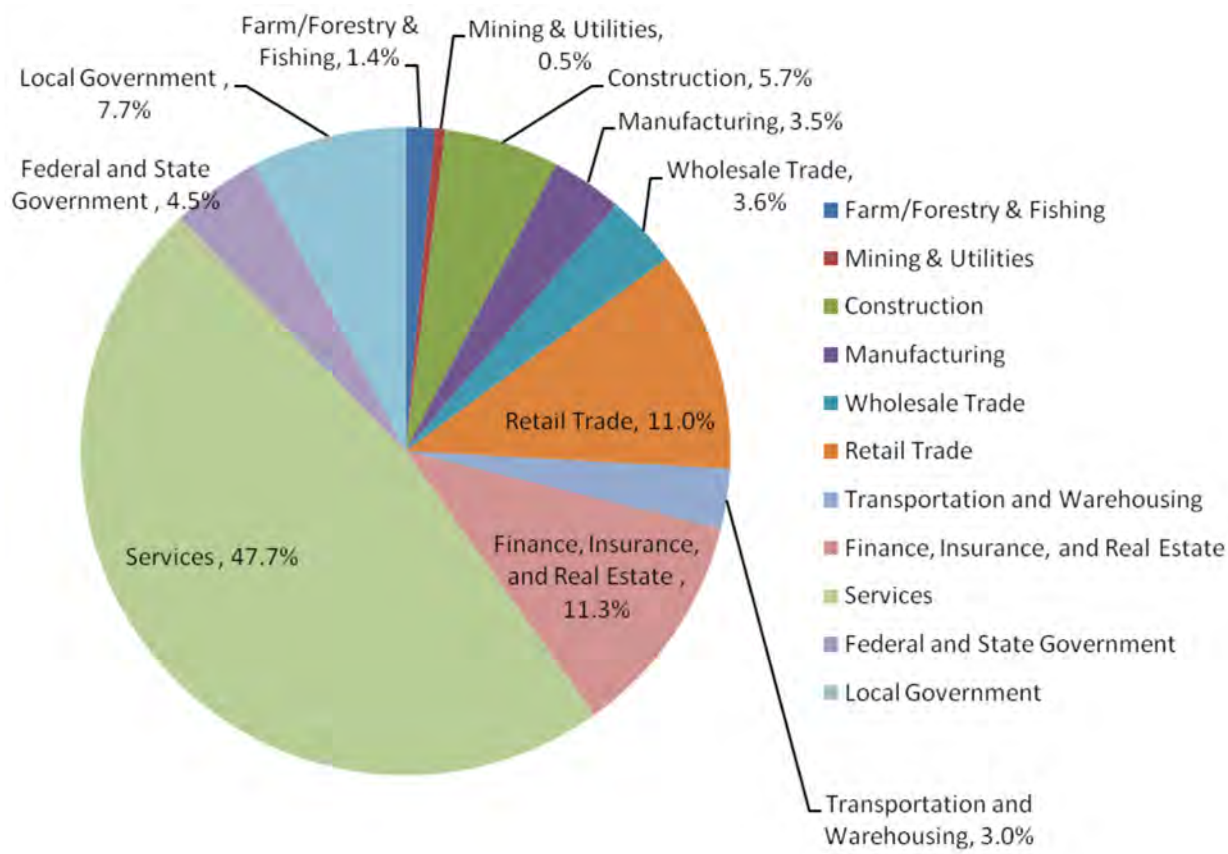


Figure 2.5-3 Employment Sectors, Miami-Dade County, 2009



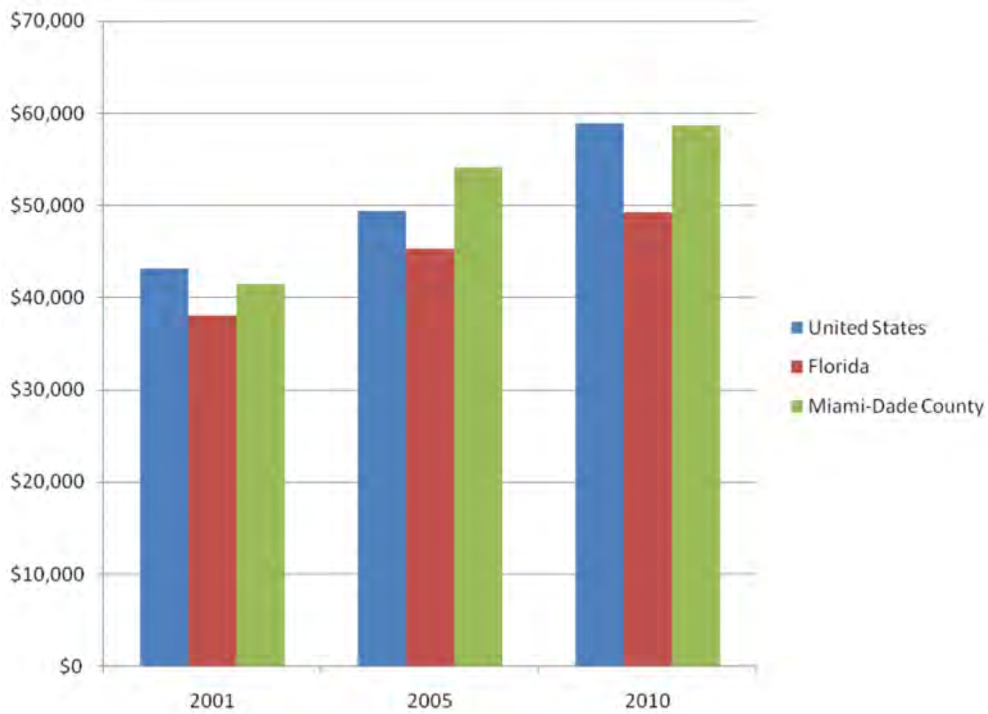
Source: Table 2.5-3

Figure 2.5-4 Employment Sectors, Florida, 2009



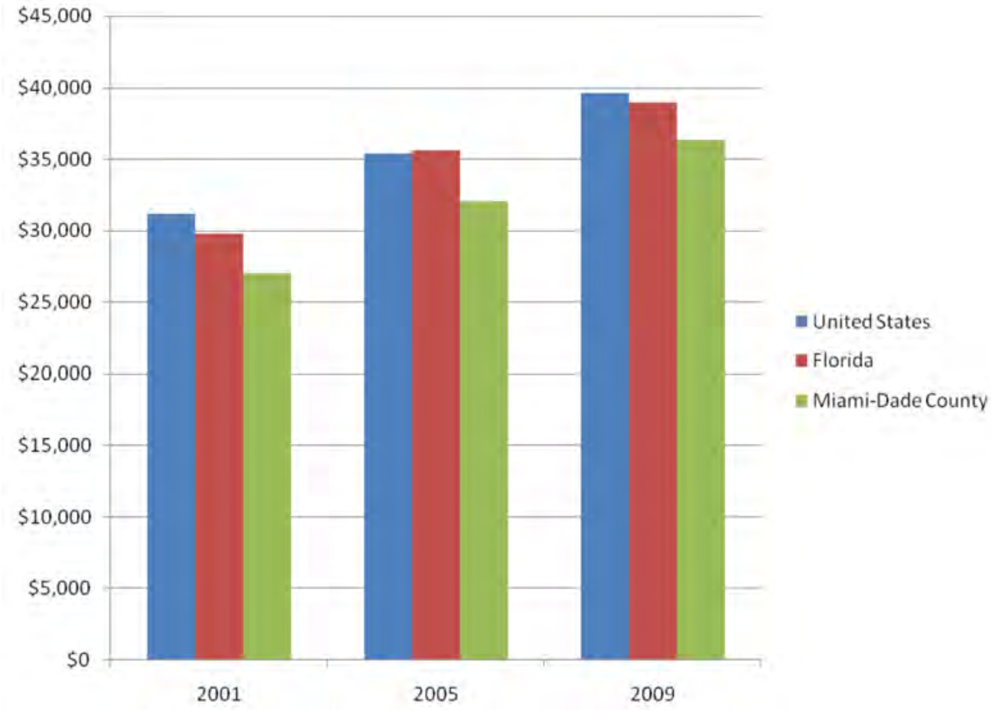
Source: Table 2.5-9

Figure 2.5-5 Average Annual Wage, Heavy and Civil Engineering Construction, 2001 to 2010



Source: Table 2.5-12

Figure 2.5-6 Per Capita Personal Income, 2009



Source: Table 2.5-14

Figure 2.5-7 Airports, Highways, Ports, Intracoastal Waterways and Railroads

Figure 2.5-8a Highways and Streets

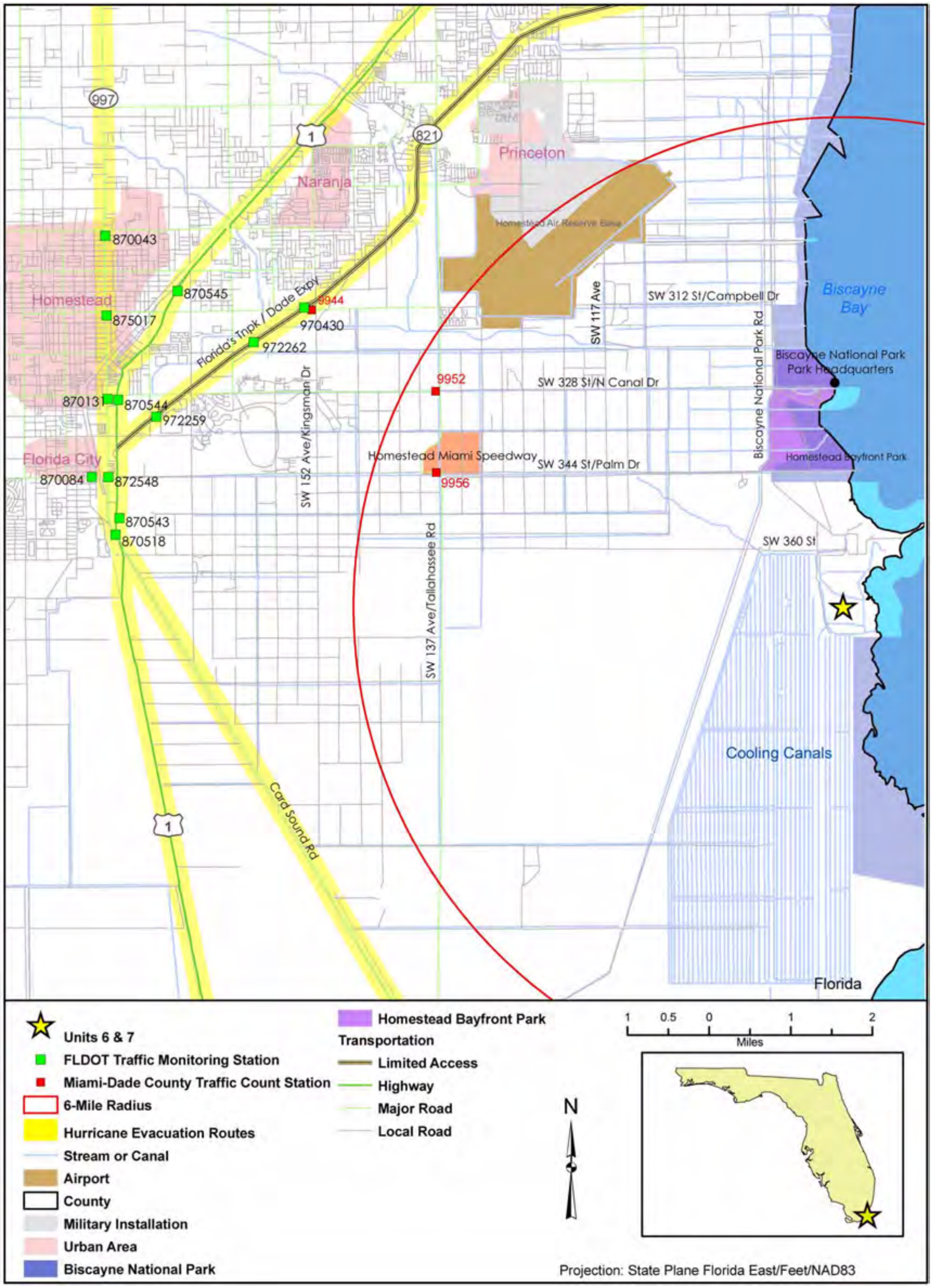
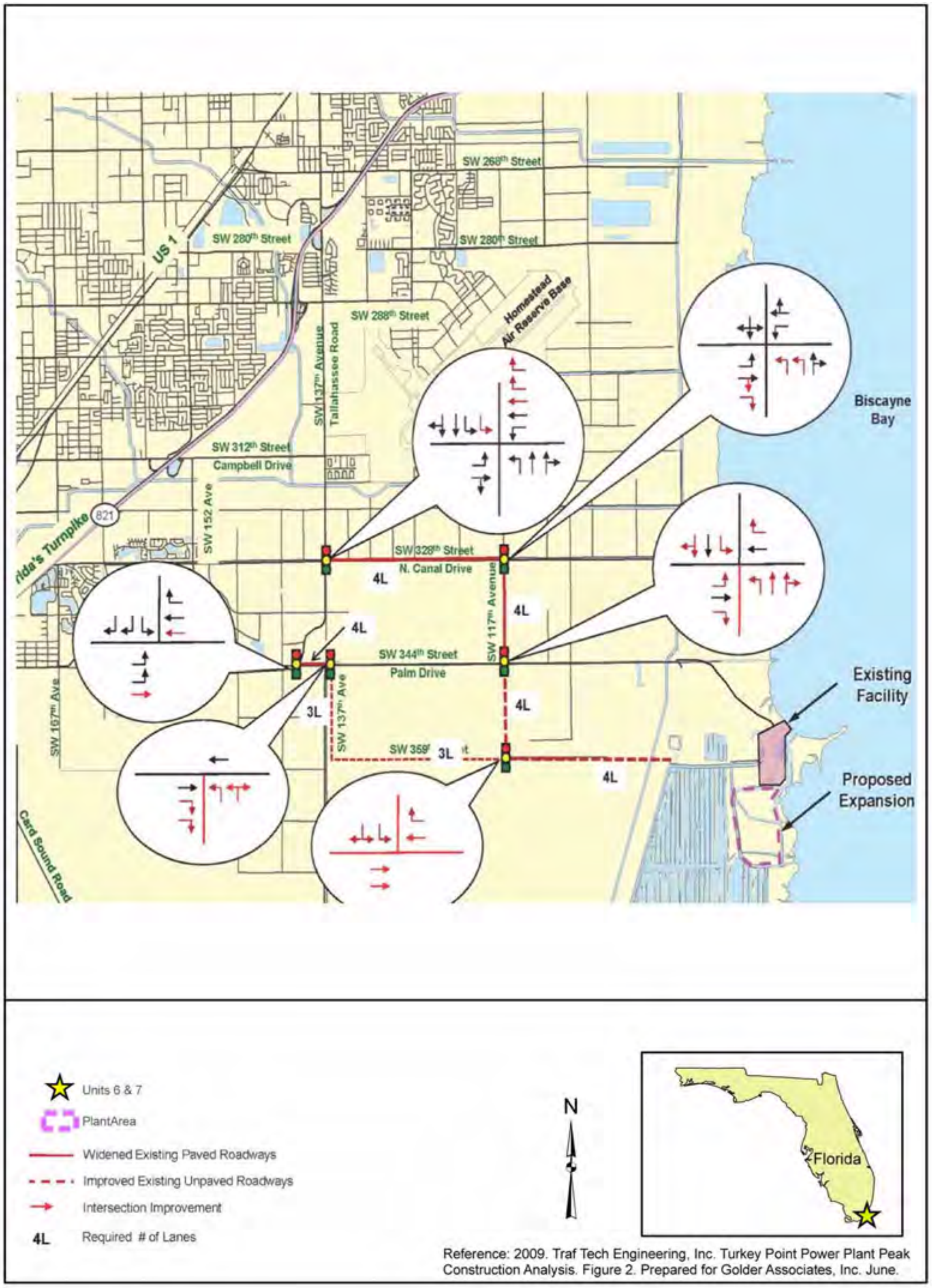
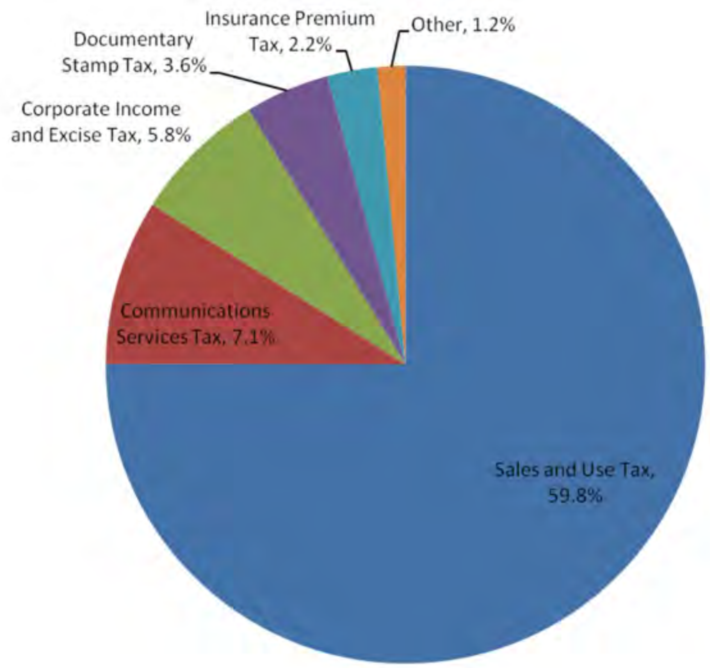


Figure 2.5-8b Traffic Study, Turkey Point Area



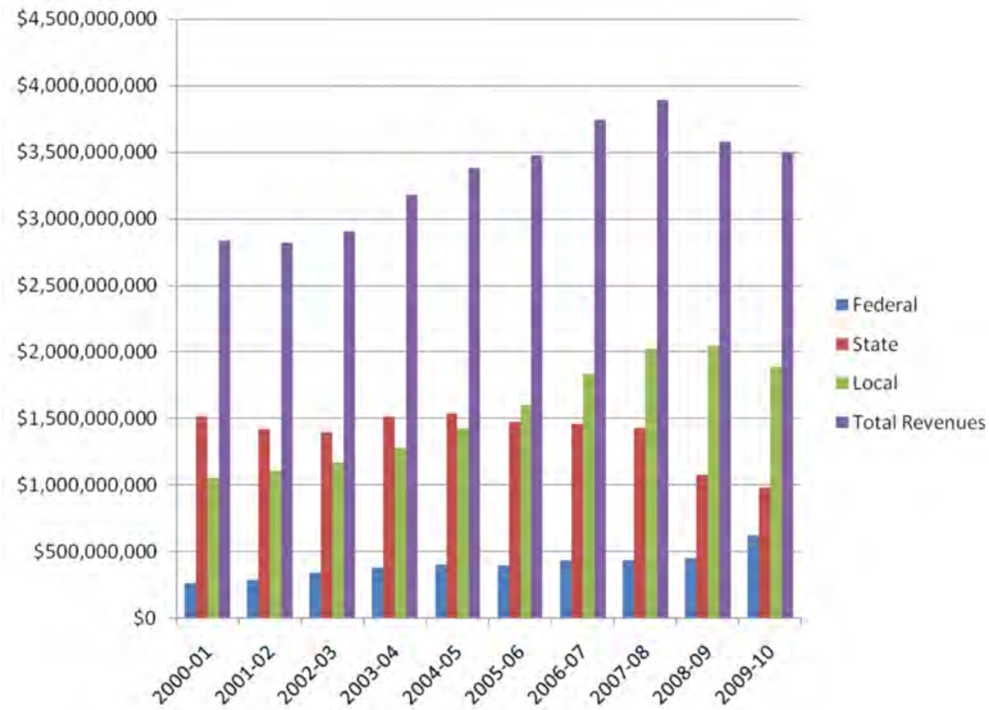
Reference: 2009. Traf Tech Engineering, Inc. Turkey Point Power Plant Peak Construction Analysis. Figure 2. Prepared for Golder Associates, Inc. June.

Figure 2.5-9 Florida Revenues by Source, 2010–2011



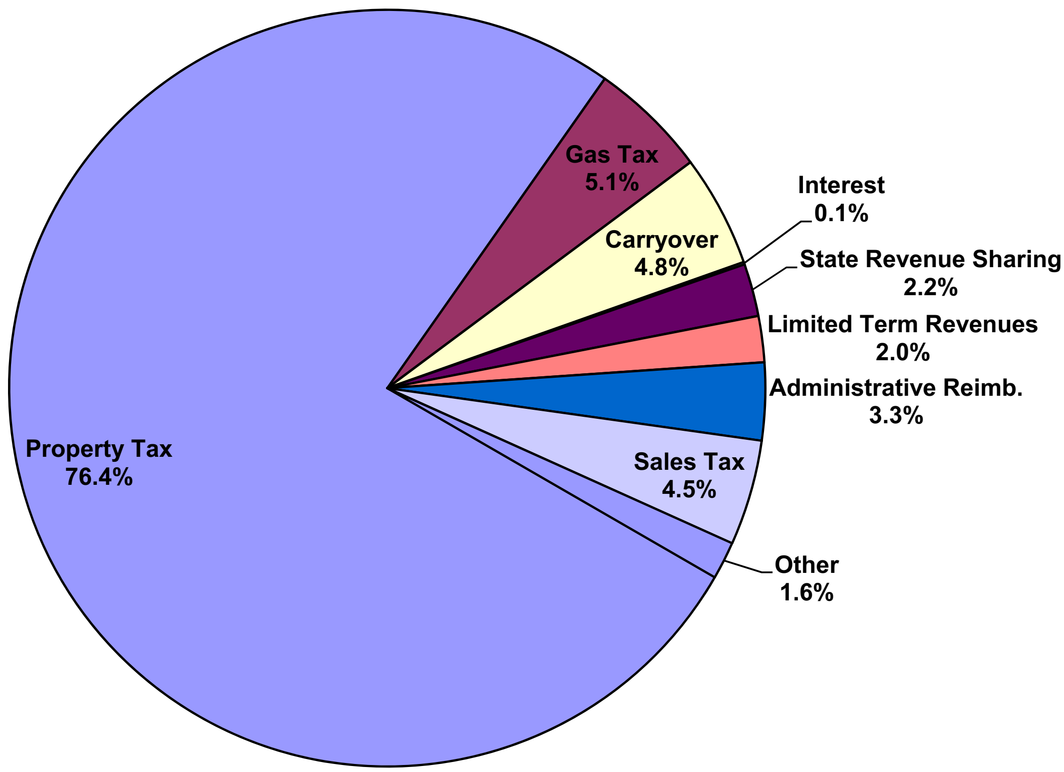
Source: Table 2.5-18

Figure 2.5-10 Miami-Dade School District, Revenues by Source, FY 2000–2001 to FY 2009–2010



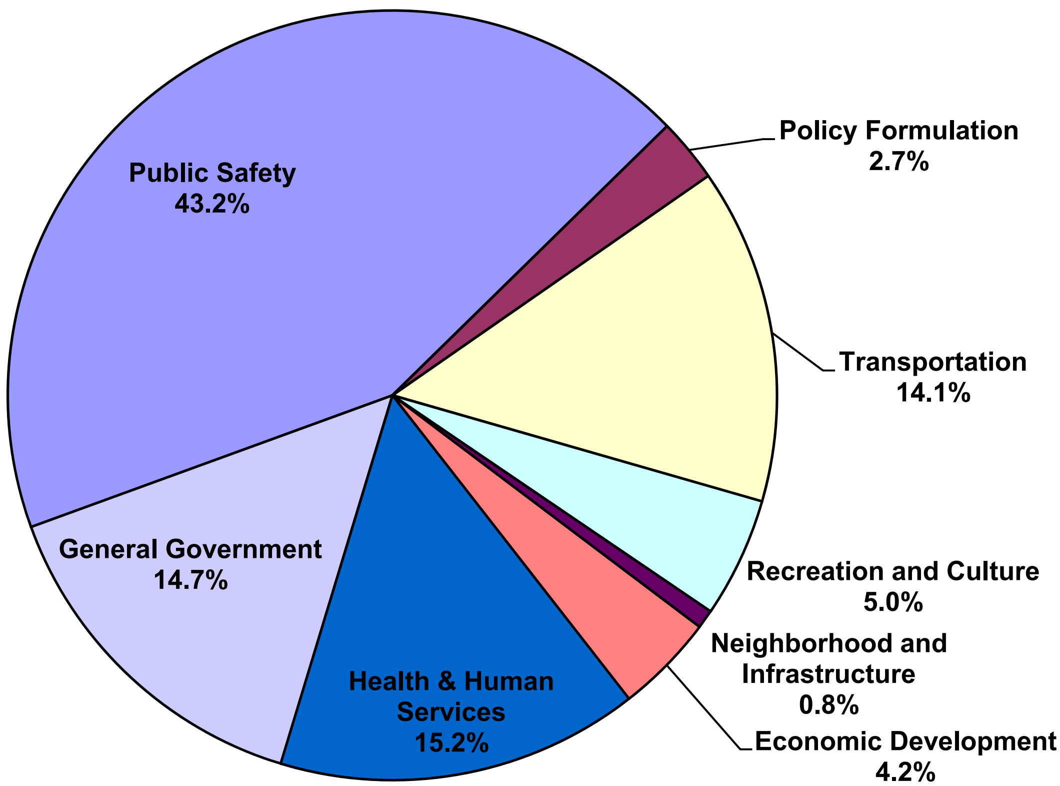
Source: Table 2.5-21

Figure 2.5-11 Miami-Dade County Revenues by Source, 2011–2012



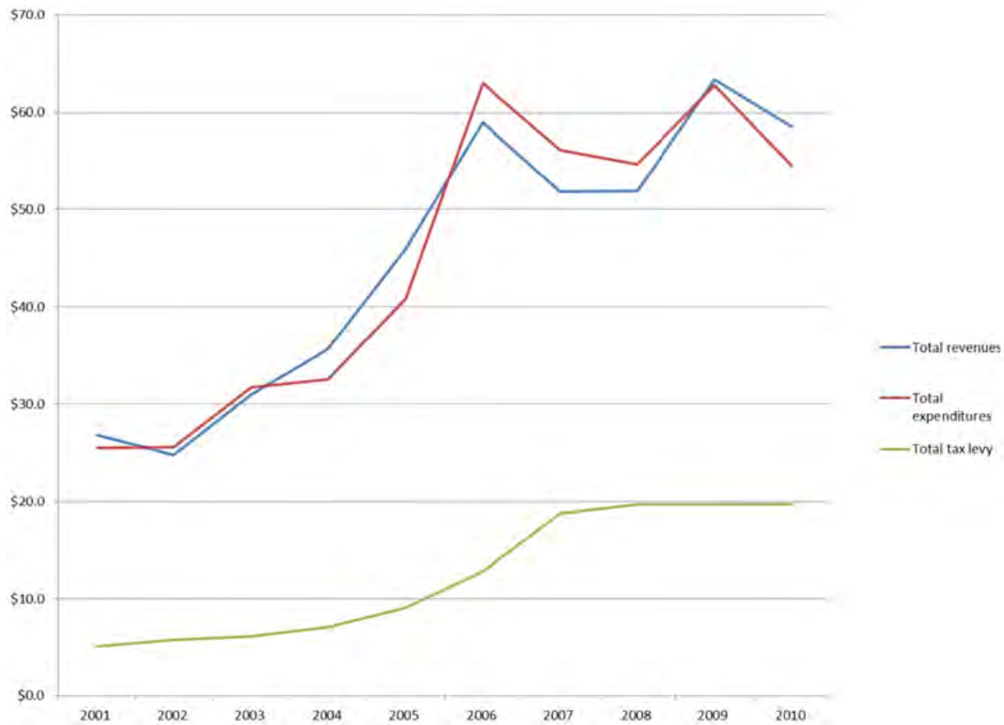
Source: Table 2.5-22

Figure 2.5-12 Miami-Dade County Expenditures by Category, 2011–2012



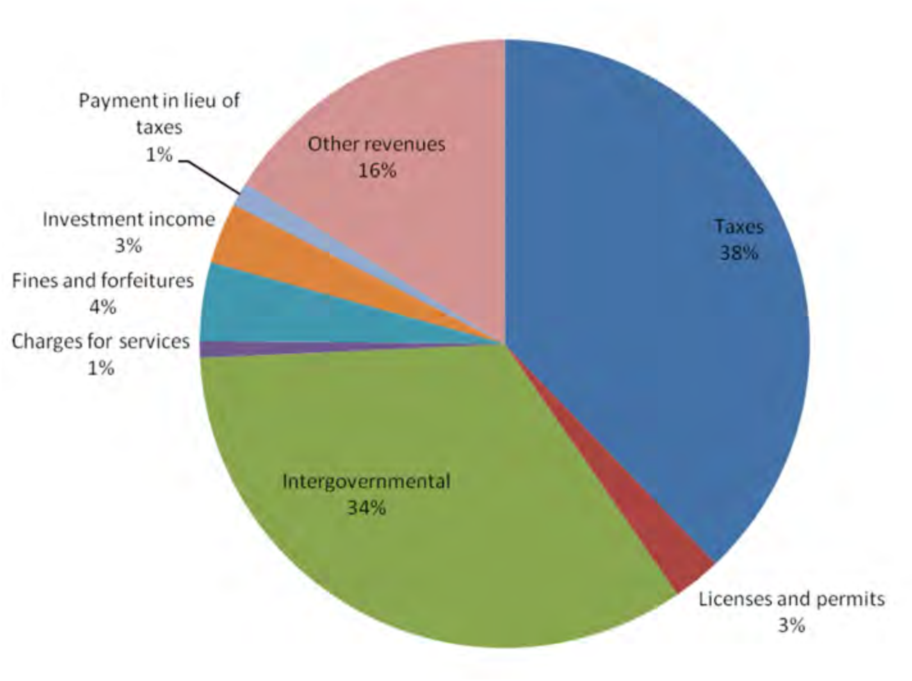
Source: Table 2.5-22

Figure 2.5-13 Homestead, Revenues and Expenditures, 2001–2010 (Millions of Dollars)



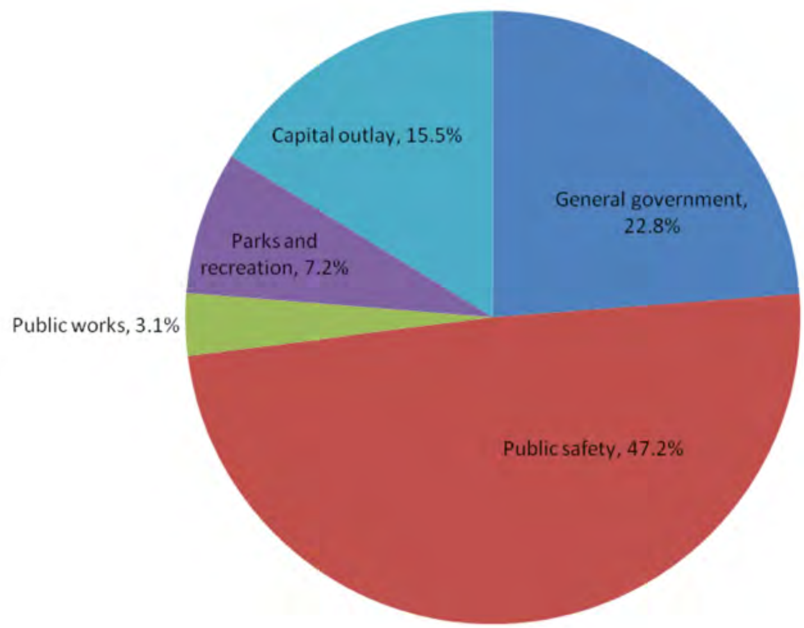
Source: Table 2.5-23

Figure 2.5-14 Homestead, Revenues by Source, 2010



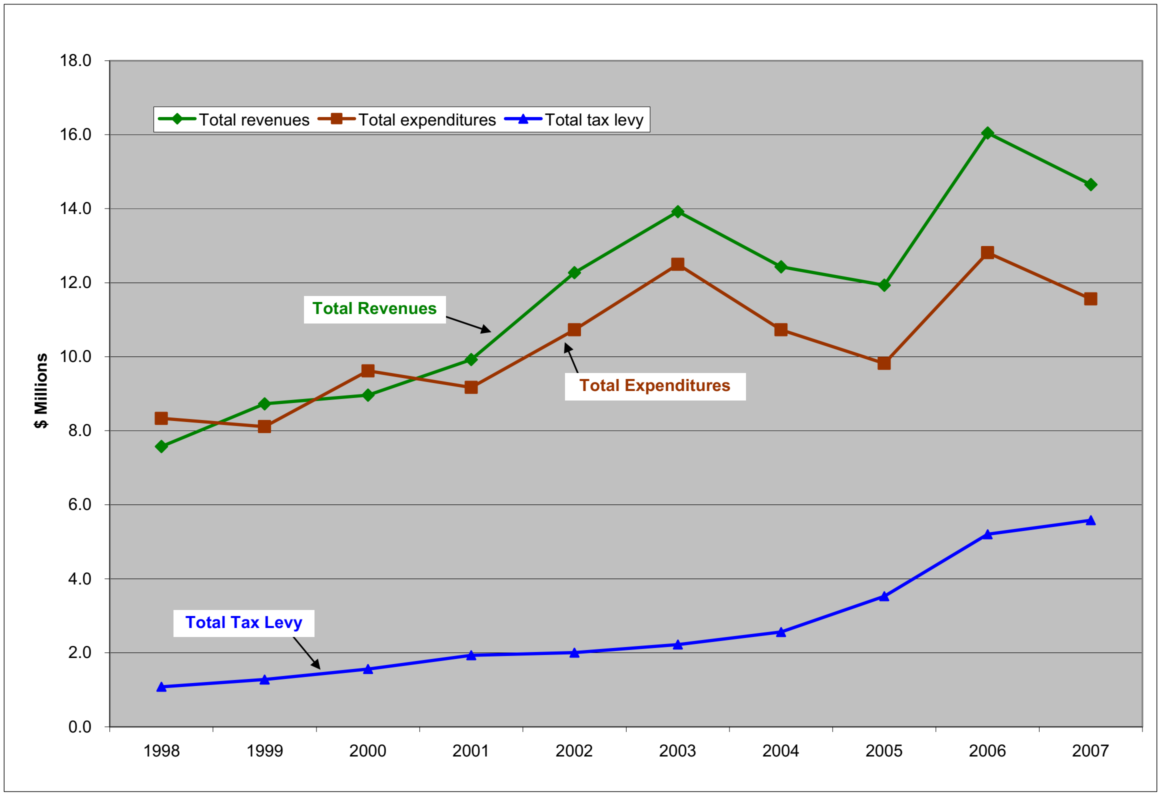
Source: Table 2.5-23

Figure 2.5-15 Homestead, Expenditures by Category, 2010



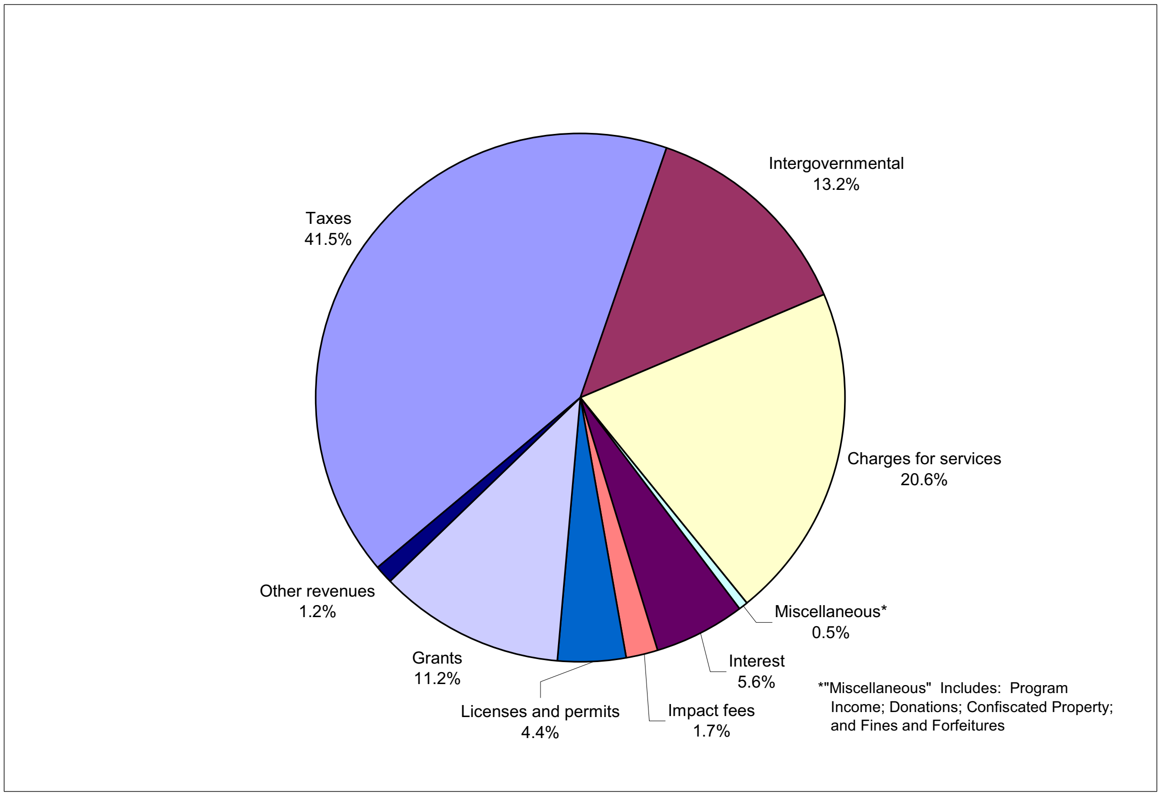
Source: Table 2.5-23

Figure 2.5-16 City of Florida City Revenues, Expenditures, and Total Tax Levy, 1998–2007



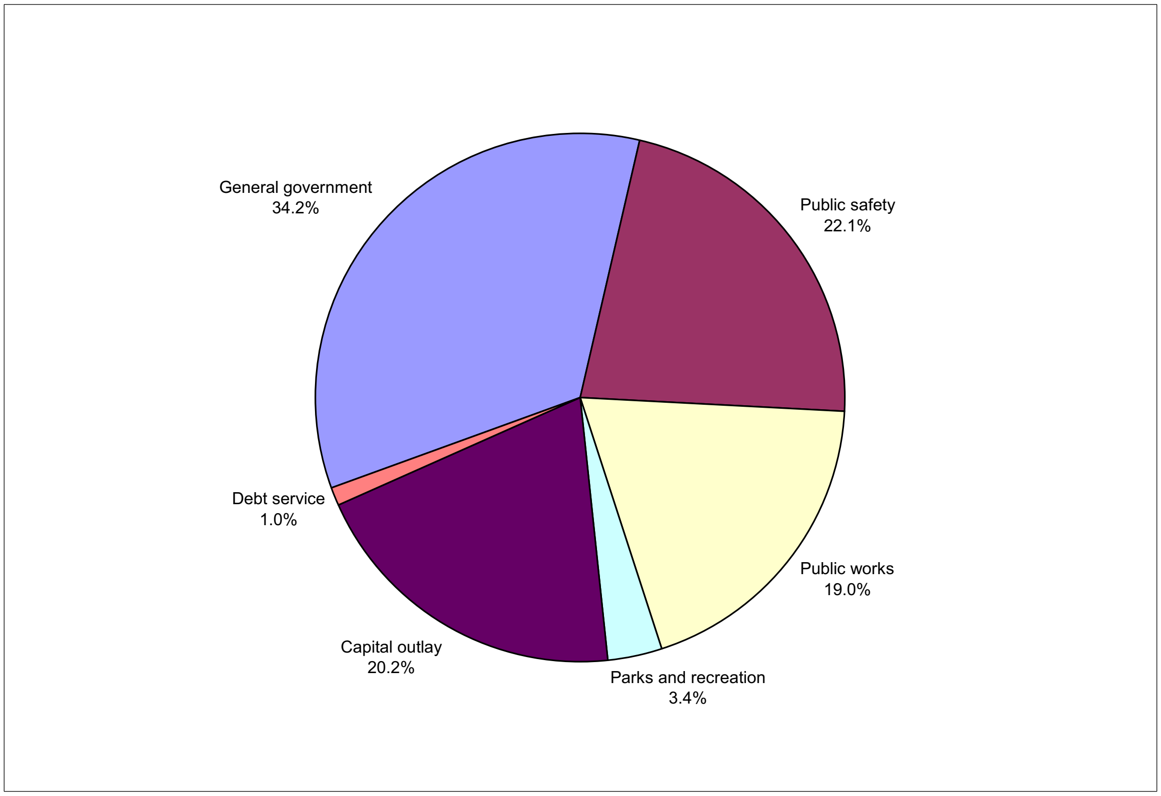
Source: CFCF May 2008 (Tables 2.5-26 and 2.5-27).

Figure 2.5-17 City of Florida City Revenues by Source, 2007



Source: CFCF May 2008 (Table 2.5-26).

Figure 2.5-18 City of Florida City Expenditures by Category, 2007



Source: CFCF May 2008 (Table 2.5-26).

Figure 2.5-19 Recreational Areas in 6-Mile Region

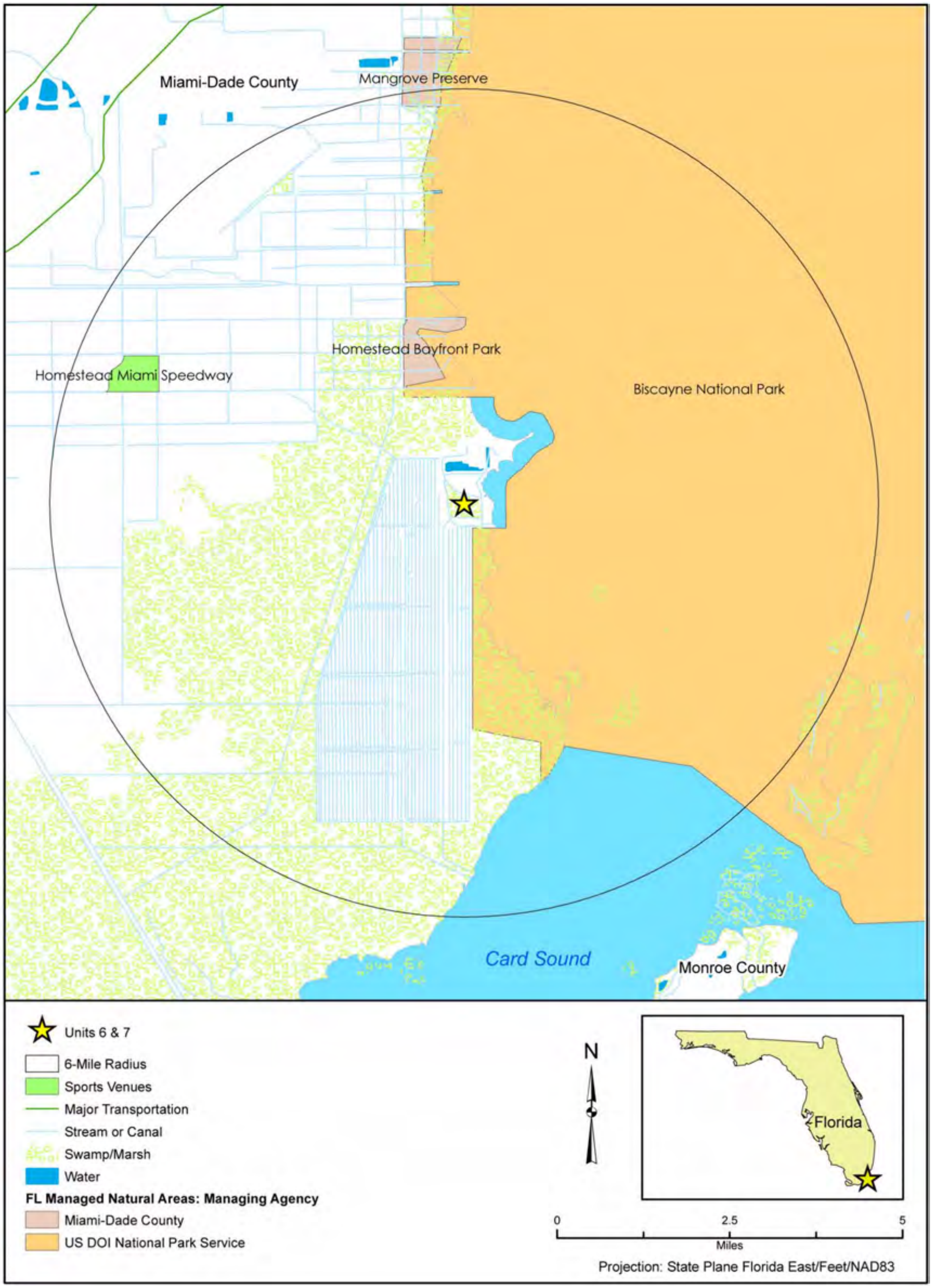


Figure 2.5-20 Federal, State, and Select Non-Profit Recreational Areas in 50-Mile Region

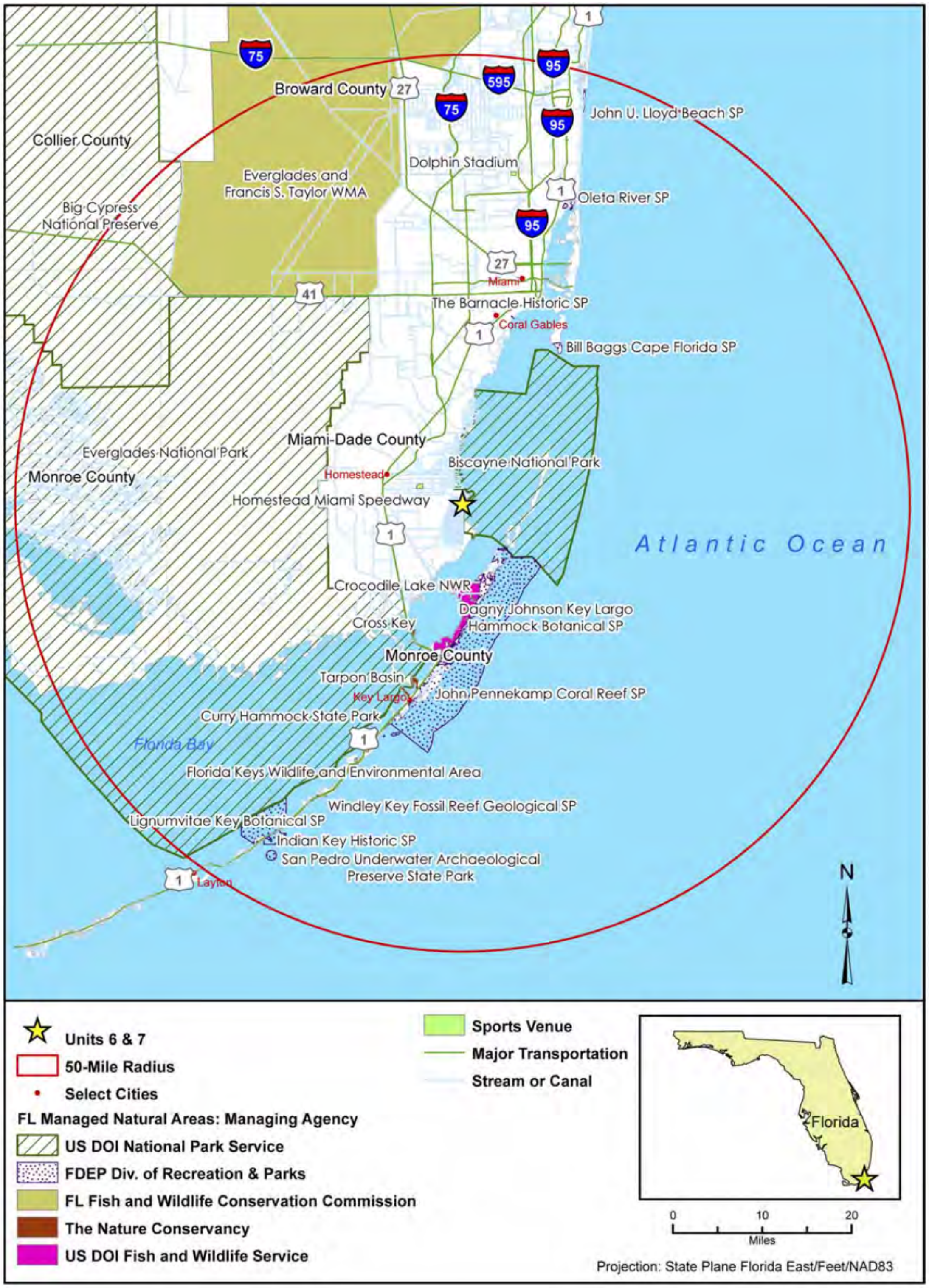


Figure 2.5-21 Regional Water Management Districts of Florida

Figure 2.5-22 Miami-Dade County Public Water Supply Areas

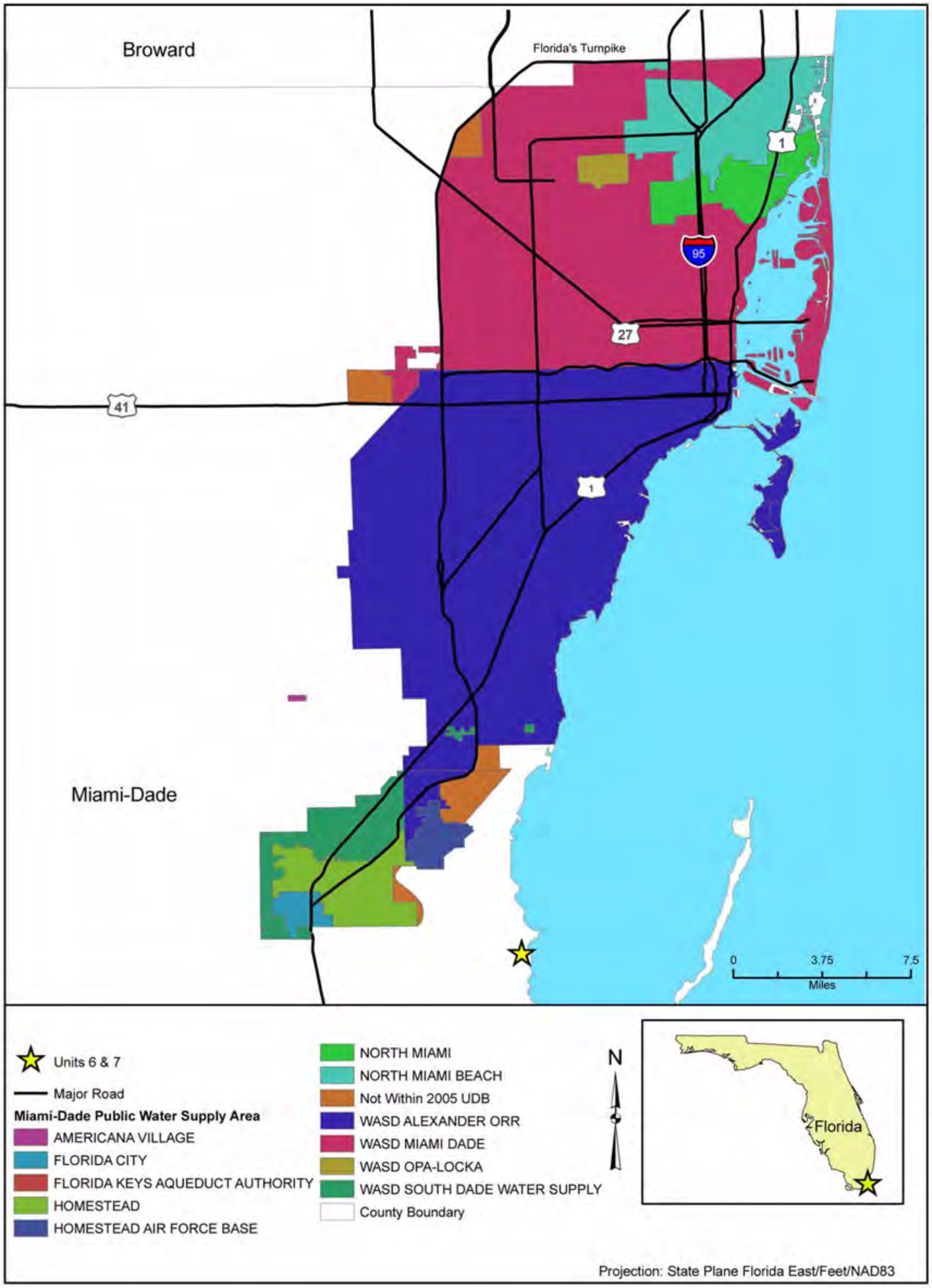


Figure 2.5-23 Miami-Dade County School District

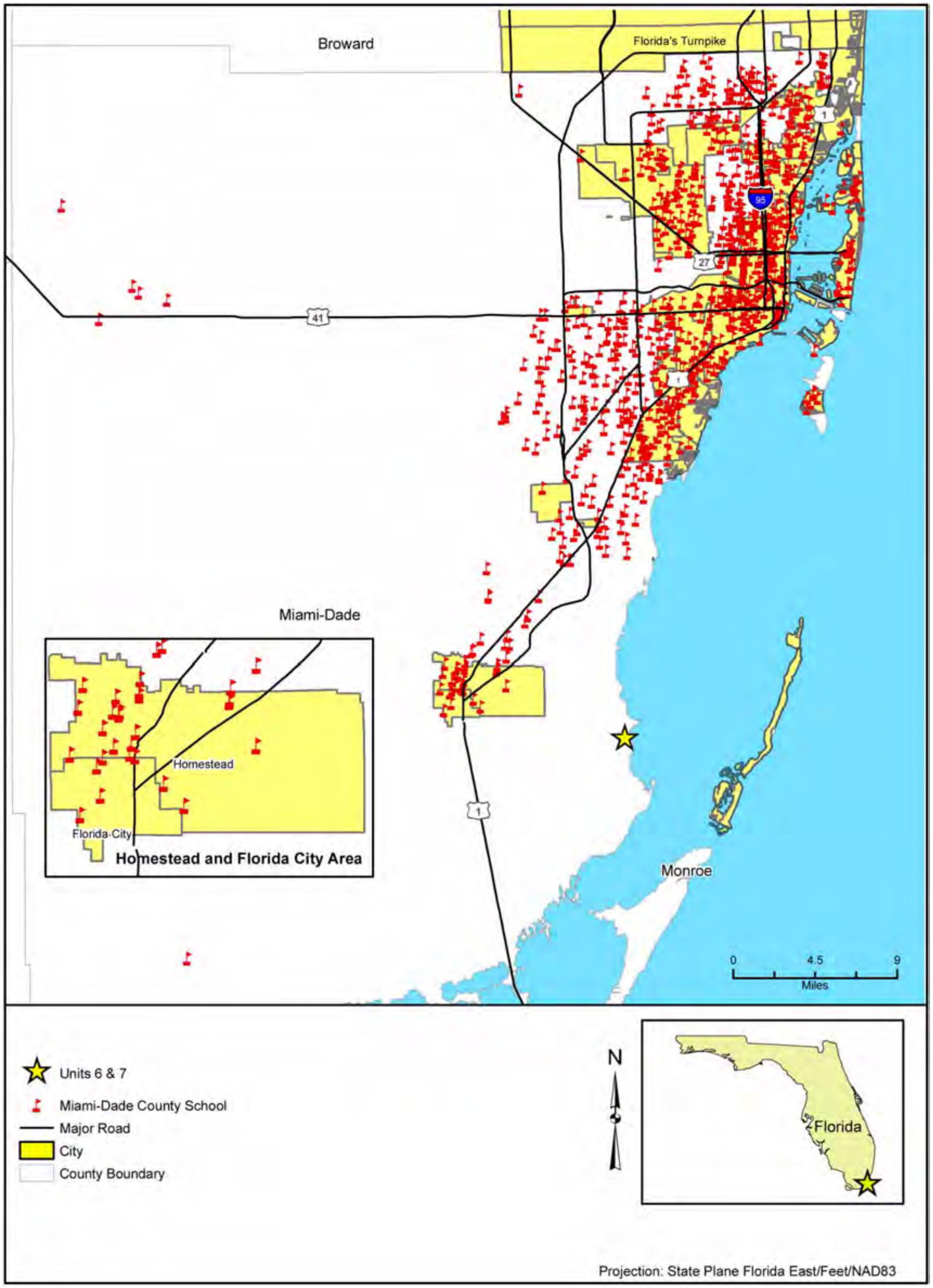


Figure 2.5-24 Significant Black Minority Population

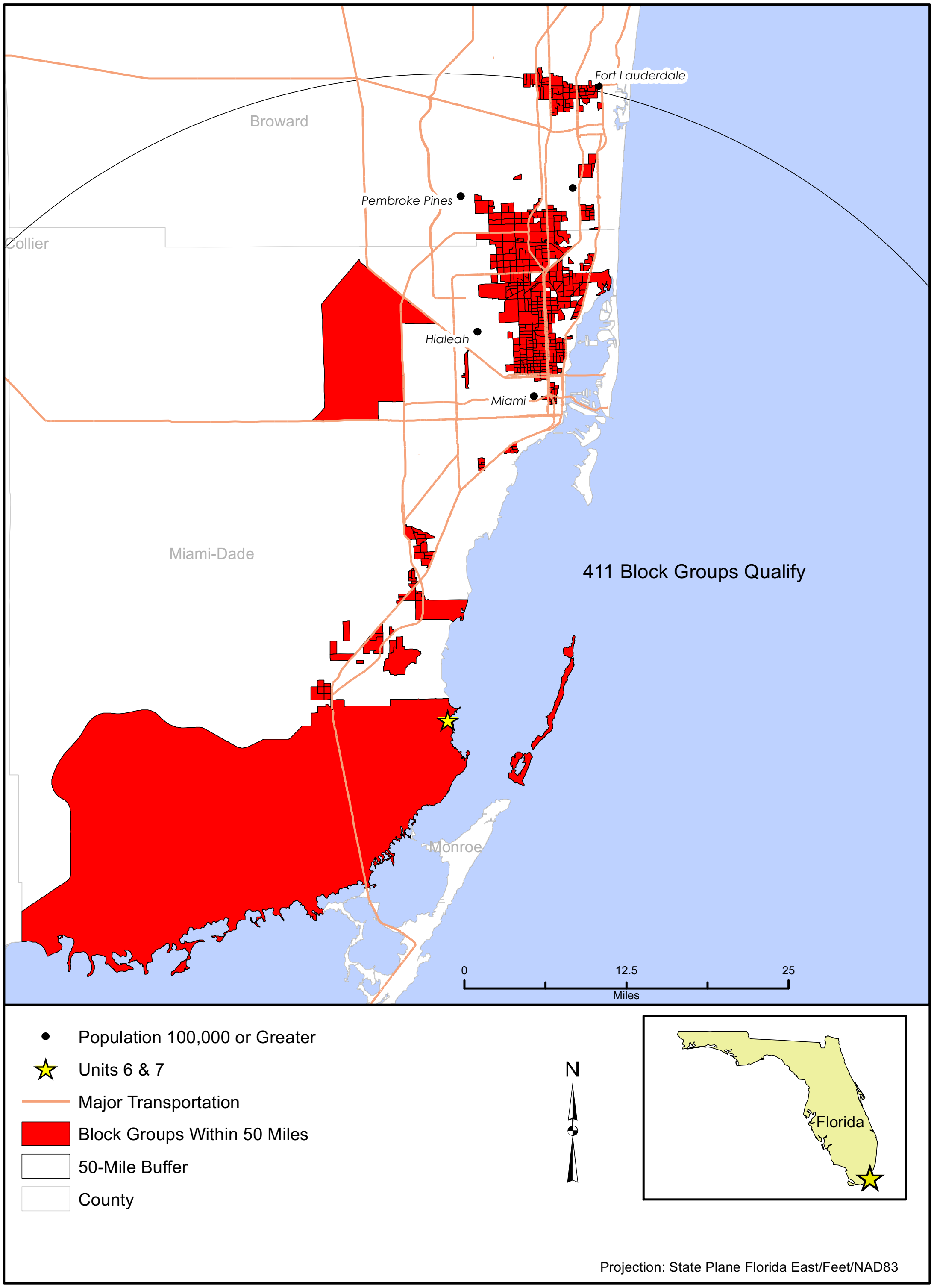


Figure 2.5-25 Significant American Indian/Alaskan Native Minority Population

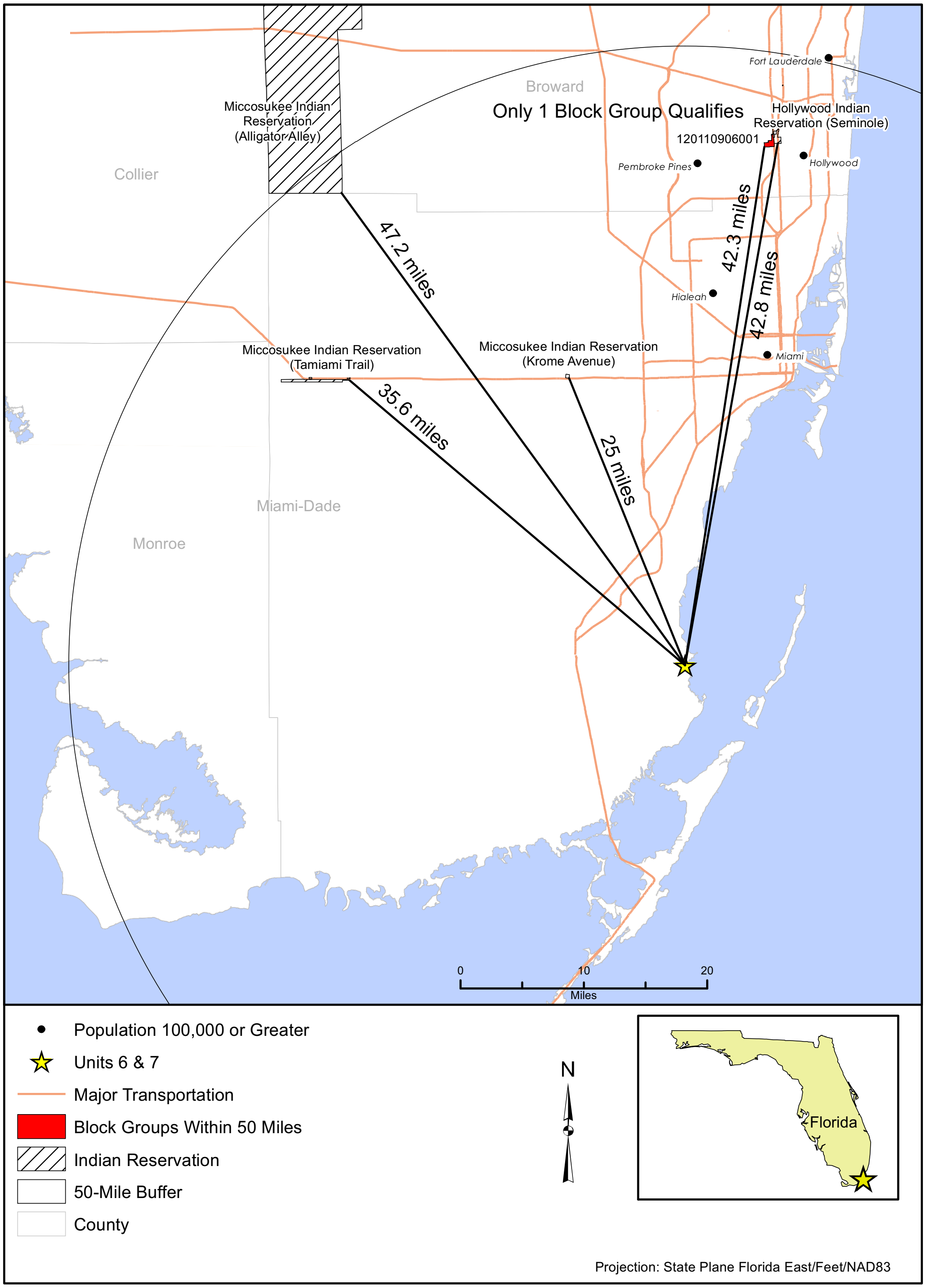


Figure 2.5-26 Asian Minority Population

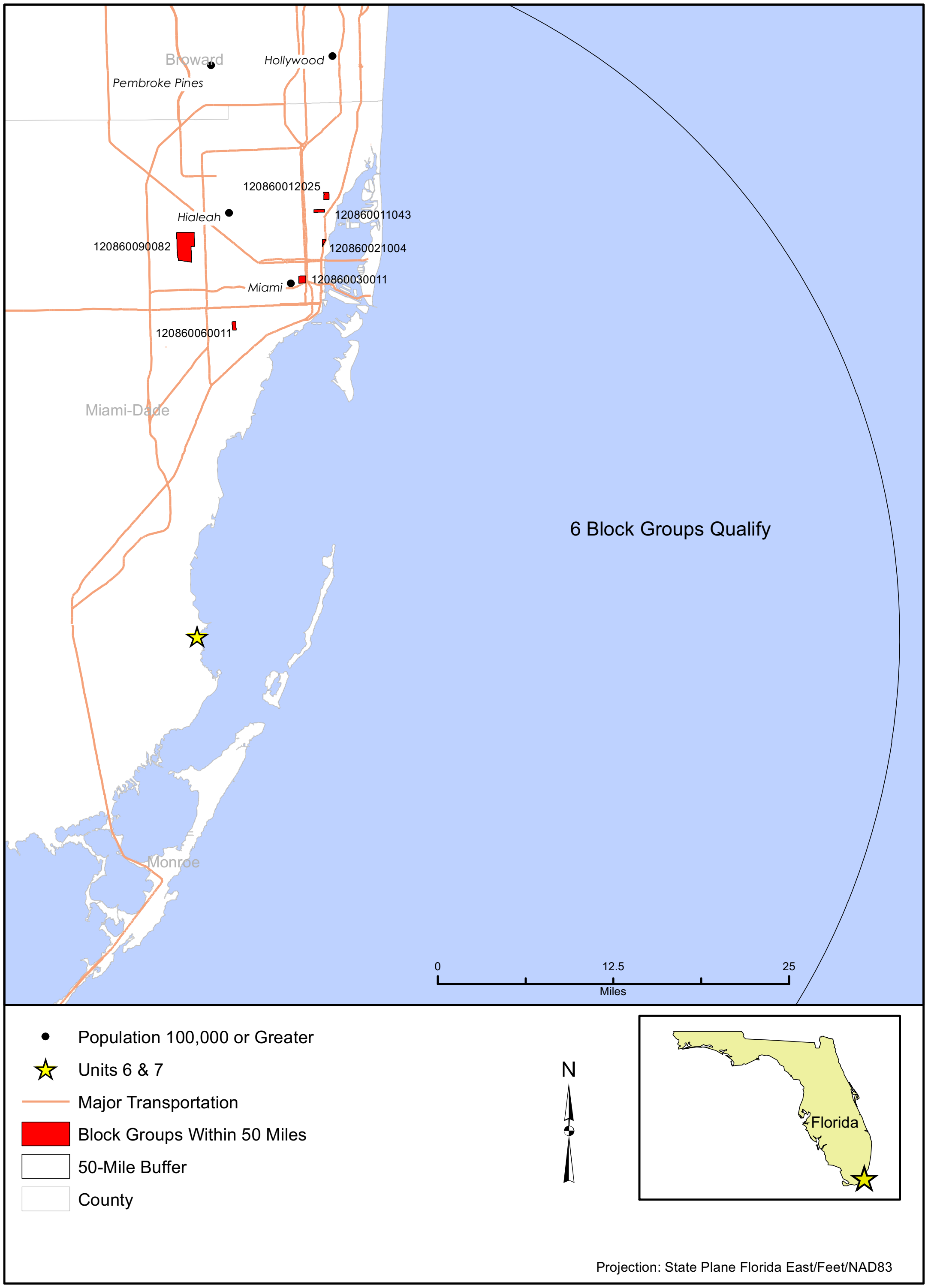


Figure 2.5-27 Significant Other Races Minority Population

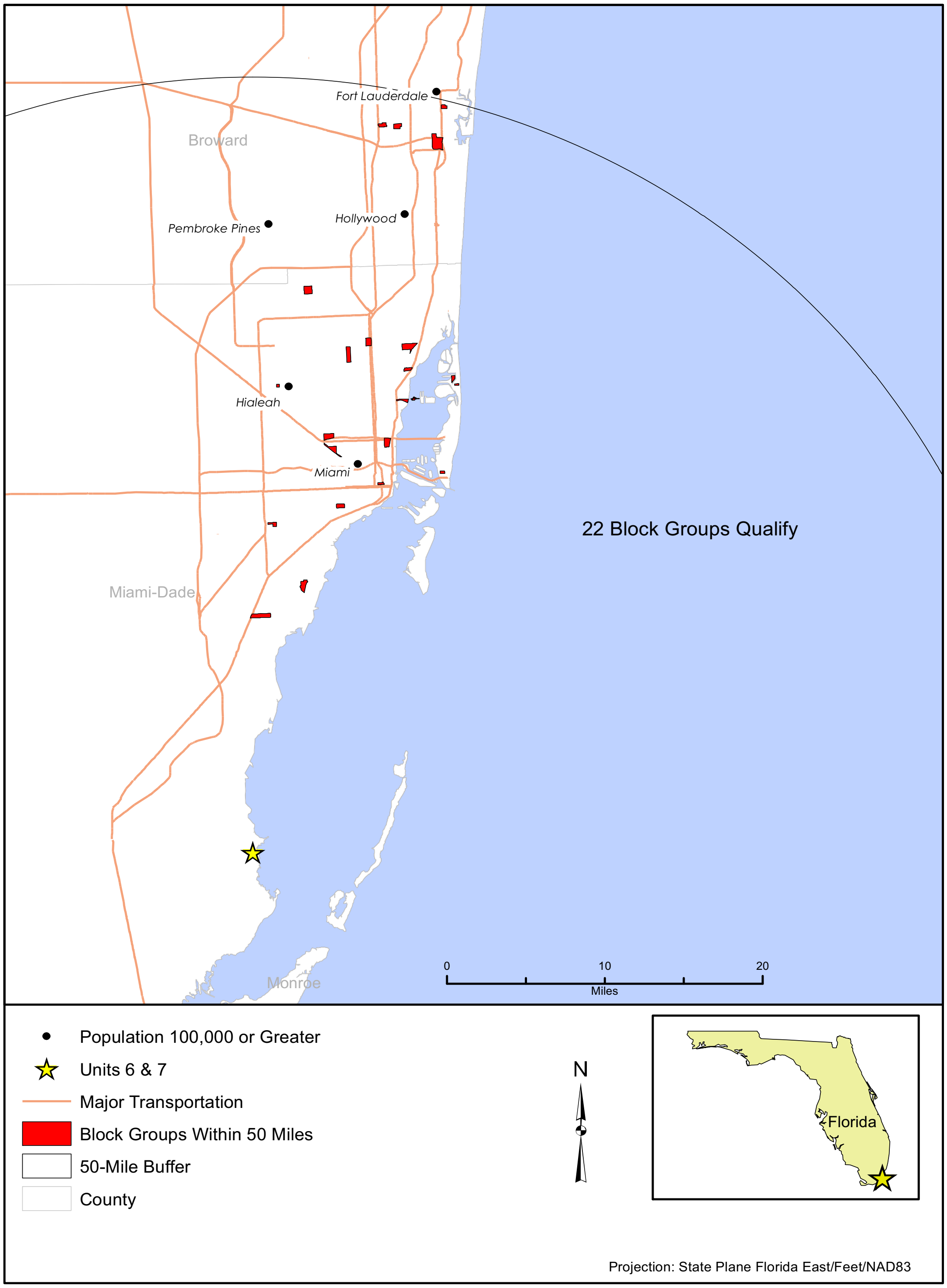


Figure 2.5-28 Significant Multiracial Minority Population

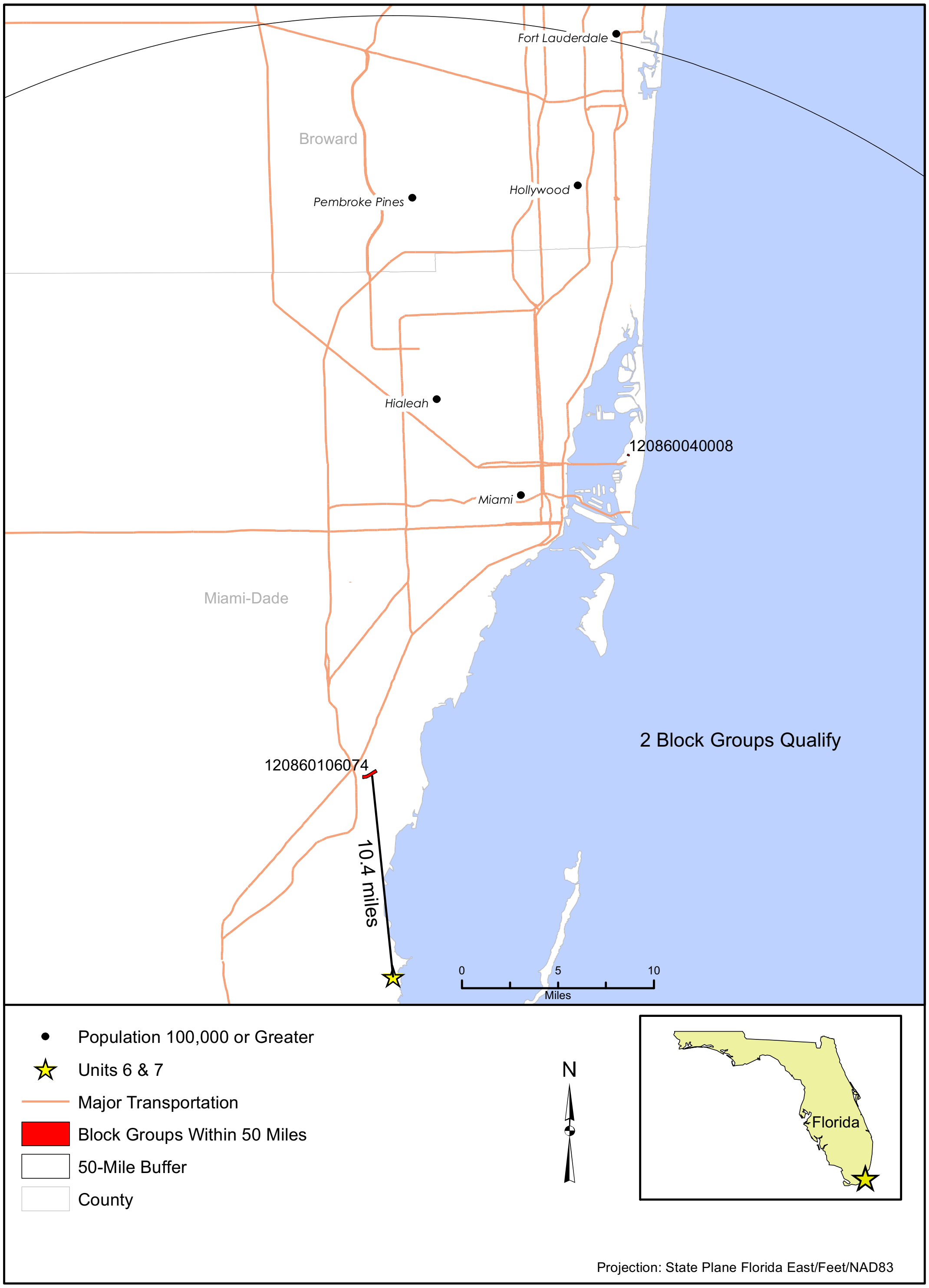


Figure 2.5-29 Significant Aggregate Racial Minority Population

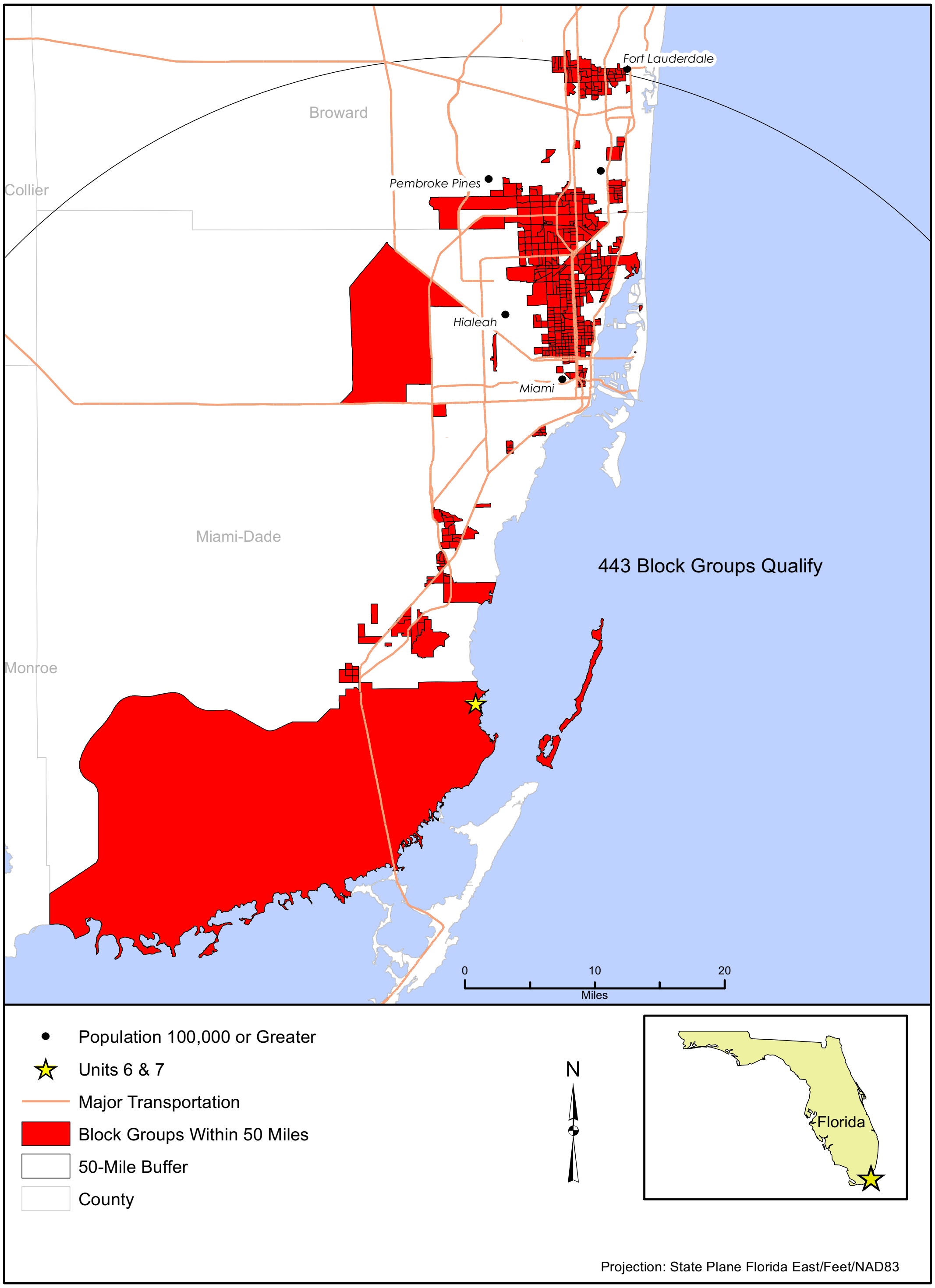


Figure 2.5-30 Significant Hispanic Ethnicity Minority Population

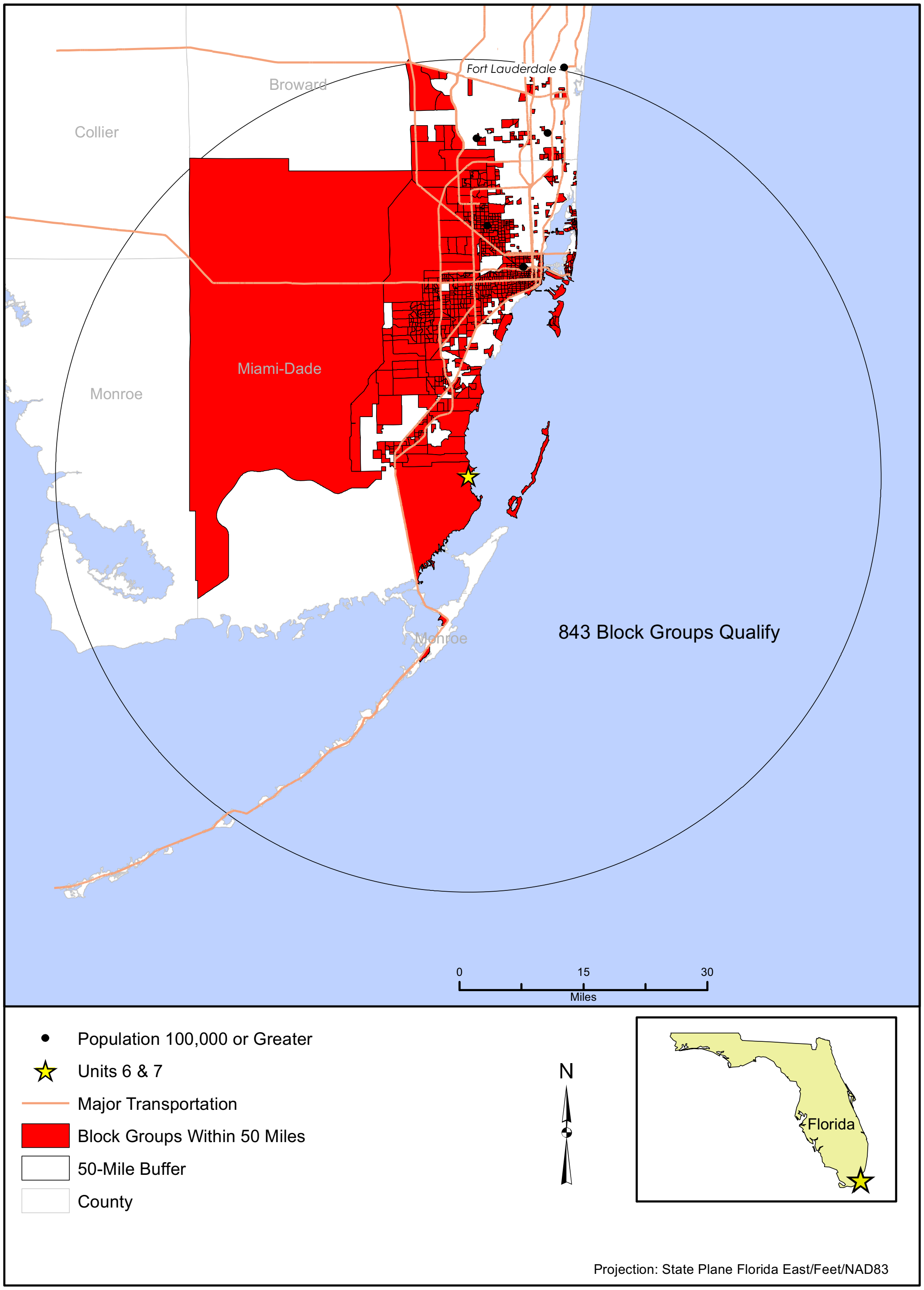
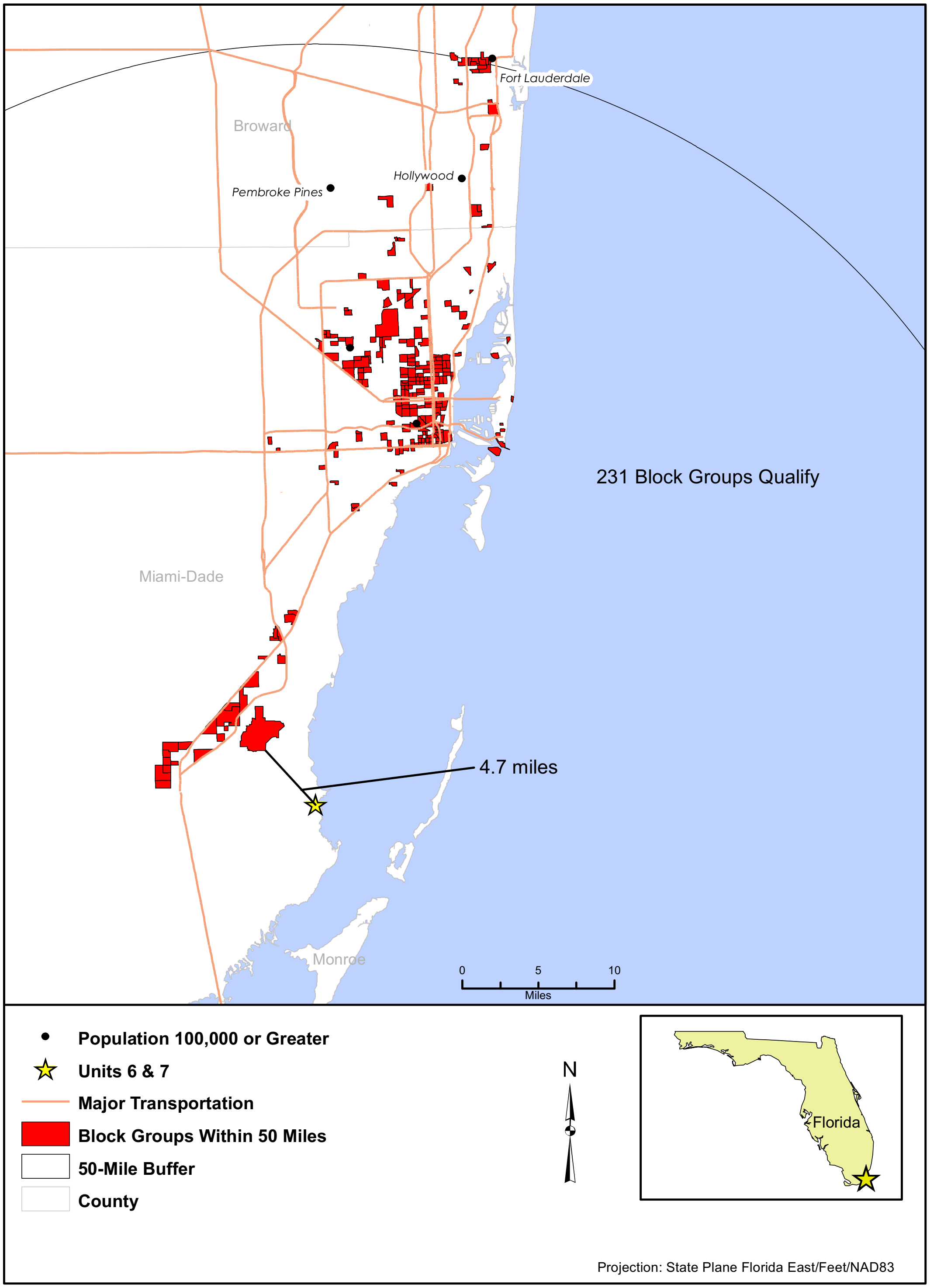


Figure 2.5-31 Significant Low Income Household Population



APPENDIX 2.5A

SHPO/NATIVE TRIBE CORRESPONDENCE

Florida Power & Light Company, P.O. Box 14000, Juno Beach, FL 33408-0420
Environmental Services Department

FPL

FLHR-09-0062

February 20, 2009

Ms. Laura Kammerer
Florida Department of State
Division of Historical Resources
RA Gray Building, 4th floor
500 S. Bronough St.
Tallahassee FL 32399-0250

SUBJECT: Florida Power & Light Company Turkey Point Units 6 & 7 Project, Miami Dade County, Florida

Dear Ms. Kammerer:

Florida Power & Light Company (FPL) is preparing permit and license applications to the U.S. Nuclear Regulatory Commission (NRC), the Florida Department of Environmental Protection (FDEP) and the United States Army Corps of Engineers (USACE) to allow construction and operation of two new nuclear units and associated project features at our existing Turkey Point property in Miami-Dade County, Florida (the "proposed action").

This project will require federal approval by the NRC and USACE. Therefore, consistent with Section 106 of the National Historic Preservation Act (NHPA) of 1966 (Public Law 89-665, as amended), as implemented by 36 CFR 800 (Protection of Historic Properties, effective January 2001), a cultural resource assessment is in progress. Moreover, this project is being conducted in accordance with F.A.C. Electrical Power Plant Siting Act and as prescribed by DEP Form 62-11.211(1), F.A.C. Accordingly, the cultural resource assessment will comply with Chapter 267, Florida Statutes (Florida Historical Resources Act), the minimum field methods, data analysis, and Chapter 1A-46 (Archaeological and Historical Report Standards and Guidelines), F.A.C.

Janus Research is assisting FPL with the cultural resource investigations and will be contacting your office on FPL's behalf to obtain required information as needed. A cultural resource assessment (CRA) survey of the proposed power plant site and facilities associated with the project is in progress. A copy of this report will be submitted with the Site Certification Application. A CRA survey of additional facilities associated with the proposed project (e.g., transmission lines) will be conducted once final routes and locations are selected. Field work in areas where FPL does not control the property may have to wait until the final right of way is secured. Copies of the CRA report for associated facilities will be forwarded to you office when completed and post SCA submittal.

The Turkey Point property is located in Miami-Dade County, Florida, adjacent to Biscayne Bay and Card Sound, about 25 miles south of Miami (Figure 1). The total, non-contiguous property area is approximately 11,000 acres. The developed portion of the property includes a natural gas fueled generating unit; two oil/gas-fired generating units, and two nuclear-powered generating units. This proposed action would further develop approximately 300 acres of the property west and south of these existing units, primarily within an existing cooling canal /industrial wastewater treatment facility. In addition, FPL will construct (1) pipelines to convey dual cooling water supplies (reclaimed and saltwater) to new cooling towers, (2) power transmission lines to connect the new units with the regional electric grid, and (3) a reclaimed water treatment facility to condition the reclaimed water for cooling water uses. In addition, because fill material is necessary for the unit foundations, FPL is proposing to place fill sourced from a commercial mine and/or nearby FPL-owned property approximately 4 miles northwest of the proposed site. These areas are shown in Figures 2 and 3. Figures 2A and 2B include the project features in the vicinity of the proposed plant area. Figure 3 also provides an expanded view of the area showing the proposed transmission corridor.

Please note that an Unanticipated Finds Plan will be in place prior to construction in the unlikely event that any cultural remains are encountered during construction. In the event that human remains, archeological or historical objects are found during construction or maintenance activities, all activity that might disturb the human remains will cease in accordance with the provisions of Chapter 872.05. In addition, if historical or archeological artifacts are discovered, notification will be made to the Florida Department of Environmental Protection Southeast District Office and Bureau of Historical Preservation, Division of Historical Resources Office.

Thank you for your attention to this request; I will follow up with you to confirm receipt and to address any questions or concerns you may have. Should you need to talk to me earlier, please reach me by telephone at 561-691-2808.

Sincerely,

Matthew J. Raffenberg
Manager, Environmental Licensing

FLORIDA DEPARTMENT OF STATE
Kurt S. Browning
Secretary of State
DIVISION OF HISTORICAL RESOURCES

Ms. Kathleen Hoffman
Janus Research
1300 North Westshore Blvd., Suite 100
Tampa, Florida 33607

July 10, 2009

Re: DHR Project File No.: 2009-3841 / Received by DHR: June 30, 2009
Cultural Resource Assessment Survey for the Turkey Point Units 6 & 7 Site, Associated Non-Linear Facilities, and Spoils Areas on Plant Property, Miami-Dade County, Florida

Dear Ms. Hoffman:

Our office received and reviewed the above referenced survey report in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, and 36 C.F.R., Part 800: Protection of Historic Properties for assessment of possible adverse impact to cultural resources (any prehistoric or historic district, site, building, structure, or object) listed, or eligible for listing, in the National Register of Historic Places (NRHP).

In October 2008, December 2008, March 2009, and April 2009, Janus Research conducted an archaeological and historical Phase I survey of the proposed Turkey Point Units 6 & 7 site, associated non-linear facilities, and spoils areas on plat property on behalf of the Florida Power & Light Company. Janus Research identified no cultural resources within the project area during the investigation.

Our office finds the submitted report complete and sufficient in accordance with Chapter 1A-46, *Florida Administrative Code.* Based on the information provided, it is the opinion of this office that the proposed development will have no effect on historic properties. However, we also concur with Janus Research that, prior to construction, an unanticipated finds plan should be developed to outline the procedures and identify personnel to be contacted if significant archaeological material or human remains are encountered during construction.

If you have any questions concerning our comments, please contact Samantha Earnest, Historic Preservationist, by electronic mail at *swearnest@dos.state.fl.us*, or by telephone at 850-245-6333 or 800-847-7278.

Sincerely,

Laura A. Kammerer

Laura A. Kammerer
Deputy State Historic Preservation Officer
For Review and Compliance

500 S. Bronough Street • Tallahassee, FL 32399-0250 • http://www.flheritage.com

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☐ **Archaeological Research**
(850) 245-6444 • FAX: 245-6452

☑ **Historic Preservation**
(850) 245-6333 • FAX: 245-6437

FLORIDA DEPARTMENT OF STATE
Kurt S. Browning
Secretary of State
DIVISION OF HISTORICAL RESOURCES

Mr. Matthew J. Raffenberg
Florida Power & Light Company
P.O. Box 14000
Juno Beach, Florida 33408-0420

July 13, 2009

Re: DHR Project File No.: 2009-3838 / Received by DHR: June 25, 2009
Cultural Resource Assessment Survey Work Plan for the Turkey Point Units 6 & 7 Site and Associated Non-Linear Facilities
Miami-Dade County, Florida

Dear Mr. Raffenberg:

Our office received and reviewed the above referenced work plan in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, and 36 C.F.R., Part 800: Protection of Historic Properties for assessment of possible adverse impact to cultural resources (any prehistoric or historic district, site, building, structure, or object) listed, or eligible for listing, in the National Register of Historic Places (NRHP).

In October 2008, December 2008, March 2009, and April 2009, Janus Research conducted an archaeological and historical Phase I survey of the proposed Turkey Point Units 6 & 7 site, associated non-linear facilities, and spoils areas on plat property on behalf of the Florida Power & Light Company. This survey was submitted to this office in June 2009 (DHR Project File No. 2009-3841). Janus Research identified no cultural resources within the project area during the investigation. As a result, the above referenced work plan included the following recommendations:

1. No further field investigations of the site or associated non-linear facilities are recommended.
2. A copy of the final survey results should be sent to the five federally recognized tribes with cultural affiliation to Florida.
3. Prior to construction, an unanticipated finds plan should be developed to outline the procedures and identify personnel to be contacted if significant archaeological material or human remains are encountered during construction.

Based on the information provided, our office concurs with these recommendations as outlined in the work plan.

500 S. Bronough Street • Tallahassee, FL 32399-0250 • http://www.flheritage.com

☐ Director's Office (850) 245-6300 • FAX: 245-6436
☐ Archaeological Research (850) 245-6444 • FAX: 245-6452
☑ Historic Preservation (850) 245-6333 • FAX: 245-6437

If you have any questions concerning our comments, please contact Samantha Earnest, Historic Preservationist, by electronic mail at *swearnest@dos.state.fl.us*, or by telephone at 850-245-6333 or 800-847-7278.

Sincerely,

Laura A. Kammerer

Laura A. Kammerer
Deputy State Historic Preservation Officer
For Review and Compliance

FLORIDA DEPARTMENT OF STATE
Kurt S. Browning
Secretary of State
DIVISION OF HISTORICAL RESOURCES

Mr. Matthew J. Raffenberg
Florida Power & Light Company
P.O. Box 14000
Juno Beach, Florida 33408-0420

July 13, 2009

Re: DHR Project File No.: 2009-3839 / Received by DHR: June 25, 2009
Cultural Resource Assessment Survey Work Plan for the Turkey Point Units 6 & 7 Associated Linear Facilities
Miami-Dade County, Florida

Dear Mr. Raffenberg:

Our office received and reviewed the above referenced work plan in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, and 36 C.F.R., Part 800: Protection of Historic Properties for assessment of possible adverse impact to cultural resources (any prehistoric or historic district, site, building, structure, or object) listed, or eligible for listing, in the National Register of Historic Places (NRHP).

In 2009, Janus Research conducted background research to identify previously recorded archaeological resources within 100 feet and historic cultural resources within 500 feet of the associated linear facilities, and to identify areas of high, medium, and low probability for the presence of unrecorded cultural resources. As a result of this analysis, Janus Research has made the following recommendations:

1. Archaeological and Historic Survey and Identification Plan for Access Roads and Bridges:

    a. Historic access roads and bridges will be surveyed prior to construction.
    b. No archaeological survey will be necessary for existing roads with no proposed widening.
    c. A visual survey of all roads will be conducted to identify areas of high archaeological probability within new roads or areas of road widening.
    d. A standard archaeological survey will be conducted of these high probability areas. Testing will be conducted at 25-meter intervals within the area of potential effect (APE).

2. Archaeological Survey and Identification Plan for the Transmission Line Corridors, Reclaimed Water Delivery Pipelines, and Potable Water Pipelines

    a. Surveys will be conducted prior to construction.
    b. The APE for the survey will be confined to the construction corridor and associated staging areas.

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c. The APE will be subjected to a visual survey to refine archaeological probability areas.
d. All previously recorded archaeological sites in the APE will be field verified and re-evaluated. Updated Florida Master Site File (FMSF) forms will be completed for each previously recorded site.
e. A reconnaissance level survey will be conducted for previously surveyed areas that do not meet current professional standards.
f. In areas that have not been previously surveyed, a standard archaeological survey will be conducted of high and moderate probability zones. Testing will be conducted at 25-meter and 50-meter intervals respectively, with judgmental testing of low probability zones. Shovel testing will be confined to the APE.

3. Historic Resource Survey and Identification Plan for the Transmission Line Corridors, Reclaimed Water Delivery Pipelines, and Potable Water Pipelines

   a. Surveys will be conducted prior to construction.
   b. A standard historic resource survey will be conducted to identify resources in areas that have not been previously surveyed. FMSF forms will be completed for newly identified resources.
   c. All previously recorded historic districts and individual resources in the APE will be field verified. Individual structures or buildings within the boundaries of a previously recorded historic district will not be field verified. Updated FMSF forms will be completed only if substantial changes have occurred since a resource's initial recording, including: demolition, change in National Register status, and change in original massing.
   d. The boundaries of both previously recorded and newly identified historic districts will be noted and recorded on FMSF forms. Individual buildings within the historic district will not be recorded.
   e. A reconnaissance level historic resource survey will be conducted of the APE for indirect impacts of the transmission line corridors. This APE will be determined in consultation with our office.

4. A copy of the final survey report should be sent to the five federally recognized tribes with cultural affiliation to Florida.

5. Due to the proximity of the project to Tribal lands associated with the Florida-resident Seminole Tribe of Florida and the Miccosukee Tribe of Indians of Florida, a meeting is recommended prior to the initiation of field investigations. The purpose of this meeting will be to review the project, address any comments resulting form the project notification letters previously sent to the Tribes, and to identify any cultural issues, sacred areas, or traditional use areas within the APE. Further coordination is recommended to resolve any potential concerns should any such issues be identified during the survey.

6. Prior to construction, an unanticipated finds plan should be developed to outline the procedures and identify personnel to be contacted if significant archaeological material or human remains are encountered during construction.

7. Section 106 consultation will be conducted with this office to identify and resolve any adverse effects to significant resource.

Based on the information provided, our office concurs with these recommendations as outlined in the work plan. We look forward to receipt of the final survey report for review and comment.

If you have any questions concerning our comments, please contact Samantha Earnest, Historic Preservationist, by electronic mail at *swearnest@dos.state.fl.us*, or by telephone at 850-245-6333 or 800-847-7278.

Sincerely,

Laura A. Kammerer

Laura A. Kammerer
Deputy State Historic Preservation Officer
For Review and Compliance

Florida Power & Light Company, P.O. Box 14000, Juno Beach, FL 33408-0420
Environmental Services Department

FPLMTI-09-0722

December 15, 2009

Mr. Steve Terry
Section 106 Coordinator
Miccosukee Tribe of Indians of Florida
PO Box Tamiami Station
Miami, Florida 33144

SUBJECT: Information Sharing Supporting Section 106 of the *National Historic Preservation Act* for the Proposed Turkey Point Units 6 & 7 On-Site Project Facilities, Florida

Florida Power and Light Company (FPL) has submitted a Combined Operating License (COL) Application to the Nuclear Regulatory Commission (NRC) to construct and operate nuclear power Unit 6 & 7 at the Turkey Point site, located east of Homestead, Florida. The Unit 6 & 7 project would provide clean, safe and reliable power to meet the needs of FPL's customers. As part of its COL Application, FPL included an environmental report to assist the NRC prepare an environmental impact statement (EIS) under the *National Environmental Policy Act*. The decision by the NRC on whether to issue the license for construction and operation of Units 6 & 7 meets the definition of an "undertaking" under the *National Historic Preservation Act* (NHPA) and its implementing regulations 36 CFR Part 800.16(y).

FPL has shared project information with the Florida Division of Historical Resources (DHR) and the Florida State Historic Preservation Officer for this proposed project. Specifically a final cultural resources assessment (CRA) report of on-site areas and associated non- linear facilities and a preliminary CRA report on the associated linear facilities were submitted to the DHR as part of FPL's Site Certification Application (SCA).

By recommendation from the DHR, FPL hereby offers to share project information with potentially interested Tribes to assist us in identifying important cultural resources that could be present in the vicinity of the proposed undertaking. Attached is the CRA report addressing the on-site areas and other non-linear associated facilities affected by the proposed undertaking. Linear facilities (namely access roads, transmissions lines, and water pipelines) are being permitted as corridors in the SCA process. Therefore, the CRA report for the project's linear facilities will be shared with you after placement of those facilities is finalized.

Description of the Proposed Project

The project would add two new nuclear generating units and supporting facilities at a site within the existing Turkey Point plant property boundaries. The Project includes the construction and operation of Turkey Point Unit 6 & 7 on the site as well as new transmission lines and other off-site associated linear and non-linear facilities.

FPL's Turkey Point plant property comprises approximately 11,000 acres in unincorporated southeast Miami-Dade County, Florida, east of Florida City and the City of Homestead, and bordered by Biscayne Bay to the east. The existing Turkey Point Plant consist of two nominal 400-megawatt (MW) natural gas/oil steam electric generating units (Units 1 & 2); two nominal 700-MW nuclear units (Units 3 & 4); and a nominal 1,150 MW natural gas-fired combined-cycle unit (Unit 5). The existing closed- loop cooling canals and industrial wastewater facility occupy approximately 5,900 acres. The location of the Turkey Point plant property is shown in Figure 1.

The site for Turkey Point Units 6 & 7 is south of Units 3 &4 and occupies approximately 300-acres within the industrial wastewater facility. Two nuclear generating units, each with an approximate electrical out put of 1,100 MWe (net), including supporting buildings, facilities and equipment will be located on the site, along with a laydown area. Proposed off-Site associated facilities include: nuclear administration building, training building and parking area; an FPL reclaimed water treatment facility and reclaimed water pipelines; radial collector wells and delivery pipelines; equipment barge unloading area; an FPL–owned fill source; transmission lines and system improvements within Miami-Dade County; access roads and bridges; and a potable water pipeline. The site and proposed off-site associated facilities are shown in Figures 2 to 5. Because the linear facilities are being permitted as corridors, the areas shown on these figures is actually larger than the areas that will be impacted by actual construction and operation of the linear facilities.

Information Sharing with the Florida Division of Historical Resources

On February 20, 2009, FPL notified the DHR that it was commencing a CRA of on-site areas and would be contacting the SHPO to obtain required information as needed. On June 25, 2009, FPL forwarded to DHR its CRA survey work plans for the on- and off-site project areas. In that submittal, FPL requested concurrence that (1) the determination and definition of the Areas of Potential Effect (APEs) are appropriate for the project and (2) implementation of the work plans would constitute a reasonable and good-faith effort to carry out appropriate identification efforts of historic properties that could potentially be impacted by the project. On July 13, 2009, the DHR concurred with all the recommendations provided by FPL in the on-and off-site CRA survey work plans. The DHR recommended that the final CRA survey results be sent to the five federally-recognized tribes with cultural affiliation to Florida.

On June 30, 2009, as part of the Site Certification Application, FPL submitted its final CRA report of on-site areas and associated non-linear facilities and the preliminary CRA report on the associated linear facilities to the DHR. On July 10, 2009, DHR found FPL's final CRA report of on-site areas and associated non-linear facilities complete and sufficient in accordance with Chapter 1A-46 F.A.C. The DHR offered its opinion that the project would have no effect on historic properties and recommended that the CRA report of on-site areas and associated non-linear facilities be sent to the five federally recognized tribes with cultural affiliation to Florida.

Information Sharing with Potentially Interested Tribes

The purpose of this letter is to share information with potentially interested Tribes in accordance with Section 106 of the NHPA and 36 CFR Part 800.2(c)(2)(ii). The NRC will conduct formal NHPA consultation with Tribes per Federal government-to-government guidance during the preparation of the environmental impact statement. However both the NRC and the DHR have encouraged FPL to share information with Tribes to identify tribal concerns for important cultural resources that could potentially be impacted by the proposed project. On March 20, 2009, FPL submitted a letter to the Miccosukee Tribe of Indians of Florida sharing initial project information.

FPL welcomes your input and comments on the proposed undertaking and the cultural properties of importance to you. FPL is requesting your review of this information so that you can identify concerns about cultural resources, present views about the proposed undertaking's potential effects on such properties, and participate in the resolution of adverse effects. FPL is particularly interested in any information you may have regarding resources, traditional cultural places, sites, or properties of tribal importance that may be adversely affected by the proposed project. This information will assist FPL in identifying important cultural resources in the project area. FPL requests a written response to this information review by January 29, 2010.

Mr. Matthew Raffenberg is FPL's environmental permitting lead and will be your contact for this information sharing request. Please reach Mr. Raffenberg at (561) 691-2808 or by email matthew.raffenberg@fpl.com if you have any questions about this information.

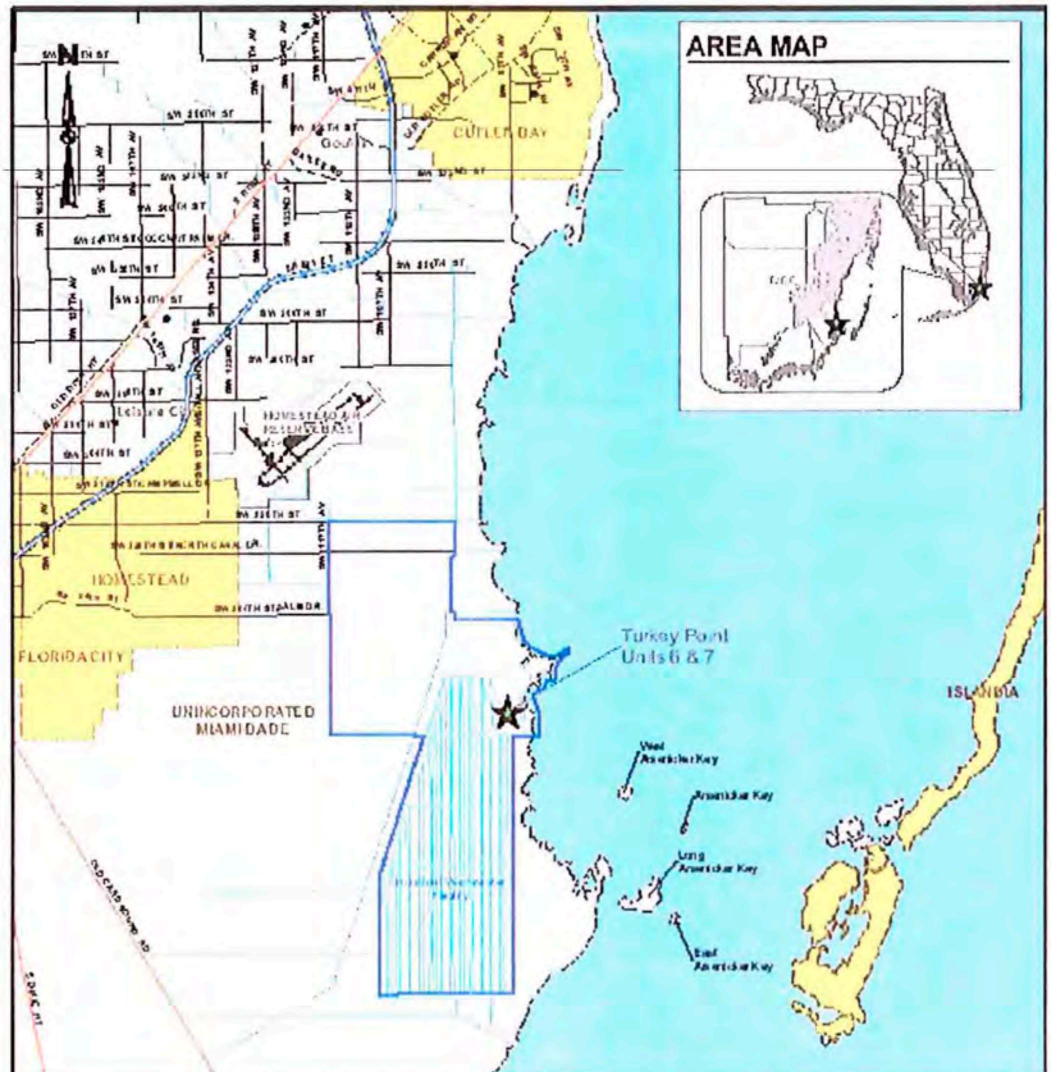
Sincerely,

Barbara F Linkiewicz

Barbara Linkiewicz

Director of Environmental Licensing

cc: Mike Halpin, FDEP Siting Office
Laura Kammerer, Florida Division of Historical Resources
Kathleen Hoffman, Janus Research



LEGEND

- Turkey Point Units 6 & 7
- Turkey Point Plant Property
- Municipal Boundaries

PROJECT: TURKEY POINT UNITS 6 & 7 PROJECT

TITLE: LOCATION OF TURKEY POINT PLANT

REFERENCES

1. Local City Boundaries, Municipal Boundaries, Major Roads, Miami-Dade County GIS, 2006

FPL

FIGURE 1

LEGEND

- Turkey Point Plant Property
- Turkey Point Units 6 & 7 Site
- Associated Non-Linear Facilities

REFERENCES

1. Imagery, Miami-Dade County, 2007.

TURKEY POINT UNITS 6 & 7 PROJECT

SITE AND ASSOCIATED NON-LINEAR FACILITIES ON TURKEY POINT PLANT PROPERTY

FPL

REV 0

FIGURE 2

LEGEND

Turkey Point Plant Property
Associated Non-Linear Facilities

REFERENCES

1. Imagery, Miami-Dade County, 2007.

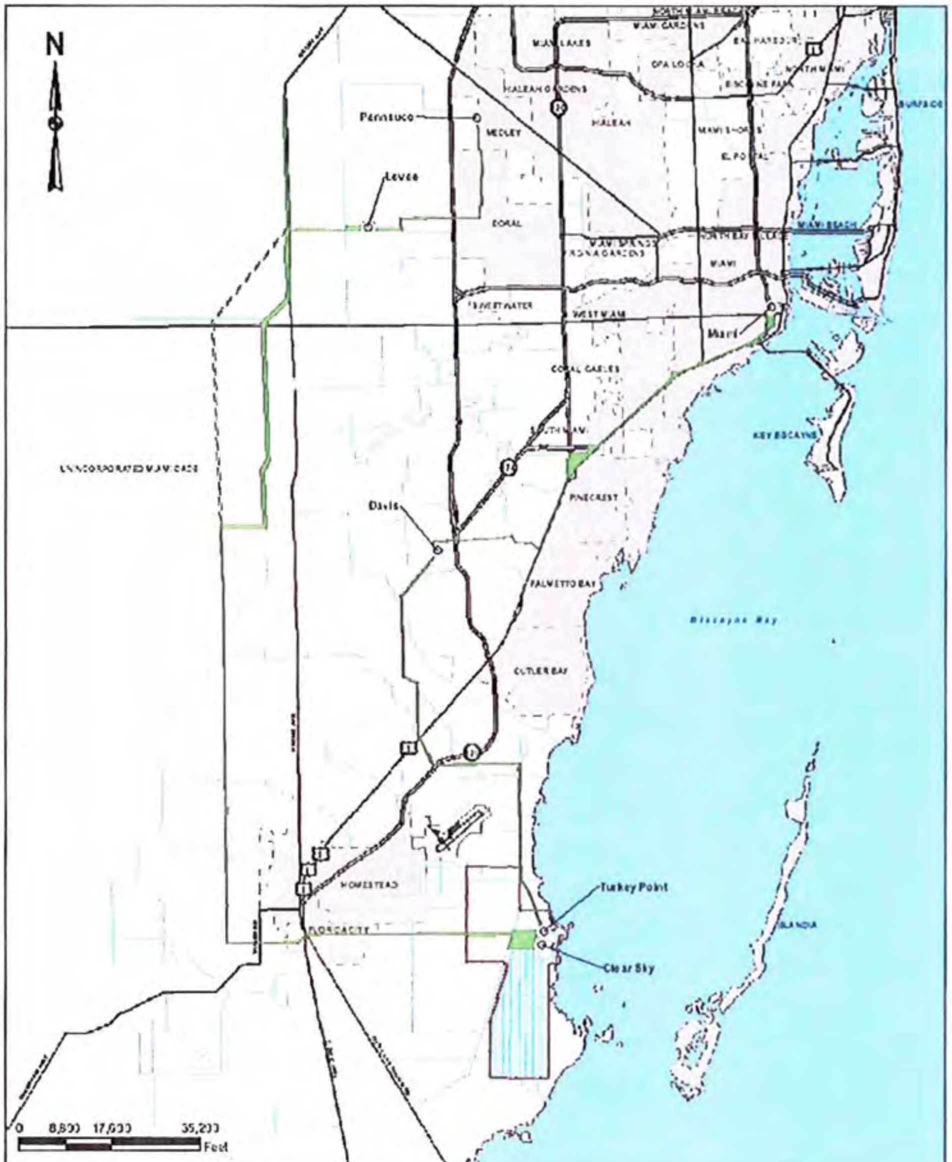
PROJECT
TURKEY POINT UNITS 6 & 7 PROJECT

TITLE
ASSOCIATED NON-LINEAR FACILITIES
FPL-OWNED FILL SOURCE

FPL

REV 0

FIGURE 3

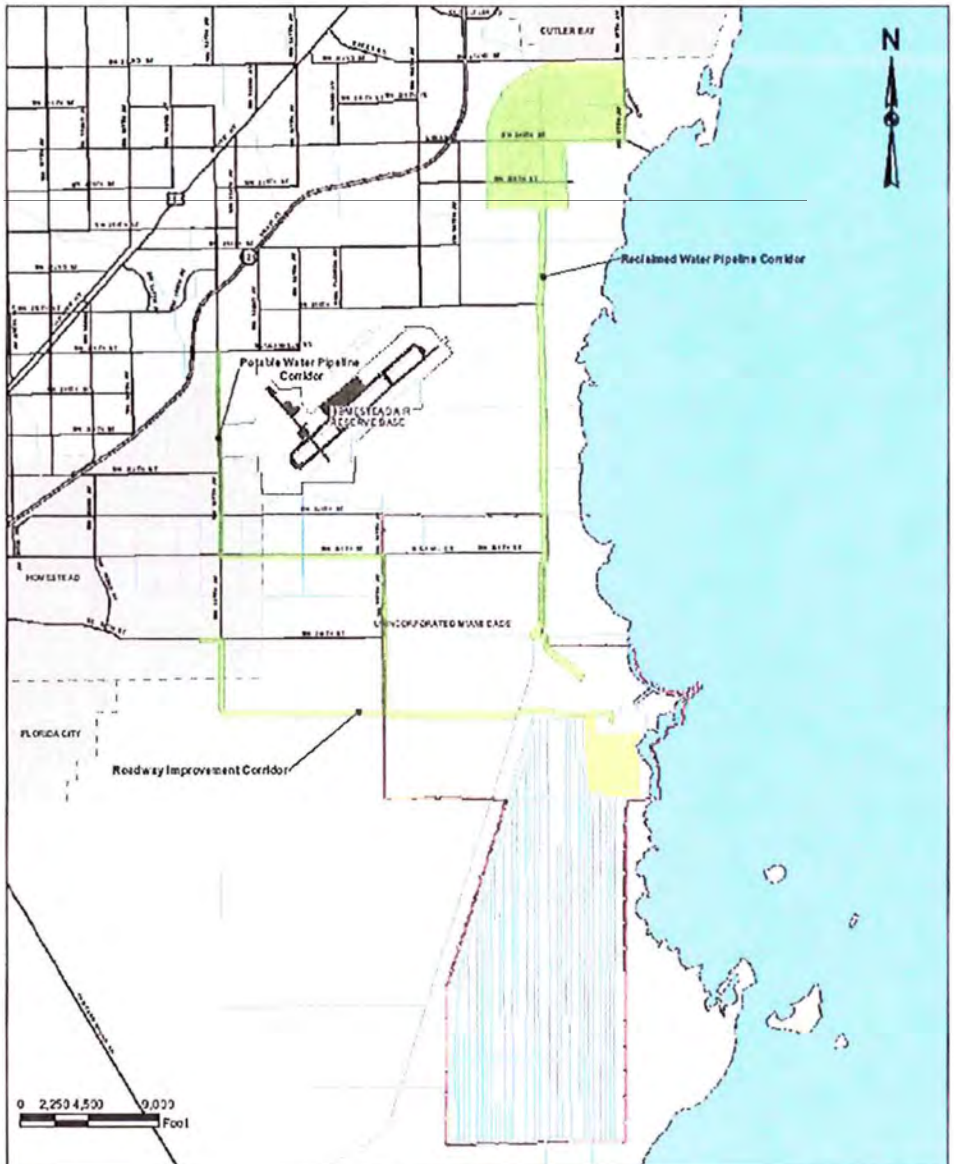


LEGEND

- O FPL Substations
- Associated Linear Facilities - Transmission Lines and Corridors
- Secondary Corridor
- Turkey Point Plant Property

REFERENCES

FIGURE 4	ASSOCIATED LINEAR FACILITIES TRANSMISSION	TURKEY POINT UNITS 6 & 7 PROJECT	FPL



LEGEND

- Turkey Point Units 6 & 7 Site
- Associated Linear Facilities - Corridors
- Turkey Point Plant Property

REFERENCES

FIGURE 5	ASSOCIATED LINEAR FACILITIES: RECLAIMED WATER PIPELINES, ROADWAY IMPROVEMENTS, & POTABLE WATER PIPELINES	TURKEY POINT UNITS 6 & 7 PROJECT

FPL

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Tampa Bay • Miami • Ft. Myers • Atlanta

Joyce Bear
Cultural Preservation Manager
Muscogee (Creek) Nation
P.O. Box 580
Okmulgee, OK 74447

JSRMNT-09-0718
December 16, 2009

SUBJECT: Information Sharing Supporting Section 106 of the *National Historic Preservation Act* for the Proposed Turkey Point Units 6 & 7 On-Site Project Facilities, Florida

Dear Mrs. Bear:

Florida Power and Light Company (FPL) has submitted a Combined Operating License (COL) Application to the Nuclear Regulatory Commission (NRC) to construct and operate nuclear power Unit 6 & 7 at the Turkey Point site, located east of Homestead, Florida. The Unit 6 & 7 project would provide clean, safe and reliable power to meet the needs of FPL's customers. As part of its COL Application, FPL included an environmental report to assist the NRC prepare an environmental impact statement (EIS) under the *National Environmental Policy Act*. The decision by the NRC on whether to issue the license for construction and operation of Units 6 & 7 meets the definition of an "undertaking" under the *National Historic Preservation Act* (NHPA) and its implementing regulations 36 CFR Part 800.16(y).

FPL has shared project information with the Florida Division of Historical Resources (DHR) and the Florida State Historic Preservation Officer for this proposed project. Specifically a final cultural resources assessment (CRA) report of on-site areas and associated non- linear facilities and a preliminary CRA report on the associated linear facilities were submitted to the DHR as part of FPL's Site Certification Application (SCA).

By recommendation from the DHR, FPL hereby offers to share project information with potentially interested Tribes to assist us in identifying important cultural resources that could be present in the vicinity of the proposed undertaking. Attached is the CRA report addressing the on-site areas and other non-linear associated facilities affected by the proposed undertaking. Linear facilities (namely access roads, transmissions lines, and water pipelines) are being permitted as corridors in the SCA process. Therefore, the CRA report for the project's linear facilities will be shared with you after placement of those facilities is finalized.

Description of the Proposed Project

The project would add two new nuclear generating units and supporting facilities at a site within the existing Turkey Point plant property boundaries. The Project includes the construction and operation of Turkey Point Unit 6 & 7 on the site as well as new transmission lines and other off-site associated linear and non-linear facilities.

FPL's Turkey Point plant property comprises approximately 11,000 acres in unincorporated southeast Miami-Dade County, Florida, east of Florida City and the City of Homestead, and bordered by Biscayne Bay to the east. The existing Turkey Point Plant consist of two nominal 400-megawatt (MW) natural gas/oil steam electric generating units (Units 1 & 2); two nominal 700-MW nuclear units (Units 3 & 4); and a nominal 1,150 MW natural gas-fired combined-cycle unit (Unit 5). The existing closed- loop cooling canals and industrial wastewater facility occupy approximately 5,900 acres. The location of the Turkey Point plant property is shown in Figure 1.

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Information Sharing with the Florida Division of Historical Resources

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On June 30, 2009, as part of the Site Certification Application, FPL submitted its final CRA report of on-site areas and associated non-linear facilities and the preliminary CRA report on the associated linear facilities to the DHR. On July 10, 2009, DHR found FPL's final CRA

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Information Sharing with Potentially Interested Tribes

The purpose of this letter is to share information with potentially interested Tribes in accordance with Section 106 of the NHPA and 36 CFR Part 800.2(c)(2)(ii). The NRC will conduct formal NHPA consultation with Tribes per Federal government-to-government guidance during the preparation of the environmental impact statement. However both the NRC and the DHR have encouraged FPL to share information with Tribes to identify tribal concerns for important cultural resources that could potentially be impacted by the proposed project. On March 20, 2009, Janus Research, on behalf of FPL, submitted a letter to the Muscogee (Creek) Nation sharing initial project information.

FPL welcomes your input and comments on the proposed undertaking and the cultural properties of importance to you. FPL is requesting your review of this information so that you can identify concerns about cultural resources, present views about the proposed undertaking's potential effects on such properties, and participate in the resolution of adverse effects. FPL is particularly interested in any information you may have regarding resources, traditional cultural places, sites, or properties of tribal importance that may be adversely affected by the proposed project. This information will assist FPL in identifying important cultural resources in the project area. FPL requests a written response to this information review by January 29, 2010.

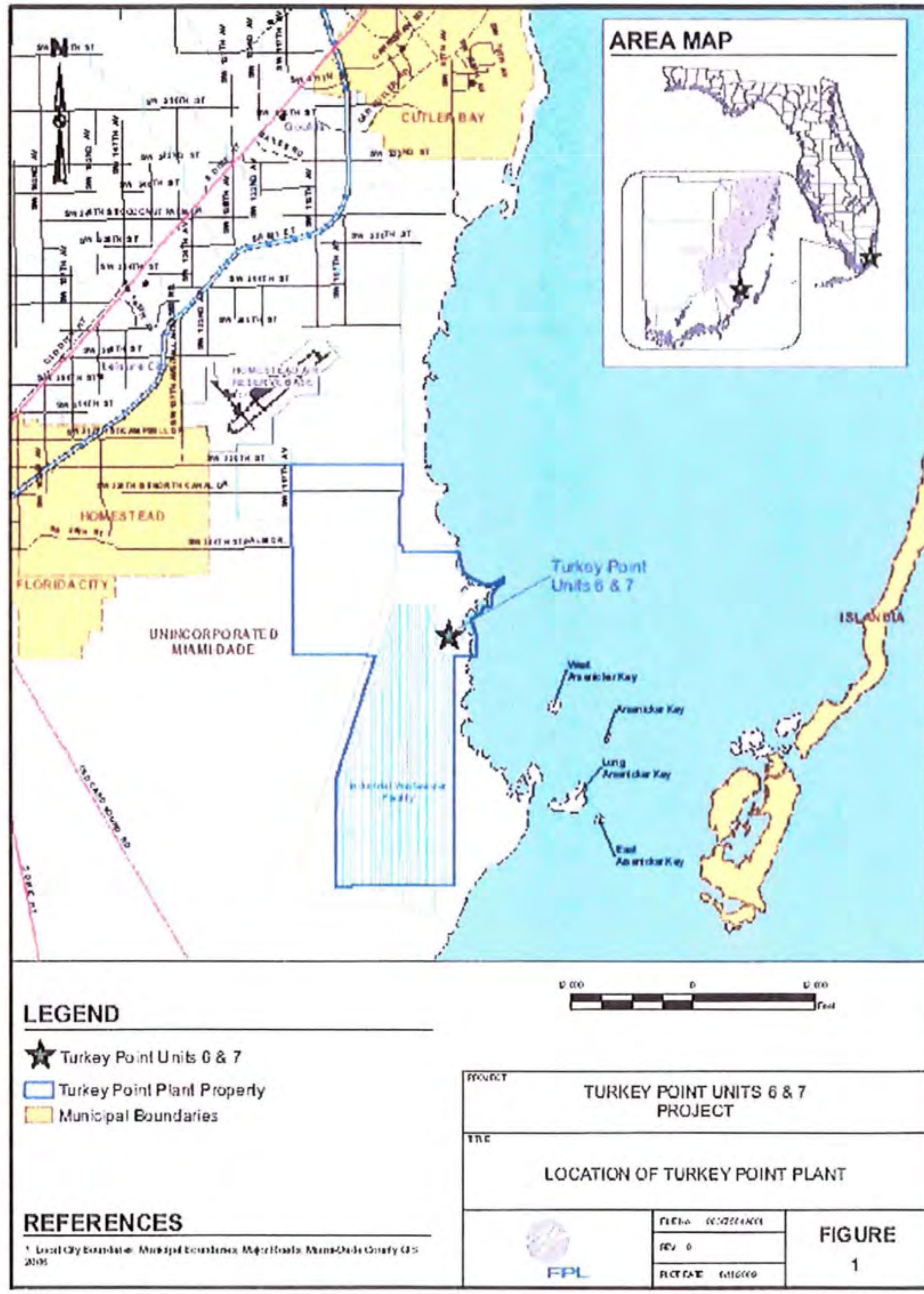
Mr. Matthew Raffenberg is FPL's environmental permitting lead and will be your contact for this information sharing request. Please reach Mr. Raffenberg at (561) 691-2808 or by email matthew.raffenberg@fpl.com if you have any questions about this information.

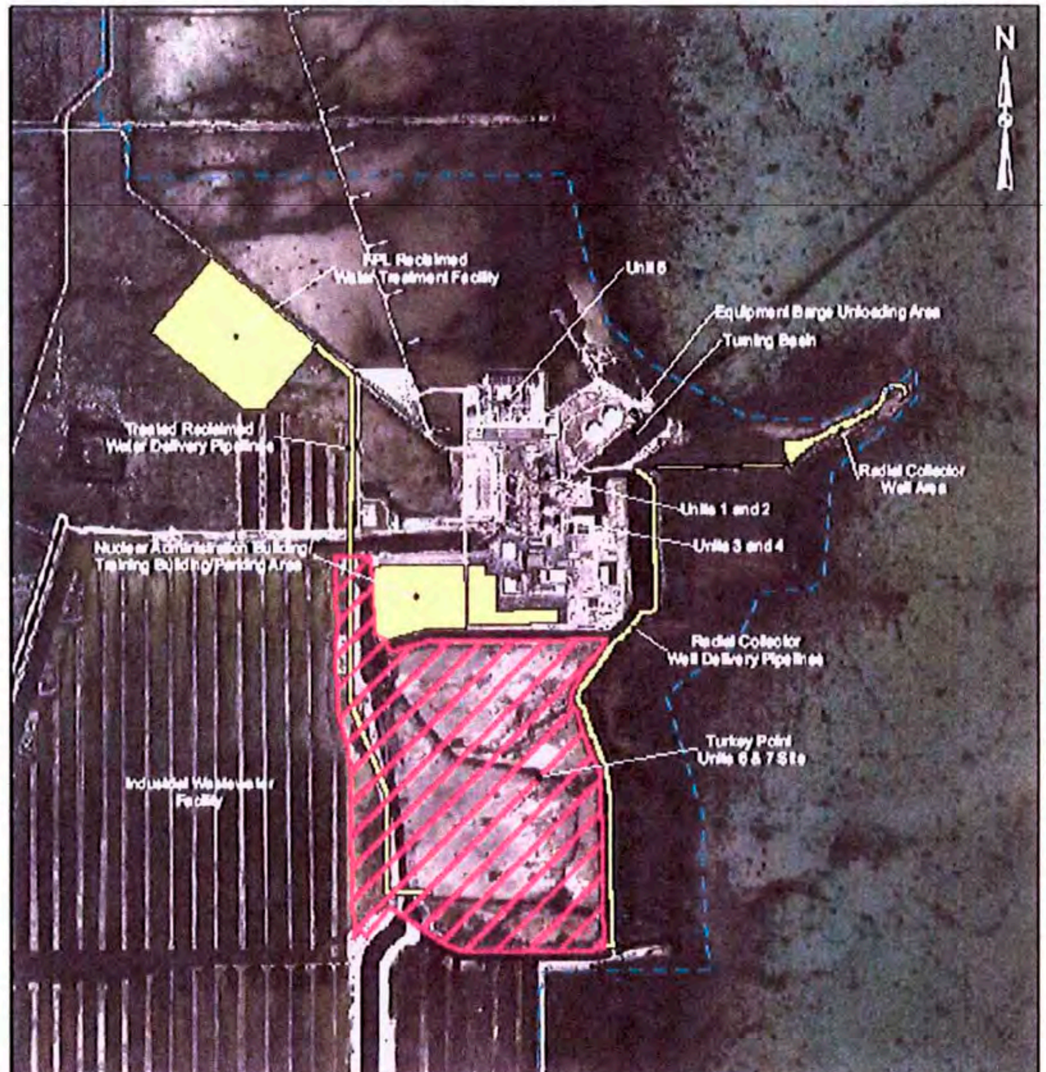
Sincerely,

Kathleen S. Hoffman, Ph.D.

Vice-President

cc: Mike Halpin, FDEP Siting Office
Laura Kammerer, Florida Division of Historical Resources
Matthew Raffenberg, FPL


AREA MAP
CUTLER BAY
HOMESTEAD
FLORIDA CITY
UNINCORPORATED MIAMI DADE
Turkey Point Units 6 & 7
ISLANDIA
LEGEND
Turkey Point Units 6 & 7
Turkey Point Plant Property
Municipal Boundaries
REFERENCES
PROJECT
TURKEY POINT UNITS 6 & 7 PROJECT
TITLE
LOCATION OF TURKEY POINT PLANT
FPL
FIGURE
1



LEGEND

- Turkey Point Plant Property
- Turkey Point Units 6 & 7 Site
- Associated Non-Linear Facilities

REFERENCES

1. Imagery Miami-Dade County 2007

PROJECT: TURKEY POINT UNITS 6 & 7 PROJECT

TITLE: SITE AND ASSOCIATED NON-LINEAR FACILITIES ON TURKEY POINT PLANT PROPERTY

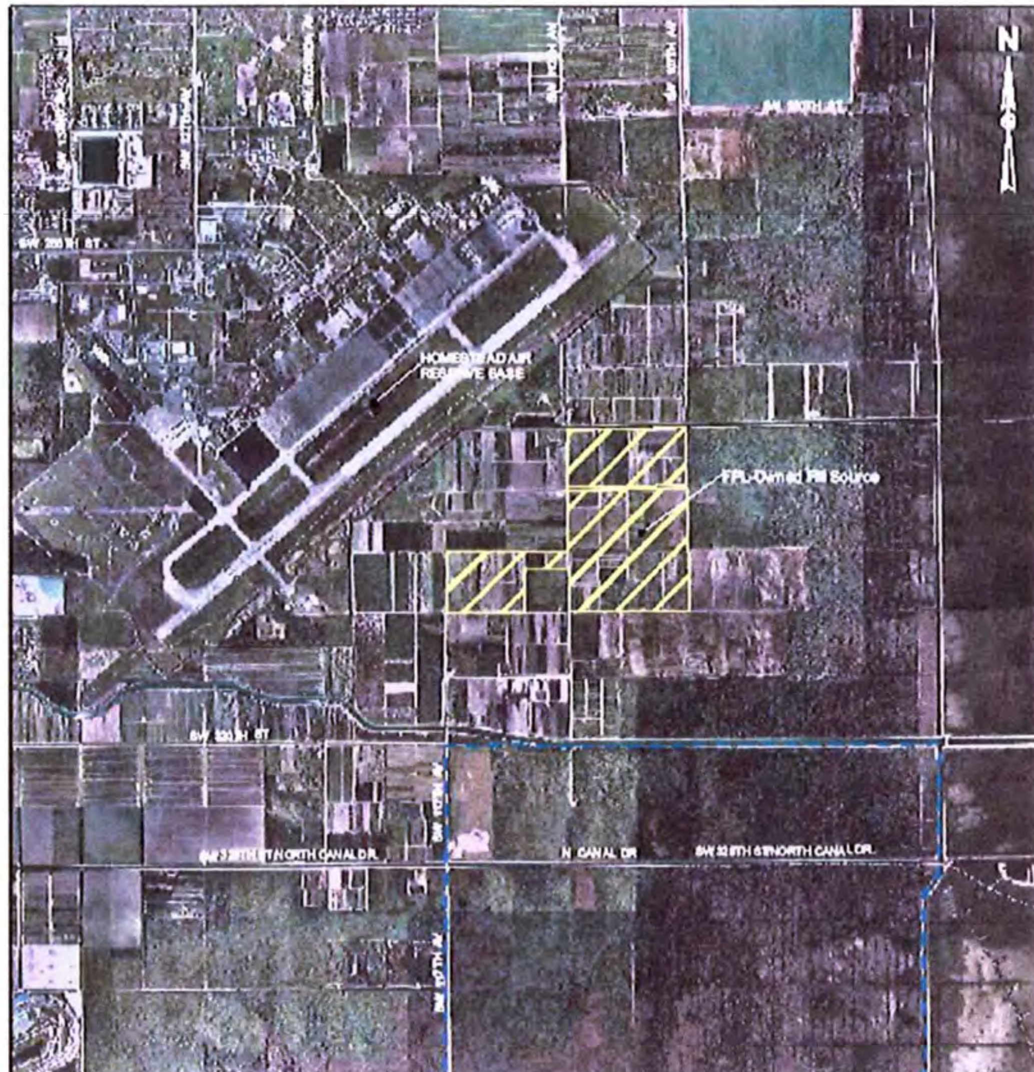
FPL

FILE No.

REV. 0

PLOT DATE

FIGURE 2



LEGEND

Turkey Point Plant Property
Associated Non-Linear Facilities

REFERENCES

Imagery: Miami-Dade County 2007

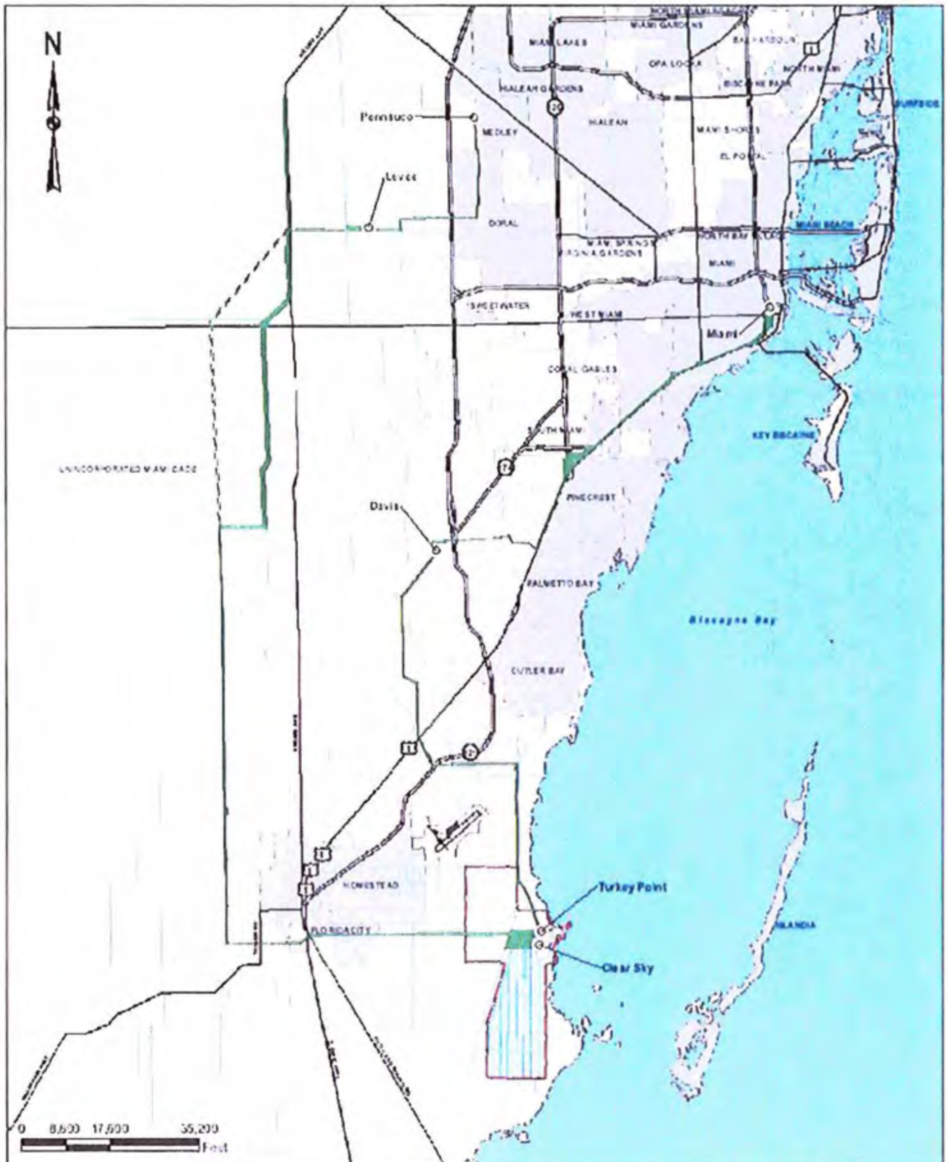
PROJECT: TURKEY POINT UNITS 6 & 7 PROJECT

TITLE: ASSOCIATED NON-LINEAR FACILITIES FPL-OWNED FILL SOURCE

FPL

REV 0

FIGURE 3



LEGEND

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- Associated Linear Facilities - Transmission Lines and Corridors
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REFERENCES

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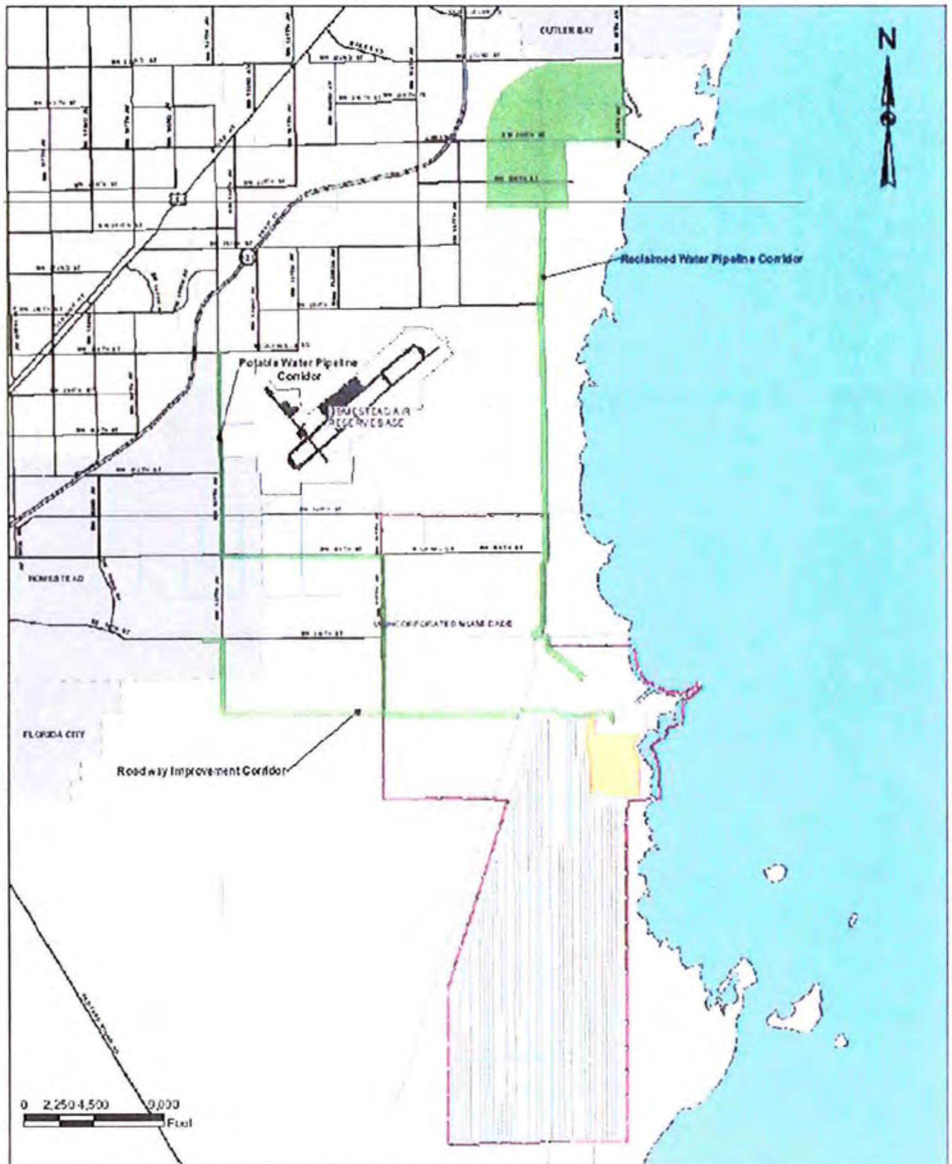
FPL



LEGEND

- Turkey Point Units 6 & 7 Site
- Associated Linear Facilities - Corridors
- Turkey Point Plant Property

REFERENCES

FIGURE 5	TITLE: ASSOCIATED LINEAR FACILITIES: RECLAIMED WATER PIPELINES, ROADWAY IMPROVEMENTS, & POTABLE WATER PIPELINES	PROJECT: TURKEY POINT UNITS 6 & 7 PROJECT	FPL

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W.S. Steele
Tribal Historic Preservation Officer
Seminole Tribe of Florida
Tribal Historic Preservation Office
HC 61, Box 21-A
Clewiston, FL 33440

JSRSTF-09-0721
December 16, 2009

SUBJECT: Information Sharing Supporting Section 106 of the *National Historic Preservation Act* for the Proposed Turkey Point Units 6 & 7 On-Site Project Facilities, Florida

Dear Mr. Steele:

Florida Power and Light Company (FPL) has submitted a Combined Operating License (COL) Application to the Nuclear Regulatory Commission (NRC) to construct and operate nuclear power Unit 6 & 7 at the Turkey Point site, located east of Homestead, Florida. The Unit 6 & 7 project would provide clean, safe and reliable power to meet the needs of FPL's customers. As part of its COL Application, FPL included an environmental report to assist the NRC prepare an environmental impact statement (EIS) under the *National Environmental Policy Act*. The decision by the NRC on whether to issue the license for construction and operation of Units 6 & 7 meets the definition of an "undertaking" under the *National Historic Preservation Act* (NHPA) and its implementing regulations 36 CFR Part 800.16(y).

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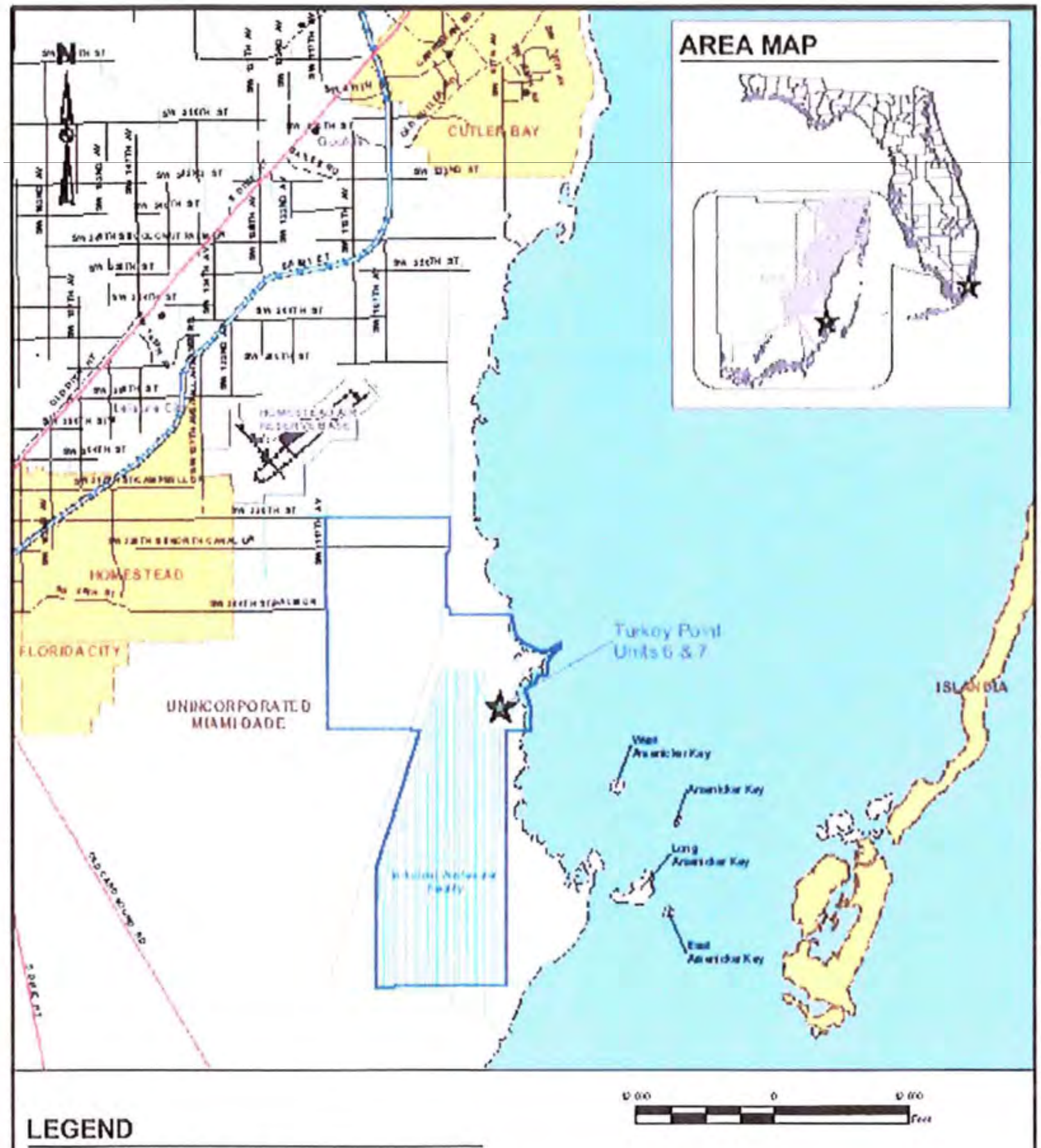
Sincerely,

Kathleen S. Hoffman, Ph.D.

Vice-President

cc: Mike Halpin, FDEP Siting Office
Laura Kammerer, Florida Division of Historical Resources
Matthew Raffenberg, FPL



LEGEND

Turkey Point Units 6 & 7

Turkey Point Plant Property

Municipal Boundaries

REFERENCES

1. Local City Boundaries, Municipal Boundaries, Major Roads: Miami-Dade County GIS 2008

PROJECT

TURKEY POINT UNITS 6 & 7
PROJECT

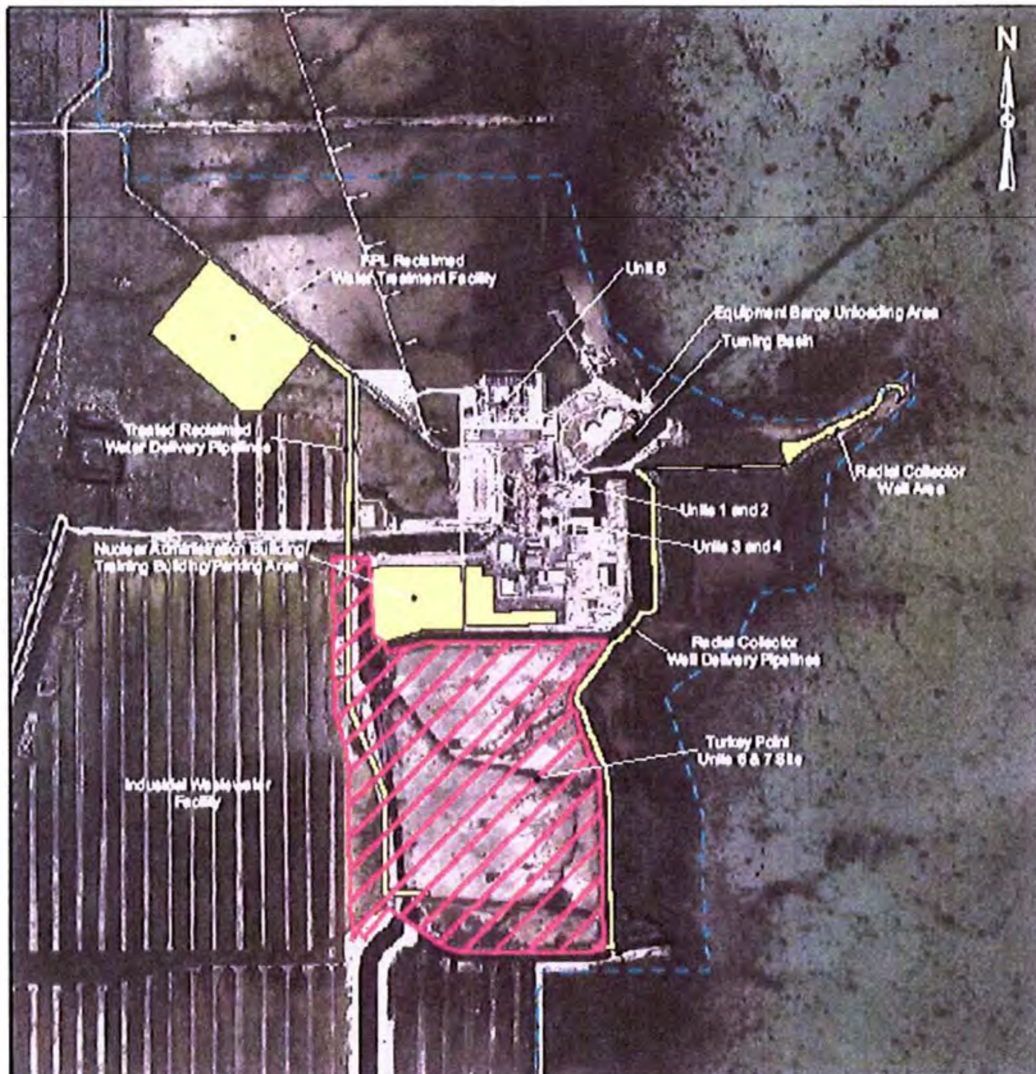
TITLE

LOCATION OF TURKEY POINT PLANT

FPL

REV 0

FIGURE
1



1750 0 1750 Feet

LEGEND

- Turkey Point Plant Property
- Turkey Point Units 6 & 7 Site
- Associated Non-Linear Facilities

REFERENCES

1. Imagery: Miami-Dade County 2007

PROJECT	TURKEY POINT UNITS 6 & 7 PROJECT
TITLE	SITE AND ASSOCIATED NON-LINEAR FACILITIES ON TURKEY POINT PLANT PROPERTY

FPL	FILE No. [illegible]	FIGURE 2
	REV 0	
	PLOT DATE [illegible]	

LEGEND

Turkey Point Plant Property

Associated Non-Linear Facilities

REFERENCES

* Imagery: Miami-Dade County 2007

PROJECT

TURKEY POINT UNITS 6 & 7 PROJECT

TITLE

ASSOCIATED NON-LINEAR FACILITIES
FPL-OWNED FILL SOURCE

FPL

REV. 0

FIGURE 3

LEGEND

- FPL Substations
- Associated Linear Facilities - Transmission Lines and Corridors
- Secondary Corridor
- Turkey Point Plant Property

REFERENCES

FIGURE 4	ASSOCIATED LINEAR FACILITIES TRANSMISSION	TURKEY POINT UNITS 6 & 7 PROJECT	FPL

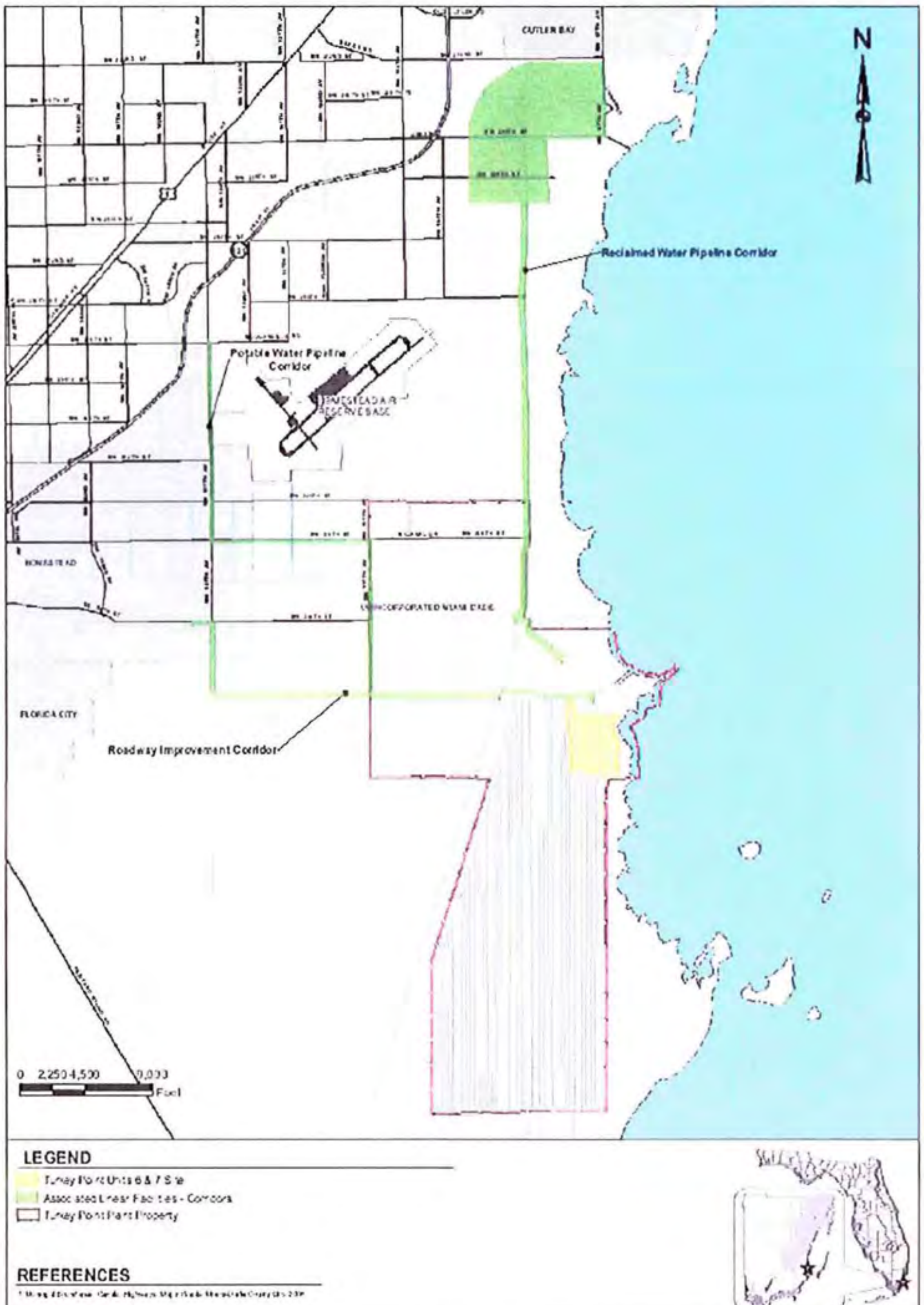


FIGURE 5

ASSOCIATED LINEAR FACILITIES: RECLAIMED WATER PIPELINES, ROADWAY IMPROVEMENTS, & POTABLE WATER PIPELINES

TURKEY POINT UNITS 6 & 7 PROJECT

FPL

JANUS MAIN OFFICE
1107 N. Ward Street
Tampa, FL 33607

JANUS RESEARCH
— EST. 1979 —

Tel. 813.636.8200
Fax 813.636.8212
janus@janus-research.com

Tampa Bay • Miami • Ft. Myers • Atlanta

Robert Thrower
Tribal Historic Preservation Officer
Poarch Band of Creek Indians
5811 Jack Springs Road
Atmore, AL 36502

JSRPBC-09-0719
December 16, 2009

SUBJECT: Information Sharing Supporting Section 106 of the *National Historic Preservation Act* for the Proposed Turkey Point Units 6 & 7 On-Site Project Facilities, Florida

Dear Mr. Thrower:

Florida Power and Light Company (FPL) has submitted a Combined Operating License (COL) Application to the Nuclear Regulatory Commission (NRC) to construct and operate nuclear power Unit 6 & 7 at the Turkey Point site, located east of Homestead, Florida. The Unit 6 & 7 project would provide clean, safe and reliable power to meet the needs of FPL's customers. As part of its COL Application, FPL included an environmental report to assist the NRC prepare an environmental impact statement (EIS) under the *National Environmental Policy Act*. The decision by the NRC on whether to issue the license for construction and operation of Units 6 & 7 meets the definition of an "undertaking" under the *National Historic Preservation Act* (NHPA) and its implementing regulations 36 CFR Part 800.16(y).

FPL has shared project information with the Florida Division of Historical Resources (DHR) and the Florida State Historic Preservation Officer for this proposed project. Specifically a final cultural resources assessment (CRA) report of on-site areas and associated non- linear facilities and a preliminary CRA report on the associated linear facilities were submitted to the DHR as part of FPL's Site Certification Application (SCA).

By recommendation from the DHR, FPL hereby offers to share project information with potentially interested Tribes to assist us in identifying important cultural resources that could be present in the vicinity of the proposed undertaking. Attached is the CRA report addressing the on-site areas and other non-linear associated facilities affected by the proposed undertaking. Linear facilities (namely access roads, transmissions lines, and water pipelines) are being permitted as corridors in the SCA process. Therefore, the CRA report for the project's linear facilities will be shared with you after placement of those facilities is finalized.

Description of the Proposed Project

The project would add two new nuclear generating units and supporting facilities at a site within the existing Turkey Point plant property boundaries. The Project includes the construction and operation of Turkey Point Unit 6 & 7 on the site as well as new transmission lines and other off-site associated linear and non-linear facilities.

FPL's Turkey Point plant property comprises approximately 11,000 acres in unincorporated southeast Miami-Dade County, Florida, east of Florida City and the City of Homestead, and bordered by Biscayne Bay to the east. The existing Turkey Point Plant consist of two nominal 400-megawatt (MW) natural gas/oil steam electric generating units (Units 1 & 2); two nominal 700-MW nuclear units (Units 3 & 4); and a nominal 1,150 MW natural gas-fired combined-cycle unit (Unit 5). The existing closed- loop cooling canals and industrial wastewater facility occupy approximately 5,900 acres. The location of the Turkey Point plant property is shown in Figure 1.

The site for Turkey Point Units 6 & 7 is south of Units 3 &4 and occupies approximately 300-acres within the industrial wastewater facility. Two nuclear generating units, each with an approximate electrical out put of 1,100 MWe (net), including supporting buildings, facilities and equipment will be located on the site, along with a laydown area. Proposed off-Site associated facilities include: nuclear administration building, training building and parking area; an FPL reclaimed water treatment facility and reclaimed water pipelines; radial collector wells and delivery pipelines; equipment barge unloading area; an FPL–owned fill source; transmission lines and system improvements within Miami-Dade County; access roads and bridges; and a potable water pipeline. The site and proposed off-site associated facilities are shown in Figures 2 to 5. Because the linear facilities are being permitted as corridors, the areas shown on these figures is actually larger than the areas that will be impacted by actual construction and operation of the linear facilities.

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Vice-President

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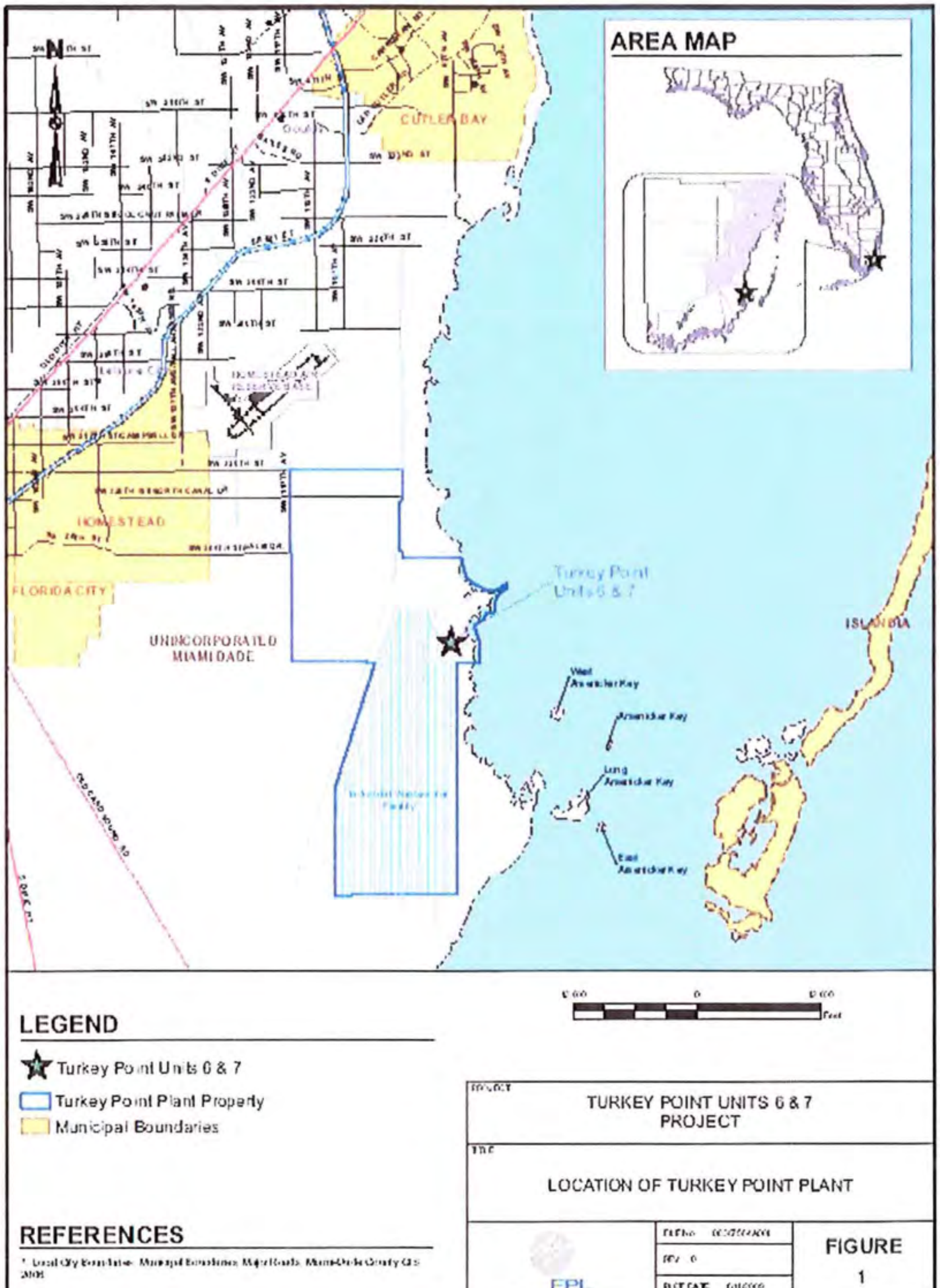
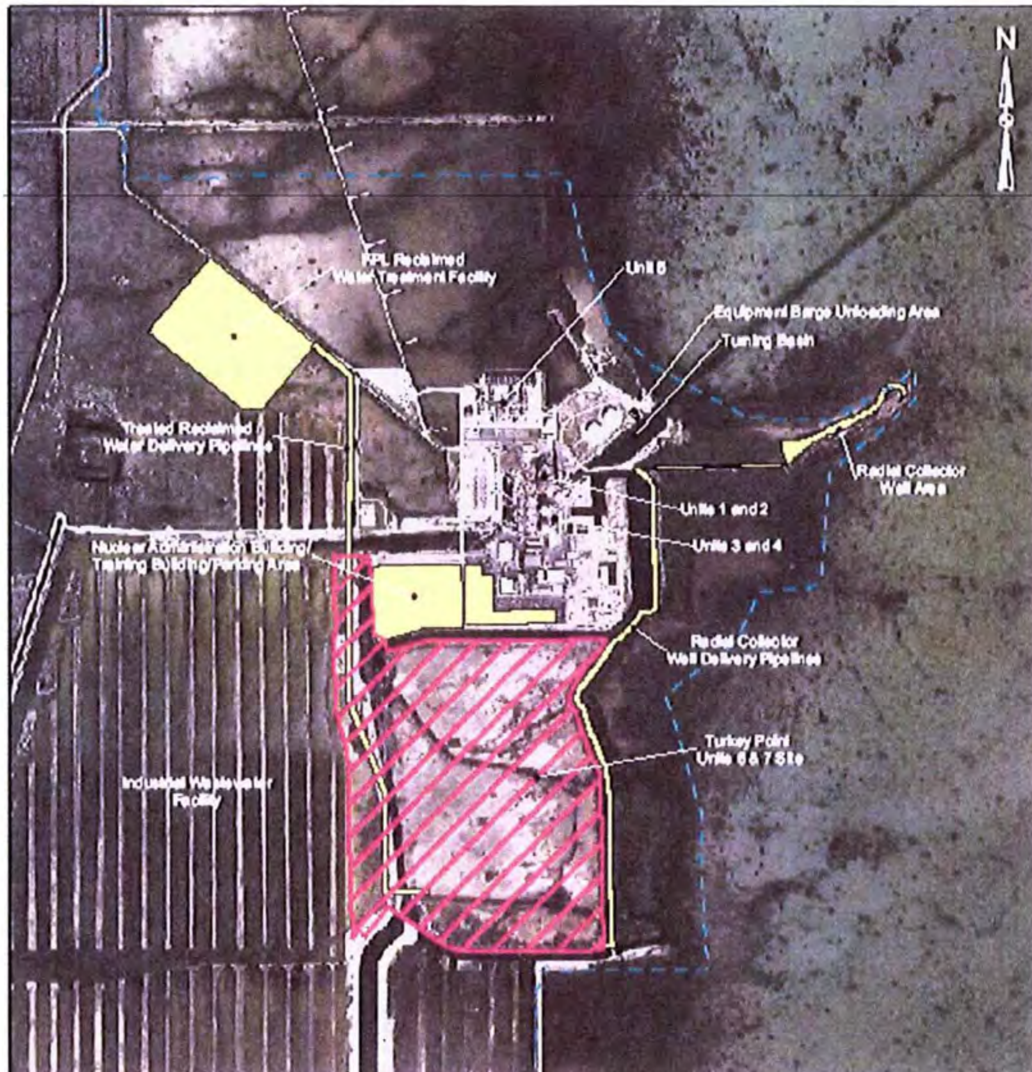

AREA MAP
CUTLER BAY
HOMESTEAD
FLORIDA CITY
UNINCORPORATED MIAMI DADE
Turkey Point Units 6 & 7
ISLANDIA
West Arsenicker Key
Arsenicker Key
Long Arsenicker Key
East Arsenicker Key
LEGEND
Turkey Point Units 6 & 7
Turkey Point Plant Property
Municipal Boundaries
REFERENCES
TURKEY POINT UNITS 6 & 7 PROJECT
LOCATION OF TURKEY POINT PLANT
FPL
FIGURE
1



LEGEND

- Turkey Point Plant Property
- Turkey Point Units 6 & 7 Site
- Associated Non-Linear Facilities

REFERENCES

* Imagery Miami-Dade County 2007

PROJECT

TURKEY POINT UNITS 6 & 7 PROJECT

TITLE

SITE AND ASSOCIATED NON-LINEAR FACILITIES ON TURKEY POINT PLANT PROPERTY

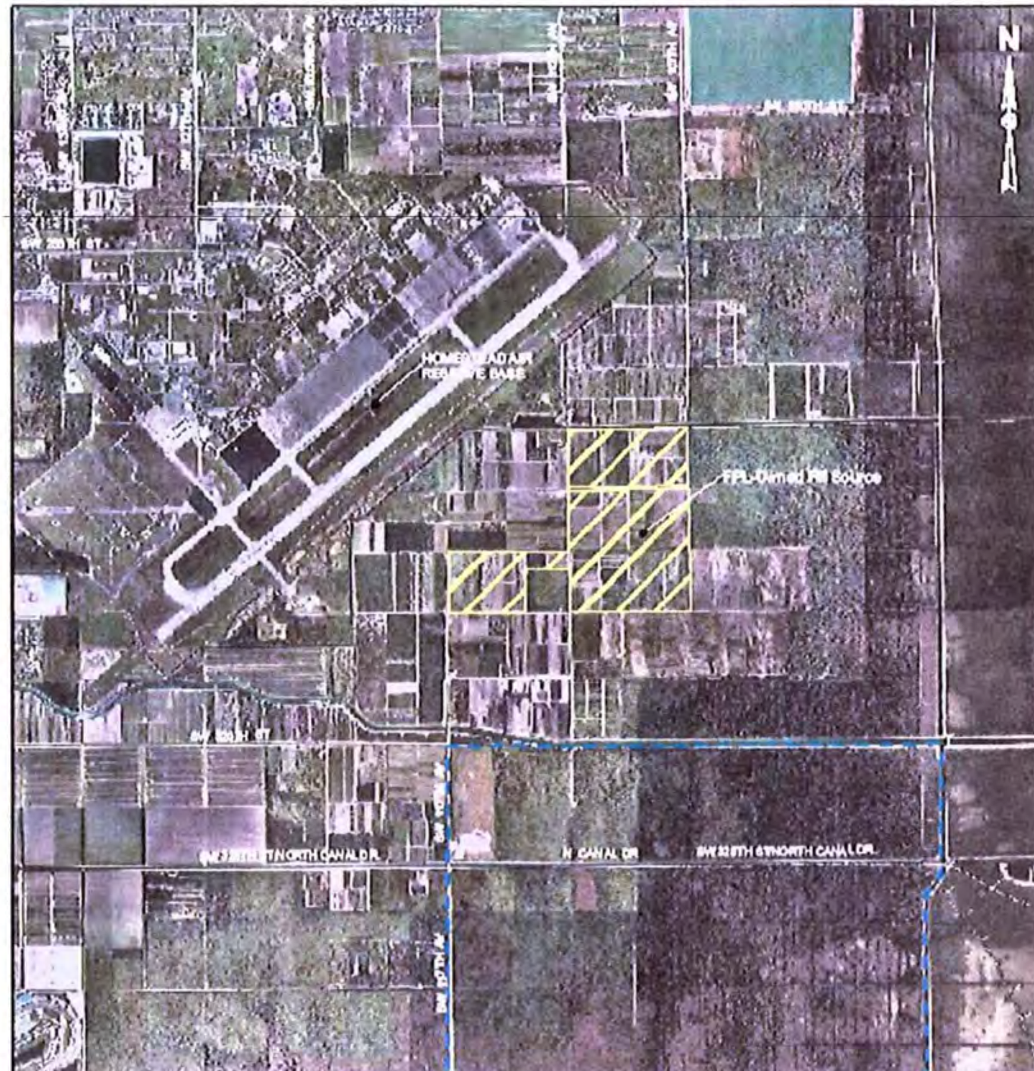
FPL

FILE No.

REV 0

PLOT DATE

FIGURE 2



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Turkey Point Plant Property

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PROJECT

TURKEY POINT UNITS 6 & 7
PROJECT

TITLE

ASSOCIATED NON-LINEAR FACILITIES
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FPL

REV 0

FIGURE
3

LEGEND

- O FPL Substations
- Associated Linear Facilities - Transmission Lines and Corridors
- Secondary Corridor
- Turkey Point Plant Property

REFERENCES

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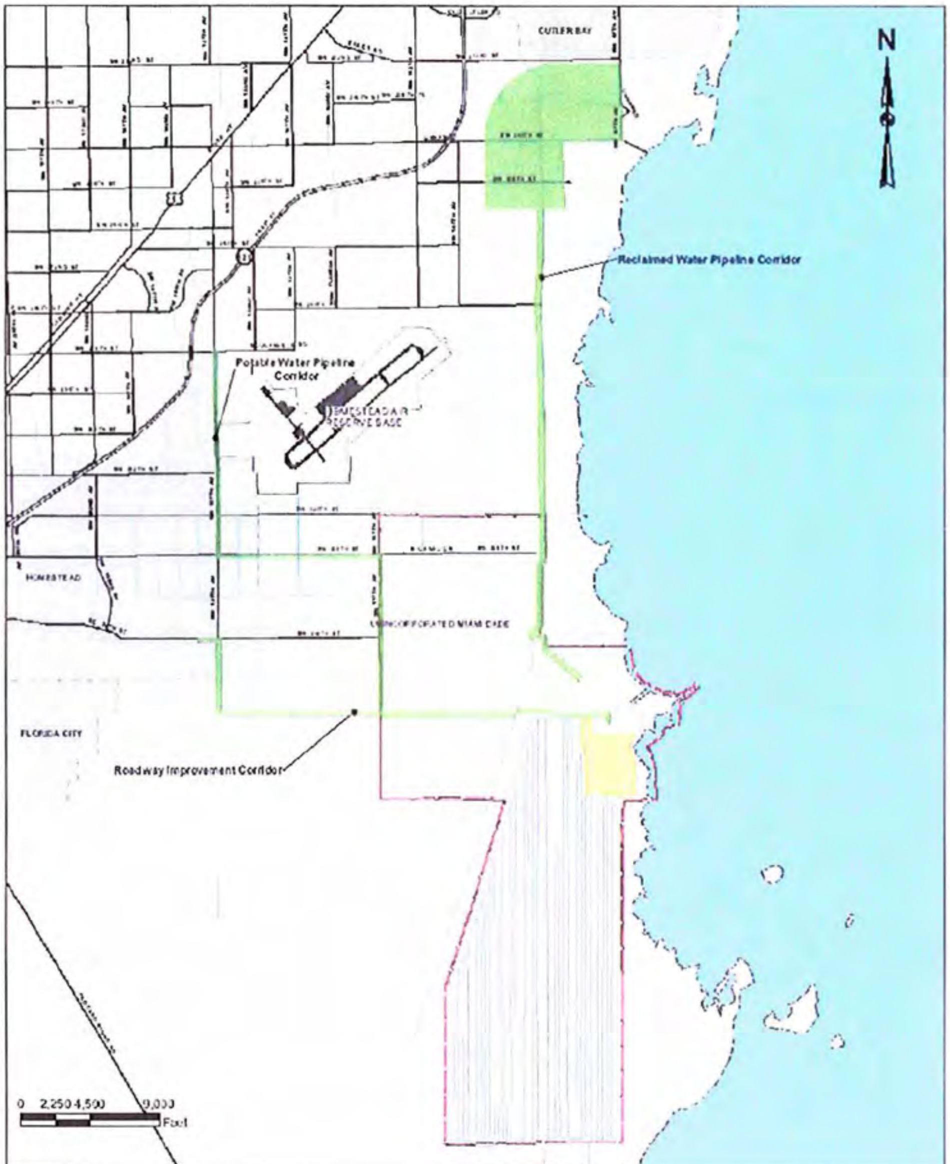

LEGEND

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- Turkey Point Plant Property

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Tampa Bay • Miami • Ft. Myers • Atlanta

Natalie Deere
Tribal Historic Preservation Officer
Seminole Nation of Oklahoma
P.O. Box 1498
Wewoka, OK 74884

JSRSNO-09-0720
December 16, 2009

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Kathl. S. Hoffman

Kathleen S. Hoffman, Ph.D.

Vice-President

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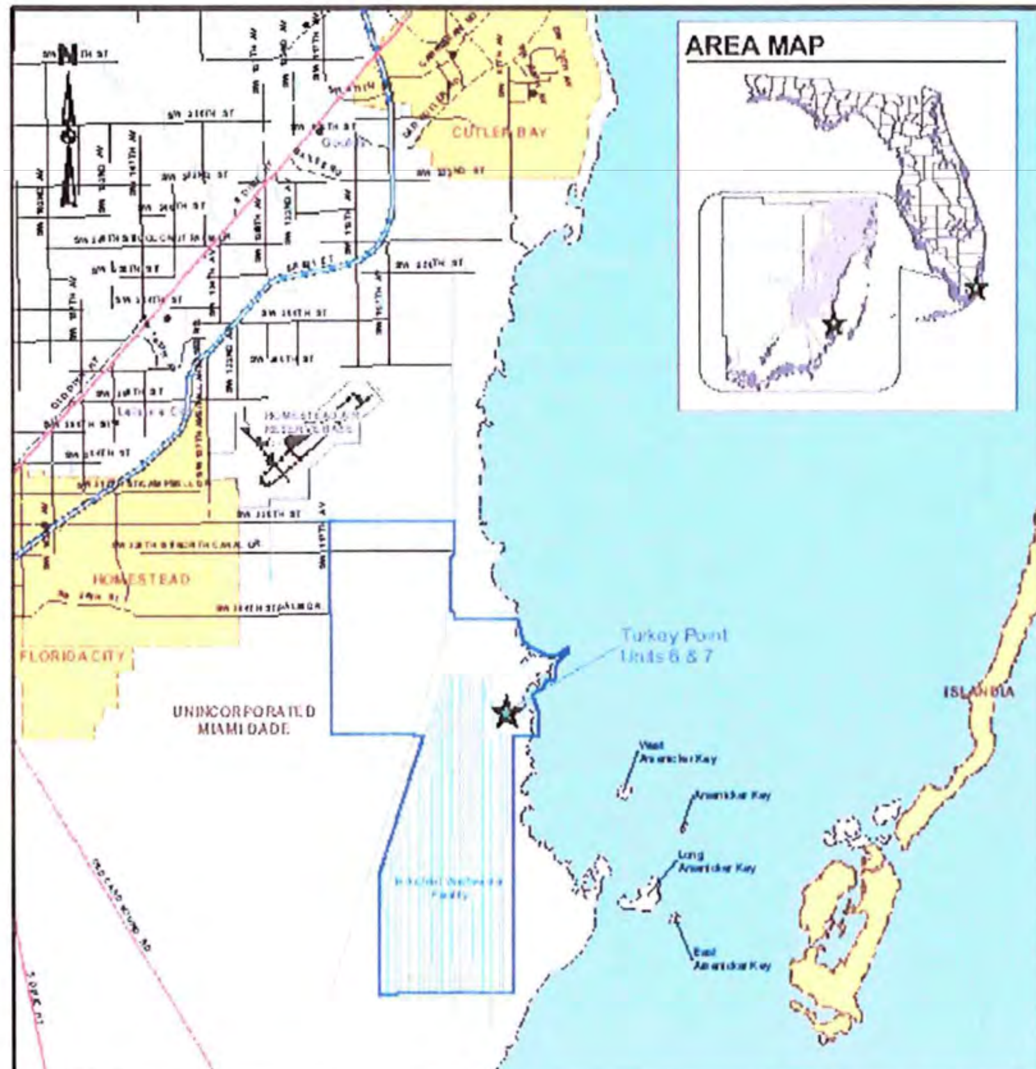

LEGEND

Turkey Point Units 6 & 7

Turkey Point Plant Property

Municipal Boundaries

REFERENCES

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PROJECT

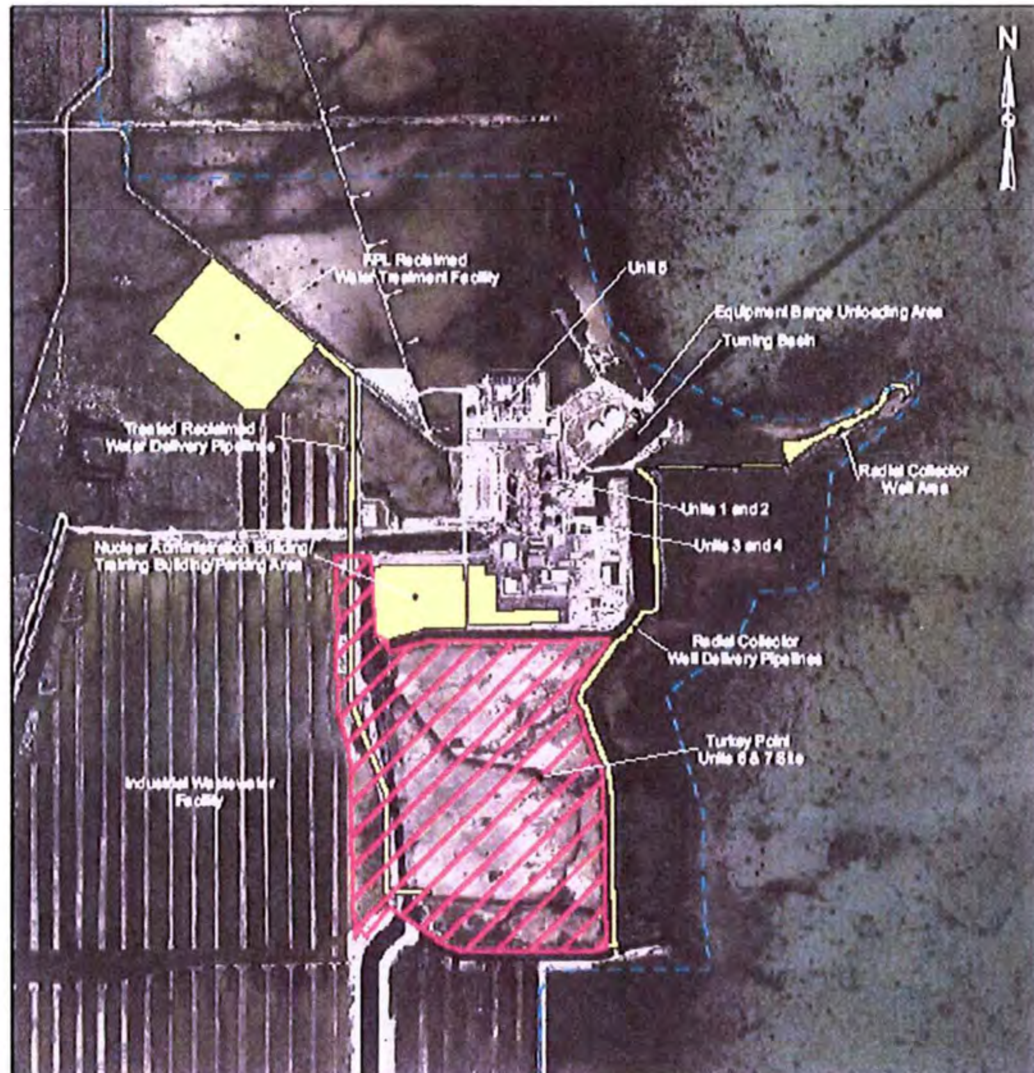
TURKEY POINT UNITS 6 & 7 PROJECT

TITLE

LOCATION OF TURKEY POINT PLANT

FPL

FIGURE 1



1750 0 1750 Feet

LEGEND

- Turkey Point Plant Property
- Turkey Point Units 6 & 7 Site
- Associated Non-Linear Facilities

REFERENCES

1 Imagery Miami-Dade County 2007

PROJECT

TURKEY POINT UNITS 6 & 7 PROJECT

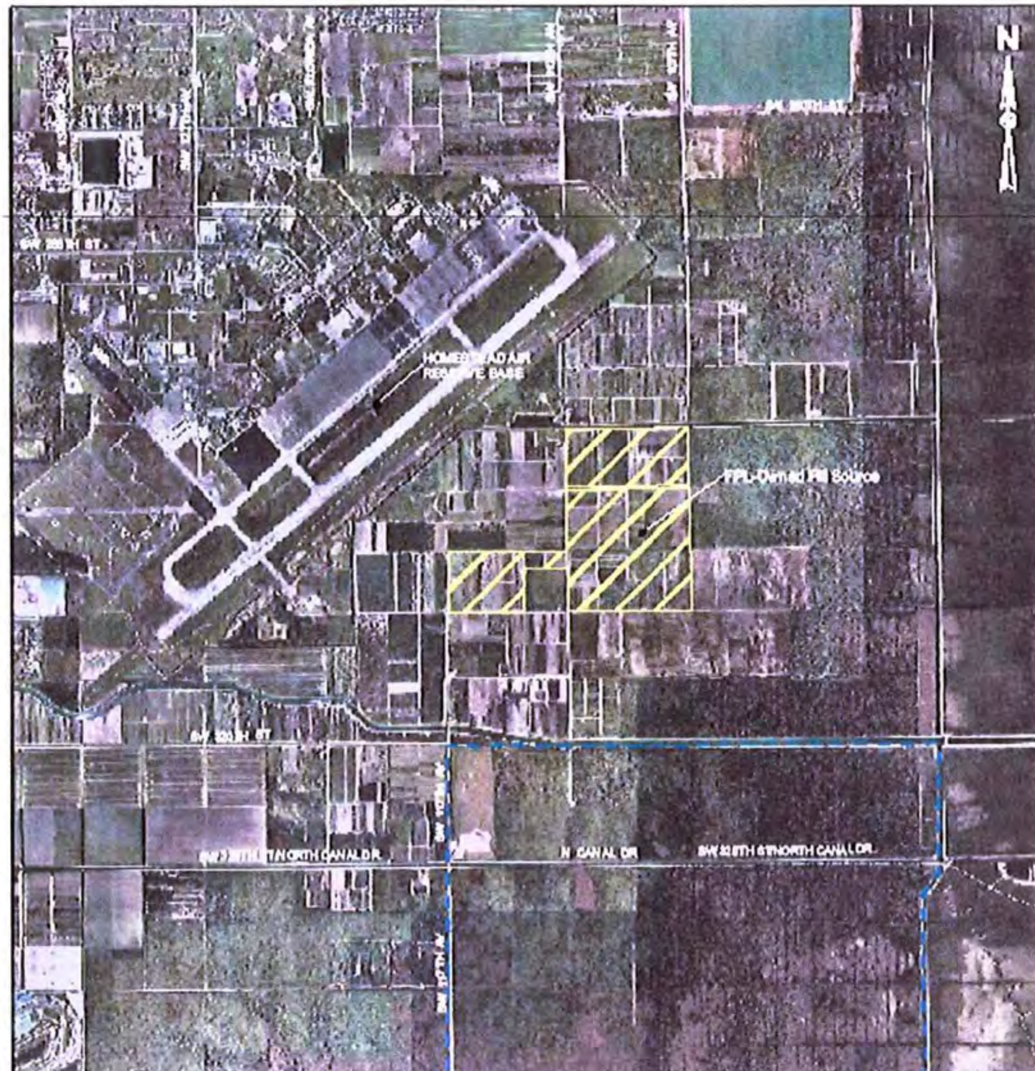
TITLE

SITE AND ASSOCIATED NON-LINEAR FACILITIES ON TURKEY POINT PLANT PROPERTY

FPL

REV 0

FIGURE 2



LEGEND

Turkey Point Plant Property
Associated Non-Linear Facilities

REFERENCES

* Imagery Miami-Dade County 2007

PROJECT

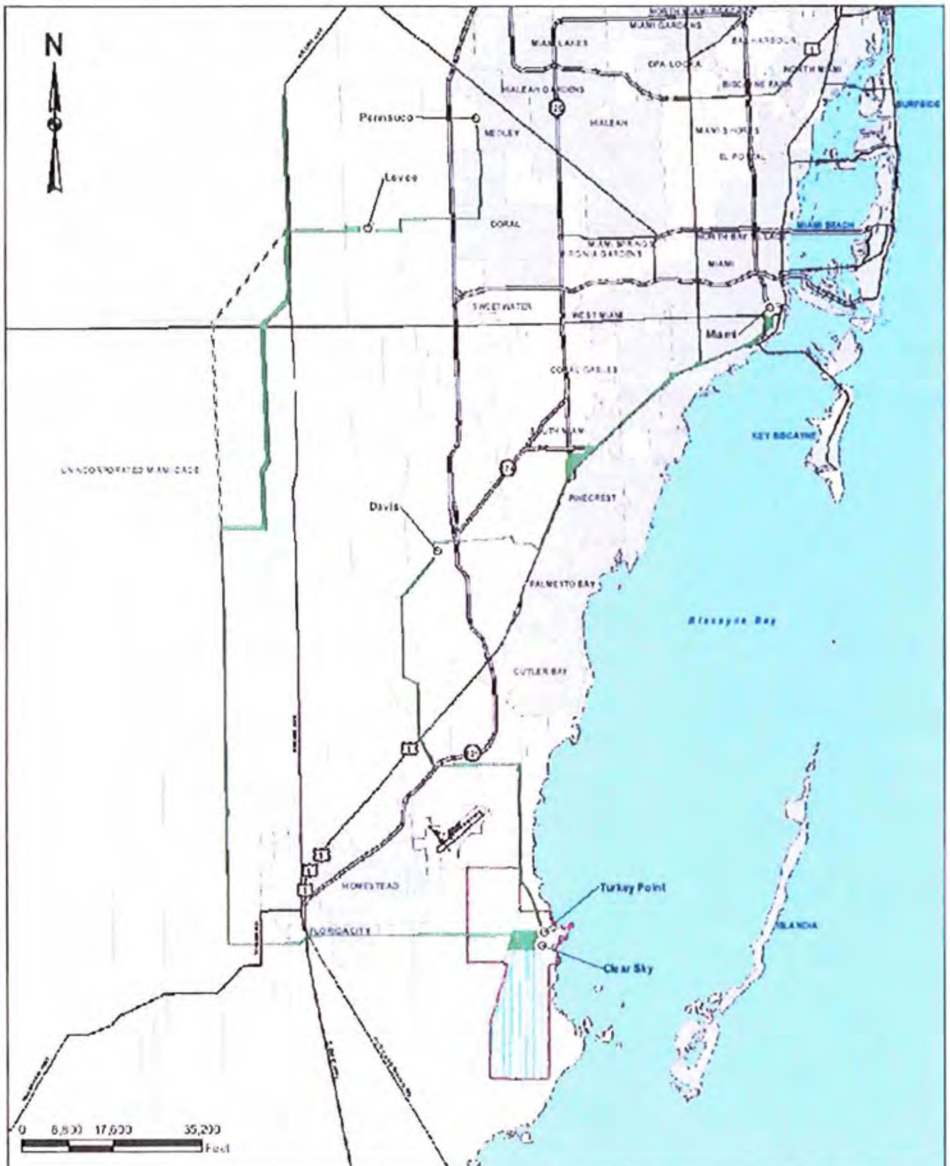
TURKEY POINT UNITS 6 & 7
PROJECT

TITLE

ASSOCIATED NON-LINEAR FACILITIES
FPL-OWNED FILL SOURCE

FPL

FIGURE
3



LEGEND

- FPL Substations
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REFERENCES

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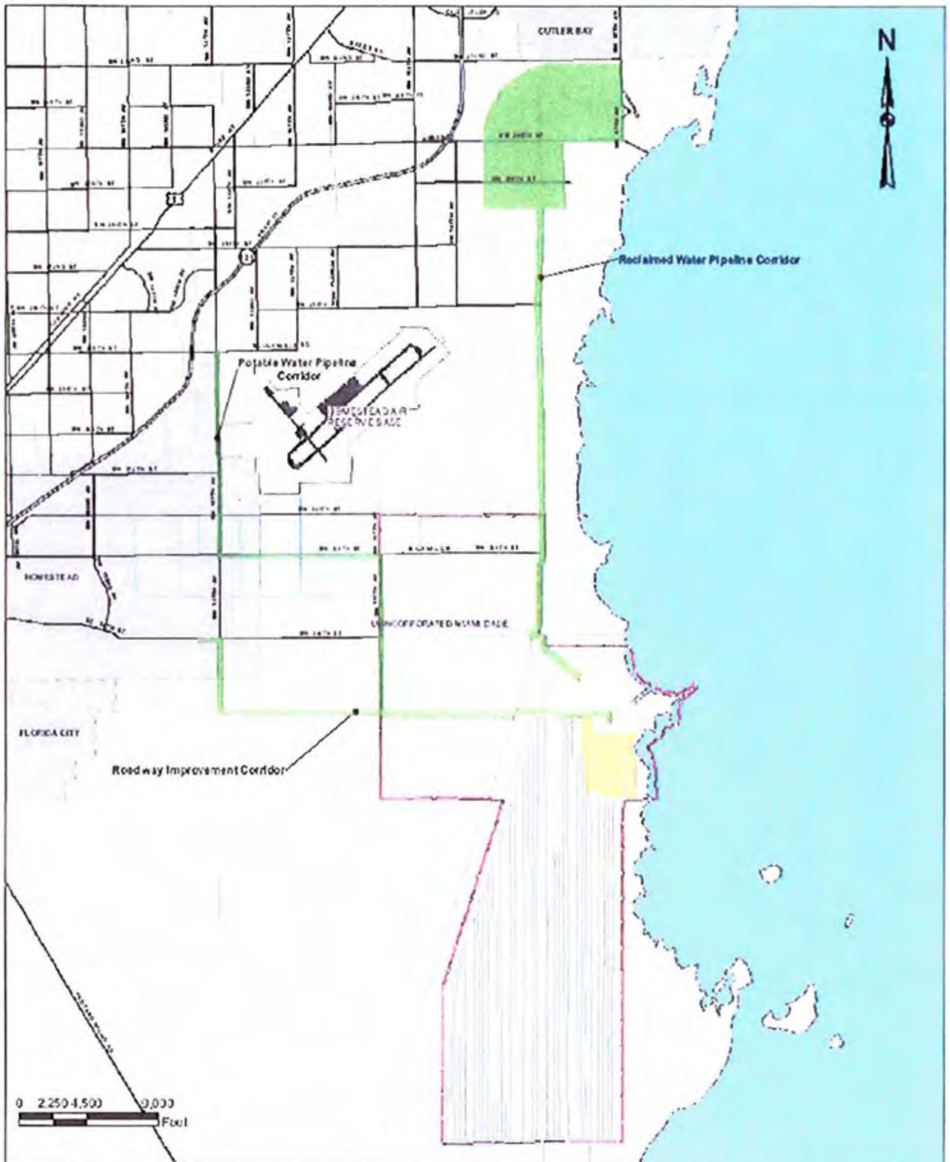

LEGEND

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REFERENCES

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SEMINOLE TRIBE OF FLORIDA
TRIBAL HISTORIC PRESERVATION OFFICE

TRIBAL HISTORIC
PRESERVATION OFFICE

SEMINOLE TRIBE OF FLORIDA
AH-TAH-THI-KI MUSEUM

HC-61, BOX 21A
CLEWISTON, FL 33440

PHONE: (863) 983-6549
FAX: (863) 902-1117

Florida Power and Light Company
700 Universe Boulevard
Juno Beach, FL 33408-2683
Attn: Matthew Raffenberg

THPO #: 005028

December 22, 2009

Subject: Proposed Turkey Point Units 6 & & On-site Project Facilities, Miami-Dade County, Florida

To Whom It May Concern:

The Seminole Tribe of Florida Tribal Historic Preservation Office (STOF-THPO) has received the **Florida Power and Light Company's** correspondence concerning the aforementioned project. The STOF-THPO has no objection to your findings at this time. However, the STOF-THPO would like to be informed if cultural resources that are potentially ancestral or historically relevant to the Seminole Tribe of Florida are inadvertently discovered during the construction process. We thank you for the opportunity to review the information that has been sent to date regarding this project. Please reference to ***THPO-005028*** for any related issues.

We look forward to working with you in the future.

Sincerely,

Willard Steele,
Tribal Historic Preservation Officer
Seminole Tribe of Florida

Direct routine inquiries to:

Anne Mullins
Compliance Review Supervisor
annemullins@semtribe.com

SECTION 2.6: GEOLOGY
TABLE OF CONTENTS

SECTION 2.6 LIST OF FIGURES

2.6 GEOLOGY

The geological conditions at the Units 6 & 7 plant area are summarized in this section. The information is subdivided into three categories: physiography, stratigraphy, and structural geology.

The geological information in this section is based on the information contained in FSAR Subsection 2.5.1.

2.6.1 GEOLOGICAL CONDITIONS

The Turkey Point plant property is located within the Atlantic Coastal Plains physiographic province (Figure 2.6-1). Elevation of the ground surface in the 200-mile radius site region varies from 3 feet below MSL to 345 feet above MSL (FDEP 2008).

2.6.1.1 Physiography

The Turkey Point plant property is located within Miami-Dade County, Florida, approximately 25 miles south of Miami, 8 miles east of Florida City, and 9 miles southeast of Homestead, Florida. The plant property is located within the Southern Slope sub-province of the Southern Zone physiographic subregion of the Florida Platform within the Atlantic Coastal Plain physiographic province (Figure 2.6-1) (Randazzo and Jones 1997 and White 1970).

Surficial deposits at Units 6 & 7 consist of organic muck and the Miami Limestone (Figure 2.6-2). The organic muck is the dominant sediment type, whereas the Miami Limestone is located surficially in the northwestern portion of the plant area.

The plant area is at or near sea level with an existing elevation of –2.4 to 0.8 feet (NAVD 88) and is generally flat. The plant area is flat and uniform throughout with the exception of the vegetated depressions. The vegetative depressions are surficial dissolution features within the Miami Limestone and are described in FSAR Subsections 2.5.1, 2.5.3, and 2.5.4.4.

2.6.1.2 Stratigraphy

Strata sampled during the Units 6 & 7 subsurface investigation are shown in Figure 2.6-3 as they occur from the ground surface to a depth beneath the plant area. Most of the 88 borings drilled penetrate the Miami Limestone, Key Largo Limestone, and Fort Thompson Formation to a depth up to 125 feet. Thirty-four deeper borings penetrated into the underlying Tamiami Formation at approximately 115 feet and continued to a depth of approximately 150 feet. Two deep borings, B-601 and B-701, penetrated into the Peace River Formation of the Hawthorn Group at depths ranging from 216 to 224 feet, respectively. Boring B-701 advanced into the Arcadia Formation of the Hawthorn Group at a depth of 455 feet before terminating at a final depth of 615.5 feet.

2.6.1.3 Structural Geology

The Turkey Point plant property lies on the stable Florida carbonate platform, and no faults or folds are mapped within 25 miles. The plant property is on a tectonically stable region characterized by extremely low rates of seismicity. New data including geologic mapping and bedding attitudes inferred from lithologic contacts in boreholes indicate flat, planar bedding in Pleistocene and older units and an absence of geologic structures within the plant property. No topographic features within the vicinity of the plant area indicate the presence of surface faulting.

Based on an analysis of aerial imagery, Grossman's Hammock is the only lineament within the 25-mile radius site vicinity. Grossman's Hammock is a north-south-trending vegetated rock reef 8 miles long. Based on ground penetrating radar analysis, there is no faulting associated with this feature (Kruse et al. 2000). Crone and Wheeler (2000) and Wheeler (2006) classify Grossman's Hammock as a non-tectonic feature.

No geomorphic features or lineaments associated with faulting within the plant property were identified during analysis of aerial imagery. The lineament analysis did identify linear and ellipsoidal/circular features associated with changes in vegetation within the 5- and 0.6-mile radii of the plant area. These features are loci of more highly concentrated vegetation. These features are likely the result of the surficial dissolution of the limestone bedrock and are described in detail in FSAR Subsection 2.5.3.8.2. There is no geomorphic expression of these features or other evidence that would indicate tectonic faulting associated with these vegetation lineaments. Data obtained during site characterization indicated the absence of collapse sinkholes in the plant area.

Results of the subsurface exploration program at the plant area reveal continuous, horizontal stratigraphy, which precludes the presence of faults, folds, or structures related to tectonic deformation.

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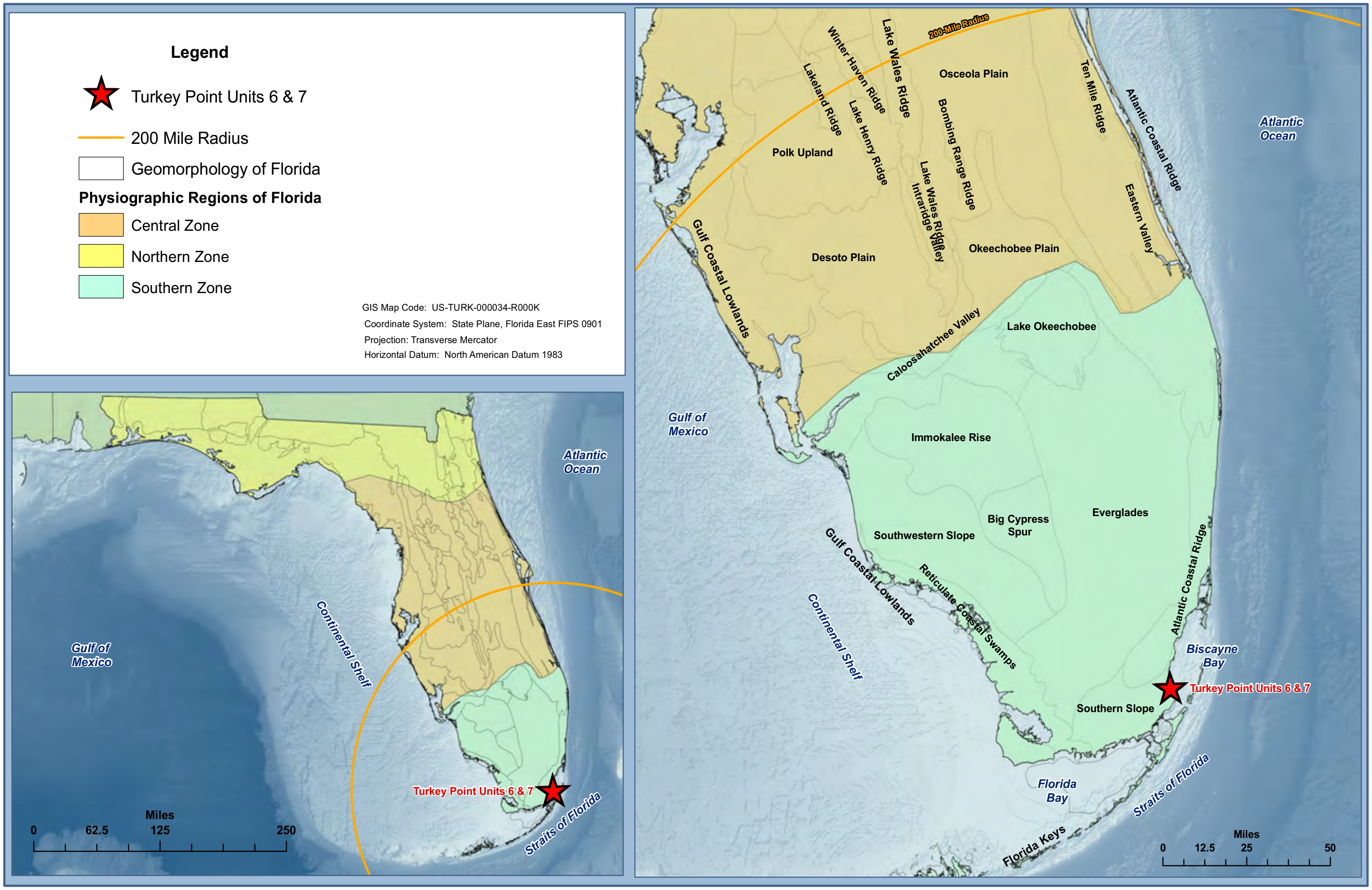
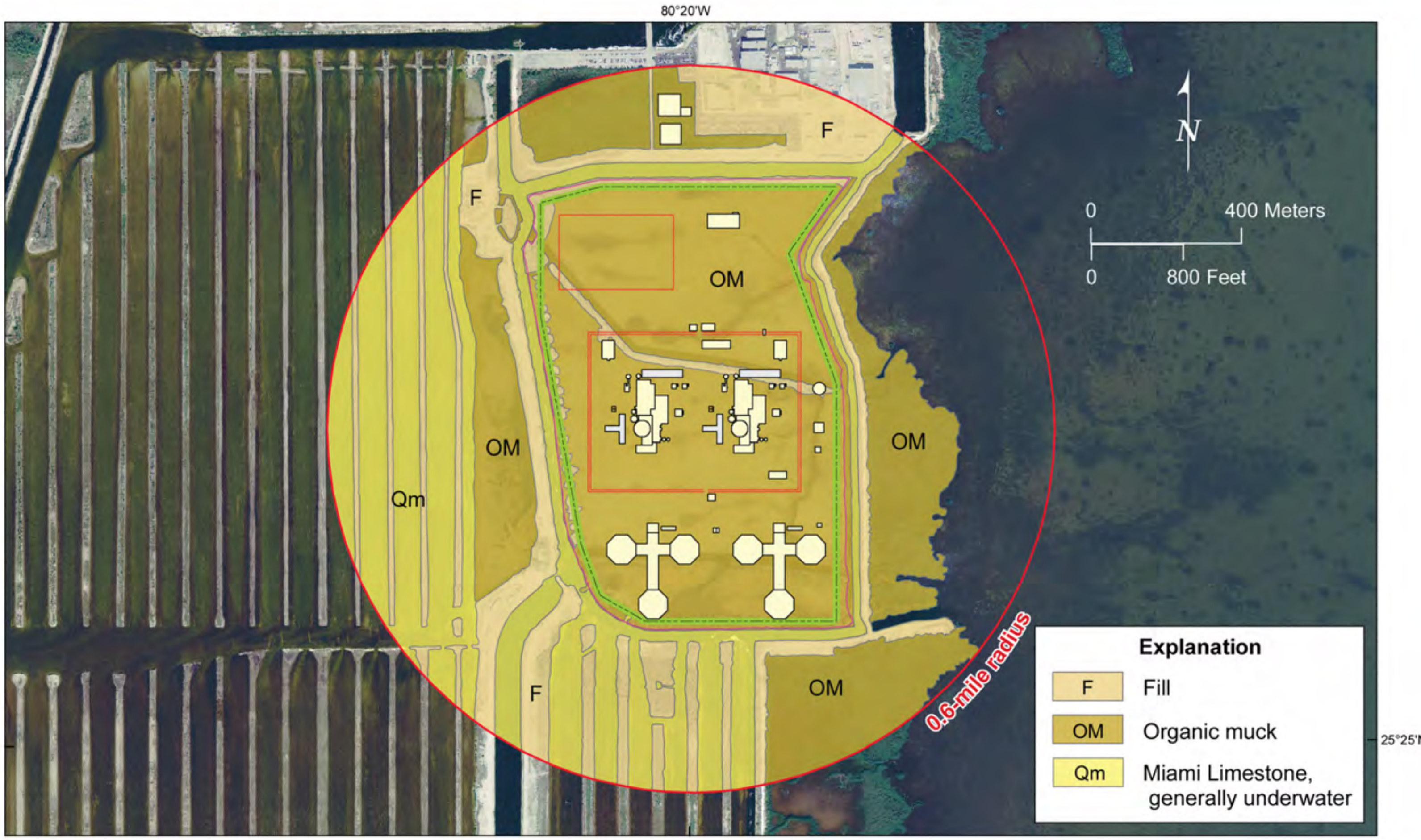
Figure 2.6-1 Map of Physiographic Provinces



Modified from Randazzo and Jones 1997, White 1970
Note: Florida is within the Atlantic Coastal Plain physiographic province.

Figure 2.6-2 Units 6 & 7 Geologic Map (0.6-Mile Radius)



Base sources: NOAA 2008 and FDEP 2004
Source of geologic information: Scott et al. 2001

Figure 2.6-3 Turkey Point Site Stratigraphy

ERATHEM	SYSTEM	SERIES	HYDRO-GEOLOGIC UNIT		STRATIGRAPHIC UNIT		LITHOLOGY	APPROXIMATE TOP ELEVATION (ft NAVD 88)	APPROXIMATE THICKNESS (ft)
CENEZOIC	QUATERNARY	HOLOCENE			organic muck		organic soil and silt	0	3
		PLEISTOCENE	Surficial aquifer system	Biscayne aquifer	Miami Limestone		sandy, oolitic limestone	-3	25
					Key Largo Limestone		well indurated, vuggy, coralline limestone	-28	22
					Fort Thompson Formation		poor/well indurated fossiliferous limestone	-50	65
	TERTIARY	PLIOCENE		Semi-confining unit	Tamiami Formation		sand and silt with calcarenitic limestone	-115	105
								formation contact based on natural gamma signature	
		MIOCENE	Intermediate confining unit		Hawthorn Group	Peace River Formation	silty calcareous sand and silt	-220	235
						Arcadia Formation	calcareous wackestone with indurated limestones, sandstone, and sand	-455	>160
								drilling ended at -616.5 ft	

Note: These units were sampled during the Units 6 & 7 subsurface investigation.

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2.7 METEOROLOGY, AIR QUALITY, AND NOISE

This section describes the regional and local climatological, meteorological, and air quality characteristics applicable to Units 6 & 7. This section also provides site-specific meteorological information for use in evaluating construction and operational impacts. This section concludes with a brief description of existing noise-generating sources at the Turkey Point plant property and predicted noise levels relative to estimated background conditions.

2.7.1 REGIONAL CLIMATOLOGY

This section identifies sources of climatological data used to characterize various aspects of the climate representative of the region around Units 6 & 7, describes large-scale general climatic features and regional air quality, and their relationship to conditions at Turkey Point (Subsection 2.7.1.2). This section also summarizes normal, mean, and extreme values of several standard weather parameters (Subsection 2.7.1.3).

2.7.1.1 Data Sources

Sources of data used to characterize local and regional climatological conditions pertinent to Units 6 & 7 include the National Weather Service (NWS) at its Miami International Airport first-order station and 16 nearby cooperative network land-based reporting stations. The cooperative network stations are located within approximately 50 miles of Units 6 & 7. In addition, historical data is available from measurements made at the current meteorological monitoring stations operated in compliance with RG 1.23 and RG 1.206 under the established meteorological monitoring program in support of existing Units 3 & 4 and located on the Turkey Point plant property close to the Units 6 & 7 plant area.

The referenced land-based cooperative network locations of climatological observing stations are in Broward, Monroe, Miami-Dade, and Collier counties in Florida. Table 2.7-1 identifies the specific stations and their approximate distance and direction from the midpoint between Units 6 & 7. Figure 2.7-1 illustrates these station locations relative to Units 6 & 7.

The objective of selecting nearby, offsite climatological monitoring stations is to determine mean and extreme values, as measured at those locations, that are reasonably representative of conditions that would be expected to be observed at Units 6 & 7. The 50-mile radius shown in Figure 2.7-1 provides a relative indication of the distance between the climate stations and Units 6 & 7.

The identification of stations to be included was based on the following general considerations:

- Proximity to the plant area (i.e., within the nominal 50-mile radius indicated above, to the extent practical)

- Coverage in all directions surrounding the plant area (to the extent possible)
- Where more than one station exists for a given direction relative to the plant area, a station was chosen if it contributed one or more extreme conditions (e.g., rainfall, snowfall, maximum and/or minimum temperatures) for that general direction or added content for describing climatic conditions in the plant area

Nevertheless, if an overall extreme precipitation or temperature condition was identified for a station located within a reasonable distance beyond 50 miles, and that event was considered to be reasonably representative for the plant area, such stations were also included, regardless of directional coverage.

Normal (i.e., 30-year average), mean, and extreme values of temperature, rainfall, and snowfall are based on the following references: (NCDC Feb 2009a), (NCDC 2004), (NCDC Feb 2002a), (NCDC Feb 2006), (USU 2008), (SERCC Jun 2008a and SERCC Jun 2008b).

First-order NWS stations also record measurements, typically every hour, of other weather elements, including winds, several indicators of atmospheric moisture content (i.e., relative humidity, dew point, and wet bulb temperatures), and barometric pressure, as well as other observations when those conditions occur (e.g., fog, thunderstorms). The long-term (30 years) data from the NWS Miami International Airport first-order station was used to describe the general climatic conditions at Units 6 & 7. This is the closest first-order station to Turkey Point. Table 2.7-2, excerpted from the 2008 local climatological data (LCD) annual summary for the Miami International Airport, Florida NWS station, presents the long-term characteristics of these parameters.

Additional data sources were also used in describing the climatological characteristics of the plant area and region, including, among others, the following references: (ASCE 2005), (NOAA-CSC 2008), (NCDC Sep 2002b), (NCDC 2009b, NCDC 2008c and NCDC 2008d), (Wang and Angell Apr 1999), (USDA 2007).

2.7.1.2 General Climate Description

The location of Units 6 & 7 would be on the lower east coast of Florida within the Atlantic Coastal Ridge, which is a flat stretch of land that borders both the Atlantic Ocean and the Gulf of Mexico (see Figure 2.1-2). The Units 6 & 7 plant area is relatively flat with an approximate finished grade elevation of 25.5 feet (North American Vertical Datum 1988 [NAVD 88]). Topographic features within 5 miles and 50 miles of the plant area are addressed in Subsection 2.7.4.6. Elevations within 50 miles of the plant area range from approximate elevation –2.5 feet (NAVD 88) to the north-northeast to an approximate elevation of 86 feet (NAVD 88) to the north. Biscayne Bay is directly east of Units 6 & 7.

The state of Florida is divided into seven climate divisions by the National Oceanic and Atmospheric Administration (NOAA). A climate division represents a region within a state that is as climatically homogeneous as possible. The Units 6 & 7 plant area is located within the Lower East Coast Division (Division 6), which includes most of Miami-Dade, Broward, Palm Beach, and Martin counties (NOAA 2008a). The general climate in this division is classified as subtropical maritime (or humid subtropical) and is characterized by long and warm summers, with abundant rainfall, followed by mild, dry winters. The chief factors that govern the climate are latitude, land and water distribution, prevailing winds, storms, pressure systems, and ocean currents. The wet season, which is hot and humid, lasts from May to October, when it gives way to the dry season. The dry season features mild temperatures with some invasions of colder air, which is when little winter rainfall occurs with the passing of a cold front (NCDC Feb 2006).

The Azores-Bermuda high-pressure system (NCDC Feb 2006) exerts a powerful influence on the weather during the winter months. Within high-pressure systems, air is subsiding, and as a consequence, precipitation cannot take place. The Azores-Bermuda high remains over the Sahara Desert throughout the year, but extends over Florida during the winter. As the water around the peninsula warms in the spring, the high-pressure system over Florida weakens and the summer rains begin. Some years, the influence of the Azores-Bermuda high-pressure system is greater than others, so even in the Units 6 & 7 area; rain may fall in the winter. Because of the clockwise circulation around the western extent of the Azores-Bermuda high pressure and the proximity of the Atlantic Ocean, maritime tropical air mass characteristics prevail much of the year. Together, these factors govern late spring, summer, and early fall temperature and precipitation patterns. Florida does not experience the potential for high air pollution because it does not contain heavy industry or the climate and topographical conditions that cause air stagnation.

The El Niño-Southern Oscillation is a physical phenomenon that occurs in the equatorial Pacific Ocean where the water temperature oscillates between being unusually warm (El Niño) and unusually cold (La Niña). El Niño and La Niña are among the strongest drivers of the climate of North America, with impacts that vary across different regions. These oceanic events shift the position of the jet streams across the continent, which act to steer the fronts and weather systems. The southeast United States experiences particularly strong long-term weather shifts, with Florida feeling the greatest impacts. El Niño typically brings 30 to 40 percent more rainfall and cooler temperatures to Florida in the winter, while La Niña brings a warmer and much drier than normal winter and spring. La Niña is frequently a trigger to periodic drought in Florida (NCDC Feb 2006).

The marine influence of the Atlantic Ocean is evidenced by the low daily range of temperature and the rapid warming of cold air masses that pass to the east of the state. The regional area is subject to winds from the east and southeast about half of the time, and in several specific respects has a climate whose features differ from farther inland. One of the features is the annual precipitation for the area. During the early morning hours, more rainfall occurs along the beach areas than at Miami International Airport, while during the afternoon, the reverse situation is true (NCDC Feb 2009a). The Miami International Airport lies approximately 9 miles inland. Monthly precipitation exhibits a cyclical pattern, with the predominant maximum occurring in the summer months and the minimum occurring during the winter months (see Table 2.7-2).

The region is subject to sea/land breeze circulations, local winds that are driven by the differential heating of the air over the ocean and over the land surface. In south Florida, the existence and intensity of the sea breeze depends largely on seasonal and latitudinal factors as well as on the time of day. Sea/land breeze circulations influence local temperature, humidity, wind speed, stability, and wind direction and precipitation. The most notable sea breeze impacts are a shift in wind to the onshore direction, an increase in wind speed, a decrease in temperature, and an increase in humidity.

An even more striking difference appears in the annual number of days with temperatures reaching 90°F or higher, with inland stations having four times more than the beach areas. Minimum temperature contrasts are also particularly marked under proper conditions, with the difference between inland locations and the beach areas frequently reaching to 15 degrees or more, especially in the winter. Freezing temperatures occur occasionally in the inland suburban areas and farming districts, but rarely near the ocean (NCDC Feb 2009a).

Hurricanes affect the area often enough that they are an annual concern within the FPL service area. The months of greatest frequency are September and October. Destructive tornadoes are rare. Funnel clouds are occasionally sighted offshore and a few touch the ground briefly but significant damage is seldom reported. Waterspouts (tornadoes over water) are often visible from the beaches during the summer months; however, significant damage is seldom reported. Further information regarding tornadoes, hurricanes, and tropical cyclones is provided in Subsection 2.7.3. The months of June, July, and August have the highest frequency of dangerous lightning events (NCDC Feb 2009a).

2.7.1.3 Normal, Mean, and Extreme Climatological Conditions

This subsection addresses normal and period-of-record mean and extreme values for several standard weather elements representative of this climate setting (i.e., temperature, atmospheric water vapor, precipitation, and wind conditions). All references to seasonal periods in this subsection pertain to winter (December, January, February), spring (March, April, May), summer (June, July, August), and fall (September, October, November).

As indicated previously, Table 2.7-2 presents the more extensive set of meteorological measurements and observations made at the Miami International Airport, NWS Station, located approximately 25 miles north of Units 6 & 7. For comparison, Table 2.7-3 summarizes the annual normal daily maximum, minimum, range, and mean temperatures, as well as the normal annual rainfall and snowfall totals for Miami International Airport and 16 nearby cooperative network reporting stations. Table 2.7-4 summarizes the climatological extremes for maximum and minimum temperatures and maximum 24-hour and monthly rainfall and snowfall for Miami International Airport, and 16 nearby cooperative network reporting stations.

Long-term periods of record for temperature and precipitation for the climatological observing stations, as well as summaries of the latest 30-year station normal values from 1971 through 2000, are readily available from the National Climatic Data Center (NCDC).

2.7.1.3.1 Temperature

Daily mean temperatures are based on the average of the daily mean maximum and mean minimum temperature values. The annual daily normal temperatures are similar over the area, ranging from 73.8°F at the Fort Lauderdale Experiment Station weather observing station to 78.4°F at the Hialeah weather observing station (see Table 2.7-3), which are separated by a distance of approximately 18 miles.

Diurnal (day-to-night) temperature ranges, as indicated by the differences between the daily mean maximum and minimum temperatures, however, are more variable, ranging from 9.0°F at the Miami Beach weather observing station to 19.8°F at the Oasis Ranger Station (NCDC Feb 2002a). In general, diurnal temperature ranges among the one NWS and the 16 nearby cooperative weather observer stations are greater at those stations farther from the Atlantic Ocean and adjacent bays, and are less for those stations closer to those waters (see Figure 2.7-1).

On a monthly basis, the local climate data (LCD) summary for the Miami International Airport indicates that the daily normal dry bulb temperature is highest during July (83.7°F) and reaches a minimum (68.1°F) in January (NCDC Feb 2009a).

As Table 2.7-4 indicates, extreme maximum temperatures recorded in the vicinity of the Units 6 & 7 plant area at land-based stations have ranged from 96°F to 104°F, with the highest reading observed at the Flamingo Ranger Station on June 24, 1998. The record high temperatures for the Homestead Experiment Station (100°F), Miami 12 SSW (98°F), Miami International Airport (98°F), Royal Palm Ranger (102°F), and Tavernier (98°F) weather observing stations have been reached on two or three occasions.

The extreme minimum temperatures in the vicinity of the Units 6 & 7 plant area have ranged from 21°F to 42°F, with the lowest reading on record observed at the Pompano Beach weather observing station on February 9, 1995 (SERCC Jun 2008b).

The extreme maximum and minimum temperature data, and the historical station records that they are based on, indicate that synoptic-scale conditions can be responsible for periods of record-setting heat. Synoptic-scale conditions can also be responsible for cold air outbreaks that tend to affect the overall Turkey Point plant property. The general similarity of the respective extremes suggests that these statistics are representative of the Turkey Point site area (SERCC Jun 2008b; NCDC 2004). However, as with the variation in the weather observing station diurnal temperature ranges noted above, proximity to the water has a moderating influence on normal and extreme maximum and minimum temperatures as well.

2.7.1.3.2 Atmospheric Water Vapor

Based on a 25-year period of record, the LCD summary for the Miami International Airport NWS station (see Table 2.7-2) indicates that the mean annual wet bulb temperature is 69.6°F, with a seasonal maximum during the period June through September and a seasonal minimum during the winter months (December through February). The highest monthly mean wet bulb temperature is 76.4°F in August; the lowest monthly mean value (62.0°F) occurs during January (NCDC May 2009).

Based on a 25-year period of record, the LCD summary shows a mean annual dew point temperature of 67.1°F, also reaching its seasonal maximum and minimum during the summer (August 74.4°F) and winter (January 59.1°F), respectively (NCDC Feb 2009a).

The 30-year period of record of normal daily relative humidity averages 73 percent annually, typically reaching its diurnal maximum in the early morning (approximately 7:00 a.m.) and its diurnal minimum during the midday (around 1:00 p.m.). There is less variability in this daily pattern with the passage of weather systems, persistent cloud cover, and precipitation. Nevertheless, this daily pattern is evident throughout the year. The LCD summary shows that average early morning (7:00 a.m.) relative humidity levels are equal to or greater than 83 percent from June through February and are not much lower during the remaining months of the year (NCDC Feb 2009a).

2.7.1.3.3 Precipitation

Normal annual rainfall totals for the 17 nearby observing stations listed in Table 2.7-3 vary greatly, ranging from 44.8 inches at the Tavernier (Monroe County) observing station (approximately 31 miles to the south-southwest of the Units 6 & 7) to 66 inches at the Hialeah station (approximately 27 miles to the north) (SERCC Jun 2008b).

The LCD summary of normal rainfall totals for Miami International Airport indicates that the seasonal maximum occurs during the summer through early fall (June through September). This 4-month period accounts for approximately 54 percent (31.34 inches) of the total annual precipitation (58.53 inches). With the exception of July (5.79 inches), the normal monthly rainfall during this 4-month period is greater than 8 inches. The maximum overall normal monthly total rainfall occurs during August (8.63 inches) (NCDC March 2009b).

Historical precipitation extremes (i.e., rainfall and snowfall) are presented in Table 2.7-4 for the 17 nearby climatological observing stations. Based on the maximum 24-hour and monthly precipitation totals recorded among these stations and, more importantly, the areal distribution of these stations around the Turkey Point plant property, the data are reasonably representative of the extremes of rainfall and snowfall that might be expected to be observed at the Units 6 & 7 plant area.

The overall highest 24-hour rainfall total in the area, 15.1 inches, occurred on August 26, 2005, at the Perrine 4 W cooperative weather observing station (SERCC Jun 2008a), approximately 13 miles north-northwest of the Units 6 & 7 plant area. This extreme rainfall event was directly associated with Hurricane Katrina (see Subsection 2.7.3.5).

The overall highest monthly rainfall total in the area, 34.4 inches during October 1965, was recorded at the Pompano Beach cooperative observing station (USU 2008), located approximately 57 miles to the north-northeast of Units 6 & 7. This total represents the accumulation of 12 days of measurable precipitation during that month, with approximately 86 percent being recorded on October 14 (6.75 inches), October 15 (12.7 inches), and October 31 (10.01 inches). This monthly record rainfall was not associated with any hurricanes or tropical storms (USU 2008). Further information on extreme rainfall events in the area is presented in Subsection 2.7.4.1.2.

While snow is far from common in southeast Florida, it does fall there from time to time. Snow has never been reported at the Miami International Airport. However, snow was reported on January 19, 1977 in Homestead, Florida, where the southeastern municipal limit is approximately 4.5 miles west of the Turkey Point plant property. The total snowfall noted in the data records was estimated to be 0.05 inches (USU 2008). However, notes made by the station observer indicate that the snow melted before reaching the ground (NOAA Jan 1977). This was during one of the worst mid-1970s cold waves and snow fell that day in several parts of Dade County, Florida, but not at the NWS office at the Miami Airport, which is why the official records do not report snow.

The LCD for Miami International Airport (Table 2.7-2) indicates a trace of snow in May 1998. It is important to note that the snowfall data reported on the LCD comprises all forms of frozen precipitation, including hail. A review of data records for Miami International Airport on May 6, 1998 indicates that the minimum temperature for this day was 70°F. As a result, the trace amount reported on the Miami International Airport LCD was determined to be hail.

See Subsection 2.7.4.1.2 for more details regarding these events and a description of other station precipitation records.

2.7.1.3.4 Wind Conditions

Based on a 30-year period of record, the LCD summary for the Miami International Airport NWS station (Table 2.7-2) indicates that the annual prevailing wind direction (i.e., the direction from which the wind blows most often) is from 120 degrees (i.e., from the southeast). Monthly prevailing winds are from the southeast during the late winter through mid-spring (February through April) and again during the period summer through early fall (June through September). During October and November, the prevailing wind direction backs to more easterly. The prevailing winds are more northerly during the winter months (December through January) (NCDC Feb 2009a). These characteristics are further enhanced by the establishment of the Bermuda high in the summer, and the passage of northerly cold fronts in the winter (see Subsection 2.7.1.2).

Based on a 25-year period of record, the Miami International Airport LCD summary shows an annual mean wind speed of approximately 8.7 mph. On a seasonal basis, the highest average wind speeds occur during the spring (approximately 9.7 mph) and are lowest during the summer months (approximately 7.6 mph). On average, the LCD indicates that the highest monthly average wind speed (approximately 10.1 mph) occurs during March (NCDC Feb 2009a).

Characteristics of extreme wind conditions for design basis purposes are described in Subsection 2.7.3.3. An onsite Turkey Point meteorological monitoring program is operated in support of Units 3 & 4 for the purpose of climatological characterization as related to the dispersion of radioactive and nonradioactive effluents released into the atmosphere. Wind data summaries, based on data obtained from the Turkey Point meteorological monitoring program, are addressed in Subsections 2.7.4.3 and 2.7.4.4.

2.7.2 AIR QUALITY

This subsection addresses current ambient air quality conditions in the area and region (e.g., the compliance status of various air pollutants), projected air quality conditions resulting from the operation of Units 6 & 7, and the climatology of restrictive dispersion conditions in the region. The pollutants that are currently monitored in the region are nonradiological and include parameters such as particulate matter and select gaseous pollutants, and are described in Subsection 2.7.2.1. Based on plant design, construction, and operating basis considerations, Subsection 2.7.2.2 addresses projected air quality conditions during the operation of Units 6 & 7 and what sources would contribute to nonradiological emissions. Subsection 2.7.2.3 characterizes climatological conditions in the area and region that may be restrictive to atmospheric dispersion.

2.7.2.1 Regional Air Quality Conditions

The Turkey Point plant property is located within the Southeast Florida Intrastate Air Quality Control Region. This region includes Broward County, Dade County, Indian River County, Martin County, Monroe County, Okeechobee County, Palm Beach County, and St. Lucie County (U.S. EPA Jul 2008a). The Units 6 & 7 plant area is located in extreme southeastern Miami-Dade County. The Southeast Florida Intrastate Air Quality Control Region is in attainment for all criteria air pollutants (U.S. EPA Jul 2008b). Attainment areas are areas where the ambient levels of criteria air pollutants are designated as being “better than, unclassifiable/attainment, or cannot be classified or better than” the EPA-promulgated National Ambient Air Quality Standards (NAAQS). Criteria pollutants are those for which NAAQS have been established: sulfur dioxide, particulate matter (i.e., PM_{10} and $PM_{2.5}$, which are particles with nominal aerodynamic diameters less than or equal to 10.0 and 2.5 microns, respectively), carbon monoxide, nitrogen dioxide, ozone (1-hr and 8-hr); and lead (U.S. EPA Jul 2007).

There are three pristine areas in the state of Florida designated as *Mandatory Class I Federal Areas Where Visibility is an Important Value.* They include the Chassahowitzka Wilderness Area, Everglades National Park, and St. Marks Wilderness Area (U.S. EPA Jul 2008c). The Everglades National Park is the closest of the Class I areas, located approximately 13 miles west of the Units 6 & 7. The Chassahowitzka Wilderness Area and St. Marks Wilderness Area are located over 250 miles northwest of the Turkey Point plant property.

In addition to Class I federal areas, there are two national parks and a national wildlife refuge in the vicinity of the Turkey Point plant property that are PSD Class II federal areas. Biscayne National Park is immediately north and east of the Turkey Point plant property while the Biscayne Bay Aquatic Preserve is northeast, east, and southeast of the property. Homestead Bayfront Park is a recreational park approximately 1.7 miles north of the Units 6 & 7 plant area. The Biscayne Trail is approximately 2 miles north of the plant area. The Everglades Mitigation Bank is southwest of the Turkey Point plant property.

2.7.2.2 Projected Air Quality Conditions

The Units 6 & 7 steam supply systems and other related radiological systems would not be sources of criteria pollutants or other air toxics. Supporting equipment (e.g., diesel generators, fire pump engines), and other nonradiological emission-generating sources (e.g., cooling towers, storage tanks, and related equipment) or activities would not be significant sources of criteria pollutant emissions (see Sections 3.6 and 5.5).

Supporting equipment would only be operated on an intermittent test or emergency-use basis. Therefore, these emission sources would not impact ambient air quality levels in the vicinity of the Turkey Point plant property, nor would they be a significant factor in the design and operation of Units 6 & 7. The combination of insignificant emissions and the relatively large separation distance from the Turkey Point plant property to the Chassahowitzka Wild and St. Marks Wilderness Class I areas would not result in a significant impact on visibility as a result of project construction and facility operations.

These nonradiological emission sources would be regulated by the Florida Department of Environmental Protection (FDEP) as required under the Florida Administrative Code (F.A.C.), Title 62, Chapters 4 through 297 depending on the source type, source emissions, and permitting requirements for construction and operation.

Emission-generating sources and activities related to construction of Units 6 & 7, potential impacts, and mitigation measures are addressed in Subsection 4.4.1.2. Nonradiological emission-generating sources associated with routine facility operations are addressed further in Subsection 3.6.3.1. Characteristics of these proposed emission sources and the potential effects on air quality and visibility associated with their operation are addressed in Subsections 5.8.1 and 5.3.3, respectively.

2.7.2.3 Restrictive Dispersion Conditions

Atmospheric dispersion can be described as the horizontal and vertical transport and diffusion of pollutants released into the atmosphere. Horizontal and vertical dispersion of a pollutant along the downwind trajectory from a source is controlled primarily by wind direction variation, wind speed, and atmospheric stability.

In general, lower wind speeds represent less turbulent airflow, which is restrictive to both horizontal and vertical dispersion. And, although wind direction tends to be more variable under lower wind speed conditions (which increases horizontal transport), air parcels containing pollutants often recirculate within a limited area, thereby increasing cumulative exposure.

Major air pollution episodes are usually related to the presence of stagnating high-pressure weather systems (or anticyclones) that influence a region with light and variable wind conditions for 4 consecutive days or more. An updated air stagnation climatology report titled Air Stagnation Climatology for the United States (Wang and Angell 1999) has been published with data for the continental United States based on more than 50 years of observations. In this study, stagnation conditions were defined as 4 or more consecutive days when meteorological conditions were conductive to poor dispersion. Although inter-annual frequency varies, the data in Figures 1 and 2 of that report indicates that, on average, the region surrounding Units 6 & 7 can expect approximately 20 days per year with stagnation conditions, or approximately 4 cases or less per year, with a mean duration of 5 days or less for each case (Wang and Angell Apr 1999).

Air stagnation conditions primarily occur during an “extended” summer season (May through October). This is a result of the weaker pressure and temperature gradients, and therefore weaker wind circulations, during this period (as opposed to the winter season). Based on Wang and Angell Figures 17 to 67, the highest incidence of air stagnation is recorded between July and September, typically reaching its peak during August, when the Bermuda high-pressure system establishes. As the LCD summary in Table 2.7-2 for Miami International Airport indicates, this 3-month period coincides with the lowest monthly mean wind speeds during the year. Air stagnation is at a relative minimum within the “extended” summer season during May and June (Wang and Angell Apr 1999).

The dispersion of air pollutants is also a function of the mixing height. The mixing height (or depth) is defined as the height above the surface through which relatively vigorous vertical mixing takes place. Lower mixing heights (and wind speeds), therefore, are a relative indicator of more restrictive dispersion conditions. The United States Department of Agriculture (USDA) Forest Service Ventilation Climate Information System (USDA 2007) reports statistical data for mean monthly morning and afternoon mixing heights and wind speeds for locations in the contiguous United States, Alaska, and Hawaii. The data used to compute the statistics is based on observations for the period 1961–1990 for mixing heights and 1959–1998 for wind speed. Monthly statistics for these parameters include minimum, maximum, and mean values, average wind direction, and most frequent wind direction and are based on the longitude and latitude of the Units 6 & 7 plant area.

Table 2.7-5 summarizes minimum, maximum, and mean morning and afternoon mixing heights and surface wind speeds on a monthly, seasonal, and annual basis for the area. As atmospheric sounding measurements are still only made from a relatively small number of observation stations, these statistics represent model-derived values within the interactive database for a specific location (USDA 2007)—in this case, the Turkey Point plant property. The seasonal and annual values listed in Table 2.7-5 were derived as weighted means based on the corresponding monthly values.

From a climatological standpoint, the lowest morning mixing heights occur in the summer, and the highest morning mixing heights occur during the spring. The afternoon mixing heights reach a seasonal minimum in the fall and a maximum during the spring due to more intense daytime heating.

The wind speeds listed in Table 2.7-6 representing the location of the Units 6 & 7 plant area are reasonably consistent with the LCD summary for Miami International Airport in Table 2.7-2, in that the lowest mean wind speeds are shown to occur during the summer. This period of minimum wind speeds also coincides with the “extended” summer season described by Wang and Angell (Wang and Angell Apr 1999) that is characterized by relatively higher air stagnation conditions.

2.7.3 SEVERE WEATHER

This subsection addresses severe weather phenomena that affect the Turkey Point area and region and that are considered in the design and operating bases for Units 6 & 7. These phenomena and observed properties include:

- The frequencies of thunderstorms and lightning (Subsection 2.7.3.1)
- Observed and probabilistic extreme wind conditions (Subsection 2.7.3.2)
- Tornadoes and related wind and pressure characteristics (Subsection 2.7.3.3)
- The frequency and magnitude of hail, snowstorms, and ice storms (Subsection 2.7.3.4)
- Tropical cyclones and related effects (Subsection 2.7.3.5)

2.7.3.1 Thunderstorms and Lightning

Thunderstorms can occur in the area at any time during the year. Based on a 61-year period of record, Miami International Airport averages approximately 73 thunderstorm-days (i.e., days on which thunder is heard at an observing station) per year (see Table 2.7-2). On average, August has the highest monthly frequency of occurrence—approximately 15 days. Annually, 74 percent of thunderstorm-days are recorded during June, July, August, and September. From November through March, a thunderstorm might be expected to occur approximately 1 to 2 days per month (NCDC Feb 2009a).

The mean frequency of lightning strokes to earth can be estimated using a method attributed to the Electric Power Research Institute (EPRI), as reported by the USDA Rural Utilities Service (USDA Aug 1998). This methodology assumes a relationship between the average number of thunderstorm-days per year (T) and the number of lightning strokes to earth per square mile per year (N), where:

$$N = 0.31T$$

Based on the average number of thunderstorm-days per year (73) at Miami International Airport (see Table 2.7-2), the frequency of lightning strokes to earth per square mile is approximately 23 per year for the site area. This estimate of frequency is somewhat lower than the mean of the 10-year (1989 to 1999) cloud-to-ground flash density of approximately 12 to 14 flashes/square-kilometers/year or 4.6 to 5.4 flashes/square-miles/year reported by the NWS for the area that includes Units 6 & 7. Considering the fact that the estimated cloud-to-ground flash density is based on both cloud-to-ground and cloud-to-cloud lightning flashes, the actual number of lightning strokes to earth would be somewhat lower and more comparable to the estimate provided by the EPRI method (NSSL Jan 2006).

In order to estimate the frequency of lightning strokes on Units 6 & 7, a rectangular area of approximately 30 acres (0.047 square-miles) was identified to encompass the power blocks of both units. Given the estimated annual average frequency of lightning strokes to earth, the frequency of lightning strokes to Units 6 & 7 can be estimated as follows:

(23 lightning strokes/square-miles/year) x (0.047 square-miles) = 1.1 lightning strokes/year, or about once each year.

2.7.3.2 Extreme Winds

From a climatological standpoint, the frequency of peak wind speed gusts can be characterized from information in the *Climate Atlas of the United States* (NCDC Sep 2002b), which is based on observations made for the 30-year period of record from 1971 to 2000. Frequencies of occurrence were developed from values reported as the 5-second peak gust for the day. Mean annual occurrences of peak gusts greater than or equal to 50 mph, 40 mph, and 30 mph in the area range between 0.5 and 1.4 days per year, less than 9.5 days per year, and 40.5 and 50.4 days per year, respectively.

Estimating the wind loading on plant structures for design and operating bases considers the basic wind speed, which is the 3-second gust speed at 33 feet (10 meters) above the ground in Exposure Category C (ASCE 2005).

The basic wind speed is approximately 150 mph, as estimated by linear interpolation from the plot of basic wind speeds in Figure 6-1B of ASCE 7-05 (ASCE 2005) for that portion of the United States that includes the Units 6 & 7 plant area. The plant area is located in a hurricane prone region as defined in Section 6.2 of the ASCE-SEI design standard, that is, along the U.S. Atlantic Ocean and Gulf of Mexico coasts where the basic wind speed is greater than 90 mph (ASCE 2005).

From a probabilistic standpoint, this value is associated with a mean recurrence interval of 50 years. Section C6.0 (Table C6-3) of the ASCE-SEI design standard provides conversion factors for estimating 3-second-gust wind speeds for other recurrence intervals (ASCE 2005). Based on this guidance, the 100-year return period value is determined by multiplying the 50-year return period value by a scaling factor of 1.07, which yields a 100-year return period 3-second-gust wind speed of approximately 161 mph. Additionally, using the guidance of RG 1.221 (U.S. NRC Oct 2011), it was determined that the nominal 3-second wind gust speed that can be expected to occur at the Turkey Point site with a return period of 1.0E07 years is 260 mph. The 3-second gust wind speed was determined by digitizing the contours from Figure 1 of RG 1.221, and overlaying the Turkey Point site location.

2.7.3.3 Tornadoes

The design basis tornado characteristics applicable to structures, systems, and components important to safety include the following parameters as identified in RG 1.76:

- Maximum wind speed
- Translational speed
- Maximum rotational speed
- Radius of maximum rotational speed
- Pressure drop
- Rate of pressure drop

Based on Figure 1 of RG 1.76 and the coordinates for the midpoint between the Units 6 & 7 shield buildings (see FSAR Subsection 2.1.1.2), the Turkey Point plant property is located within Tornado Intensity Region II. The design basis tornado characteristics for Tornado Intensity Region II (RG 1.76, Revision 1) that apply to the plant property are:

- Maximum wind speed = 200 mph
- Translational speed = 40 mph
- Maximum rotational speed = 160 mph
- Radius of maximum rotational speed = 150 feet
- Pressure drop = 0.9 pounds per square inch (psi)
- Rate of pressure drop = 0.4 psi/sec

Revision 1 of RG 1.76 retains the 1E-07 exceedance probability for tornado wind speeds, the same as the original version of that RG. Revision 2 of NUREG/CR-4461 describes the relationship between the previous use of the original Fujita scale of wind speed ranges for different tornado intensity classifications and the Enhanced Fujita Scale wind speed ranges in the revised analysis of tornado characteristics. That document was the basis for most of the technical revisions to RG 1.76.

Tornadoes observed within a 2-degree latitude and longitude square, centered on the Units 6 & 7 plant area, are used to characterize their frequency of occurrence from a climatological standpoint. The data was obtained from the NCDC *Storm Events* database of tornado occurrences by location, date, and time; starting and ending coordinates; Fujita-scale wind speed classification (or F-scale); Pearson-scale path length and path-width dimensions (or P-scale); and other storm-related statistics (NCDC 2008c).

The 2-degree square area for this evaluation includes all or portions of six counties in Florida. All tornado occurrences within the 2-degree latitude/longitude square were included. Through the nearly 58-year period from 1950 through 2007, the records in the database indicate that a total of 297 tornadoes occurred within the 2-degree latitude/longitude square (NCDC 2008c).

Tornado F-scale classifications (with corresponding wind speed range based on the original Fujita scale of wind speeds) and respective frequencies of occurrence are as follows:

Tornado F-Scale Classification	Corresponding Wind Speed Range in Meters Per Second	Respective Occurrences
F5	≥117 (261–318 mph)	0
F4	93 to 116 (207–260 mph)	0
F3	70 to 92 (158–206 mph)	4
F2	50 to 69 (113–157 mph)	17
F1	33 to 49 (73–112 mph)	65
F0	18 to 32 (40–72 mph)	211

Twelve of the tornadoes are assigned an undefined F-scale magnitude of “F” in the *Storm Events* database, because the begin location and end location are both unknown and most have no description of the incident available. and are assumed to be comparable to an F0 classification (NCDC 2008c).

Tornadoes have occurred in the area during every month of the year with a peak frequency occurring in the summer. On a monthly basis, the greatest number of events has been recorded in June, followed by the second-highest count during August, followed by the third highest count during May. The smallest amount of the tornadoes have occurred during the winter months (NCDC 2008c).

Tornadoes that occur over a body of water are called waterspouts. Waterspouts probably occur more frequently in the Florida Keys than anywhere else in the world (NWS Jan 2007). Waterspouts are generally broken into two categories: fair weather waterspouts and tornadic waterspouts. Tornadic waterspouts are simply tornadoes that form over water, or move from land to water. They have the same characteristics as a land tornado (NWS Jan 2007). The maximum rotational wind speed of waterspouts has been estimated to be as high as 219 miles per hour (AMS Mar 1977). Fair weather waterspouts are quite common over south Florida’s coastal waters from late spring to early fall. The term “fair weather” comes from the fact that this type of waterspout forms during fair and relatively calm weather, often during the early to mid-morning and sometimes during the late afternoon. Waterspouts can move onshore and become tornadoes and cause significant damage and injuries to people. However, typically, fair weather waterspouts dissipate rapidly when they make landfall, and rarely penetrate far inland (NWS Jan 2007).

It is estimated that the Florida Keys area experiences 50 to 500 waterspouts each year. In terms of waterspouts per unit area, the most active region after the Florida Keys is the entire southeast Florida coast from Stuart, Florida to Homestead, Florida (AMS Mar 1977). Conventional data-reporting sources for the Florida Keys area likely underestimate the actual yearly waterspout population. This tendency is likely present in the storm data compiled by the NCDC for the Florida Keys (Monroe County), which only reports 421 waterspouts for the period of record January 1, 1950 through April 30, 2008 (NCDC 2008b). The tendency for underreporting in the Florida Keys may be attributed to the fact that much of the population is concentrated in a few areas of much higher density, such as the city of Key West, and the duration of a waterspout is only approximately 14 minutes.

2.7.3.4 Hailstorms, Snowstorms, and Ice Storms

Frozen precipitation in the area typically occurs in the form of hail. The frequency of occurrence and characteristics of these types of weather events are based on the following two references: the latest version of *The Climate Atlas of the United States* (NCDC Sep 2002b), which has been developed from observations made over the 30-year period of record from 1961 to 1990, and the NCDC *Storm Events* database for Florida (NCDC 2009b) based on observations for the period of January 1950 to May 2008.

Though hail can occur at any time of the year in the area and is associated with well-developed thunderstorms, it has been observed primarily during late spring and the summer months (May through August), reaching a peak during May, and occurring least often from late fall through the winter months (December, January, and February) (NCDC 2008c).

The *Climate Atlas* (NCDC Sep 2002b) indicates that most of Miami-Dade County can expect, on average, hail with diameters of 0.75 inch or greater approximately one day per year. The *Climate Atlas* also shows a similar frequency in the eastern portions of the adjacent Broward County. However, a relatively lower frequency of occurrence is indicated for the west portion of Broward County and the extreme western and southern portions of Miami-Dade County (less than 0.5 days per year). Other nearby counties of Collier and Monroe, which are directly adjacent to the Gulf of Mexico, can expect 0.75-inch or greater hail about 0.5 days or less per year. The *Climate Atlas* indicates that the occurrence of hail with diameters greater than or equal to 1.0 inch is relatively less frequent over the area and confined to the northeastern portion of Miami-Dade County and the southeastern portion of Broward County (NCDC Sep 2002b).

NCDC cautions that hailstorm events are point observations and somewhat dependent on population density. This may explain the areal extent of higher frequencies around Miami-Dade and Broward Counties, and what could be interpreted as generally lower frequencies of occurrence in the other nearby counties. The slightly higher annual mean frequency of approximately 0.5 to 1 day per year with hail greater than or equal to 0.75 inch in diameter is considered to be a representative indicator for the Turkey Point site.

Hailstorm events within Miami-Dade and surrounding counties have generally reported maximum hailstone diameters ranging between 1.75 and 4.0 inches. Golf ball-size hail (approximately 1.75 inches in diameter) is not a rare occurrence, having been observed numerous times in the area (NCDC 2009b). However, in terms of extreme hailstorm events, the NCDC *Storm Events* database indicates that grapefruit- to softball-size hail (approximately 4.0 to 4.5 inches in diameter, respectively) was observed on March 29, 1963 (4.0 inches), in Miami-Dade County. The exact location of this event is unknown (NCDC 2009b).

Winters bring no accumulation of snowfall in southeastern Florida. Snow has never been reported at the Miami International Airport; however, snow was reported in January 1977, in Homestead, Florida. The total snowfall was estimated to be only 0.05 inches (USU 2008). However, notes made by the station observer indicate that the snow melted before reaching the ground (NOAA Jan 1977). This was during one of the worst mid-1970s cold waves and snow fell that day in several parts of Dade County, Florida, but not at the NWS office at the Miami International Airport, which is why the official records do not reflect the reports of snow.

The *Storm Events* database for Florida (NCDC 2009b) indicates that ice storms have not been reported in Broward, Collier, Monroe, or Miami-Dade Counties in the period January 1, 1950 through March 31, 2009. In addition, the *Climate Atlas* (NCDC Sep 2002b) indicates that the mean numbers of days per year with frozen precipitation in all counties of southeastern Florida is zero.

2.7.3.5 Tropical Cyclones

Tropical cyclones include not only hurricanes and tropical storms, but systems classified as tropical depressions, subtropical storms, subtropical depressions, and extratropical storms. This characterization considers all “tropical cyclones” (rather than systems classified only as hurricanes and tropical storms) because storm classifications are generally downgraded once landfall occurs and the system weakens, although they may still result in significant rainfall and extreme wind events as they travel through the region.

NOAA’s Coastal Services Center (NOAA-CSC) provides a comprehensive historical database, extending from 1851 through 2007, of tropical cyclone tracks based on information compiled by the National Hurricane Center. This database indicates that a total of 53 tropical cyclone centers or storm tracks (including extratropical storms) have passed within 100 nautical miles of Turkey Point, during this historical period (NOAA-CSC 2007). Storm classifications and respective frequencies of occurrence spanning this 157-year period of record are:

- Hurricanes — Category 5 (3), Category 4 (10), Category 3 (13), Category 2 (8), Category 1 (16)
- Extratropical storms — 3

Wind speeds (1-minute average) corresponding to each of the Saffir-Simpson Hurricane categories are listed below:

Saffir-Simpson Hurricane Categories	
Classification	Wind Speed (mph)
Category 1	74–95
Category 2	96–110
Category 3	111–130
Category 4	131–155
Category 5	>155

Tropical cyclones have occurred as early as June and as late as November. During the months of August through October, hurricanes occur with increasing frequency. Three Category 5 hurricanes tracked within 100 nautical miles of Turkey Point. Two were no-named hurricanes occurring in September of 1935 and September of 1947. Hurricane Andrew, the third Category 5 hurricane, occurred in August 1992.

Tropical cyclones are responsible for at least 14 separate rainfall records among the 17 NWS and cooperative observer network stations listed in Table 2.7-4, which includes eight 24-hour (daily) rainfall totals and 6 monthly rainfall totals (see Table 2.7-4). On August 26, 2005, a 24-hour record was set at the Perrine 4 W cooperative observing station as a result of Hurricane Katrina (15.1 inches) (SERCC Jun 2008a).

Monthly station records were established due to partial contributions from the following tropical cyclones (NOAA-CSC 2008):

- Hurricane Donna and Tropical Storm Florence in September 1960 (21.95 inches at Dania 4 WNW; 27.54 inches at Miami 12 SSW; 24.4 inches at Miami International Airport; and 29.5 inches at Perrine 4 W).

  Hurricane Donna was responsible for unprecedented damage as it moved along a path through the coastal areas of southern and western Florida. The first advisories for Donna were given on September 2, 1960 when it was located about 700 miles west of the Lesser

Antilles and had maximum winds estimated at 135 mph. The hurricane tracked west-northwestward and on September 10 moved into the central Florida Keys. The last report from the Tavenier station estimated the wind speed to be 135 mph. Wind gusts of 97 mph were reported at the Miami Airport Tower (NOAA-CSC 2008).

Florence intensified into a tropical storm on September 18, 1960 north of Puerto Rico and moved westward. Wind speeds reached 50 to 55 mph. The storm weakened the next day as it moved westward to the Florida Straits and just north of Cuba, then moved slowly northward over southern Florida on September 23 and 24 with accompanying heavy rains before turning northwestward and then into the Gulf of Mexico (NOAA-CSC 2008). This tropical storm was responsible for the 24-hour maximum rainfall (8.4 inches) at the Miami Beach cooperative observing station.

As indicated above, significant amounts of rainfall can still be associated with a tropical cyclone once the system moves inland. Wind speed intensity, however, noticeably decreases as the system passes over terrain and is subjected to increased frictional forces. Examples of such effects associated with some of the more intense tropical cyclones that have passed within 100 nautical miles of Turkey Point are:

- Hurricane Andrew (August 1992). Hurricane Andrew (Category 5) caused an estimated $26 billion in damage in the United States making it the most expensive natural disaster at that time in the United States. Andrew dropped sufficient rain to cause local floods even though the hurricane was relatively small and generally moved fast. Rainfall totals in excess of four to seven inches were recorded in southeast Florida. At landfall in southern Miami-Dade County, Florida, the central pressure was 922 millibars, which was the third lowest this century (after the 1935 Florida Keys Labor Day storm and Hurricane Camille in 1969) for a land falling hurricane in the U.S. The storm devastated Miami-Dade County then moved northwest across the Gulf of Mexico to make a second landfall in a sparsely populated area of south-central Louisiana as a Category 3 storm on August 26. Hurricane Andrew is historic because this is the first time that a hurricane significantly affected a commercial nuclear power plant. The eye of the storm, with sustained winds of up to 145 mph and gusts of 175 mph, passed over the Turkey Point plant property and caused extensive onsite and offsite damage. However, there was no damage to the safety-related systems of Units 3 & 4 except for minor water intrusion and some damage to insulation and paint (USNRC 1993).

- Hurricane Katrina (August 2005). Katrina was one of the strongest storms to impact the coast of the United States during the last 100 years. Hurricane Katrina developed initially as a tropical depression on August 23, 2005 and strengthened into Tropical Storm Katrina the next day. It then moved slowly along a northwesterly then westerly track through the Bahamas, increasing in strength during this time. A few hours before landfall in south Florida on August 25, Katrina strengthened to become a Category 1 hurricane. Landfall occurred between

Hallandale Beach and North Miami Beach, Florida, with maximum sustained winds of 81 mph. The storm continued to move southwest across the tip of the Florida peninsula. Katrina was responsible for the maximum reported 24-hour rainfall (15.1 inches) at the Perrine 4 W cooperative station on August 26, 2005 (SERC Jun 2008a). This observation agrees with an analysis conducted by NOAA's Climate Prediction Center that showed parts of the region received heavy rainfall, more than 15 inches in some locations, which caused localized flooding (NOAA-CSC 2008).

2.7.4 LOCAL METEOROLOGY AND TOPOGRAPHY

Data acquired by the NWS at its Miami International Airport, first-order station 16, and nearby cooperative network reporting stations, as compiled and summarized by the NCDC, the Utah State GIS Climate Search, Southeast Regional Climate Center (USU 2008; NCDC Feb 2002a; NCDC Sep 2002b; SERCC Jun 2008a and SERCC Jun 2008b), were used to characterize normals and period-of-record means and extremes of temperature, rainfall, and frozen precipitation in the vicinity of Units 6 & 7. Subsection 2.7.1.1 identifies the sources of these climatological summaries and other data resources. The approximate distances and directions of these climatological observing stations relative to the Units 6 & 7 plant area are listed in Table 2.7-1; their locations are shown in Figure 2.7-1.

As indicated in Subsection 2.7.1.1, first-order NWS stations also record measurements, typically every hour, of other weather elements, including winds, relative humidity, dew point, and wet bulb temperatures, barometric pressure, and other observations when those conditions occur (e.g., fog, thunderstorms).

Besides using data from these nearby climatological observing stations, measurements from the tower-mounted meteorological monitoring system that currently supports Units 3 & 4 were also used to characterize dispersion conditions. Refer to Subsections 6.4.2 and 6.4.3 for a description of relevant details about this pre-application monitoring program, including: tower location; terrain features and elevations in the vicinity of Units 6 & 7; instrumentation and measurement levels; data recording and processing; and system operation, maintenance, and calibration activities.

Sea breezes are an almost daily occurrence during the summer. However, their strength and degree of inland penetration vary daily depending on the direction and speed of the prevailing wind. Sea/land breeze circulations influence local temperature, humidity, wind speed, and wind direction and precipitation. The most notable sea breeze impacts are a shift in wind to the onshore direction, an increase in wind speed, a decrease in temperature, and an increase in humidity.

2.7.4.1 Normal, Mean, and Extreme Values

Subsection 2.7.1.3 summarizes normals and period-of-record means and extremes for several standard weather elements (i.e., temperature, atmospheric water vapor, precipitation, and wind conditions).

To substantiate that mean and extreme values at these stations, based on their long-term records of observations, are representative of conditions that might be expected at the Units 6 & 7 plant area, this subsection provides additional details regarding the individual station records from which the values presented in Subsection 2.7.1.3 were obtained.

Historical extremes of temperature, rainfall, and snowfall are listed in Table 2.7-4 for the NWS first-order station and cooperative observing stations in the Turkey Point area.

2.7.4.1.1 Temperature

Characteristics of the normal daily maximum and minimum temperatures, the daily mean temperatures, and the diurnal temperature ranges for the nearby climatological observing stations that make such measurements are addressed in Subsection 2.7.1.3.1 and presented in Table 2.7-3. The overall maximum and minimum temperature extremes observed in the Turkey Point area are summarized in Subsection 2.7.1.3.1 as well.

Extreme maximum temperatures recorded in the region have ranged from 96°F to 104°F for land-based observations, with the highest reading observed at the Flamingo Ranger Station on June 24, 1998. As Table 2.7-4 and the accompanying notes show, the record high temperature for several stations have been reached on two or three occasions, e.g., Homestead Experiment Station, Miami 12 SSW, Miami International Airport, Royal Palm Ranger Station, and Tavernier (NCDC 2004; NCDC Feb 2002a; NCDC July 2005; NCDC Feb 2006; USU 2008; SERCC Jun 2008a).

Extreme minimum temperatures in the region have ranged from 21°F to 42°F, with the lowest reading on record observed at the Pompano Beach cooperative station (approximately 57 miles to the north-northeast) on February 9, 1995. More noteworthy, though, Table 2.7-4 and the accompanying notes indicate that record low temperatures were also set at the NWS Miami International Airport, Flamingo Ranger Station, Miami Beach, Perrine 4 W, Tamiami Trail 40 Mile Bend, and Tavernier stations during a cold wave outbreak on December 24 and 25, 1989. Record minimum temperatures for the Fort Lauderdale, Fort Lauderdale Experiment Station, Miami 12 SSW, and Royal Palm Ranger cooperative stations were all set on January 20, 1977 (NCDC Feb 2002a; NCDC 2004; NCDC July 2005; NCDC Feb 2006; SERCC Jun 2008a; USU 2008).

The extreme maximum and minimum temperature data indicates that synoptic-scale conditions responsible for periods of record-setting excessive heat as well as significant cold air outbreaks tend to affect the overall Turkey Point area. The similarity of the respective extremes and their dates of occurrence suggest that these statistics are reasonably representative of the temperature extremes that might be expected to be observed at the Units 6 & 7 plant area.

2.7.4.1.2 Atmospheric Water Vapor

Annual, seasonal, and monthly characteristics of the wet bulb and dew point temperatures, along with relative humidity (including diurnal variations), based on measurements at the nearby Miami International Airport NWS station are described in Subsection 2.7.1.3.2.

2.7.4.1.3 Precipitation

Characteristics of the normal annual rainfall and snowfall totals for the 17 nearby land-based climatological observing stations reporting precipitation are described in Subsection 2.7.1.3.3 and presented in Table 2.7-3. The overall maximum daily and monthly totals observed in the Turkey Point area for these forms of precipitation are summarized in Subsection 2.7.1.3.3 as well.

Because precipitation is a point measurement, mean and extreme statistics, such as individual storm event, or daily or cumulative monthly totals vary from station to station. Assessing the variability of precipitation extremes across the area, in an effort to evaluate whether the available long-term data are representative of conditions at the site, largely depends on station coverage.

Historical precipitation extremes (rainfall and snowfall) are presented in Table 2.7-4 for the 17 nearby climatological observing stations. Maximum recorded 24-hour rainfall totals range from 7.5 inches at the Tamiami Trail 40 Mile Bend station, 38 miles northwest of the Turkey Point plant property, to 15.1 inches at the Perrine 4 W observing station, approximately 13 miles to the north-northwest. The maximum 24-hour rainfall total at the Perrine 4 W cooperative weather observing station (SERCC Jun 2008a) was directly associated with Hurricane Katrina. Maximum monthly rainfall totals range from 17.5 inches at Miami Beach, approximately 28 miles to the northeast, to 34.4 inches at the Pompano Beach observing station, approximately 57 miles to the north-northeast (USU 2008).

The 34.4 inches during October 1965 recorded at Pompano Beach represents the accumulation of 12 days of measurable precipitation during that month, with approximately 86 percent being recorded on October 14 (6.75 inches), October 15 (12.7 inches), and October 31 (10.01 inches). During the 2-day period of October 14 and 15, heavy rainfall was brought about by lifting of conditionally unstable layers of air to saturation as a result of a stationary front lingering over extreme southern Florida (NHRL Apr 1967; NOAA 2008b). On October 31, 1965, a persistence easterly wind flow off of the ocean resulted in occasional showers and thunderstorms (NOAA 2008b).

In general, when monthly rainfall records are established at a given weather observing station, regardless of their cause(s), significant amounts of precipitation are usually measured at most of the other stations in the site area, particularly when associated with the passage of tropical cyclones. This is usually not the case for maximum 24-hour rainfall records because of the occurrence of more local-scale events such as thunderstorms. For the 24-hour rainfalls from Table 2.7-4, the four most inland stations relative to easterly storms (Flamingo Ranger Station, Oasis Ranger Station, Royal Palm Ranger Station, and Tamiami Trail 40 Mile Bend) report significantly less rainfall than the other stations. They average 8.33 inches while the balance averages 11.73 inches. It is true that not all of the coastal stations report high consistently, but it is true the inland stations report low consistently.

Snow is far from common in southeast Florida and has never been reported at the Miami International Airport. However, snow was reported on January 19, 1977, in Homestead, Florida. The total snowfall was estimated to be 0.05 inches (USU 2008). This was during one of the worst mid-1970s cold waves and snow fell that day in several parts of Miami-Dade County, Florida, but not at the NWS office at the Miami International Airport, which is why the official records do not reflect the snow.

2.7.4.2 Fog

The closest station to the Turkey Point plant property at which observations of fog are made and routinely recorded is the Miami International Airport NWS station, approximately 25 miles to the north. The 2009 LCD summary for this station (Table 2.7-2) indicates an average of approximately 5 days per year of heavy fog conditions, based on a 45-year period of record. The NWS defines heavy fog as fog that reduces visibility to one-quarter mile or less.

On a seasonal basis, heavy fog conditions occur most often during the winter months (December through February), reaching peak frequency in January, and averaging 0.9 days per month. Heavy fog conditions occur least from May through September, averaging much less than one day per month (NCDC Feb 2009a).

The frequency of heavy fog conditions at the Units 6 & 7 plant area would be expected to be very similar to the Miami International Airport NWS station observations because of their proximity to each other (about 25 miles). This is consistent with the low frequency of occurrence reported in *The Climate Atlas of the United States* (NCDC Sep 2002b), which indicates an annual average frequency of 5.5 to 10.4 days per year in the area that includes the Turkey Point plant property. The seasonal variation is very similar to that in the 2009 LCD for the Miami International Airport NWS station (NCDC Feb 2009a).

Enhancement of naturally occurring fog conditions resulting from the operation of the Units 6 & 7 circulating water system and service water system cooling towers is addressed in Subsection 5.3.3.1.

2.7.4.3 Average Wind Direction and Wind Speed Conditions

The distribution of wind direction and wind speed is an important consideration when characterizing the dispersion climatology of a site. Long-term average wind motions at the macro- and synoptic scales (i.e., on the order of several thousand down to several hundred kilometers) are influenced by the general circulation patterns of the atmosphere at the macroscale and by large-scale topographic features (e.g., land-water interfaces such as coastal areas). These characteristics are addressed in Subsection 2.7.1.2.

Site-specific or microscale (i.e., 2 kilometers or less) wind conditions, while they may reflect these larger-scale circulation effects, are influenced primarily by local and, to a lesser extent, meso- or regional-scale (i.e., up to approximately 200 kilometers) topographic features. Wind measurements at these smaller scales are available from the onsite Units 3 & 4 meteorological monitoring program, and these were compared to data recorded at the Miami International Airport NWS station.

A description of the Units 3 & 4 meteorological monitoring program is provided in Section 6.4. Wind direction and wind speed measurements are made at two levels on a guyed 60-meter primary instrumented tower (the lower level at 10 meters and the upper level at 60 meters).

Figures 2.7-2 through 2.7-13 present annual and seasonal wind rose plots (i.e., graphical distributions of the direction from which the wind is blowing) and wind speeds for each of 16, 22.5-degree compass sectors centered on north, north-northeast, northeast, etc., for the 10- and 60-meter levels based on measurements for three annual periods (2002, 2005, and 2006). These years were selected as a period of data that is defendable, representative, and complete, but not older than 10 years from the date of the application, in accordance with RG 1.23.

As shown in Figure 2.7-2, the wind direction distribution at the 10-meter level generally follows an easterly orientation on an annual basis. The prevailing wind (i.e., the direction from which the wind blows most often) is from the east; with approximately 41 percent of the winds blowing from the east-northeast through east-southeast sectors. Conversely, winds from the west-northwest through west-southwest sectors occur approximately 7 percent of the time.

Seasonally, winds from the southeast quadrant predominate during the spring and summer seasons (March through August) (Figures 2.7-4 and 2.7-5). During the winter season, the prevailing wind direction shifts to the north-northwest because of increased cold frequency of frontal passages. Winds from the northeast quadrant predominate during the fall season

(September through November) (Figure 2.7-6). Plots of individual monthly wind roses at the 10-meter measurement level are presented in Figure 2.7-7, Sheets 1 to 12.

Wind rose plots based on measurements at the 60-meter level are shown in Figures 2.7-8 through 2.7-13. By comparison, wind direction distributions for the 60-meter level are fairly similar to the 10-meter level wind roses on composite annual and seasonal bases in terms of the predominant directional quadrants and variation over the course of the year. Plots of individual monthly wind roses at the 60-meter measurement level are presented in Figure 2.7-13, Sheets 1 to 12.

Wind information summarized in the LCD for the Miami International Airport NWS station (Table 2.7-2) indicates a prevailing southeast wind direction on an annual basis, as well as seasonal variations (NCDC Feb 2009a), that appear to be somewhat similar to the 10-meter level wind flow at the Turkey Point plant property. A comparison of monthly prevailing wind directions for both locations indicates that the prevailing winds are generally within the same quadrant at both locations. Differences between the two wind direction distributions are attributable to many factors such as topographic setting, sensor exposure, instrument threshold and accuracy, and length of record.

Table 2.7-6 summarizes seasonal and annual mean wind speeds based on measurements from the upper and lower levels of the meteorological tower operated in support of Units 6 & 7 during annual periods in 2002, 2005, and 2006, and from wind instrumentation at the Miami International Airport NWS station based on a 24-year period of record (NCDC Feb 2009a). The elevation of the wind instruments at the Miami International Airport NWS station is reasonably comparable to the lower level measurements at the Turkey Point plant property.

Annually, mean wind speeds at the 10- and 60-meter levels are 3.8 and 5.6 meters per second, respectively, at the Turkey Point plant property. The annual mean wind speed at the Miami International Airport (3.9 meters per second), is almost identical to the 10-meter level at Turkey Point, differing by only 0.1 meters per second. Seasonal average wind speeds at Miami International Airport are very similar throughout the year except during the winter and spring seasons when speeds average approximately 0.3 meters per second higher than those at Turkey Point. Seasonal mean wind speeds for both locations follow the same pattern described in Subsection 2.7.2.3 in relation to the seasonal variation of relatively higher air stagnation and restrictive dispersion conditions in the region. It should be noted that this is only a qualitative comparison since short term conditions at Turkey Point are compared to long-term trends at Miami.

There were few calm winds recorded by the Units 3 & 4 meteorological monitoring system at the 10-meter level and the 60-meter level during the annual periods in 2002, 2005, and 2006. [Note: Wind speeds greater than 0.5 mph (starting threshold of sensor) are considered non-calm winds.

However, 42 hours of actual calm conditions occurred over the 2002, 2005, and 2006 periods. These hours, however, were not considered valid and were not used in the meteorological data set.]

2.7.4.4 Wind Direction Persistence

Wind direction persistence is a relative indicator of the duration of atmospheric transport from a specific sector width to a corresponding downwind sector width that is 180 degrees opposite. Atmospheric dilution is directly proportional to the wind speed (other factors remaining constant). When combined with wind speed, a wind direction persistence/wind speed distribution further indicates the downwind sectors with relatively more or less dilution potential (higher or lower wind speeds, respectively) associated with a given transport wind direction.

Tables 2.7-7 and 2.7-8 present wind direction persistence/wind speed distributions (in hours) based on measurements from the Units 3 & 4 meteorological monitoring program for three annual periods (2002, 2005, and 2006). The distributions account for durations ranging from 1 hour to 48 hours for wind directions from 22.5-degree upwind sectors centered on each of the 16 standard compass radials (i.e., north, north-northeast, northeast, etc.) and for wind speed groups greater than or equal to 5, 10, 15, 20, 25, 30, 35, and 40 mph. Distributions are provided for wind measurements made at the lower (10-meter) and the upper (60-meter) tower levels, respectively, identified in the preceding subsection.

At the 10-meter level, the longest persistence period is 36 hours for winds from the east-northeast and southeast sectors. The durations appear only in the lowest two wind speed groups for wind speeds greater than or equal to 5 and 10 mph. Persistence periods lasting for at least 12 hours are indicated for several direction sectors for wind speeds greater than or equal to 5, 10, 15 and 20 mph, including winds from the northeast through south directions; and periods of 12 hour durations are also indicated from the north and north-northwest sectors for wind speed groups greater than or equal to 5 and 10 mph. For wind speeds greater than or equal to 25 mph, maximum persistence is limited to 4 hours.

At the 60-meter level, the longest persistence period is 36 hours and occurs for winds from the northeast, east-northeast, and north-northwest sectors (Table 2.7-8) for wind speeds greater than or equal to 5 and 10 mph and from the northeast sector for wind speeds greater than or equal to 15 and 20 mph. For wind speeds greater than or equal to 25 mph, maximum persistence periods are limited to 12 hours for winds from the northeast and east-southeast sectors.

2.7.4.5 Atmospheric Stability

Atmospheric stability is a relative indicator of the potential diffusion of pollutants released into the ambient air. Atmospheric stability is based on the delta temperature (ΔT) method defined in Table 1 of Revision 1 to RG 1.23.

The method classifies stability based on the temperature change with height (i.e., the difference in °C per 100 meters or ΔT). Stability classifications are assigned according to the following criteria:

- Extremely Unstable (Class A): ΔT ≤ –1.9°C
- Moderately Unstable (Class B): –1.9°C < ΔT ≤ –1.7°C
- Slightly Unstable (Class C): –1.7°C < ΔT ≤ –1.5°C
- Neutral Stability (Class D): –1.5°C < ΔT ≤ –0.5°C
- Slightly Stable (Class E): –0.5°C < ΔT ≤ +1.5°C
- Moderately Stable (Class F): +1.5°C < ΔT ≤ +4.0°C
- Extremely Stable (Class G): +4.0°C < ΔT

The diffusion capacity is greatest for extremely unstable conditions and decreases progressively through the remaining unstable, neutral, and stable classifications.

During the 3-year period of record that includes calendar years 2002, 2005, and 2006 at Turkey Point, ΔT was determined from the difference between temperature measurements made at the 60- and 10-meter tower levels. Seasonal and annual frequencies of atmospheric stability class and associated 10-meter level mean wind speeds for this period of record are presented in Table 2.7-9.

The data in Table 2.7-9 indicates a predominance of neutral stability (Class D) and slightly stable (Class E) conditions throughout the year, 28.5 percent and 36.5 percent of the time for these stability classes, respectively, and 65 percent combined. Extremely unstable conditions (Class A) are more frequent during the spring and occur least often during the summer and autumn months. Such extremely unstable conditions are attributed to relatively lower mean wind speeds and greater insolation in the summer and higher mean wind speeds and lesser insolation in the spring. Extremely stable conditions (Class G) are most frequent during the winter (approximately 10 percent of the time), owing in part to increased radiational cooling at night, and occur least often during the summer months.

Joint frequency distributions of wind speed and wind direction by atmospheric stability class and for all stability classes combined for the 10-meter and 60-meter wind measurement levels at Turkey Point are presented in Table 2.7-10 and Table 2.7-11 respectively, for the 3-year period of record that includes calendar years 2002, 2005, and 2006. The 10-meter level joint frequency distributions are used to evaluate short-term dispersion estimates for accidental atmospheric releases (see Subsection 2.7.5) and to evaluate long-term diffusion estimates of routine releases to the atmosphere (see Subsection 2.7.6).

2.7.4.6 Topographic Description

The Turkey Point plant property is an 9400-acre tract in a rural area of Miami-Dade County, Florida. Units 6 & 7 would be constructed on 218 acres south of Units 3 & 4. The combined power block footprints of Units 6 & 7 encompass an area of approximately 6 acres. The finished grade of Units 6 & 7 is approximately elevation 25.5 feet (NAVD 88).

Terrain features within 50 miles, based on digital map elevations, are illustrated in Figure 2.7-1. Terrain elevation profiles along each of the 16 standard 22.5-degree compass radials out to a distance of 50 miles are shown in Figure 2.7-14, Sheets 1 through 6. Because Units 6 & 7 are relatively close to one another and because of the distance covered by these profiles, the locus of these radial lines is the center point between the Units 6 & 7 power block buildings.

The Turkey Point plant property lies on the lower east coast of Florida within the Atlantic Coastal Ridge, which is generally a flat stretch of land that borders the Atlantic Ocean. The terrain within 50 miles is generally flat with elevations decreasing to the west through the south as the Florida Everglades and adjacent bay waters are reached. Terrain elevations tend to increase to the west-northwest through the north-northeast from the plant area with maximum relief of up to approximately 60 feet relative to the finished plant grade. Figure 2.7-1 indicates that the highest elevation within 50 miles is 86.12 feet above MSL (this spot elevation does not fall along one of the 16 standard direction radials presented in Figure 2.7-14). Figure 2.7-1 also indicates that the lowest elevation within 50 miles, 2.49 feet below MSL, is to the northeast of the Turkey Point plant property.

More detailed topographic features within 5 miles of Units 6 & 7, also based on digital map elevations, are shown in Figure 2.7-15. Terrain within this radial distance primarily consists of flat plains with very little elevation change relative to nominal plant grade.

While there would be clearing, grubbing, excavation, leveling, and landscaping activities associated with the construction of Units 6 & 7 (see Section 3.9), these alterations to the existing terrain would be localized and would not represent a significant change to the flat to gently rolling topographic character of the vicinity or the surrounding area. Neither the mean and extreme climatological characteristics of the area nor the meteorological characteristics of the Turkey Point plant property and vicinity would be affected as a result of plant construction.

The dimensions and operating characteristics of the facilities associated with Units 6 & 7, including paved, concrete, or other improved surfaces, are insufficient to generate discernible, long-term effects to local- or microscale meteorological conditions, or to the mean and extreme climatological characteristics of the area addressed previously in Subsection 2.7.4.1.

Wind flow would be altered in areas immediately adjacent to and downwind of larger structures. However, these effects would likely dissipate within ten structure heights downwind of the intervening structure(s). Similarly, while ambient temperatures immediately above any improved surfaces could increase, these temperature effects will be too limited in their vertical profile and horizontal extent to alter local-, area-, or regional-scale mean or extreme ambient temperature patterns.

Units 6 & 7 would use mechanical draft cooling towers as a means of heat dissipation during normal operation. Potential meteorological effects as a result of the cooling towers could include localized enhanced ground-level fogging, cloud shadowing and precipitation enhancement, and increased ground-level humidity. These localized effects are addressed in Subsections 5.3.3.1 and 5.3.3.2.

2.7.5 SHORT-TERM DIFFUSION ESTIMATES

2.7.5.1 Regulatory Basis and Technical Approach

To evaluate potential health effects of postulated design basis accidents at Units 6 & 7, the NRC-sponsored PAVAN computer code (NUREG/CR-2858) was used to estimate relative ground-level atmospheric concentrations (X/Q) at the exclusion area boundary (EAB) and low population zone (LPZ) for postulated accidental releases of radioactive material. According to Subsection B of RG 1.23, the recommended meteorological data for a combined license which does not reference an early site permit is a consecutive 24-month period of data that is defendable, representative, and complete, but not older than 10 years from the date of application.

The 2002, 2005, and 2006 period of data taken was determined to be the best available (using validated data with least data substitution), representative (tower and sensor siting in accordance with RG 1.23, Revision 1), and complete (with annualized composite data recovery of 90 percent), without being older than 10 years. Because RG 1.23, Revision 1 specifies that more years of data is preferable, three years (i.e., 2002, 2005, and 2006) of data was used in characterizing the atmospheric conditions for Units 6 & 7.

According to 10 CFR Part 100, it is necessary to consider the doses for various time periods immediately following the onset of a postulated ground-level release at the EAB and for the duration of the exposure for the LPZ and the population center distances. Therefore, the relative atmospheric dispersion factors (X/Qs) are estimated for various time periods ranging from 2 hours to 30 days.

Meteorological data was used to determine various postulated accident conditions as recommended in RG 1.145. Compared to an elevated release, a ground-level release usually results in higher ground-level concentrations at downwind receptors as a result of less dispersion and shorter traveling distances. The ground-level release scenario provides a bounding case, and none of the release heights are higher than 2.5 times the height of the nearby reactor building, elevated releases were not considered.

The PAVAN program implements the guidance provided in RG 1.145. Primarily, the code computes X/Q values at the EAB and LPZ for each combination of wind speed and atmospheric stability class for each of 16 downwind direction sectors (i.e., north, north-northeast, northeast, etc.). The X/Q values calculated for each direction sector are then ranked in descending order, and an associated cumulative frequency distribution is derived based on the frequency distribution of wind speeds and stabilities for the complementary upwind direction sector. The X/Q value that is equaled or exceeded 0.5 percent of the total time becomes the maximum sector-dependent X/Q value.

The calculated X/Q values were also ranked independently of wind direction to develop a cumulative frequency distribution for the entire site. The PAVAN program then selects the X/Qs that equaled or exceeded 5 percent of the total time.

The larger of the two values (i.e., the maximum sector-dependent 0.5 percent X/Q or the overall site 5 percent X/Q value) is used to represent the X/Q value for a 0–2 hour time period. To determine X/Qs for longer time periods, the program calculates an annual average X/Q value using the procedure described in RG 1.111. The program then uses logarithmic interpolation between the 0–2 hour X/Qs for each sector and the corresponding annual average X/Q to calculate the values for intermediate time periods (i.e., 0–8 hours, 8–24 hours, 1–4 days, and 4–30 days). As suggested in NUREG/CR-2858, each of the sector-specific 0–2 hour X/Q values provided in the PAVAN output file were examined for “reasonability” by comparing them with the ordered X/Q values presented in the model output.

The PAVAN model was configured to calculate offsite X/Q values assuming both “wake credit allowed” and “wake credit not allowed”. Several sector distances from the power block area (PBA) to the EAB (NE, ENE, E, SE, and ESE) are within the building wake influence zone. No building wake credit was taken for EAB receptors within the building wake influence zone to ensure conservative results. Also, because the LPZ is farther away from the units than the EAB, the “wake-credit not allowed” scenario of the PAVAN results was used for the X/Q analyses at both the EAB and the LPZ.

The following input data and assumptions were used in the PAVAN modeling analysis:

- Meteorological data: 3-year (2002, 2005, and 2006) onsite joint frequency distributions of wind speed, wind direction, and atmospheric stability
- Wind sensor height: 10 meters (33 feet)
- Vertical temperature difference: (10 meters–60 meters)

- Number of wind speed categories in joint frequency distributions: 13
- Minimum reactor building cross-sectional area: 2636 square meters
- Type of release: Ground-level (model-designated)
- Distances from release point to EAB for all downwind sectors
- Distances from release point to LPZ for all downwind sectors

The PAVAN model uses building cross-sectional area and containment height to estimate wake-related X/Q values. If the EAB and the LPZ are both located beyond the building wake influence zone, these two input parameters have no effect in calculating the non-wake X/Q values.

The joint frequency distribution (JFD) input to the PAVAN dispersion modeling analysis are presented in Table 2.7-10 (see also Subsection 2.7.4.4 for additional information). There were no hours of calm wind conditions at the 10-meter measurement level during the period of record.

2.7.5.2 PAVAN Modeling Results

For modeling convenience, Units 6 & 7 were conservatively treated as one unit in estimating the shortest distance to each boundary receptor in each direction. This was done by using a source boundary which encloses both Units 6 & 7. Using the source boundary approach, the shortest distance from the source boundary to the EAB is presented in Table 2.7-12 for each of the 16 direction sectors.

The maximum direction-dependent 0.5 percent X/Q value and the overall 5 percent X/Q value were conservatively estimated using the source boundary concept. Similarly, the shortest distances from the source boundary to the LPZ were used in the PAVAN modeling run to determine the X/Q values at the LPZ.

Based on the PAVAN modeling results, the maximum 0-2 hour, 0.5 percent, direction-dependent X/Q value was compared with 5 percent overall site 0-2 hour X/Q value at the EAB. The higher of the two was used as the proper X/Q at the EAB for each time period. The same approach was used to determine the proper X/Qs at the LPZ.

Tables 2.7-13 (EAB without and with wake credit) and 2.7-14 (LPZ with no wake credit) present the X/Qs for each of the 16 downwind sectors for the appropriate time period(s). The overall site 5 percent X/Q (s/m^3) value at either the EAB (with or without wake credit for select sectors) or the

LPZ is higher than the sector-dependent 0.5 percent X/Q (s/m^3) value. These values are summarized below.

Receptor Location	X/Q 0–2 hours	X/Q 0–8 hours	X/Q 8–24 hours	X/Q 1–4 days	X/Q 4–30 days	X/Q Annual Average
EAB	4.19E-04	+	+	+	+	+
DCD Value	5.1E-04	Not provided	Not provided	Not provided	Not provided	Not provided
LPZ	+	1.87E-5	1.25E-5	5.25E-6	1.51E-6	+
DCD Value	Not provided	2.2E-04	1.6E-04	1.0E-04	8.0E-05	Not provided

Table Notes: + The value is not provided because there is no equivalent DCD value.

As required in Section 7.1, below are the 50 percent X/Q values at the EAB and LPZ:

Receptor Location	X/Q 0–2 hours	X/Q 0–8 hours	X/Q 8–24 hours	X/Q 1–4 days	X/Q 4–30 days	X/Q Annual Average
EAB	1.89E-04	1.38E-04	1.18E-04	8.40E-05	5.15E-05	2.83E-05
LPZ	9.18E-06	5.29E-06	4.02E-06	2.21E-06	9.39E-07	3.29E-07

2.7.6 LONG-TERM (ROUTINE) DIFFUSION ESTIMATES

2.7.6.1 Regulatory Basis and Technical Approach

This subsection provides estimates of annual average atmospheric dispersion factors (X/Q values) and relative dry deposition factors (D/Q values) to a distance of 50 miles (80 kilometers) for annual average release limit calculations and person-rem estimates.

The NRC-sponsored XOQDOQ computer program (NUREG/CR-2919) was used to estimate X/Q and D/Q values from routine releases of gaseous effluents to the atmosphere. The XOQDOQ computer code has the primary function of calculating annual average X/Q and D/Q values at receptors of interest (e.g., EAB, nearest milk animal, nearest resident, nearest vegetable garden, and nearest meat animal).

The XOQDOQ dispersion model implements the assumptions outlined in RG 1.111. The program assumes that the material released to the atmosphere follows a Gaussian distribution around the plume centerline. In estimating concentrations for longer time periods, the Gaussian distribution is assumed to be evenly distributed within a given directional sector. A straight-line trajectory is assumed between the release point and all receptors.

Since the NRC-sponsored XOQDOQ model was used in the analysis, diffusion parameters (σ_y and σ_z) as specified in RG 1.145 and implemented by the XOQDOQ code were used in estimating the X/Q and D/Q values. The following input data and assumptions was used in the XOQDOQ modeling analysis:

- Meteorological data: 3-year (2002, 2005, and 2006) onsite joint frequency distributions of wind speed, wind direction, and atmospheric stability (see Table 2.7-5)
- Type of release: Ground-level
- Wind sensor height: 10 meters
- Vertical temperature difference: (10 meters–60 meters)
- Number of wind speed categories: 13
- Release height: 10 meters
- Minimum Shield Building cross-sectional area: 2636 square meters
- Shield Building height: 69.7 meters above grade
- Distances from the release point to the nearest residence, EAB, vegetable garden, milk animal, and meat animal

No residential milk cows have been identified within 5 miles of the Turkey Point plant property, and no dairies have been identified within 50 miles. It was conservatively assumed that all residents have a vegetable garden and are raising beef cattle for residential consumption.

The AP1000 standard plant design was used to calculate the minimum building cross-sectional area as called for in NUREG/CR-2919 for evaluating building downwash effects on dispersion. Therefore, based on the width (43.3 meters) and height above grade (60.9 meters – normalized for building taper) of the shield building, the cross-sectional area (normalized to a rectangle) of the shield structure was calculated to be 2636 square meters.

Distances from Units 6 & 7 to various receptors of interest (i.e., nearest residence, meat animal, EAB, and vegetable garden) are presented in Table 2.7-15.

As described in Subsection 2.7.5, site-specific meteorological data covering the 3-year period of record (2002, 2005, and 2006) was used to quantitatively evaluate diffusion estimates. Therefore, the lower level (10 meters) joint frequency distributions of wind speed, wind direction, and atmospheric stability (based on 60 meter and 10 meter data) were used as input in the XOQDOQ modeling analysis.

2.7.6.2 XOQDOQ Modeling Results

Table 2.7-16 summarizes the maximum relative concentration and relative deposition (i.e., X/Q and D/Q) values predicted by the XOQDOQ model for identified sensitive receptors of interest in the area as a result of routine releases of gaseous effluents. The listed maximum X/Q values reflect several plume depletion scenarios that account for radioactive decay: no decay and the default half-life decay periods of 2.26 and 8 days.

The overall maximum annual average X/Q value with no decay is 1.70E-05 seconds/cubic meter and occurs at the EAB along the south-southeast, southeast, and west sectors as a result of releases from the PBA. The maximum annual average X/Q values (along with the direction and distance of the receptor locations relative to Units 6 & 7) for the other sensitive receptor types are:

- 1.4E-07 seconds/cubic meter for the nearest resident occurring in the north sector at a distance of 2.7 miles
- 9.6E-08 seconds/cubic meter for the nearest vegetable garden occurring in the northwest sector at a distance of 4.8 miles

Tables 2.7-17 and 2.7-18 summarize the annual average X/Q values (for no decay) and D/Q values, respectively, for the 22 standard radial distances between 0.25 miles and 50 miles, and for the 10 distance-segment boundaries between 0.5 miles and 50 miles downwind along each of the 16 standard direction radials separated by 22.5 degrees. Table 2.7-19 summarizes X/Q values and D/Q values for the receptors of interest.

2.7.7 NOISE

An ambient noise monitoring survey was performed in June 2008 to assess the existing ambient noise in areas adjacent to the Turkey Point units. The purpose of the noise survey was to determine baseline noise impacts at and around the Units 6 & 7 plant area, at the Turkey Point plant property boundary, and offsite receptors. The location of the noise monitoring sites is shown in Figure 2.7-16. The receptors of primary concern are the nearest residences to the northwest, the day care facility to the west, and Homestead Bayfront Park to the north.

The field effort to collect the baseline noise level data was conducted on June 3 and 4, 2008, during the daytime and nighttime. The survey consisted of measuring the background noise levels at eight locations both onsite and offsite spanning a 2-day period.

Six of the eight monitoring locations (monitoring sites S1, S4, S5, S6, S7, and S8) were selected to delineate the existing noise levels produced by the existing units as well as other noise sources at the Turkey Point plant property boundary and at the nearest public receptors. Additionally, monitoring sites S2 and S3 were selected to delineate the existing onsite noise levels produced solely by the existing units and were located on the transmission line to the northwest of Unit 5. Monitoring sites S4 and S5 were located approximately 1.6 miles northwest and 2 miles north, respectively, from the existing units. These monitoring sites were chosen to delineate the noise levels at or near the plant property boundaries, and are the closest public access to Turkey Point. Monitoring sites S6, S7, and S8 were located at the day-care facility to the west, at the Homestead Bayfront Park entrance, and at the nearest residence, respectively. Monitoring site S1 was located at the southeast corner of the Homestead Miami Speedway. Background measurements for Units 6 & 7 were collected while Units 1, 2, 3, 4, and 5 were operating at base load.

The baseline daytime sound pressure level (noise level equivalent [Leq]) measurements for the monitoring locations within and near the Turkey Point plant property boundary (monitoring sites S2, S3, S4, and S5) ranged from a low of 44 dBA at site S5 to a high of 68 dBA at site S3. The nighttime Leq measurements ranged from a low of 47 dBA at site S5 to a high of 67 dBA at site S3. These monitoring sites are closest to Unit 5, which had an audible contribution. Also contributing to the observed sound levels were transient noise sources such as traffic, birds, insects, and wind.

The baseline daytime Leq measurements for the monitoring locations beyond the plant property boundary (monitoring sites S1, S6, S7, and S8) ranged from a low of 46 dBA at site S7 to a high of 67 dBA at site S8. The contributing audible noise sources to the highest observed noise levels at site S8, the nearest residence, were transient noises that included traffic, birds, insects, and wind. The nighttime Leq measurements beyond the plant property boundary ranged from a low of 41 dBA at site S7 to a high of 56 dBA at site S1. The contributing audible noise sources to the highest observed noise levels at site S1 were transient noises that included insects, wind noise, and traffic.

Section 2.7 References

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Table 2.7-1
NWS and Cooperative Observing Stations Near Units 6 & 7

Station	County	Approximate Distance (miles)	Direction Relative to Units 6 & 7 Plant Area	Elevation (feet)
Dania 4 WNW	Broward	46	NNE	10
Flamingo Ranger Station	Monroe	41	SW	3
Fort Lauderdale	Broward	47	NNE	16
Fort Lauderdale Exp Station	Broward	46	N	10
Hialeah	Miami-Dade	27	N	12
Homestead Exp Station	Miami-Dade	12	NW	11
Kendall 2 E	Miami-Dade	18	NNE	20
Miami Beach	Miami-Dade	28	NE	5
Miami 12 SSW[(a)]	Miami-Dade	16	NNE	10
Miami 12 SSW[(b)]	Miami-Dade	16	NNE	10
Miami International Airport[(c)]	Miami-Dade	25	N	29
Oasis Ranger Station	Collier	53	NW	8
Perrine 4 W	Miami-Dade	13	NNW	10
Pompano Beach	Broward	57	NNE	15
Royal Palm Ranger Station	Miami-Dade	17	WSW	7
Tamiami Trail 40-Mile Bend	Miami-Dade	38	NW	15
Tavernier	Monroe	31	SSW	7

(a) Period of record 1933–1958
(b) Period of record 1958–1988
(c) National Weather Service First-Order-Station

Table 2.7-2
2008 Local Climatological Data Summary for Miami International Airport

NORMALS, MEANS, AND EXTREMES
MIAMI (KMIA)

LATITUDE: 25 ° 49'N LONGITUDE: -80 ° 17'W ELEVATION (FT): GRND: 6 BARO: 29 TIME ZONE: EASTERN (UTC -5) WBAN: 12839

	ELEMENT	POR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
TEMPERATURE °F	NORMAL DAILY MAXIMUM	30	76.5	77.7	80.7	83.8	87.2	89.5	90.9	90.6	89.0	85.4	81.2	77.5	84.2
	MEAN DAILY MAXIMUM	61	75.7	77.1	79.8	82.7	85.9	88.1	89.6	89.9	88.3	85.0	80.5	77.0	83.3
	HIGHEST DAILY MAXIMUM	66	88	89	93	96	96	98	98	98	97	95	91	87	98
	YEAR OF OCCURRENCE		1987	2008	2003	1971	2008	1985	1998	1990	1987	1980	2002	1989	JUL 1998
	MEAN OF EXTREME MAXS.	61	83.5	85.3	87.7	90.0	91.3	92.8	93.4	93.8	92.3	89.8	86.0	83.7	89.1
	NORMAL DAILY MINIMUM	30	59.6	60.5	64.0	67.6	72.0	75.2	76.5	76.5	75.7	72.2	67.5	62.2	69.1
	MEAN DAILY MINIMUM	61	59.7	61.1	64.4	68.0	72.0	74.9	76.5	76.6	75.9	72.4	66.6	61.9	69.2
	LOWEST DAILY MINIMUM	66	30	32	32	46	53	60	69	68	68	51	39	30	30
	YEAR OF OCCURRENCE		1985	1947	1980	1971	1945	1984	2002	1950	1983	1943	1950	1989	DEC 1989
	MEAN OF EXTREME MINS.	61	42.4	45.8	49.3	56.7	64.2	70.0	72.1	72.3	71.9	63.0	52.6	45.5	58.8
	NORMAL DRY BULB	30	68.1	69.1	72.4	75.7	79.6	82.4	83.7	83.6	82.4	78.8	74.4	69.9	76.7
	MEAN DRY BULB	61	67.7	69.1	72.2	75.4	79.0	81.6	83.0	83.3	82.1	78.7	73.6	69.5	76.3
	MEAN WET BULB	25	62.0	63.3	64.8	66.7	71.1	75.0	76.0	76.4	75.8	72.3	67.9	64.1	69.6
	MEAN DEW POINT	25	59.1	60.3	61.7	63.4	68.3	73.0	73.9	74.4	74.0	70.1	65.5	61.2	67.1
	NORMAL NO. DAYS WITH:														
	MAXIMUM >= 90	30	0.0	0.0	0.3	1.7	4.8	10.8	18.0	16.9	10.8	2.6	0.0	0.0	65.9
	MAXIMUM <= 32	30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	MINIMUM <= 32	30	0.1	0.0	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2
	MINIMUM <= 0	30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
H/C	NORMAL HEATING DEG. DAYS	30	52	39	15	1	0	0	0	0	0	0	4	38	149
	NORMAL COOLING DEG. DAYS	30	133	154	236	315	442	510	568	568	517	433	291	194	4361
RH	NORMAL (PERCENT)	30	73	71	70	67	71	76	74	76	78	75	74	73	73
	HOUR 01 LST	30	81	80	78	76	79	83	82	83	84	82	81	80	81
	HOUR 07 LST	30	85	84	82	79	80	83	83	85	87	85	84	84	83
	HOUR 13 LST	30	59	57	56	54	58	65	63	65	66	63	63	60	61
	HOUR 19 LST	30	70	68	66	64	69	74	72	75	77	73	72	71	71
S	PERCENT POSSIBLE SUNSHINE	20	66	68	74	76	72	68	72	71	70	70	67	63	70
W/O	MEAN NO. DAYS WITH:														
	HEAVY FOG(VISBY <= 1/4 MI)	45	0.9	0.6	0.5	0.4	0.2	0.2	0.1	0.1	0.2	0.3	0.5	0.7	4.7
	THUNDERSTORMS	61	0.9	1.1	1.8	2.8	6.3	12.5	14.6	15.4	11.4	4.3	1.0	0.6	72.7
CLOUDINESS	MEAN:														
	SUNRISE-SUNSET (OKTAS)	48	4.3	4.2	4.3	4.2	4.6	5.4	5.1	5.1	5.3	4.6	4.3	4.2	4.6
	MIDNIGHT-MIDNIGHT (OKTAS)	32	3.8	3.8	3.8	3.5	4.1	4.9	4.4	4.4	4.7	4.0	3.8	3.6	4.1
	MEAN NO. DAYS WITH:														
	CLEAR	47	9.2	8.6	8.5	8.4	6.3	3.1	2.6	2.5	2.1	6.6	7.5	8.9	74.3
	PARTLY CLOUDY	47	13.1	12.1	14.1	14.9	15.3	14.3	17.4	17.8	15.5	14.3	14.0	12.9	175.7
	CLOUDY	47	8.7	7.6	8.3	6.7	9.3	12.6	11.0	10.7	12.4	10.1	8.5	9.1	115.0
PR	MEAN STATION PRESSURE(IN)	25	30.10	30.07	30.04	30.00	29.98	30.00	30.04	29.99	29.94	29.96	30.03	30.08	30.02
	MEAN SEA-LEVEL PRES. (IN)	25	30.12	30.09	30.06	30.02	30.00	30.02	30.06	30.01	29.96	29.98	30.05	30.10	30.04
WINDS	MEAN SPEED (MPH)	25	8.9	9.2	10.1	9.8	9.1	7.8	7.6	7.4	7.8	8.9	9.3	8.6	8.7
	PREVAIL.DIR(TENS OF DEGS)	40	35	12	12	11	09	12	12	11	11	06	10	35	12
	MAXIMUM 2-MINUTE:														
	SPEED (MPH)	12	30	55	43	37	43	41	41	60	43	69	36	29	69
	DIR. (TENS OF DEGS)		09	19	26	16	10	14	10	13	10	15	18	22	15
	YEAR OF OCCURRENCE		1998	1998	2003	2008	1999	2007	2005	2005	1998	2005	1998	1997	OCT 2005
	MAXIMUM 3-SECOND														
	SPEED (MPH)	12	40	104	51	52	63	53	55	78	51	92	44	40	104
	DIR. (TENS OF DEGS)		26	19	26	15	33	14	04	12	28	15	31	23	19
	YEAR OF OCCURRENCE		2004	1998	2003	2008	1998	2007	2008	2005	2004	2005	1998	1997	FEB 1998
PRECIPITATION	NORMAL (IN)	30	1.88	2.07	2.56	3.36	5.52	8.54	5.79	8.63	8.38	6.19	3.43	2.18	58.53
	MAXIMUM MONTHLY (IN)	66	6.66	8.07	10.57	17.29	18.54	22.36	13.51	16.88	24.40	21.64	13.84	6.39	24.40
	YEAR OF OCCURRENCE		1969	1983	1986	1979	1968	1968	1947	1943	1960	1991	1992	1958	SEP 1960
	MINIMUM MONTHLY (IN)	66	0.04	0.01	0.02	0.05	0.44	1.81	1.77	1.65	2.63	0.72	0.09	0.12	0.01
	YEAR OF OCCURRENCE		1951	1944	1956	1981	1965	1945	1963	1954	1951	2002	1970	1988	FEB 1944
	MAXIMUM IN 24 HOURS (IN)	66	2.68	5.73	7.07	16.21	11.59	8.20	4.67	6.92	7.58	12.66	8.01	5.26	16.21
	YEAR OF OCCURRENCE		1973	1966	1949	1979	1977	1977	2003	1964	1960	2000	1992	2000	APR 1979
	NORMAL NO. DAYS WITH:														
	PRECIPITATION >= 0.01	30	7.5	6.8	6.2	6.1	10.3	15.6	16.0	18.9	17.4	13.4	9.0	7.3	134.5
	PRECIPITATION >= 1.00	30	0.4	0.5	0.8	0.9	1.4	2.7	1.6	2.5	2.7	1.7	0.9	0.5	16.6
SNOWFALL	NORMAL (IN)	30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	MAXIMUM MONTHLY (IN)	5	0.0	0.0	0.0	0.0	T	0.0	0.0	0.0	0.0	0.0	0.0	0.0	T
	YEAR OF OCCURRENCE						1998								MAY 1998
	MAXIMUM IN 24 HOURS (IN)	59	0.0	0.0	0.0	0.0	T	0.0	0.0	0.0	0.0	0.0	0.0	0.0	T
	YEAR OF OCCURRENCE						1998								MAY 1998
	MAXIMUM SNOW DEPTH (IN)	53	0	0	0	0	0	0	0	0	0	0	0	0	0
	YEAR OF OCCURRENCE														
	NORMAL NO. DAYS WITH:														
	SNOWFALL >= 1.0	30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

published by: NCDC Asheville, NC 3 30 year Normals (1971-2000)

Source: NCDC Feb 2009a

Table 2.7-3
Climatological Normals at Selected NWS and Cooperative Observing Stations in Units 6 & 7 Area

Station	Normal Annual Temperatures (°F)				Normal Annual Precipitation	
	Mean Monthly Maximum	Mean Monthly Minimum	Mean Monthly Range	Mean Monthly Mean	Rainfall (inches)	Snowfall (inches)
Dania 4 WNW	NA	NA	NA	NA	54.7[b]	0.0[b]
Flamingo Ranger Station	84.3[a]	66.1[a]	18.2	75.2[a]	47.5[a]	0.0[b]
Fort Lauderdale	83.4[a]	68.3[a]	15.1	75.9[a]	64.2[a]	0.0[b]
Fort Lauderdale Experiment Station	83.5[b]	64.1[b]	19.4	73.8[b]	60.9[b]	0.0[b]
Hialeah	85.3[a]	71.4[a]	13.9	78.4[a]	66.0[a]	0.0[b]
Homestead Experiment Station	84.1[c]	65.5[c]	18.6	74.8[c]	58.2[c]	0.0[b]
Kendall 2 E	NA	NA	NA	NA	61.6[b]	0.0[b]
Miami Beach	80.3[a]	71.3[a]	9.0	75.9[a]	46.6[a]	0.0[b]
Miami 12 SSW (POR 1931–1958)	83.4[b]	66.3[b]	17.1	74.9[d]	55.8[b]	0.0[b]
Miami 12 SSW (POR 1958–1988)	82.9[b]	66.3[b]	16.6	74.6[d]	57.2[b]	0.0[b]
Miami International Airport	84.2[a]	69.1[a]	15.1	76.7[a]	58.5[a]	0.0[b]
Oasis Ranger Station	85.7[b]	65.9[b]	19.8	75.8[d]	58.8[c]	0.0[b]
Perrine 4 W	83.2[b]	64.9[b]	18.5	74.1[d]	61.6[c]	0.0[b]
Pompano Beach	84.5[a]	67.5[a]	17.0	76.0[a]	57.3[a]	0.0[b]
Royal Palm Ranger Station	84.9[a]	65.3[a]	19.6	75.1[a]	55.6[a]	0.0[b]
Tamiami Trail 40 Mile Bend	85.6[a]	66.0[a]	19.6	75.8[a]	51.6[a]	0.0[b]
Tavernier	82.4[a]	71.0[a]	11.4	76.7[a]	44.8[a]	0.0[b]

(a) NCDC July 2005
(b) SERCC Jun 2008a and SERCC Jun 2008b
(c) NCDC Feb 2002a
(d) Value calculated as the mean of Mean Annual Maximum and Mean Annual Minimum
NA — Not Available

Table 2.7-4 (Sheet 1 of 2)
Climatological Extremes at Selected NWS and Cooperative Observing Stations in Units 6 & 7 Area

Station	Maximum Temperature (°F)	Minimum Temperature (°F)	Maximum 24-Hr Rainfall (inches)	Maximum Monthly Rainfall (inches)	Maximum 24-Hr Snowfall (inches)	Maximum Monthly Snowfall (inches)
Dania 4 WNW	96[(a), (b)] (10/03/1965)	42[(a), (b)] (11/19/1951)	9.5[(a), (b)] (10/30/1969)	22.0[(a), (b)] (09/1960)	0.0[(a), (b)]	0.0[(a), (b)]
Flamingo Ranger Station	104[(c)] (06/24/1998)	25[(c)] (12/25/1989)	8.2[(c)] (08/18/1981)	24.7[(a)] (05/1975)	0.0[(c)]	0.0[(c)]
Fort Lauderdale	99[(c)] (07/13/1980)	28[(c)] (01/20/1977)	14.6[(c)] (04/25/1979)	24.4[(c)] (06/1992)	0.0[(c)]	0.0[(c)]
Fort Lauderdale Experiment Station	100[(a), (b)] (06/24/1977)	26[(a,b)] (01/20/1977)	11.5[(a), (b)] (04/25/1979)	21.3[(a), (b)] (06/1966)	0.0[(a), (b)]	0.0[(a), (b)]
Hialeah	100[(c)] (07/10/1998)	28[(c)] (01/13/1981)	10.0[(c)] (05/05/1977)	31.9[(c)] (06/1999)	0.0[(c)]	0.0[(c)]
Homestead Experiment Station	100[(a), (b), (d)] (06/24/1944)	26[(a), (b), (e)] (02/16/1943)	11.5[(a), (b)] (10/05/1933)	27.3[(a), (b)] (08/1981)	T[(a), (b)] (01/19/1977)	T[(a), (b)] (01/1977)
Kendall 2 E	NA	NA	9.8[(a), (b)] (05/25/1958)	23.2[(a), (b)] (08/1973)	0.0[(a), (b)]	0.0[(a), (b)]
Miami Beach	98[(c)] (08/29/1999)	32[(c)] (12/24/1989)	8.4[(c)] (09/23/1960)	17.5[(c)] (05/1984)	0.0[(c)]	0.0[(c)]
Miami 12 SSW (POR 1931–1958)	98[(a), (b), (f)] (06/18/1934)	28[(a), (b), (g)] (02/06/1947)	7.6[(a), (b)] (09/22/1948)	23.8[(a), (b)] (09/1948)	0.0[(a), (b)]	0.0[(a), (b)]
Miami 12 SSW (POR 1958–1988)	97[(a), (b), (h)] (08/10/1987)	25[(a), (b)] (01/20/1977)	10.1[(a), (b)] (09/10/1960)	27.5[(a), (b)] (09/1960)	0.0[(a), (b)]	0.0[(a), (b)]
Miami International Airport	98[(k,l)] (07/03/1998)	30[(k,m)] (12/25/1989)	14.9[(k)] (04/25/1979)	24.4[(k)] (09/1960)	0.0[(c)]	0.0[(c)]
Oasis Ranger Station	103[(a), (b)] (06/18/1981)	26[(a,b,n)] (02/16/1991)	8.1[(a), (b)] (08/24/1995)	24.2[(a), (b)] (06/1999)	0.0[(a), (b)]	0.0[(a), (b)]
Perrine 4 W	98[(a), (b)] (07/04/1998)	29[(a), (b)] (12/24/1989)	15.1[(a), (b)] (08/26/2005)	29.5[(a), (b)] (09/1960)	0.0[(a), (b)]	0.0[(a), (b)]
Pompano Beach	101[(a)] (07/16/1981)	21[(a)] (02/09/1995)	12.7[(a)] (10/15/1965)	34.4[(a), (b)] (10/1965)	0.0[(a)]	0.0[(a)]
Royal Palm Ranger Station	102[(a,o)] (04/28/2007)	24[(a)] (01/20/1977)	9.6[(a)] (06/09/1997)	25.5[(a), (b)] (06/1969)	0.0[(a)]	0.0[(a)]
Tamiami Trail 40 Mile Bend	102[(a)] (06/17/1981)	28[(a,p)] (12/25/1989)	7.5[(a,q)] (10/16/1999)	23.5[(a), (b)] (06/1969)	0.0[(a)]	0.0[(a)]
Tavernier	98[(a,r)] (09/03/2003)	35[(a,s)] (12/24/1989)	13.8[(a)] (06/02/1982)	21.8[(a), (b)] (06/1967)	0.0[(a)]	0.0[(a)]

(a) Reference: USU 2008.

(b) Reference: SERCC Jun 2008a.

(c) Reference: NCDC 2004.

(d) Occurs on multiple dates: 07/21/1942; 06/24/1944 (most recent date shown in table).

(e) Occurs on multiple dates: 12/13/1934; 03/02/1941; 02/16/43 (most recent date shown in table).

(f) Occurs on multiple dates: 07/09/1932; 06/18/1934 (most recent date shown in table).

Table 2.7-4 (Sheet 2 of 2)
Climatological Extremes at Selected NWS and Cooperative Observing Stations in Units 6 & 7 Area

(g) Occurs on multiple dates: 01/28/1940; 02/06/1947 (most recent date shown in table).

(h) Occurs on multiple dates: 05/01/1971; 06/25/1987 (most recent date shown in table).

(i) Occurs on multiple dates: 08/06/1954; 07/19/1981; 06/04/1985 (most recent date shown in table).

(j) Occurs on multiple dates: 01/22/1985; 12/25/1989 (most recent date shown in table).

(k) Reference: NCDC Feb 2009a.

(l) Occurs on multiple dates: 06/04/1985; 07/03/1998; 08/01/1990 (most recent date shown in table).

(m) Occurs on multiple dates: 01/22/1985; 12/25/1989 (most recent date shown in table).

(n) Occurs on multiple dates: 01/12/1989; 12/25/1989; 02/16/1991 (most recent date shown in table).

(o) Occurs on multiple dates: 07/22/1996; 04/28/1907 (most recent date shown in table).

(p) Occurs on multiple dates: 01/22/1985; 12/25/1989 (most recent date shown in table).

(q) Occurs on multiple dates: 09/23/1948; 10/16/1999 (most recent date shown in table).

(r) Occurs on multiple dates: 08/14/1957; 09/03/1963 (most recent date shown in table).

(s) Occurs on multiple dates: 01/13/1981;12/24/1989 (most recent date shown in table).

NA — Not Available. This parameter is not measured at this station.

Table 2.7-5
Monthly, Seasonal, and Annual Morning and Afternoon Mixing Heights and Wind Speed for Units 6 & 7

Period	Statistic[a]	Mixing Height (m, AGL)[b]		Wind Speed — (m/sec)	
		AM	PM	AM	PM
January	Min	252	858	2.7	2.4
	Max	863	1400	4.7	4.5
	Mean	522	1105	3.5	3.2
February	Min	359	910	2.5	2.2
	Max	1012	1458	4.6	4.4
	Mean	599	1239	3.5	3.3
March	Min	406	1,043	2.8	2.6
	Max	1010	1552	4.8	4.6
	Mean	681	1311	3.5	3.3
April	Min	272	1128	2.5	2.2
	Max	1056	1689	4.4	4.0
	Mean	668	1412	3.3	3.1
May	Min	327	881	2.1	2.2
	Max	1224	1618	4.6	4.3
	Mean	688	1338	3.1	2.9
June	Min	327	725	1.8	2.2
	Max	928	1464	4.1	4.3
	Mean	577	1165	3.1	2.9
July	Min	240	806	1.8	1.9
	Max	788	1547	4.6	4.0
	Mean	474	1234	2.8	2.7
August	Min	254	958	2.1	2.1
	Max	774	1489	4.4	4.0
	Mean	478	1237	2.3	2.8
September	Min	234	868	2.5	2.2
	Max	952	1430	4.8	5.0
	Mean	541	1139	3.4	3.2
October	Min	376	868	2.4	2.7
	Max	1076	1556	4.6	4.6
	Mean	607	1184	3.6	3.6
November	Min	343	768	2.5	2.7
	Max	981	1406	5.0	4.7
	Mean	606	1138	3.6	3.4
December	Min	292	886	2.2	2.3
	Max	970	1486	4.7	5.1
	Mean	569	1128	3.4	3.4
Winter	Mean	563	1157	3.5	3.3
Spring	Mean	679	1354	3.3	3.1
Summer	Mean	510	1212	2.7	2.7
Fall	Mean	585	1154	3.5	3.4
Annual	Mean	584	1219	3.5	3.1

(a) Monthly minimum, maximum, and mean values are based directly on summaries available from USDA—Forest Service Ventilation Climate Information System. Seasonal and annual mean values represent weighted averages based on the number of days in the appropriate months.
(b) AGL = above ground level
Source: USDA 2007

Table 2.7-6
Seasonal and Annual Mean Wind Speeds for Turkey Point (2002, 2005, and 2006) and the Miami International Airport NWS Station (1971–2000, Normals)

Primary Tower Elevation	Location	Winter	Spring	Summer	Fall	Annual
Upper Level (60 meters) (m/sec)	Turkey Point Plant Property	6.1	5.9	4.8	5.5	5.6
Lower Level (10 meters) (m/sec)	Turkey Point Plant Property	3.7	4.0	3.5	3.7	3.8
Single Level (10 meters) (m/sec)	Miami International Airport[(a)NCDC 2009b]	4.0	4.3	3.4	3.9	3.9

(a) Source: NCDC Feb 2009a

Winter = December, January, February
Spring = March, April, May
Summer = June, July, August
Fall = September, October, November

Table 2.7-7 (Sheet 1 of 3)
Wind Direction Persistence/Wind Speed Distributions for the Turkey Point Plant Property 10-Meter Level

Site Name: Turkey Point Units 6 & 7	
Start Date: 01/01/2002 00:00	End Date: 12/31/2002 23:00
Start Date: 01/01/2005 00:00	End Date: 12/31/2005 23:00
Start Date: 01/01/2006 00:00	End Date: 12/31/2006 23:00
Number of Sectors Included:	1 Width in Degrees 22.5
10-Meter Wind Speed (mph)	10-Meter Wind Direction (degrees)
Number of valid speed and direction observations: 25,407	

Speed Greater than or Equal to: 5.00 mph																
Direction																
Hours	**N**	**NNE**	**NE**	**ENE**	**E**	**ESE**	**SE**	**SSE**	**S**	**SSW**	**SW**	**WSW**	**W**	**WNW**	**NW**	**NNW**
1	997	395	1465	2359	3979	3009	1836	1323	960	587	397	313	300	306	539	1554
2	527	144	1004	1553	2870	2007	1205	806	554	303	191	135	136	136	251	1008
4	170	27	593	852	1710	1034	642	350	230	104	71	40	42	46	73	519
8	23	0	268	345	722	324	265	72	49	9	11	4	7	6	6	177
12	6	0	129	178	294	101	137	7	13	0	0	0	1	1	0	62
18	0	0	47	79	71	6	44	0	1	0	0	0	0	0	0	20
24	0	0	15	51	17	0	19	0	0	0	0	0	0	0	0	8
30	0	0	3	29	6	0	10	0	0	0	0	0	0	0	0	0
36	0	0	0	15	0	0	4	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Speed Greater than or Equal to: 10.00 mph																
Direction																
Hours	**N**	**NNE**	**NE**	**ENE**	**E**	**ESE**	**SE**	**SSE**	**S**	**SSW**	**SW**	**WSW**	**W**	**WNW**	**NW**	**NNW**
1	202	157	889	1114	1771	1398	861	583	429	312	205	102	76	74	97	379
2	99	73	667	750	1196	933	602	342	233	186	117	39	25	43	42	233
4	33	15	432	402	628	493	351	131	84	59	42	6	4	16	11	105
8	10	0	193	171	201	156	152	27	13	2	4	0	0	1	0	22
12	2	0	87	99	46	52	84	3	1	0	0	0	0	0	0	4
18	0	0	27	57	17	1	29	0	0	0	0	0	0	0	0	0
24	0	0	9	31	6	0	15	0	0	0	0	0	0	0	0	0
30	0	0	3	15	0	0	8	0	0	0	0	0	0	0	0	0
36	0	0	0	7	0	0	2	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.7-7 (Sheet 2 of 3)
Wind Direction Persistence/Wind Speed Distributions for the Turkey Point Plant Property 10-Meter Level

Speed Greater than or Equal to: 15.00 mph																
Direction																
Hours	**N**	**NNE**	**NE**	**ENE**	**E**	**ESE**	**SE**	**SSE**	**S**	**SSW**	**SW**	**WSW**	**W**	**WNW**	**NW**	**NNW**
1	16	16	165	115	225	227	203	75	66	74	63	21	4	10	11	58
2	6	9	117	69	132	144	143	38	42	41	31	7	2	5	3	32
4	1	4	69	29	57	75	92	12	18	13	8	0	0	3	0	11
8	0	0	24	3	12	17	38	0	3	0	0	0	0	0	0	0
12	0	0	13	0	3	6	18	0	0	0	0	0	0	0	0	0
18	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Speed Greater than or Equal to: 20.00 mph																
Direction																
Hours	**N**	**NNE**	**NE**	**ENE**	**E**	**ESE**	**SE**	**SSE**	**S**	**SSW**	**SW**	**WSW**	**W**	**WNW**	**NW**	**NNW**
1	0	1	7	3	15	31	36	16	8	12	6	4	0	1	0	3
2	0	0	5	1	5	19	24	8	5	7	1	1	0	0	0	0
4	0	0	3	0	2	9	16	2	3	2	0	0	0	0	0	0
8	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Speed Greater than or Equal to: 25.00 mph																
Direction																
Hours	**N**	**NNE**	**NE**	**ENE**	**E**	**ESE**	**SE**	**SSE**	**S**	**SSW**	**SW**	**WSW**	**W**	**WNW**	**NW**	**NNW**
1	0	0	0	2	5	8	16	9	5	2	1	1	0	0	0	0
2	0	0	0	1	3	3	13	6	4	1	0	0	0	0	0	0
4	0	0	0	0	1	1	7	2	2	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.7-7 (Sheet 3 of 3)
Wind Direction Persistence/Wind Speed Distributions for the Turkey Point Plant Property 10-Meter Level

Speed Greater than or Equal to: 30.00 mph																
Direction																
Hours	**N**	**NNE**	**NE**	**ENE**	**E**	**ESE**	**SE**	**SSE**	**S**	**SSW**	**SW**	**WSW**	**W**	**WNW**	**NW**	**NNW**
1	0	0	0	0	2	0	7	8	4	0	0	0	0	0	0	0
2	0	0	0	0	1	0	2	6	3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Speed Greater than or Equal to: 35.00 mph																
Direction																
Hours	**N**	**NNE**	**NE**	**ENE**	**E**	**ESE**	**SE**	**SSE**	**S**	**SSW**	**SW**	**WSW**	**W**	**WNW**	**NW**	**NNW**
1	0	0	0	0	0	0	0	7	2	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Speed Greater than or Equal to: 40.00 mph																
Direction																
Hours	**N**	**NNE**	**NE**	**ENE**	**E**	**ESE**	**SE**	**SSE**	**S**	**SSW**	**SW**	**WSW**	**W**	**WNW**	**NW**	**NNW**
1	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.7-8 (Sheet 1 of 3)
Wind Direction Persistence/Wind Speed Distributions for the Turkey Point Plant Property 60-Meter Level

Site Name: Turkey Point Units 6 & 7	
Start Date: 01/01/2002 00:00	End Date: 12/31/2002 23:00
Start Date: 01/01/2005 00:00	End Date: 12/31/2005 23:00
Start Date: 01/01/2006 00:00	End Date: 12/31/2006 23:00
Number of Sectors Included:	1 Width in Degrees 22.5
60-Meter Wind Speed (mph)	60-Meter Wind Direction (degrees)
Number of valid speed and direction observations: 23,943	

Speed Greater than or Equal to: 5.00 mph																
								Direction								
Hours	**N**	**NNE**	**NE**	**ENE**	**E**	**ESE**	**SE**	**SSE**	**S**	**SSW**	**SW**	**WSW**	**W**	**WNW**	**NW**	**NNW**
1	1506	594	1762	2539	3822	3326	2123	1537	1109	753	544	383	489	580	711	1527
2	984	208	1208	1697	2683	2268	1396	948	651	424	287	165	249	308	382	1051
4	481	39	703	914	1530	1171	738	421	283	168	115	51	93	112	129	593
8	154	1	320	354	569	375	302	84	72	25	33	6	12	17	18	244
12	48	0	155	199	217	115	147	16	27	1	7	1	4	2	0	114
18	5	0	70	105	37	8	38	0	6	0	0	0	0	0	0	38
24	0	0	36	58	0	0	8	0	0	0	0	0	0	0	0	18
30	0	0	18	28	0	0	0	0	0	0	0	0	0	0	0	8
36	0	0	9	9	0	0	0	0	0	0	0	0	0	0	0	2
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Speed Greater than or Equal to: 10.00 mph																
								Direction								
Hours	**N**	**NNE**	**NE**	**ENE**	**E**	**ESE**	**SE**	**SSE**	**S**	**SSW**	**SW**	**WSW**	**W**	**WNW**	**NW**	**NNW**
1	1122	371	1403	2023	2965	2346	1476	965	760	513	383	234	290	344	447	1232
2	740	150	1035	1416	2113	1574	1028	603	459	290	221	110	160	188	250	881
4	385	32	640	803	1205	830	600	278	196	110	86	34	65	81	85	514
8	133	1	303	335	454	286	266	63	41	14	24	4	12	15	11	224
12	40	0	152	197	176	94	134	11	10	0	2	0	4	2	0	104
18	5	0	69	105	28	7	36	0	1	0	0	0	0	0	0	35
24	0	0	36	58	0	0	8	0	0	0	0	0	0	0	0	18
30	0	0	18	28	0	0	0	0	0	0	0	0	0	0	0	8
36	0	0	9	9	0	0	0	0	0	0	0	0	0	0	0	2
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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Table 2.7-8 (Sheet 2 of 3)
Wind Direction Persistence/Wind Speed Distributions for the Turkey Point Plant Property 60-Meter Level

Speed Greater than or Equal to: 15.00 mph																
Direction																
Hours	**N**	**NNE**	**NE**	**ENE**	**E**	**ESE**	**SE**	**SSE**	**S**	**SSW**	**SW**	**WSW**	**W**	**WNW**	**NW**	**NNW**
1	438	137	923	921	1073	785	609	387	233	226	185	109	92	107	189	591
2	263	62	719	650	726	530	435	243	132	135	104	50	34	55	103	382
4	117	15	482	387	406	282	272	113	51	51	38	14	3	20	28	186
8	38	0	244	185	144	99	123	24	7	2	7	0	0	5	5	50
12	11	0	123	114	49	38	63	2	1	0	1	0	0	1	0	13
18	1	0	52	58	11	4	20	0	0	0	0	0	0	0	0	0
24	0	0	30	22	0	0	6	0	0	0	0	0	0	0	0	0
30	0	0	18	5	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Speed Greater than or Equal to: 20.00 mph																
Direction																
Hours	**N**	**NNE**	**NE**	**ENE**	**E**	**ESE**	**SE**	**SSE**	**S**	**SSW**	**SW**	**WSW**	**W**	**WNW**	**NW**	**NNW**
1	55	26	345	209	153	125	151	92	54	57	61	19	13	26	29	104
2	25	9	267	135	89	74	102	48	31	30	30	6	5	15	12	55
4	4	0	179	73	43	30	61	13	13	7	7	0	1	6	2	17
8	0	0	87	28	13	6	32	1	1	0	0	0	0	1	0	1
12	0	0	44	13	4	2	16	0	0	0	0	0	0	0	0	0
18	0	0	28	7	0	0	6	0	0	0	0	0	0	0	0	0
24	0	0	21	1	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Speed Greater than or Equal to: 25.00 mph																
Direction																
Hours	**N**	**NNE**	**NE**	**ENE**	**E**	**ESE**	**SE**	**SSE**	**S**	**SSW**	**SW**	**WSW**	**W**	**WNW**	**NW**	**NNW**
1	2	1	79	11	14	32	36	30	9	16	9	7	3	10	2	12
2	0	0	55	3	5	22	24	17	5	8	4	3	1	6	0	6
4	0	0	34	0	1	14	13	4	3	1	0	0	0	4	0	0
8	0	0	15	0	0	6	5	0	0	0	0	0	0	0	0	0
12	0	0	4	0	0	2	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.7-8 (Sheet 3 of 3)
Wind Direction Persistence/Wind Speed Distributions for the Turkey Point Plant Property 60-Meter Level

Speed Greater than or Equal to: 30.00 mph																
Direction																
Hours	**N**	**NNE**	**NE**	**ENE**	**E**	**ESE**	**SE**	**SSE**	**S**	**SSW**	**SW**	**WSW**	**W**	**WNW**	**NW**	**NNW**
1	0	0	1	0	1	9	21	16	7	6	4	3	0	4	0	2
2	0	0	0	0	0	5	15	8	5	3	1	1	0	2	0	0
4	0	0	0	0	0	1	7	2	3	0	0	0	0	0	0	0
8	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Speed Greater than or Equal to: 35.00 mph																
Direction																
Hours	**N**	**NNE**	**NE**	**ENE**	**E**	**ESE**	**SE**	**SSE**	**S**	**SSW**	**SW**	**WSW**	**W**	**WNW**	**NW**	**NNW**
1	0	0	0	0	0	2	14	10	5	2	1	1	0	0	0	0
2	0	0	0	0	0	0	9	6	4	1	0	0	0	0	0	0
4	0	0	0	0	0	0	3	2	2	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Speed Greater than or Equal to: 40.00 mph																
Direction																
Hours	**N**	**NNE**	**NE**	**ENE**	**E**	**ESE**	**SE**	**SSE**	**S**	**SSW**	**SW**	**WSW**	**W**	**WNW**	**NW**	**NNW**
1	0	0	0	0	0	1	8	8	5	1	0	0	0	0	0	0
2	0	0	0	0	0	0	4	6	4	0	0	0	0	0	0	0
4	0	0	0	0	0	0	1	2	2	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.7-9
Seasonal and Annual Vertical Stability Class and Mean 10-Meter Level Wind Speed Distributions for Units 6 & 7
(2002, 2005, and 2006)

Period	Vertical Stability Categories[a]						
	A	**B**	**C**	**D**	**E**	**F**	**G**
Winter							
Frequency (%)	5.17	6.08	9.14	26.64	31.01	11.67	10.29
Wind Speed (m/sec)	5.61	5.19	4.93	4.53	3.56	2.04	1.97
Spring							
Frequency (%)	12.52	7.62	7.52	23.72	30.37	9.35	8.90
Wind Speed (m/sec)	5.79	5.18	4.83	4.60	3.66	2.12	1.93
Summer							
Frequency (%)	2.78	4.37	6.52	30.78	42.21	11.61	1.73
Wind Speed (m/sec)	4.77	4.70	4.46	4.16	3.13	1.81	1.71
Fall							
Frequency (%)	3.33	4.38	6.39	32.61	41.67	8.45	3.17
Wind Speed (m/sec)	4.70	4.64	4.68	4.30	3.32	1.96	2.15
Annual							
Frequency (%)	5.90	5.59	7.36	28.51	36.47	10.26	5.92
Wind Speed (m/sec)	5.47	4.98	4.74	4.37	3.38	1.97	1.96

(a) Vertical stability based on temperature difference (ΔT) between 60-meter and 10-meter measurement levels.

Table 2.7-10 (Sheet 1 of 8) Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for Units 6 & 7 (2002, 2005, and 2006)

Hours at Each Wind Speed and Direction

Total Period

Period of Record: 3-Year Composite (2002, 2005, 2006)

Elevation: 10M **Speed:** WS10M

Direction: WD10M **Lapse:** DT10M-60M

Stability Class” A Extremely Unstable

	Wind Speed (m/s)												
Wind Direction (from)	**0.22–0.50**	**0.51–0.75**	**0.76–1.0**	**1.1–1.5**	**1.6–2.0**	**2.1–3.0**	**3.1–5.0**	**5.1–7.0**	**7.1–10.0**	**10.1–13.0**	**13.1–18.0**	**>18.0**	**Total**
N	0	0	0	0	0	5	40	26	3	0	0	0	74
NNE	0	0	0	0	0	0	20	23	0	0	0	0	43
NE	0	0	0	0	0	1	35	73	12	0	0	0	121
ENE	0	0	0	0	0	0	9	69	10	0	0	0	88
E	0	0	0	0	0	0	15	72	16	0	0	0	103
ESE	0	0	0	0	0	0	39	110	35	0	0	0	184
SE	0	0	0	0	0	0	46	78	23	1	0	0	148
SSE	0	0	0	0	1	14	110	77	13	0	0	0	215
S	0	0	0	0	0	4	58	92	22	0	0	0	176
SSW	0	0	0	0	0	2	11	37	15	0	0	0	65
SW	0	0	0	0	0	0	6	16	6	0	0	0	28
WSW	0	0	0	0	0	0	5	6	2	0	0	0	13
W	0	0	0	0	1	0	8	6	2	0	0	0	17
WNW	0	0	0	1	0	3	8	4	3	0	0	0	19
NW	0	0	1	0	2	1	20	14	0	0	0	0	38
NNW	0	0	0	0	0	4	67	76	21	0	0	0	168
Totals	**0**	**0**	**1**	**1**	**4**	**34**	**497**	**779**	**183**	**1**	**0**	**0**	**1500**

Number of Calm Hours not included above for:	**Total Period**	**0**
Number of Variable Direction Hours for:	**Total Period**	**0**
Number of Invalid Hours for:	**Total Period**	**873**
Number of Valid Hours for:	**Total Period**	**1500**
Total Hours for:	**Total Period**	**26280**

Note:Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 60-meter and 10-meter measurement levels.

Table 2.7-10 (Sheet 2 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for Units 6 & 7 (2002, 2005, and 2006)

Hours at Each Wind Speed and Direction

Total Period

Period of Record: 3-Year Composite (2002, 2005, 2006)

Elevation: 10M **Speed:** WS10M

Direction: WD10M **Lapse:** DT10M-60M

Stability Class: B Moderately Unstable

	Wind Speed (m/s)												
Wind Direction (from)	**0.22–0.50**	**0.51–0.75**	**0.76–1.0**	**1.1–1.5**	**1.6–2.0**	**2.1–3.0**	**3.1–5.0**	**5.1–7.0**	**7.1–10.0**	**10.1–13.0**	**13.1–18.0**	**>18.0**	**Total**
N	0	0	0	0	2	8	46	17	2	0	0	0	75
NNE	0	0	0	0	1	4	21	11	0	0	0	0	37
NE	0	0	0	0	0	0	65	45	5	0	0	0	115
ENE	0	0	0	0	0	2	55	60	4	0	0	0	121
E	0	1	0	0	1	1	47	69	19	0	0	0	138
ESE	0	0	0	0	0	1	94	109	16	0	0	0	220
SE	0	0	0	0	0	11	46	65	22	0	0	0	144
SSE	0	0	0	0	0	22	81	50	5	0	0	0	158
S	0	0	0	0	0	8	72	47	7	0	0	0	134
SSW	0	0	0	0	2	6	22	38	5	0	0	0	73
SW	0	0	0	0	2	3	5	16	14	0	0	0	40
WSW	0	0	0	0	1	2	3	9	0	0	0	0	15
W	0	0	0	0	0	0	8	3	1	0	0	0	12
WNW	0	0	0	0	0	1	8	6	1	0	0	0	16
NW	0	0	1	0	3	2	22	4	0	0	0	0	32
NNW	0	0	0	0	2	8	56	18	5	0	0	0	89
Totals	**0**	**1**	**1**	**0**	**14**	**79**	**651**	**567**	**106**	**0**	**0**	**0**	**1419**

Number of Calm Hours not included above for:	**Total Period**	**0**
Number of Variable Direction Hours for:	**Total Period**	**0**
Number of Invalid Hours for:	**Total Period**	**873**
Number of Valid Hours for:	**Total Period**	**1419**
Total Hours for:	**Total Period**	**26280**

Table 2.7-10 (Sheet 3 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for Units 6 & 7
(2002, 2005, and 2006)

Hours at Each Wind Speed and Direction

Total Period

Period of Record: 3-Year Composite (2002, 2005, 2006)

Elevation: 10M **Speed:** WS10M

Direction: WD10M **Lapse:** DT10M-60M

Stability Class: C Slightly Unstable

	Wind Speed (m/s)												
Wind Direction (from)	**0.22–0.50**	**0.51–0.75**	**0.76–1.0**	**1.1–1.5**	**1.6–2.0**	**2.1–3.0**	**3.1–5.0**	**5.1–7.0**	**7.1–10.0**	**10.1–13.0**	**13.1–18.0**	**>18.0**	**Total**
N	0	0	0	0	2	16	43	15	3	0	0	0	79
NNE	0	0	0	0	2	5	33	4	1	0	0	0	45
NE	0	0	0	0	1	8	78	60	6	0	0	0	153
ENE	0	0	0	1	0	7	75	90	20	0	0	0	193
E	0	0	0	0	0	7	152	143	14	0	0	0	316
ESE	1	0	0	0	0	15	175	128	19	0	0	0	338
SE	0	0	0	1	2	16	76	72	10	1	0	0	178
SSE	0	0	0	1	4	30	81	34	5	0	0	0	155
S	0	0	0	1	2	14	43	27	5	0	0	0	92
SSW	0	0	0	0	5	9	16	42	6	0	0	0	78
SW	0	0	0	0	0	4	11	13	5	0	0	0	33
WSW	0	0	0	0	0	11	13	7	0	0	0	0	31
W	0	0	1	2	2	3	7	8	0	0	0	0	23
WNW	0	0	0	0	1	3	16	8	2	0	0	0	30
NW	0	0	0	1	2	15	19	7	0	0	0	0	44
NNW	0	0	0	3	2	18	35	18	6	0	0	0	82
Totals	**1**	**0**	**1**	**10**	**25**	**181**	**873**	**676**	**102**	**1**	**0**	**0**	**1870**

Number of Calm Hours not included above for:	**Total Period**	**0**
Number of Variable Direction Hours for:	**Total Period**	**0**
Number of Invalid Hours for:	**Total Period**	**873**
Number of Valid Hours for:	**Total Period**	**1870**
Total Hours for:	**Total Period**	**26280**

Table 2.7-10 (Sheet 4 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for Units 6 & 7
(2002, 2005, and 2006)

Hours at Each Wind Speed and Direction

Total Period

Period of Record 3-Year Composite (2002, 2005, 2006)

Elevation: 10M **Speed:** WS10M

Direction: WD10M **Lapse:** DT10M-60M

Stability Class: D Neutral

	Wind Speed (m/s)												
Wind Direction (from)	**0.22–0.50**	**0.51–0.75**	**0.76–1.0**	**1.1–1.5**	**1.6–2.0**	**2.1–3.0**	**3.1–5.0**	**5.1–7.0**	**7.1–10.0**	**10.1–13.0**	**13.1–18.0**	**>18.0**	**Total**
N	0	0	5	13	18	75	121	42	4	0	0	0	278
NNE	0	0	1	4	11	35	54	25	4	0	0	0	134
NE	2	0	3	7	14	72	179	239	76	0	0	0	592
ENE	1	1	1	6	14	112	480	336	29	0	0	0	980
E	2	2	0	7	20	105	799	520	61	0	0	0	1516
ESE	1	0	1	7	21	114	644	271	50	0	0	0	1109
SE	0	0	1	10	11	72	270	160	47	6	2	0	579
SSE	0	1	1	12	16	78	191	111	7	1	2	2	422
S	1	0	1	3	11	45	178	59	7	0	1	1	307
SSW	0	1	2	5	16	36	95	62	15	4	0	0	236
SW	0	0	2	4	11	19	73	54	17	1	0	0	181
WSW	1	1	1	5	7	20	56	39	11	0	0	0	141
W	0	0	0	1	16	39	64	21	1	0	0	0	142
WNW	0	0	3	9	15	37	57	14	3	0	0	0	138
NW	0	1	1	14	20	47	55	11	6	0	0	0	155
NNW	1	1	0	18	25	62	155	62	9	0	0	0	333
Totals	**9**	**8**	**23**	**125**	**246**	**968**	**3471**	**2026**	**347**	**12**	**5**	**3**	**7243**

Number of Calm Hours not included above for:	**Total Period**	**0**
Number of Variable Direction Hours for:	**Total Period**	**0**
Number of Invalid Hours for:	**Total Period**	**873**
Number of Valid Hours for:	**Total Period**	**7243**
Total Hours for:	**Total Period**	**26280**

Table 2.7-10 (Sheet 5 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for Units 6 & 7
(2002, 2005, and 2006)

Hours at Each Wind Speed and Direction

Total Period

Period of Record 3-Year Composite (2002, 2005, 2006)

Elevation: 10M **Speed:** WS10M

Direction: WD10M **Lapse:** DT10M-60M

Stability Class: E Slightly Stable

Wind Speed (m/s)												
Wind Direction (from)	**0.22–0.50**	**0.51–0.75**	**0.76–1.0**	**1.1–1.5**	**1.6–2.0**	**2.1–3.0**	**3.1–5.0**	**5.1–7.0**	**7.1–10.0**	**10.1–13.0**	**13.1–18.0**	**>18.0**	**Total**
N	0	2	11	19	46	151	131	13	0	0	0	0	373
NNE	3	7	9	17	22	44	75	20	6	0	0	0	203
NE	0	2	5	23	22	89	252	140	22	1	0	0	556
ENE	3	3	9	36	75	289	586	132	3	3	0	0	1139
E	4	5	5	69	181	594	062	232	20	7	2	0	2181
ESE	2	6	12	66	118	349	571	170	31	14	1	0	1340
SE	4	4	10	60	57	227	385	125	24	7	6	0	909
SSE	2	4	8	24	35	119	194	68	12	1	1	3	471
S	1	2	5	23	48	107	127	25	1	1	3	0	343
SSW	0	5	11	31	38	64	66	20	1	1	0	0	237
SW	2	5	7	22	27	44	32	24	5	1	0	0	169
WSW	0	3	4	41	27	32	38	6	0	0	0	0	151
W	1	1	9	36	36	70	34	3	0	0	0	0	190
WNW	2	4	11	40	44	60	27	3	0	0	0	0	191
NW	1	5	7	28	41	96	64	8	1	0	0	0	251
NNW	2	3	19	34	57	164	256	26	1	0	0	0	562
Totals	**27**	**61**	**142**	**569**	**874**	**2499**	**3900**	**1015**	**127**	**36**	**13**	**3**	**9266**

Number of Calm Hours not included above for:	**Total Period**	**0**
Number of Variable Direction Hours for:	**Total Period**	**0**
Number of Invalid Hours for:	**Total Period**	**873**
Number of Valid Hours for:	**Total Period**	**9266**
Total Hours for:	**Total Period**	**26280**

Table 2.7-10 (Sheet 6 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for Units 6 & 7
(2002, 2005, and 2006)

Hours at Each Wind Speed and Direction

Total Period

Period of Record 3-Year Composite (2002, 2005, 2006)

Elevation:	10M	**Speed:**	WS10M
Direction:	WD10M	**Lapse:**	DT10M-60M
Stability Class: F	Moderately Stable		

Wind Speed (m/s)													
Wind Direction (from)	**0.22–0.50**	**0.51–0.75**	**0.76–1.0**	**1.1–1.5**	**1.6–2.0**	**2.1–3.0**	**3.1–5.0**	**5.1–7.0**	**7.1–10.0**	**10.1–13.0**	**13.1–18.0**	**>18.0**	**Total**
N	1	7	13	49	67	117	27	1	0	0	0	0	282
NNE	1	1	4	21	16	14	6	3	0	0	0	0	66
NE	3	3	5	17	11	13	10	0	0	0	0	0	62
ENE	1	1	2	16	21	30	5	1	0	0	0	0	77
E	3	1	8	25	42	116	15	0	0	0	0	0	210
ESE	4	3	7	23	44	80	20	0	0	0	0	0	181
SE	3	6	7	21	34	63	10	1	0	0	0	0	145
SSE	2	3	6	19	19	25	5	0	0	0	0	0	79
S	1	1	2	17	10	23	7	0	0	0	0	0	61
SSW	1	4	8	21	17	22	5	0	0	1	0	0	79
SW	3	4	4	33	24	26	4	1	0	1	0	0	100
WSW	4	4	8	23	32	48	11	2	0	1	0	0	133
W	8	5	9	40	53	49	1	0	0	0	0	0	165
WNW	11	7	7	49	46	46	7	0	0	0	0	0	173
NW	5	6	17	66	82	85	28	0	0	0	0	0	289
NNW	5	8	21	83	145	180	60	2	0	0	0	0	504
Totals	**56**	**64**	**128**	**523**	**663**	**937**	**221**	**11**	**0**	**3**	**0**	**0**	**2606**

Number of Calm Hours not included above for:	**Total Period**	**0**
Number of Variable Direction Hours for:	**Total Period**	**0**
Number of Invalid Hours for:	**Total Period**	**873**
Number of Valid Hours for:	**Total Period**	**2606**
Total Hours for:	**Total Period**	**26280**

Table 2.7-10 (Sheet 7 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for Units 6 & 7
(2002, 2005, and 2006)

Hours at Each Wind Speed and Direction

Total Period

Period of Record: 3-Year Composite (2002, 2005, 2006)

Elevation: 10M **Speed:** WS10M

Direction: WD10M **Lapse:** DT10M-60M

Stability Class: G Extremely Stable

Wind Speed (m/s)													
Wind Direction (from)	**0.22–0.50**	**0.51–0.75**	**0.76–1.0**	**1.1–1.5**	**1.6–2.0**	**2.1–3.0**	**3.1–5.0**	**5.1–7.0**	**7.1–10.0**	**10.1–13.0**	**13.1–18.0**	**>18.0**	**Total**
N	3	1	7	29	60	167	11	0	0	0	0	0	278
NNE	0	2	1	10	8	6	0	0	0	0	0	0	27
NE	2	0	1	4	0	2	0	0	0	0	0	0	9
ENE	0	0	0	2	0	0	0	0	0	0	0	0	2
E	1	1	0	1	5	2	0	0	0	0	0	0	10
ESE	0	0	1	0	2	0	0	0	0	0	0	0	3
SE	1	0	3	1	2	5	0	0	0	0	0	0	12
SSE	1	2	3	4	2	2	0	0	0	0	0	0	14
S	1	1	2	3	2	5	0	0	0	0	0	0	14
SSW	2	2	3	6	5	12	1	0	0	0	0	0	31
SW	3	0	3	14	15	21	2	0	0	0	0	0	58
WSW	1	1	2	11	22	20	2	0	0	0	0	0	59
W	1	3	6	21	33	24	0	0	0	0	0	0	88
WNW	3	5	9	39	52	35	0	0	0	0	0	0	143
NW	5	3	5	35	53	102	7	0	0	0	0	0	210
NNW	7	2	11	34	135	327	29	0	0	0	0	0	545
Totals	**31**	**23**	**57**	**214**	**396**	**730**	**52**	**0**	**0**	**0**	**0**	**0**	**1503**

Number of Calm Hours not included above for:	**Total Period**	**0**
Number of Variable Direction Hours for:	**Total Period**	**0**
Number of Invalid Hours for:	**Total Period**	**873**
Number of Valid Hours for:	**Total Period**	**1503**
Total Hours for:	**Total Period**	**26280**

Table 2.7-10 (Sheet 8 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (10-Meter Level) by Atmospheric Stability Class for Units 6 & 7 (2002, 2005, and 2006)

Hours at Each Wind Speed and Direction

Summary of All Stability Classes
Total Period

Period of Record: 3-Year Composite (2002, 2005, 2006)

Elevation: 10M **Speed:** WS10M

Direction: WD10M **Lapse:** DT10M-60M

	Wind Speed (m/s)												
Wind Direction (from)	**0.22–0.50**	**0.51–0.75**	**0.76–1.0**	**1.1–1.5**	**1.6–2.0**	**2.1–3.0**	**3.1–5.0**	**5.1–7.0**	**7.1–10.0**	**10.1–13.0**	**13.1–18.0**	**>18.0**	**Total**
N	4	10	36	110	195	539	419	114	12	0	0	0	1439
NNE	4	10	15	52	60	108	209	86	11	0	0	0	555
NE	7	5	14	51	48	185	619	557	121	1	0	0	1608
ENE	5	5	12	61	110	440	210	688	66	3	0	0	2600
E	10	10	13	102	249	825	2090	1036	130	7	2	0	4474
ESE	8	9	21	96	185	559	543	788	151	14	1	0	3375
SE	8	10	21	93	106	394	833	501	126	15	8	0	2115
SSE	5	10	18	60	77	290	662	340	42	2	3	5	1514
S	4	4	10	47	73	206	485	250	42	1	4	1	1127
SSW	3	12	24	63	83	151	216	199	42	6	0	0	799
SW	8	9	16	73	79	117	133	124	47	3	0	0	609
WSW	6	9	15	80	89	133	128	69	13	1	0	0	543
W	10	9	25	100	141	185	122	41	4	0	0	0	637
WNW	16	16	30	138	158	185	123	35	9	0	0	0	710
NW	11	15	32	144	203	348	215	44	7	0	0	0	1019
NNW	15	14	51	172	366	763	658	202	42	0	0	0	2283
Totals	**124**	**157**	**353**	**1442**	**2222**	**5428**	**9665**	**5074**	**865**	**53**	**18**	**6**	**25407**

Number of Calm Hours not included above for:	**Total Period**	**0**
Number of Variable Direction Hours for:	**Total Period**	**0**
Number of Invalid Hours for:	**Total Period**	**873**
Number of Valid Hours for:	**Total Period**	**25407**
Total Hours for:	**Total Period**	**26280**

Table 2.7-11 (Sheet 1 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for Units 6 & 7 (2002, 2005, and 2006)

Hours at Each Wind Speed and Direction

Total Period

Period of Record: 3-Year Composite (2002, 2005, 2006)

Elevation: 60M **Speed:** WS60M

Direction: WD60M **Lapse:** DT10M-60M

Stability Class: A Extremely Unstable

	Wind Speed (m/s)												
Wind Direction (from)	**0.22–0.50**	**0.51–0.75**	**0.76–1.0**	**1.1–1.5**	**1.6–2.0**	**2.1–3.0**	**3.1–5.0**	**5.1–7.0**	**7.1–10.0**	**10.1–13.0**	**13.1–18.0**	**>18.0**	**Total**
N	0	0	0	0	0	0	14	36	22	2	0	0	74
NNE	0	0	0	0	0	0	5	21	18	1	0	0	45
NE	0	0	0	0	0	0	1	43	72	7	0	0	123
ENE	0	0	0	0	0	0	0	31	40	5	0	0	76
E	0	0	0	0	0	0	4	45	54	5	0	0	108
ESE	0	0	0	0	0	0	16	89	66	3	0	0	174
SE	0	0	0	0	0	0	34	55	42	8	0	0	139
SSE	0	0	0	0	0	6	71	95	30	1	0	0	203
S	0	0	0	0	0	0	34	89	50	6	0	0	179
SSW	0	0	0	0	0	2	6	23	29	9	0	0	69
SW	0	0	0	0	0	0	1	6	13	4	0	0	24
WSW	0	0	0	0	0	0	5	4	4	0	0	0	13
W	0	0	0	0	1	0	1	6	6	2	0	0	16
WNW	0	0	0	0	0	1	3	9	4	0	3	0	20
NW	0	0	0	0	0	3	5	14	21	0	0	0	43
NNW	0	0	0	0	0	1	14	61	67	10	0	0	153
Totals	**0**	**0**	**0**	**0**	**1**	**13**	**214**	**627**	**538**	**63**	**3**	**0**	**1459**

Number of Calm Hours not included above for:	**Total Period**	**0**
Number of Variable Direction Hours for:	**Total Period**	**0**
Number of Invalid Hours for:	**Total Period**	**2337**
Number of Valid Hours for:	**Total Period**	**1459**
Total Hours for:	**Total Period**	**26280**

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 60-meter and 10-meter measurement levels.

Table 2.7-11 (Sheet 2 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for Units 6 & 7 (2002, 2005, and 2006)

Hours at Each Wind Speed and Direction

Total Period

Period of Record 3-Year Composite (2002, 2005, 2006)

Elevation: 60M **Speed:** WS60M

Direction: WD60M **Lapse:** DT10M-60M

Stability Class: B Moderately Unstable

Wind Speed (m/s)													
Wind Direction (from)	**0.22–0.50**	**0.51–0.75**	**0.76–1.0**	**1.1–1.5**	**1.6–2.0**	**2.1–3.0**	**3.1–5.0**	**5.1–7.0**	**7.1–10.0**	**10.1–13.0**	**13.1–18.0**	**>18.0**	**Total**
N	0	0	0	0	0	4	22	32	11	1	0	0	70
NNE	0	0	0	0	0	1	13	22	7	0	0	0	43
NE	0	0	0	0	0	1	22	68	42	5	0	0	138
ENE	0	0	1	0	1	1	12	56	42	3	0	0	116
E	0	0	0	0	0	1	16	62	43	1	0	0	123
ESE	0	0	0	0	0	1	51	101	42	3	0	0	198
SE	0	0	0	0	1	6	42	44	43	6	0	0	142
SSE	0	0	0	0	0	11	57	48	26	1	0	0	143
S	0	0	0	0	0	3	39	70	21	1	0	0	134
SSW	0	0	0	0	1	3	15	34	16	3	0	0	72
SW	0	0	0	0	2	1	5	3	21	4	0	0	36
WSW	0	0	0	0	0	0	3	6	6	0	0	0	15
W	0	0	0	0	1	0	3	4	3	1	0	0	12
WNW	0	0	0	0	0	1	2	4	10	0	1	0	18
NW	0	0	0	0	2	2	12	11	3	0	0	0	30
NNW	0	0	0	0	0	4	24	35	18	3	0	0	84
Totals	**0**	**0**	**1**	**0**	**8**	**40**	**338**	**600**	**354**	**32**	**1**	**0**	**1374**

Number of Calm Hours not included above for:	**Total Period**	**0**
Number of Variable Direction Hours for:	**Total Period**	**0**
Number of Invalid Hours for:	**Total Period**	**2337**
Number of Valid Hours for:	**Total Period**	**1374**
Total Hours for:	**Total Period**	**26280**

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 60-meter and 10-meter measurement levels.

Table 2.7-11 (Sheet 3 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for Units 6 & 7 (2002, 2005, and 2006)

Hours at Each Wind Speed and Direction

Total Period

Period of Record 3-Year Composite (2002, 2005, 2006)

Elevation: 60M **Speed:** WS60M

Direction: WD60M **Lapse:** DT10M-60M

Stability Class: C Slightly Unstable

	Wind Speed (m/s)												
Wind Direction (from)	**0.22–0.50**	**0.51–0.75**	**0.76–1.0**	**1.1–1.5**	**1.6–2.0**	**2.1–3.0**	**3.1–5.0**	**5.1–7.0**	**7.1–10.0**	**10.1–13.0**	**13.1–18.0**	**>18.0**	**Total**
N	0	0	0	0	0	7	24	30	17	0	0	0	78
NNE	0	0	0	0	0	3	19	19	4	2	0	0	47
NE	0	0	0	1	0	6	35	62	56	7	0	0	167
ENE	0	0	0	0	1	5	27	77	69	11	0	0	190
E	0	0	0	0	0	2	86	147	64	1	0	0	300
ESE	0	0	0	0	0	2	111	123	60	1	0	0	297
SE	0	0	0	0	1	11	54	68	47	2	1	0	184
SSE	0	0	0	1	4	16	58	49	13	1	0	0	142
S	0	0	0	2	1	13	25	31	11	1	0	0	84
SSW	0	0	0	0	2	5	14	24	24	4	0	0	73
SW	0	0	0	0	1	1	7	16	11	2	1	0	39
WSW	0	0	0	0	0	6	7	6	5	0	0	0	24
W	0	0	0	1	0	8	1	8	5	0	0	0	23
WNW	0	0	0	1	0	2	6	7	10	1	1	0	28
NW	0	0	0	0	3	5	16	10	8	2	0	0	44
NNW	0	0	0	0	0	5	18	26	16	5	0	0	70
Totals	**0**	**0**	**0**	**6**	**13**	**97**	**508**	**703**	**420**	**40**	**3**	**0**	**1790**

Number of Calm Hours not included above for:	**Total Period**	**0**
Number of Variable Direction Hours for:	**Total Period**	**0**
Number of Invalid Hours for:	**Total Period**	**2337**
Number of Valid Hours for:	**Total Period**	**1790**
Total Hours for:	**Total Period**	**26280**

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 60-meter and 10-meter measurement levels.

Table 2.7-11 (Sheet 4 of 8) Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for Units 6 & 7 (2002, 2005, and 2006)

Hours at Each Wind Speed and Direction

Total Period

Period of Record 3-Year Composite (2002, 2005, 2006)

Elevation: 60M **Speed:** WS60M

Direction: WD60M **Lapse:** DT10M-10M

Stability Class: D Neutral

	Wind Speed (m/s)												
Wind Direction (from)	**0.22–0.50**	**0.51–0.75**	**0.76–1.0**	**1.1–1.5**	**1.6–2.0**	**2.1–3.0**	**3.1–5.0**	**5.1–7.0**	**7.1–10.0**	**10.1–13.0**	**13.1–18.0**	**>18.0**	**Total**
N	0	0	2	4	13	30	90	83	42	2	0	0	266
NNE	0	0	0	1	8	20	42	24	30	4	0	0	129
NE	0	0	1	2	7	40	117	113	238	102	5	0	625
ENE	0	0	0	1	13	44	226	337	339	28	0	0	988
E	0	3	0	3	7	42	389	514	290	24	0	0	1272
ESE	0	0	1	4	7	64	444	373	146	17	0	0	1056
SE	0	0	1	6	6	40	171	164	150	21	2	2	563
SSE	0	0	1	5	6	37	137	115	91	7	5	4	408
S	0	0	1	5	4	23	98	103	44	3	1	2	284
SSW	0	0	0	2	6	19	55	70	48	8	4	0	212
SW	0	0	0	3	7	12	31	64	52	6	2	0	177
WSW	0	0	0	2	2	16	24	20	31	8	1	0	104
W	0	0	0	4	7	19	26	37	30	3	0	0	126
WNW	0	0	0	4	7	25	36	26	18	6	1	0	123
NW	0	0	0	2	14	16	39	26	17	9	0	0	123
NNW	0	0	1	4	10	25	49	102	91	8	1	0	291
Totals	**0**	**3**	**8**	**52**	**124**	**472**	**1974**	**2171**	**1657**	**256**	**22**	**8**	**6747**

Number of Calm Hours not included above for:	**Total Period**	**0**
Number of Variable Direction Hours for:	**Total Period**	**0**
Number of Invalid Hours for:	**Total Period**	**2337**
Number of Valid Hours for:	**Total Period**	**6747**
Total Hours for:	**Total Period**	**26280**

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 60-meter and 10-meter measurement levels.

Table 2.7-11 (Sheet 5 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for Units 6 & 7 (2002, 2005, and 2006)

Hours at Each Wind Speed and Direction

Total Period

Period of Record 3-Year Composite (2002, 2005, 2006)

Elevation: 60M **Speed:** WS60M

Direction: WD60M **Lapse:** DT10M-60M

Stability Class: E Slightly Stable

	Wind Speed (m/s)												
Wind Direction (from)	**0.22–0.50**	**0.51–0.75**	**0.76–1.0**	**1.1–1.5**	**1.6–2.0**	**2.1–3.0**	**3.1–5.0**	**5.1–7.0**	**7.1–10.0**	**10.1–13.0**	**13.1–18.0**	**>18.0**	**Total**
N	0	0	0	2	1	20	109	167	56	0	0	0	355
NNE	0	0	0	1	3	13	52	66	36	0	0	0	171
NE	0	0	3	5	11	17	96	169	225	55	0	0	581
ENE	0	0	0	2	8	49	283	476	237	11	0	0	1066
E	0	3	1	5	12	101	553	799	340	18	3	0	1835
ESE	1	0	1	5	14	92	474	505	225	17	10	1	1345
SE	0	0	0	8	20	97	311	339	157	14	11	5	962
SSE	0	2	2	4	13	63	168	143	113	16	4	4	532
S	0	0	5	7	8	55	129	98	40	4	2	2	350
SSW	0	0	1	6	12	29	90	64	32	2	1	0	237
SW	0	0	2	3	6	27	50	42	28	3	1	0	162
WSW	0	0	1	4	4	22	28	34	12	0	0	0	105
W	0	0	0	10	8	30	49	41	5	1	0	0	144
WNW	0	1	3	5	6	22	57	46	17	1	0	0	158
NW	0	0	3	9	9	29	46	45	41	3	0	0	185
NNW	0	0	1	6	7	24	78	173	129	1	0	0	419
Totals	**1**	**6**	**23**	**82**	**142**	**690**	**2573**	**3207**	**1693**	**146**	**32**	**12**	**8607**

Number of Calm Hours not included above for:	**Total Period**	**0**
Number of Variable Direction Hours for:	**Total Period**	**0**
Number of Invalid Hours for:	**Total Period**	**2337**
Number of Valid Hours for:	**Total Period**	**8607**
Total Hours for:	**Total Period**	**26280**

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 60-meter and 10-meter measurement levels.

Table 2.7-11 (Sheet 6 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for Units 6 & 7 (2002, 2005, and 2006)

Hours at Each Wind Speed and Direction

Total Period

Period of Record 3-Year Composite (2002, 2005, 2006)

Elevation:	60M	**Speed:**	WS60M
Direction:	WD60M	**Lapse:**	DT10M-60M
Stability Class: F		Moderately Stable	

	Wind Speed (m/s)												
Wind Direction (from)	**0.22–0.50**	**0.51–0.75**	**0.76–1.0**	**1.1–1.5**	**1.6–2.0**	**2.1–3.0**	**3.1–5.0**	**5.1–7.0**	**7.1–10.0**	**10.1–13.0**	**13.1–18.0**	**>18.0**	**Total**
N	0	0	2	7	14	28	83	124	51	0	0	0	309
NNE	0	0	0	7	6	19	41	18	4	0	0	0	95
NE	0	0	1	9	6	30	45	8	7	0	0	0	106
ENE	0	0	1	6	9	21	30	13	4	0	0	0	84
E	1	3	1	7	11	29	82	49	4	0	0	0	187
ESE	1	1	2	6	11	29	112	73	7	0	0	0	242
SE	0	2	5	6	11	25	69	55	1	0	0	0	174
SSE	0	0	5	12	8	29	54	27	0	0	0	0	135
S	0	0	1	1	5	17	35	20	0	0	0	0	79
SSW	1	1	3	1	7	14	53	11	3	0	1	0	95
SW	0	1	3	3	7	15	37	19	2	0	1	0	88
WSW	0	0	2	2	9	16	28	23	13	0	1	0	94
W	0	1	7	8	9	23	54	53	7	0	0	0	162
WNW	0	0	1	3	11	31	53	49	10	0	0	0	158
NW	0	1	3	4	9	20	45	45	37	0	0	0	164
NNW	0	0	4	8	10	33	68	102	76	0	0	0	301
Totals	**3**	**10**	**41**	**90**	**143**	**379**	**889**	**689**	**226**	**0**	**3**	**0**	**2473**

Number of Calm Hours not included above for:	**Total Period**	**0**
Number of Variable Direction Hours for:	**Total Period**	**0**
Number of Invalid Hours for:	**Total Period**	**2337**
Number of Valid Hours for:	**Total Period**	**2473**
Total Hours for:	**Total Period**	**26280**

Note:Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 60-meter and 10-meter measurement levels.

Table 2.7-11 (Sheet 7 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for Units 6 & 7 (2002, 2005, and 2006)

Hours at Each Wind Speed and Direction

Total Period

Period of Record 3-Year Composite (2002, 2005, 2006)

Elevation:	60M	**Speed:**	WS60M
Direction:	WD60M	**Lapse:**	DT10M-60M
Stability Class: G		Extremely Stable	

	Wind Speed (m/s)												
Wind Direction (from)	**0.22–0.50**	**0.51–0.75**	**0.76–1.0**	**1.1–1.5**	**1.6–2.0**	**2.1–3.0**	**3.1–5.0**	**5.1–7.0**	**7.1–10.0**	**10.1–13.0**	**13.1–18.0**	**>18.0**	**Total**
N	0	1	1	5	7	29	65	128	117	3	0	0	356
NNE	0	2	1	4	5	19	45	14	7	0	0	0	97
NE	0	2	0	1	9	23	38	1	0	0	0	0	74
ENE	0	1	2	2	6	23	19	1	0	0	0	0	54
E	0	1	1	7	4	13	23	4	0	0	0	0	53
ESE	0	0	2	8	4	13	11	1	0	0	0	0	39
SE	0	1	3	2	4	6	7	5	0	0	0	0	28
SSE	0	1	0	5	3	7	13	7	0	0	0	0	36
S	0	1	0	0	5	7	6	15	1	0	0	0	35
SSW	0	0	0	4	2	4	14	11	6	0	0	0	41
SW	0	1	0	4	1	9	16	21	10	0	0	0	62
WSW	1	0	1	3	4	7	26	10	11	0	0	0	63
W	0	0	1	2	4	12	34	26	3	0	0	0	82
WNW	0	0	0	2	4	22	47	44	4	0	0	0	123
NW	2	1	1	4	6	23	49	39	20	0	0	0	145
NNW	0	2	0	4	2	21	40	77	59	0	0	0	205
Totals	**3**	**14**	**13**	**57**	**70**	**238**	**453**	**404**	**238**	**3**	**0**	**0**	**1493**

Number of Calm Hours not included above for:	**Total Period**	**0**
Number of Variable Direction Hours for:	**Total Period**	**0**
Number of Invalid Hours for:	**Total Period**	**2337**
Number of Valid Hours for:	**Total Period**	**1493**
Total Hours for:	**Total Period**	**26280**

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 60-meter and 10-meter measurement levels.

Table 2.7-11 (Sheet 8 of 8)
Joint Frequency Distribution of Wind Speed and Wind Direction (60-Meter Level) by Atmospheric Stability Class for Units 6 & 7 (2002, 2005, and 2006)

Hours at Each Wind Speed and Direction

Summary of All Stability Classes
Total Period

Period of Record 3-Year Composite (2002, 2005, 2006)

Elevation:	60M	**Speed:**	WS60M
Direction:	WD60M	**Lapse:**	DT10M-60M

	Wind Speed (m/s)												
Wind Direction (from)	**0.22–0.50**	**0.51–0.75**	**0.76–1.0**	**1.1–1.5**	**1.6–2.0**	**2.1–3.0**	**3.1–5.0**	**5.1–7.0**	**7.1–10.0**	**10.1–13.0**	**13.1–18.0**	**>18.0**	**Total**
N	0	1	5	18	35	118	407	600	316	8	0	0	1508
NNE	0	2	1	13	22	75	217	184	106	7	0	0	627
NE	0	2	5	18	33	117	354	464	640	176	5	0	1814
ENE	0	1	4	11	38	143	597	991	731	58	0	0	2574
E	1	10	3	22	34	188	1153	1620	795	49	3	0	3878
ESE	2	1	6	23	36	201	1219	1265	546	41	10	1	3351
SE	0	3	9	22	43	185	688	730	440	51	14	7	2192
SSE	0	3	8	27	34	169	558	484	273	26	9	8	1599
S	0	1	7	15	23	118	366	426	167	15	3	4	1145
SSW	1	1	4	13	30	76	247	237	158	26	6	0	799
SW	0	2	5	13	24	65	147	171	137	19	5	0	588
WSW	1	0	4	11	19	67	121	103	82	8	2	0	418
W	0	1	8	25	30	92	168	175	59	7	0	0	565
WNW	0	1	4	15	28	104	204	185	73	8	6	0	628
NW	2	2	7	19	43	98	212	190	147	14	0	0	734
NNW	0	2	6	22	29	113	291	576	456	27	1	0	1523
Totals	**7**	**33**	**86**	**287**	**501**	**1929**	**6949**	**8401**	**5126**	**540**	**64**	**20**	**23943**

Number of Calm Hours not included above for:	**Total Period**	**0**
Number of Variable Direction Hours for:	**Total Period**	**0**
Number of Invalid Hours for:	**Total Period**	**2337**
Number of Valid Hours for:	**Total Period**	**23943**
Total Hours for:	**Total Period**	**26280**

Note: Stability class based on the vertical temperature difference (ΔT or lapse rate) between the 60-meter and 10-meter measurement levels.

Table 2.7-12
Exclusion Area Boundary and Low Population Zones Distances from Units 6 & 7 Power Block Area

Distance from Units 6 & 7 PBA				
Directional Sector	**To EAB (feet)**	**To EAB (meters)**	**To LPZ (feet)**	**To LPZ (meters)**
S	2,756	840	22,484	6,853
SSW	2,687	819	22,474	6,850
SW	2,375	724	22,411	6,831
WSW	2,559	780	23,284	7,097
W	2,566	782	25,230	7,690
WNW	2,589	789	25,230	7,690
NW	2,513	766	26,568	8,098
NNW	2,516	767	28,330	8,635
N	2,516	767	29,423	8,968
NNE	2,516	767	29,209	8,903
NE	**1,427**	**435**	27,677	8,436
ENE	**1,503**	**458**	26,371	8,038
E	**1,572**	**479**	24,862	7,578
ESE	**1,932**	**589**	23,655	7,210
SE	**1,923**	**586**	22,805	6,951
SSE	2,782	848	22,523	6,865

Bolded values in table represent sector distances eligible for the building wake credit.

Table 2.7-13
PAVAN Results — X/Q Values at the EAB

Downwind Sector	Distance (Meters)	0–2 hrs (sec/m3)	0–8 hrs (sec/m3)	8–24 hrs (sec/m3)	1–4 days (sec/m3)	4–30 days (sec/m3)	Annual Average (sec/ m3)	Hrs Per Yr Max 0-2 Hr X/Q Exceeded In Sector
S	840	2.51E-04	1.60E-04	1.28E-04	7.87E-05	3.91E-05	1.67E-05	6.2
SSW	819	1.03E-04	6.27E-05	4.89E-05	2.86E-05	1.32E-05	5.15E-06	1.1
SW	724	1.25E-04	8.25E-05	6.69E-05	4.25E-05	2.21E-05	9.95E-06	2.8
WSW	780	1.17E-04	8.27E-05	6.97E-05	4.80E-05	2.82E-05	1.46E-05	0.5
W	782	1.38E-04	1.06E-04	9.27E-05	6.93E-05	4.57E-05	2.74E-05	2.2
WNW	789	1.33E-04	9.65E-05	8.23E-05	5.83E-05	3.55E-05	1.94E-05	1.7
NW	766	1.39E-04	9.58E-05	7.94E-05	5.28E-05	2.94E-05	1.43E-05	2
NNW	767	1.18E-04	7.77E-05	6.30E-05	4.00E-05	2.08E-05	9.39E-06	2.3
N	767	1.10E-04	7.00E-05	5.57E-05	3.41E-05	1.68E-05	7.06E-06	1.4
NNE	767	1.23E-04	7.73E-05	6.13E-05	3.71E-05	1.80E-05	7.44E-06	3
NE	**435**	**3.78E-04**	**2.35E-04**	**1.85E-04**	**1.11E-04**	**5.29E-05**	**2.14E-05**	**36.1**
ENE	**458**	**3.66E-04**	**2.26E-04**	**1.78E-04**	**1.05E-04**	**4.96E-05**	**1.98E-05**	**32.6**
E	**479**	**4.01E-04**	**2.55E-04**	**2.03E-04**	**1.24E-04**	**6.09E-05**	**2.56E-05**	**39.5**
ESE	**589**	**3.51E-04**	**2.24E-04**	**1.78E-04**	**1.09E-04**	**5.42E-05**	**2.29E-05**	**28.6**
SE	**586**	**4.25E-04**	**2.72E-04**	**2.18E-04**	**1.35E-04**	**6.73E-05**	**2.89E-05**	**43.7**
SSE	848	3.04E-04	2.05E-04	1.69E-04	1.10E-04	5.98E-05	2.83E-05	12.9
Max 0-2 hr X/Q		4.25E-04	Total Hours Entire Site Max 0-2 hr X/Q Exceeded					216.7
S	840	2.48E-04	1.46E-04	1.12E-04	6.30E-05	2.76E-05	1.00E-05	6.4
SSW	819	9.36E-05	5.35E-05	4.05E-05	2.21E-05	9.26E-06	3.19E-06	1.2
SW	724	1.03E-04	6.48E-05	5.14E-05	3.11E-05	1.51E-05	6.26E-06	2.8
WSW	780	1.10E-04	7.30E-05	5.95E-05	3.83E-05	2.03E-05	9.36E-06	0.5
W	782	1.37E-04	9.74E-05	8.21E-05	5.66E-05	3.32E-05	1.72E-05	2.2
WNW	789	1.30E-04	8.81E-05	7.26E-05	4.76E-05	2.60E-05	1.24E-05	1.7
NW	766	1.35E-04	8.63E-05	6.89E-05	4.23E-05	2.10E-05	8.91E-06	2.1
NNW	767	1.10E-04	6.81E-05	5.35E-05	3.17E-05	1.50E-05	5.98E-06	2.4
N	767	1.01E-04	6.01E-05	4.64E-05	2.66E-05	1.19E-05	4.47E-06	1.5
NNE	767	1.17E-04	6.85E-05	5.24E-05	2.93E-05	1.27E-05	4.58E-06	3.1
NE	**435**	**3.54E-04**	**2.03E-04**	**1.54E-04**	**8.46E-05**	**3.57E-05**	**1.24E-05**	**36**
ENE	**458**	**3.26E-04**	**1.87E-04**	**1.42E-04**	**7.80E-05**	**3.30E-05**	**1.15E-05**	**29.1**
E	**479**	**3.92E-04**	**2.28E-04**	**1.74E-04**	**9.68E-05**	**4.17E-05**	**1.49E-05**	**39.1**
ESE	**589**	**3.51E-04**	**2.05E-04**	**1.56E-04**	**8.69E-05**	**3.74E-05**	**1.34E-05**	**29.5**
SE	**586**	**4.19E-04**	**2.47E-04**	**1.89E-04**	**1.06E-04**	**4.64E-05**	**1.69E-05**	**43.7**
SSE	848	2.98E-04	1.86E-04	1.46E-04	8.75E-05	4.17E-05	1.69E-05	13.1
Max 0-2 hr X/Q		4.19E-04	Total Hours Entire Site Max 0-2 hr X/Q Exceeded					214.3

Bolded values indicate sectors eligible to receive the building wake credit.

Table 2.7-14
PAVAN Results — X/Q Values LPZ
(Building Wake Credit Not Included)

Downwind Sector	Distance (Meters)	0–2 hrs (sec/m^3)	0–8 hrs (sec/m^3)	8–24 hrs (sec/m^3)	1–4 days (sec/m^3)	4–30 days (sec/m^3)	Annual Average (sec/m^3)	Hrs Per Yr Max 0-2 Hr X/Q Exceeded In Sector
S	6853	3.19E-05	1.37E-05	8.94E-06	3.56E-06	9.50E-07	1.89E-07	21.1
SSW	6850	8.26E-06	3.59E-06	2.37E-06	9.60E-07	2.63E-07	5.38E-08	3.2
SW	6831	7.44E-06	3.52E-06	2.42E-06	1.07E-06	3.34E-07	8.02E-08	3.4
WSW	7097	8.69E-06	4.31E-06	3.04E-06	1.42E-06	4.76E-07	1.25E-07	0.7
W	7690	1.14E-05	5.86E-06	4.20E-06	2.05E-06	7.27E-07	2.05E-07	2.4
WNW	7690	1.05E-05	5.19E-06	3.64E-06	1.69E-06	5.61E-07	1.45E-07	2.3
NW	8098	9.70E-06	4.51E-06	3.08E-06	1.34E-06	4.08E-07	9.49E-08	2.8
NNW	8635	6.86E-06	3.08E-06	2.07E-06	8.70E-07	2.51E-07	5.46E-08	2.8
N	8968	5.29E-06	2.34E-06	1.56E-06	6.46E-07	1.82E-07	3.87E-08	1.6
NNE	8903	7.34E-06	3.13E-06	2.05E-06	8.15E-07	2.17E-07	4.28E-08	3
NE	8436	1.12E-05	4.61E-06	2.95E-06	1.12E-06	2.80E-07	5.12E-08	5.2
ENE	8038	1.23E-05	5.05E-06	3.24E-06	1.23E-06	3.09E-07	5.67E-08	3.7
E	7578	1.85E-05	7.67E-06	4.94E-06	1.90E-06	4.79E-07	8.92E-08	8.7
ESE	7210	2.57E-05	1.07E-05	6.89E-06	2.66E-06	6.77E-07	1.27E-07	15.4
SE	6951	3.00E-05	1.28E-05	8.31E-06	3.28E-06	8.65E-07	1.69E-07	20.4
SSE	6865	4.15E-05	1.87E-05	1.25E-05	5.25E-06	1.51E-06	3.29E-07	43.7
Max 0-2 hr X/Q		4.15E-05	Total Hours Entire Site Max 0-2 hr X/Q Exceeded					140.4

Table 2.7-15
Distances to Sensitive Receptors for XOQDOQ Modeling From Units 6 & 7 Power Block Area

Direction	Name	Type of Receptor	Distance From Power Block Area (Miles)
N	Biscayne National Park	Resident	2.7
NNW	Military Canal Residence	Resident/Meat Animal	5.1
NNW	Bananas, plantains, coconuts, lemons	Vegetable Garden	5.1
NW	Satellite School	Resident	1.99
NW	Single-Family Home	Resident/Meat Animal	4.0
NW	Mowry Drive Residence	Vegetable Garden	4.8
W	Unit 7	Not Applicable	0.13

Table 2.7-16
XOQDOQ-Predicted X/Q and D/Q Values at Receptors of Interest

Type of Location	Sector	Distance (miles)	X/Q (s/m^3) (No Decay, no dry deposition)
EAB	SSE	0.53	1.7E-5
	SE	0.36	1.7E-5
	W	0.49	1.7E-5
Residence/Meat Animal	N	2.7	1.4E-7
	NW	4.0	1.3E-7
	NNW	5.1	5.5E-8
Vegetable Garden	NW	4.8	9.6E-8
	NNW	5.1	5.5E-8
Unit 7	W	0.13	1.6E-4
School	NW	1.99	5.7E-7
Property Boundary	SSE	0.35	3.4E-5
Type of Location	**Sector**	**Distance (miles)**	**X/Q (s/m^3) (2.26-Day Decay, no dry deposition)**
EAB	SSE	0.53	1.7E-5
	SE	0.36	1.7E-5
	W	0.49	1.7E-5
Residence/Meat Animal	N	2.7	1.3E-7
	NW	4.0	1.3E-7
	NNW	5.1	5.4E-8
Vegetable Garden	NW	4.8	9.4E-8
	NNW	5.1	5.4E-8
Unit 7	W	0.13	1.6E-4
School	NW	1.99	5.2E-7
Property Boundary	SSE	0.35	3.4E-5
Type of Location	**Sector**	**Distance (miles)**	**X/Q (s/m^3) (8-Day Decay, dry deposition)**
EAB	SE	0.36	1.6E-5
	W	0.49	1.6E-5
Residence/Meat Animal	N	2.7	1.1E-7
	NW	4.0	1.0E-7
	NNW	5.1	4.1E-8
Vegetable Garden	NW	4.8	7.2E-8
	NNW	5.1	4.1E-8
Unit 7	W	0.13	1.5E-4
School	NW	1.99	4.3E-7
Property Boundary	SSE	0.35	3.2E-5
Type of Location	**Sector**	**Distance (miles)**	**D/Q ($1/m^2$)**
EAB	W	0.49	1.4E-7
Residence/Meat Animal	N	2.7	7.5E-10
	NW	4.0	5.8E-10
	NNW	5.1	2.4E-10
Vegetable Garden	NW	4.8	3.8E-10
	NNW	5.1	2.4E-10
Unit 7	W	0.13	1.0E-6
School	NW	1.99	2.9E-9
Property Boundary	SSE	0.35	1.2E-7

Table 2.7-17 (Sheet 1 of 2)
XOQDOQ-Predicted Annual Average X/Q Values at the Standard Radial Distances and Distance-Segment Boundaries
No Decay Undepleted X/Qs

No Decay Undepleted X/Qs at Various Distances

RELEASE POINT - GROUND LEVEL - NO INTERMITTENT RELEASES
NO DECAY, UNDEPLETED
CORRECTED USING STANDARD OPEN TERRAIN FACTORS
ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) — DISTANCE IN MILES FROM THE SITE

SECTOR	.250	.500	.750	1.000	1.500	2.000	2.500	3.000	3.500	4.000	4.500
S	3.597E-05	1.079E-05	5.472E-06	2.745E-06	1.107E-06	6.119E-07	3.987E-07	2.843E-07	2.155E-07	1.705E-07	1.394E-07
SSW	1.064E-05	3.280E-06	1.745E-06	8.876E-07	3.595E-07	1.968E-07	1.263E-07	8.892E-08	6.668E-08	5.230E-08	4.243E-08
SW	1.673E-05	5.351E-06	2.913E-06	1.481E-06	5.939E-07	3.208E-07	2.029E-07	1.413E-07	1.050E-07	8.168E-08	6.579E-08
WSW	2.761E-05	8.963E-06	5.030E-06	2.577E-06	1.035E-06	5.582E-07	3.520E-07	2.444E-07	1.810E-07	1.405E-07	1.129E-07
W	5.162E-05	1.657E-05	9.278E-06	4.764E-06	1.924E-06	1.042E-06	6.592E-07	4.590E-07	3.409E-07	2.651E-07	2.135E-07
WNW	3.753E-05	1.202E-05	6.649E-06	3.403E-06	1.372E-06	7.415E-07	4.686E-07	3.259E-07	2.419E-07	1.880E-07	1.513E-07
NW	2.636E-05	8.298E-06	4.552E-06	2.332E-06	9.450E-07	5.136E-07	3.263E-07	2.279E-07	1.697E-07	1.323E-07	1.068E-07
NNW	1.776E-05	5.564E-06	2.994E-06	1.519E-06	6.093E-07	3.298E-07	2.092E-07	1.460E-07	1.086E-07	8.467E-08	6.830E-08
N	1.330E-05	4.161E-06	2.250E-06	1.142E-06	4.586E-07	2.484E-07	1.577E-07	1.101E-07	8.201E-08	6.395E-08	5.161E-08
NNE	1.375E-05	4.255E-06	2.256E-06	1.145E-06	4.624E-07	2.526E-07	1.618E-07	1.139E-07	8.532E-08	6.688E-08	5.423E-08
NE	1.429E-05	4.344E-06	2.247E-06	1.138E-06	4.620E-07	2.547E-07	1.649E-07	1.169E-07	8.822E-08	6.955E-08	5.667E-08
ENE	1.447E-05	4.389E-06	2.263E-06	1.149E-06	4.695E-07	2.595E-07	1.681E-07	1.193E-07	9.003E-08	7.099E-08	5.786E-08
E	2.023E-05	6.085E-06	3.110E-06	1.577E-06	6.447E-07	3.574E-07	2.324E-07	1.654E-07	1.252E-07	9.890E-08	8.075E-08
ESE	2.616E-05	7.820E-06	3.961E-06	1.995E-06	8.100E-07	4.494E-07	2.934E-07	2.095E-07	1.589E-07	1.259E-07	1.030E-07
SE	3.274E-05	9.759E-06	4.913E-06	2.473E-06	1.005E-06	5.582E-07	3.646E-07	2.605E-07	1.977E-07	1.566E-07	1.282E-07
SSE	6.209E-05	1.845E-05	9.261E-06	4.638E-06	1.872E-06	1.039E-06	6.799E-07	4.866E-07	3.698E-07	2.933E-07	2.403E-07

ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) — DISTANCE IN MILES FROM THE SITE

SECTOR	5.000	7.500	10.000	15.000	20.000	25.000	30.000	35.000	40.000	45.000	50.000
S	1.169E-07	6.302E-08	4.218E-08	2.527E-08	1.762E-08	1.334E-08	1.064E-08	8.789E-09	7.454E-09	6.448E-09	5.665E-09
SSW	3.534E-08	1.857E-08	1.221E-08	7.143E-09	4.902E-09	3.666E-09	2.894E-09	2.372E-09	1.997E-09	1.717E-09	1.500E-09
SW	5.445E-08	2.796E-08	1.809E-08	1.035E-08	7.000E-09	5.177E-09	4.051E-09	3.295E-09	2.757E-09	2.357E-09	2.049E-09
WSW	9.326E-08	4.744E-08	3.048E-08	1.725E-08	1.157E-08	8.497E-09	6.610E-09	5.349E-09	4.455E-09	3.793E-09	3.285E-09
W	1.766E-07	9.034E-08	5.828E-08	3.317E-08	2.233E-08	1.645E-08	1.282E-08	1.040E-08	8.675E-09	7.396E-09	6.415E-09
WNW	1.251E-07	6.399E-08	4.128E-08	2.350E-08	1.584E-08	1.168E-08	9.113E-09	7.394E-09	6.173E-09	5.267E-09	4.571E-09
NW	8.851E-08	4.568E-08	2.966E-08	1.704E-08	1.155E-08	8.551E-09	6.698E-09	5.451E-09	4.563E-09	3.902E-09	3.394E-09
NNW	5.662E-08	2.927E-08	1.903E-08	1.097E-08	7.462E-09	5.544E-09	4.354E-09	3.552E-09	2.980E-09	2.553E-09	2.225E-09
N	4.280E-08	2.215E-08	1.442E-08	8.318E-09	5.657E-09	4.203E-09	3.300E-09	2.693E-09	2.259E-09	1.935E-09	1.686E-09
NNE	4.514E-08	2.369E-08	1.557E-08	9.096E-09	6.239E-09	4.665E-09	3.683E-09	3.018E-09	2.541E-09	2.184E-09	1.908E-09
NE	4.737E-08	2.525E-08	1.676E-08	9.931E-09	6.871E-09	5.171E-09	4.104E-09	3.378E-09	2.855E-09	2.462E-09	2.157E-09
ENE	4.837E-08	2.578E-08	1.712E-08	1.014E-08	7.013E-09	5.277E-09	4.187E-09	3.445E-09	2.911E-09	2.510E-09	2.199E-09
E	6.762E-08	3.625E-08	2.416E-08	1.438E-08	9.983E-09	7.531E-09	5.987E-09	4.934E-09	4.175E-09	3.605E-09	3.161E-09
ESE	8.640E-08	4.664E-08	3.123E-08	1.872E-08	1.305E-08	9.880E-09	7.877E-09	6.508E-09	5.518E-09	4.772E-09	4.192E-09
SE	1.076E-07	5.813E-08	3.896E-08	2.338E-08	1.631E-08	1.236E-08	9.856E-09	8.146E-09	6.910E-09	5.978E-09	5.253E-09
SSE	2.019E-07	1.095E-07	7.360E-08	4.433E-08	3.102E-08	2.354E-08	1.881E-08	1.557E-08	1.322E-08	1.145E-08	1.007E-08

VENT AND BUILDING PARAMETERS:

RELEASE HEIGHT	(METERS)	.00	REP. WIND HEIGHT	(METERS)	10.0
DIAMETER	(METERS)	.00	BUILDING HEIGHT	(METERS)	69.7
EXIT VELOCITY	(METERS)	.00	BLDG.MIN.CRS.SEC.AREA	(SQ.METERS)	2636.0
			HEAT EMISSION RATE	(CAL/SEC)	.0

Table 2.7-17 (Sheet 2 of 2)
XOQDOQ-Predicted Annual Average X/Q Values at the Standard Radial Distances and Distance-Segment Boundaries
No Decay Undepleted X/Qs

RELEASE POINT - GROUND LEVEL - NO INTERMITTENT RELEASES
NO DECAY, UNDEPLETED
CHI/Q (SEC/METER CUBED) FOR EACH SEGMENT

SEGMENT BOUNDARIES IN MILES FROM THE SITE

DIRECTION FROM SITE	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	5.442E-06	1.251E-06	4.098E-07	2.180E-07	1.403E-07	6.573E-08	2.563E-08	1.340E-08	8.809E-09	6.456E-09
SSW	1.705E-06	4.046E-07	1.301E-07	6.756E-08	4.273E-08	1.947E-08	7.274E-09	3.687E-09	2.378E-09	1.720E-09
SW	2.818E-06	6.697E-07	2.097E-07	1.065E-07	6.630E-08	2.946E-08	1.058E-08	5.213E-09	3.306E-09	2.361E-09
WSW	4.814E-06	1.166E-06	3.639E-07	1.837E-07	1.138E-07	5.009E-08	1.767E-08	8.561E-09	5.369E-09	3.801E-09
W	8.893E-06	2.163E-06	6.811E-07	3.457E-07	2.151E-07	9.525E-08	3.393E-08	1.657E-08	1.043E-08	7.412E-09
WNW	6.400E-06	1.543E-06	4.843E-07	2.454E-07	1.525E-07	6.748E-08	2.405E-08	1.176E-08	7.420E-09	5.277E-09
NW	4.398E-06	1.061E-06	3.369E-07	1.721E-07	1.076E-07	4.808E-08	1.740E-08	8.608E-09	5.469E-09	3.910E-09
NNW	2.909E-06	6.871E-07	2.160E-07	1.102E-07	6.882E-08	3.080E-08	1.120E-08	5.579E-09	3.563E-09	2.558E-09
N	2.182E-06	5.171E-07	1.629E-07	8.317E-08	5.200E-08	2.330E-08	8.491E-09	4.230E-09	2.701E-09	1.939E-09
NNE	2.206E-06	5.208E-07	1.669E-07	8.645E-08	5.461E-08	2.485E-08	9.265E-09	4.692E-09	3.026E-09	2.187E-09
NE	2.220E-06	5.201E-07	1.697E-07	8.931E-08	5.704E-08	2.639E-08	1.009E-08	5.198E-09	3.386E-09	2.465E-09
ENE	2.241E-06	5.273E-07	1.730E-07	9.114E-08	5.824E-08	2.695E-08	1.030E-08	5.304E-09	3.453E-09	2.513E-09
E	3.090E-06	7.241E-07	2.390E-07	1.267E-07	8.127E-08	3.785E-08	1.460E-08	7.567E-09	4.946E-09	3.610E-09
ESE	3.945E-06	9.130E-07	3.014E-07	1.608E-07	1.036E-07	4.863E-08	1.898E-08	9.924E-09	6.522E-09	4.778E-09
SE	4.905E-06	1.133E-06	3.746E-07	2.000E-07	1.290E-07	6.059E-08	2.370E-08	1.241E-08	8.164E-09	5.986E-09
SSE	9.247E-06	2.116E-06	6.983E-07	3.740E-07	2.418E-07	1.141E-07	4.492E-08	2.364E-08	1.560E-08	1.146E-08

XOQDOQ – TURKEY POINT COL (3 YEAR COMPOSITE 2002, 2005, 2006 Met Data)

Table 2.7-18 (Sheet 1 of 2)
XOQDOQ-Predicted Annual Average D/Q Values at the Standard Radial Distances and Distance-Segment Boundaries
D/Qs at Various Distances

RELEASE POINT - GROUND LEVEL - NO INTERMITTENT RELEASES
CORRECTED USING STANDARD OPEN TERRAIN FACTORS
******************** RELATIVE DEPOSITION PER UNIT AREA (M**-2) AT FIXED POINTS BY DOWNWIND SECTORS ********************

DIRECTION FROM SITE	DISTANCES IN MILES .25	.50	.75	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50
S	1.312E-07	4.436E-08	2.278E-08	1.083E-08	3.889E-09	1.929E-09	1.136E-09	7.437E-10	5.233E-10	3.878E-10	2.988E-10
SSW	5.059E-08	1.711E-08	8.784E-09	4.176E-09	1.500E-09	7.439E-10	4.380E-10	2.868E-10	2.018E-10	1.496E-10	1.153E-10
SW	1.466E-07	4.957E-08	2.545E-08	1.210E-08	4.346E-09	2.155E-09	1.269E-09	8.310E-10	5.847E-10	4.333E-10	3.339E-10
WSW	2.370E-07	8.015E-08	4.115E-08	1.956E-08	7.027E-09	3.485E-09	2.052E-09	1.344E-09	9.455E-10	7.007E-10	5.400E-10
W	4.078E-07	1.379E-07	7.081E-08	3.366E-08	1.209E-08	5.997E-09	3.531E-09	2.312E-09	1.627E-09	1.206E-09	9.291E-10
WNW	3.077E-07	1.040E-07	5.342E-08	2.540E-08	9.122E-09	4.524E-09	2.664E-09	1.744E-09	1.227E-09	9.095E-10	7.009E-10
NW	1.928E-07	6.520E-08	3.347E-08	1.591E-08	5.716E-09	2.835E-09	1.669E-09	1.093E-09	7.691E-10	5.700E-10	4.392E-10
NNW	1.380E-07	4.667E-08	2.396E-08	1.139E-08	4.092E-09	2.029E-09	1.195E-09	7.824E-10	5.505E-10	4.080E-10	3.144E-10
N	1.027E-07	3.474E-08	1.784E-08	8.480E-09	3.046E-09	1.511E-09	8.895E-10	5.824E-10	4.098E-10	3.037E-10	2.340E-10
NNE	7.283E-08	2.463E-08	1.265E-08	6.012E-09	2.160E-09	1.071E-09	6.306E-10	4.129E-10	2.905E-10	2.153E-10	1.659E-10
NE	5.551E-08	1.877E-08	9.639E-09	4.582E-09	1.646E-09	8.163E-10	4.806E-10	3.147E-10	2.215E-10	1.641E-10	1.265E-10
ENE	4.950E-08	1.674E-08	8.594E-09	4.086E-09	1.468E-09	7.278E-10	4.286E-10	2.806E-10	1.975E-10	1.463E-10	1.128E-10
E	5.807E-08	1.964E-08	1.008E-08	4.793E-09	1.722E-09	8.538E-10	5.027E-10	3.292E-10	2.316E-10	1.717E-10	1.323E-10
ESE	6.472E-08	2.189E-08	1.124E-08	5.342E-09	1.919E-09	9.517E-10	5.604E-10	3.669E-10	2.582E-10	1.913E-10	1.474E-10
SE	9.289E-08	3.141E-08	1.613E-08	7.667E-09	2.754E-09	1.366E-09	8.042E-10	5.266E-10	3.705E-10	2.746E-10	2.116E-10
SSE	2.081E-07	7.037E-08	3.613E-08	1.718E-08	6.171E-09	3.060E-09	1.802E-09	1.180E-09	8.302E-10	6.152E-10	4.741E-10

DIRECTION FROM SITE	DISTANCES IN MILES 5.00	7.50	10.00	15.00	20.00	25.00	30.00	35.00	40.00	45.00	50.00
S	2.374E-10	1.055E-10	6.389E-11	3.229E-11	1.954E-11	1.310E-11	9.390E-12	7.051E-12	5.482E-12	4.379E-12	3.574E-12
SSW	9.157E-11	4.068E-11	2.464E-11	1.245E-11	7.538E-12	5.054E-12	3.622E-12	2.719E-12	2.114E-12	1.689E-12	1.379E-12
SW	2.653E-10	1.179E-10	7.139E-11	3.608E-11	2.184E-11	1.464E-11	1.049E-11	7.879E-12	6.126E-12	4.893E-12	3.994E-12
WSW	4.290E-10	1.906E-10	1.154E-10	5.835E-11	3.531E-11	2.368E-11	1.697E-11	1.274E-11	9.905E-12	7.912E-12	6.458E-12
W	7.381E-10	3.279E-10	1.986E-10	1.004E-10	6.077E-11	4.074E-11	2.919E-11	2.192E-11	1.704E-11	1.362E-11	1.111E-11
WNW	5.568E-10	2.474E-10	1.498E-10	7.574E-11	4.584E-11	3.073E-11	2.202E-11	1.654E-11	1.286E-11	1.027E-11	8.383E-12
NW	3.489E-10	1.550E-10	9.390E-11	4.746E-11	2.873E-11	1.926E-11	1.380E-11	1.036E-11	8.058E-12	6.436E-12	5.254E-12
NNW	2.498E-10	1.110E-10	6.722E-11	3.397E-11	2.056E-11	1.379E-11	9.879E-12	7.418E-12	5.768E-12	4.607E-12	3.761E-12
N	1.859E-10	8.260E-11	5.004E-11	2.529E-11	1.531E-11	1.026E-11	7.354E-12	5.522E-12	4.294E-12	3.430E-12	2.799E-12
NNE	1.318E-10	5.856E-11	3.547E-11	1.793E-11	1.085E-11	7.276E-12	5.214E-12	3.915E-12	3.044E-12	2.432E-12	1.985E-12
NE	1.005E-10	4.464E-11	2.704E-11	1.367E-11	8.272E-12	5.546E-12	3.974E-12	2.984E-12	2.320E-12	1.853E-12	1.513E-12
ENE	8.959E-11	3.980E-11	2.411E-11	1.219E-11	7.375E-12	4.945E-12	3.543E-12	2.661E-12	2.069E-12	1.652E-12	1.349E-12
E	1.051E-10	4.669E-11	2.828E-11	1.429E-11	8.652E-12	5.801E-12	4.157E-12	3.121E-12	2.427E-12	1.939E-12	1.582E-12
ESE	1.171E-10	5.204E-11	3.152E-11	1.593E-11	9.643E-12	6.466E-12	4.633E-12	3.479E-12	2.705E-12	2.161E-12	1.764E-12
SE	1.681E-10	7.468E-11	4.524E-11	2.287E-11	1.384E-11	9.280E-12	6.649E-12	4.993E-12	3.882E-12	3.101E-12	2.531E-12
SSE	3.767E-10	1.673E-10	1.014E-10	5.123E-11	3.101E-11	2.079E-11	1.490E-11	1.119E-11	8.698E-12	6.948E-12	5.671E-12

USNRC COMPUTER CODE - XOQDOQ, VERSION 2.0
XOQDOQ - TURKEY POINT COL (3 YEAR COMPOSITE 2002, 2005, 2006 Met Data)

Table 2.7-18 (Sheet 2 of 2)
XOQDOQ-Predicted Annual Average D/Q Values at the Standard Radial Distances and Distance-Segment Boundaries
D/Qs at Various Distances

RELEASE POINT - GROUND LEVEL - NO INTERMITTENT RELEASES

************************ RELATIVE DEPOSITION PER UNIT AREA (M**-2) BY DOWNWIND SECTORS ************************

SEGMENT BOUNDARIES IN MILES

DIRECTION FROM SITE	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	2.226E-08	4.560E-09	1.190E-09	5.346E-10	3.024E-10	1.163E-10	3.365E-11	1.334E-11	7.122E-12	4.408E-12
SSW	8.586E-09	1.759E-09	4.591E-10	2.062E-10	1.166E-10	4.486E-11	1.298E-11	5.143E-12	2.747E-12	1.700E-12
SW	2.488E-08	5.095E-09	1.330E-09	5.974E-10	3.380E-10	1.300E-10	3.760E-11	1.490E-11	7.958E-12	4.926E-12
WSW	4.022E-08	8.239E-09	2.151E-09	9.660E-10	5.465E-10	2.101E-10	6.080E-11	2.410E-11	1.287E-11	7.964E-12
W	6.921E-08	1.418E-08	3.701E-09	1.662E-09	9.403E-10	3.616E-10	1.046E-10	4.146E-11	2.214E-11	1.370E-11
WNW	5.221E-08	1.069E-08	2.792E-09	1.254E-09	7.094E-10	2.728E-10	7.892E-11	3.128E-11	1.670E-11	1.034E-11
NW	3.272E-08	6.702E-09	1.750E-09	7.858E-10	4.445E-10	1.709E-10	4.945E-11	1.960E-11	1.047E-11	6.479E-12
NNW	2.342E-08	4.798E-09	1.252E-09	5.625E-10	3.182E-10	1.224E-10	3.540E-11	1.403E-11	7.493E-12	4.638E-12
N	1.743E-08	3.571E-09	9.323E-10	4.187E-10	2.369E-10	9.109E-11	2.635E-11	1.044E-11	5.577E-12	3.452E-12
NNE	1.236E-08	2.532E-09	6.610E-10	2.969E-10	1.679E-10	6.458E-11	1.868E-11	7.405E-12	3.954E-12	2.447E-12
NE	9.421E-09	1.930E-09	5.038E-10	2.263E-10	1.280E-10	4.922E-11	1.424E-11	5.644E-12	3.014E-12	1.865E-12
ENE	8.400E-09	1.721E-09	4.492E-10	2.017E-10	1.141E-10	4.389E-11	1.270E-11	5.032E-12	2.687E-12	1.663E-12
E	9.854E-09	2.019E-09	5.269E-10	2.367E-10	1.339E-10	5.149E-11	1.489E-11	5.903E-12	3.152E-12	1.951E-12
ESE	1.098E-08	2.250E-09	5.873E-10	2.638E-10	1.492E-10	5.739E-11	1.660E-11	6.580E-12	3.514E-12	2.175E-12
SE	1.576E-08	3.229E-09	8.430E-10	3.786E-10	2.142E-10	8.236E-11	2.383E-11	9.444E-12	5.043E-12	3.121E-12
SSE	3.532E-08	7.234E-09	1.889E-09	8.482E-10	4.798E-10	1.845E-10	5.338E-11	2.116E-11	1.130E-11	6.993E-12

OVENT AND BUILDING PARAMETERS:

RELEASE HEIGHT	(METERS)	.00	REP. WIND HEIGHT	(METERS)	10.0	
DIAMETER	(METERS)	.00	BUILDING HEIGHT	(METERS)	69.7	
EXIT VELOCITY	(METERS)	.00	BLDG.MIN.CRS.SEC.AREA	(SQ.METERS)	2636.0	
			HEAT EMISSION RATE	(CAL/SEC)		.0

ALL GROUND LEVEL RELEASES.

XOQDOQ - TURKEY POINT COL (3 YEAR COMPOSITE 2002, 2005, 2006 Met Data)

Table 2.7-19
XOQDOQ-Predicted Annual X/Qs and D/Qs at Sensitive Receptors

RELEASE POINT - GROUND LEVEL - NO INTERMITTENT RELEASES
CORRECTED USING STANDARD OPEN TERRAIN FACTORS
SPECIFIC POINTS OF INTEREST

0RELEASE ID	TYPE OF LOCATION	DIRECTION FROM SITE	DISTANCE (MILES)	DISTANCE (METERS)	X/Q (SEC/CUB.METER) NO DECAY UNDEPLETED	X/Q (SEC/CUB.METER) 2.260 DAY DECAY UNDEPLETED	X/Q (SEC/CUB.METER) 8.000 DAY DECAY DEPLETED	D/Q (PER SQ.METER)
A	Residential	NW	3.97	6388.	1.3E-07	1.3E-07	1.0E-07	5.8E-10
A	Residential	NNW	5.06	8145.	5.5E-08	5.4E-08	4.1E-08	2.4E-10
A	Residential	N	2.69	4333.	1.4E-07	1.3E-07	1.1E-07	7.5E-10
A	Vegetable	NW	4.78	7692.	9.6E-08	9.4E-08	7.2E-08	3.8E-10
A	Vegetable	NNW	5.06	8145.	5.5E-08	5.4E-08	4.1E-08	2.4E-10
A	UNIT 7	W	.13	215.	1.6E-04	1.6E-04	1.5E-04	1.0E-06
A	School	NW	1.99	3198.	5.2E-07	5.2E-07	4.3E-07	2.9E-09
A	EAB	S	.52	840.	1.0E-05	1.0E-05	9.1E-06	4.1E-08
A	EAB	SSW	.51	819.	3.2E-06	3.2E-06	2.9E-06	1.7E-08
A	EAB	SW	.45	724.	6.3E-06	6.3E-06	5.8E-06	5.9E-08
A	EAB	WSW	.48	780.	9.4E-06	9.3E-06	8.6E-06	8.4E-08
A	EAB	W	.49	782.	1.7E-05	1.7E-05	1.6E-05	1.4E-07
A	EAB	WNW	.49	789.	1.2E-05	1.2E-05	1.1E-05	1.1E-07
A	EAB	NW	.48	766.	8.9E-06	8.9E-06	8.2E-06	7.1E-08
A	EAB	NNW	.48	767.	6.0E-06	6.0E-06	5.5E-06	5.0E-08
A	EAB	N	.48	767.	4.5E-06	4.5E-06	4.1E-06	3.8E-08
A	EAB	NNE	.48	767.	4.6E-06	4.6E-06	4.2E-06	2.7E-08
A	EAB	NE	.27	435.	1.2E-05	1.2E-05	1.2E-05	4.9E-08
A	EAB	ENE	.28	458.	1.1E-05	1.1E-05	1.1E-05	4.1E-08
A	EAB	E	.30	479.	1.5E-05	1.5E-05	1.4E-05	4.5E-08
A	EAB	ESE	.37	589.	1.3E-05	1.3E-05	1.2E-05	3.6E-08
A	EAB	SE	.36	586.	1.7E-05	1.7E-05	1.6E-05	5.2E-08
A	EAB	SSE	.53	848.	1.7E-05	1.7E-05	1.5E-05	6.5E-08
A	Prop Line	S	.36	577.	1.9E-05	1.9E-05	1.8E-05	7.5E-08
A	Prop Line	SSW	2.72	4373.	1.1E-07	1.1E-07	8.6E-08	3.6E-10
A	Prop Line	SW	1.50	2409.	6.0E-07	5.9E-07	5.1E-07	4.4E-09
A	Prop Line	WSW	1.36	2195.	1.3E-06	1.3E-06	1.1E-06	8.9E-09
A	Prop Line	W	1.35	2173.	2.4E-06	2.4E-06	2.1E-06	1.6E-08
A	Prop Line	WNW	1.80	2903.	9.2E-07	9.2E-07	7.7E-07	5.8E-09
A	Prop Line	NW	1.64	2641.	7.8E-07	7.7E-07	6.6E-07	4.6E-09
A	Prop Line	NNW	1.51	2430.	6.0E-07	6.0E-07	5.1E-07	4.0E-09
A	Prop Line	N	1.12	1797.	8.9E-07	8.8E-07	7.7E-07	6.4E-09
A	Prop Line	NNE	1.10	1773.	9.2E-07	9.1E-07	8.0E-07	4.7E-09
A	Prop Line	NE	.39	624.	6.7E-06	6.6E-06	6.2E-06	2.8E-08
A	Prop Line	ENE	.40	647.	6.3E-06	6.3E-06	5.8E-06	2.4E-08
A	Prop Line	E	.39	635.	9.1E-06	9.1E-06	8.4E-06	2.9E-08
A	Prop Line	ESE	.43	688.	1.0E-05	1.0E-05	9.4E-06	2.8E-08
A	Prop Line	SE	.37	595.	1.6E-05	1.6E-05	1.5E-05	5.1E-08
A	Prop Line	SSE	.35	564.	3.4E-05	3.4E-05	3.2E-05	1.2E-07

0VENT AND BUILDING PARAMETERS:

RELEASE HEIGHT	(METERS)	.00	REP. WIND HEIGHT	(METERS)	10.0
DIAMETER	(METERS)	.00	BUILDING HEIGHT	(METERS)	60.9
EXIT VELOCITY	(METERS)	.00	BLDG.MIN.CRS.SEC.AREA	(SQ.METERS)	2636.0
			HEAT EMISSION RATE	(CAL/SEC)	.0

Figure 2.7-1 Climatological Observing Stations Near Units 6 & 7

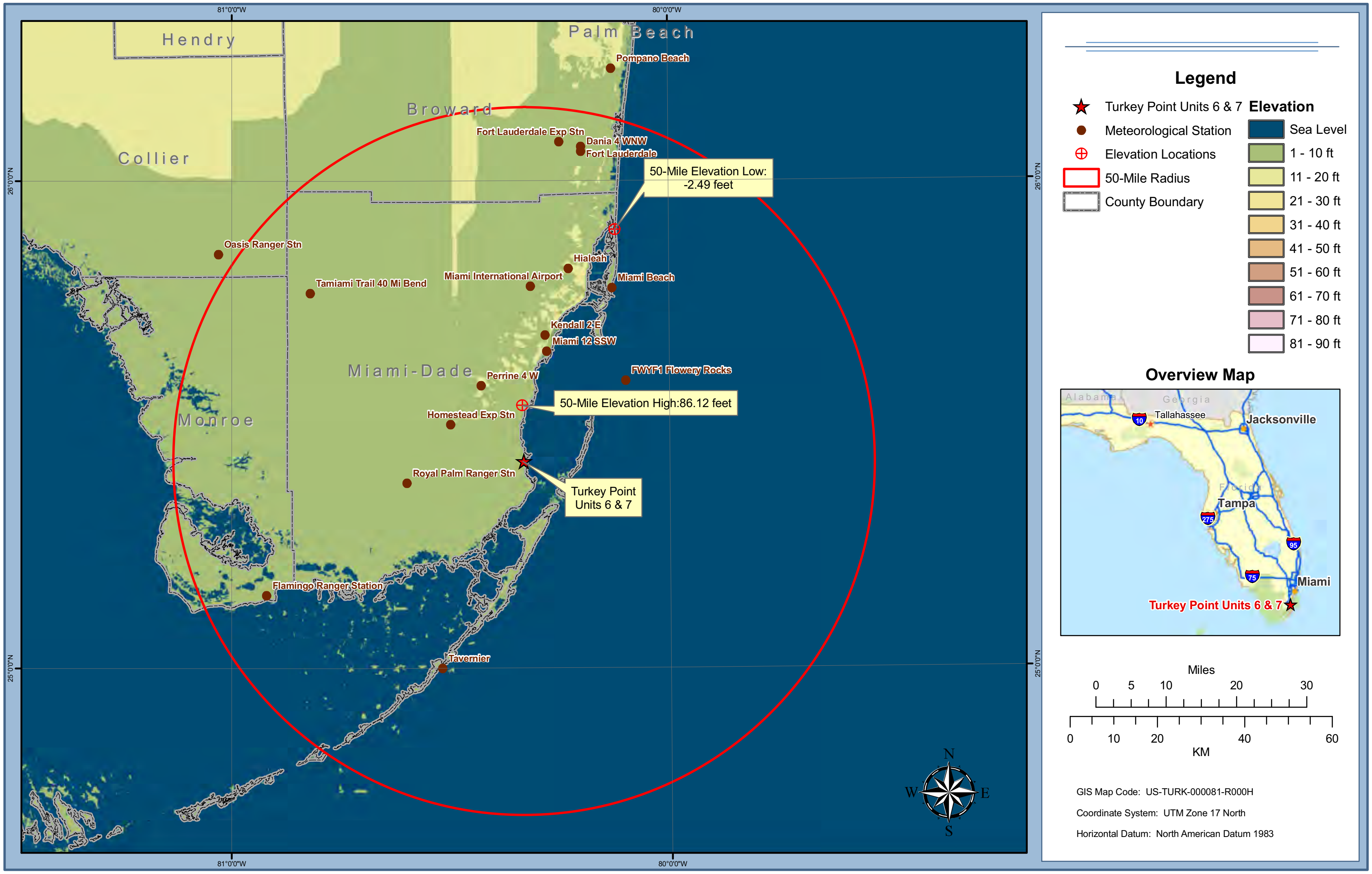


Figure 2.7-2 10-Meter Level 3-Year Composite Wind Rose — Annual (2002, 2005, and 2006)

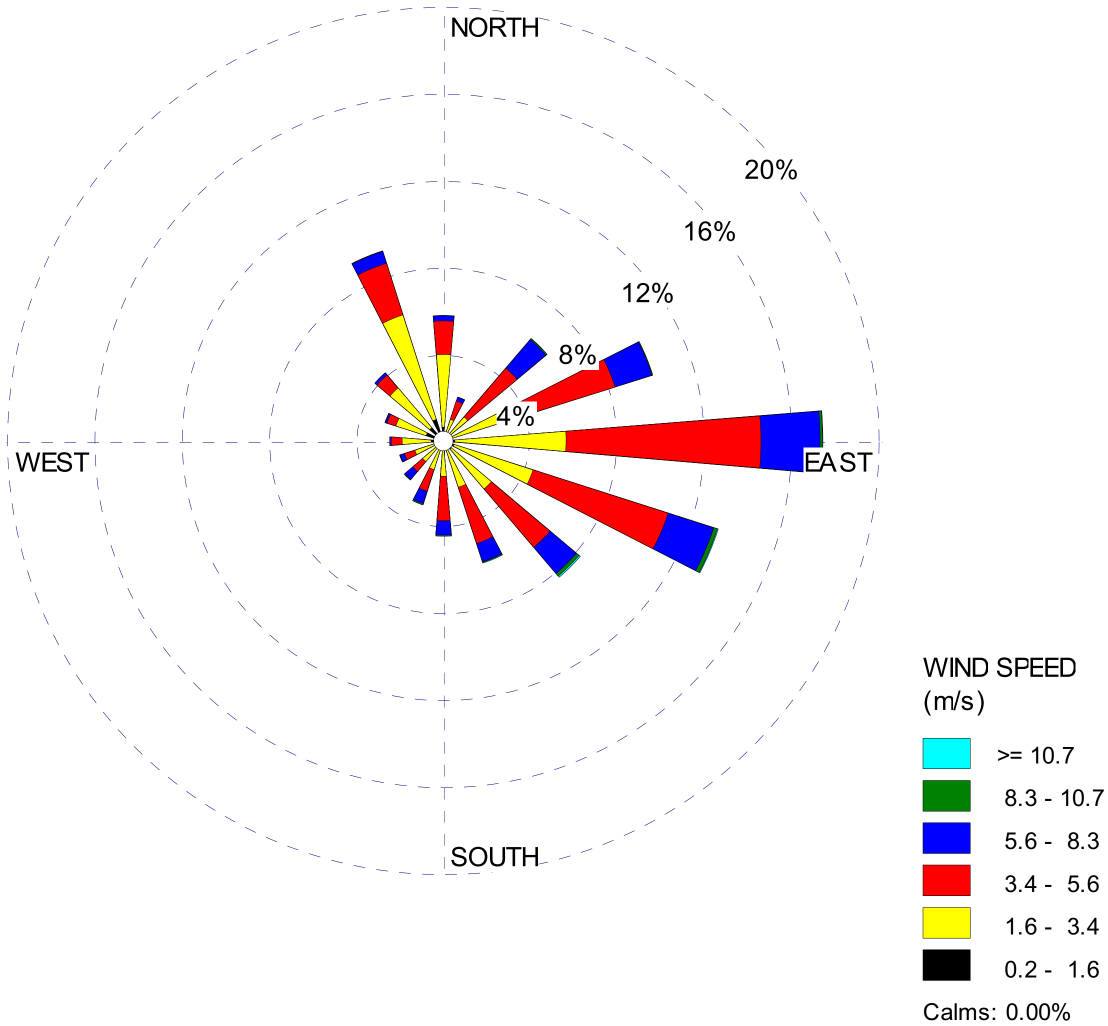


Figure 2.7-3 10-Meter Level 3-Year Composite Wind Rose — Winter (2002, 2005, and 2006)

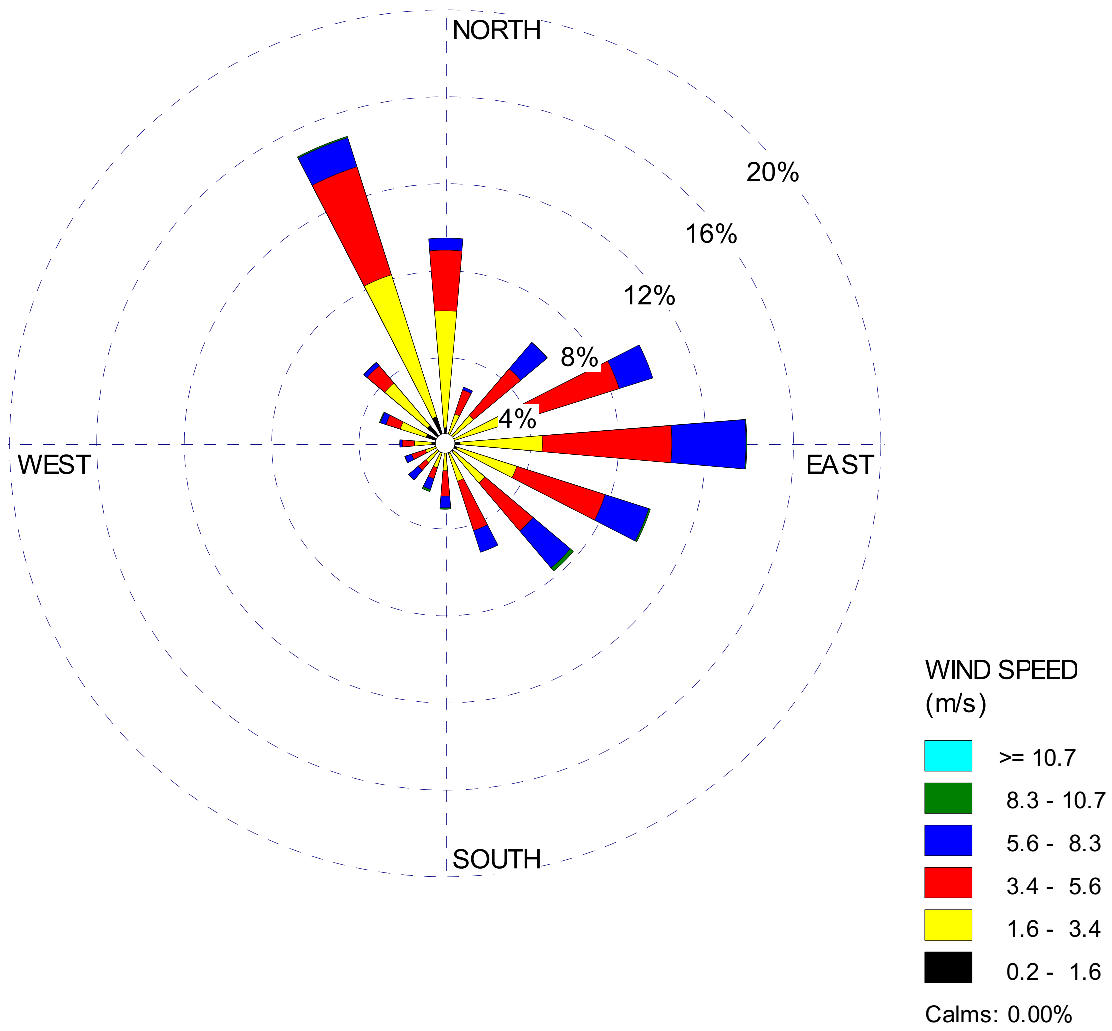


Figure 2.7-4 10-Meter Level 3-Year Composite Wind Rose — Spring (2002, 2005, and 2006)

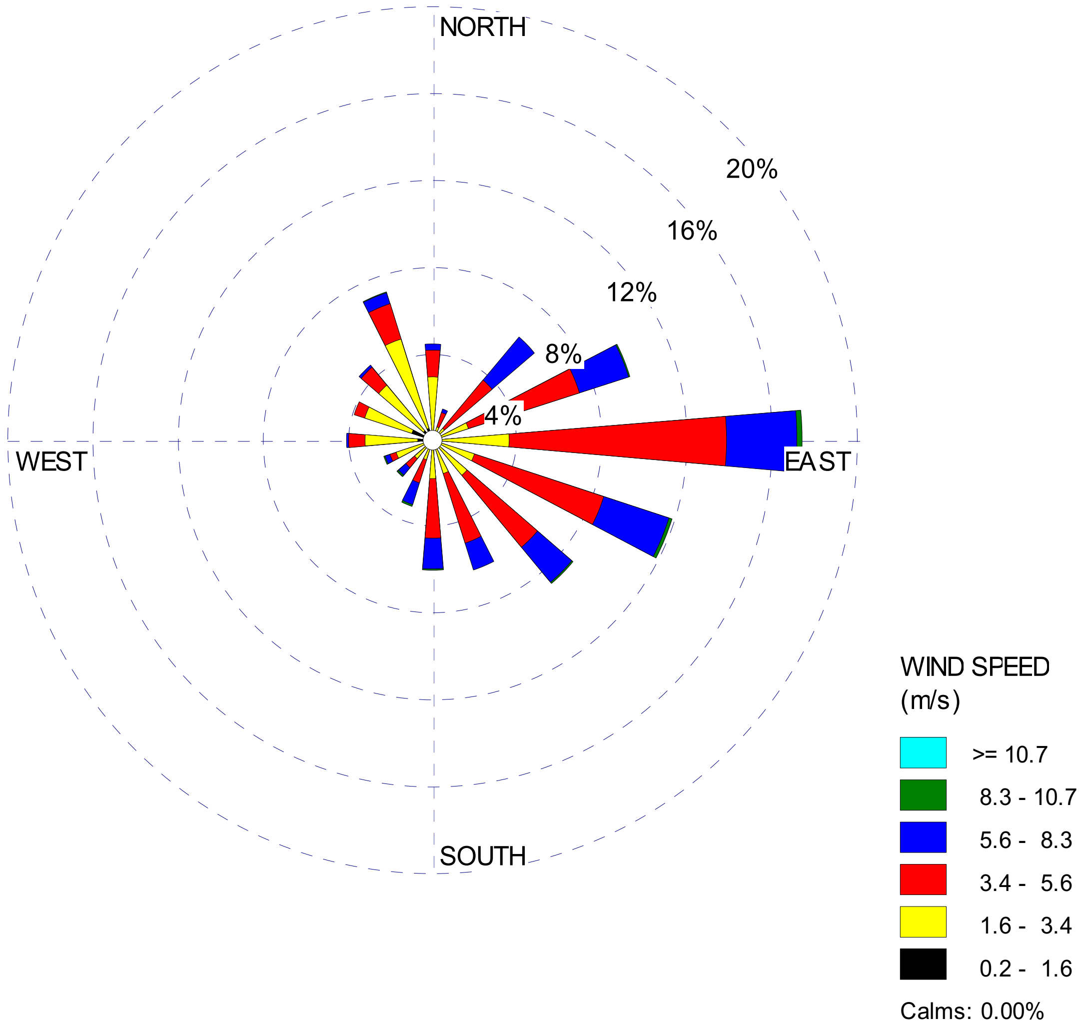


Figure 2.7-5 10-Meter Level 3-Year Composite Wind Rose — Summer (2002, 2005, and 2006)

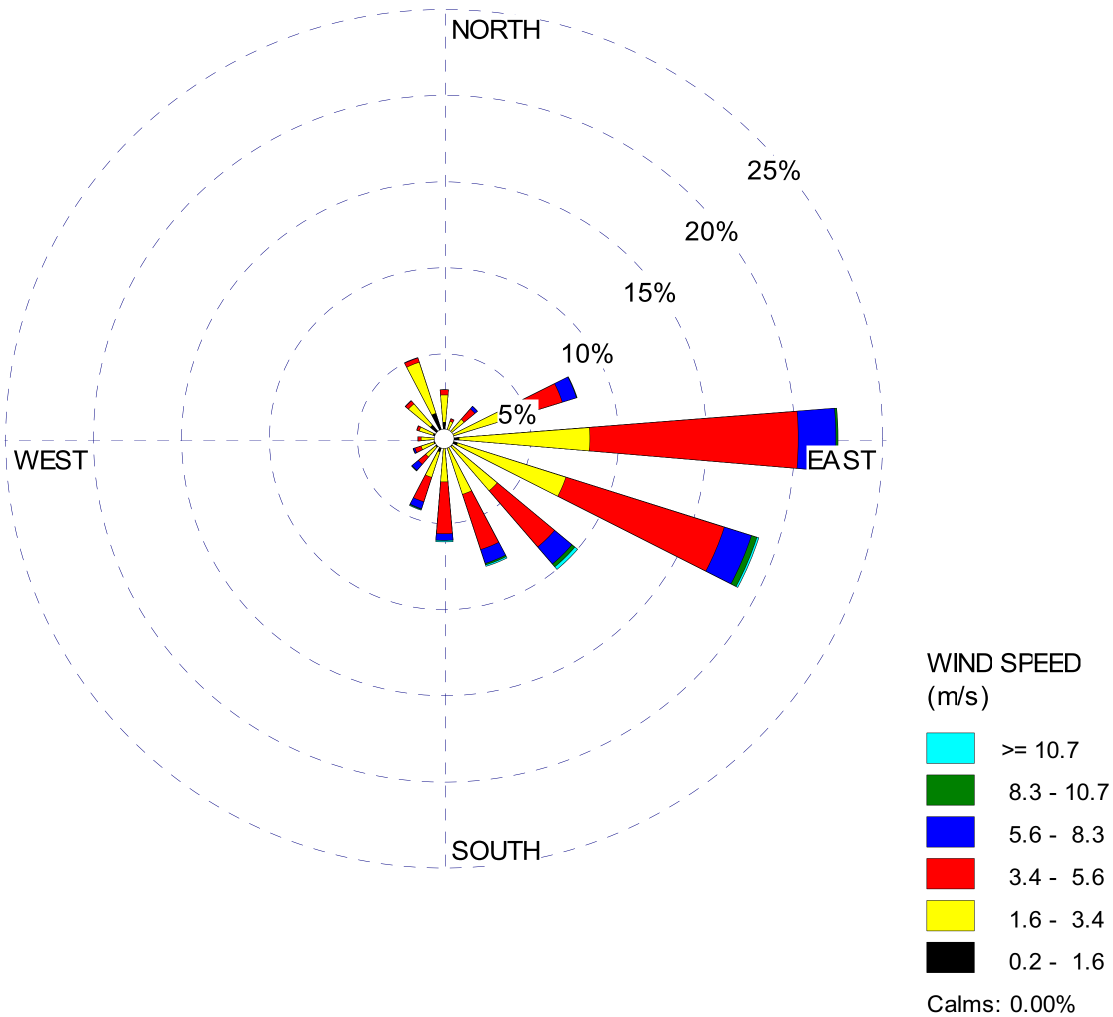


Figure 2.7-6 10-Meter Level 3-Year Composite Wind Rose — Fall (2002, 2005, and 2006)

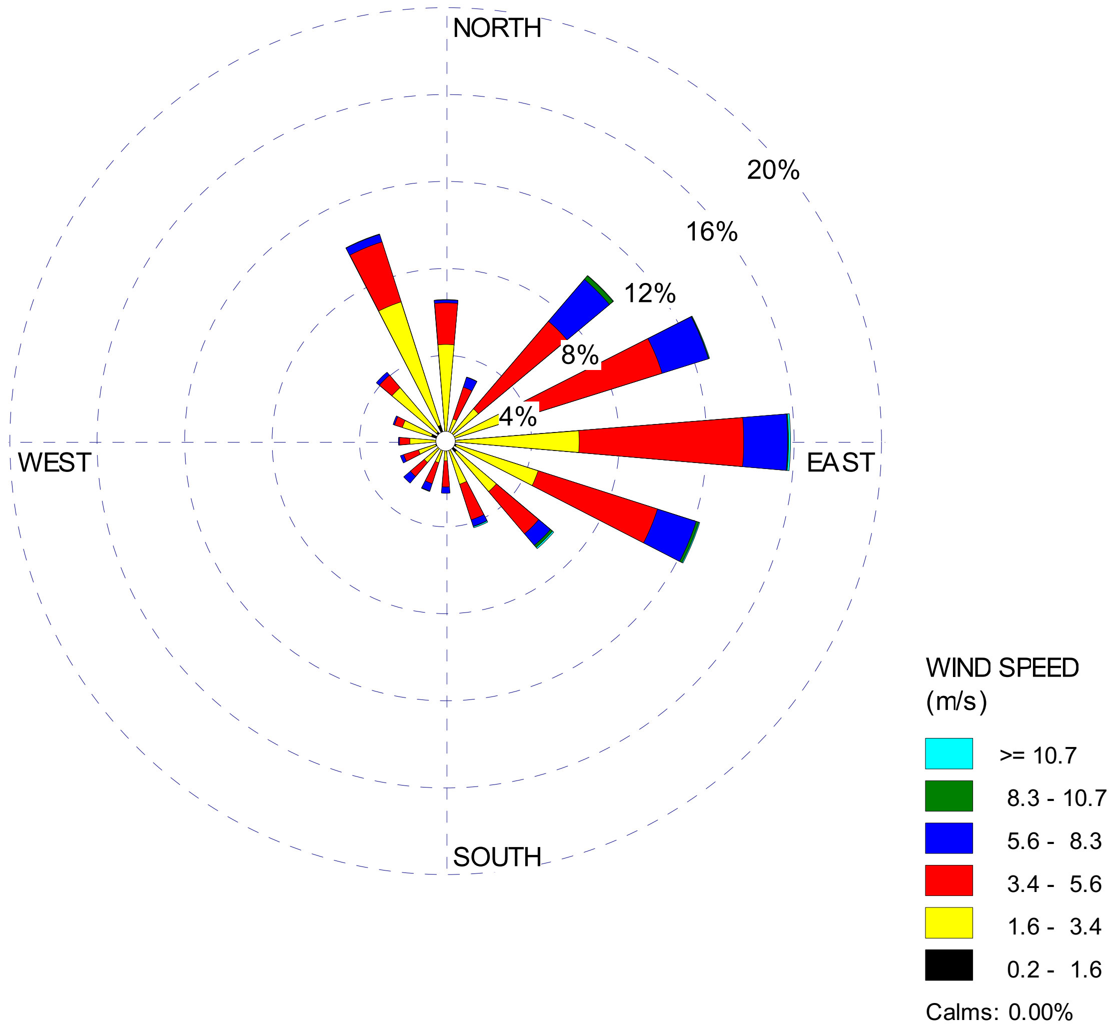


Figure 2.7-7 10-Meter Level 3-Year Composite Wind Rose — January (2002, 2005, and 2006) (Sheet 1 of 12)

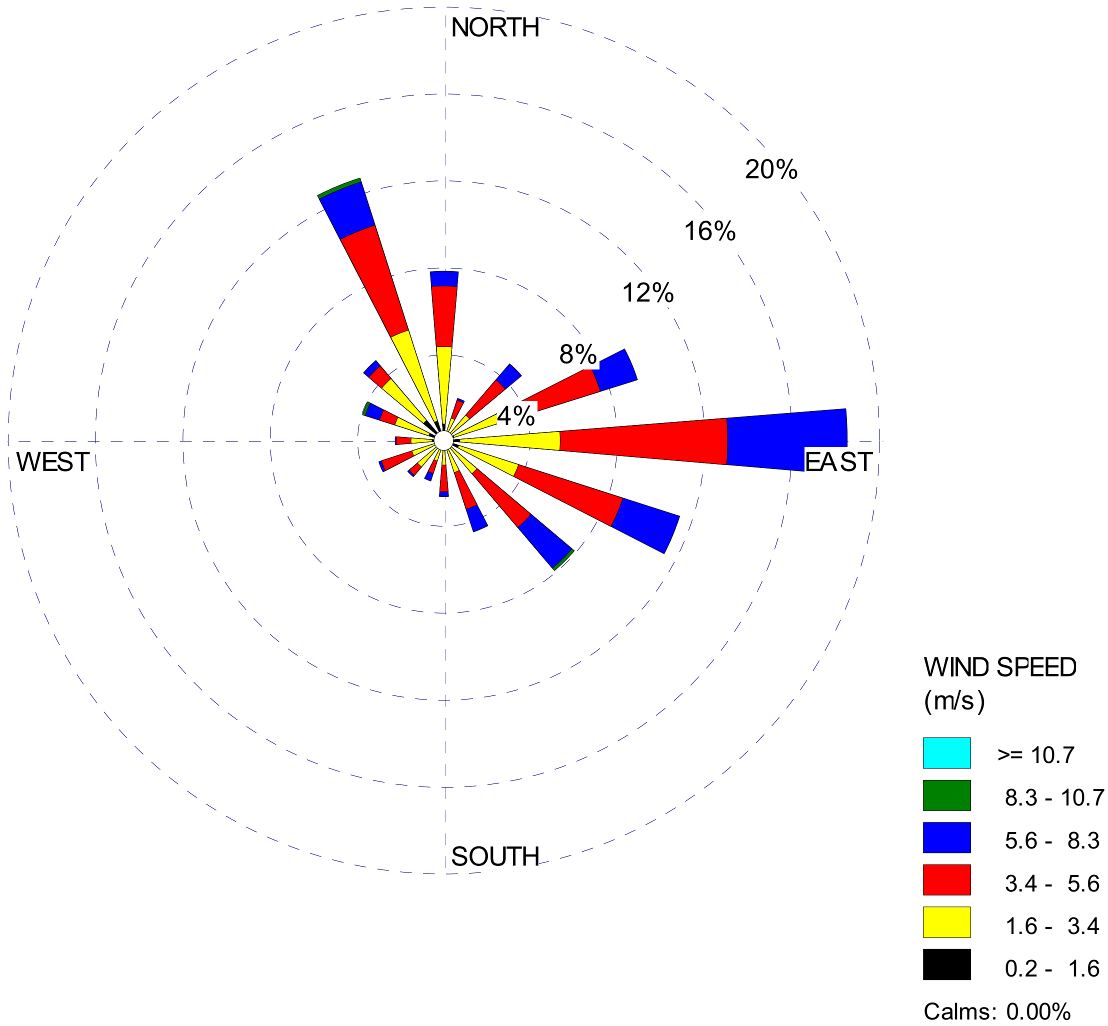


Figure 2.7-7 10-Meter Level 3-Year Composite Wind Rose — February (2002, 2005, and 2006) (Sheet 2 of 12)

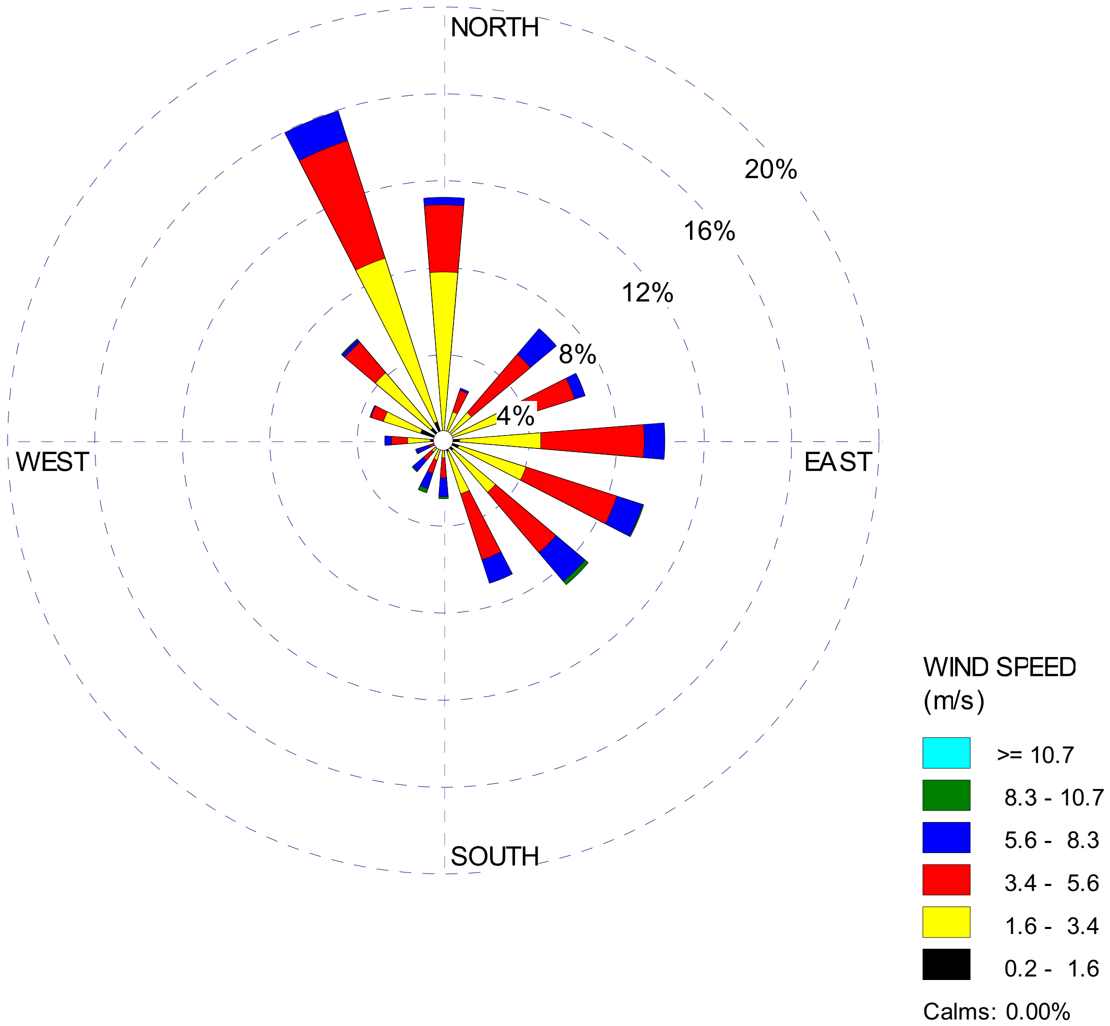


Figure 2.7-7 10-Meter Level 3-Year Composite Wind Rose — March (2002, 2005, and 2006) (Sheet 3 of 12)

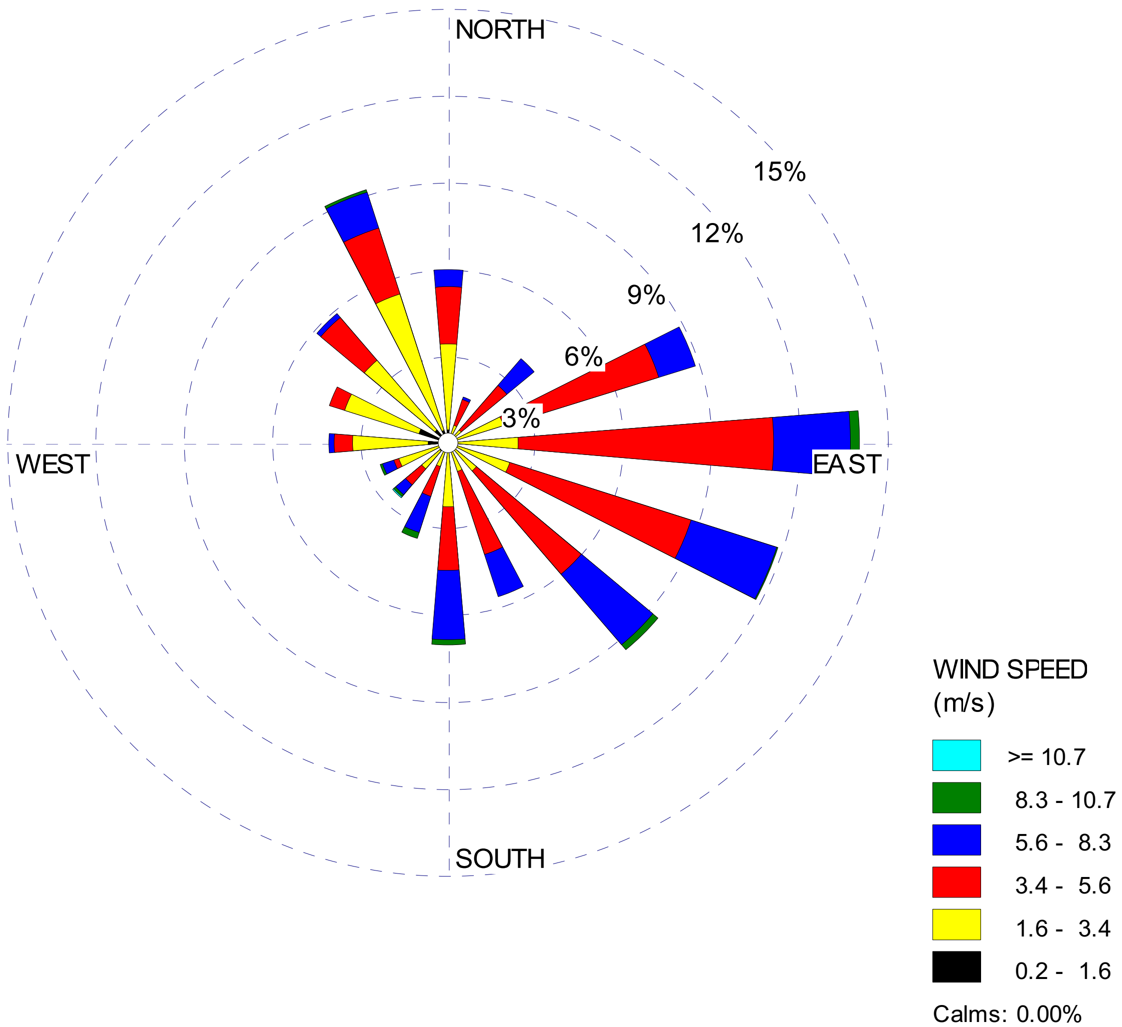
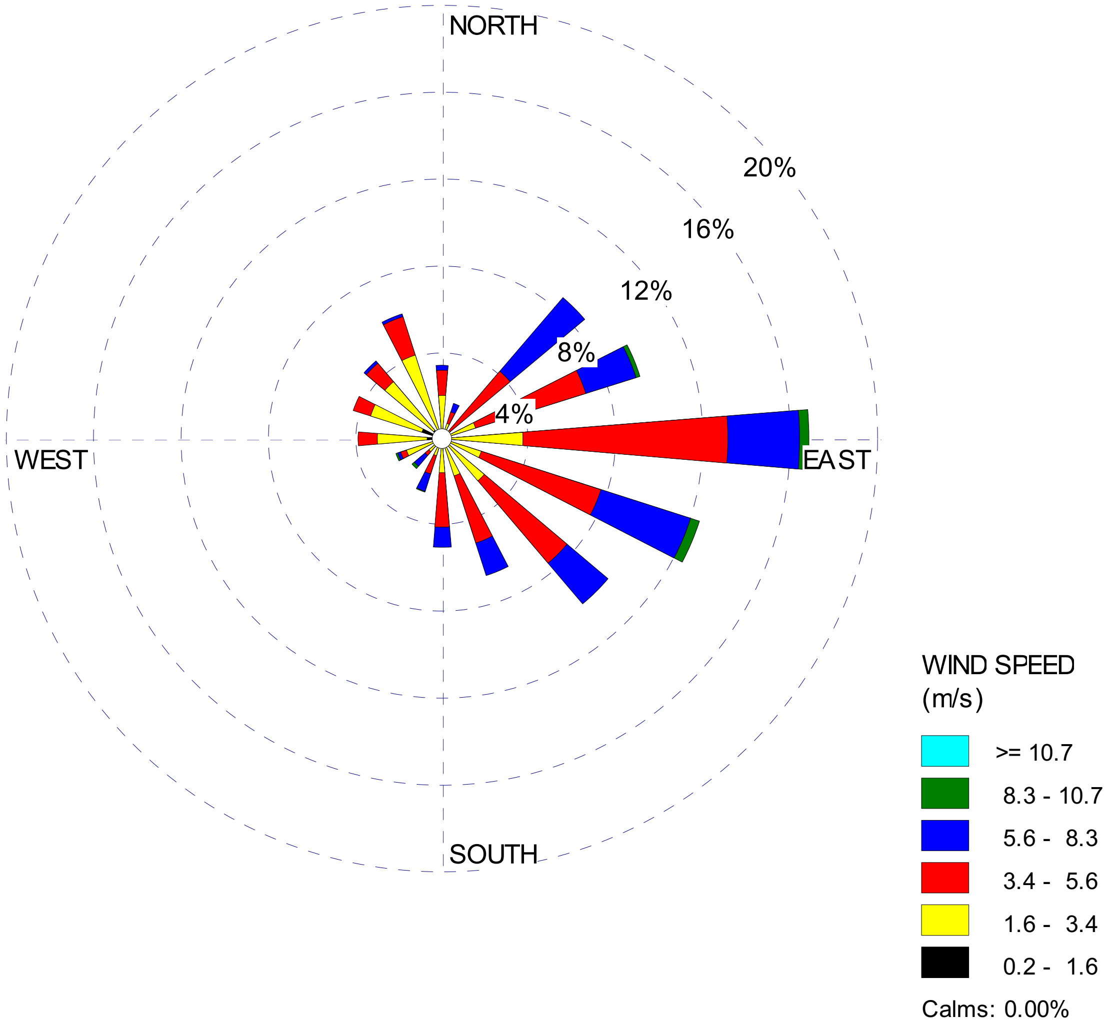


Figure 2.7-7 10-Meter Level 3-Year Composite Wind Rose — April (2002, 2005, and 2006) (Sheet 4 of 12)



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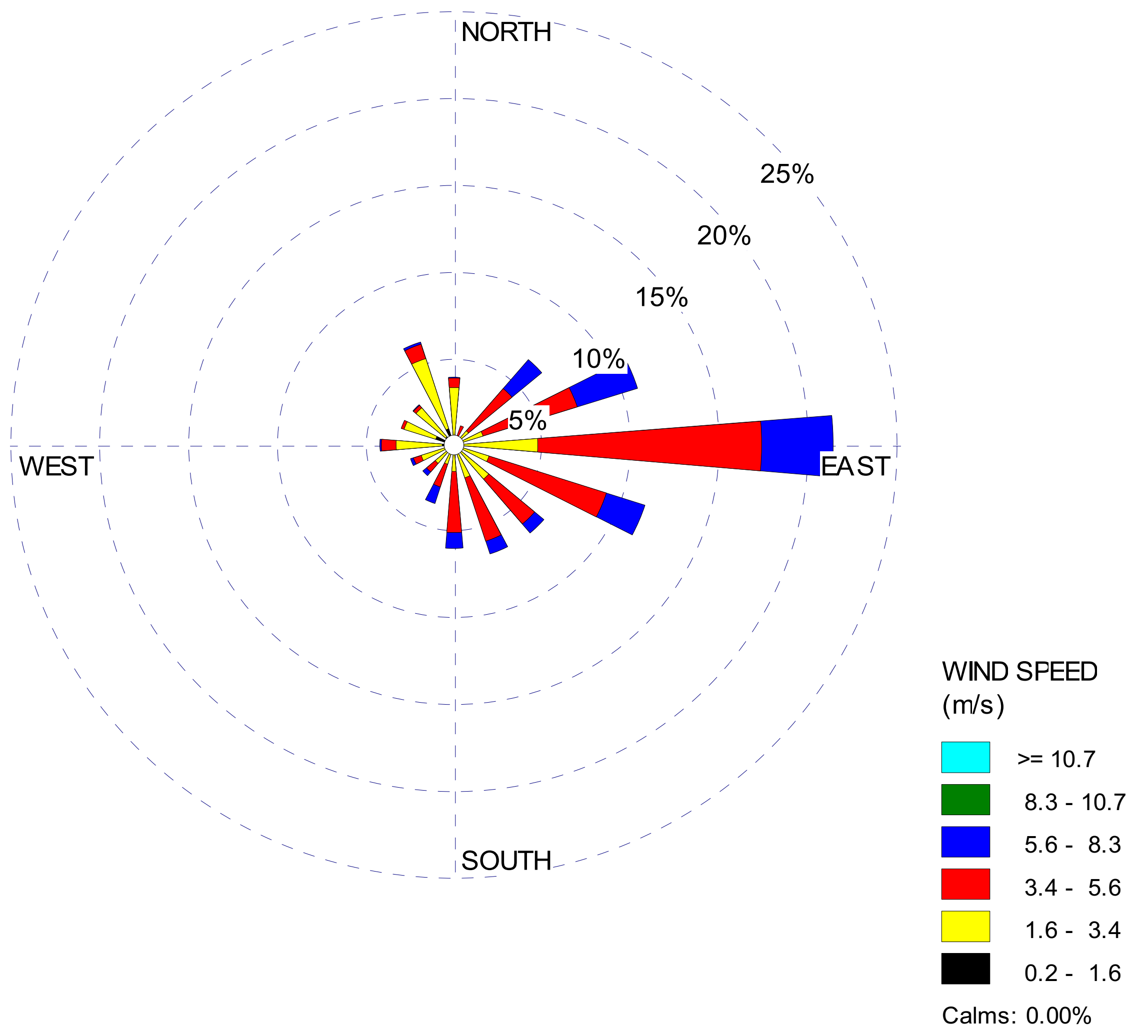


Figure 2.7-7 10-Meter Level 3-Year Composite Wind Rose — June (2002, 2005, and 2006) (Sheet 6 of 12)

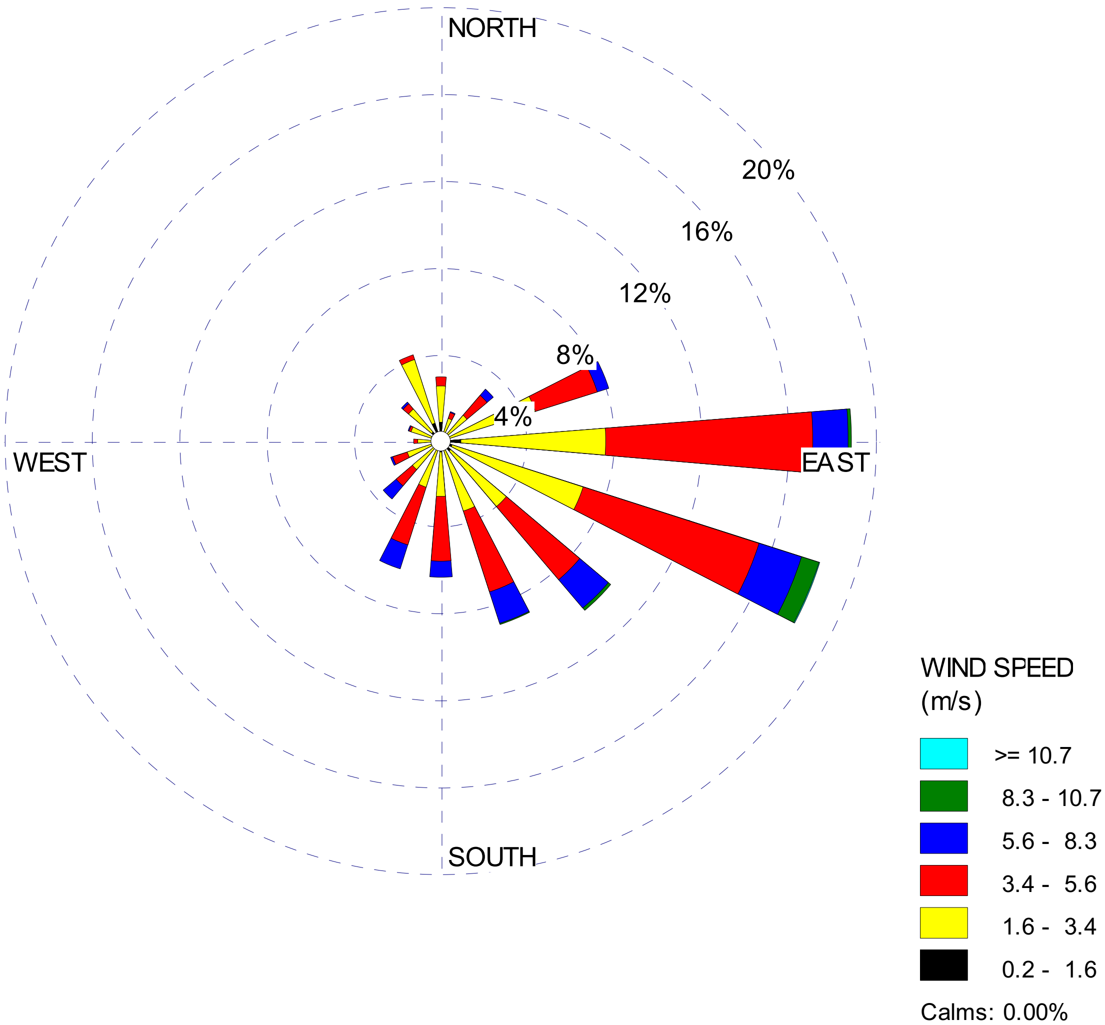


Figure 2.7-7 10-Meter Level 3-Year Composite Wind Rose — July (2002, 2005, and 2006) (Sheet 7 of 12)

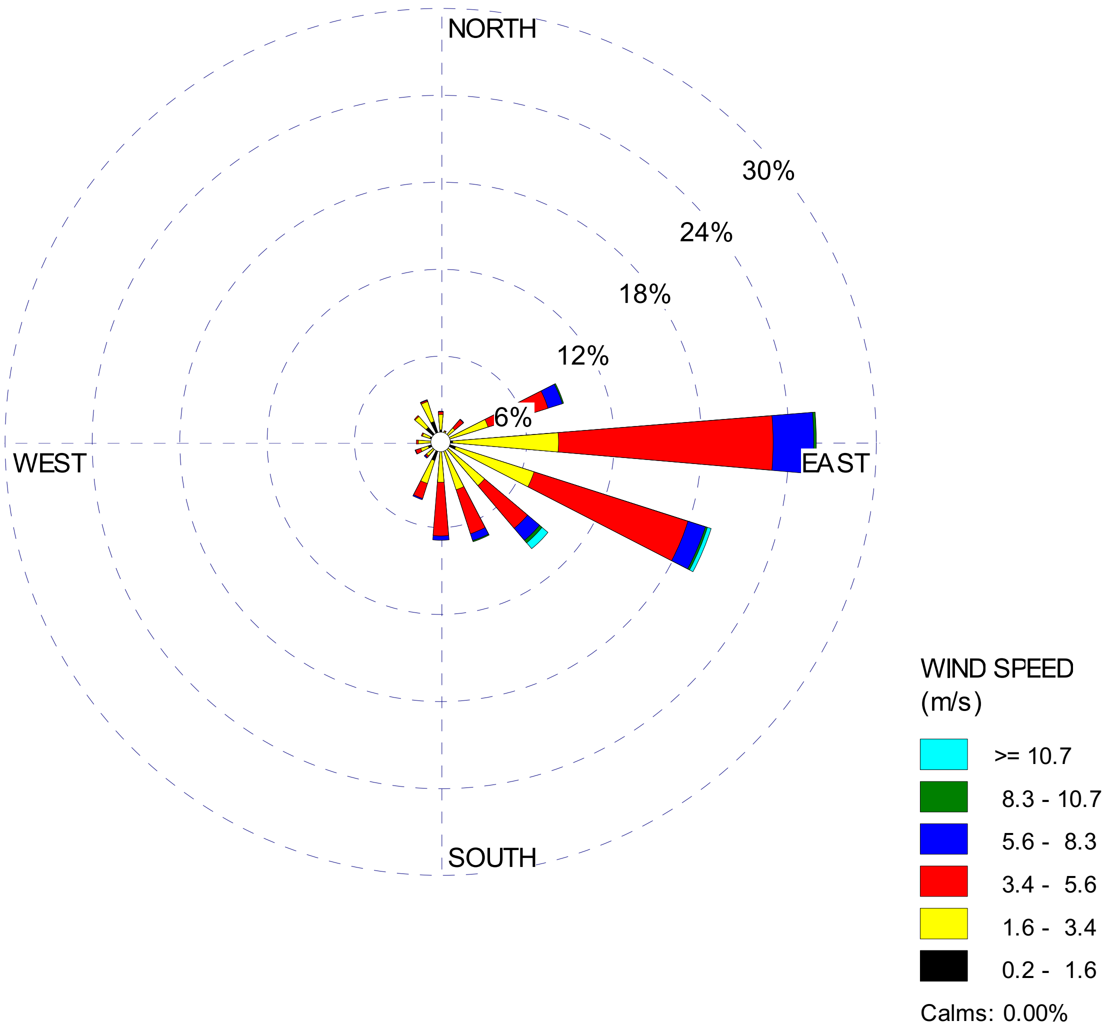
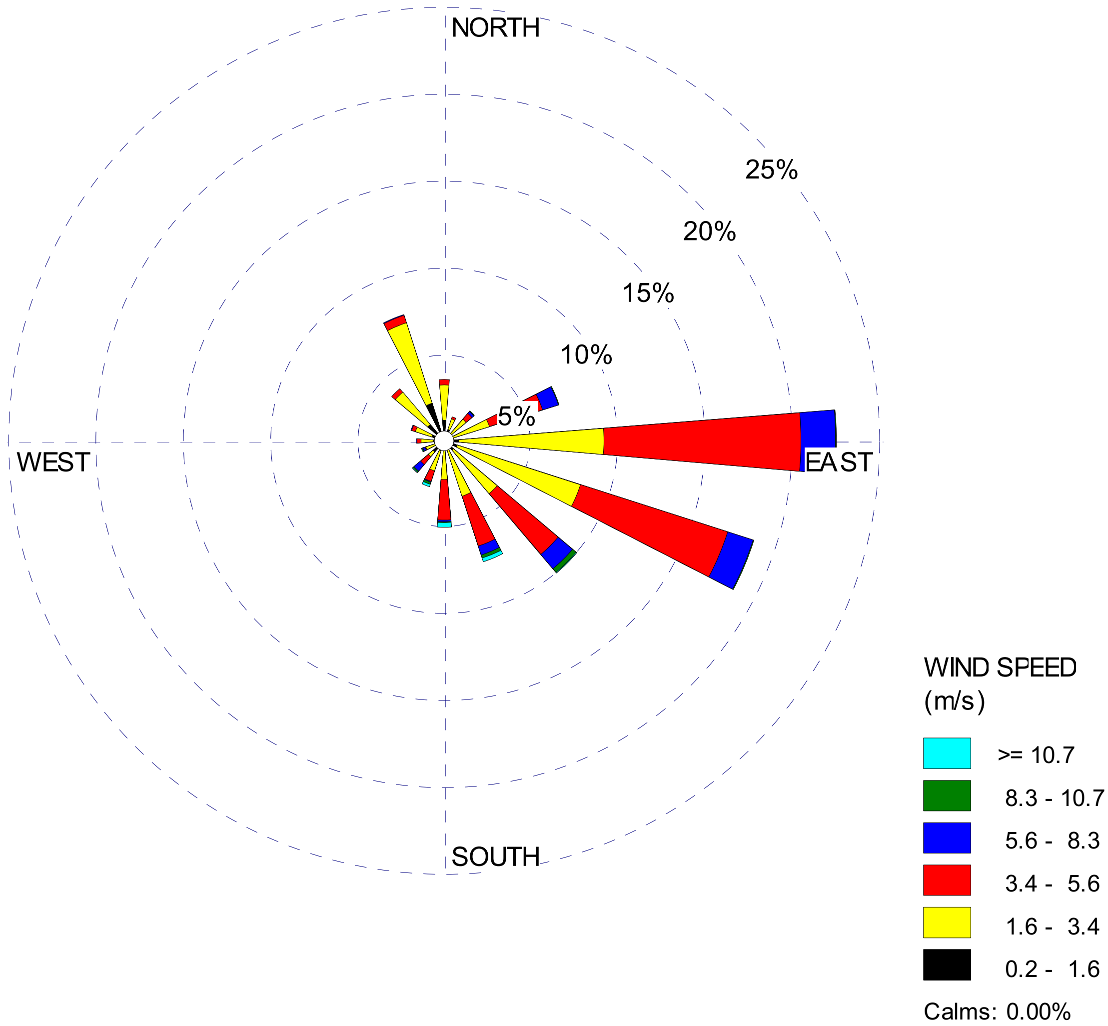


Figure 2.7-7 10-Meter Level 3-Year Composite Wind Rose — August (2002, 2005, and 2006) (Sheet 8 of 12)



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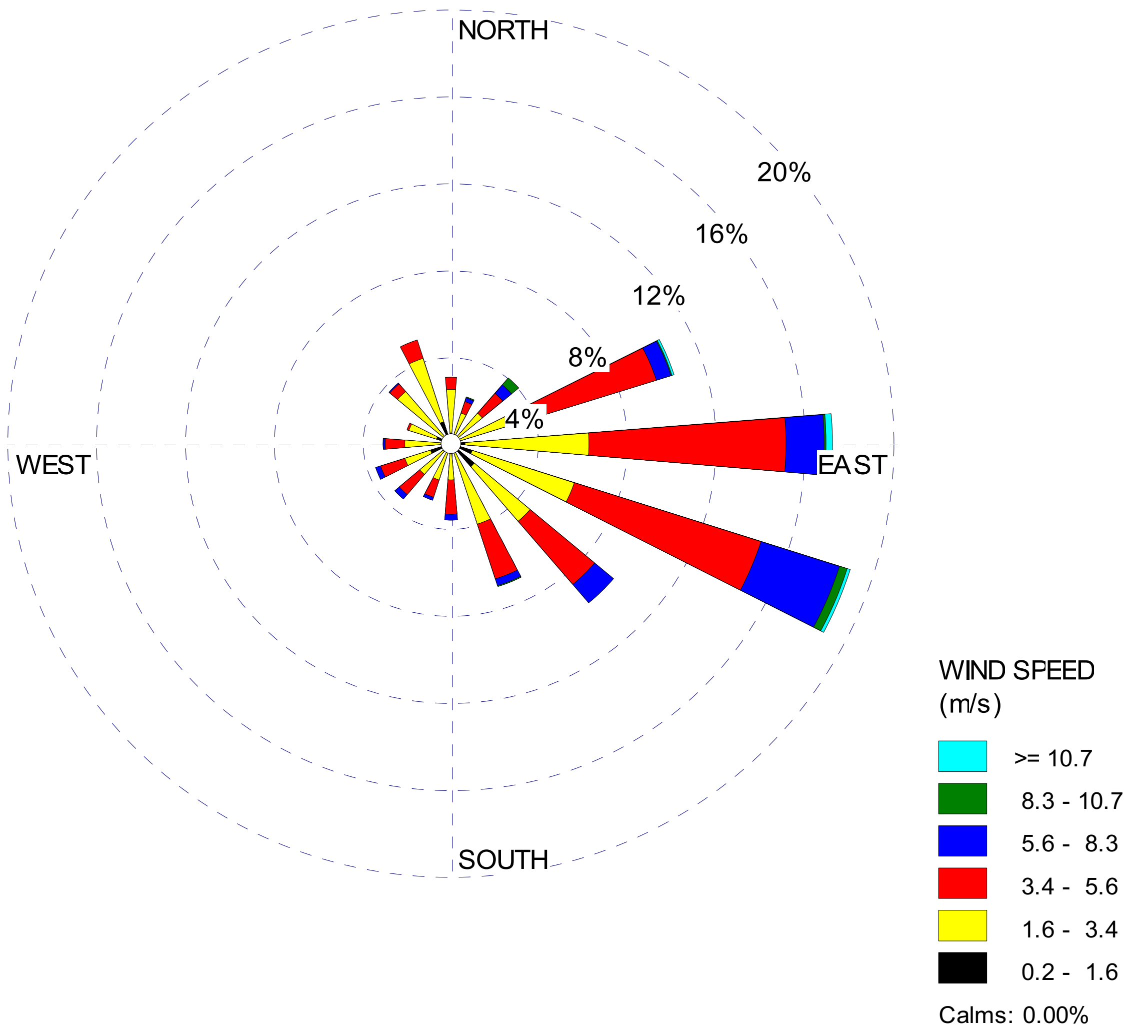
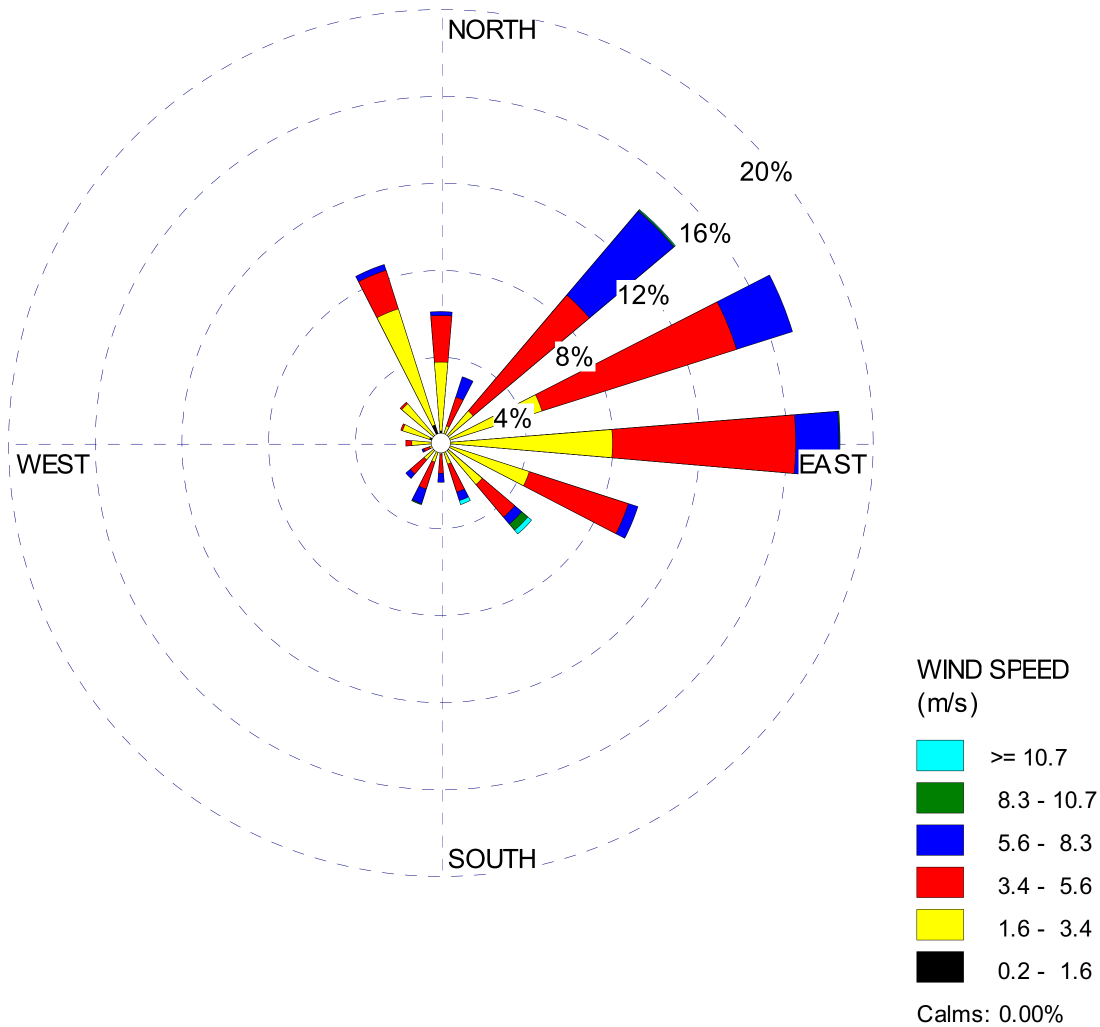


Figure 2.7-7 10-Meter Level 3-Year Composite Wind Rose — October (2002, 2005, and 2006) (Sheet 10 of 12)



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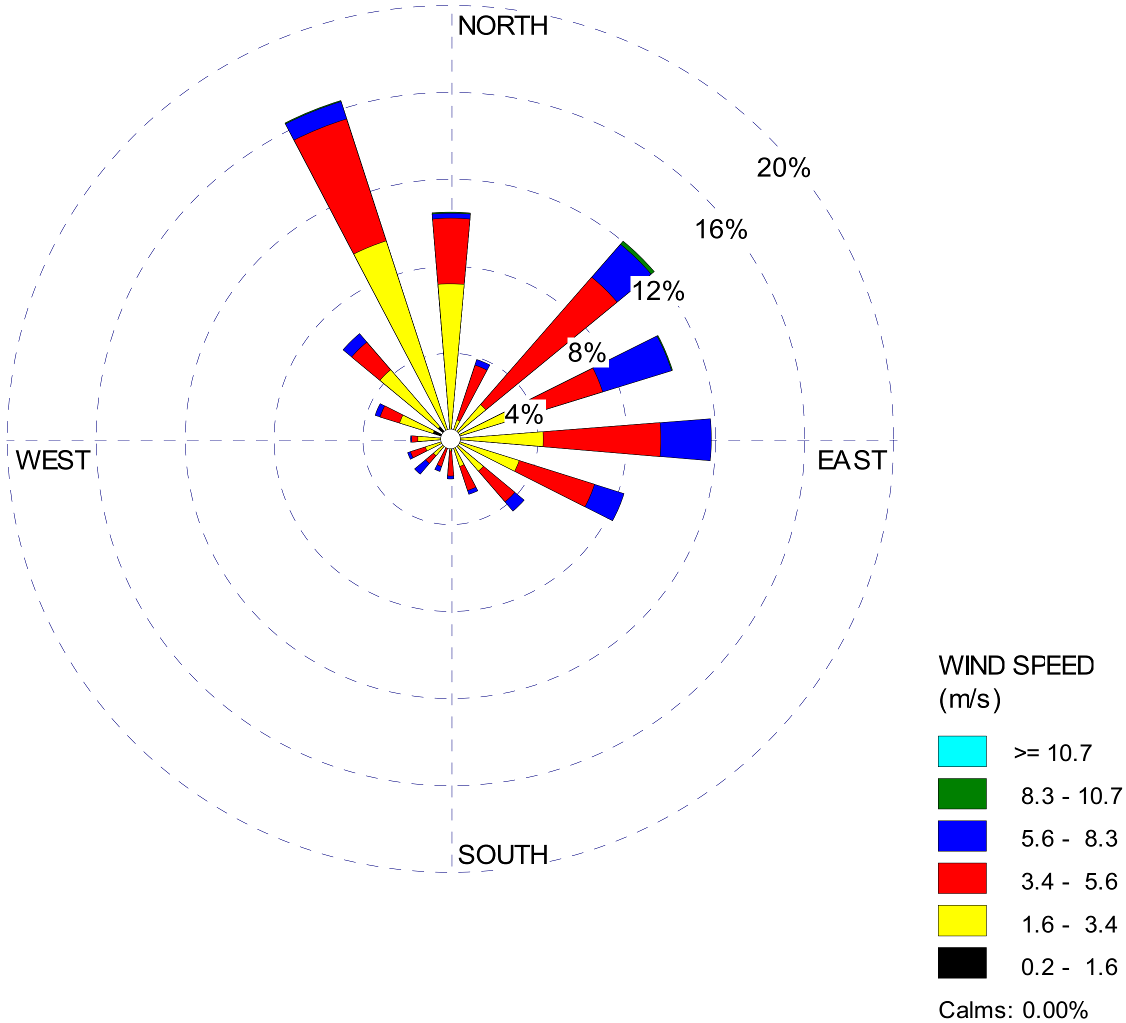


Figure 2.7-7 10-Meter Level 3-Year Composite Wind Rose — December (2002, 2005, and 2006) (Sheet 12 of 12)

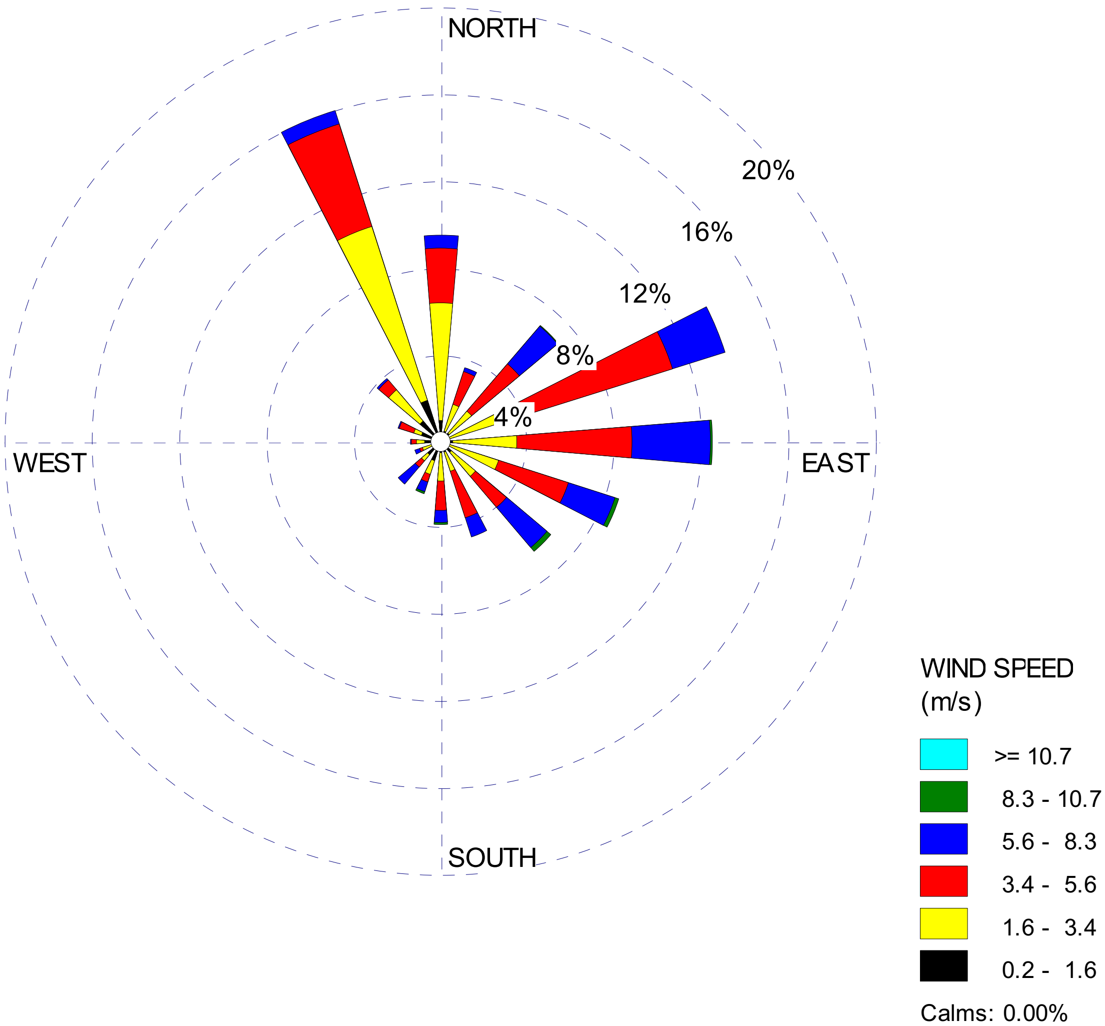


Figure 2.7-8 60-Meter Level 3-Year Composite Wind — Annual (2002, 2005, and 2006)

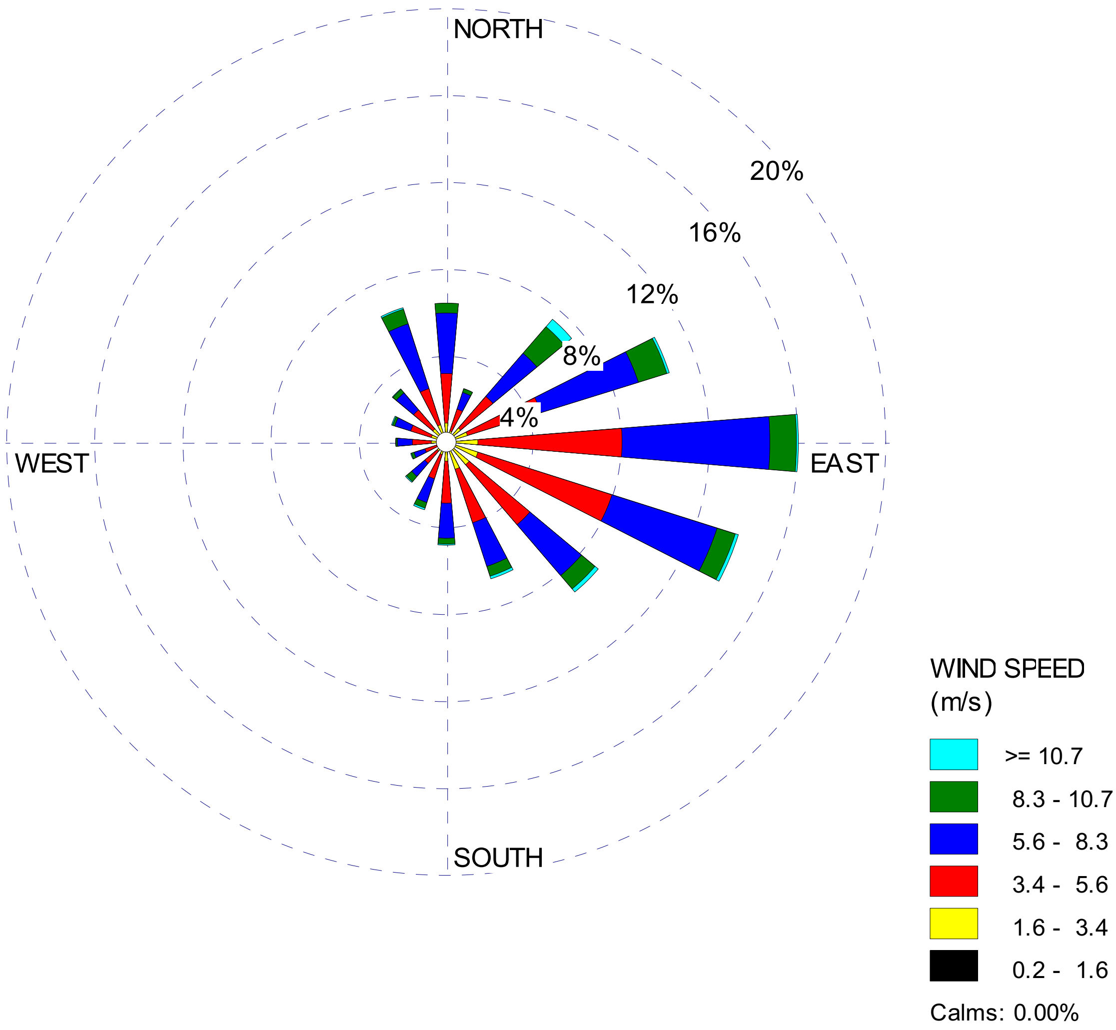


Figure 2.7-9 60-Meter Level 3-Year Composite Wind Rose — Winter (2002, 2005, and 2006)

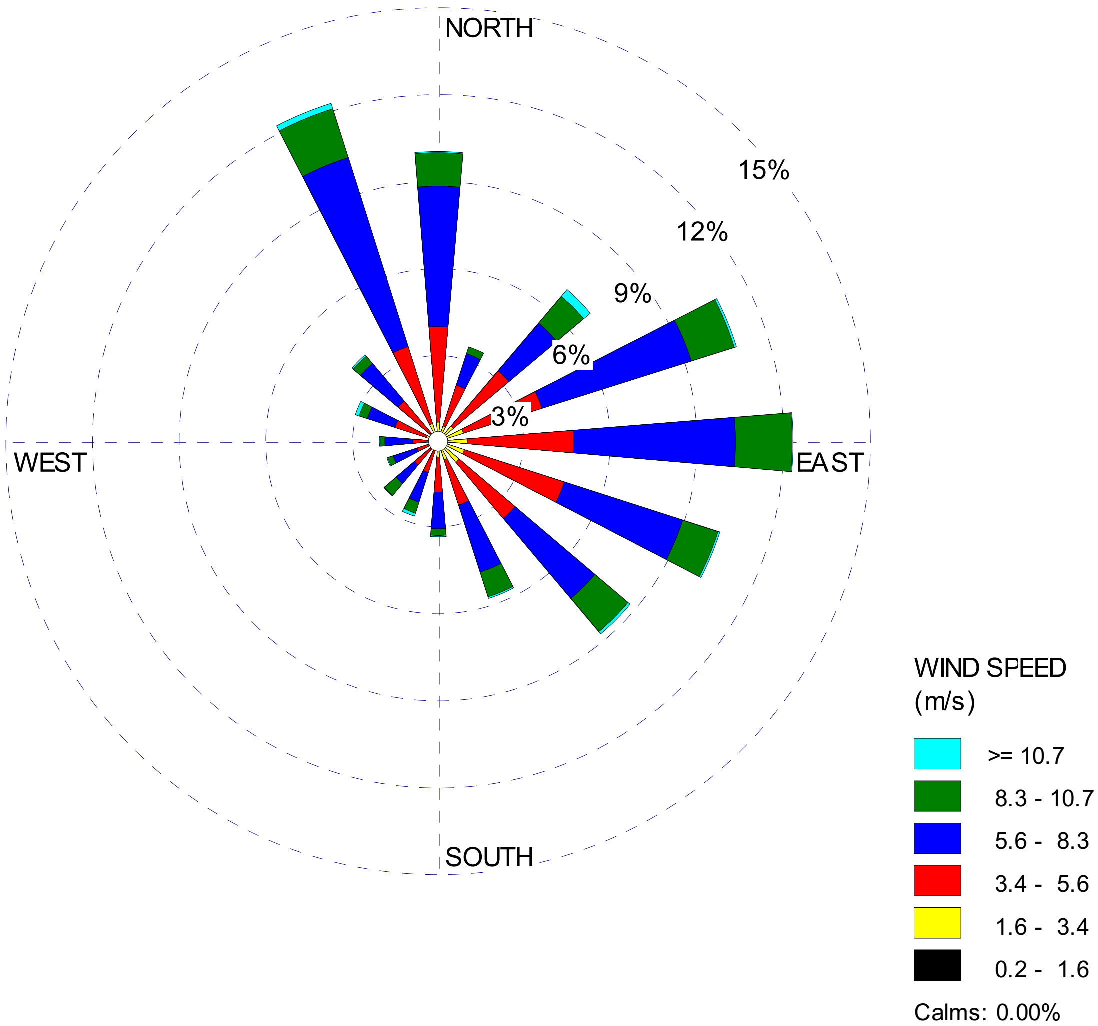


Figure 2.7-10 60-Meter Level 3-Year Composite Wind Rose — Spring (2002, 2005, and 2006)

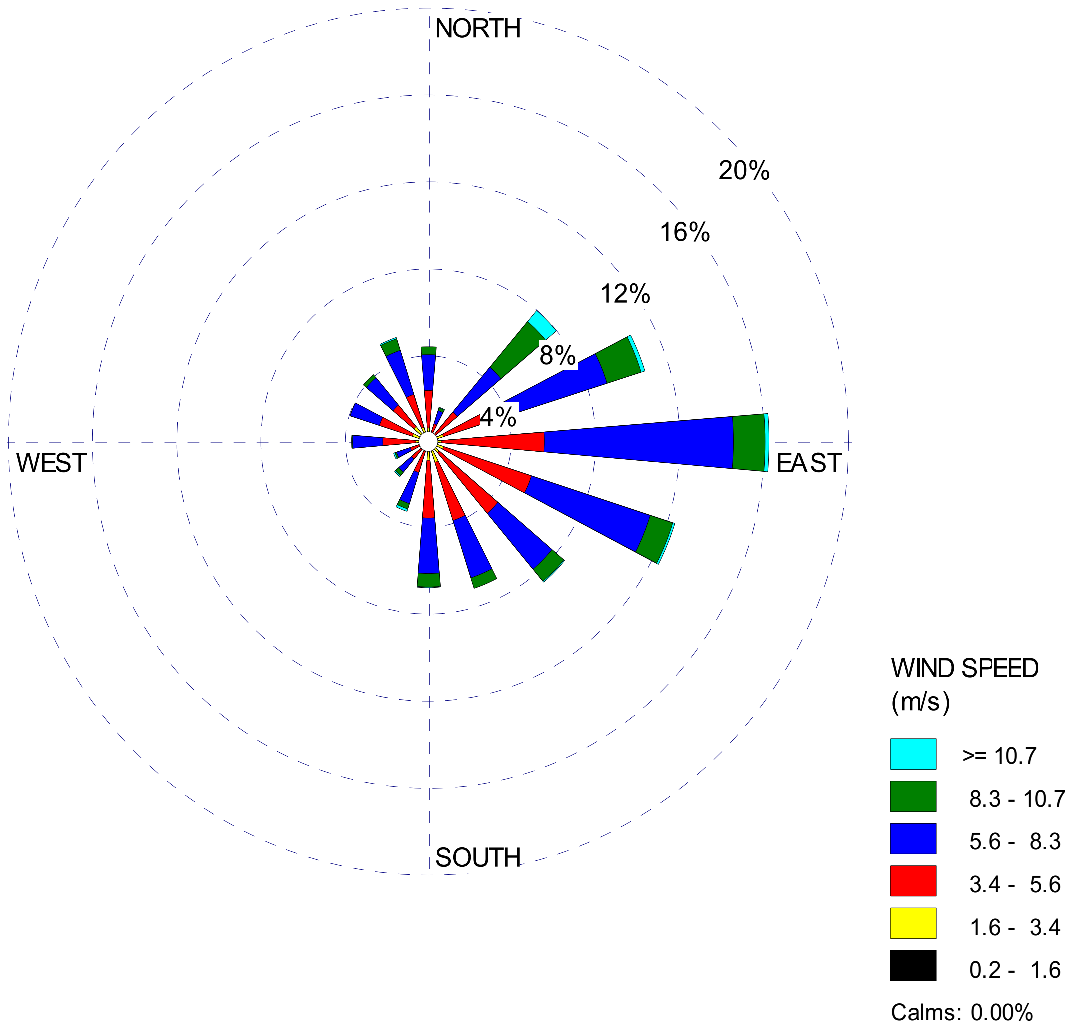


Figure 2.7-11 60-Meter Level 3-Year Composite Wind Rose — Summer (2002, 2005, and 2006)

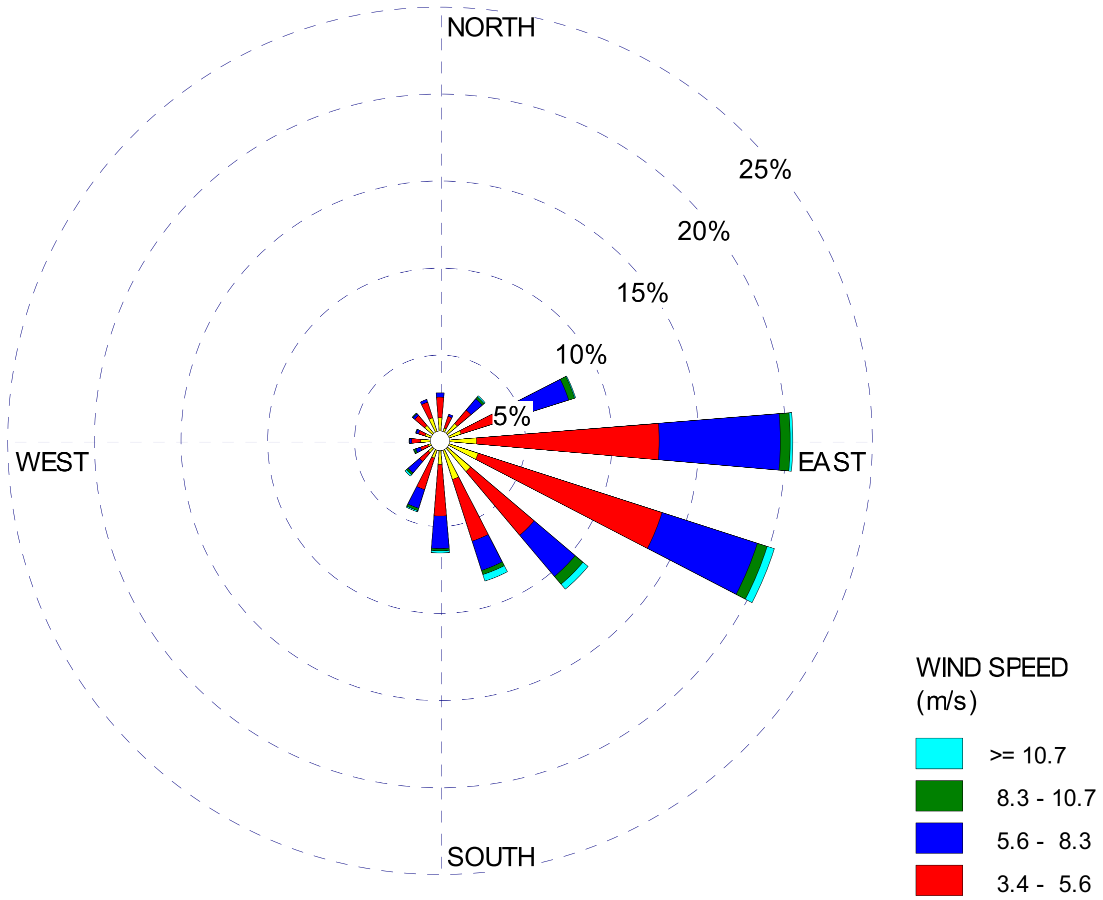


Figure 2.7-12 60-Meter Level 3-Year Composite Wind Rose — Fall (2002, 2005, and 2006)

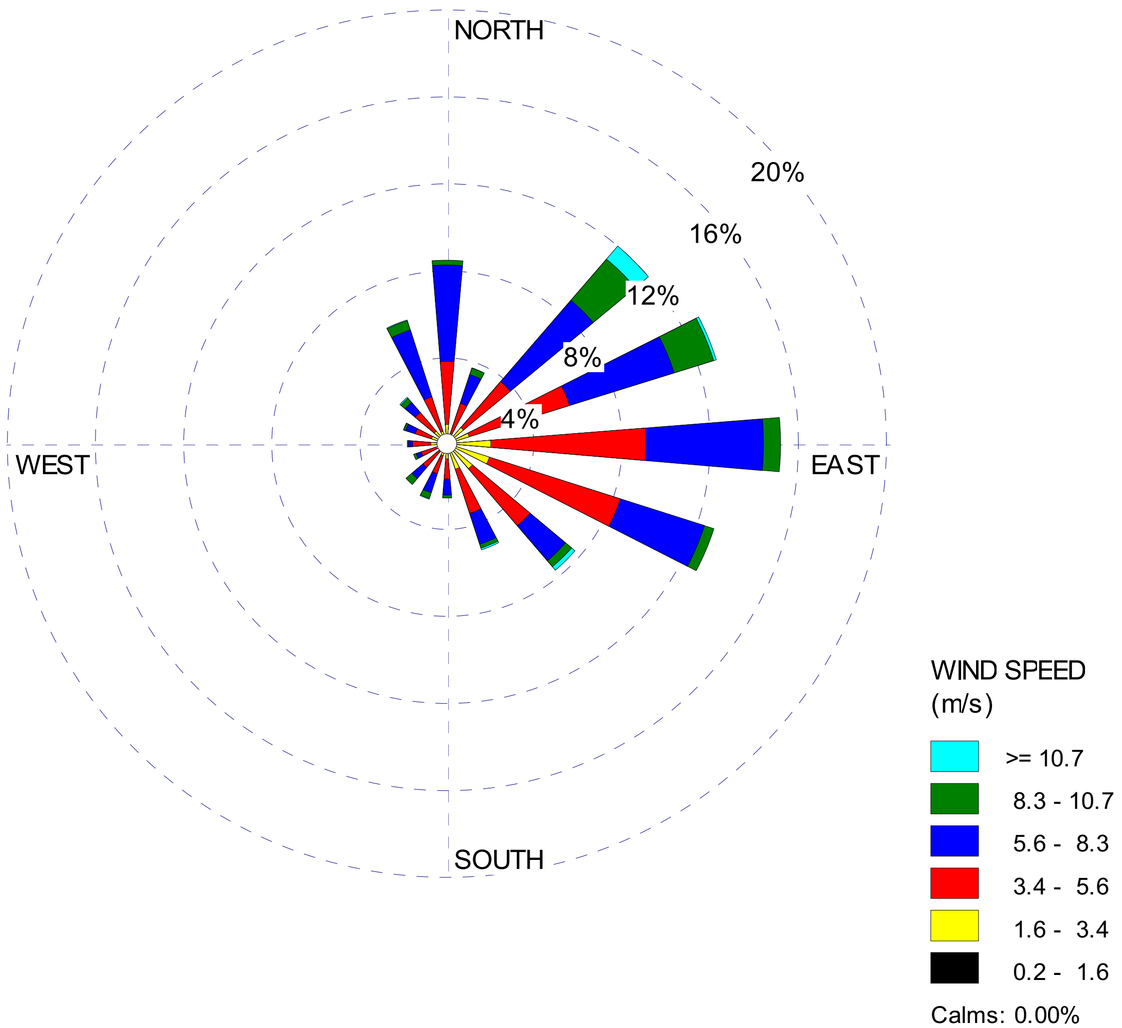


Figure 2.7-13 60-Meter Level 3-Year Composite Wind Rose — January (2002, 2005, and 2006) (Sheet 1 of 12)

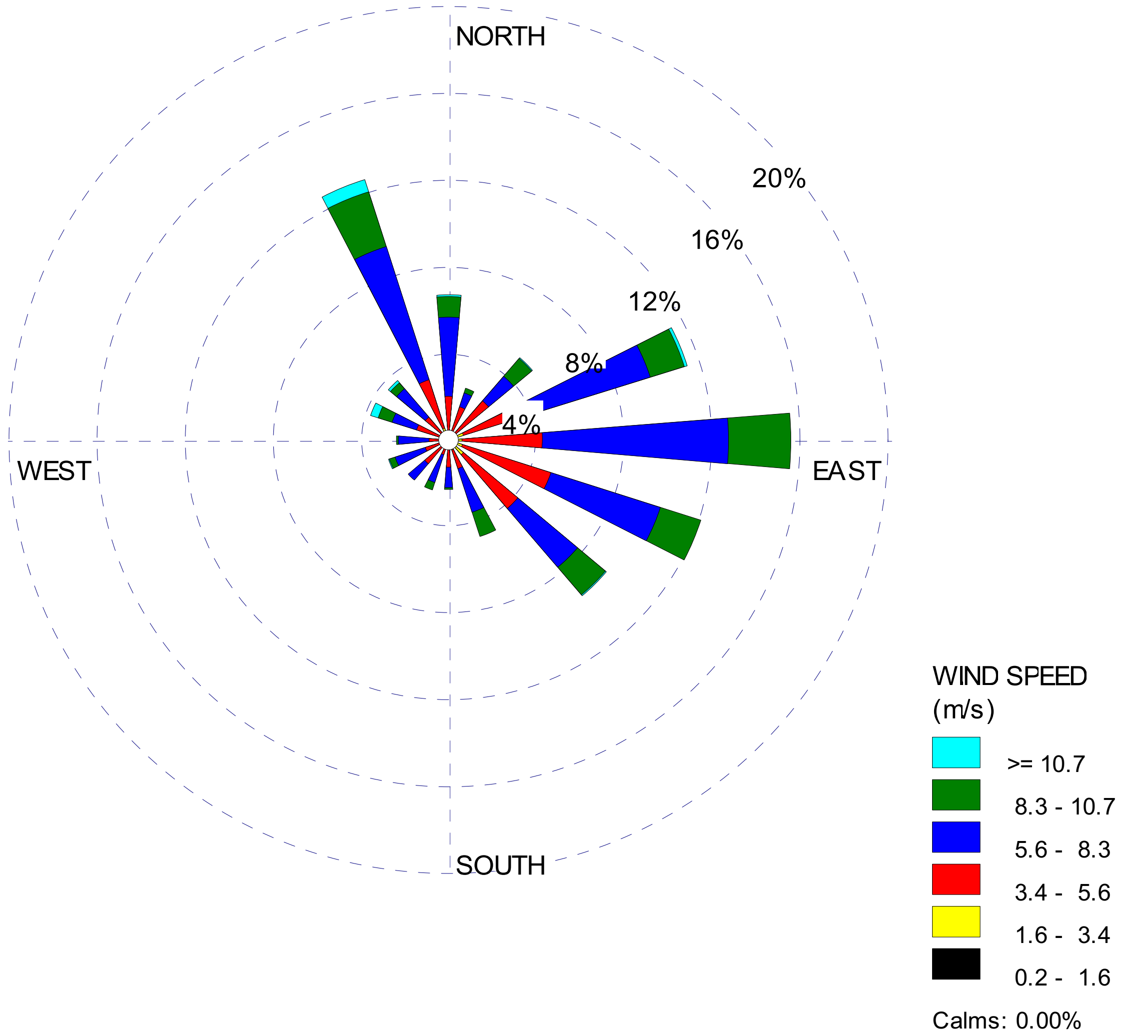


Figure 2.7-13 60-Meter Level 3-Year Composite Wind Rose — February (2002, 2005, and 2006) (Sheet 2 of 12)

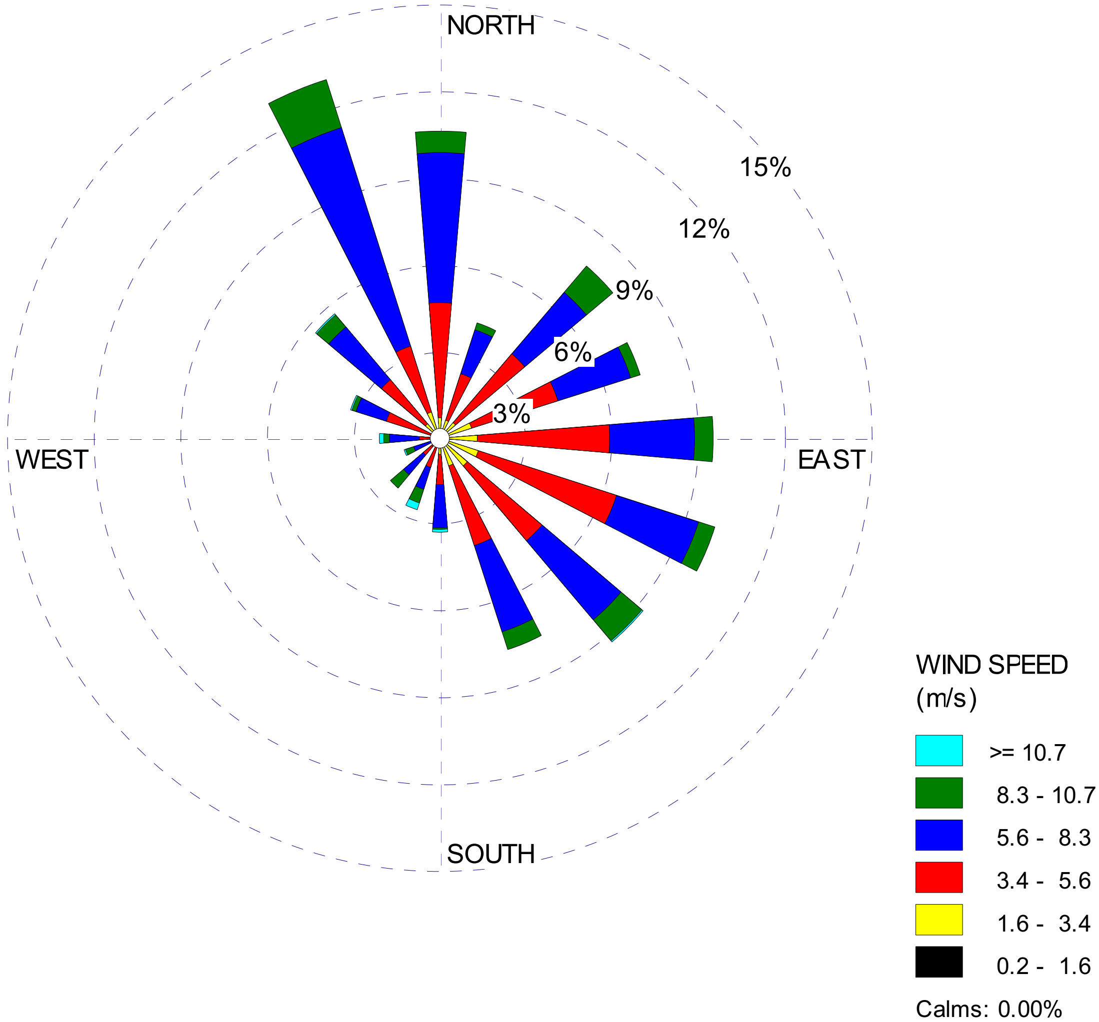


Figure 2.7-13 60-Meter Level 3-Year Composite Wind Rose — March (2002, 2005, and 2006) (Sheet 3 of 12)

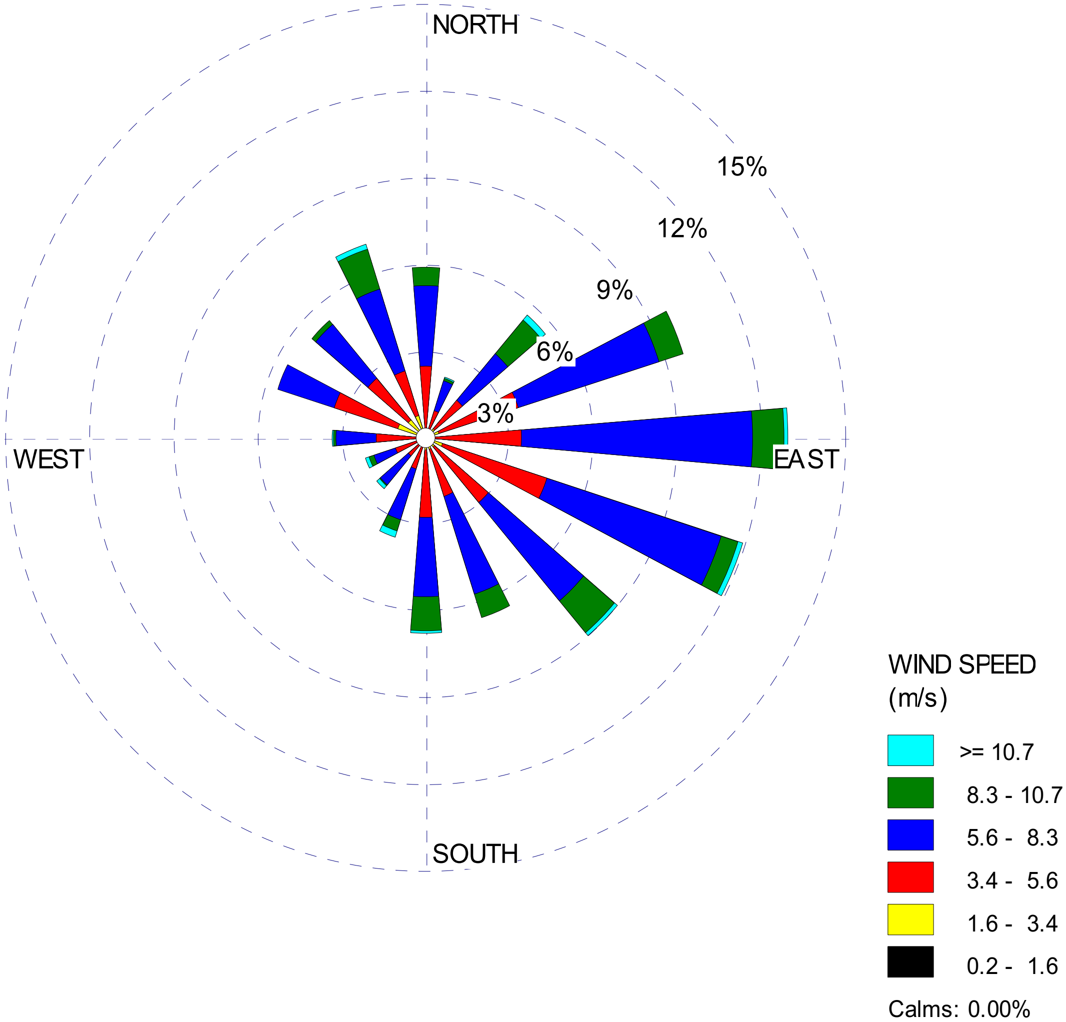


Figure 2.7-13 60-Meter Level 3-Year Composite Wind Rose — April (2002, 2005, and 2006) (Sheet 4 of 12)

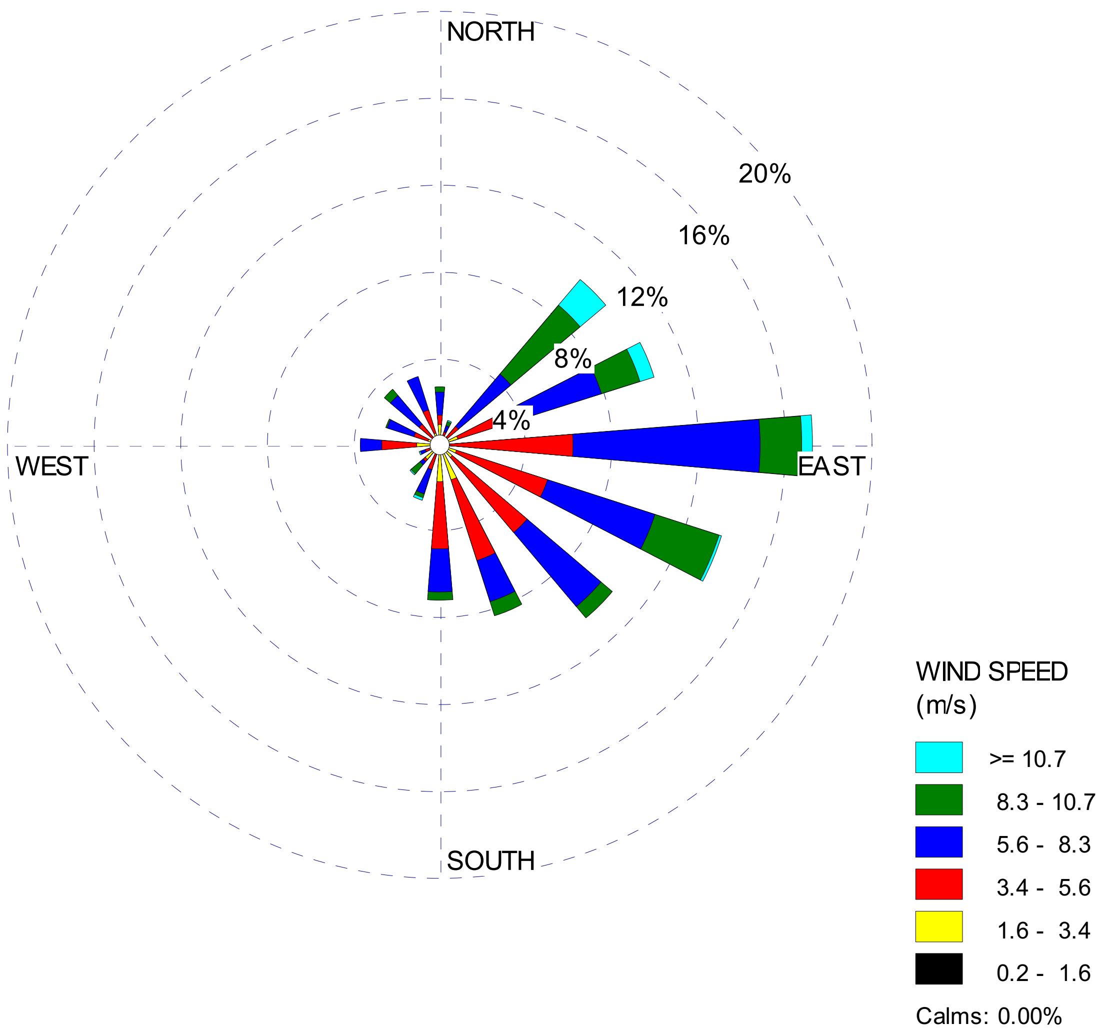


Figure 2.7-13 60-Meter Level 3-Year Composite Wind Rose — May (2002, 2005, and 2006) (Sheet 5 of 12)

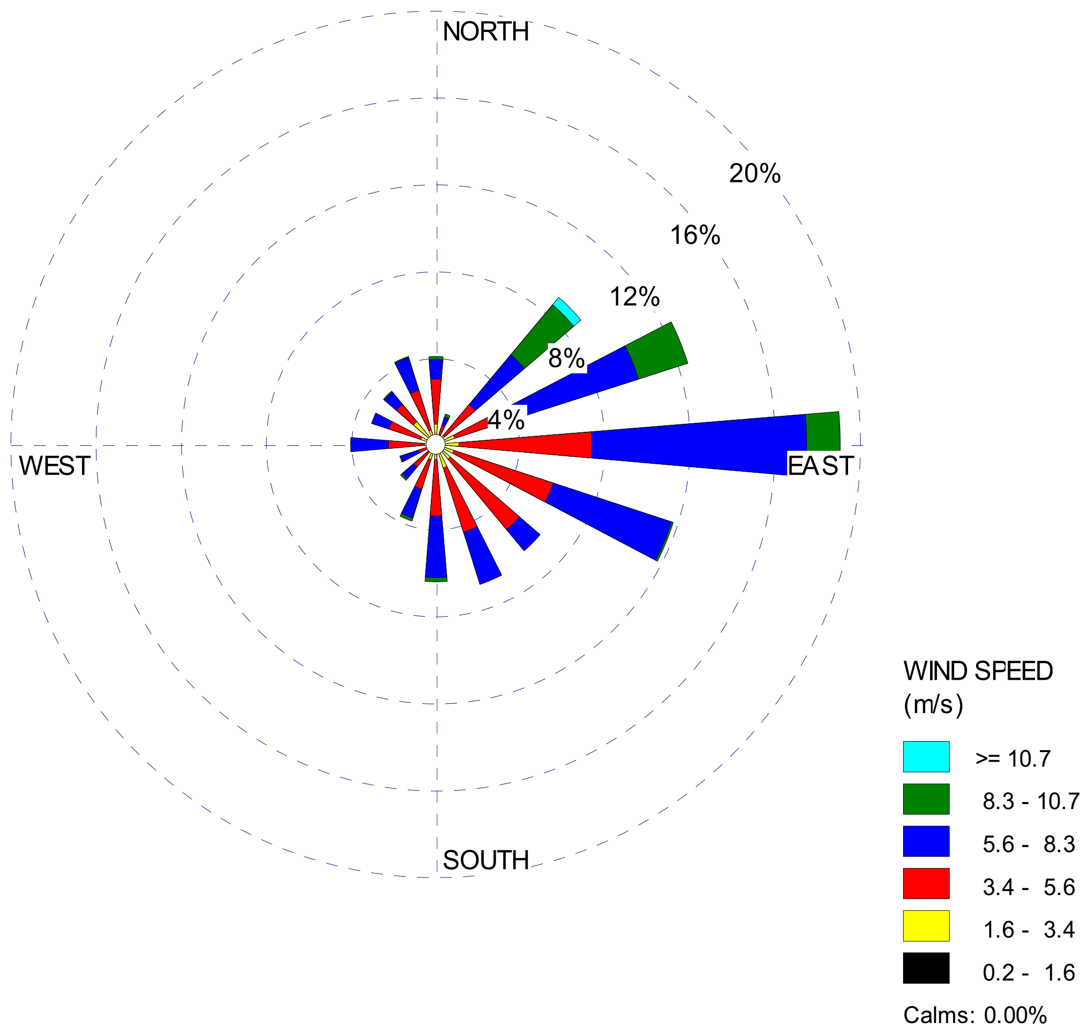


Figure 2.7-13 60-Meter Level 3-Year Composite Wind Rose — June (2002, 2005, and 2006) (Sheet 6 of 12)

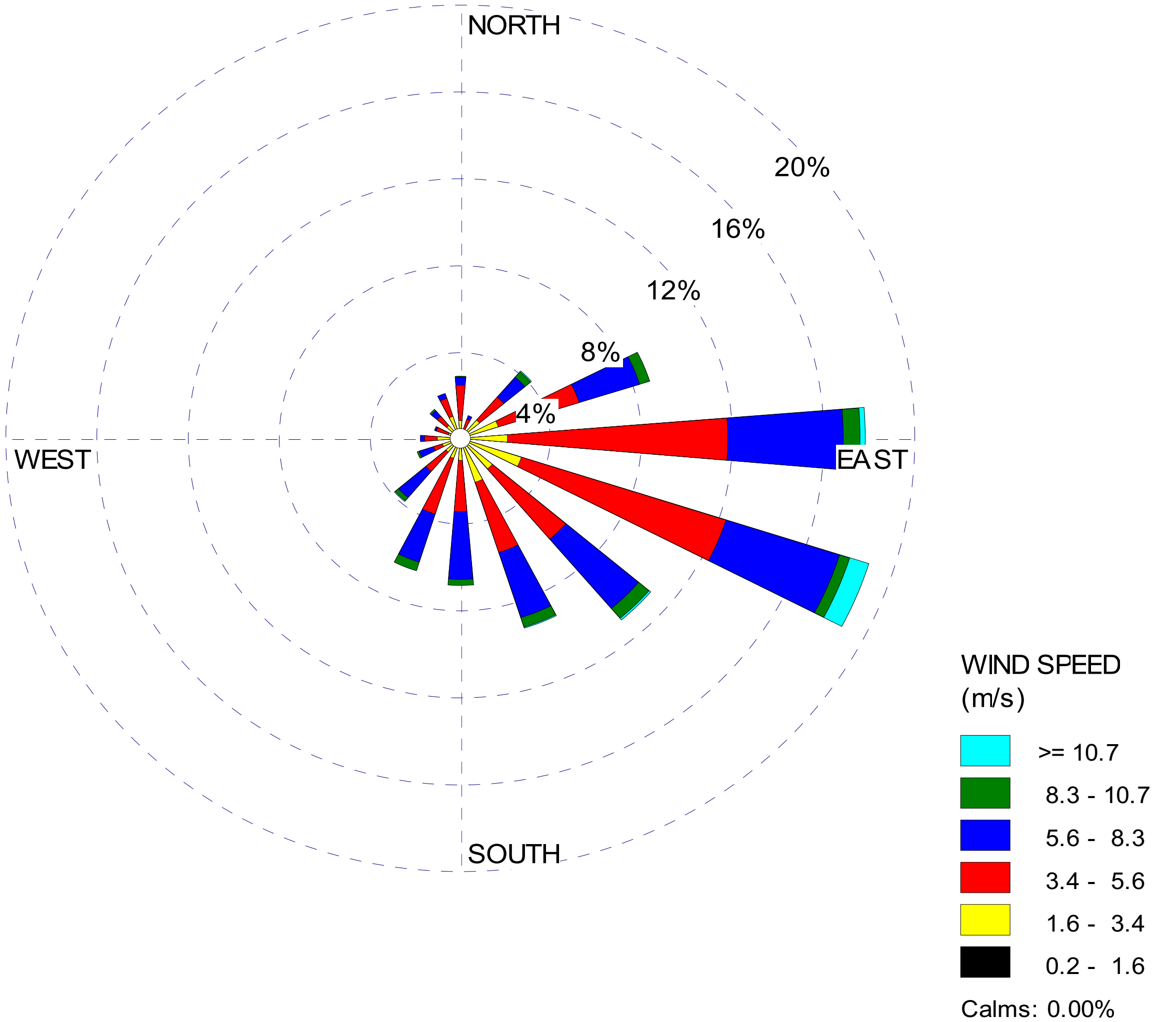


Figure 2.7-13 60-Meter Level 3-Year Composite Wind Rose — July (2002, 2005, and 2006) (Sheet 7 of 12)

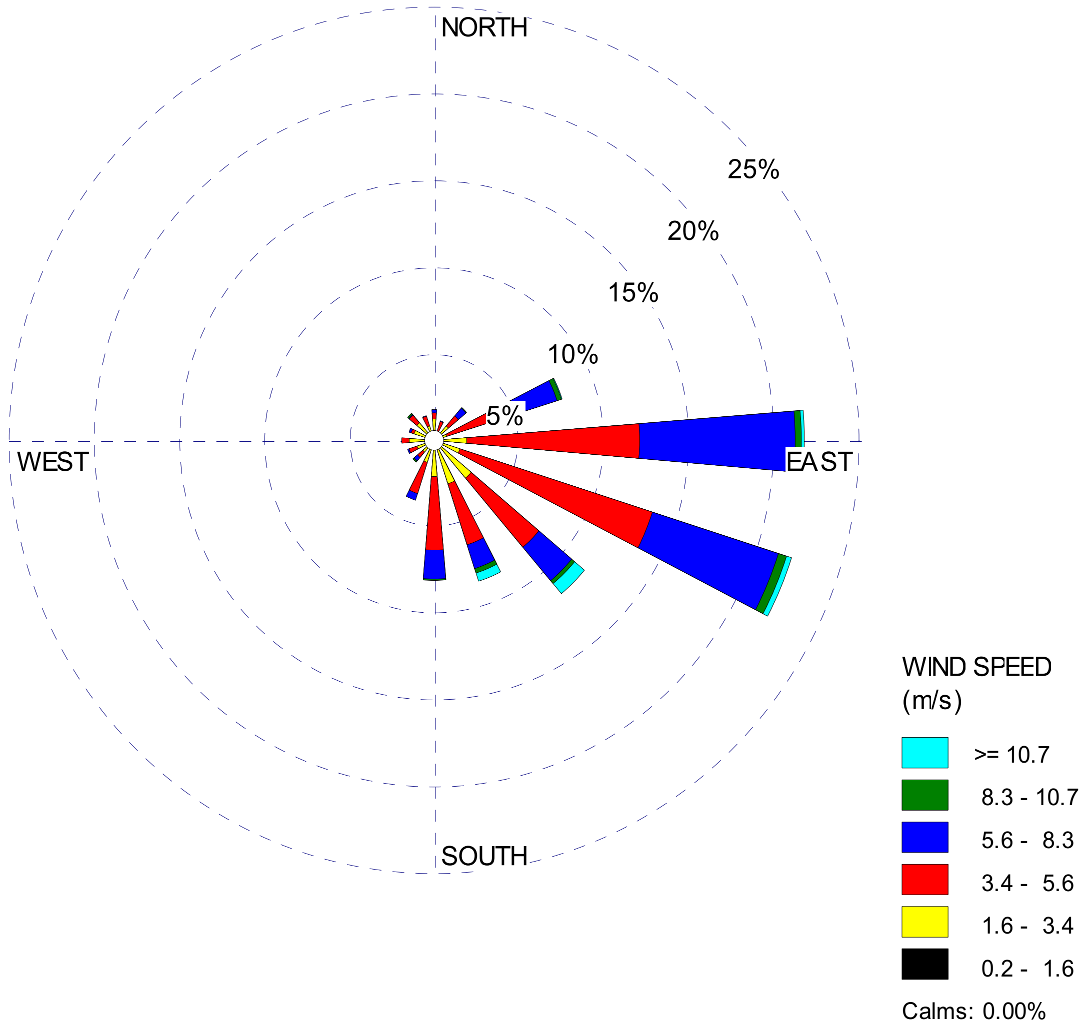


Figure 2.7-13 60-Meter Level 3-Year Composite Wind Rose — August (2002, 2005, 2006) (Sheet 8 of 12)

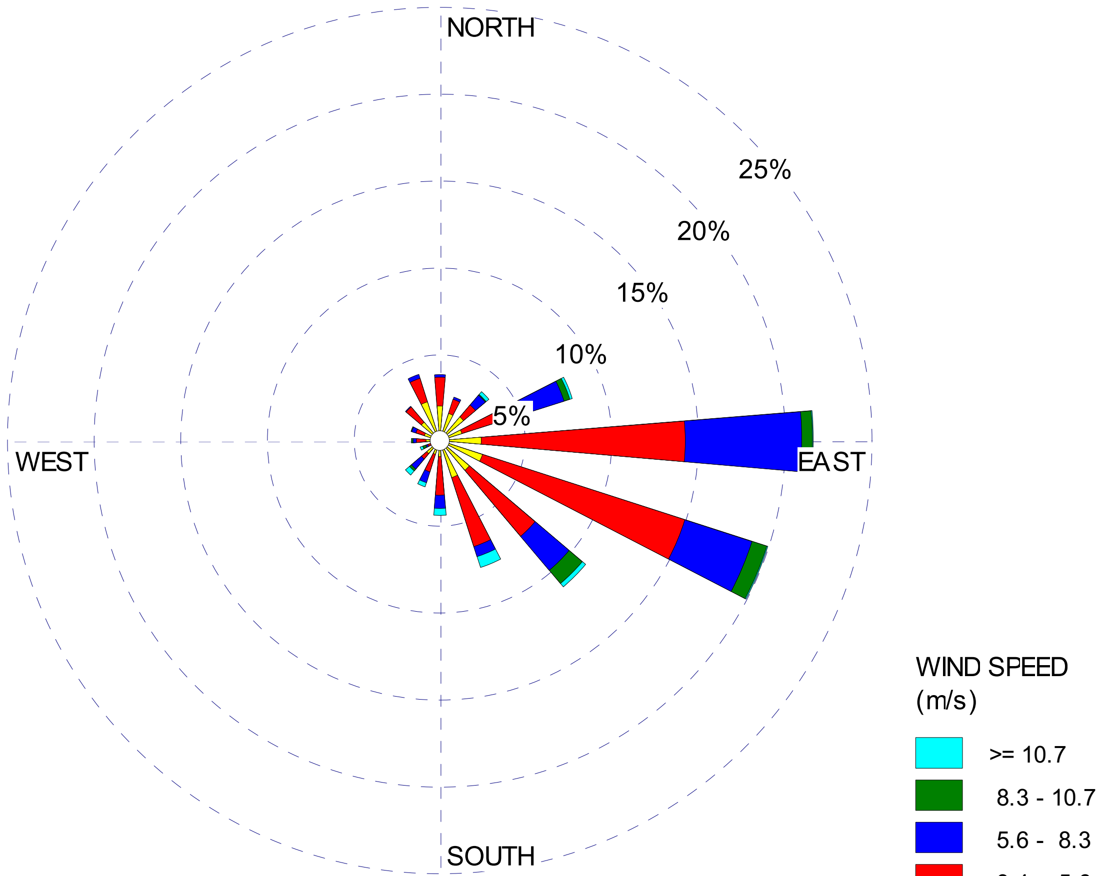


Figure 2.7-13 60-Meter Level 3-Year Composite Wind Rose — September (2002, 2005, and 2006) (Sheet 9 of 12)

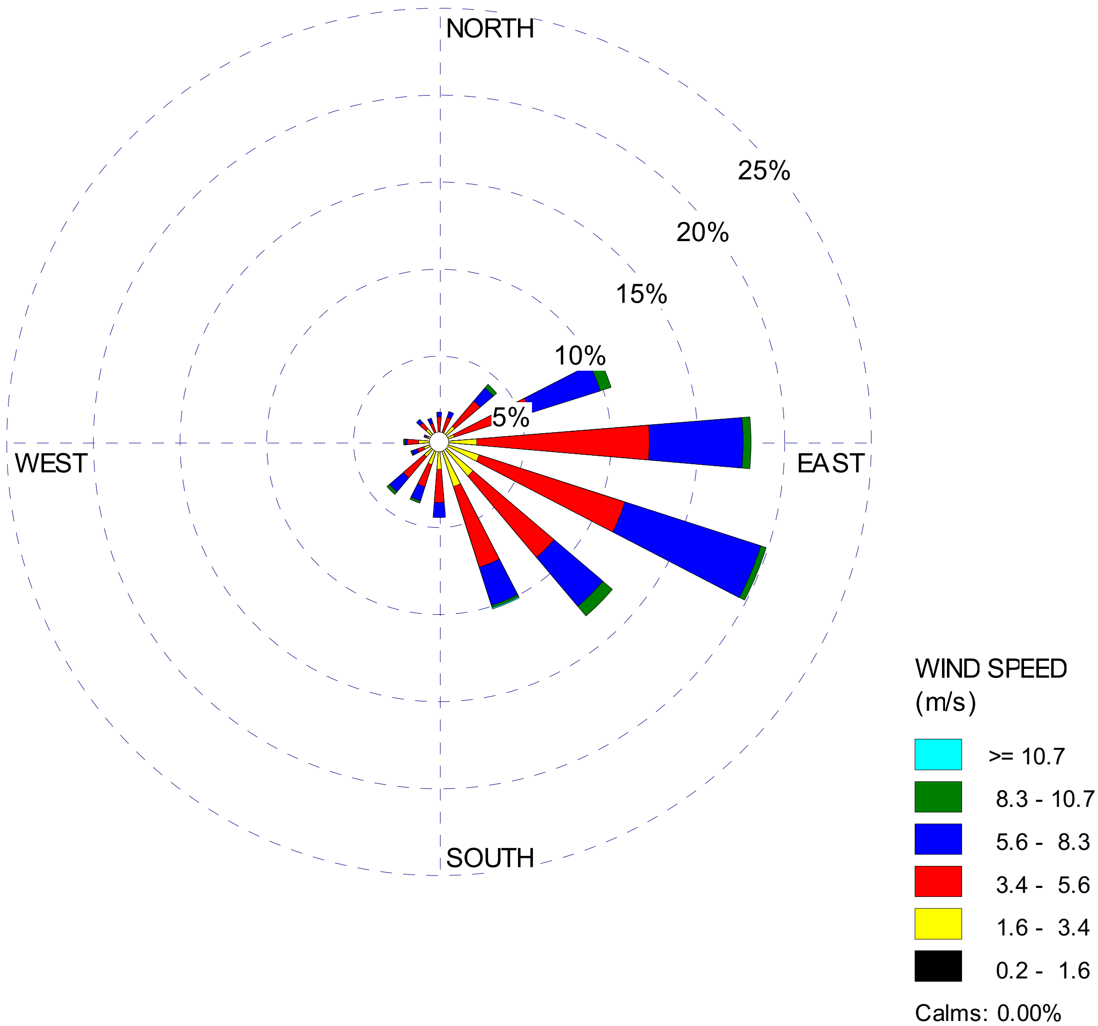


Figure 2.7-13 60-Meter Level 3-Year Composite Wind Rose — October (2002, 2005, and 2006) (Sheet 10 of 12)

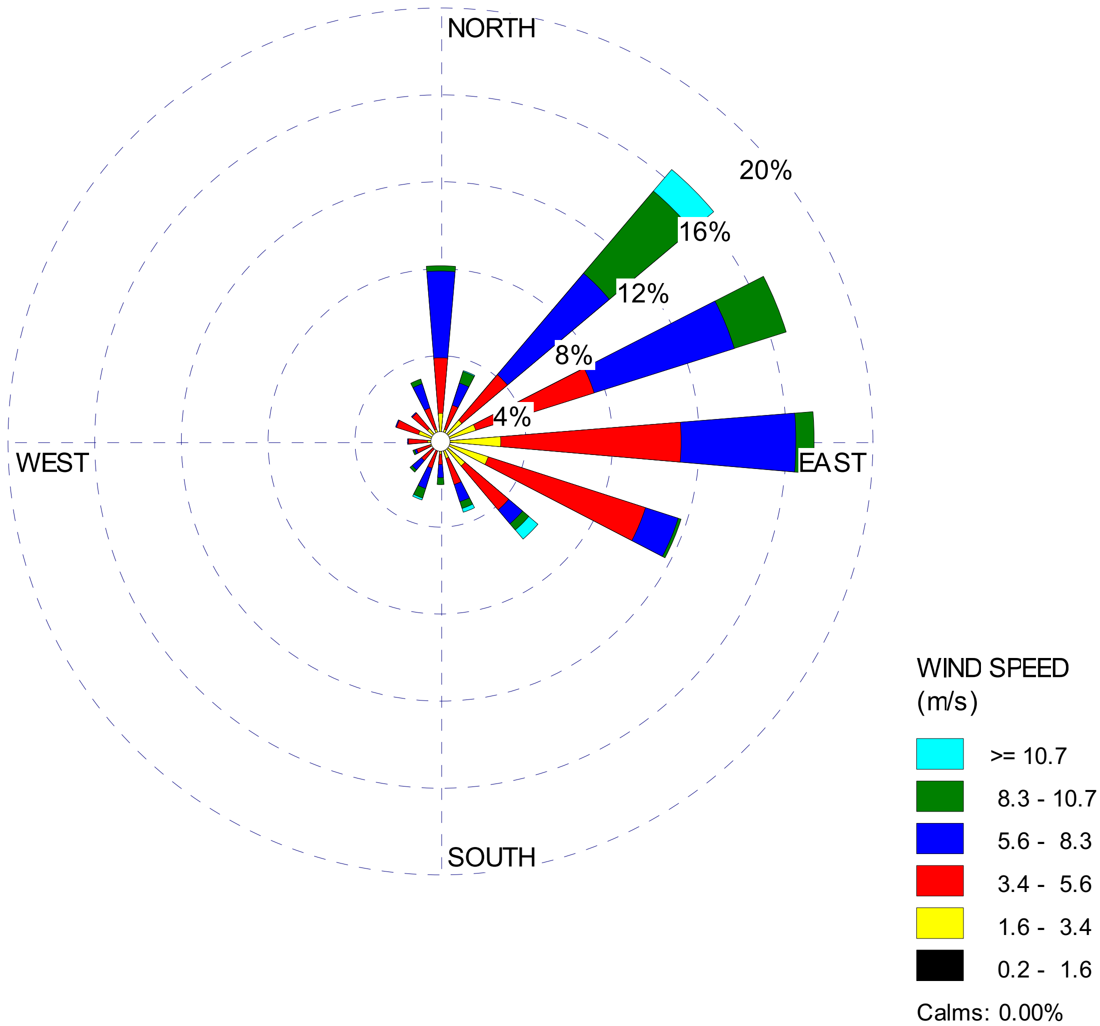


Figure 2.7-13 60-Meter Level 3-Year Composite Wind Rose — November (2002, 2005, and 2006) (Sheet 11 of 12)

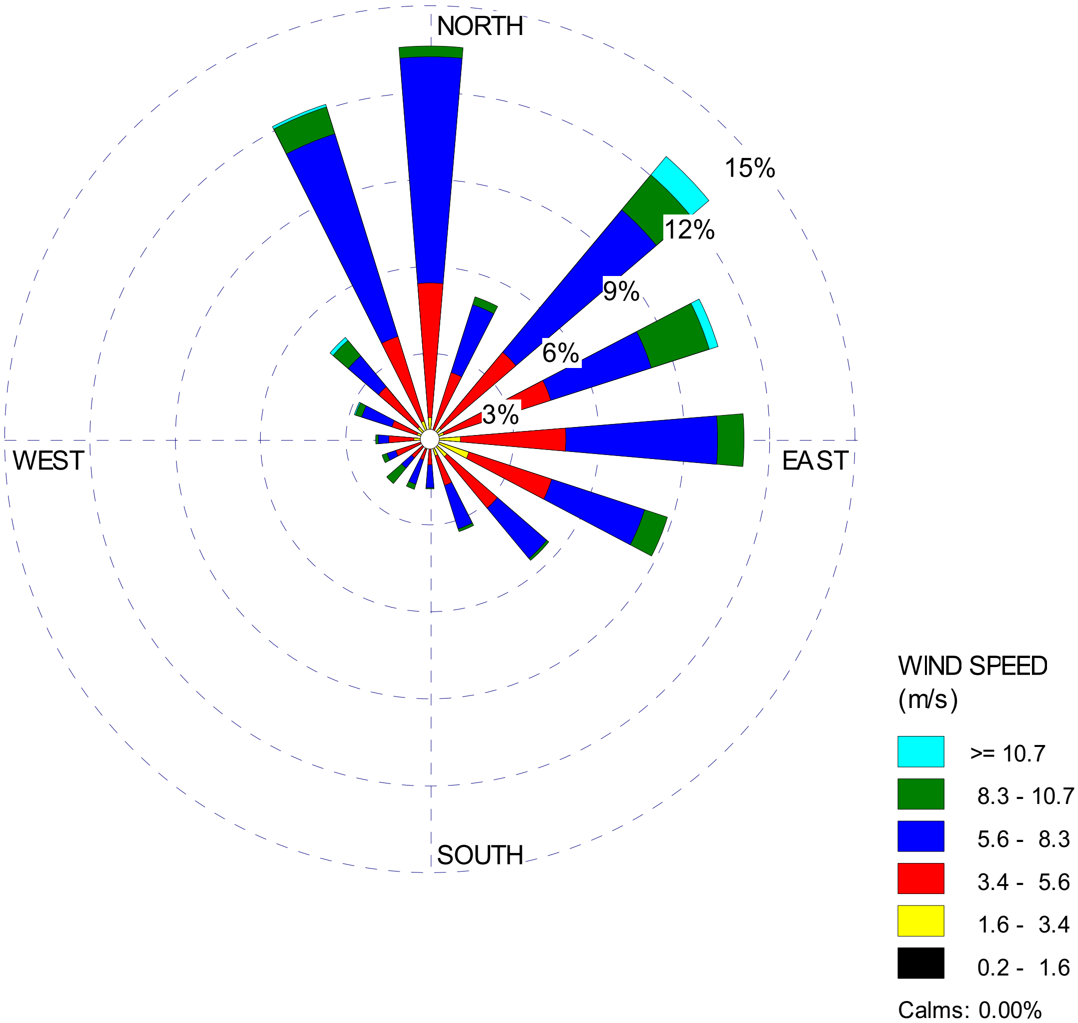


Figure 2.7-13 60-Meter Level 3-Year Composite Wind Rose — December (2002, 2005, and 2006) (Sheet 12 of 12)

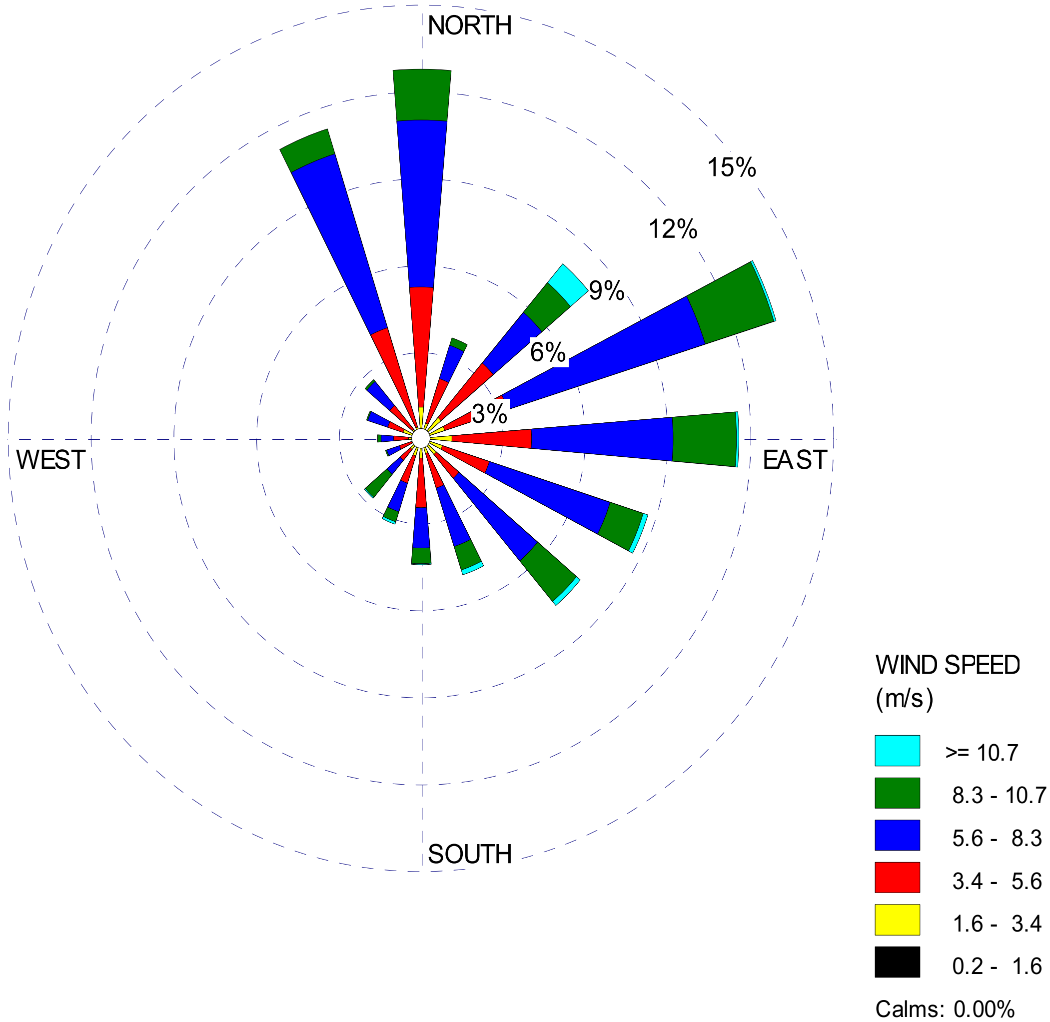
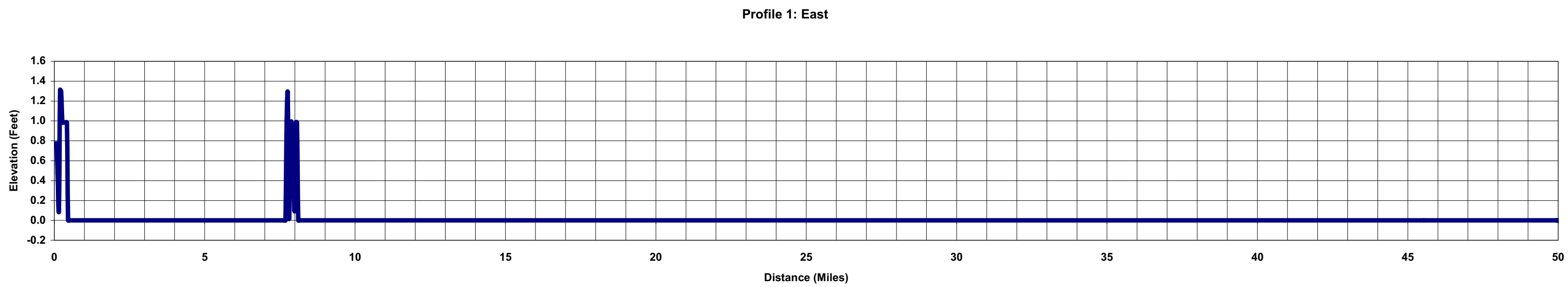


Figure 2.7-14 Terrain Elevation Profiles within 50 miles of Units 6 & 7 (Sheet 1 of 8)



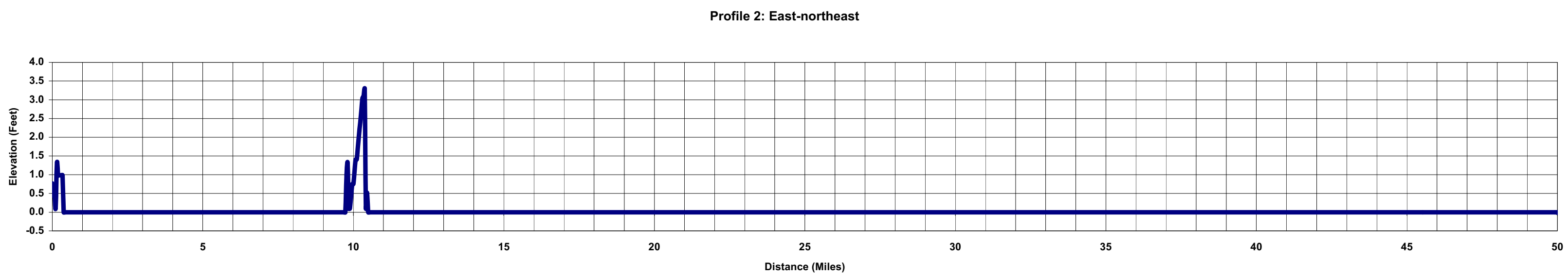
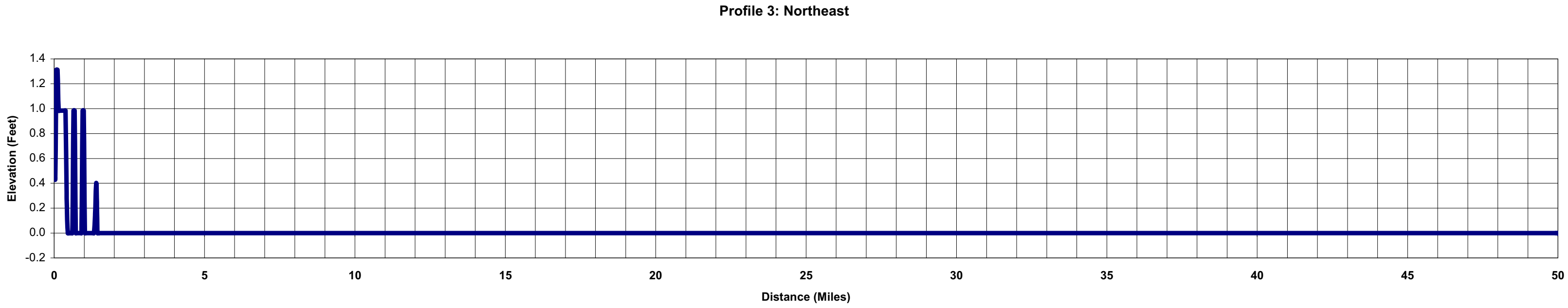


Figure 2.7-14 Terrain Elevation Profiles within 50 miles of Units 6 & 7 (Sheet 2 of 8)



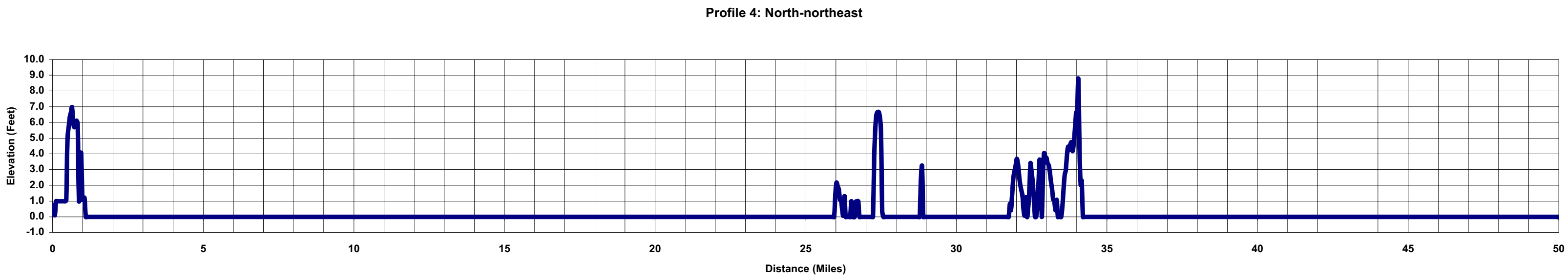
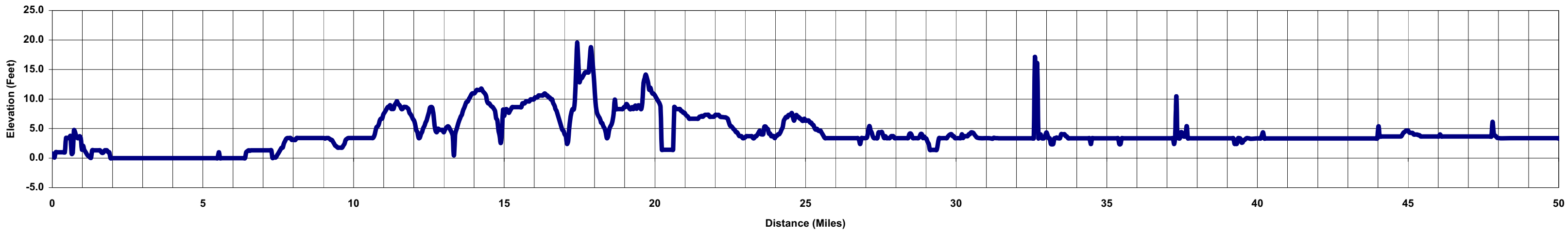


Figure 2.7-14 Terrain Elevation Profiles within 50 miles of Units 6 & 7 (Sheet 3 of 8)

Profile 5: North



Profile 6: North-northwest

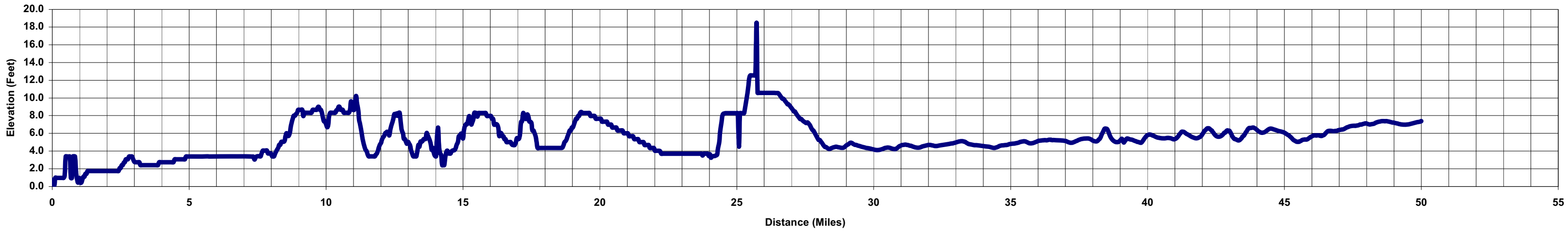
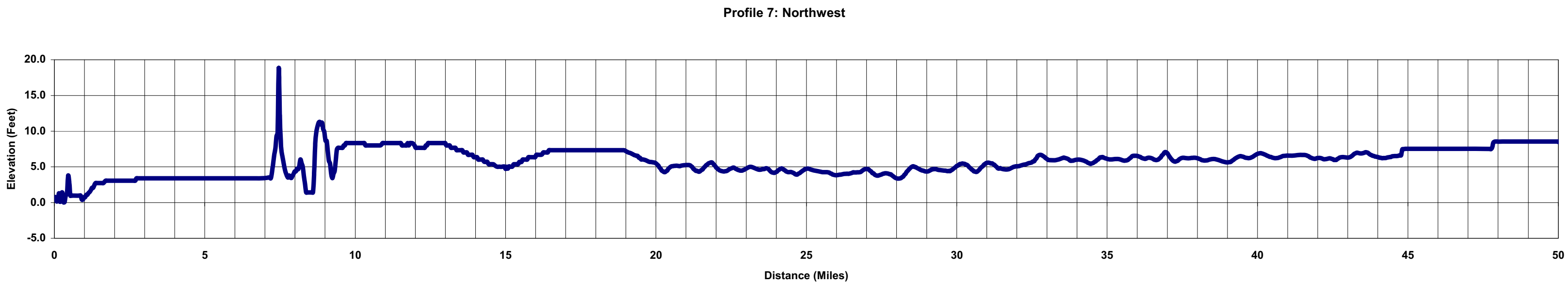


Figure 2.7-14 Terrain Elevation Profiles within 50 miles of Units 6 & 7 (Sheet 4 of 8)



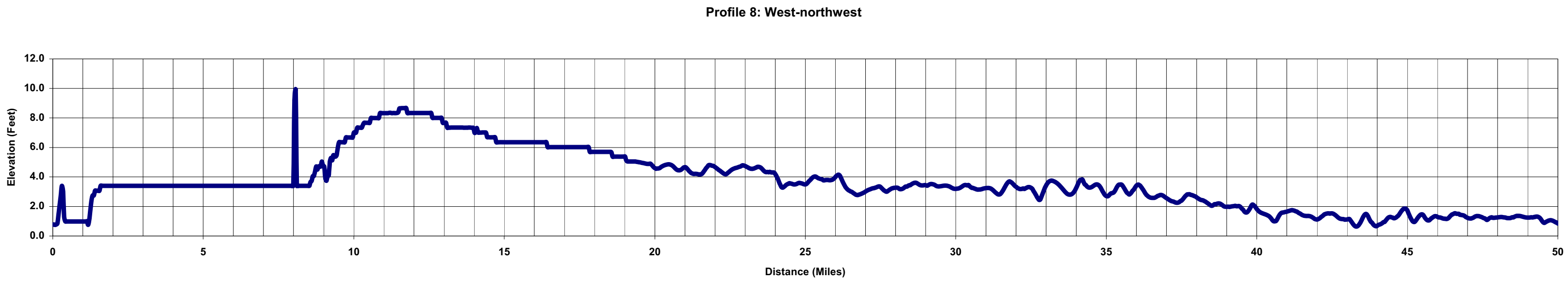
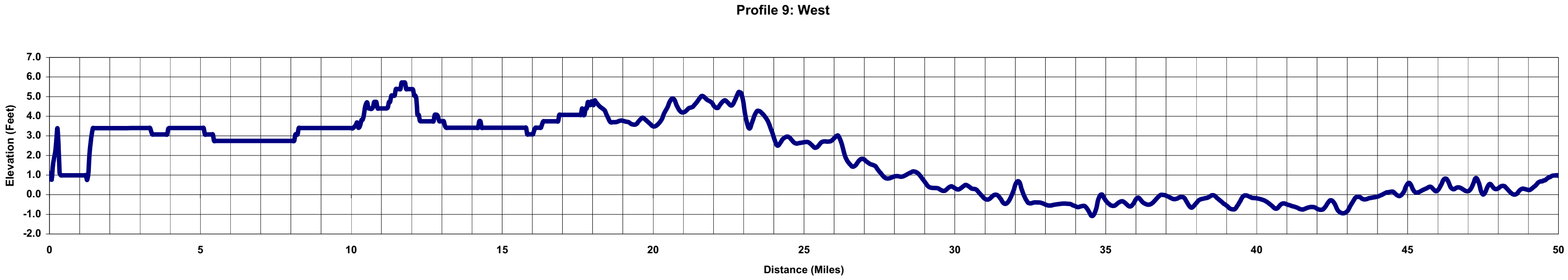


Figure 2.7-14 Terrain Elevation Profiles within 50 miles of Units 6 & 7 (Sheet 5 of 8)



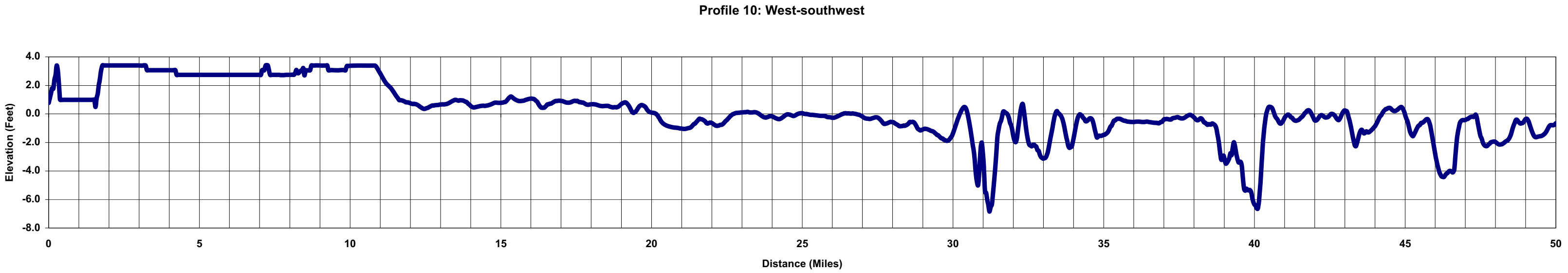
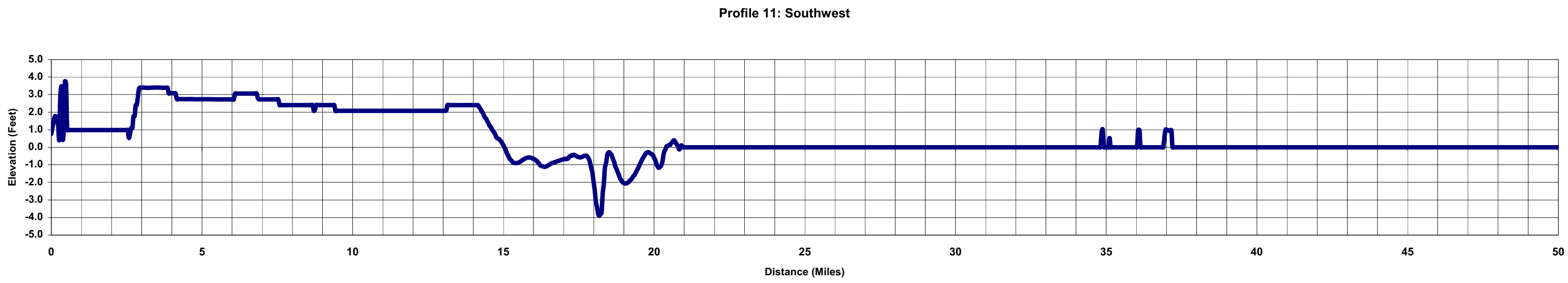


Figure 2.7-14 Terrain Elevation Profiles within 50 miles of Units 6 & 7 (Sheet 6 of 8)



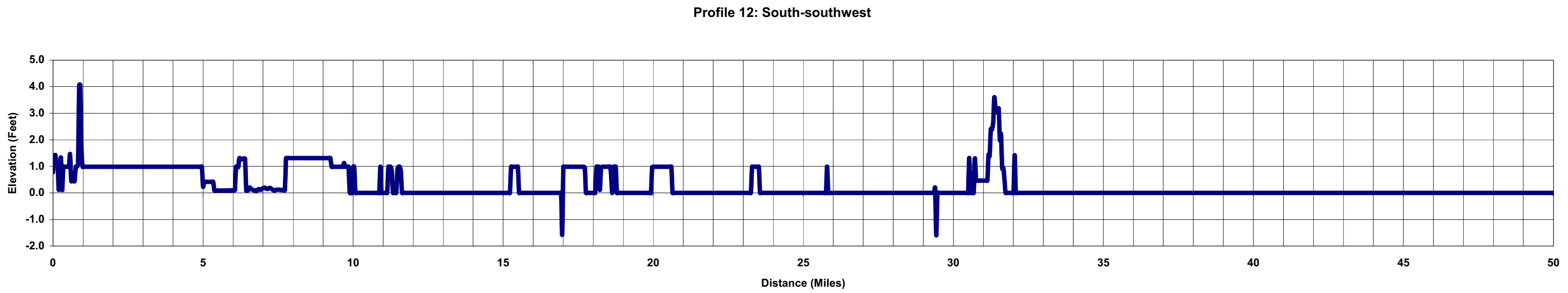
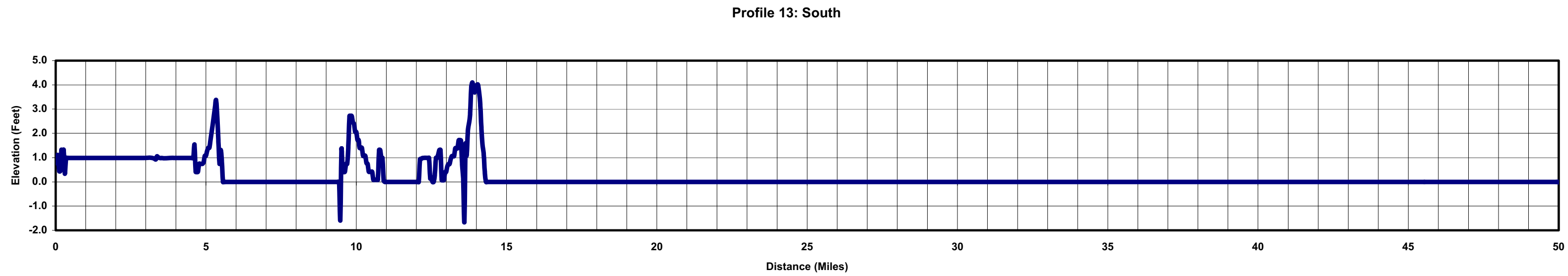


Figure 2.7-14 Terrain Elevation Profiles within 50 miles of Units 6 & 7 (Sheet 7 of 8)



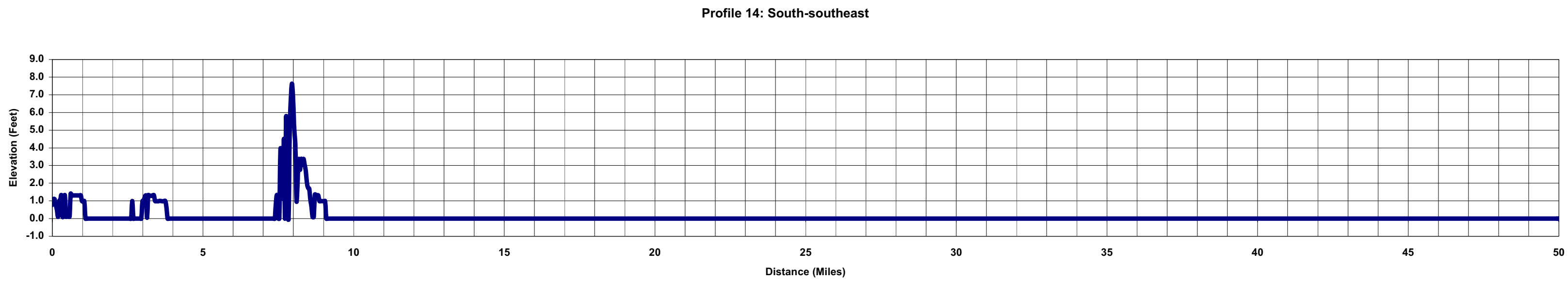
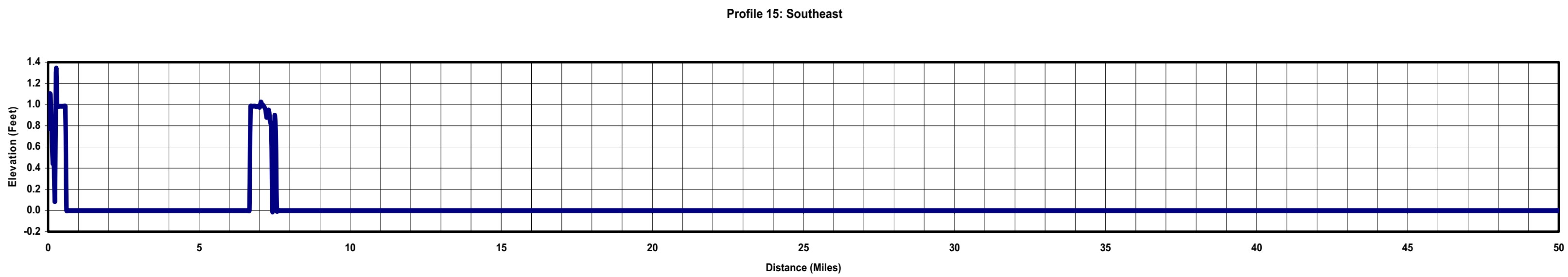
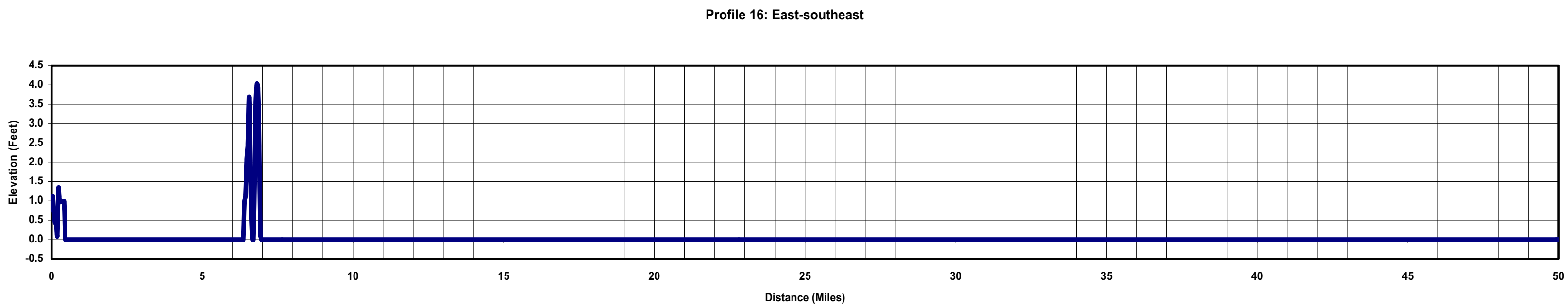


Figure 2.7-14 Terrain Elevation Profiles within 50 miles of Units 6 & 7 (Sheet 8 of 8)





Reference: ESRI Data and Maps and Streetmap USA, 2005, USGS Seamless Data Distribution

Figure 2.7-15 Topographic Features Within a 50-mile Radius of Units 6 & 7

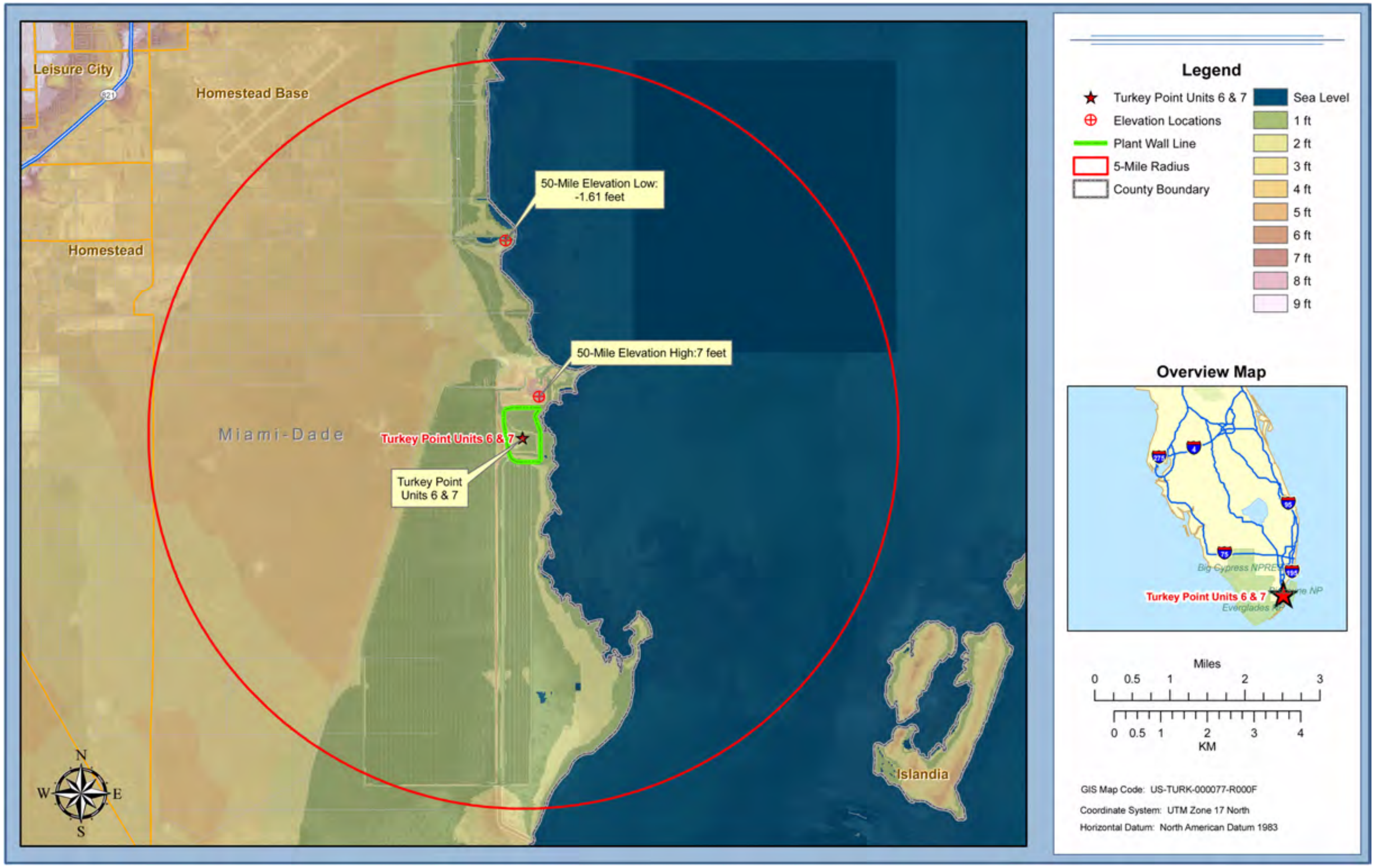


Figure 2.7-16 Noise Monitoring Locations

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2.8 RELATED FEDERAL PROJECT ACTIVITIES

The purpose of this section is to identify any federal activities that are related to the construction and operation of Units 6 & 7 in Miami-Dade County, Florida. This section describes the cumulative impacts due to other related federal activities and determines the possible need for another federal agency to participate in the preparation of the environmental impact statement as a cooperating agency. In accordance with 10 CFR Part 51 Subpart A, related activities that may result in cumulative impacts that are under state or local agency jurisdiction are described. However, actions related only to the granting of licenses, permits, or approvals by other federal agencies for Units 6 & 7 are not considered in this review because such activities typically have an independent environmental review, in accordance with NUREG-1555.

In accordance with NUREG-1555, the following impact categories (federal/state/local) were identified:

- Actions associated with acquisition and/or use of the proposed site and transmission corridors or of any offsite property needed for the project
- Projects that will be required either to provide an adequate source of plant cooling water or to ensure an adequate supply of cooling water over the lifetime of the new units
- Projects or activities that must be completed as a condition of plant construction or operation
- Projects that are contingent on construction and operation of the new units
- Agency plans or commitments that will result in significant new power purchases that would be applicable to the analysis used to justify the need for power associated with Units 6 & 7

2.8.1 Land Acquisition and Use

The Florida Electrical Power Plant Siting Act, Sections 403.501-403.518, Florida Statutes, mandates a site certification process for obtaining a single site-related license that will include state, regional, and local requirements for construction and operation of a power plant and associated facilities of the type and magnitude being proposed. Pursuant to these statutes, the environmental impacts of the construction of Units 6 & 7 and associated linear and non-linear facilities will be reviewed by the state of Florida and other local and regional bodies. Although these are state-led processes, the potential cumulative impacts of these offsite actions, with regard to both construction and operation, need to be considered as part of related activities.

Transmission corridor alternatives considered for Units 6 & 7 will involve the Department of the Interior and the U.S. Army Corps of Engineers, depending on the corridor selected.

There will also be coordination with Everglades National Park and Biscayne National Park, as necessary, regarding possible impacts to the current Everglades restoration project being performed adjacent to the Turkey Point plant property.

2.8.2 Cooling Water Source and Supply

Currently, there are two natural gas/oil conventional boiler units (Units 1 & 2), two pressurized water nuclear reactors (Units 3 & 4), and one combined-cycle natural gas unit (Unit 5) located on the Turkey Point plant property.

Units 1 through 4 use the cooling canals of the industrial wastewater facility for cooling. Unit 5 uses mechanical draft cooling towers for heat dissipation. These towers receive water from the Upper Floridan aquifer for use as makeup water and route their blowdown to the industrial wastewater facility. Potable water from the Miami-Dade County water supply system, a municipal water source, is provided for potable and service water use for Units 1 through 5 and would also be used for Units 6 & 7.

Two sources of makeup water are planned to replace cooling tower blowdown for Units 6 & 7. One source would be water reclaimed for reuse after processing by the Miami-Dade Water and Sewer Department, conveyed via pipelines to the Turkey Point plant property. An onsite FPL reclaimed water treatment facility would further treat the reclaimed water for use in the cooling system. When reclaimed water cannot supply the quantity and/or quality of water needed for the circulating water system, a second source for makeup water would consist of radial collector wells that would withdraw saltwater from under Biscayne Bay. The wells would be located on the Turkey Point peninsula, east of the existing units. Blowdown from the circulating water system would be transferred to a common blowdown sump before being discharged to deep injection wells.

In summary, there are no known planned federal projects or activities that Units 6 & 7 require to meet cooling water requirements, and no federal projects or activities are required to ensure continuous water supply over the plant lifetime.

2.8.3 Projects Affecting Construction or Operation

There are no federal projects or activities that must be completed as a condition of, or are contingent on, Units 6 & 7 construction or operation.

State and/or local projects or activities that must be completed as a condition of, or are contingent on, Units 6 & 7 construction or operation include road improvements and installation of the reclaimed water and potable water pipelines.

2.8.4 Plans or Commitments Resulting in Significant Power Purchases

As described in Chapter 8, there is a demonstrated need for power generated by the proposed project. FPL's reliability analysis did not identify plans or commitments for significant new power purchases from any federal, state, or local agency.

2.8.5 Other Federal Activities

Two related federal activities associated with Units 3 & 4 are potential federal-related activities that may need to be considered for cumulative impacts. A power uprate for Units 3 & 4 is scheduled for 2012, and the construction of an independent spent fuel storage installation is scheduled for 2009.

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CHAPTER 3 PLANT DESCRIPTION

3.1 EXTERNAL APPEARANCE AND PLANT LAYOUT

3.1.1 EXISTING SITE

The 218-acre Units 6 & 7 plant area is located within the approximately 9400-acre Turkey Point plant property in Miami-Dade County, Florida, approximately 25 miles south of Miami, 8 miles east of Florida City, and 9 miles southeast of Homestead, Florida. Units 1 through 5 occupy approximately 195 acres on the Turkey Point plant property.

Units 1 & 2 are each 400 MWe (nominal) natural gas/oil steam electric generating units that have been in service since 1967 (Unit 1) and 1968 (Unit 2), respectively. Units 3 & 4 are 700 MWe (nominal) pressurized water reactor nuclear units that have been in service since 1972 (Unit 3) and 1973 (Unit 4), respectively. Turkey Point Unit 5 is a nominal 1150 MWe (nominal) natural gas combined-cycle unit that began operating in 2007. All five of the steam electric generating units lie within the developed area of the Turkey Point plant property. An aerial photograph showing the five existing power generating units is provided as Figure 3.1-1.

A closed-loop system of canals is used by Units 1 through 4 to provide cooling. This system is a permitted industrial wastewater facility. The industrial wastewater facility is a closed-loop system of recirculating canals occupying an area of approximately 5900 acres on the Turkey Point plant property. Unit 5 uses mechanical draft cooling towers for heat dissipation. These towers receive water from the Upper Floridan aquifer for use as makeup water and route their blowdown to the cooling canals of the industrial wastewater facility.

3.1.2 PROPOSED SITE

The Westinghouse AP1000 plant design has been selected for Units 6 & 7 (approximately 1100 MWe each, net output power), a nuclear plant design certified under 10 CFR Part 52, Subpart B. The location of the new units would be directly south of Units 3 & 4 in the northeast portion of the industrial wastewater facility, with Biscayne Bay to the east. An aerial photograph of the Units 6 & 7 plant area showing the existing generating units (Units 1 through 5) in the background is provided in Figure 3.1-2. Figure 3.1-3 shows the plot plan with major structures identified. Figure 2.7-15 provides topographical features within a 5-mile radius around Units 6 & 7.

Units 6 & 7 would share the primary and backup meteorological towers with Units 3 & 4. The current meteorological tower locations are shown on Figure 6.4-1 and Figure 6.4-2. (The backup meteorological tower would be relocated during Units 6 & 7 construction to a suitable area on the Turkey Point plant property.) The radioactive liquid release points and the radioactive gaseous release points for the new units are presented in Section 3.5. The nonradioactive liquid release points and the nonradioactive gaseous release points for the new units are presented in Section 3.6.

The new AP1000 units and support facilities are designed around a Westinghouse standardized unit approach. Each AP1000 unit consists of five principal structures:

1. Nuclear island
2. Turbine building
3. Annex building
4. Diesel generator building
5. Radwaste building

The structures that make up the nuclear island include the containment building, shield building, and auxiliary building. The foundation for the nuclear island will be an integral basemat that supports these buildings. The containment building will be a free-standing steel containment vessel with elliptical upper and lower heads. It will be surrounded by the shield building. The shield building will be a structure that, in conjunction with the internal structures of the containment building, provides the required shielding for the reactor coolant system and the other radioactive systems and components housed in the containment building.

The auxiliary building will be a reinforced concrete structure that wraps around approximately 70 percent of the circumference of the shield building. The primary function of the auxiliary building is to provide protection and separation for the mechanical and electrical equipment located outside of the containment building. The main control room will be contained within the auxiliary building. The auxiliary building will provide protection to safety-related equipment from the consequences of either a postulated internal or external event. The auxiliary building will also provide shielding for the radioactive equipment and piping that is housed within the building.

The turbine building will be a rectangular steel column and beam structure with its long axis oriented radially from the containment building. The turbine building will house the turbine, generator, and associated mechanical and electrical systems.

The annex building will be a combination reinforced concrete and steel-framed structure with insulated metal siding. The annex building will provide the main personnel entrance to the power block. The building also will contain the control support area, machine shop, the ancillary diesel generators, other electrical equipment and various heating, ventilation, and air conditioning systems.

The diesel generator building will be a single-story, steel-framed structure with insulated metal siding. The building will house two diesel generators to provide backup power in the event of disruption of the normal power source.

The radwaste building will be a steel-framed structure. The radwaste building will house low-level liquid radwaste holdup tanks and processing system. The building will include facilities for segregated storage of various categories of waste before processing, for processing by mobile systems, and for storing processed waste in shipping and disposal containers.

For each unit, the closed-cycle circulating water system (CWS) would consist of three mechanical draft cooling towers, an open channel (flume) with a pump intake structure, and the two sources of makeup water for the cooling towers. The primary source of makeup water for the cooling towers would be treated reclaimed water from the Miami-Dade Water and Sewer Department (MDWASD). The other source available for makeup water to the CWS would be saltwater via substratum radial collector wells. Saltwater would be used when a sufficient supply and/or quality of treated reclaimed water is unavailable. The CWS cooling towers would be situated at the southern end of the Units 6 & 7 plant area. Blowdown flow from the cooling towers would be directed to a common blowdown sump before being discharged to deep injection wells. A description of the CWS, including deep injection wells, is provided in Section 3.4.

In addition to the CWS cooling towers, Units 6 & 7 will include one service water system cooling tower (a 2-cell tower) for each unit. These mechanical draft cooling towers will occupy an area of approximately 0.5 acre per unit and will be located near the turbine building. The source of makeup water for the service water cooling towers would be potable water from the MDWASD potable water supply.

Additional plant structures would include warehouses, nuclear administration building, training building, other offices and buildings, security buildings, parking areas, sanitary waste treatment plant, switchyard, and transmission towers. A reclaimed water treatment facility, makeup water reservoir, and pipelines would be constructed for treating, storing, and delivering the reclaimed water from the MDWASD.

Units 6 & 7 would be constructed from materials architecturally similar to Units 1 through 4. The overall goal would be to provide an aesthetically pleasing effect. An artist's rendition of Units 6 & 7 with the existing Units 1 through 5 is provided in Figure 3.1-4. Photographs that show the new units from several vantage points are included as Figures 3.1-5 and 3.1-6. Figure 3.1-5 shows the expected view from the local transportation corridor-SW 344th Street/Palm Drive. Figure 3.1-6 shows the expected view from Biscayne Bay.

Figure 3.1-1 Existing Turkey Point Units 1 to 5

Figure 3.1-2 View of Location of Units 6 & 7 with Existing Units 1 to 5 in Background

Figure 3.1-3 Plot Plan Showing Major Structures

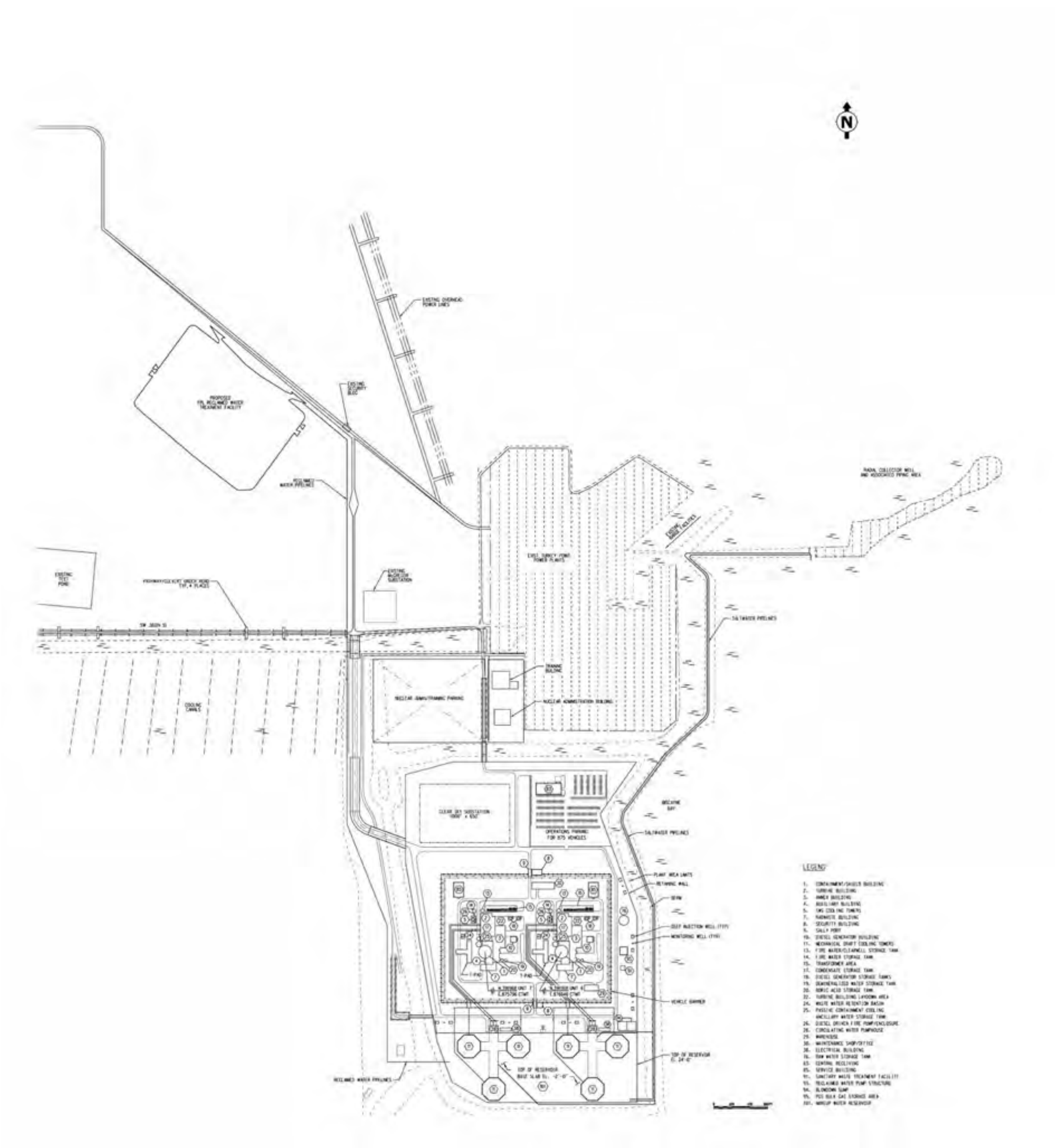
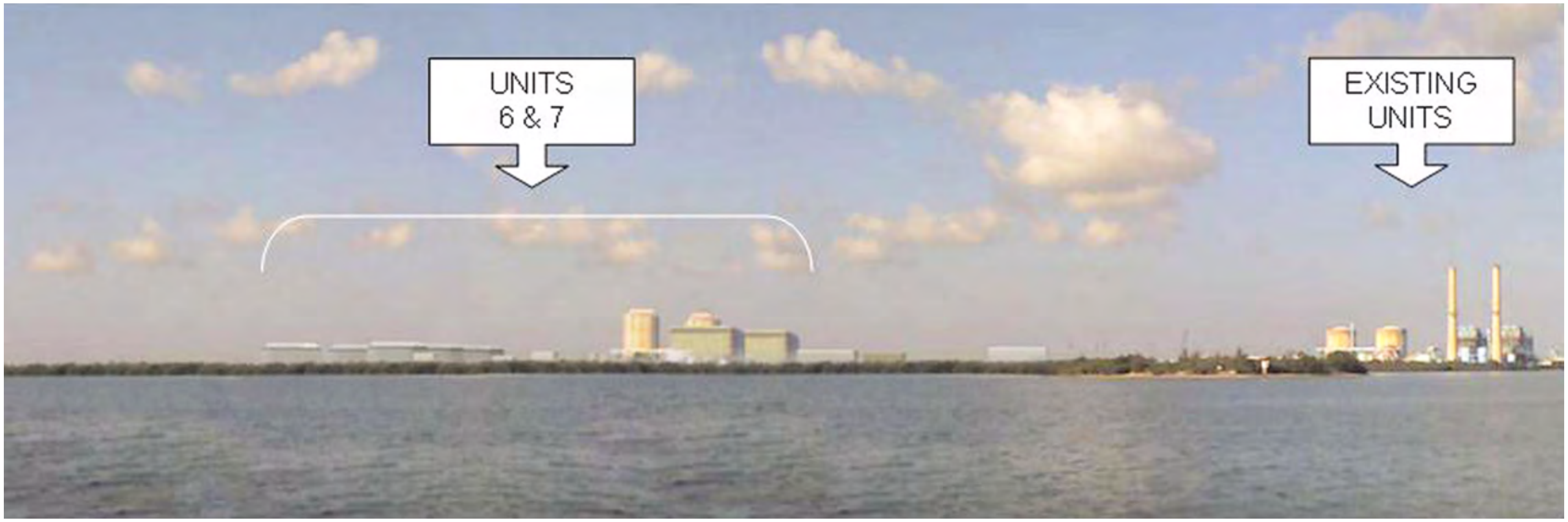


Figure 3.1-4 Architectural Feature Rendering for Units 6 & 7

Figure 3.1-5 Visual Rendering From Transportation Corridor

Figure 3.1-6 Visual Rendering From Biscayne Bay



3.2 REACTOR POWER CONVERSION SYSTEM

Two Westinghouse AP1000 units are proposed for Units 6 & 7. The architect-engineer has not yet been selected. Major components for each unit include a single reactor pressure vessel, two steam generators, and four reactor coolant pumps for converting reactor thermal energy into steam. A single high-pressure turbine and three low-pressure turbines drive a single electric generator. Figure 3.2-1 provides a simplified diagram of the reactor power conversion system.

The reactor contains a matrix of fuel rods assembled into 157 mechanically identical fuel assemblies along with control and structural elements. A fuel assembly consists of 264 fuel rods in a 17 x 17 square array. The assemblies, containing various fuel enrichments, are configured into the core arrangement located and supported by the reactor internals. The reactor internals also direct the flow of the coolant past the fuel rods. The coolant and moderator is light water at a normal operating pressure of 2250 psia. The fuel, internals, and coolant are contained within a heavy-walled reactor pressure vessel.

The fuel rods consist of enriched uranium, in the form of cylindrical pellets of sintered uranium dioxide contained in ZIRLO™[1] tubing, with an initial fuel cycle enrichment of 2.35 to 4.45 weight percent U-235. The average concentration of U-235 in reloads is 4.54 weight percent. The total weight of uranium dioxide is 211,588 pounds as shown in DCD Table 4.1-1 (WEC 2011). Reload core designs, as well as the initial cycle design, are anticipated to operate approximately 18 months between refueling, accumulating an average burnup of discharged fuel of approximately 50,553 megawatt-days per metric ton of uranium (MWD/MTU), with a cycle burnup of approximately 21,000 MWD/MTU. The NRC has approved maximum fuel rod average burnup of 60,000 MWD/MTU. Extended burnup to 62,000 MWD/MTU has been established as described in DCD Subsection 4.3.1.1.1. The total fuel capacity for each unit is approximately 84.5 MTU.

The ZIRLO tubing is plugged and seal-welded at the ends to encapsulate the fuel. An axial blanket comprised of fuel pellets with reduced enrichment may be placed at each end of the enriched fuel pellet stack to reduce the neutron leakage and to improve fuel use.

The AP1000 reactor is connected to two steam generators via two primary hot leg pipes and four primary cold leg pipes. A reactor coolant pump is located in each primary cold leg pipe to circulate pressurized reactor coolant through the reactor core. The coolant flows through the reactor core, making contact with the fuel rods containing the enriched uranium dioxide fuel. As the coolant passes through the core, heat from the nuclear fission process is transferred from the fuel rods to the coolant. The heat is transported to the steam generators by the circulating reactor coolant and passes through the steam generator tubes to heat the feedwater from the secondary

1. ZIRLO is a registered trademark of Westinghouse Electric Company.

system. Reactor coolant is pumped back to the reactor by the reactor coolant pumps, where it is reheated to start the heat transfer cycle over again. Inside the steam generators, the heat from the primary system is transferred through the tube walls to convert the incoming feedwater from the secondary system into steam. The steam is transported from the steam generators by the main steam piping to drive the high-pressure and low-pressure turbines connected to the electric generator. After passing through three low-pressure turbines, the steam is condensed back to water by cooled water circulating inside the tubes of three main condensers. The heat rejected in the main condensers is removed by the circulating water system. The condensate is then preheated and pumped back to the steam generators as feedwater to repeat the steam cycle.

Transportation of fuel and waste is addressed in Section 3.8.

3.2.1 ENGINEERED SAFETY FEATURES

Engineered safety features protect the plant workers and the public in the event of an accidental release of radioactive fission products from the reactor coolant system. The engineered safety features function to localize, control, mitigate, and terminate such accidents and to maintain radiation exposure levels to the public below applicable limits and guidelines, such as those in 10 CFR Part 20 and 10 CFR Part 100. The following subsections define the engineered safety features.

3.2.1.1 Containment

The containment vessel is a free-standing cylindrical steel vessel with ellipsoidal upper and lower heads. It is surrounded by a Seismic Category I reinforced concrete shield building. The function of the containment vessel, as part of the overall containment system, is to contain the release of radioactivity following postulated design basis accidents. The containment vessel also functions as the safety-related ultimate heat sink by transferring the heat associated with accident sources to the surrounding environment. The following paragraph details this safety-related feature.

Passive Containment Cooling System: The function of the passive containment cooling system is to maintain the containment air temperature below a specified maximum value and to reduce the containment temperature and pressure following a postulated design basis event. The passive containment cooling system removes thermal energy from the containment atmosphere. The passive containment cooling system also serves as the safety-related ultimate heat sink for other design basis events and shutdowns. The passive containment cooling system limits the release of radioactive material to the environment by reducing the pressure differential between the containment atmosphere and the external environment. This diminishes the driving force for leakage of fission products from the containment to the atmosphere in the event of a postulated design basis accident.

3.2.1.2 Containment Isolation System

The major function of the containment isolation system of the AP1000 is to provide containment isolation to allow the normal or emergency passage of fluids through the containment boundary while preserving the integrity of the containment boundary, if required. This prevents or limits the escape of fission products that may result from postulated accidents. Containment isolation provisions are designed so that fluid lines penetrating the primary containment boundary are isolated in the event of an accident. This minimizes the release of radioactivity to the environment.

3.2.1.3 Passive Core Cooling System

The primary function of the passive core cooling system is to provide emergency core cooling following postulated design basis events. The passive core cooling system provides reactor coolant system makeup and boration during transients or accidents where the normal reactor coolant system makeup supply from the chemical and volume control system is lost or is insufficient. The passive core cooling system provides safety injection to the reactor coolant system to provide adequate core cooling for the complete range of loss of coolant accident events up to, and including, the double-ended rupture of the largest primary loop reactor coolant system piping. The passive core cooling system provides core decay heat removal during transients, accidents, or whenever the normal heat removal paths are lost.

3.2.1.4 Main Control Room Emergency Habitability System

The main control room emergency habitability system is designed so that the main control room remains habitable following a postulated design basis event. With a loss of all alternating current power sources, the habitability system maintains an acceptable environment for continued operating staff occupancy.

3.2.1.5 Fission Product Control

Post-accident safety-related fission product control for the AP1000 is provided by natural removal processes inside containment, the containment boundary, and the containment isolation system. The natural removal processes, including various aerosol removal processes and pool scrubbing, remove airborne particulates and elemental iodine from the containment atmosphere following a postulated design basis event.

3.2.2 TURBINE GENERATOR

The turbine generator serves no safety-related function and therefore has no nuclear safety design basis. The turbine generator system is designed to convert the thermal energy of the steam flowing through the turbine into rotational mechanical work, which rotates a generator to provide electrical power. It consists of a double-flow, high-pressure cylinder (high-pressure turbine) and three double-flow, low-pressure cylinders (low-pressure turbines) that exhaust to the condenser. It is a six-flow, tandem compound, 1800 rpm reheat unit. The turbine system includes stop, control, and intercept valves directly attached to the turbine and in the steam flow path, crossover and crossunder piping between the turbine cylinders and the moisture separator reheater. This design is provided as the reference design in DCD Chapter 10. The manufacturer of the turbine generator system has not yet been selected.

Each turbine generator has an output of approximately 1200 MWe for each reactor thermal output of 3415 MWt. The generator rating is 1,375,000 kVA with a power factor of 0.9. Plant electrical consumption (station and auxiliary service loads) is approximately 108 MWe or approximately 9 percent of generator output at rated power. The systems of the turbine cycle have been designed to meet the maximum expected turbine generator conditions. The net electrical power is addressed in FSAR Section 1.1.

The significant design features and performance characteristics for the major steam and power conversion system components are listed in DCD Table 10.1-1. Turbine generator design parameters are listed in DCD Table 10.2-1.

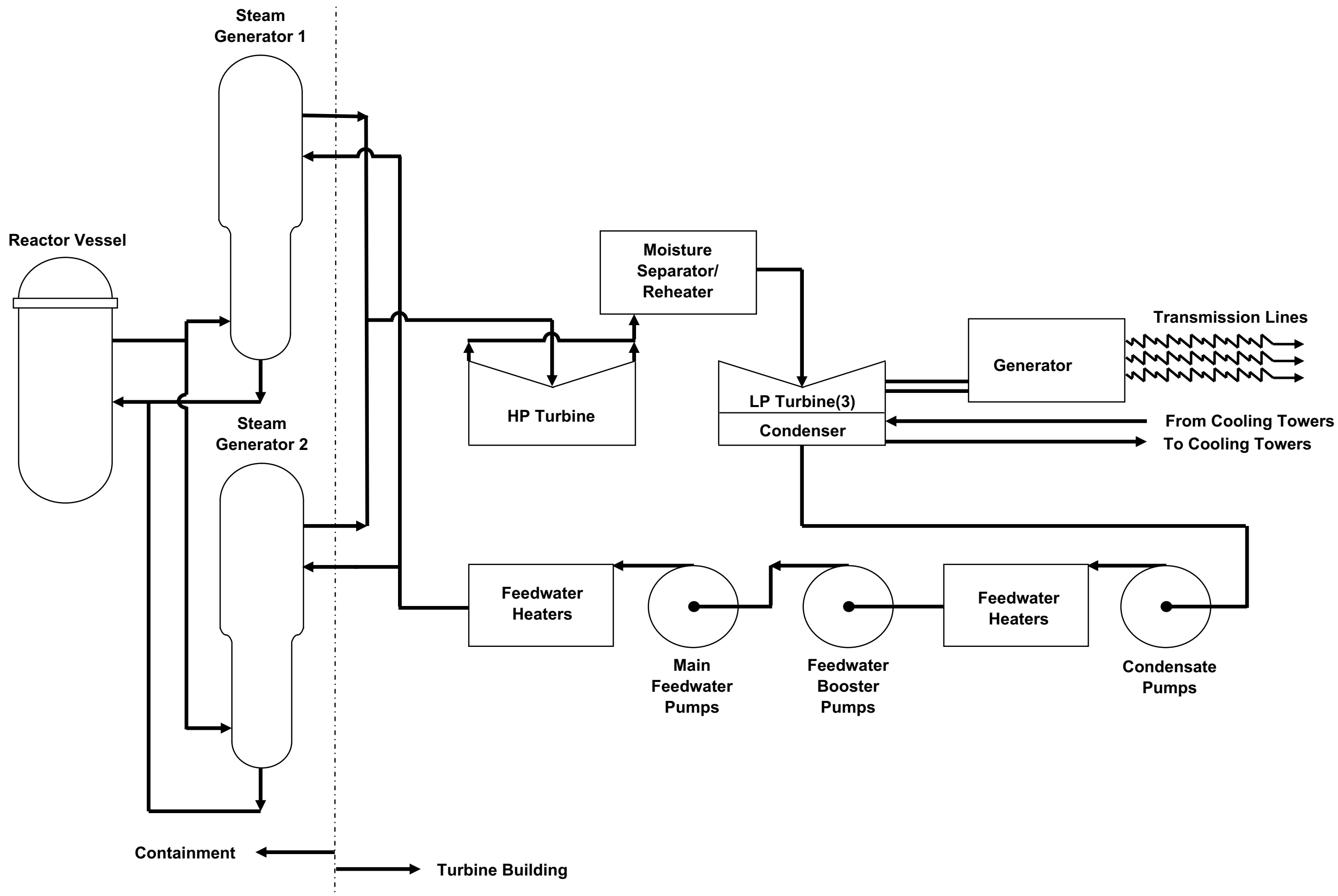
The main condenser is a three-shell, single-pass, multi-pressure, spring-supported unit with a total surface area of 12.36E5 square feet or 4.12E5 square feet per shell available for heat transfer. Each shell is located beneath its respective low-pressure turbine. The condenser rejects approximately 7.54E9 Btu/hour of waste heat to the circulating water system. The condenser is equipped with titanium tubes. The titanium material provides good corrosion and erosion resisting properties. Additional main condenser design data is presented in DCD Table 10.4.1-1.

In a multi-pressure condenser, the condenser shells operate at slightly different pressures and temperatures. Condensate in the low-pressure condenser shell drains through internal piping to the high-pressure (hottest) shell where it is slightly heated and mixed with condensate of the high pressure shell. This condensate then flows through a single outlet to the suction of the condensate pumps.

Section 3.2 References

WEC 2011. Westinghouse Electric Company, LLC. *AP1000 Design Control Document*, Document No. APP-GW-GL-700, Tier 2 Material, Rev. 19, June 13, 2011.

Figure 3.2-1 Simplified Diagram of Reactor Power Conversion



3.3 PLANT WATER USE

Plant water use for Units 6 & 7 is based on two AP1000 units. Consumption and treatment requirements are determined from the DCD (WEC 2011) water quality guidelines and site characteristics. Reclaimed water from the Miami-Dade Water and Sewer Department (MDWASD) would supply makeup water for the circulating water system of Units 6 & 7. When reclaimed water cannot supply the quantity and/or quality of water needed for the circulating water system, additional makeup water would be saltwater supplied from radial collector wells. The circulating water system would be designed to accommodate 100 percent supply from reclaimed water, saltwater, or a combination of the two sources. The ratio of water supplied by the two makeup water sources would vary based on the availability of reclaimed water from the MDWASD. Makeup water for the service water system would be supplied by the MDWASD potable water supply. This water would also be the source for potable water, the demineralized water system, fire protection, and miscellaneous water users. Effluents would be discharged to the Boulder Zone via deep injection wells permitted by the Florida Department of Environmental Protection (FDEP) underground injection control program.

3.3.1 WATER CONSUMPTION

Each unit would use closed-cycle, mechanical draft cooling towers for both circulating water system cooling and service water system cooling. Makeup water would be required to replenish circulating water system and service water system water lost to evaporation, drift, and blowdown.

For makeup to the circulating water system, reclaimed water would be supplied to the FPL reclaimed water treatment facility from the MDWASD. In accordance with FDEP regulations (Florida Administrative Code 62-610.668), MDWASD would be required to provide high-level disinfection of reclaimed water before industrial use by FPL in open cooling towers. The FPL reclaimed water treatment facility would be designed to further treat the reclaimed water from MDWASD prior to use in the circulating water system. The FPL reclaimed water treatment facility would include pumps, trickling filters, clarifiers, deep bed filters, and solids-handling equipment to reduce the levels of iron, magnesium, oil and grease, total suspended solids, nutrients, and silica to usable levels for the circulating water system.

From the FPL reclaimed water treatment facility, the treated reclaimed water would be piped to and stored in the makeup water reservoir before being pumped to the circulating water system cooling tower basins for each unit. Additional circulating water makeup would be saltwater supplied from radial collector wells. The wells would be located on the Turkey Point peninsula, east of the existing units. These wells would provide water to the circulating water system cooling tower basins. Saltwater would be used in instances where sufficient supply and/or quality of reclaimed water from the MDWASD would be unavailable to Units 6 & 7.

The MDWASD potable water supply would provide makeup water for the service water cooling towers of each unit. Additionally, the MDWASD potable water supply would also provide water for the potable water system, fire protection system, the demineralized water system, and other miscellaneous users for each unit. Water balances for this arrangement are provided by data listed in Tables 3.3-1 and 3.3-2 in conjunction with Figure 3.3-1. Hydrologic and water use impacts of this arrangement are addressed in Section 5.2.

Tables 3.3-1 and 3.3-2 define normal and maximum water use for two units based on AP1000 design parameters and site-specific characteristics. Table 3.3-1 assumes reclaimed water is supplied as the source of makeup to the circulating water system. Table 3.3-2 assumes reclaimed water is unavailable and, therefore, saltwater is supplied as the source of makeup to the circulating water system. Evaporation and drift estimates for the circulating water and service water cooling towers are based on site characteristics and AP1000 design parameters for the cooling systems included in Tables 3.4-1 and 3.4-2.

3.3.1.1 Plant Water Demand

Tables 3.3-1 and 3.3-2 provide the total water use estimate for Units 6 & 7. These tables include normal and maximum flows for corresponding streams defined in Figure 3.3-1. Water demand includes makeup water for the circulating water and service water systems and water supply for potable water, fire protection, and the demineralized water system. Normal values listed are expected values for normal plant operation with the two units in operation. Maximum values are those expected for extreme conditions with the two units in operation. The maximum values would not be concurrent. Fire water usage is based on monthly average use required to maintain fire protection system availability.

3.3.1.2 Plant Water Discharges

Tables 3.3-1 and 3.3-2 also provide cooling water and wastewater discharge estimates for the two units. These include losses from both the service water and circulating water systems of each unit through cooling tower water evaporation and drift, as well as rejection of blowdown from the cooling towers. The water balances provided by the data listed in Tables 3.3-1 and 3.3-2 in conjunction with Figure 3.3-1 include estimates for the wastewater flows from the two units, including radiological effluent discharges, sanitary waste, miscellaneous drains, and demineralizer waste discharges. Normal values listed are expected values for normal plant operation with two units in operation. Maximum values are those expected for extreme conditions with two units in operation. Flow rates given are not necessarily concurrent.

The cooling tower blowdown and wastewater from Units 6 & 7 would be discharged to the Boulder Zone via deep injection wells. A blowdown sump serving Units 6 & 7 would collect effluent streams including cooling tower blowdown, wastewater retention basin effluents, and raw water required for liquid radwaste dilution for discharge to the Boulder Zone. Processed liquid radioactive effluents would be batch-discharged to the Boulder Zone through the blowdown sump effluent stream.

During the construction phase, the wastewater system collects system wastes produced during miscellaneous system flushing. Wastes would be treated to meet permit limits before discharge to the blowdown sump for subsequent discharge to the Boulder Zone. Alternatively, drain wastes may be released to an existing suitable site facility or collected in tanks and disposed of in accordance with local regulation using appropriate licensed haulers.

3.3.2 WATER TREATMENT

Water treatment would be performed to maintain satisfactory water quality for plant use and discharge from the plant to the environment as permitted by state and local regulations. Representative chemicals for water treatment to control biofouling and algae, to adjust pH, inhibit corrosion and scale formation, for disinfection and for dechlorination are identified in Section 3.6. The effluent from water treatment would be within the limits of the FDEP underground injection control program.

3.3.2.1 Cooling Tower Makeup

Reclaimed water from the MDWASD would be treated at the FPL reclaimed water treatment facility and used as circulating water system cooling tower makeup. This treatment would occur before storage in the makeup water reservoir. The makeup water for the circulating water cooling towers would be treated to prevent biofouling in the raw water supply piping to the circulating water cooling towers. Reclaimed water and saltwater would have separate chemical treatments for use in the cooling towers.

Additional treatment for biofouling, scaling, and suspended matter, with biocides, antiscalants, and dispersants would be performed as needed for the circulating water system and service water system. Treatment for the circulating water system (reclaimed water and saltwater) would occur through injection of chemicals from a local chemical feed system into system piping. Treatment for the service water system would occur through injection of chemicals from the turbine island chemical feed system into system piping. Cooling water chemistry would be controlled by the addition of chemicals and maintaining the proper cycles of concentration.

3.3.2.2 Demineralized Water

The MDWASD potable water supply would provide water for the demineralized water system of each unit. This water would be treated by filtration and primary and secondary demineralization processes, which produces in highly purified water for various plant systems. Reverse osmosis would be the primary demineralization treatment process designed to reduce dissolved solids, salts, and organics. In the secondary stage of purification, the treated water would pass through an electrodeionization system where dissolved carbon dioxide and most of the remaining ions would be removed. Spent resin would be removed and replaced.

Discharges from systems using demineralized water for makeup would be routed to the wastewater retention basin or the liquid radwaste system before discharge.

3.3.2.3 Potable Water System

The potable water system would provide a water supply for domestic use and human consumption. Water provided from the MDWASD potable water supply would be supplied to the potable water distribution system for each unit. This water would meet federal, state, and local water quality standards and would not need to be pretreated.

3.3.2.4 Fire Protection Water System

The fire protection water system of each unit would be used for fire suppression and as a backup supply of water to other water systems, including the passive containment cooling system. The system would consist of storage tanks, pressure maintenance equipment, and a distribution system. The MDWASD potable water supply would be the source of water for the fire protection water system. This water would meet federal, state and local water quality standards and would not need to be pretreated.

Section 3.3 References

Florida Administration Code 62-610.668, Florida Department of Environmental Protection, July 2007. Available at http://www.dep.state.fl.us/legal/Rules/wastewater/62-610.doc (accessed on March 10, 2009).

WEC 2011. Westinghouse Electric Company, LLC*. AP1000 Design Control Document*, Document No. APP-GW-GL-700, Tier 2 Material, Rev. 19, June 13, 2011.

Table 3.3-1 (Sheet 1 of 2)
Plant Water Use 100% Reclaimed Water

Stream Number	Stream Description[(a)]	Normal Case[(b),(c)]	Maximum Case[(b), (c)]	Notes
1	MDWASD Potable Water Supply	936	2553	
2	MDWASD Potable Water Supply to Power Plant Users	448	889	
3	Potable Water Influent	35	70	
4	Potable Water Effluent	35	70	
5	Sanitary Waste to Blowdown Sump	48	95	
6	MDWASD Potable Water Supply to Demineralized Water Treatment/ Miscellaneous Users	413	819	
7	MDWASD Potable Water Supply to Fire Water and Equipment/ Floor Washdown	20	20	
8	Equipment/Floor Washdown Influent	10	10	
9	Equipment/Floor Washdown Effluent	10	10	
10	Fire Water Influent	10	10	(d)
11	Fire Water Effluent	10	10	
12	Ultrafiltration Unit Influent	393	799	
13	Ultrafiltration Unit Effluent/Reverse Osmosis Influent	353	719	
14	Reverse Osmosis Effluent/Electrodeionization Unit Influent	247	503	
15	Electrodeionization Unit Effluent/Demineralized Water Tank Influent	234	477	
16	Demineralized Water Tank Effluent/Demineralized Water Users Influent	234	477	
17	Ultrafiltration Reject	40	80	
18	Reverse Osmosis Unit Reject	106	216	
19	Electrodeionization Unit Reject	13	26	
20	Demineralized Water Treatment Combined Reject Stream	159	322	
21	Liquid Radwaste Effluent	3	150	(e)
22	Treated Liquid Radwaste Effluent	3	150	(e)
23	Not used			
24	Not used			
25	Demineralized Water User Effluent to Turbine Building Drain System	231	327	
26	Turbine Building Drain System Effluent	251	347	
27	Oil/Water Separator Effluent	251	347	
28	Miscellaneous Low Volume Waste	410	669	
29	MDWASD Potable Water Supply Makeup to Service Water System	488	1664	(f)
30	Service Water System Cooling Tower Evaporation	366	1248	(f)
31	Service Water System Cooling Tower Drift	1	1	(g)
32	Service Water System Cooling Tower Blowdown	121	415	(f),(h)
33	Alternate Blowdown from Service Water System Cooling Towers	0	0	
34	Wastewater Retention Basin Effluent to Blowdown Sump	410	669	
35	Service Water System Blowdown to Circulating Water System	121	415	(h)
36	Reclaimed Water to FPL Reclaimed Water Treatment Facility	50,481	50,187	(i)

Table 3.3-1 (Sheet 2 of 2)
Plant Water Use 100% Reclaimed Water

Stream Number	Stream Description[a]	Normal Case[b],[c]	Maximum Case[b], [c]	Notes
37	FPL Reclaimed Water Treatment Facility Effluent to Makeup Water Reservoir	40,686	40,392	(i)
38	Makeup Water Reservoir Effluent	40,686	40,392	(i)
39	Reclaimed Water Makeup to Circulating Water System	38,400	38,400	(j)
40	Saltwater Supply from Radial Collector Wells	0	0	(i)
41	Saltwater Makeup to Circulating Water System	0	0	(j)
42	Circulating Water System Cooling Tower Evaporation	28,800	28,800	(j)
43	Circulating Water System Cooling Tower Drift	7	7	(g)
44	Circulating Water System Cooling Tower Blowdown	9714	10,008	(j)
45	Reclaimed Water Dilution	2286	1992	(i)
46	Saltwater Dilution	0	0	(i)
47	Alternate Dilution Supply for Liquid Radwaste Discharge	2286	1992	(e), (i)
48	FPL Reclaimed Water Treatment Facility Bypass to Blowdown Sump	0	0	
49	FPL Reclaimed Water Treatment Facility Effluent to Future FPL Users	9739	9739	
50	Blowdown Sump Effluent	12,458	12,764	
51	Discharge to Deep Injection Wells	12,461	12,914	
52	FPL Reclaimed Water Treatment Facility Waste	0	0	(k)
53	FPL Reclaimed Water Treatment Facility Solid Waste	56	56	(i)
54	Units 1 Through 5 Sanitary Waste	13	25	

(a) Streams are shown in Figure 3.3-1.
(b) The flow rate values (in gpm) are for two AP1000 units.
(c) Flows are not necessarily concurrent. Maximum case is defined as the maximum overall water use for Units 6 & 7. Some streams are affected by other flow rates and not all streams would be at maximum flow conditions. For example, dilution supply for liquid radwaste discharge flow is inversely proportional to circulating water system cooling tower blowdown. Additional information is provided in Note (e).
(d) Fire water use is based on monthly average use required to maintain fire protection system availability.
(e) The liquid radwaste discharge flow may be up to 150 gpm (for two units). However, given the liquid radwaste activity level, the discharge flow rate would be controlled to be compatible with the available dilution flow.
(f) The service water cooling towers are assumed operating at four cycles of concentration. Flows are determined by weather conditions and water chemistry.
(g) The service water system and circulating water system cooling tower drifts are conservatively assumed to be 0.0005 percent of the cooling tower water flow.
(h) Concentrated blowdown from the service water system would be routed to the circulating water system. The blowdown from the circulating water system will therefore include the additional input from the service water system blowdown.
(i) During maximum flow for overall water use, MDWASD potable water supply makeup to the service water system increases while makeup to CWS is unchanged. This results in more service water system blowdown to CWS and thus, more CWS cooling tower blowdown. Since alternate dilution supply for liquid radwaste discharge is inversely proportional to CWS cooling tower blowdown, there would be less reclaimed water dilution. Additionally, since makeup to CWS is unchanged and the alternate dilution supply for liquid radwaste discharge is decreased, less reclaimed water supply is required.
(j) The circulating water cooling towers are assumed operating at four cycles of concentration. Flows are determined by weather conditions and water chemistry.
(k) Wastewater would be recirculated within the FPL reclaimed water treatment facility. Discharge would occur when facility drains are required.

Table 3.3-2 (Sheet 1 of 2)
Plant Water Use 100% Saltwater

Stream Number	Stream Description[a]	Normal Case[b],[c]	Maximum Case[b], [c]	Notes
1	MDWASD Potable Water Supply	936	2553	
2	MDWASD Potable Water Supply to Power Plant Users	448	889	
3	Potable Water Influent	35	70	
4	Potable Water Effluent	35	70	
5	Sanitary Waste to Blowdown Sump	48	95	
6	MDWASD Potable Water Supply to Demineralized Water Treatment/ Miscellaneous Users	413	819	
7	MDWASD Potable Water Supply to Fire Water and Equipment/ Floor Washdown	20	20	
8	Equipment/Floor Washdown Influent	10	10	
9	Equipment/Floor Washdown Effluent	10	10	
10	Fire Water Influent	10	10	(d)
11	Fire Water Effluent	10	10	
12	Ultrafiltration Unit Influent	393	799	
13	Ultrafiltration Unit Effluent/Reverse Osmosis Influent	353	719	
14	Reverse Osmosis Effluent/Electrodeionization Unit Influent	247	503	
15	Electrodeionization Unit Effluent/Demineralized Water Tank Influent	234	477	
16	Demineralized Water Tank Effluent/ Demineralized Water Users Influent	234	477	
17	Ultrafiltration Reject	40	80	
18	Reverse Osmosis Unit Reject	106	216	
19	Electrodeionization Unit Reject	13	26	
20	Demineralized Water Treatment Combined Reject Stream	159	322	
21	Liquid Radwaste Effluent	3	150	(e)
22	Treated Liquid Radwaste Effluent	3	150	(e)
23	Not used			
24	Not used			
25	Demineralized Water User Effluent to Turbine Building Drain System	231	327	
26	Turbine Building Drain System Effluent	251	347	
27	Oil/Water Separator Effluent	251	347	
28	Miscellaneous Low-Volume Waste	410	669	
29	MDWASD Potable Water Supply Makeup to Service Water System	488	1664	(f)
30	Service Water System Cooling Tower Evaporation	366	1248	(g)
31	Service Water System Cooling Tower Drift	1	1	(g)
32	Service Water System Cooling Tower Blowdown	121	415	(f), (h)
33	Alternate Blowdown from Service Water System Cooling Towers	0	0	
34	Wastewater Retention Basin Effluent to Blowdown Sump	410	669	
35	Service Water System Blowdown to Circulating Water System	121	415	(h)

Table 3.3-2 (Sheet 2 of 2)
Plant Water Use 100% Saltwater

Stream Number	Stream Description[(a)]	Normal Case[(b),(c)]	Maximum Case[(b), (c)]	Notes
36	Reclaimed Water to FPL Reclaimed Water Treatment Facility	0	0	
37	FPL Reclaimed Water Treatment Facility Effluent to Makeup Water Reservoir	0	0	
38	Makeup Water Reservoir Effluent	0	0	(i)
39	Reclaimed Water Makeup to Circulating Water System	0	0	(i)
40	Saltwater Supply from Radial Collector Wells	86,400	86,400	
41	Saltwater Makeup to Circulating Water System	86,400	86,400	(j)
42	Circulating Water System Cooling Tower Evaporation	28,800	28,800	(j)
43	Circulating Water System Cooling Tower Drift	7	7	(g)
44	Circulating Water System Cooling Tower Blowdown	57,714	58,008	(j)
45	Reclaimed Water Dilution	0	0	
46	Saltwater Dilution	0	0	
47	Alternate Dilution Supply for Liquid Radwaste Discharge	0	0	(e)
48	FPL Reclaimed Water Treatment Facility Bypass to Blowdown Sump	0	0	
49	FPL Reclaimed Water Treatment Facility Effluent to Future FPL Users	0	0	
50	Blowdown Sump Effluent	58,172	58,772	
51	Discharge to Deep Injection Wells	58,175	58,922	
52	FPL Reclaimed Water Treatment Facility Waste	0	0	(j)
53	FPL Reclaimed Water Treatment Facility Solid Waste	0	0	
54	Units 1 Through 5 Sanitary Waste	13	25	

(a) Streams are shown in Figure 3.3-1.
(b) The flow rate values (in gpm) are for two AP1000 units.
(c) Flows are not necessarily concurrent. Maximum case is defined as the maximum overall water use for Units 6 & 7. Some streams are affected by other flow rates and not all streams would be at maximum flow conditions. For example, dilution supply for liquid radwaste discharge flow is inversely proportional to circulating water system cooling tower blowdown. Additional information is provided in Note (e).
(d) Fire water use is based on monthly average use required to maintain fire protection system availability.
(e) The liquid radwaste discharge flow may be up to 150 gpm (for two units). However, given the liquid radwaste activity level, the discharge flow rate would be controlled to be compatible with the available dilution flow.
(f) The service water cooling towers are assumed operating at four cycles of concentration. Flows are determined by weather conditions and water chemistry.
(g) The service water system and circulating water system cooling tower drifts are conservatively assumed to be 0.0005 percent of the cooling tower water flow.
(h) Concentrated blowdown from the service water system would be routed to the circulating water system. The blowdown from the circulating water system will therefore include the additional input from the service water system blowdown.
(i) The circulating water cooling towers are assumed operating at one and a half cycles of concentration. Flows are determined by weather conditions and water chemistry.
(j) Wastewater would be recirculated within the FPL reclaimed water treatment facility. Discharge would occur when facility drains are required.

Figure 3.3-1 Water Balance Diagram (Sheet 1 of 2)

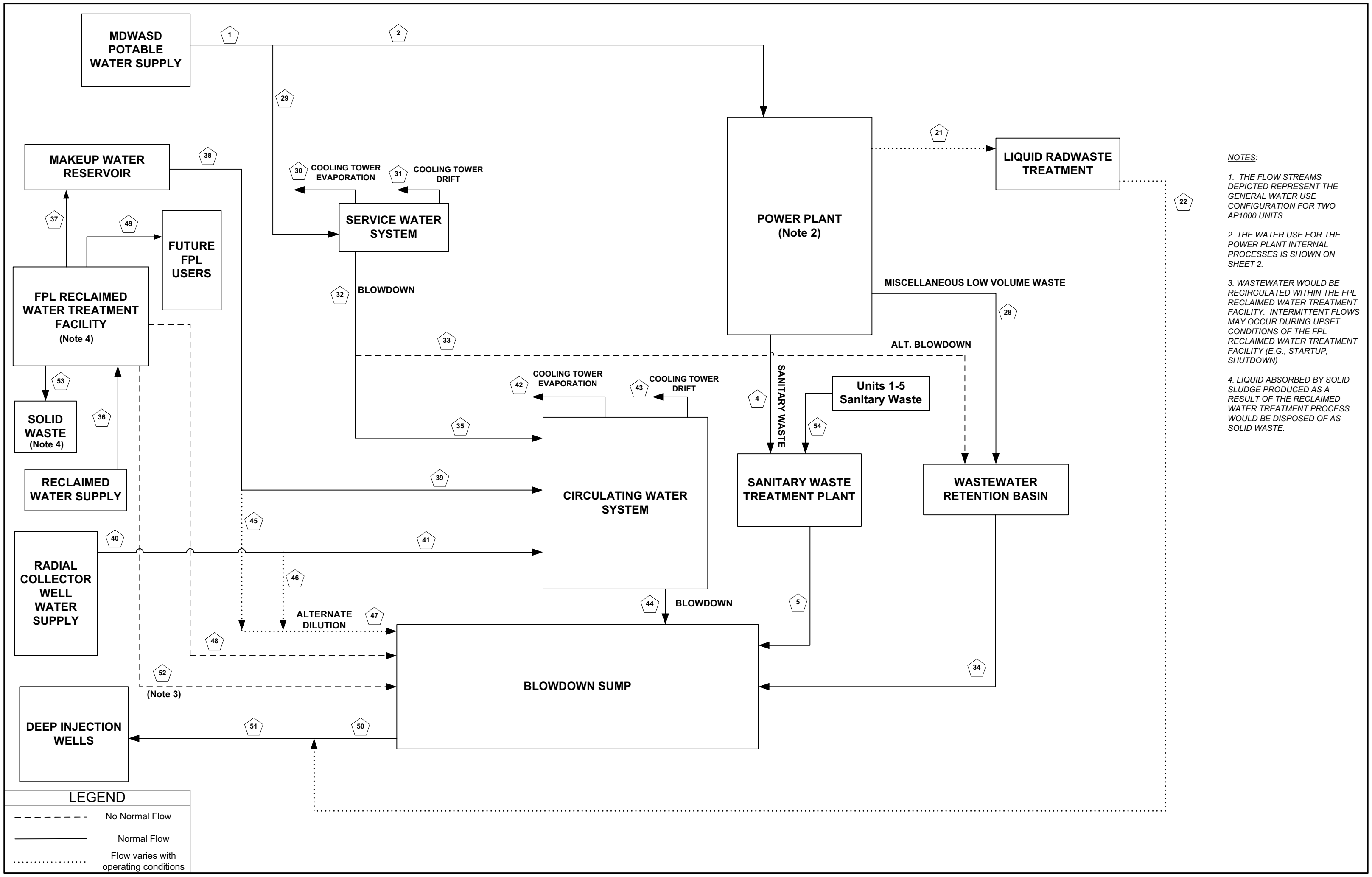
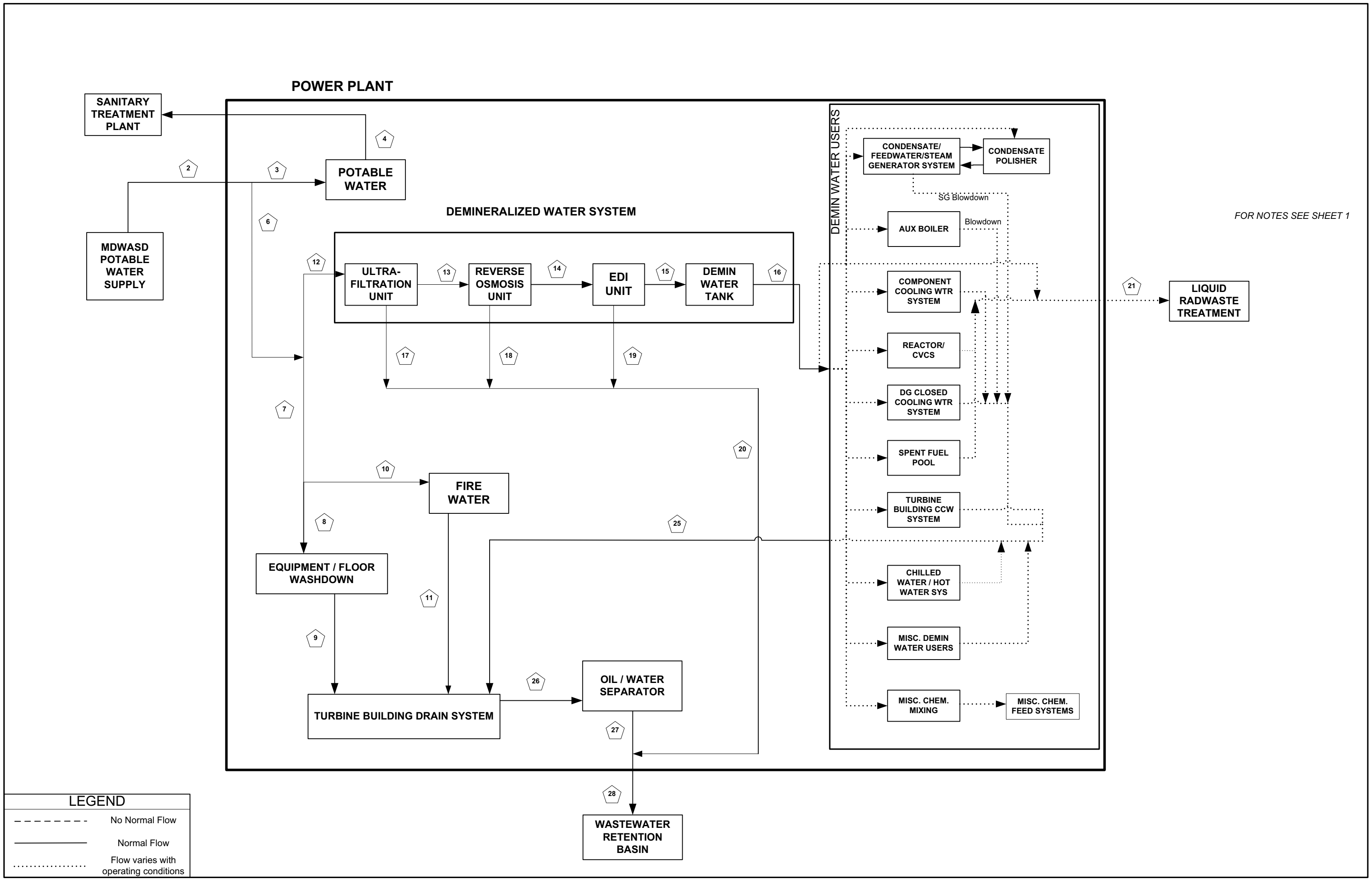


Figure 3.3-1 Water Balance Diagram (Sheet 2 of 2)



3.4 COOLING SYSTEM

Units 6 & 7 cooling systems, operational modes, and components design parameters were determined from the DCD (WEC 2011), site-specific characteristics, and engineering evaluations. The plant cooling systems and the operational modes are described in Subsection 3.4.1. Component descriptions for the raw water system and makeup water supply options are presented in Subsection 3.4.2. These parameters were used to evaluate the environmental impacts from cooling system operation. The plant cooling systems would have makeup water from the reclaimed water supply, potable water supply, and saltwater supply. Blowdown from the plant would ultimately be discharged to the deep injection wells on the plant property. Figure 3.4-1 is a simplified cooling water system flow diagram for Units 6 & 7. The circulating water system and service water system along with associated systems locations are shown in Figure 3.1-3.

3.4.1 DESCRIPTION AND OPERATIONAL MODES

The cooling system selected for Units 6 & 7 will transfer waste heat generated as a by-product of each unit's electrical power generation to the environment. Site-specific characteristics were used in addition to the AP1000 design parameters to evaluate the impacts for Units 6 & 7 to the environment. Units 6 & 7 will be equipped with two cooling systems that transfer heat to the environment from primary and secondary systems during different modes of plant operation for each unit. These systems will be the circulating water system and the service water system. There will be five operational modes:

- Normal operation (full load)
- Cooldown
- Refueling (full core offload)
- Plant startup
- Minimum to support shutdown cooling and spent fuel cooling

3.4.1.1 Normal Plant Cooling

3.4.1.1.1 Circulating Water System

Each AP1000 unit will have a circulating water system that will be used to dissipate 7540E06 Btu/hour as condenser heat load, 86E06 Btu/hour as turbine building cooling water heat load, and 1.61E06 Btu/hour as condenser vacuum pump heat load, for a total of 7628E06 Btu/hour for one unit. The waste heat rejected from the condenser, turbine building closed cooling water heat exchangers, and condenser vacuum pump seal water heat exchangers would be 1.53E10

Btu/hour for two units. The circulating water system for Units 6 & 7 would use a closed cycle, wet cooling system via mechanical draft cooling towers for heat dissipation.

The heated cooling water from the condenser, turbine building closed cooling water system heat exchangers, and condenser vacuum pump seal water heat exchangers would flow through return piping to the distribution header of the mechanical draft cooling towers. The heated cooling water would be circulated to the spray headers of the wet mechanical draft cooling towers, where the heat content of the cooling water would be transferred to the ambient air via evaporative cooling and conduction. Mechanical fans would provide airflow past the water droplets as they fall through the tower fill, rejecting heat to the atmosphere. After passing through the cooling tower, the cooled water collects in the tower basin and would be pumped back to the condenser, turbine building closed cooling water system heat exchangers, and condenser vacuum pump seal water heat exchangers completing the closed cycle cooling water loop.

The circulating water system would consist of three 33-1/3-percent-capacity circulating water pumps, three mechanical draft cooling towers, and associated piping, valves, and instrumentation for each unit. The circulating water pumps flow rate would be approximately 660,100 gpm per unit. The water would be pumped through the condenser, turbine building closed cooling water heat exchangers, and condenser vacuum pump seal water heat exchangers (all in parallel), and then to the mechanical draft cooling towers to dissipate heat to the atmosphere.

Makeup water would compensate for water losses during plant operation from circulating water system evaporation, drift, and blowdown. Three circulating water cooling towers are estimated to have evaporation water losses of approximately 14,400 gpm per unit during normal plant operation. Drift loss for the circulating water system is described in Subsection 5.3.3. The raw water makeup system would supply makeup water that would come from reclaimed water and/or saltwater sources. The design parameters for each makeup water source are addressed in the following paragraphs.

Reclaimed Water

Reclaimed water would be provided from the Miami-Dade Water and Sewer Department (MDWASD) for makeup water to the circulating water system. The maximum reclaimed water makeup rate to the circulating water system would be approximately 19,200 gpm per unit. This is based on maintaining four cycles of concentration in the cooling towers. Blowdown from the circulating water system would be transferred to a common blowdown sump before being discharged to the deep injection wells. The normal operating blowdown rate at four cycles of concentration would be approximately 4860 gpm per unit.

Saltwater

Saltwater would be used as makeup from the radial collector wells for the circulating water system when a sufficient quantity and/or quality of reclaimed water is not available. The maximum saltwater makeup rate to the circulating water system would be approximately 43,200 gpm per unit. This is based on maintaining 1.5 cycles of concentration in the cooling towers. Blowdown from the circulating water system would be transferred to a common blowdown sump before being discharged to the deep injection wells. The normal operating blowdown rate for saltwater at 1.5 cycles of concentration would be approximately 28,860 gpm per unit.

Combination of Reclaimed Water and Saltwater

When reclaimed water is not available in a sufficient quantity, a combination of reclaimed and saltwater would be used as a source of cooling water. The ratio of water supplied by the two makeup water sources would vary based on the availability of reclaimed water from the MDWASD. The makeup water and the blowdown rates for this combined usage would be within the flow rates identified above.

3.4.1.1.2 Service Water System

Each unit will have a nonsafety-related service water system to provide cooling water to the component cooling water system heat exchangers in the turbine building. The system will consist of a dedicated closed cycle system with a mechanical draft cooling tower to dissipate heat. Service water will be pumped to the component cooling water heat exchangers for heat removal.

Heated service water will return to the distribution header of the mechanical draft cooling tower. Mechanical fans will provide airflow past the water droplets as they fall through the tower fill, rejecting heat from the service water to the atmosphere. The cooled water will be collected in the tower basin and returned to the pump suction for recirculation through the system. Table 3.4-1 provides nominal service water flows and heat loads at the various operating modes for the service water system.

The service water cooling towers are estimated to have evaporation water losses of approximately 366 gpm during normal conditions and approximately 1248 gpm during cooldown conditions for two units. Blowdown flow from the service water towers would be discharged to the circulating water system cooling tower basin at a maximum flow rate of up to approximately 415 gpm for two units. The blowdown would be directed to the wastewater retention basin as necessary. A maximum makeup water flow rate of approximately 1664 gpm for two units will be required to accommodate a maximum of approximately 624 gpm per unit evaporation rate and approximately 208 gpm per unit blowdown rate. Makeup water to the service water cooling towers would be potable water from the MDWASD.

Drift loss would be minimal for the service water system cooling tower. Maximum service water system blowdown and makeup rates are based on maintaining four cycles of concentration in the cooling tower.

3.4.1.2 Operational Modes

The circulating water system would be used to provide plant cooling during plant startup, normal plant operations, and plant cooldown. The maximum heat load removed by the circulating water system would be during normal plant operation mode and would bound the water makeup, evaporation, and discharge rates for the other operational modes.

The service water system would be used to provide heat removal from the component cooling water system during modes of normal operation, including startup, normal plant operations, cooldown, minimum to support shutdown cooling and spent fuel cooling, and refueling. The maximum heat load removed by the service water system would be during the cooldown mode and would bound the water makeup, evaporation, and discharge rates for the other operational modes.

3.4.1.3 Additional information

3.4.1.3.1 Station Load Factor

The units are expected to operate at a maximum capacity factor of 93 percent, taking into consideration scheduled outages and other plant maintenance. On a long-term basis, an average heat load of approximately 1.26E14 Btu/year (annualizing 93 percent of the maximum rated heat load of 1.55E10 Btu/hour) would be dissipated to the atmosphere.

3.4.1.3.2 Antifouling Treatment

Circulating water chemistry would be maintained by a local chemical feed system. The local chemical feed equipment will inject the required chemicals into the circulating water at the circulating water system cooling tower basin. This would be in an effort to maintain a noncorrosive, nonscale-forming condition and would limit the biological film formation that reduces the heat transfer rate in the cooling towers, condenser, and the heat exchangers supplied by the circulating water system. Additional biocide and algaecide would be provided at the cooling towers to allow for local treatment in the cooling towers, as required. Addition of biocide treatment chemicals would also be provided by chemical feed injection metering pumps into the makeup water pipelines to control biological fouling.

The plant service water system chemistry would be maintained by the turbine island chemical feed system. The turbine island chemical feed system equipment would inject the required chemicals into the service water system in an effort to maintain a noncorrosive, nonscale-forming condition. This would also limit the biological film formation that reduces the heat transfer rate in the cooling towers, condenser, and the heat exchangers supplied by the service water system. Chemicals and biocides would be injected into service water pump discharge piping in the turbine building.

The chemicals and biocides used in the circulating water and service water systems are presented in Table 3.6-1.

3.4.2 COMPONENT DESCRIPTIONS

3.4.2.1 Raw Water System

The raw water system for Units 6 & 7 would be the source of makeup water for the circulating water system, service water system, and other systems demand as described in detail in Section 3.3. The raw water would be supplied from different sources depending on the availability of each source and the makeup water requirements for each system. The raw water supplies for the circulating water system makeup would be from reclaimed water and/or saltwater sources. The raw water for the service water system makeup would be potable water provided by the MDWASD.

The following paragraphs describe the different raw water system supplies for makeup water for the circulating water system and the service water system.

3.4.2.1.1 Circulating Water System Makeup Water

3.4.2.1.1.1 Raw Water Makeup Supply from Reclaimed Water

Reclaimed water would be provided for use as makeup water to the circulating water system from the MDWASD. In accordance with FDEP regulations (Florida Administrative Code 62-610.668), MDWASD would be required to provide high-level disinfection of reclaimed water before industrial use in open cooling towers.

The reclaimed water would be further treated at the FPL reclaimed water treatment facility to further reduce levels of iron, magnesium, oil and grease, total suspended solids, nutrients, and silica to suitable levels for the circulating water system. The treated reclaimed water would then be supplied to the makeup water reservoir. The makeup water reservoir would be used as storage for the circulating water systems. Three 50-percent capacity pumps for each unit would transfer reclaimed water from the makeup water reservoir to the circulating water systems providing the required makeup.

3.4.2.1.1.2 Raw Water Makeup Supply from Saltwater

Saltwater would be supplied by radial collector wells, with caissons located on the Turkey Point peninsula, east of the existing units.

Each radial collector well would consist of a central reinforced concrete caisson extending below the ground level with laterals projecting from the caisson. The well laterals would be advanced horizontally a distance of up to 900 feet and installed at a depth of approximately 25 to 40 feet below the bottom of Biscayne Bay. The design for a typical radial collector well is illustrated in Figure 3.4-2. The wells would be designed and located to induce recharge from Biscayne Bay. The general location of the radial collector wells are shown in Figure 3.1-3.

There would be four 33 1/3 percent radial collector wells (30,000 gpm capacity per well). Three wells would meet the makeup water requirements for the circulating water systems; the fourth would be an installed spare. Two 50 percent pumps (15,000 gpm capacity per pump) in each well caisson would transfer the saltwater to the circulating water systems.

3.4.2.1.2 Service Water System Makeup Water

The MDWASD potable water system would provide water to the raw water storage tank. The raw water storage tank is common for the two units. Two 100 percent raw water ancillary transfer pumps for each unit would transfer the required makeup water to the service water system. The demineralized water system, potable water system, and firewater system would use potable water supplied from the MDWASD.

3.4.2.2 Final Plant Discharge

The cooling towers blowdown and other site wastewater streams would be collected in a common blowdown sump and injected through the deep injection wells. Biocides and chemical additives in the discharge stream are addressed in detail in the Section 3.6. The deep injection wells would meet the requirements established in the underground injection control program permits. Treated liquid radwaste would be diluted with the blowdown sump discharge flow, as depicted in Figure 3.4-1, at a rate required to maintain the required dilution rate. Additional information on liquid radwaste is addressed in Section 3.5. The maximum sump discharge flow for two units when 100 percent reclaimed water is used would be approximately 12,764 gpm, and the maximum sump discharge flow for two units when 100 percent saltwater is used would be approximately 58,922 gpm. The treated radwaste stream would be mixed with the blowdown sump pump discharge before being discharged in the deep injection wells. Figure 3.4-3 is a typical Class I injection well design.

3.4.2.3 Heat Dissipation System

3.4.2.3.1 Circulating Water System

The circulating water system would use three mechanical draft cooling towers as a normal heat sink for each unit. The cooling towers would use fiberglass-reinforced plastic structural members and casing. The circulating water system cooling towers would be octagonal and would rise approximately 67 feet above the top of the basin curb. Internal construction materials could include fiberglass-reinforced plastic or polyvinyl chloride for piping laterals, reinforced thermosetting resin for spray nozzles, and polyvinyl chloride for fill and drift eliminator materials. Mechanical draft towers use mechanical fans to generate airflow across sprayed water to reject heat to the atmosphere. Six mechanical draft cooling towers would be required to dissipate a maximum waste heat load of up to 1.53E10 Btu/hour from the two units, would operate with approximately a 7.1°F approach temperature, and would provide a less than 91°F return temperature at design ambient conditions. Table 3.4-2 provides specifications of the circulating water system cooling towers.

3.4.2.3.2 Service Water System

The service water system will have a cooling tower that is a rectilinear mechanical draft structure for each unit. The cooling tower is a counterflow-induced draft tower and is divided into two cells. Each cell uses one fan, located in the top portion of the cell, to draw air upward through the fill counter to the downward flow of water. Each fan is driven by a two-speed electrical motor through a gear reducer. During normal power operation, one cell is inactive and water flow to that cell is shut off by a motor-operated isolation valve. One operating service water pump supplies flow to the operating cell. When the service water system is used to support plant shutdown cooling, both tower cells are normally placed in service along with both service water pumps for increased cooling capacity.

Table 3.4-1 provides system flow rates and the expected heat duty for various operating modes of the service water tower. The service water tower will maintain a maximum 93.5°F return temperature to the component cooling water system heat exchangers during normal operation mode. Temperature rise through the component cooling water system heat exchangers would be approximately 20°F during normal operation and approximately 33°F during cooldown operation based on the heat transfer rates defined in Table 3.4-1. Each unit’s service water system cooling tower would be adjacent to the turbine building occupying an area of approximately 0.5 acre.

Section 3.4 References

Florida Administration Code 62-610.668, Florida Department of Environmental Protection, July 2007. Available at: http://www.dep.state.fl.us/legal/Rules/wastewater/62-610.doc (accessed March 4, 2009).

WEC 2011. Westinghouse Electric Company, LLC. *AP1000 Design Control Document*, Document No. APP-GW-GL-700, Tier 2 Material, Rev. 19, June 13, 2011.

Table 3.4-1
Nominal Service Water Flows and Heat Loads at Different Operational Modes per Unit

Operational Mode	Flow (gpm)	Heat Transferred (Btu/hour)
Normal Operation (Full Load)	10,500	103E06
Cooldown	21,000	346E06
Refueling (Full Core Offload)	10,500	74.9E06
Plant Startup	21,000	75.8E06
Minimum to Support Shutdown Cooling and Spent Fuel Cooling	10,000	170E06

Table 3.4-2
Circulating Water System Cooling Tower Design Specifications per Unit

Design Condition	Value
Number of Towers (per Unit)	3
Circulating Water Flow (per Tower)	210,367 gpm
Cycle of Concentration[(a)]	1.5 to 4
Approximate Height (above Basin Curb)	67 feet
Approximate Base Diameter	246 feet
Number of Cells (per Tower)	12
Number of Fans per Cell	1
Exit Air Delivery per Fan	1,764,500 acfm
Design Wet Bulb Temperature[(b)]	83.9°F
Design Range	24.4°F
Design Approach	7.1°F
Drift Rate	0.0005% (of the flow rate)
Predicted Sound Level at 3 Feet	85 dBA

(a) Cycles of concentration for reclaimed water is 4 and for saltwater is 1.5.
(b) Includes 3.3°F interference allowance

Figure 3.4-1 Simplified Cooling System Flow Diagram

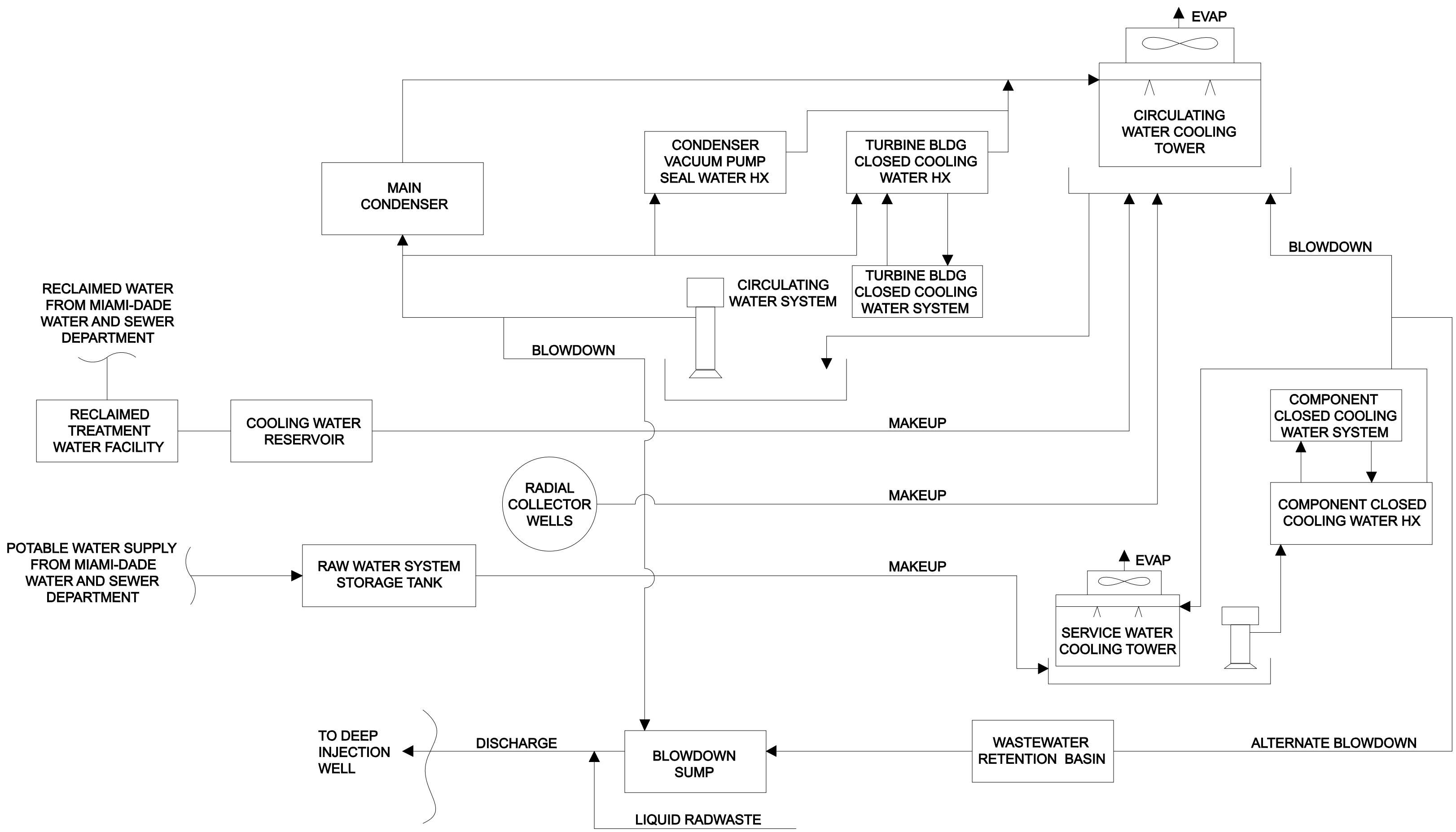


Figure 3.4-2 Typical Radial Collector Well Design

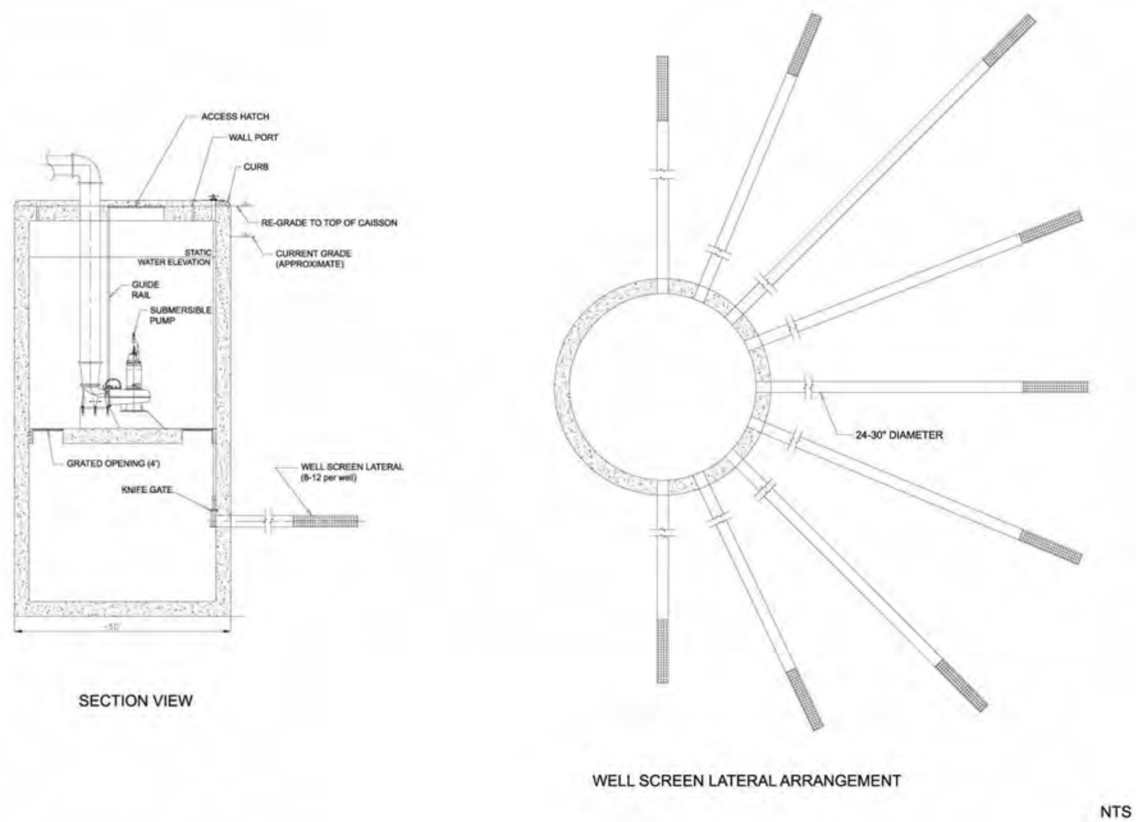
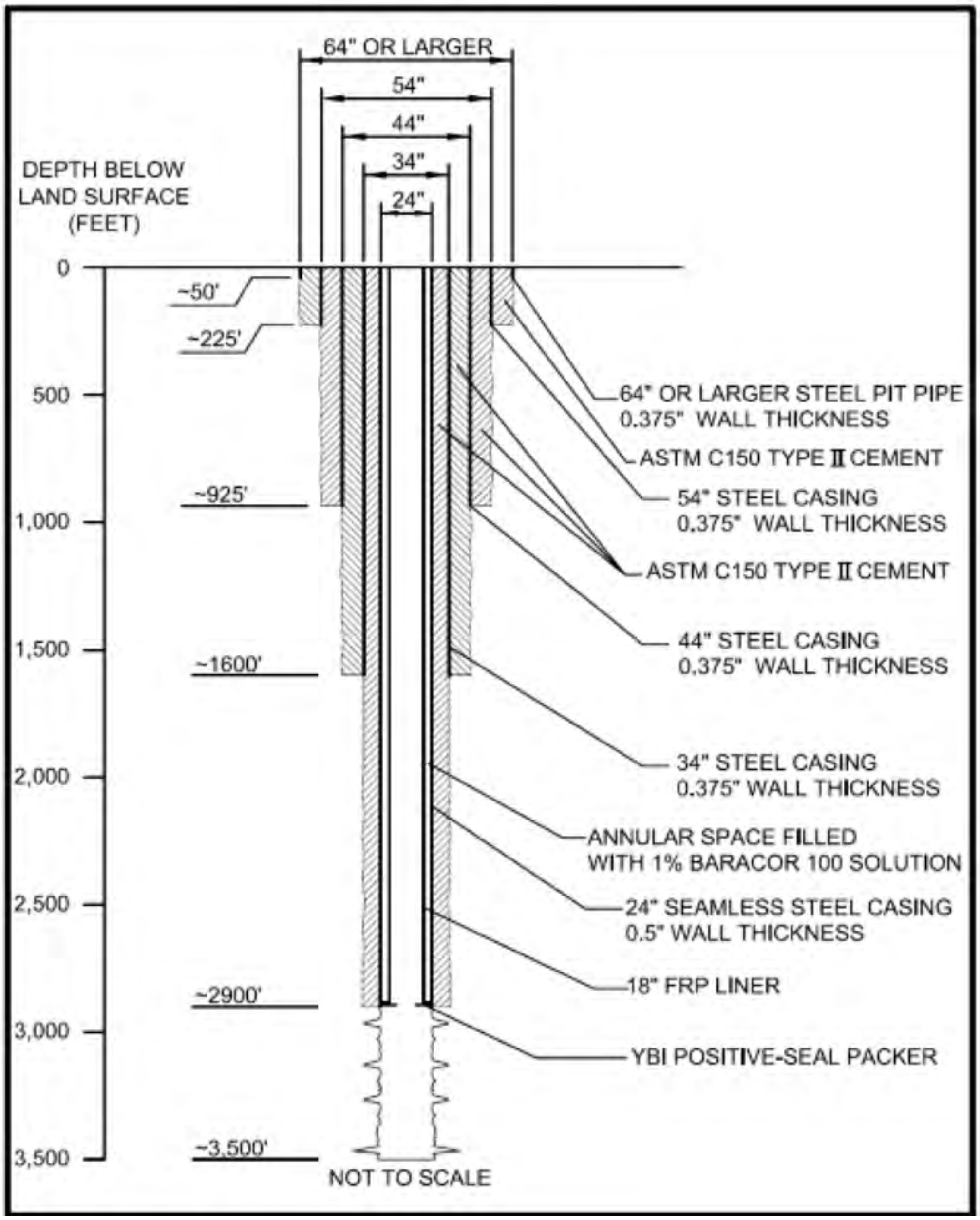


Figure 3.4-3 Typical Injection Well Design



3.5 RADIOACTIVE WASTE MANAGEMENT SYSTEM

Radioisotopes are produced during the operation of nuclear reactors, through the processes of fission and activation. Fission products have the potential to enter the reactor coolant system by diffusion or by way of defects in the fuel cladding. The primary cooling water may contain dissolved or suspended corrosion products and nonradioactive materials from plant components that can be activated in the reactor core as the water passes through the core. These radioisotopes can exit the reactor coolant either by plant systems designed to remove impurities, by small leaks that occur in the reactor coolant system (RCS) and auxiliary systems, or by breaching of systems for maintenance. Therefore, each plant generates radioactive waste that can be liquid, solid, or gaseous.

Radioactive waste management systems will be designed to minimize releases from reactor operations to values ALARA. These systems will be designed and maintained to meet the requirements of 10 CFR Part 20 and 10 CFR Part 50, Appendix I. Requirements for the design of these systems, and the plant effluents used to determine the maximum individual population doses from normal plant operations, are provided in Section 5.4. Lastly, environmental impacts resulting from management of low-level wastes are expected to be bounded by the NRC's findings in 10 CFR 51.51 (b).

The information presented in this section is for a single unit. The design for a second unit would be the same and the data given in this section would double for a second unit.

3.5.1 LIQUID RADIOACTIVE WASTE MANAGEMENT SYSTEM

The liquid radioactive waste management systems for each unit include the systems that will be used to process and dispose of liquids containing radioactive material. These include:

- Steam generator blowdown processing system
- Radioactive waste drain system
- Liquid radioactive waste system

The liquid radioactive waste system will be designed to control, collect, process, handle, store, and dispose of liquid radioactive waste generated as the result of normal operation, including anticipated operational occurrences.

The liquid radioactive waste system will provide holdup capacity as well as permanently installed processing capacity of 75 gpm through the ion exchange/filtration train. This will be adequate capacity to meet the anticipated processing requirements of the plant. The projected flows of various liquid waste streams to the liquid radioactive waste system under normal conditions are identified in DCD Table 11.2-1 (WEC 2011).

The liquid radioactive waste system design could accept equipment malfunctions without affecting the capability of the system to handle both anticipated liquid waste flows and possible surge load due to excessive leakage.

The liquid radioactive waste system, shown in DCD Figure 11.2-1, will include tanks, pumps, ion exchangers, and filters. The liquid radioactive waste system is designed to process, or store for processing by mobile equipment, radioactively contaminated wastes in four major categories:

- Borated, reactor-grade, wastewater — this input will be collected from the RCS effluents received through the chemical and volume control system (CVS), primary sampling system sink drains, and equipment leakoffs and drains.
- Floor drains and other wastes with potentially high suspended solids content — this input will be collected from various building floor drains and sumps.
- Detergent wastes — this input will come from the plant hot sinks and showers, and some cleanup and decontamination processes. It generally has low concentrations of radioactivity.
- Chemical wastes — this input will come from the laboratory and other relatively small volume sources. It may be mixed hazardous and radioactive wastes or other radioactive wastes with high dissolved solids content.

Nonradioactive secondary-system waste normally would not be processed by the liquid radioactive waste system. Secondary system effluent will be handled by the steam generator blowdown processing system and by the turbine building drain system. However, radioactivity could enter the secondary systems from steam generator tube leakage. If significant radioactivity were detected in secondary side systems, blowdown would be diverted to the liquid radioactive waste system for processing and disposal.

3.5.1.1 Waste Input Streams

3.5.1.1.1 RCS Effluents

The effluent subsystem will receive borated and hydrogen-bearing liquid from two sources: the reactor coolant drain tank and the CVS. The reactor coolant drain tank will collect leakage and drainage from various primary systems and components inside containment. Effluent from the CVS will be produced mainly as a result of RCS heatup, boron concentration changes, and RCS level reduction for refueling.

Input collected by the effluent subsystem would normally contain hydrogen and dissolved radioactive gases. Therefore, it will be routed through the liquid radioactive waste system vacuum degasifier before being stored in the effluent holdup tanks.

The liquid radioactive waste system vacuum degasifier could also be used to degas the RCS before shutdown by operating the CVS in an open loop configuration. This would be done by taking one of the effluent holdup tanks out of normal waste service and draining it. Then normal CVS letdown would be directed through the degasifier to the dedicated effluent holdup tank. From there, it would be pumped back to the suction of the CVS makeup pumps with the effluent holdup tank pump. The makeup pumps would return the fluid to the RCS in the normal fashion. This process would be continued as necessary for degassing the RCS.

The input to the reactor coolant drain tank would potentially be at high temperature. Therefore, provisions will be made for recirculation through a heat exchanger for cooling. The tank will be inerted with nitrogen and vented to the gaseous radwaste system (WGS). Transfer of water from the reactor coolant drain tank will be controlled to maintain an essentially fixed tank level to minimize tank pressure variation.

RCS effluents from the CVS letdown line or the reactor coolant drain subsystem will pass through the vacuum degasifier, where dissolved hydrogen and fission gases will be removed. These gaseous components will be sent via a water separator to the WGS. A degasifier discharge pump will then transfer the liquid to the currently selected effluent holdup tank. If flows from the letdown line and the reactor coolant drain tank are routed to the degasifier concurrently, the letdown flow would have priority and the drain tank input would be automatically suspended. In the event of abnormally high degasifier water level, inputs would be automatically stopped by closing the letdown control and containment isolation valves.

The effluent holdup tanks will vent to the radiologically controlled area ventilation system and, in abnormal conditions, may be purged with air to maintain a low hydrogen gas concentration in the tanks' atmosphere. Hydrogen monitors are included in the tanks' vent lines to alert the operator of elevated hydrogen levels.

The contents of the effluent holdup tanks will be recirculated and sampled, recycled through the degasifier for further gas stripping, returned to the RCS via the CVS makeup pumps, discharged to the mobile treatment facility, processed through the ion exchangers, or directed to the monitor tanks for discharge without treatment. Processing through the ion exchangers will be the normal mode.

The liquid radioactive waste system will process waste with an upstream filter followed by four ion exchange resin vessels in series. Any of these vessels could be manually bypassed and the order of the last two can be interchanged to provide complete usage of the ion exchange resin.

The top of the first vessel will normally be charged with activated carbon, to act as a deep bed filter and remove oil from floor drain wastes. Moderate amounts of other wastes could also be routed through this vessel. It could be bypassed for processing of relatively clean waste streams. This vessel will be somewhat larger than the other three, with an extra sluice connection to allow the top bed of activated carbon to be removed. This feature will be associated with the deep bed filter function of the vessel; the top layer of activated carbon collects particulates, and the ability to remove it without disturbing the underlying zeolite bed minimizes solid waste production.

The second, third, and fourth beds will be in identical ion exchange vessels that will be selectively loaded with resin depending on prevailing plant conditions.

After deionization, the water will pass through an after-filter where radioactive particulates and resin fines will be removed. The processed water will then enter one of the monitor tanks. When one of the monitor tanks is full, the system will automatically realign to route processed water to another tank.

The contents of the monitor tank will be recirculated and sampled. In the unlikely event of radioactivity in excess of operational targets, the tank contents would be returned to a waste holdup tank for additional processing.

Normally, however, the radioactivity will be well below the discharge limits, and the dilute boric acid will be discharged for dilution to the circulating water blowdown. The discharge flow rate will be set to limit the boric acid concentration in the circulating water blowdown stream to an acceptable concentration for local requirements. Detection of high radiation in the discharge stream will stop the discharge flow and operator action will be required to reestablish discharge. The raw water system, which provides makeup for the circulating water system, will be used as a backup source for dilution water when cooling tower blowdown is not available for the discharge path.

3.5.1.1.2 Floor Drains and Other Wastes with Potentially High Suspended Solid Contents

Potentially contaminated floor drain sumps and other sources that tend to be high in particulate loading will be collected in the waste holdup tank. Additives may be introduced to the tank to improve filtration and ion exchange processes. Tank contents may be recirculated for mixing and sampling. The tanks will have sufficient holdup capability to allow time for realignment and maintenance of the process equipment.

The wastewater will be processed through the waste pre-filter to remove the bulk of the particulate loading. Next, it will pass through the ion exchangers and the waste after-filter before entering a monitor tank. The monitor tank contents will be sampled and, if necessary, returned to a waste holdup tank or recirculated directly through the filters and ion exchangers.

Wastewater meeting the discharge limits will be discharged to the circulating water blowdown through a radiation detector that will stop the discharge if high radiation is detected.

3.5.1.1.3 Detergent Wastes

The detergent wastes from the plant hot sinks and showers will contain soaps and detergents. These wastes are generally not compatible with the ion exchange resins. The detergent wastes will not be processed and will be collected in the chemical waste tank. If the detergent waste activity is low enough, the wastes will be discharged without processing.

When sufficient detergent wastes are produced and processing is necessary, mobile processing equipment is brought into one of the radwaste building mobile systems facility truck bays provided for this purpose.

3.5.1.1.4 Chemical Wastes

Inputs to the chemical waste tank normally will be generated at a low rate. These wastes will be only collected; no internal processing will be provided. Chemicals could be added to the tank for pH or other adjustment. Because the volume of these wastes will be low, they can be treated using mobile equipment or by shipment offsite.

3.5.1.1.5 Steam Generator Blowdown

Steam generator blowdown will normally be accommodated within the steam generator blowdown system. If steam generator tube leakage results in significant levels of radioactivity in the steam generator blowdown stream, this stream would be redirected to the liquid radioactive waste system for treatment before discharge. In this event, one of the waste holdup tanks would be drained to prepare it for blowdown processing. The blowdown stream will be brought into that holdup tank, and continuously or in batches pumped through the waste ion exchangers. The number of ion exchangers in service will be determined by the operator to provide adequate purification without excessive resin usage. The blowdown will then be collected in a monitor tank, sampled, and discharged in a monitored fashion.

3.5.1.2 Radioactive Releases

Liquid waste will be produced both on the primary side (primarily from adjustment of reactor coolant boron concentration and from reactor coolant leakage) and the secondary side (primarily from steam generator blowdown processing and from secondary side leakage). Primary and secondary coolant activity levels will be based on operating plant experience.

Except for RCS degasification in anticipation of shutdown, primary side effluents will not be recycled for reuse. Primary side effluents will be routed to the liquid radwaste system for processing. Fluid recycling will be provided for the steam generator blowdown fluid which is normally returned to the condensate system.

The liquid waste will be discharged from the monitor tank in a batch operation, and the discharge flow rate will be restricted as necessary to maintain an acceptable concentration when diluted by the circulating water discharge flow.

The annual average release of radionuclides from the plant is determined using the PWR-GALE code. The PWR-GALE code models releases that use source terms derived from data obtained from the experience of operating PWRs. The code input parameters used in the analysis are listed in DCD Table 11.2-6. The annual releases for a single unit are presented in DCD Table 11.2-7.

The total releases include an adjustment factor of 0.16 curies per year to account for anticipated operational occurrences. The adjustment uses the same distribution of nuclides as the calculated releases.

3.5.1.3 Doses

As described in Subsection 5.4.1.1, the maximum individual and population doses due to normal plant operation are not evaluated.

3.5.1.4 Cost Benefit Analysis of Population Doses

As described in FSAR Subsection 11.2.3.5, the liquid effluent pathways are not evaluated and no cost benefit analysis has been performed.

3.5.2 GASEOUS RADIOACTIVE WASTE MANAGEMENT SYSTEM

During reactor operation, radioactive isotopes of xenon, krypton, and iodine will be created as fission products. Some of these radionuclides will be released to the reactor coolant. Subsequent leakage of reactor coolant results in a release to the containment atmosphere of these noble gases. Airborne releases will be limited both by restricting reactor coolant leakage and by limiting the concentrations of radioactive noble gases and iodine in the RCS.

Iodine will be removed by ion exchange in the CVS. Removal of the noble gases from the RCS would not normally be necessary because the gases would not build up to unacceptable levels when fuel defects are within normally anticipated ranges. If noble gas removal were required because of high RCS concentration, the CVS can be operated in conjunction with the liquid radwaste system degasifier to remove the gases.

The WGS will be designed to perform the following major functions:

- Collect gaseous wastes that are radioactive or hydrogen-bearing
- Process and discharge the waste gas, keeping offsite releases of radioactivity within acceptable limits

In addition to the WGS release pathway, release of radioactive material to the environment will occur through the various building ventilation systems. The estimated annual release includes contributions from the major building ventilation pathways.

The WGS will be designed to receive hydrogen-bearing and radioactive gases generated during process operation. The radioactive gas flowing into the WGS will enter as trace contamination in a stream of hydrogen and nitrogen.

WGS inputs are:

- Letdown diversion for dilution, RCS with maximum hydrogen concentration
- Letdown diversion for RCS degassing
- Reactor coolant drain tank liquid transfer to maintain proper reactor coolant drain tank level
- Reactor coolant drain tank gas venting

3.5.2.1 System Description

3.5.2.1.1 General Description

The WGS, as shown on DCD Figures 11.3-1 and 11.3-2, will be a once-through, ambient temperature, activated carbon delay system. The system will include a gas cooler, a moisture separator, an activated carbon-filled guard bed, and two activated carbon-filled delay beds. Also included in the system will be an oxygen analyzer subsystem and a gas sampling subsystem.

DCD Table 11.3-2 lists the key design parameters for the WGS components.

The radioactive fission gases entering the system will be carried by hydrogen and nitrogen gas. The primary influent source will be the liquid radwaste system degasifier. The degasifier will extract both hydrogen and fission gases from the CVS letdown flow that is diverted to the liquid radwaste system or from the reactor coolant drain tank discharge.

Reactor coolant degassing will not be required during power operation with fuel defects at or below the design basis level of 0.25 percent. However, the WGS will periodically receive influent when CVS letdown is processed through the liquid radwaste system degasifier during RCS dilution and volume control operations. Because the degasifier is a vacuum type and requires no purge gas, the maximum gas influent rate to the WGS from the degasifier will equal the rate that hydrogen enters the degasifier (dissolved in liquid).

The other major source of input to the WGS will be the reactor coolant drain tank. Hydrogen dissolved in the influent to the reactor coolant drain tank will enter the WGS either via the tank vent or the liquid radwaste system degasifier discharge.

The tank vent would normally be closed, but can be periodically opened on high pressure to vent the gas that has come out of solution. The reactor coolant drain tank liquid would normally discharge to the liquid radwaste system via the degasifier, where the remaining hydrogen would be removed.

The reactor coolant drain tank will be purged with nitrogen gas to discharge hydrogen and fission gases to the WGS before operations requiring tank access. The reactor coolant drain tank will also be purged with nitrogen gas to dilute and discharge oxygen after tank servicing or inspection operations which allow air to enter the tank.

Influents to the WGS will first pass through the gas cooler where they will be cooled to about 40°F by the chilled water system. Moisture formed due to gas cooling will be removed in the moisture separator.

After leaving the moisture separator, the gas will flow through a guard bed that protects the delay beds from abnormal moisture carryover or chemical contaminants. The gas will then flow through two delay beds in series where the fission gases undergo dynamic adsorption by the activated carbon and are thereby delayed relative to the hydrogen or nitrogen carrier gas flow. Radioactive decay of the fission gases during the delay period significantly reduces the radioactivity of the gas flow leaving the system.

The activated carbon volume will be twice the theoretical amount required to achieve the holdup times given in DCD Table 11.3-1.

The effluent from the delay bed will pass through a radiation monitor and discharges to the ventilation exhaust duct. The radiation monitor will be interlocked to close the WGS discharge isolation valve on high radiation. The discharge isolation valve will also close on low ventilation system exhaust flow rate to prevent the accumulation of hydrogen in the aerated vent.

3.5.2.1.2 System Operation

During normal operation, the WGS will usually not be in operation. When there is no waste gas inflow to the system, the discharge isolation valve closes which will maintain the WGS at a positive pressure, preventing the ingress of air during the periods of low waste gas flow. When the WGS is in use, its operation will be passive, using the pressure provided by the influent sources to drive the waste gas through the system.

The largest input to the WGS will be from the liquid radwaste system degasifier, which processes the CVS letdown flow when diverted to the liquid radwaste system and the liquid effluent from the liquid radwaste system reactor coolant drain tank.

The CVS letdown flow will be diverted to the liquid radwaste system only during dilutions, borations, and RCS degassing in anticipation of shutdown. The design basis influent rate from the liquid radwaste system degasifier will be the full diversion of the CVS letdown flow, when the RCS is operating with maximum allowable hydrogen concentration. Because the liquid radwaste system degasifier is a vacuum type that operates without a purge gas, this input rate will be very small, approximately 0.5 standard cubic feet per minute (scfm).

The liquid radwaste system degasifier will also be used to degas liquid pumped out of the reactor coolant drain tank. The amount of fluid pumped out, and therefore the gas sent to the WGS, will depend on the input into the reactor coolant drain tank. This will be smaller than the input from the CVS letdown line.

The final input to the WGS will be from the reactor coolant drain tank vent. A nitrogen cover gas will be maintained in the reactor coolant drain tank. This input will consist of nitrogen, hydrogen, and radioactive gases. The tank operates at nearly constant level, with its vent line normally closed, so this input will be minimal. Venting will be required only after enough gas has evolved from the input fluid to increase the reactor coolant drain tank pressure.

The influent will first pass through a gas cooler. Chilled water will flow through the gas cooler at a fixed rate to cool the waste gas to about 40°F regardless of waste gas flow rate. Moisture formed due to gas cooling will be removed in the moisture separator, and collected water will be periodically discharged automatically. To reduce the potential for waste gas bypass of the gas cooler in the event of valve leakage, a float-operated drain trap will be provided that automatically closes on low water level.

The gas leaving the moisture separator will be monitored for temperature, and a high alarm will alert the operator to an abnormal condition requiring attention. Oxygen concentration will also be monitored. On a high oxygen alarm, a nitrogen purge will be automatically injected into the influent line.

The waste gas then will flow through the guard bed, where iodine and chemical (oxidizing) contaminants will be removed. The guard bed will also remove any remaining excessive moisture from the waste gas. The waste gas will flow through the two delay beds where xenon and krypton will be delayed by a dynamic adsorption process. The discharge line will be equipped with a valve that automatically closes on either high radioactivity in the WGS discharge line or low ventilation exhaust duct flow.

The adsorption of radioactive gases in the delay bed will occur without reliance on active components or operator action. Operator error or active component failure will not result in an uncontrolled release of radioactivity to the environment. Failure to remove moisture before the delay beds (due to loss of chilled water or other causes) will result in a gradual reduction in WGS performance. Reduced performance will be indicated by high temperature and discharge radiation alarms. A high-high radiation signal will automatically terminate a discharge.

3.5.2.2 Radioactive Releases

Releases of radioactive effluent by way of the atmospheric pathway will occur due to:

- Venting of the containment that contains activity as a result of leakage of reactor coolant and as a result of activation of naturally occurring Ar-40 in the atmosphere to form radioactive Ar-41
- Ventilation discharges from the auxiliary building that contain activity as a result of leakage from process streams
- Ventilation discharges from the turbine building.
- Condenser air removal system (gaseous activity entering the secondary coolant as a result of primary to secondary leakage is released via this pathway).
- WGS discharges

These releases will be ongoing throughout normal plant operations and will be within the NRC release limits provided in 10 CFR Part 20 and 10 CFR Part 50, Appendix I. There will be no gaseous waste holdup capability in the gaseous waste management system and thus no criteria are required for determining the timing of releases or the release rates to be used.

3.5.2.2.1 Estimated Annual Releases

The annual average airborne releases of radionuclides from the plant are determined using the PWR-GALE code. The PWR-GALE code models releases using realistic source terms derived from data obtained from the experience of many operating pressurized water reactors. The code input parameters used in the analysis are provided in DCD Table 11.2-6. The expected annual releases for a single unit are presented in DCD Table 11.3-3.

3.5.2.2.2 Release Points

Airborne effluents will normally be released through the plant vent or the turbine building vent. The plant vent will provide the release path for containment venting releases, auxiliary building ventilation releases, annex building releases, radwaste building releases, and WGS discharge. The turbine building vents will provide the release path for the condenser air removal system, gland seal condenser exhaust and the turbine building ventilation releases.

3.5.2.3 Doses

The calculated maximum individual and population doses for normal plant operation are addressed in Section 5.4.

3.5.2.4 Cost Benefit Analysis of Population Doses

The site-specific cost-benefit analysis regarding population doses due to gaseous effluents during normal plant operation is addressed in FSAR Subsection 11.3.3.4. This FSAR subsection applies to the cost-benefit analysis for each unit. The dollar/person millirem reduction is included in the calculation for the cost-benefit analysis in the FSAR subsection.

3.5.3 SOLID RADIOACTIVE WASTE MANAGEMENT SYSTEM

Solid radioactive wastes will be produced in multiple ways at a nuclear power station. The waste could be either dry or wet solids, and the source could be an operational activity or maintenance function.

The solid radioactive waste management system will collect, process, and package solid radioactive wastes generated as a result of normal plant operation, including anticipated operational occurrences. The system will be designed to have sufficient capacity, based on normal waste generation rates, to ensure that maintenance or repair of the equipment does not impact power generation.

Operating procedures would encourage plant operators to segregate wastes to keep mixed wastes at a minimum. However, the waste handling system will be designed to allow handling and disposal of mixed waste, if it is created, as described below.

For each unit, the solid waste management system will be designed to collect and accumulate spent ion exchange resins and deep bed filtration media, spent filter cartridges, dry active wastes, and mixed wastes generated as a result of normal plant operation, including anticipated operational occurrences. The system will be located in the auxiliary and radwaste buildings. Processing and packaging of wastes will be by mobile systems in the auxiliary building truck bay and in the mobile systems facility part of the radwaste building. The packaged waste will be stored in the auxiliary and radwaste buildings until it is shipped offsite to a licensed disposal facility.

The use of mobile systems for the processing functions will permit the use of the latest technology and avoid the equipment obsolescence problems experienced with installed radwaste processing equipment. The most appropriate and efficient systems could be used as they become available.

This system will not handle large, radioactive waste materials such as core components or radioactive process wastes from the plant's secondary cycle. However, the volumes and activities of the secondary cycle wastes are provided in this subsection.

3.5.3.1 System Description

The waste management system will include the spent resin system. The flows of wastes through the solid waste management system are shown in DCD Figure 11.4-1. The radioactivity of influents to the system will depend on reactor coolant activities and the decontamination factors of the processes in the CVS, spent fuel cooling system, and the liquid waste processing system.

The parameters used to calculate the estimated activity of the influents to the solid waste management system are listed in DCD Table 11.4-1. The AP1000 design has sufficient radwaste storage capacity to accommodate the maximum generation rate.

The radioactivity of the dry active waste would be expected to normally range from 0.1 curies per year to 8 curies per year with a maximum of about 16 curies per year. This waste will include spent HVAC filters, compressible trash, noncompressible components, mixed wastes, and solidified chemical wastes. These activities will be produced by relatively long-lived radionuclides (such as Cr-51, Fe-55, Co-58, Co-60, Nb-95, Cs-134 and Cs-137), and therefore, radioactivity decay during processing and storage will be minimal. These activities apply to the waste as generated and to the waste as shipped.

The estimated expected and maximum annual quantities of waste influents by source and form are listed in DCD Table 11.4-1 with disposal volumes. The annual radwaste influent rates are derived by multiplying the average influent rate (e.g., volume per month, volume per refueling cycle) by 1 year of time. The annual disposal rate is determined by applying the radwaste packaging efficiency to the annual influent rate. The influent volumes are conservatively based on an 18-month refueling cycle. Annual quantities based on a 24-month refueling cycle will be less than those for an 18-month cycle.

All radwaste that is packaged and stored will be shipped offsite for disposal. The AP1000 design does not include provisions for permanent storage of radwaste. Radwaste will be stored ready for shipment. Shipped volumes of radwaste for disposal are estimated in DCD Table 11.4-1 from the estimated expected or maximum influent volumes by making adjustments for volume reduction processing and the expected container filling efficiencies. For drum compaction, the overall volume reduction factor, including packaging efficiency, is 3.6. For box compaction, the overall volume reduction factor is 5.4. These adjustments result in a packaged internal waste volume for each waste source, and the number of containers required to hold this volume is based on the container's internal volume. The disposal volume is based on the number of containers and the external (disposal) volume of the containers.

The disposal volumes of wet and dry wastes are approximately 547 and 1417 cubic feet/year, respectively as shown in DCD Table 11.4-1. The wet wastes shipping volumes include 510 cubic feet/year of spent ion exchange resins and deep bed filter activated carbon, approximately 20 cubic feet/year of volume reduced liquid chemical wastes and 17 cubic feet/year of mixed liquid wastes. The spent resins and activated carbon will be initially stored in the spent resin storage tanks located in the truck bay of the auxiliary building. When a sufficient quantity has accumulated, the resin will be sluiced into high-integrity containers in anticipation of transport for offsite disposal. Liquid chemical wastes will be reduced in volume and packaged into drums (20 cubic feet/year) and will be stored in the packaged waste storage room of the radwaste building. The estimated mixed liquid wastes will fill less than three drums per year (about 17 cubic feet/year) and will be stored on containment pallets in the waste accumulation room of the radwaste building until shipped offsite for processing.

The two spent resin storage tanks (275 cubic feet usable, each) and one high-integrity container in the spent resin waste container fill station at the west end of the truck bay of the auxiliary building will provide more than a year of spent resin storage at the expected rate, and several months of storage at the maximum generation rate. The expected radwaste generation rate is based on the following assumptions:

- All ion exchange resin beds are disposed of and replaced every refueling cycle
- The WGS activated carbon guard bed is replaced every refueling cycle
- The WGS delay beds are replaced every 10 years
- All wet filters are replaced every refueling cycle
- Rates of compactible and non-compactible radwaste, chemical waste, and mixed wastes are estimated using historical operating plant data

The maximum radwaste generation rate is based on:

- The ion exchange resin beds are disposed of based on operation with 0.25 percent fuel defects

- The WGS activated carbon guard bed is replaced twice every refueling cycle
- The WGS delay beds are replaced every 5 years
- All wet filters are replaced based upon operation with 0.25 percent fuel defects
- Expected rates of compactible and noncompactible radwaste, chemical waste, and mixed wastes are increased by about 50 percent
- Primary to secondary system leakage contaminates the condensate polishing system and blowdown system resins and membranes, and are replaced

The dry solid radwaste will include approximately 1383 cubic feet/year of compactible and non-compactible waste packed into about 14 boxes (90 cubic feet each) and about 10 drums per year. Drums will be used for higher activity compactible and noncompactible wastes. Compactible waste will include HVAC exhaust filter, ground sheets, boot covers, hairnets, etc. Noncompactible waste will include about 60 cubic feet/year of dry activated carbon and other solids such as broken tools and wood. Solid mixed wastes will occupy 7.5 cubic feet/year (one drum). The low activity spent filter cartridges may be compacted to about 3 cubic feet/year and will be stored in the packaged waste storage room. Compaction will be performed by mobile equipment or offsite. The volume of high activity filter cartridges will be about 22.5 cubic feet/year and will be stored in portable processing or storage casks in the truck bay of the auxiliary building.

The total volume of radwaste to be stored in the radwaste building packaged waste storage room will be 1417 cubic feet/year at the expected rate and 2544 cubic feet/year at the maximum rate. The compactible and noncompactible dry wastes, packaged in drums or steel boxes, will be stored with the mixed liquid and mixed solid, volume reduced liquid chemical wastes, and the lower activity filter cartridges. The quantities of liquid radwaste stored in the packaged waste storage room of the radwaste building will consist of approximately 20 cubic feet of chemical waste and approximately 17 cubic feet of mixed liquid waste. The useful storage volume in the packaged waste storage room will be approximately 3900 cubic feet (10 feet deep, 30 feet long, and 13 feet high), which will accommodate more than one full offsite waste shipment using a tractor trailer truck. The packaged waste storage room will provide storage for more than 2 years at the expected rate of generation and more than a year at the maximum rate of generation. One four-drum containment pallet will provide more than 8 months of storage capacity for the liquid mixed wastes and the volume reduced liquid chemical wastes at the expected rate of generation and more than 4 months at the maximum rate.

FPL expects that, consistent with its current commercial agreements, a third-party contractor will process, store, own, and ultimately dispose of low-level waste generated as a result of operations. Activities associated with the transportation, processing, and ultimate disposal of low-level waste are expected to comply with all applicable laws and regulations in order to assure the public's health and safety. In particular, the third-party contractor would conduct its operations consistent with NRC regulations (e.g., 10 CFR Part 20), which will assure that the radiological impacts from these activities would be small. Lastly, environmental impacts resulting from management of low-level wastes are expected to be bounded by he NRC's findings in 10 CFR 51.51 (b).

If needed, FPL would construct additional waste storage facilities onsite. Such facilities would be designed and operated pursuant to the guidance in Appendix 11.4-A of the Standard Review Plan, NUREG-0800.

A conservative estimate of solid wet waste includes blowdown material based on continuous operation of the steam generator blowdown purification system, with leakage from the primary to secondary system. The volume of radioactively contaminated material from this source is estimated to be 540 cubic feet/year. Although included here for conservatism, this volume of contaminated resin will be removed from the plant within the contaminated electrodeionization unit and not stored as wet waste.

The condensate polishing system will include mixed bed ion exchanger vessels for purification of the condensate as described in DCD Section 10.4.6. If the resins become radioactive, the resins would be transferred from the condensate polishing vessel directly to a temporary processing unit or to the temporary processing unit via the spent resin tank. The processing unit, located outside of the turbine building, would dewater and process the resins as required for offsite disposal. Radioactive condensate polishing resin would have very low activity. It would be packaged in containers as permitted by U.S. DOT regulations. After packaging, the resins may be stored in the radwaste building. Based on a typical condensate polishing system operation of 30 days per refueling cycle with leakage from the primary system to the secondary system, the volume of radioactively contaminated resin is estimated to be 206 cubic feet/year (one 309-cubic-foot bed per refueling cycle).

The parameters used to calculate the activities of the steam generator blowdown solid waste and condensate polishing resins are given in DCD Table 11.4-1. Based on the above volumes, the disposal volume is estimated to be 939 cubic feet/year.

DCD Tables 11.4-4 and 11.4-8 list the expected principal radionuclides in primary wastes and secondary wastes, respectively. These values represent the radionuclide content in these wastes as shipped.

The spent fuel storage facility is located in the auxiliary building fuel handling area and will house pools that provide storage space for the irradiated fuel. Each unit will have a separate pool with capacity for 889 fuel assemblies. All portions of the spent fuel transfer operation will be completed underwater and the waterways will be deep enough to maintain adequate shielding above the fuel. The spent fuel pools will have access to a cask-loading pit for loading the spent fuel assemblies into transportation casks. The fuel-handling building will also house equipment for the decontamination of the shipping cask before it leaves the building. The DOE is responsible for the acceptance of title, subsequent transportation, and disposal of spent fuel in accordance with the Nuclear Waste Policy Act of 1982, as amended. FPL has executed a standard spent nuclear fuel disposal contract with DOE for Units 6 & 7.

Section 3.5 References

WEC 2011. Westinghouse Electric Company, LLC. *AP1000 Design Control Document*, Document No. APP-GW-GL-700, Tier 2 Material, Rev. 19, June 13, 2011.

3.6 NONRADIOACTIVE WASTE SYSTEMS

The following section provides descriptions of nonradioactive waste streams that would be expected from the operation of Units 6 & 7.

This section is divided into three subsections that evaluate these nonradioactive waste systems as follows:

- Effluents containing chemicals or biocides
- Sanitary system effluents
- Other effluents

3.6.1 EFFLUENTS CONTAINING CHEMICALS OR BIOCIDES

Proper water chemistry for plant operation requires the treatment of potable water, reclaimed water, and saltwater that would be used in the various plant water systems such as circulating water, service water, potable water, and demineralized water systems.

The waste effluent from the station demineralized water system, sanitary waste treatment plant, FPL reclaimed water treatment facility, filter backwash wastewater, and other nonradioactive drains throughout the station would be collected in the blowdown sump along with the blowdown from the circulating water and service water systems. The combined stream would be pumped to the deep injection wells. The combined stream would be controlled through engineering design and operational procedures to meet the requirements established in the underground injection control permits.

The effluent waste stream constituents and concentrations in the blowdown sump are identified in Table 3.6-2 for a reclaimed water supply as makeup to the circulating water system and Table 3.6-3 for a saltwater supply as makeup to the circulating water system. The characterization of the circulating water system blowdown is based on two makeup water cases that use either 100 percent reclaimed or 100 percent saltwater supply as makeup water. Saltwater from the radial collector wells would be used as makeup for the circulating water system when an adequate quantity and/or quality of reclaimed water is not available. Constituents in effluent discharge in the case of combined reclaimed and saltwater supply would be within the rates and limits described for each individual water supply.

The water treatment chemicals used in the circulating water system, service water system, FPL reclaimed water treatment facility, steam generator blowdown system, and demineralized water system are identified in Table 3.6-1. Table 3.6-1 shows the chemicals that would be used in each system, the estimated amount used per year, the frequency of use, and the chemical concentration. The circulating water system chemicals are based on two cases of makeup water supply: 100 percent reclaimed or 100 percent saltwater. The quantity of chemical additives to the plant systems in the case of combined reclaimed and saltwater supply would be within the concentration of chemicals described for each individual water supply.

The systems that treat the water for plant operation are described in Subsection 3.3.2. The concentration factors for the CWS and service water system cooling systems are addressed in Section 3.4. The concentrations of material in the reclaimed water, saltwater, and potable water supplies are presented in Section 2.3. A description of the sources of reclaimed and saltwater supply is provided in Section 3.4. The airborne concentration of chemicals and solids in spray is addressed in Subsection 5.3.3. The discharge limits are presented in Subsection 5.5.1.1.

3.6.2 SANITARY SYSTEM EFFLUENTS

A sanitary waste system would be maintained onsite during the preconstruction, construction, and operation of Units 6 & 7. During construction, portable sanitary waste facilities would be used until the permanent sanitary waste treatment facility is functional, and as needed during the peak construction or outage activities to augment the permanent system. These temporary facilities may include centralized restroom and hand wash trailers in addition to single restroom units placed throughout the site, as necessary. The waste collected in these temporary facilities would be disposed of by a licensed sanitary waste disposal contractor.

Sanitary treatment would be provided by a packaged sanitary treatment plant located on the Units 6 & 7 plant area. The sanitary treatment plant would be designed to process sanitary effluent from Units 1 through 7 and would operate in compliance with applicable FDEP rules.

Units 6 & 7 will have a sanitary drainage system. The sanitary drainage system will collect sanitary waste from plant restrooms and locker room facilities and carries this waste to the sanitary treatment plant where it will be processed. The sanitary drainage system will not service facilities in radiologically controlled areas.

For Units 6 & 7, the sanitary treatment plant would be designed to accommodate 50 gallons per person per day for 500 people during normal operation per unit and 1000 people during plant shutdown per unit. The sanitary treatment plant would also be designed to accommodate the sanitary effluent from Units 1 through 5. The design flows for the sanitary system are provided in Tables 3.3-1 and 3.3-2.

The waste sludge generated by the sanitary treatment plant, estimated at 1300 gallons per day at 1.5—2 percent solids content, would be disposed of offsite via contract with a licensed waste transportation and disposal company. Offsite disposal methods may include land filling, incineration, land application, and/or further treatment at licensed facilities. The treated liquid effluent from the sanitary drainage system would be pumped to the blowdown sump where it would be combined with other effluent streams, as described in Subsection 3.6.1. The combined effluent would be discharged to the deep injection wells.

3.6.3 OTHER EFFLUENTS

This subsection describes the other miscellaneous nonradioactive gaseous, liquid, and solid effluents not addressed in Subsection 3.6.1 or 3.6.2 that are discharged to the environment. The applicable state permits for the gaseous, liquid, and solid effluents are described in Section 1.2.

3.6.3.1 Gaseous Effluents

Each unit contains two standby diesel generators, two ancillary diesel generators, and one diesel-driven fire pump. During normal operation of the plant, the operation of this equipment is infrequent and typically limited to periodic testing. Plant operation would result in small amounts of nonradioactive gaseous emissions to the environment from the equipment associated with the plant auxiliary system. Table 3.6-4 shows the projected annual emissions (tons/year) from the diesel generators and the diesel-driven fire pumps. The standby diesel generators are located in the diesel generator building. The diesel-driven fire pump is located in the diesel-driven fire pump enclosure. The ancillary diesel generators are located in the annex building. Each standby diesel generator has a 60,000-gallon fuel oil storage tank and a 1300-gallon fuel oil storage day tank. The two ancillary diesel generators have a common 650-gallon fuel oil storage tank, and the diesel-driven fire pump has a 240-gallon fuel oil storage tank. The projected annual hydrocarbon emissions from the diesel storage tanks at Turkey Point Units 6 & 7 are shown in Table 3.6-5.

3.6.3.2 Liquid Effluents

The wastewater system collects and processes liquid effluent from equipment and floor drains from nonradioactive building areas, and is capable of handling the anticipated flow of wastewater during normal plant operation and during plant outages. A process diagram and flow rates of the water system are addressed in Section 3.3. The wastewater system:

- Removes oil and/or suspended solids from miscellaneous waste streams generated from the plant
- Collects system flushing wastes during startup before treatment and discharge
- Collects and processes fluid drained from equipment or systems during maintenance or inspection activities

- Directs nonradioactive equipment and floor drains that may contain oily waste to the building sumps and transfer their contents for disposal in accordance with applicable regulations and permit specifications

Wastes from the turbine building floor and equipment drains (which include laboratory and sampling sink drains, oil storage room drains, the main steam isolation valve compartment, auxiliary building penetration area, and the auxiliary building HVAC room) are collected in the two turbine building sumps. Drainage from the diesel generator building sumps, the auxiliary building nonradioactive sump, and the annex building sump is also collected in the turbine building sumps. The turbine building sumps provide a temporary storage capacity and a controlled source of fluid flow to the oil separator. A radiation monitor located on the common discharge piping of the sump pumps alarms upon detection of radioactivity in the wastewater. The radiation monitor also trips the sump pumps on detection of radioactivity to isolate the contaminated wastewater. Provisions are included for sampling the sumps. If necessary, the wastewater from the turbine building sumps will be diverted to the liquid radwaste system for processing and disposal.

The turbine building sump pumps route the wastewater from either of the two sumps to the oil separator for removal of oily waste. The diesel fuel oil area sump pump also discharges wastewater to the oil separator. A bypass line allows for the oil separator to be out of service for maintenance. The oil separator has a small reservoir for storage of the separated oily waste that flows by gravity to the waste oil storage tank. The waste oil storage tank provides temporary storage before shipment for offsite disposal. Turkey Point Units 3 & 4 generated approximately 1550 gallons of used oil in 2010. Based on this generation rate, Turkey Point Units 6 & 7 would produce approximately 1550 gallons of used oil. The used oil was transported offsite by a licensed contractor and recycled for heat reclamation. It is anticipated that similar practices would be followed for Units 6 & 7.

The wastewater from the oil separator and the condenser water box drains by gravity to the wastewater retention basin for settling of suspended solids and any required treatment before discharge. The wastewater basin transfer pumps route the basin effluent to the blowdown sump where it would be combined with the cooling tower blowdown streams as part of the final plant effluent described in Subsection 3.6.1.

Stormwater would be routed to the industrial wastewater facility.

3.6.3.3 Solid Effluents

Nonradioactive solid waste includes typical industrial wastes such as metal, wood, and paper, as well as process wastes such as nonradioactive resins, filters, and sludge. Solid waste debris would also be collected from cleaning cooling basin forebay screens and catch basin screens. A solid waste minimization program would be employed as described in Subsection 5.5.1. To the extent practicable, scrap metal, lead acid batteries, paper, and other recyclable material would be recycled offsite at an approved recycling facility. The nonradioactive wastes that cannot be recycled would be disposed of in a permitted landfill. Based on FPL's current operating experience for the existing units, Units 6 & 7 would be expected to produce approximately 1000 tons annually of nonradioactive, nonhazardous solid waste per year.

The solid waste collected from the periodic cleaning of cooling basin forebay screens and catch basin screens would be disposed of in a permitted landfill.

Approximately 4800 pounds of nonradioactive hazardous waste was generated from Turkey Point Units 3 & 4 in 2010. The majority of this waste was expired paint and laboratory chemicals. Based on this current waste generation rate, Turkey Point Units 6 & 7 would be expected to generate approximately 4800 pounds annually of nonradioactive hazardous waste. These wastes would be collected and stored onsite until disposed of at an offsite licensed commercial waste facility or recovered at an offsite permitted recycling facility. Currently, the majority of the nonradioactive hazardous waste is incinerated at a permitted offsite facility.

The reclaimed water from the Miami-Dade Water and Sewer Department (MDWASD) would be processed through the FPL reclaimed water treatment facility before it can be used as makeup water to the circulating water cooling system**.** The FPL reclaimed water treatment facility would generate solid waste (i.e., sludge) from the treatment of reclaimed water from the MDWASD. Assuming a continuous supply of reclaimed water from the MDWASD and Units 6 & 7 are in normal operation, the estimated amount of sludge produced would be approximately 435 tons per day. If the reclaimed water is not available, the estimated amount of sludge would be less. A description of the FPL reclaimed water treatment facility is provided in Section 3.3. Sludge from the FPL reclaimed water treatment facility would be disposed of in a permitted landfill.

Table 3.6-1
Estimated Chemicals Added to Liquid Effluent Streams from Two Units

System	Chemical-Type/Specific	Amount Used (gallon/year)	Frequency of Use	Chemical Concentrations
FPL Reclaimed Water Treatment Facility	Ferric Chloride	2,190,000	Continuous	50 ppm
	Polymer	20,500	Continuous	1 ppm
	Lime	42,400[c]	Continuous	383 ppm
	Sulfuric Acid	380,000	Continuous	26.2 ppm
	Methanol	1,794,000	Continuous	30.61 ppm
	Sodium Bisulfite	85,500	Continuous	1.46 ppm
Circulating Water System[a]	Proprietary Scale Inhibitor, High Stress Polymer, Phosphinosuccinic Oligomer	244,400	Continuous	60 ppm
	Sodium Hypochlorite	214,500	Shock treatment 30 minutes per day	2 ppm
Circulating Water System[b]	Sodium Hypochlorite	215,000	Shock treatment 30 minutes per day	2 ppm
	Sodium Hypochlorite	352,000	Continuous	1 ppm
	Sulfuric Acid	883,000	Continuous	53 ppm
	Proprietary scale Inhibitor, High Stress Polymer	591,500	Continuous	25 ppm
	Proprietary Scale Inhibitor, Sodium Salt of Phosphonomethylate Diamine	472,500	Continuous	20 ppm
	Proprietary Scale Inhibitor, Silicate Inhibiting Polymer	6460[d]	Intermittent — during transition	35 ppm
Demineralizer Water System	Sulfuric Acid	10,800	Continuous	172.5 ppm
	Proprietary Scale Inhibitor, Phosphoric Acid	1,790	Continuous	6 ppm
	Sodium Bisulfite	2,740	Continuous	2.92 ppm
Service Water	Sodium Hypochlorite	7,130	Shock treatment 30 minutes per day	2 ppm
	Sulfuric Acid	78,200	Continuous	649 ppm
	Proprietary Phosphoric Acid Scale Inhibitor	1,020	Continuous	6 ppm
	Proprietary Dispersant, High Stress Polymer	510	Continuous	3 ppm
Steam Generator Blowdown System	Oxygen Scavenging/ Morpholine	800	Used as needed	To be determined during detailed design
	pH Adjustment/ Carbohydrazide	800	Used as needed	To be determined during detailed design
	pH Adjustment/ Hydrazine	800	Used as needed	To be determined during detailed design

(a) The chemicals provided are based on the case of makeup water for the circulating system of 100 percent reclaimed water from the Miami-Dade Water and Sewer Department.
(b) The chemicals provided are based on the case of makeup water for the circulating system of 100 percent saltwater from the radial collector wells.
(c) Lime quantity is tons per year instead of gallons per year.
(d) Proprietary Scale Inhibitor Polymer is gallons per transition instead of gallons per year.

Table 3.6-2
Reclaimed Water Estimated Constituents and Concentrations Discharged to Deep Injection Wells[(a)]

Constituent Name	Concentration (mg/L)
Ammonia as N	Not Calculated
BOD	Not Calculated
Boron	No Data
Bromide	No Data
Hexavalent Chromium	0.065
Fluoride	2.46
Alkalinity, total as $CaCO_3$	72
Nitrate as N	16.1
Sulfate	484.0
Total Organic Carbon	118
Total Dissolved Solids	2721
Total Suspended Solids	33.6
Phosphorous	0.73
Phosphate	2.40
Aluminium	3.02
Antimony	0.0245
Arsenic	0.0131
Barium	1.86
Beryllium	0.0933
Cadmium	0.00718
Chromium	0.0653
Copper	0.0433
Iron	1.63
Lead	0.112
Nickel	0.088
Selenium	0.0359
Silver	0.0163
Zinc	0.646
Calcium	355
Magnesium	63
Manganese	0.379
Sodium	426
Silica as SiO_2	26.4
Chloride	1247
Nitrite as N	4.02
Conductivity (µmhos/cm)	5577
pH (standard units)	7.89
Total Residual Chlorine	2
Thallium	0.00620
Mercury	0.00653
Heptachlor	0.000023[(b)]
Ethylbenzene	[(b)(c)]
Toluene	0.00174[(b)]
Tetrachloroethylene	0.00359[(b)]

(a) The information provided is based on the case of makeup water for the circulating system of 100 percent reclaimed water from the Miami-Dade Water and Sewer Department.

(b) These chemicals were not included in the original evaluation used in the development of the table but have now been evaluated using recent data and added to the table to address issues raised in Contention NEPA 2.1 in LBP-11-06.

(c) Makeup water constituents were below method detection limits.

Table 3.6-3
Saltwater Estimated Constituents and Concentrations Discharged to Deep Injection Wells[(a)]

Constituent Name	Concentration(mg/L)
Ammonia as N	Not Calculated
BOD	Not Calculated
Boron	8.65
Bromide	166
Hexavalent Chromium	No Data
Fluoride	0.00162
Alkalinity, total as $CaCO_3$	149
Nitrate as N	4.19
Sulfate	4,272
Total Organic Carbon	7.0
Total Dissolved Solids	39,506-53,168[(c)]
Total Suspended Solids	13.3
Phosphorous	1.05
Phosphate	1.110
Aluminium	(b)
Antimony	(b)
Arsenic	(b)
Barium	0.1214
Beryllium	(b)
Cadmium	0.00107
Chromium	0.00441
Copper	0.0144
Iron	0.281
Lead	0.00496
Nickel	0.0260
Selenium	0.019
Silver	(b)
Zinc	10.8
Calcium	787
Magnesium	2,615
Manganese	0.0400
Sodium	19,164
Silica as SiO_2	15.4
Chloride	30,009
Nitrite as N	0.0966
Conductivity (µmhos/cm)	23,027-31,639[(c)]
pH (standard units)	7.89
Total Residual Chlorine	No Data
Thallium	(b)
Mercury	(b)

(a) The information provided is based on the case of makeup water for the circulating system of 100 percent saltwater from the radial collector wells.
(b) Makeup water constituent values were below method detection limits.
(c) Ranges for saltwater are presented for TDS and Conductivity. Maximum values presented for other constituents.

Table 3.6-4
Annual Estimated Emissions from Diesel Generators and Diesel-Driven Fire Pumps for Two Units[a]

Pollutant Discharged	Four 4000 KW Standby Diesel Generators (ton/yr)[b]	Four 35 KW Ancillary Diesel Generators (ton/yr)[b]	Two Diesel-Driven Fire Pumps (ton/yr)[b]
Sulfur Oxides	6.06E-03	8.09E-05	2.08E-04
Nitrogen Oxides + Nonmethanol Hydrocarbons[c]	—	0.050	0.122
Total Hydrocarbons + Nitrogen Oxides [c]	11.83	—	—
Particulate Matter[c]	0.599	4.25E-03	6.10E-03
Carbon Monoxide[c]	5.99	0.052	0.106[d]

(a) Assumes fuel oil Grade No. 2-D S15, sulfur content 15 ppm.
(b) Based on 4 hours of operation per month for each diesel-driven fire pump and diesel generator. There are two standby diesel generators, two ancillary diesel generators, and one diesel-driven fire pump, per unit.
(c) Emissions factors for standby diesel generator, ancillary diesel engine, and diesel-driven fire pump are based on information from 40 CFR Part 60.
(d) Based on 2008 CO exhaust emissions for a diesel-driven fire pump.

Table 3.6-5
Annual Estimated Emissions from Diesel Fuel Oil Storage Tanks for Two Units

Pollutant Discharged	Four 60,000 Gallon Standby Diesel Generator Fuel Oil Storage Tanks[a]	Four 1300 Gallon Standby Diesel Generator Fuel Oil Storage Day Tanks[a]	Two 650 Gallon Ancillary Diesel Generator Fuel Oil Storage Tanks[b]	Two 240 Gallon Diesel-Driven Fire Pump Fuel Oil Storage Tanks[c]
Hydrocarbons[d] (lbs/yr)	17.32	7.44	0.74	0.44

(a) Based on total fuel throughput of 27,802 gal/yr for each tank.
(b) Based on total fuel throughput of 278 gal/yr for each tank.
(c) Based on total fuel throughput of 1650 gal/yr for each tank.
(d) Hydrocarbon emissions from the diesel fuel oil storage tanks were calculated using the EPA TANKS Program (Version 4.0.9d).

3.7 POWER TRANSMISSION SYSTEM

This section provides a description of the design characteristics and interfaces of the power transmission system for Units 6 & 7. The FPL power transmission system consists of transmission lines and substations that link the various generation facilities, load centers, and grid interties within the FPL service territory at various voltages ranging from 69 kV to 500 kV. In Miami-Dade County at the location of Units 6 & 7, the existing transmission lines are 230 kV. The transmission lines, substation/switchyard, and associated structures and equipment for the new nuclear units are rated at transmission voltages of 230 kV and 500 kV. FPL owns and operates the transmission system for the new nuclear units. A description of the components and activities necessary to connect between Units 6 & 7 and the FPL transmission system is presented in this section.

3.7.1 SWITCHYARD INTERFACES

A new switchyard/substation on the Units 6 & 7 plant area would be used to transmit electrical power output from Units 6 & 7 to the FPL transmission system. The new substation would be known as the Clear Sky substation. The substation would consist of two sections, a 230 kV section and a 500 kV section. Units 6 & 7 would be connected to the 230 kV section of Clear Sky substation section via onsite underground transmission facilities. The plot plan (Figure 3.1-3) shows the location of the new substation.

The Clear Sky substation would be a "breaker-and-a-half" bus configuration. The breaker-and-a-half bus configuration enhances reliability by providing multiple current flow paths between the units and the transmission lines, allowing continued transmission with a bus out of service due to a fault or for maintenance.

The 500 kV section of the substation would be configured to accommodate two new transmission lines and two 230 kV/500 kV autotransformers. The 230 kV section of the substation would be connected to the 500 kV transmission lines through the autotransformers. The bus breakers on both sides of the autotransformers would provide protection.

The 230 kV section of the substation would be configured to accept four new 230 kV lines interconnecting to the transmission system with two new 230 kV transmission lines and a normally open (NO) line to supply an alternate feed of offsite power to the Turkey Point substation. This alternate feed would provide a path for offsite power between the substations in the event of loss of transmission either at the Clear Sky substation or the Turkey Point substation. The Turkey Point substation is the existing substation for Units 1 through 5. The fourth position would be available for any future requirements.

The 230 kV section of the substation will include one terminal for the Unit 6 generator step-up transformer connection, one terminal for the Unit 7 generator step-up connection, two terminals for connection to the Unit 6 reserve auxiliary transformers, and two terminals for connection to the Unit 7 reserve auxiliary transformers.

3.7.2 TRANSMISSION SYSTEM

The Clear Sky substation would be connected to the FPL transmission system through two new 500 kV and three new 230 kV transmission lines. The details of these transmission lines and their termination points to the FPL transmission system are summarized below:

Transmission Line (kV)	Termination Point	Approximate Length (miles)	Thermal Rating (MVA)
Clear Sky-Levee # 1 (500 kV)	Levee 500 kV	43	3464
Clear Sky-Levee # 2 (500 kV)	Levee 500 kV	43	3464
Clear Sky-Davis (230 kV)	Davis 230 kV	19	1191
Clear Sky-Pennsuco (230 kV)	Pennsuco 230 kV	52	1191
Clear Sky-Turkey Point (230 kV)	Turkey Point (NO)	0.5	1191
Davis-Miami (230 kV)	Miami 230 kV	18	915

See Figures 9.4-13 and 9.4-14 for a general location map of these transmission lines.

3.7.2.1 Design Parameters

The 230 kV lines would be rated at 2990 amps. These lines would be constructed with a two-conductor bundle of 954-thousand-circular-mils aluminum conductor aluminum-clad steel reinforced (ACSR/AW) conductor and optical ground wire or overhead ground wire sized based on the available fault current.

The 230 kV transmission tower structures would be single pole concrete (a gray/white color), approximately 80–90 feet high above ground depending on span length and other design factors. The substation pulloff towers would be galvanized steel or concrete.

The 500 kV transmission lines would be constructed using guyed single-circuit concrete, tubular steel or galvanized lattice steel structures. Heights would range from 140-160 feet depending on span length and other design factors. If tubular steel structures are used, similar structures with larger gauge steel would be used where the transmission lines turn light angles (2–15 degree). Similarly, where the lines turn heavy angles (55–90 degrees), three-pole structures with guys and anchors would be used. Structures would be galvanized steel (silver-gray color) or concrete (gray/white color).

The 500 kV lines would be framed in a triangular configuration. The conductor for these lines would be a three-conductor bundle of 1272-thousand-circular-mils ACSR/AW conductor with a nominal operating voltage of 500,000 volts. The maximum current rating for this conductor would be 4215 amperes. Span distance between structures would be approximately 900–1000 feet. Site-specific conditions during detailed design may require some variance from this distance to avoid and minimize impacts to wetlands or cultural resources.

The transmission lines would be designed to meet or exceed the clearance-to-ground requirements of C2-2007, the National Electrical Safety Code (NESC) (IEEE 2007). The 230 kV and 500 kV lines would be designed to keep the electric field at the conductor surface below corona inception. The electric field induced current from transmission lines would meet the allowable NESC code (IEEE 2007) and Florida Department of Environmental Protection Florida Administrative Code (F.A.C.) requirements.

3.7.3 TRANSMISSION LINE CORRIDORS

Approval of the proposed transmission line corridors is under the authority of the Florida Power Plant Siting Act. A route study and corridor selection process was performed for the new units under the requirements of this act. Specifically, the study area was defined, candidate routes were delineated, and routes evaluated using both qualitative and quantitative criteria. There are land use constraints and opportunities in the corridor selection. Examples of land use constraints in the selection of transmission corridors include airports. Examples of land use opportunities include roads, canals and other existing linear facilities. The corridor selection process involves both public meetings and meetings with various state agencies and affected local municipalities. The end result of the selection process was the identification of a preferred corridor to submit for licensing approval for each transmission line. Selection of transmission line corridors is described in Subsection 9.4.3. The proposed lengths, widths, and area of the preferred corridors (where known), including modification and use of existing rights-of-way where applicable, are also described in Subsection 9.4.3.

3.7.3.1 Transmission Line Corridor Ecological and Cultural Surveys

As part of the transmission corridor selection process, ecological and cultural resource surveys were performed along the proposed corridors. The results of the ecological and cultural or historical surveys are described in Section 2.4 and Subsection 2.5.3, respectively. Subsection 9.4.3 describes the process of corridor selection that minimized impacts to the surrounding environment, as stipulated in the PPSA. This process, which included both qualitative and quantitative criteria in the use of resource mapping and alternate route identification, was used as part of the corridor study area selection and ultimately the selection of the preferred corridor(s).

3.7.3.2 Transmission Corridor Maintenance

The safe and reliable operation of transmission lines and maintenance of the right-of-way and facilities would be achieved through regular inspection of the structures, insulators, access areas, and vegetation management in the rights-of-way. These inspections would consist of ground patrols (truck) and/or aerial (airplane/helicopter) patrols. Transmission lines normally require minimal maintenance. However, FPL would inspect the transmission lines regularly to look for problems caused by weather, vandalism, vegetation growth, etc.

In areas that are not in active agricultural cultivation, FPL would manage vegetation within the rights-of-way using a variety of methods, including trimming, mowing, and the use of growth regulators and herbicides targeting species that are incompatible with the safe access, operation, and maintenance of the transmission system.

FPL's right-of-way maintenance program is site-specific and follows standard industry practices. The exact manner in which maintenance would be performed would depend on location, type of terrain, and the surrounding environment. Vegetation removal would be minimized consistent with safe and reliable operation of the transmission lines. Each area of the right-of-way would be addressed based on site-specific vegetation. Endangered or threatened species, if present, would be considered and accommodated in the maintenance program. Growth regulators and herbicides, when selectively used, would meet federal, state, and local regulations.

3.7.3.3 Transmission System Operation

FPL is the transmission system operator and it constructs, owns, and operates all substation and transmission facilities between the plant and the point of interconnection. An interface agreement exists between FPL Transmission & Substation — Power Supply Department and FPL Turkey Point Units 1 through 5, which establishes the protocol to provide effective monitoring and oversight of all grid, switchyard and plant activities. This agreement would be updated to include Units 6 & 7. Power Supply Department directives implement the agreement. These directives facilitate prompt and effective communications between the transmission system operator and the plant operators. The transmission system operator regularly inspects switchyard(s) and performs regular maintenance and necessary repair or replacement of equipment.

FPL uses a real-time contingency analysis program that is used by FPL's transmission system operators in determining the security level of the transmission system under a number of outage contingency criteria. The program simulates a set of contingencies on the current power system and produces an output of system conditions for each defined contingency. The program provides an updated output every 5 minutes using real-time system conditions (e.g., real time line outages, real time breaker status, etc.). For each defined contingency simulated, specified elements are checked for limit violations (e.g., line overloads, voltage limits, reactive limits at generator buses). All contingencies that cause violations are output along with the identification of the violations and information and magnitude of the violation. The output of the contingency analysis program is used continuously by the operators to make critical decisions in response to potential severe conditions.

3.7.3.4 Noise

Transmission lines and substations can produce noise from corona discharge (the electrical breakdown of air into charged particles). The noise, referred to as corona noise, occurs when air ionizes near irregularities, such as nicks, scrapes, dirt, or insects on the conductors. Corona noise is composed of both broadband noise, characterized as a crackling noise, and pure tones, characterized as a humming noise. Corona noise, which is greater with increased voltage, is also affected by weather. During dry weather, the noise level is low and often indistinguishable from background noise. In wet conditions, water drops collecting on conductors can cause louder corona discharges.

During rain showers, the corona noise would likely not be readily distinguishable from background noise. During very moist, non-rainy conditions, such as heavy fog, the resulting small increase in the background noise levels would not be expected to result in annoyance to adjacent residents.

Periodic maintenance activities, particularly vegetation management, would produce noise from mowing, bush-hogging, and tree and limb trimming and grinding. This noise, particularly from bush-hogging or helicopter patrol operation, would be loud enough to disturb adjacent residents. However, this would be of short duration during the day and an infrequent occurrence.

The noise levels resulting from transmission system operations would be in accordance with state and local code requirements. Actual decibel noise levels would be held to a minimum by proper sizing of conductors and the use of corona-free hardware.

Additional information regarding noise levels resulting from transmission system operation is provided in Subsections 5.6.3.4 and 5.8.1.1.

3.7.3.5 General Methods of Construction

Transmission line construction would occur as a series of tasks accomplished in sequence by different specialized crews. Construction phases would consist of right-of-way clearing, access road and pad construction (where necessary), line construction, and right-of-way restoration. Construction phases would follow standard industry practices and would be performed sequentially along the right-of-way such that activities in any one area would be short term.

Clearing would be required for construction of the transmission line structures, pads, and roads. In the structure/pad areas, the right-of-way would be cleared across the entire right-of-way width. Upland areas that are not heavily vegetated with trees would be mowed. All vegetation in the right-of-way whose mature height exceeds 14 feet would also be cleared. The machinery required for clearing would include bulldozers, shearing machinery, and chain saws.

The initial step of transmission line construction would be the installation of foundations, if required. Foundations would be either steel or concrete. The actual type would be determined during detailed design. For steel foundations, the caisson would be vibrated into the ground using a vibratory hammer suspended from a crane. For concrete foundations, a hole would be excavated using an augering machine. Reinforcing steel would then be installed, and concrete would be hauled and poured in place by concrete mixing trucks. For precast foundations, a backhoe would be used to excavate the hole. If concrete poles are used, they would be directly embedded without a separate foundation.

The structures would be framed and erected using cranes and other support vehicles. After the structures are set, wire-pulling equipment would be used to install conductors and overhead ground wires. Bulldozers, tractors, trailers, and light vehicles, as required, would also be used to support line construction. Helicopters could also be used as part of the conductor stringing operation.

Section 3.7 References

IEEE, 2007, C2-2007, National Electrical Safety Code (NESC).

F.A.C. 2008. Florida Administrative Code 62-814.450, Florida Department of Environmental Protection, June 2008. Available at http://www.dep.state.fl.us/legal/Rules/62-814/62-814.doc.

3.8 TRANSPORTATION OF RADIOACTIVE MATERIALS

Operation of new Units 6 & 7 would require transportation of unirradiated fuel, irradiated fuel (spent nuclear fuel), and radioactive waste. The subsections that follow describe transportation of these three types of radioactive materials.

Subsection 5.7.2 also addresses the conditions in 10 CFR 51.52 (a) (1) through (a) (5) regarding use of Table S-4 to characterize both the impacts of radioactive materials transportation and to provide an analysis of the radiological impacts from incident-free transportation of these materials. Section 7.4 addresses postulated radiological transportation accidents.

3.8.1 TRANSPORTATION OF UNIRRADIATED FUEL

Transportation of new fuel assemblies to the Turkey Point site from a fuel fabrication facility would be in accordance with DOT (49 CFR Parts 173, 178, and 397) and NRC regulations (10 CFR Part 71). The initial fuel loading will consist of 157 fuel assemblies per unit. On an annualized basis, refueling will require an average of 43 fuel assemblies per unit per year. The fuel assemblies would be fabricated at a fuel fabrication plant and shipped by truck to the Turkey Point site shortly before they would be required. The details of container design, shipping procedures, and transportation routings would be in accordance with DOT and NRC regulations and would depend on the requirements of the suppliers providing the fuel fabrication services. Truck shipments would not exceed 73,000 pounds, as governed by federal and/or state gross vehicle weight restrictions.

3.8.2 TRANSPORTATION OF IRRADIATED FUEL

Spent fuel assemblies would typically be discharged from each unit on an 18-month refueling cycle and would remain in the spent fuel pool at each unit for at least 5 years while short half-life isotopes decay. As described in Subsection 3.5.3, each unit will have a spent fuel pool with capacity for 889 assemblies, which is adequate to support 11 refueling cycles plus margin for one full core offload. After a sufficient decay period, the fuel would be removed from the pool, packaged in spent fuel shipping/storage casks, licensed in accordance with 10 CFR Part 72, and transferred to either an independent spent fuel storage installation facility onsite or an offsite disposal facility. Packaging of the fuel for offsite shipment would comply with applicable DOT (49 CFR Parts 173 and 178) and NRC regulations (10 CFR Part 71) for transportation of radioactive material. By law, the DOE is responsible for spent fuel transportation from reactor sites to a repository (Nuclear Waste Policy Act of 1982, as amended). DOE would determine the transport mode.

3.8.3 TRANSPORTATION OF RADIOACTIVE WASTE

As described in Subsection 3.5.3, low-level radioactive waste would be packaged to meet transportation and disposal site acceptance requirements. Packaging of waste for offsite shipment would comply with applicable DOT (49 CFR Parts 173 and 178) and NRC regulations (10 CFR Part 71) for transportation of radioactive material. The packaged waste would be stored on site on an interim basis before being shipped offsite to a licensed processing, storage, or disposal facility. Onsite storage for more than a year at the maximum rate of generation would be provided in the waste accumulation room of the radwaste building. Radioactive waste would be shipped offsite by truck.

FPL expects that, consistent with its current commercial agreements, a third-party contractor will process, store, own, and ultimately dispose of low-level waste generated as a result of operations. Activities associated with the transportation, processing, and ultimate disposal of low-level waste would comply with applicable laws and regulations in order to ensure the public's health and safety. In particular, the third-party contractor would conduct its operations consistent with NRC regulations (e.g., 10 CFR Part 20), which will ensure that the radiological impacts from these activities would be small. Lastly, environmental impacts resulting from transportation of low-level wastes are expected to be bounded by the NRC's findings in 10 CFR 51.52 (c).

Under 10 CFR 20.2001, reactor licensees may transfer low-level radioactive waste material to another licensee that is specifically licensed to accept and treat waste prior to disposal. Studsvik, Inc., has a licensed low-level radioactive waste treatment facility in Erwin, Tennessee. FPL has signed a letter of intent with Studsvik to enter into negotiations for a contract for the performance of work by Studsvik to include the shipment, processing, storage, and disposal of low-level radioactive waste produced by Units 6 & 7 (FPL 2009). Under the proposed contract, Studsvik would treat the Class B and C waste at its Erwin, Tennessee facility and thereafter take responsibility for storage and final disposal.

Section 3.8 References

FPL 2009. Florida Power & Light Company. Letter of Intent Between Florida Power & Light Company and Studsvik, Inc., May 22, 2009.

3.9 PRECONSTRUCTION AND CONSTRUCTION ACTIVITIES

This section provides a conceptual description of preconstruction and construction activities for new Units 6 & 7. The description of activities pertinent to addressing potential impacts of plant construction and mitigative measures to prevent or minimize impacts, is presented in Chapter 4. Preconstruction and construction activities are addressed in this section. Transmission corridor and transmission line activities are presented in Section 3.7.

Preconstruction Activities

Upon receipt of necessary approvals, preconstruction activities would be initiated at the site before receipt of the COL including, for example, initial site excavation and build up, installing temporary facilities, construction support facilities, service facilities, utilities, upgrading the equipment barge unloading area, cooling water pipelines, bridges, road improvements, and other nonsafety-related structures, systems, and components.

COL Construction

Upon receipt of the COL, the construction activities described in 10 CFR 50.10(a)(1) (i-vii) could begin. Specifically, constructing the structures, systems, and components of the plant, such as the in-place erection of the containment and auxiliary buildings, placement of structure, system, and component equipment, etc., could begin.

Schedule

The construction schedule assumes approximately 69 months for preconstruction activities. Unit 6 construction would begin after receipt of the COL and would have an approximate 66-month duration for construction activities and a 6-month duration for fuel load and startup. Unit 7 safety-related construction would begin approximately 12 months after Unit 6 safety-related construction begins and would follow identical construction and fuel load/startup durations. Units 6 & 7 would initiate electric generation output in 2022 and 2023, respectively. Table 3.9-1 summarizes the projected major milestone dates for the preconstruction activities, COL construction, and startup and operations for Units 6 & 7.

Summary of Land Disturbances

The construction activities would comply with the state site certification conditions and the U.S. Army Corps permit requirements (see Section 1.2). Environmental best management practices would be implemented to minimize impacts during preconstruction and construction activities. Although soil or groundwater contamination is not anticipated at any of the onsite or offsite areas proposed for land disturbance (e.g., excavation, land clearing, grading), applicable guidelines and procedures contained in Florida Administrative Code (F.A.C.) Chapter 62-780

”Contaminated Site Cleanup Criteria” would be followed by FPL, including any required site assessments and other potential remedial actions. A summary of the major land disturbances on the plant property, in the vicinity, and the region is as follows:

Turkey Point Plant Property Land Disturbance

- Units 6 & 7 plant area including power blocks, makeup water reservoir, switchyard, deep injection wells, associated facilities, etc. (218 acres)
- Western laydown areas, including filling of dead-end canal (52 acres)
- Parking and nuclear administration and training buildings (32 acres)
- Security buildings and associated pull-off and parking areas (previously disturbed)
- Improvements/construction of the heavy haul road from the equipment barge unloading area to the Units 6 & 7 plant area (5 acres)
- Transmission infrastructure improvements (e.g., towers and bridges) (previously disturbed)
- Transmission laydown areas (3 acres)
- Sanitary waste pipeline from existing units to Units 6 & 7 plant area (previously disturbed)
- Equipment barge unloading area (0.75 acres)
- "A," "B," and "C" spoils areas (211 acres)
- Radial collector wells and associated facilities (3 acres), radial collector well laydown area (3 acres), and water supply pipelines to the Units 6 & 7 plant area (13 acres)
- FPL reclaimed water treatment facility (44 acres), reclaimed water supply pipelines to the facility from the Miami-Dade Water and Sewer Department South District Wastewater Treatment Plant, and water supply pipelines from the facility to the Units 6 & 7 plant area (6 acres)
- Potable water pipelines (previously disturbed)

Vicinity Land Disturbance

- FPL-owned fill source (300 acres)

- Improvements to SW 328th Street/N. Canal Drive, SW 344th Street/Palm Drive, SW 359th Street, SW 137th Avenue, and SW 117th Avenue (128 acres, includes improvements on plant property)

<u>Region Land Disturbance</u>

- Corridor for 72-inch diameter (or equivalent) reclaimed water pipelines (1876 acres)
- Corridor for 30-inch diameter (or equivalent) potable water pipelines (327 acres)
- Transmission corridors, access roads, and substation upgrades (approximately 5872 acres). (Disturbed area is based on Tables 2.2-2, 2.2-3, and 2.2-4.)

Table 3.9-2 summarizes the major land disturbances. Section 4.1 further discusses the major land disturbances related to construction activities and mitigation measures.

3.9.1 PRECONSTRUCTION ACTIVITIES

Preconstruction activities would commence in the 2nd quarter of 2013. The activities that could be performed include the following:

- Clearing, grubbing, and spoils area establishment
- Access roads, heavy haul roads, and equipment barge unloading area improvement
- Construction security
- Construction utilities
- Construction facilities and preparation activities
- Site earthwork, including power block
- Makeup water reservoir, cooling towers, and pipelines
- Reclaimed water pipelines
- Potable water pipelines
- FPL reclaimed water treatment facility
- Radial collector wells, associated facilities, and pipelines
- Deep injection wells

- Module assembly areas

The Construction Utilization Plan, as depicted in Figure 3.9-1, (Sheets 1 through 4), illustrates the disturbed land areas and other construction features.

3.9.1.1 Clearing, Grubbing, and Spoils Area Establishment

Clearing would begin with the removal of trees to the minimum extent necessary. Scrub vegetation and brush removal would be accomplished through the use of appropriate and approved techniques. Offsite disposal of any organic materials would be through approved local and state waste disposal techniques.

Spoils areas would be established on the Turkey Point plant property south of the Units 6 & 7 plant area to allow dewatering of materials during construction of Units 6 & 7 from such activities as clearing, grubbing, and excavation (see Subsection 3.9.1.6). Three separate spoils areas, denoted as “A,” “B,” and “C” on Figure 3.9-1 (Sheet 3 of 4), would be established at the southern end of the industrial wastewater facility. Spoils areas “A” and “C” would be located on the western and eastern side of the main return canal, respectively, and each pile would be 4.6 to 5 miles long. Spoils area “B” would be established at the southern end of the industrial wastewater facility and would be approximately 1.8 miles in length. The total area for spoils area “A,” “B,” and “C” would be approximately 77 acres, 18 acres, and 116 acres, respectively, resulting in a total spoils capacity of approximately 2 million cubic yards. The estimated height of the spoils pile will be determined after the spoils storage area has been surveyed and a final dirt road width for the berms has been established. It is anticipated that the final spoils elevation will be approximately 16–20 feet NAVD 88.

Drainage from the spoils piles would be controlled through measures such as berms, riprap, sedimentation filters, and detention ponds before any water drainage to the industrial wastewater facility.

3.9.1.2 Access Road, Heavy Haul Road, and Equipment Barge Unloading Area Improvement

Construction traffic would access the Turkey Point plant property via various routes including SW 117th Avenue, SW 137th Avenue/Tallahassee Road, SW 328th Street/N. Canal Drive, SW 344th Street/Palm Drive, and SW 359th Street. Road improvements would include widening SW 328th Street/N. Canal Drive, SW 344th Street/Palm Drive (west of SW 137th Avenue/Tallahassee Road), and SW 117th Avenue (north of SW 344th Street/Palm Drive) from two lanes to four lanes. SW 359th Street, which is currently an unimproved rock road, will be improved to a three lane road west of SW 117th Avenue and a four lane road east of SW 117th Avenue. SW 137th Avenue/Tallahassee Road is currently an unimproved dirt road and would be improved to a three lane road. SW 117th Avenue (south of SW 344th Street/Palm Drive) is currently an unimproved dirt road and would be improved to a four lane road. Road improvements, including road widening, additional turn lanes, signalization, etc. are described in Subsection 4.4.2.2.4.4. Figure 3.9-1 (Sheet 4) depicts the location of the roads.

The existing barge turning basin connects Biscayne Bay to the Turkey Point plant property, and would be used for module and component delivery. The turning basin is approximately 300 feet wide and 1200 feet long and is currently used for fuel deliveries for Units 1 & 2. There would be approximately 80 round-trip barge deliveries for modules and components for each unit over an approximately six-year duration. The existing equipment barge unloading area would be extended to approximately 90 feet by 150 feet (0.31 acres) and 9 feet deep, as part of a total disturbed area of 130 feet by 250 feet (0.75 acres), to accommodate heavy component offloading (Figure 3.9-1 [Sheet 2]). Limited dredging would likely be required as part of the upgrade.

The existing heavy haul road, originating at the equipment barge unloading area, would be improved and terminate at three distinct places on the Units 6 & 7 plant area, to facilitate unloading modules and components. The heavy haul road would be approximately 2 miles long and 24 feet wide and would disturb approximately 5 acres. The road would start at the equipment barge unloading area and extend generally west between Unit 5 and Units 1 & 2. The road would then extend generally south and cross over two new heavy haul bridges, one at the main cooling discharge canal and the other at the main cooling return canal. The heavy haul road would then terminate at three locations on the Units 6 & 7 plant area to allow for module and component delivery and placement (See Figure 3.9-1 [Sheet 1 of 4]). Culverts would be installed under the heavy haul road where required to maintain drainage patterns.

Until the heavy haul road bridges are completed, temporary bridge(s) would be installed over the main cooling discharge canal and the L-31E Canal to facilitate construction activities. These bridges would be removed after completion of the heavy haul bridges.

3.9.1.3 Construction Security

Construction security programs and features would be implemented as part of the site preparation activities. Security structures would include access control points and security stations. Temporary security measures would also be used.

Details of the site security plan are described in Part 8 of the COL Application.

3.9.1.4 Construction Utilities

Temporary utilities would include aboveground and underground infrastructure for power, lighting, communications, wastewater and waste treatment facilities, fire protection, and construction gases and air systems. The temporary utilities would support the construction site and associated activities, including construction offices, warehouses, storage and laydown areas, fabrication and maintenance shops, the power block, the concrete batch plant facility, and test and calibration labs.

3.9.1.5 Construction Facilities and Preparation Activities

The parking lot, laydown, storage and fabrication areas, and the road system to accommodate the site construction traffic would be cleared, grubbed, graded, and appropriately surfaced. Construction facilities, including offices, warehouses, workshops, sanitary facilities, locker rooms, training facilities, storage facilities, and access facilities would be constructed.

The site of the concrete batch plant would be prepared for cement and aggregate unloading and storage. Cement storage silos and the concrete batch plant would be erected. Dry material storage facilities would use dust control measures as necessary to meet the requirements of the applicable permits and guidelines.

Activities to support preparation of the construction facilities include:

- Conducting property surveys to establish local coordinates and the placement of benchmarks for horizontal and vertical control
- Developing laydown areas by grading, stabilizing canals, and surfacing these areas
- Installing construction fencing
- Installing shop and fabrication areas
- Installing concrete work slabs for formwork laydown, module assembly
- Installing equipment maintenance and parking areas
- Installing fuel and lubricant storage areas
- Installing concrete pads for cranes and crane assembly

3.9.1.6 Earthwork — Units 6 & 7 Plant Area

Significant earthwork would be required to establish finish grades at the Units 6 & 7 plant area, especially to raise the power block (i.e., Nuclear Island) to its required finished-floor elevation of 26.0 feet NAVD 88. Approximately 7.7 million cubic yards of general area (Category II) backfill would be required to raise the existing grade elevation of approximately –1.0 feet NAVD 88 to the finished grade elevation adjacent to the power block of 25.5 feet NAVD 88. Also, backfilling around the major power block Seismic Category I (safety-related) embedded structures would require approximately 130,000 cubic yards of safety-related (Category I) engineered structural backfill.

Approximate estimated fill requirements for the plant area and associated non-linear facilities and conceptual ranges for offsite transmission and access roads, are as follows:

<u>Onsite areas:</u>

- Plant Area (198 acres) — 7.8 million cubic yards
- Reclaimed Water Treatment Facility (44 acres) — 1.6 million cubic yards
- Laydown Areas (52 acres) — 0.7 million cubic yards
- Nuclear Admin/Training/Parking Area (32 acres) — 0.6 million cubic yards

<u>Offsite Areas</u>

- Transmission Roads and Pads — 2.0–3.0 million cubic yards
- Access Roads — 0.4–0.7 million cubic yards

Stabilization of the plant area perimeter to provide protection of the cooling canals of the industrial wastewater facility during excavation and removal of unsuitable material and placement of fill materials would progress in the following manner:

- To minimize potential impacts on the cooling canals, the Units 6 & 7 plant area would first be isolated from the industrial wastewater facility by installing temporary sheet piling. The sheet piling would be installed into the Miami Limestone Formation around the perimeter of the plant area with the top of the sheet piling extending somewhat above the adjacent existing grade elevation. After the area behind the sheet piling is backfilled, the sheet piling would be removed and re-used as this process moves around the perimeter of the plant area. Eventually additional erosion protection such as riprap would be installed along the perimeter of the plant area adjacent to the canals.

- After stabilizing the perimeter of the Units 6 & 7 plant area with sheet piles, the approximately 5-foot thick layer of the existing organic soil material, or “muck,” would be removed from the plant area and replaced with general area backfill to raise the surface above the maximum water levels expected in the industrial wastewater facility. An estimated 1.8 million cubic yards of muck would be removed (de-mucked), starting with a small area (approximately 20-foot wide) adjacent to (and inside of) the entire plant area perimeter. De-mucking would continue until the Miami Limestone Formation is exposed along the interior face of the sheet piling and replaced with backfill. De-mucking and placement of backfill would be carefully coordinated to minimize inflow of groundwater. The backfill would be placed and compacted to an approximate elevation of 0 feet NAVD 88 to create a working base for a mechanically stabilized earth (MSE) wall. This wall would be constructed around the perimeter of the Units 6 & 7 plant area, excluding the south side of the plant area where the makeup water reservoir would provide the plant area exterior wall. The MSE wall would be designed to retain the interior soil mass while also resisting wave forces resulting from the probable maximum hurricane (PMH). The MSE wall would extend from its base at approximately 0.0 feet NAVD 88 to a height that would range from elevation 20.0 feet to 21.5 feet NAVD 88.

- To establish a dry construction working surface at an approximate elevation of 0.0 feet NAVD 88, the remaining portions of the Units 6 & 7 plant area would be de-mucked and backfill placed and compacted in a manner similar to the perimeter. This process would proceed simultaneously in multiple areas across the plant area, sequenced to facilitate subsequent excavation activities, and would continue until the entire layer of muck is excavated and the plant area is backfilled to elevation 0.0 NAVD 88, except for the designated makeup water reservoir area which would not be backfilled. (See Subsection 3.9.1.8 for a description of construction activities for the makeup water reservoir.) Backfill would be obtained from a combination of an FPL-owned fill source located on a 300-acre plot located near Homestead Air Reserve Base approximately 4.5 miles from the plant area or other regional sources. Reused material excavated from the plant area would be used as Category I structural backfill. Figure 3.9-1 (Sheet 4) depicts the location of the FPL-owned fill source.

- The muck removed during excavation would be transferred to designated spoils areas, as depicted on Figure 3.9-1 (Sheet 2). Material removed from the deeper excavations and evaluated as acceptable for reuse would be stored for common Category II or Category I structural backfill.

3.9.1.7 Earthwork — Units 6 & 7 Power Block

The power block footprint encompasses the nuclear and turbine island building areas, which include the following major buildings for each unit:

— Containment building

— Auxiliary building

— Annex building

— Radwaste building

— Turbine building

Site preparation, excavation and foundation preparation for the Units 6 & 7 power block areas would include the following:

- The two excavations for the containment and auxiliary buildings would extend to an approximate elevation of –35.0 feet NAVD 88 or to the top of competent rock in the Fort Thompson Formation. To permit construction of the deep foundations and to hydraulically isolate this excavation from horizontal groundwater flow, a permanent reinforced concrete diaphragm “cutoff” wall would be constructed. It is anticipated that the diaphragm wall would be installed into the Key Largo Formation to a depth of approximately -60.0 feet NAVD 88 or just below a semi-confining layer in the Biscayne Aquifer. The top of the diaphragm wall would be at elevation 2.0 feet NAVD 88 or two feet above the construction working surface elevation of 0.0 feet NAVD 88.

- The cutoff wall will be constructed sequentially by excavating vertical panels, roughly 3 feet wide, by 12 to 14 feet long, by 60 feet deep to form the outer footprint of each deep nuclear island excavation. During excavation, each slot is kept filed with bentonite-base slurry, which counter balances the hydrostatic forces and lateral earth pressure. When the slot is completed, reinforcement is installed and concrete is placed through tremie pipes, displacing the excavation slurry to the top, where it is pumped to a mud pit for re-use. This installation approach, specifically the use of panels and recirculation of slurry material, will minimize the amount of slurry waste at the completion of wall installation. The remaining slurry will be dewatered and disposed of onsite at the spoils piles, located along the cooling canals of the industrial wastewater facility.

- After completion of this diaphragm wall, a horizontal seepage barrier, or grout plug, which prevents vertical seepage, approximately 25 feet thick, will be constructed from elevation -35 feet NAVD 88 to elevation -60 feet NAVD 88 by first drilling from the ground surface, and then grouting. The barrier will be integral with the diaphragm wall so that construction dewatering can be accomplished by use of sump pumps, or similar methodologies, located within the excavation.

- To install the grout plug, vertical boreholes will be drilled in a grid pattern and grouted in an iterative process, which is estimated to consist of four rounds of drilling and grouting, prior to excavation. Successive rounds of grouting will be performed by dividing the spacing of the previous round of boreholes used for grouting. The later rounds of grouting will experience lower grout “take” — that is, as formation voids and flow pathways are filled during the initial grouting rounds, the formation will “take” less grout. The use of this testing and remedial grouting phased approach, in addition to both overlapping criteria and a designed program to indicate completeness of the program — based on such factors as grout injection pressure, volume pumped into the formation, and observable seepage, if any — will determine the adequacy and completeness of the horizontal grouting program.

- A temporary dewatering system would be installed for the two power block area deep excavations. Drainage sumps would be installed at the bottom of the excavations from which surface drainage and/or accumulated groundwater would be pumped to the cooling canals of the industrial wastewater facility. The subsequent dewatering phases, known as the excavation phase and foundation construction, are further discussed in Section 4.2.

- Once construction of the diaphragm wall is completed around the planned deep foundation area, excavation of the existing material within its interior would commence using conventional methods (use of explosives would not be required). Excavated material not suitable for reuse would be transferred to the designated spoils areas, as depicted on Figure 3.9-1 (Sheet 2). Material removed from the excavation and evaluated as acceptable, would be stored on the plant area and used later as common Category II or Category I structural backfill.

- Lean concrete fill would be placed between the excavated surface of the Key Largo Limestone Formation at approximately -35.0 feet NAVD 88 and an approximate elevation of –16.0 feet NAVD 88. At this elevation, additional lean concrete fill, mud mat(s), and a waterproof membrane would provide an interface at –14.0 feet NAVD 88 for construction of the containment and auxiliary building reinforced concrete foundations. Category I structural fill would then be placed to prescribed compaction requirements in the annular space between the power block structures and the diaphragm wall. The Category I structural fill would extend to the top of the wall and additional Category I fill would be placed over Category II fill at a 1.5:1 horizontal to vertical slope past the diaphragm wall perimeter.

Once the power block area has been backfilled to the top of diaphragm wall, backfill of the remaining plant area would be completed in a sequence defined by the construction schedule. Finished grade of the plant area would slope up from an approximate elevation of 19.0 feet NAVD 88 (adjacent to the perimeter retaining wall) to elevation 25.5 feet NAVD 88 at the power block area near the center of the plant area. The slope of the finished grade would be approximately 0.5 percent from the exterior walls to the power block areas with contours and swales to allow drainage into the surrounding canals.

3.9.1.8 Makeup Water Reservoir, Cooling Towers, and Makeup Water Supply Pipelines

The makeup water reservoir (a reinforced concrete structure with a footprint of approximately 37 acres) would be located in the south end of the plant area. Six (6) mechanical draft cooling towers (three per unit) would be installed over the reservoir to maximize size of the reservoir. Site preparation, excavation and construction of the reservoir would include the following:

- The south perimeter of the plant area would be stabilized similar to the remainder of the plant area perimeter by driving sheet piles into the Miami Limestone Formation. In addition to restraining the return canals, this sheet piling would function as sacrificial formwork when the reservoir exterior wall is poured and only the exposed portion above approximate elevation 0.0 NAVD 88 would be removed.

- After stabilizing the canals, the muck behind the sheet piles would be excavated to the top of the Miami Limestone Formation and placed in the designated spoils areas.

- General area dewatering would not be required as the surface of the excavated area would be sealed by tremie concrete (if required) to minimize in-leakage of ground water. Local de-watering in the area of the deeper cooling tower foundations would be required and pressure grouting might be required to facilitate this dewatering.

- Concrete would be placed over the excavated area to form the reservoir base slab. The top of the base slab would be at elevation –2.0 feet NAVD 88. Reinforced concrete walls would then be constructed with the top elevation at 24.0 feet NAVD 88.

The circulating water system piping would be routed from the discharge of the circulating water pumps located on the north side of the makeup water reservoir, to the condenser in the turbine building and from the condenser to the cooling towers. The section of the circulating water piping extending beneath the condenser would require a deep excavation and local dewatering. The remaining sections of the circulating water piping would be above the Miami Limestone and would be installed as the plant area is backfilled and would not require dewatering. Completion of the circulating water system piping installation would coincide with the turbine building pedestal basemat placement.

Blowdown piping would be routed from the circulating water discharge header to the blowdown sump on the east side of the plant area. These lines would be installed above the Miami Limestone as the plant area is backfilled.

The reclaimed water pipelines would be routed from the FPL reclaimed water treatment facility to the west side of the makeup water reservoir. Excavation would be required between the FPL reclaimed water treatment facility and the plant area, but the pipelines would be above ground on the plant area.

The pipelines from the radial collector wells would require excavation on the Turkey Point peninsula and the existing berm east of the plant area, but would be above ground on the plant area.

3.9.1.9 Reclaimed Water Pipelines and Potable Water Pipelines

Reclaimed water supply pipelines would be constructed to supply reclaimed water to the FPL reclaimed water treatment facility. The buried pipelines (72-inch diameter or equivalent) would be constructed from the Miami-Dade Water and Sewer Department South District Wastewater Treatment Plant to the FPL reclaimed water treatment facilility on the Turkey Point plant property. The length of the pipelines would be approximately 9 miles. For about 6.5 miles of their length, the pipelines would be collocated with the existing Clear Sky-to-Davis transmission line right-of-way and adjacent road and canal rights-of-way. The remaining approximately 2.5 miles would be located within a new pipeline corridor. The corridor for this pipeline is approximately 1876 acres. Figure 3.9-1 (Sheet 4 of 4) shows the location of the reclaimed water pipelines.

The FPL reclaimed water treatment facility would be located northwest of the Units 6 & 7 plant area, as shown on Figure 3.9-1 (Sheet 2 of 4). Considering the additional area required for equipment laydown, parking, and other associated facilities, the total disturbed area would be approximately 44 acres.

Potable water pipelines would be constructed to supply potable water to Units 6 & 7. The buried pipelines (30-inch diameter or equivalent) would originate from an existing MDWASD supply line at the intersection of SW 288th Street and SW 137th Avenue/Tallahassee Road and proceed south to SW 328th Street/N. Canal Drive. The pipelines would then run east along SW 328th Street/N. Canal Drive to SW 117th Avenue and then south towards SW 359th Street. At the intersection of SW 359th Street, the pipelines would run east to the Turkey Point plant property. The estimated length of the potable water pipelines would be 8 miles to the plant property. The corridor for this pipeline, which will run concurrent with road improvements at several locations, is 327 acres.

3.9.1.10 Radial Collector Wells

Radial collector wells would be constructed to supply approximately 86,400 gpm of makeup water to the circulating water system cooling towers. As shown on Figure 3.9-1 (Sheet 2 of 4), the well caissons would be located on the Turkey Point peninsula, east of the existing units. Each radial collector well would consist of a central reinforced concrete caisson extending below the ground level with laterals projecting from the caisson. The well laterals would be advanced horizontally a distance of up to 900 feet and installed at a depth of approximately 25 to 40 feet below the bottom of Biscayne Bay. The design for a typical radial collector well is illustrated in Figure 3.4-2. The wells would be designed and located to induce recharge from Biscayne Bay. The radial collector well locations are shown in Figure 3.1-3.

3.9.1.11 Deep Injection Wells

Twelve deep injection wells (ten primary and two backup) would be installed, by drilling, in the plant area to provide a means of disposal of treated wastewater, sanitary waste, blowdown, and treated liquid radioactive waste effluent. The deep injection wells would be 24-inch-diameter wells and would extend approximately 2900 to 3500 feet below grade. Six dual-zone monitoring wells would also be installed by drilling to approximately 1900 feet below grade. During the deep injection and monitoring well installation, a recirculation slurry tank will be utilized to separate the drill cuttings and sand from the slurry mixture in order to re-use the slurry and minimize waste. The slurry mixture is composed primarily of bentonite, which is a nonhazardous material that is widely used in water and monitoring well installation.

Upon completion of well installation activities, excess water will be pumped from the recirculation tank, settled, and released to the industrial wastewater facility. The waste slurry mixture will be hauled to the spoils storage area for disposal. The estimated amount of waste slurry for one deep injections well and one dual-zone monitoring well is approximately 600 cubic yards and 260 cubic yards, respectively, or 8,760 cubic yards for the complete system of 12 deep injection wells and 6 dual-zone monitoring wells. A concrete surface pad would complete each deep injection well installation. The location of the deep injection wells are shown on Figure 3.1-3.

3.9.1.12 Module Assembly

The AP1000 design uses a modularization construction approach. Module components would be fabricated offsite, shipped to the site via truck or barge, and assembled into complete modules before being set in the power block. Modules that arrive by barge would be transported to the power block area or offloaded in fabrication assembly areas.

3.9.2 COL CONSTRUCTION ACTIVITIES

The construction activities that would be performed after receipt of the COL, including the structural construction and completion of structures, systems, and components, are presented in the following subsections.

3.9.2.1 Structural Construction

Each AP1000 unit is a series of buildings and structures with systems installed within the structures. Much of the commodity installation would consist of prefabricated civil/structural, electrical, mechanical, and piping modules with field-installed interconnections. The balance of the field installation consists of bulk commodity installation. Power plants are typically constructed with the major mechanical and electrical equipment and piping systems installed in each respective elevation as the civil construction advances upward. Each power block consists of five major buildings. The following is a brief description of each major building, along with the approximate maximum height of each above plant grade. Table 3.9-1 summarizes the estimated durations for major power block construction activities.

As described in Subsection 3.9.1.8, the power block is an AP1000 consisting of the following steel and concrete buildings:

- Containment building
- Auxiliary building
- Annex building
- Radwaste building
- Turbine building

The buildings, including dimensions, are described in the following paragraphs.

Containment Building

The containment building is constructed of steel and concrete with two floor elevations below plant grade and one floor elevation above grade. The containment building is a circular building with a diameter of approximately 142 feet and a height above grade (note: local grade is defined as 25.5 foot NAVD 88) of approximately 229 feet. The major activities associated with the containment building construction following the basemat foundation placement include:

- Erecting the containment vessel modules
- Placing the walls, slabs, platforms, and reactor supports
- Installing the reactor pressure vessel, steam generators, and heat exchangers
- Setting the major mechanical and electrical equipment, piping, and valves
- Installing the fuel transfer tubes
- Setting the refueling machine and the containment building crane
- Setting the upper containment building roof structure

The remaining mechanical, piping, fire sprinklers system, HVAC, and electrical installations begin in the lower elevations and continue to the upper elevations. This is the case with each of the other buildings. The containment building has the longest construction duration.

Auxiliary Building

The auxiliary building abuts the containment building and has five floor elevations (two stories below grade and three stories above grade) and reaches a height of approximately 81 feet above plant grade. The footprint of this building is approximately 254 feet by 116 feet.

Annex Building

The annex building has three main floor elevations (all above grade) and reaches a height of approximately 83 feet above plant grade. The footprint of this building is approximately 285 feet by 132 feet.

Turbine Building

The turbine building has five main floor elevations (one below plant grade and four above) and reaches a height of approximately 146 feet above plant grade. The footprint of this building is approximately 310 feet by 156 feet.

The turbine building construction would begin with the installation of turbine generator pedestal basemat and the buried circulating water pipe, followed by installation of the turbine generator pedestal columns, steam condenser modules, and turbine generator pedestal deck. The turbine generator building would then be erected once the turbine generator pedestal is complete, followed by the turbine building crane. Installation and assembly of the turbine generator would then proceed.

Radwaste Building

The radwaste building has one floor elevation above grade and reaches a height of approximately 36 feet above plant grade. The footprint of this building is approximately 175 feet by 88 feet.

3.9.3 OTHER FACILITIES AND SITE COMPLETION

Other facilities to be constructed/installed include:

- Substation, transformers, and transmission lines
- Warehouses
- Tunnels and pipe chases
- Electrical and diesel generator buildings
- Hot and cold machine shop

- Sewage treatment facility
- Fire protection pump house
- Security stations, sally ports, protected area, and delay fence
- Administration building(s)
- Various yard tanks
- Hydrogen, nitrogen, oxygen, and carbon dioxide storage facilities

The common yard area construction would occur over the full construction duration from the start of site preparation. The necessary permits and authorizations would be acquired to ensure compliance with applicable rules and regulations (see Section 1.2).

After completion of major construction activities, the Units 6 & 7 plant area would be graded to an elevation of approximately 19 feet NAVD 88 at the perimeter, sloping to a finished grade elevation of 25.5 feet NAVD 88 at the power block area.

Table 3.9-1
Construction/Operation Milestones[a]

Activity	Start	Finish
Preconstruction Activities	2Q 2013	4Q 2018
Construction Activities		
• Unit 6	3Q 2016	1Q 2022[b]
• Unit 7	3Q 2017	1Q 2023[b]
Fuel Load/Startup Activities		
• Unit 6	1Q 2022	3Q 2022
• Unit 7	1Q 2023	3Q 2023
Commercial Operation		
• Unit 6	3Q 2022	NA
• Unit 7	3Q 2023	NA

(a) All dates are approximate.
(b) 48 month standard plant construction plus activities under NRC authority (e.g., slurry wall installation)

Table 3.9-2 (Sheet 1 of 2)
Disturbed Area Acreage

Disturbed Area	Acreage
Turkey Point Property	
Units 6 & 7 plant area	218
Western laydown area	52
Training parking	9
Nuclear Administration parking	23
Heavy haul road	5
Access road upgrades	Note (1)
Transmission infrastructure improvements	Note (1)
Transmission laydown areas	3
Sanitary waste pipeline	Note (1)
Equipment barge unloading area	0.75
“A”, “B”, “C” spoils area	211
Radial collector wells and associated facilities	3
Radial collector well laydown area	3
FPL reclaimed water treatment facility	44
Reclaimed water supply pipeline to Units 6 & 7	6
Radial collector well water supply pipelines	13
Vicinity	
FPL-owned offsite fill source	300
Road Improvements (128 acres total)	
SW 117th Ave. North	9
SW 117th Ave. South	8
SW 137th Ave.	7
SW 328th St.	24
SW 344th St.	2
SW 359th Ave. East	47
SW 359th Ave. West	31
Region	
Reclaimed water pipeline corridor	1876
Potable water pipeline corridor	327
Transmission	
East Preferred Corridor (1635 acres total)	
Clear Sky to Davis	635
Davis to Miami	1000
West Preferred Corridor (3356 acres total)	
Clear Sky to Levee — 1st leg	1379
Clear Sky to Levee — 2nd leg	1413
Clear Sky to Levee — 3rd leg	252
Levee to Pennsuco	312
West Secondary Corridor (2442 acres total)	
Clear Sky to Levee — 1st leg	1379
Clear Sky to Levee — 2nd leg	499
Clear Sky to Levee — 3rd leg	252
Levee to Pennsuco	312
West Corridor Transmission Access Road 1	11

Table 3.9-2 (Sheet 2 of 2)
Disturbed Area Acreage

Disturbed Area	Acreage
West Corridor Transmission Access Road 2	365
Levee substation	2
Pennsuco substation	2
Davis substation	1
Turkey Point substation	1

(1) Previously disturbed land

Figure 3.9-1 Construction Utilization Plan (Sheet 1 of 4)

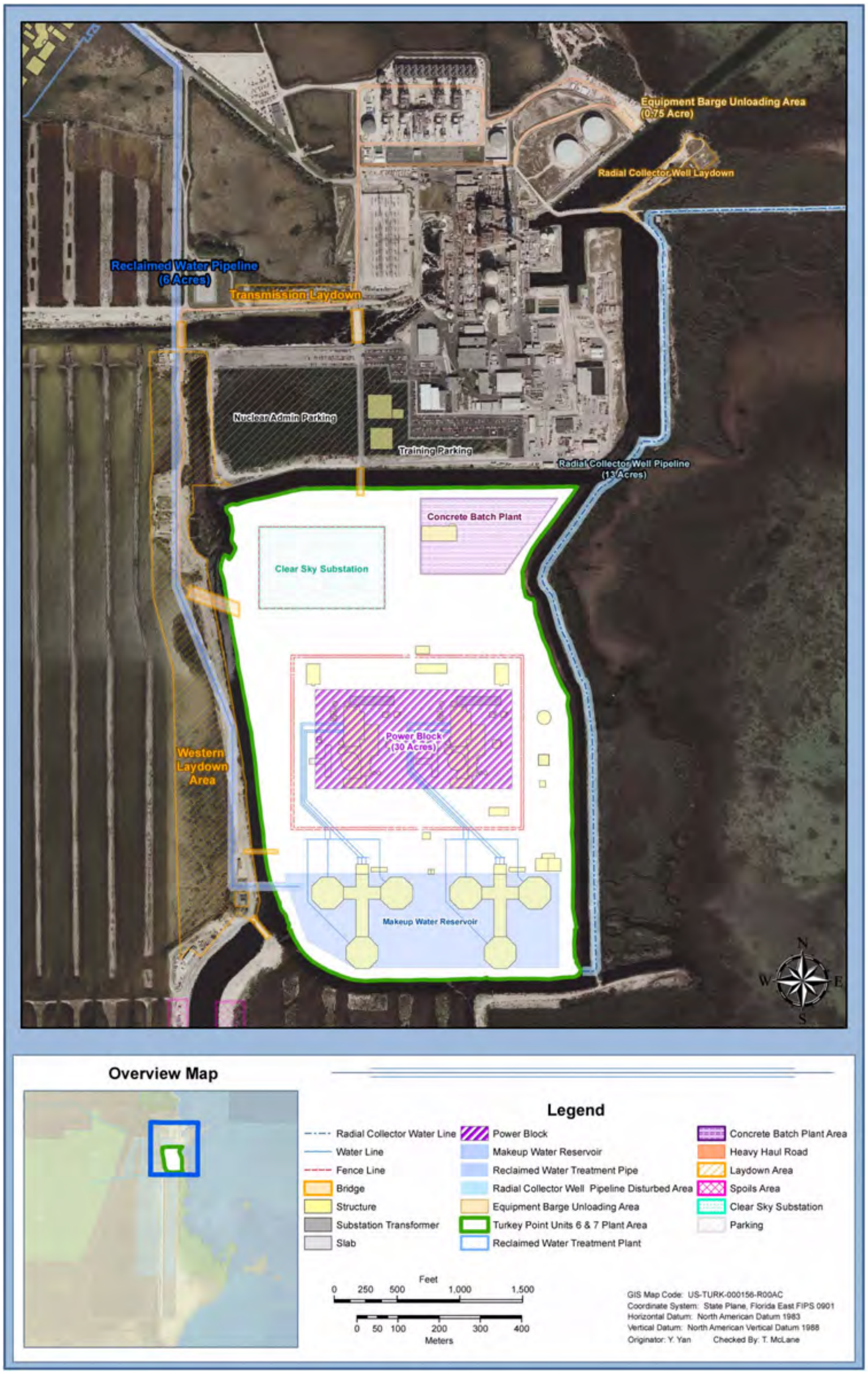


Figure 3.9-1 Construction Utilization Plan (Sheet 2 of 4)

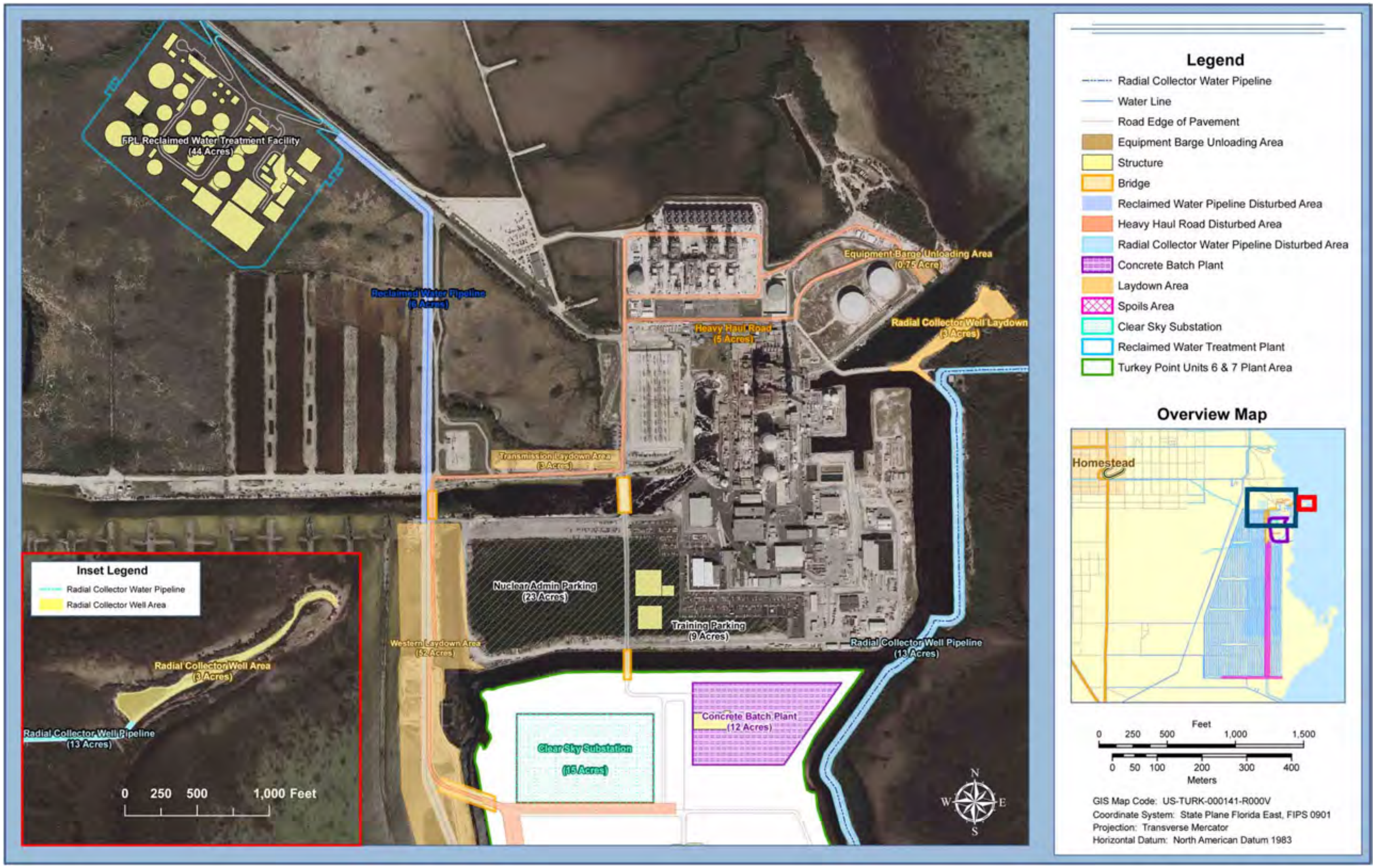


Figure 3.9-1 Construction Utilization Plan (Sheet 3 of 4)

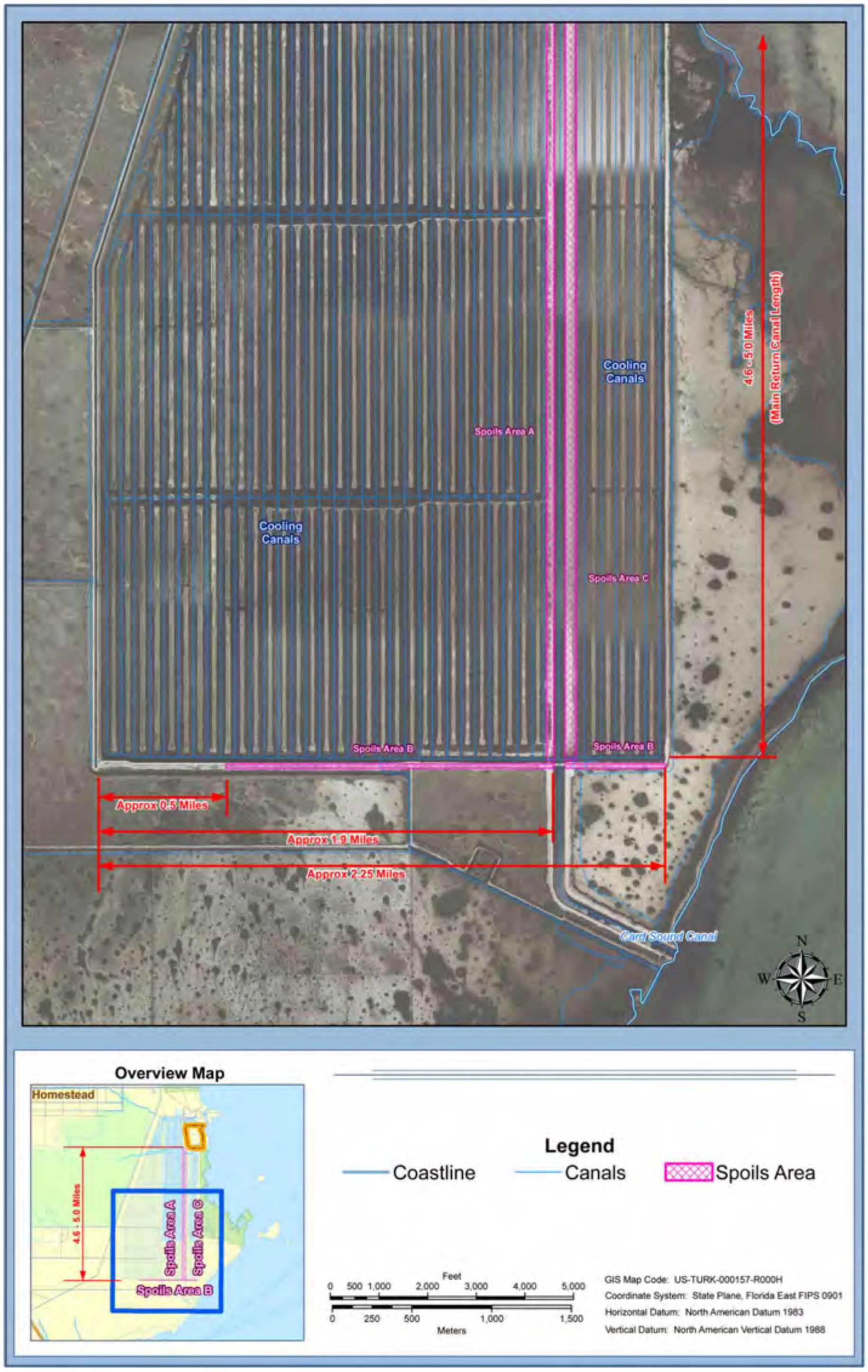
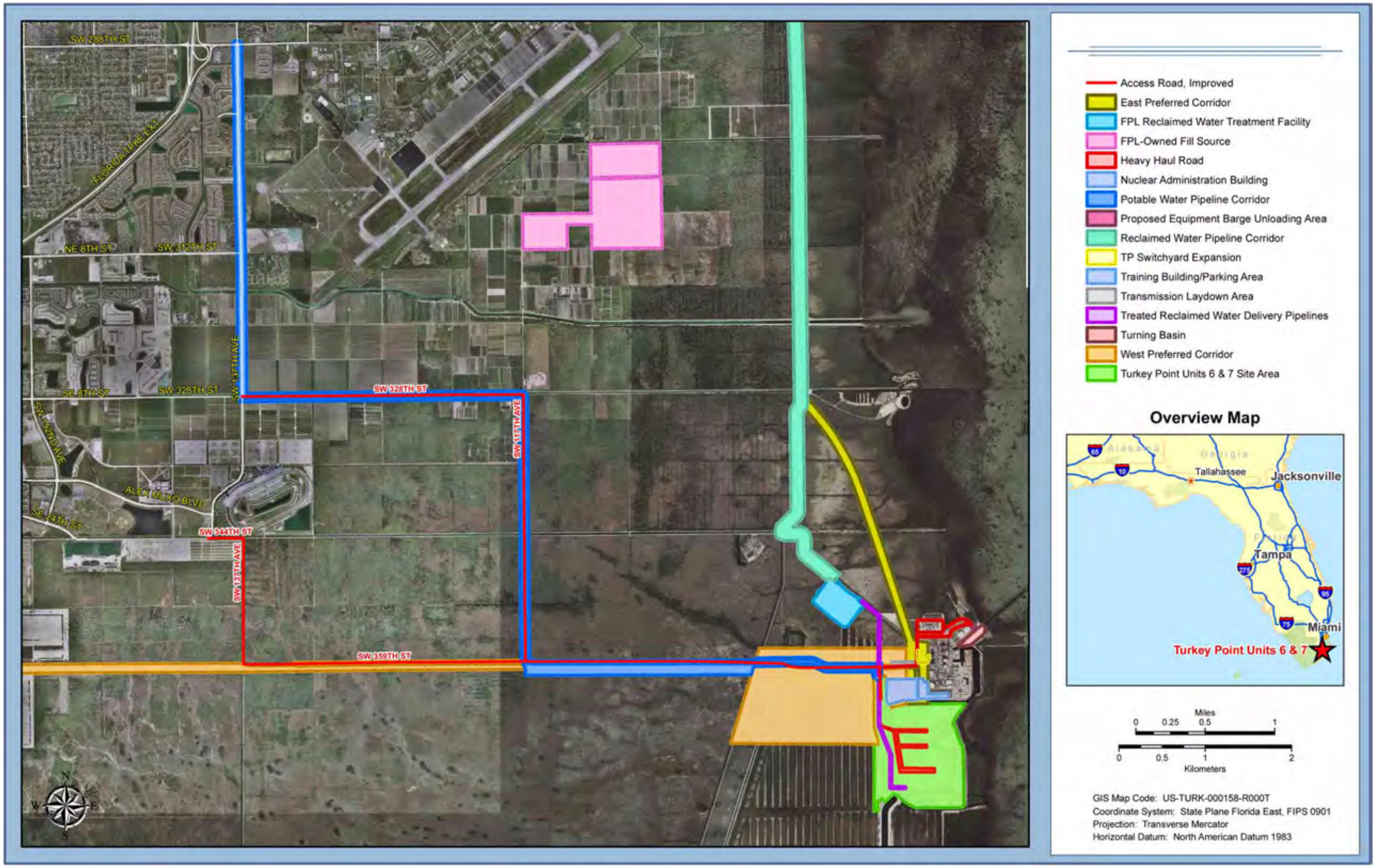


Figure 3.9-1 Construction Utilization Plan (Sheet 4 of 4)



3.10 WORKFORCE CHARACTERIZATION

A characterization of the workforce for the construction and operation of Units 6 & 7 is needed to assess the environmental and socioeconomic impacts of new unit construction and operation, as described in Sections 4.4 and 5.8, respectively. This workforce characterization involves estimating the number of personnel for construction and operation of Units 6 & 7, workforce relocation, and commuting.

As presented in Section 3.9, the construction and operation of Units 6 & 7 would be executed in distinct phases, as summarized below:

- Preconstruction Activities
- Construction Activities
- Operation

The estimated workforce, characterization, and relocation/commuting are described in the following paragraphs.

3.10.1 CONSTRUCTION WORKFORCE CHARACTERIZATION

The construction workforce for preconstruction and Units 6 & 7 construction activities would generally consist of two components: field craft labor and field nonmanual labor. Field craft labor would be the largest component of the construction workforce, consisting of approximately 75 percent of the field workforce based on conventional PWR nuclear plant construction. This labor force would consist of various disciplines, including civil, electrical, mechanical, piping, and instrumentation personnel. This labor force would be used during the construction and startup of the units. Field nonmanual labor would make up the balance of the construction workforce, or approximately 25 percent, with the assumption that design engineering would be performed offsite. The field nonmanual labor workforce would be comprised of field management, field supervision, field engineers, quality assurance/quality control, environmental/safety and health, and administrative/clerical staff.

Table 3.10-1 illustrates the representative percentage ranges for each discipline for the field craft and field nonmanual labor categories for all construction activities. The skill set makeup is representative of conventional PWR nuclear power plant construction.

3.10.1.1 Preconstruction Activities Workforce

As described in Section 3.9, preconstruction activities could occur 39 months (start of 2nd quarter 2013 through end of 2nd quarter 2016) before the start of safety-related construction for Units 6 & 7. The onsite peak construction workforce is estimated to be approximately 1475 personnel during this time period, working 40 hours per week. Table 3.10-2 and Figure 3.10-1 summarize the workforce personnel requirements by month for preconstruction activities.

3.10.1.2 Units 6 & 7 Construction Activities

The AP1000 design uses a modular construction approach. The amount of modularization depends on the characteristics of the site, transportation route restrictions, and methods. Modularization shifts some of the onsite work (and workforce) to another offsite location, thereby decreasing the required onsite construction staff. The construction duration and estimated onsite workforce presented assumes offsite fabrication with onsite module assembly.

The total onsite construction workforce, assuming the sequential construction of two units, per the construction schedule presented in Section 3.9, is based on an estimated 20.5 jobhours per net kW of generating capacity. This estimate is based on conventional non-modular PWR construction projects started after 1974, with an adjustment in jobhours/net kW for offsite modular fabrication. The estimated net generating capacity (MWe) for each unit is 1100 MWe.

In order to begin commercial operation of Units 6 & 7 in 2022 and 2023, respectively, the construction schedule assumes a 66-month duration from the start of activities under NRC authority to Unit 6 fuel load, including 6 months for startup. Unit 7 safety-related construction would begin 12 months after Unit 6 safety-related construction initiation and would follow an identical activity and duration schedule. This results in a total schedule duration of 123 months. Based on this schedule and the jobhour/net kW criteria, the onsite, peak construction workforce for the construction of the two units is estimated to be 3950 people, working 40 hours per week. Table 3.10-2 and Figure 3.10-1 summarize the workforce requirements by month of Units 6 & 7 construction activities.

3.10.2 CONSTRUCTION WORKER RELOCATION AND COMMUTING

Several assumptions are used to bound the construction workforce composition with respect to workforce commuting and relocation. It is assumed that construction workers typically commute up to a maximum of 50 miles to the jobsite. The Units 6 & 7 plant area is within 50 miles of the greater Miami-Dade metropolitan area, a large population center. It is conservatively assumed that 50 percent of the construction field craft labor workforce would be available to the project from within 50 miles, or approximately 1481 local craft personnel (based on a peak construction workforce personnel number of 3950 and 75 percent field craft labor). The balance of the construction workforce (1481 personnel) is assumed to come from outside the 50-mile radius. These personnel would relocate within the 50-mile area to minimize their commute distance and seek temporary housing.

It is further assumed that 50 percent of the field nonmanual labor workforce (494 based on 25 percent field nonmanual labor) would relocate to the area from outside the 50-mile radius and seek permanent housing.

3.10.3 OPERATIONS WORK FORCE

A study commissioned by the U.S. Department of Energy (U.S. DOE May 2004) estimated the additional operations workforce for a new unit constructed at an existing site for various new reactor technologies. Applying the DOE study analysis to Units 6 & 7 for two AP1000 units, it is estimated that the onsite operations workforce would be 403 personnel for each unit, or 806 personnel for the purpose of this ER. Fifty percent of the operations workforce is assumed to be recruited and trained from outside the Miami-Dade metropolitan area.

It is assumed that operations staffing would begin approximately 2 years before fuel load of Unit 6 to allow time for simulator training and startup testing support and increase to the full complement of personnel at the time of Unit 7 operation. Figure 3.10-2 graphically illustrates the operations workforce by month. Figure 3.10-3 illustrates the combined construction and operations workforce, by month, through initiation of Units 6 & 7 commercial operation.

Section 3.10 References

U.S. DOE (U.S. Department of Energy) 2004, S*tudy of Construction Technologies and Schedules, O&M Staffing and Cost, Decommissioning Costs and Funding Requirements for Advanced Reactor Designs*, Volume 1. Prepared under Cooperative Agreement DE-FC07-03ID14492, Prepared by Dominion Energy, Inc., Bechtel Power Corporation, TLG, Inc., and MPR Associates, May 27, 2004. Available at: http://www.ne.doe.gov/np2010/reports/1dominionstudy52704.pdf.

Table 3.10-1
Estimated Percent of Onsite Construction Labor Force by Category for Units 6 & 7

Labor Category	Installation Items/Responsibility	Estimated Percent of Total Workforce
Mechanical Equipment	NSSS, Turbine Generator, Condenser, Process Equipment, HVAC	3–4
Electrical	Equipment, Cable, Cable Tray, Conduit, Wire, Connections	10–12
Concrete	Concrete and Reinforcing Steel	10–15
Structural steel	Structural and Miscellaneous Steel	2–4
Other civil	Piling, Architectural Items, Painting, Yard Pipe, Earthwork	2–5
Piping/instrumentation	Pipe, Tubing, Valves, Hangers/ Supports	14–20
Site support	Scaffolding, Equipment Operation, Transport, Cleaning, Maintenance, etc.	25–30
Specialty labor	Fireproofing, Insulation, Rigging, etc.	7–13
Nonmanual labor	Management, Supervision, Field Engineering, QA/QC, Safety and Health, Administration	25–30

Table 3.10-2
Estimated Construction Workforce by Month for Turkey Point Units 6 & 7

Month	Number of Employees	Month	Number of Employees	Month	Number of Employees
Preconstruction Activities begin month -39		2	1525	43	3925
-39	40	3	1550	44	3900
-38	45	4	1600	45	3870
-37	55	5	1625	46	3850
-36	60	6	1650	47	3825
-35	70	7	1675	48	3800
-34	75	8	1700	49	3775
-33	90	9	1725	50	3750
-32	100	10	1750	51	3725
-31	110	11	1775	52	3700
-30	130	12	1800	53	3675
-29	150	Unit 7 Construction begins month 13		54	3650
-28	180	13	1825	55	3625
-27	230	14	1850	56	3600
-26	280	15	1900	57	3575
-25	320	16	1950	58	3550
-24	390	17	2000	59	3525
-23	465	18	2100	60	3500
-22	540	19	2250	61	3450
-21	575	20	2350	62	3400
-20	650	21	2450	63	3300
-19	740	22	2600	64	3200
-18	825	23	2750	65	3100
-17	900	24	2900	66	3000
-16	1000	25	3050	67	2900
-15	1020	26	3200	68	2800
-14	1090	27	3350	69	2700
-13	1180	28	3500	70	2600
-12	1200	29	3650	71	2500
-11	1220	30	3850	72	2400
-10	1240	31	3950	73	2300
-9	1300	32	3950	74	2200
-8	1320	33	3950	75	2100
-7	1340	34	3950	76	1900
-6	1350	35	3950	77	1700
-5	1375	36	3950	78	1500
-4	1400	37	3950	79	1300
-3	1425	38	3950	80	1100
-2	1450	39	3950	81	800
-1	1475	40	3950	82	550
Unit 6 construction begins month 1		41	3950	83	450
1	1500	42	3950	84	375

Table 3.10-3
Estimated Operational Workforce by Month for Turkey Point Units 6 & 7

Month	Unit 6	Unit 7	Total Operations Workforce
41	16	–	16
42	33	–	33
43	49	–	49
44	66	–	66
45	82	–	82
46	99	–	99
47	115	–	115
48	132	–	132
49	148	–	148
50	164	–	164
51	181	–	181
52	197	–	197
53	214	16	230
54	230	33	263
55	247	49	296
56	263	66	329
57	280	82	362
58	296	99	395
59	313	115	428
60	329	132	461
61	345	148	493
62	362	164	526
63	378	181	559
64	395	197	592
65	403	214	617
66	403	230	633
67	403	247	650
68	403	263	666
69	403	280	683
70	403	296	699
71	403	313	716
72	403	329	732
73	403	345	748
74	403	362	765
75	403	378	781
76	403	395	798
77	403	403	806
78	403	403	806
79	403	403	806
80	403	403	806
81	403	403	806
82	403	403	806
83	403	403	806
84	403	403	806

Figure 3.10-1 Projected Onsite Construction Workforce by Month for Units 6 & 7

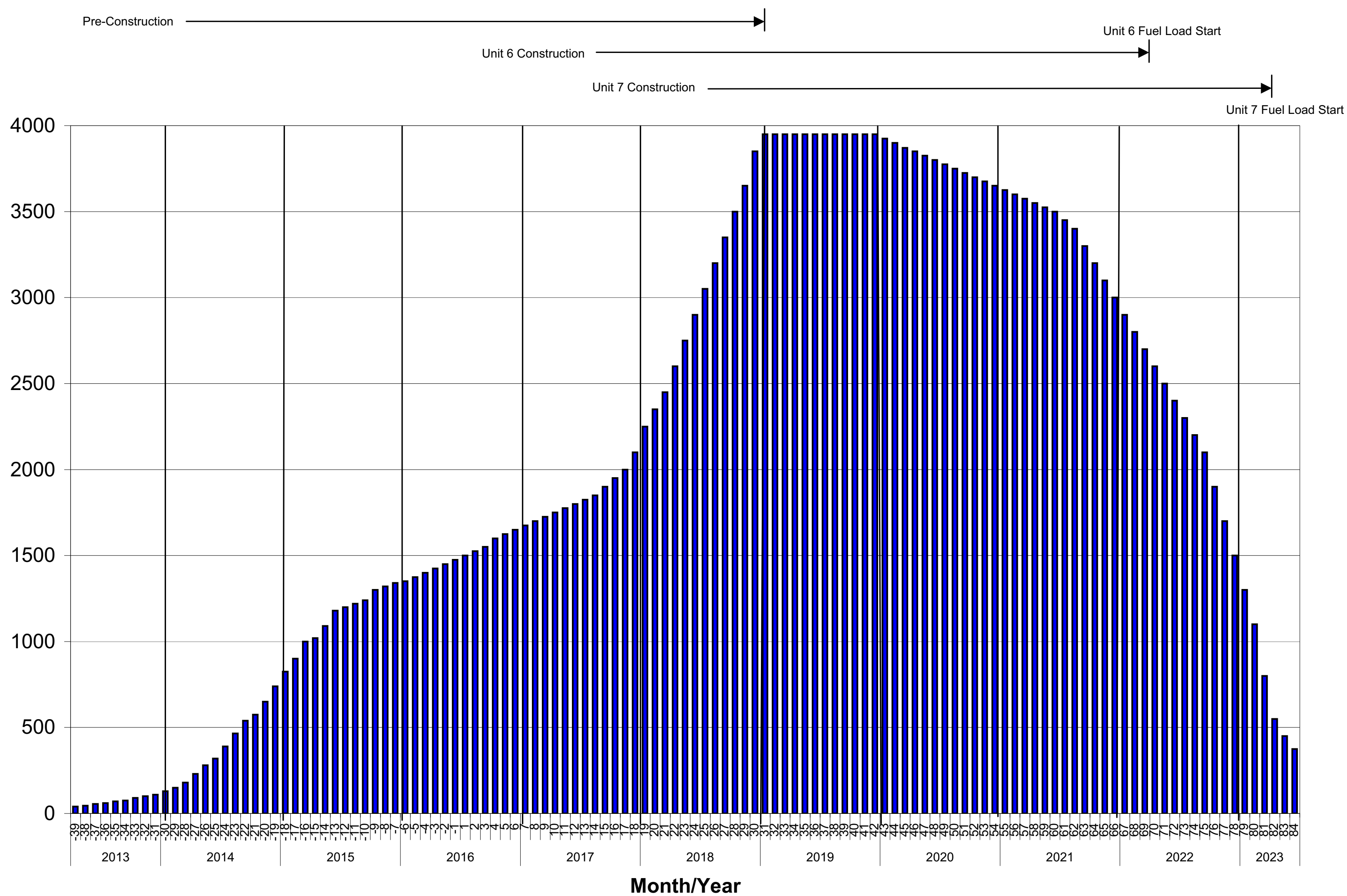


Figure 3.10-2 Projected Onsite Operations Workforce by Month for Units 6 & 7

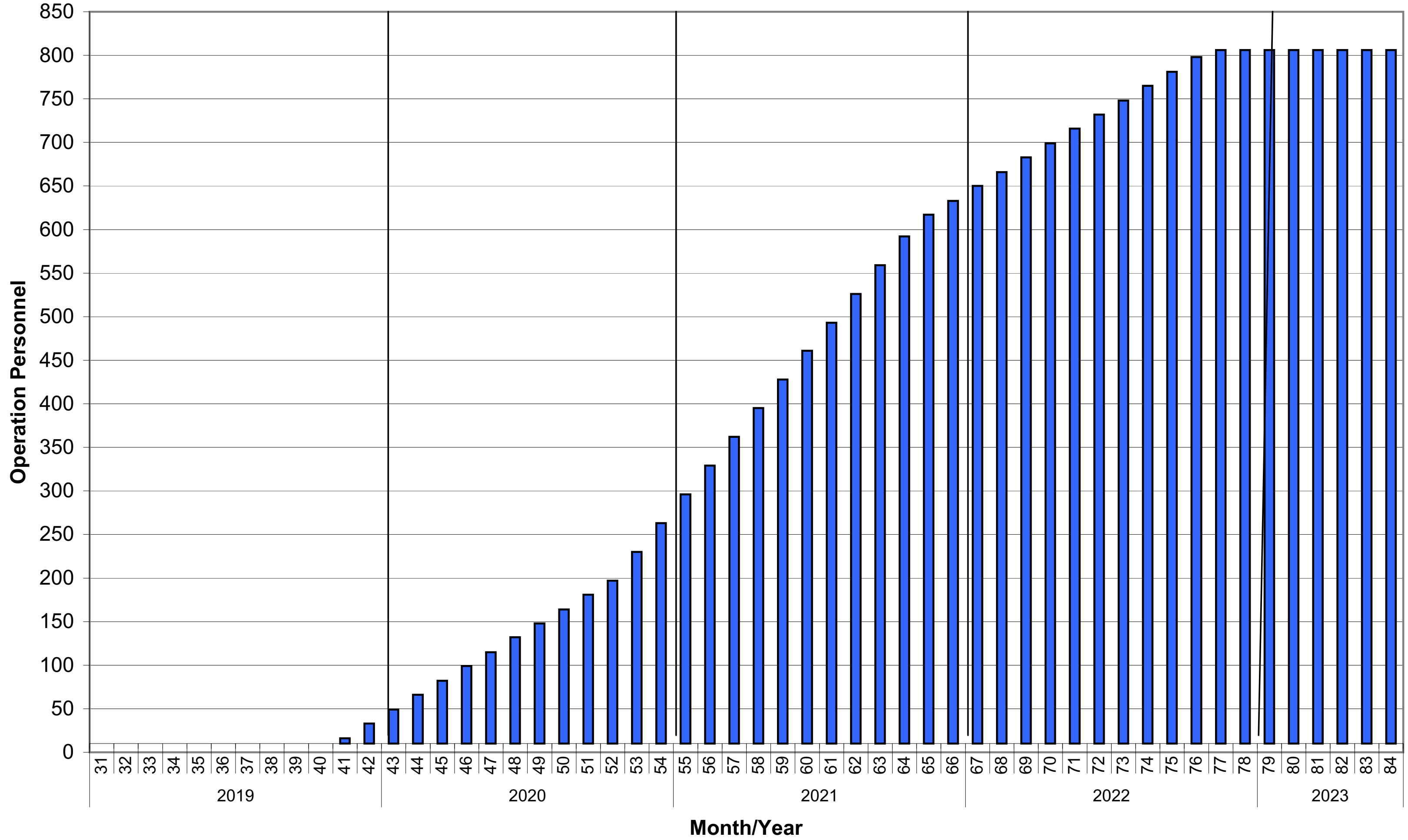
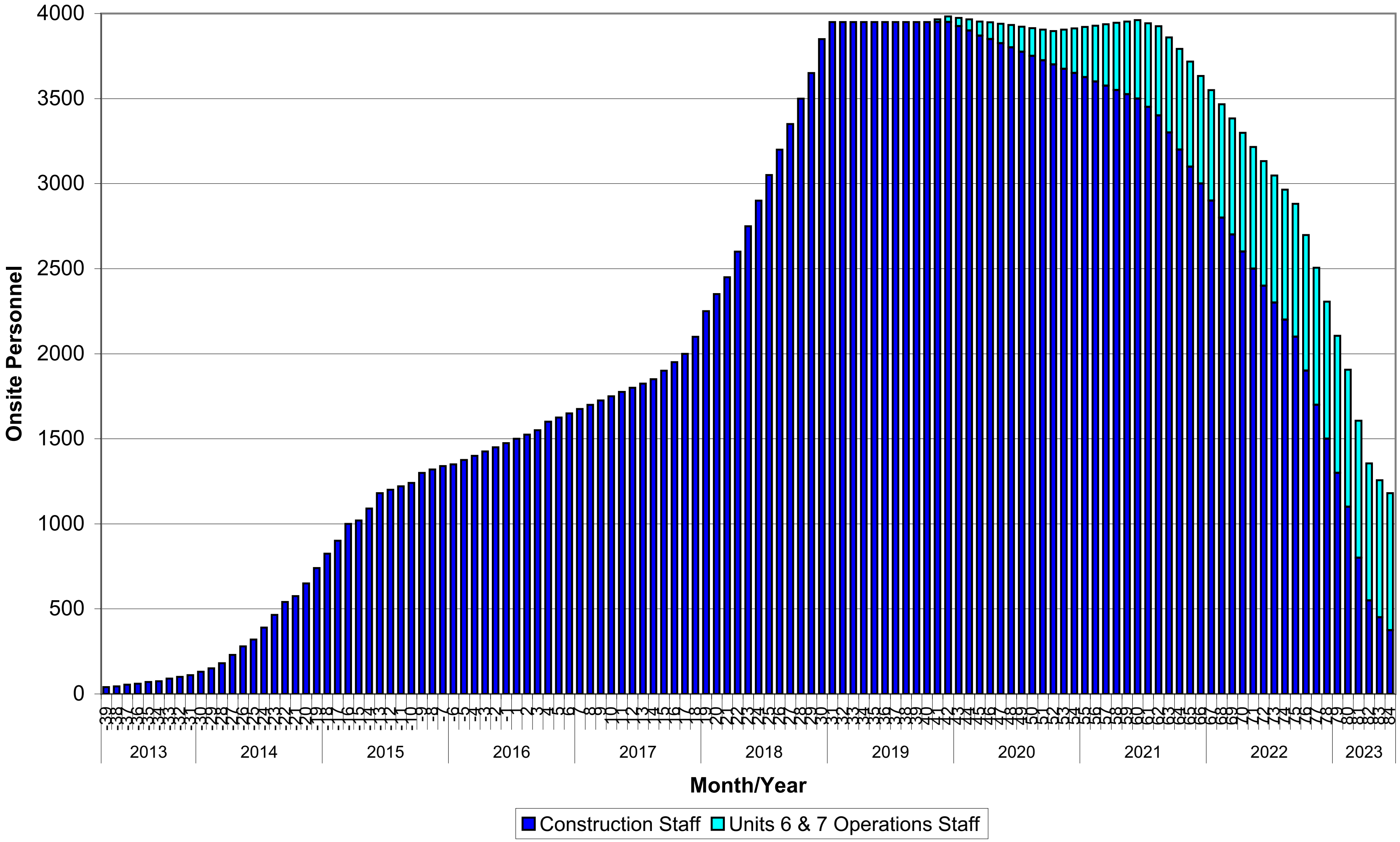


Figure 3.10-3 Projected Onsite Construction and Operations Workforce by Month for Units 6 & 7



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4.0 ENVIRONMENTAL IMPACTS OF CONSTRUCTION

Chapter 4 presents the potential environmental impacts of construction of Units 6 & 7. Impacts are analyzed, and a single significance level of potential impact to each resource (i.e., SMALL, MODERATE, or LARGE) is assigned consistent with the criteria that NRC established in 10 CFR 51, Appendix B, Table B-1, Footnote 3 as follows:

SMALL — Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, the Commission has concluded that those impacts that do not exceed permissible levels in the Commission's regulations are considered small.

MODERATE — Environmental effects are sufficient to alter noticeably, but not to destabilize, any important attribute of the resource.

LARGE — Environmental effects are clearly noticeable and are sufficient to destabilize any important attributes of the resource.

This chapter is divided into eight sections:

- Land Use Impacts (Section 4.1)
- Water-Related Impacts (Section 4.2)
- Ecological Impacts (Section 4.3)
- Socioeconomic Impacts (Section 4.4)
- Radiation Exposure to Construction Workers (Section 4.5)
- Measures and Controls to Limit Adverse Impacts During Construction (Section 4.6)
- Cumulative Impacts Related to Construction Activities (Section 4.7)
- Nonradiological Health Impacts (Section 4.8)

4.1 LAND USE IMPACTS

The following subsections describe the potential impacts of construction of Units 6 & 7 and associated facilities on land use. Based on NUREG-1555 guidance, the assessment of potential impacts is differentiated according to geographic area: (1) impacts to land use on the Turkey Point plant property (defined as the "site" for this section) and within a six-mile radius of Units 6 & 7 (defined as the "vicinity" of the site) as a result of construction activities (Subsection 4.1.1) and (2) impacts to land use at the specific area locations of construction activities for the associated transmission line corridors and other project facilities that are outside the Turkey Point plant property (defined as "offsite") and may or may not be located in whole or in part within the vicinity of the site (Subsection 4.1.2). The assessment of project land use impacts also includes a separate assessment of potential impacts to historic and cultural resources (Subsection 4.1.3).

4.1.1 THE SITE AND VICINITY

4.1.1.1 The Site

4.1.1.1.1 Site Conditions and Construction Activities

Units 6 & 7 and their associated infrastructure, including the mechanical draft cooling towers, makeup water reservoir, substation, deep injection wells, associated buildings, etc. would be located on the approximately 218-acre Units 6 & 7 plant area. A temporary concrete batch plant would also be constructed on the plant area for use during construction (Figure 3.9-1).

As described in Sections 2.2 and 2.4, the Units 6 & 7 plant area presently consist of hypersaline mudflats (majority of the plant area), open water, dwarf mangroves, uplands and wetlands, man-made remnant canals, mangrove heads, and fill areas/roadways. Specific land use classes include 0.30 acres of streams and waterways/canals, 8.38 acres of ditches, 12.14 acres of mangrove heads, 182.05 acres of non-vegetated wetlands, 6.35 acres of spoils area, and 9.05 acres of wetland spoils area. Table 4.3-1 summarizes the land use for disturbances within the plant area, based on Table 3.9-2. The plant area has been previously disturbed by construction and operational activities associated with the other Turkey Point Units. The plant area has been isolated from tidal water influence as a result of the isolation afforded by the cooling canals of the industrial wastewater facility. Construction plans are for the entire 218-acre plant area to be disturbed, as described in Section 3.9. The plant area would be permanently occupied during Units 6 & 7 operation.

Additional supporting facilities and infrastructure would be constructed on the Turkey Point plant property. These facilities and infrastructure include laydown areas (including transmission and radial collector well areas), parking areas, nuclear and administration buildings, heavy haul road, equipment barge unloading area improvements, radial collector wells and pipelines, FPL reclaimed water treatment facility and pipelines, security buildings, onsite transmission infrastructure improvements, potable water pipelines, bridge improvements/construction, access road improvements, and spoils areas. Most of the construction of the associated facilities and infrastructure necessary for Units 6 & 7 construction and operation would be on previously disturbed land resulting from construction and operation of Units 1 through 5. Major construction related land disturbances are identified in Section 3.9 (See Table 3.9-2). Permanent above grade facilities would be the FPL reclaimed water treatment facility, nuclear and administration buildings and associated parking lots, spoils areas, laydown areas, heavy haul road, equipment barge unloading area, and the radial collector well area. Temporary construction disturbance includes the below grade installation of potable water, reclaimed water, and radial collector well pipelines.

4.1.1.1.2 Regulatory Requirements

Federal Requirements

As described in Section 2.4, no farmland exists on the Units 6 & 7 plant area, and, therefore, no prime or unique farmland, as defined in the Farmland Protection Policy Act (7 U.S.C. Section 4201(b)) occurs on the plant area. Agricultural land comprises 2857.46 acres of land use within the 6-mile vicinity of the Turkey Point plant property (Figure 2.2-4; Table 2.2-2). The land acreage with use/cover designation of agricultural in the vicinity is concentrated in an area adjacent to the west-northwest corner of the plant property within Miami-Dade County. An assessment of soil types in the area of the plant property indicated that no prime farmland, as defined in the Farmland Protection Act (7 U.S.C. Section 4201(b)) occurs on the Turkey Point plant property or in the 6-mile vicinity. In addition, there is no indication of unique farmland (i.e., used for the production of specific high value foods and fiber crops) in the 6-mile vicinity. Further discussion of agriculture in the four-county region surrounding the Turkey Point plant property is provided in Subsection 2.2.3.

The Florida Coastal Management Act (§380.205-380.27, Florida Statutes) authorizes the Coastal Zone Management Section of the Florida Department of Environmental Protection (FDEP) to certify consistency with the Florida Coastal Management Program for all federal licenses, permits, activities, and projects, when such activities affect land or water use.

State of Florida Requirements

The Florida National Pollutant Discharge Elimination System (NPDES) Stormwater Permitting Program (Rule 62-621.300(5)(a), F.A.C.), the EPA-FDEP (joint) Generic Permit for Stormwater Discharge from Large and Small Construction Activities (Table 1.2-1) (Rule 62-621-300(4)(a) F.A.C), other regulatory guidance, and standard industry practices would be followed to minimize erosion and sedimentation effects and protect receiving waters and downstream areas.

Miami-Dade County Requirements

As described in Section 2.2, the Turkey Point plant property is zoned as GU, Interim District. On the Comprehensive Development Master Plan, Future Land Use Plan Map, the plant property has dual land use designations of Institutional, Utilities, and Communications and Environmental Protection Subarea F. Nuclear reactors are a permitted use in the GU zoning district, provided an Unusual Use Variance is obtained. In 2007, FPL submitted an application to Miami-Dade County for an Unusual Use Variance, several Non-Use Variances, and appropriate modifications to preexisting resolutions for two additional nuclear power plants (atomic reactors) and ancillary structures and equipment.

On December 20, 2007, the Miami-Dade County Board of County Commissioners approved FPL's application (Resolution Z-56-07), designating the public hearing subject property as Environmental Protection Subarea F and making the project subject to certain requirements.

Summary of Potential Impacts and Mitigation Measures

As stated in Subsection 2.2.1, FPL owns all of the property within the Turkey Point plant property boundary with the exception of certain encumbrances on portions of the property, specifically, certain canal, drainage, reclamation, oil, gas, and mineral rights reservations held by the Trustees of the Internal Improvement Fund of the State of Florida, and a canal reservation held by Miami-Dade County. Currently, there are no known oil or gas wells nor any sand or rock mining located within the Turkey Point plant property boundaries. Therefore, there would be no known impacts to oil, gas, or mineral resources from project construction activities.

Site preparation and construction activities for Units 6 & 7 would be conducted in accordance with applicable federal, state, and local regulations. FPL would acquire the necessary permits and authorizations, and would implement environmental controls such as stormwater management systems, fugitive dust control, and spill containment controls before earth-disturbing activities begin. Site preparation and construction activities affecting land use include clearing, grubbing, grading and excavating, dewatering, and stockpiling soils. Permanently disturbed locations would be stabilized and contoured in accordance with design specifications. When necessary, revegetation would comply with site maintenance and safety requirements. Methods to stabilize areas and prevent erosion or sedimentation would comply with applicable laws, regulations, and permit requirements; good engineering and construction practices; and recognized environmental best management practices.

Mitigation measures, designed to lessen the impact of construction activities, would be specific to erosion control, dust control, controlled plant access for personnel and vehicular traffic, and restricted construction zones. Initial site preparation work would consist of clearing, excavating, grading, and fill. Grading and drainage would be designed to minimize erosion during the construction period. The spoils storage areas would be graded and bermed (e.g., lip berm) to minimize the amount of drainage from the spoils into the industrial wastewater facility. While water quality treatment is not required, sediment control devices such as hay bales or gravel filters may be used to ensure sediment from the spoils does not physically impact the cooling canals of the industrial wastewater facility.

Because construction activities would only affect the majority of land that has already been disturbed and protective measures are required during construction activities in accordance with the Miami-Dade County Unusual Use Permit, the impacts to land use of the Turkey Point plant property from construction would be SMALL and would not require additional mitigation.

4.1.1.2 The Vicinity

Land within the vicinity of Units 6 & 7 is predominantly wetlands and forestland (Table 2.2-2, Figure 2.2-4), including environmentally protected areas as designated by the Miami-Dade County Comprehensive Development Master Plan. Biscayne National Park is immediately north and east of Turkey Point. Also, a small portion of the state-designated, 75,000-acre Biscayne Bay Aquatic Preserve lies outside of the national park boundaries. Homestead Bayfront Park is located adjacent to Biscayne National Park. The Model Lands Basin, an SFWMD Save Our Rivers acquisition, is located in the vicinity to the west of the Turkey Point plant property. The FPL-owned Everglades Mitigation Bank is adjacent to most of the western and southern boundaries of the Turkey Point plant property.

No land use impacts would occur to recreational or protected areas in the 6-mile vicinity. Most temporary and permanent facilities associated with Units 6 & 7 would be contained within the Turkey Point plant property boundaries, and construction activities for these facilities are not expected to impact land use in nearby park areas. Additionally, the Miami-Dade Unusual Use Resolution Z-56-07 stipulates several mitigative actions/plans to minimize impacts to the vicinity.

4.1.2 TRANSMISSION CORRIDORS AND OFFSITE FACILITIES AND AREAS

This subsection addresses the land use impacts from construction activities associated with the preferred transmission corridors, offsite substations, fill borrow areas, and makeup water systems.

4.1.2.1 Proposed Transmission Corridors

As described in Subsection 3.7.3, FPL has undertaken a route selection process to choose the transmission corridors that will be submitted for approval under the Florida Electrical Power Plant Siting Act (PPSA; §403.501-518, F.S). As part of the selection process, the state approves a corridor and the transmission line right-of-way is determined after state certification. The objective of the corridor selection process is to select a certifiable corridor that balances land use, socioeconomic, environmental, engineering, and cost considerations. The siting criteria included land use considerations to minimize potential disruption to such areas as national, state, and county parks; wildlife refuges; estuarine sanctuaries; landmarks; and historical sites. Also, the route selection process minimizes land use impacts by seeking opportunities to collocate with existing linear features (e.g., farm roads, canals, railroads, FPL transmission lines, other transportation rights-of-way, etc.).

New transmission lines for Units 6 & 7 would be built within Miami-Dade County. The proposed corridors for these transmission lines are described in Sections 2.2 and 3.7, and are shown in Figure 2.2-5. The land use along these proposed transmission line corridors are identified in Tables 2.2-3 and 2.2-4.

Where practicable, new transmission lines would be routed in existing corridors owned by FPL and routed adjacent to existing transmission lines or other existing linear facilities (e.g., access roads, transportation routes) to minimize impacts.

Miami-Dade County Unusual Use Resolution Z-56-07, Condition 20, requires that impacts to any Miami-Dade County-designated natural forest community, as a result of any FPL transmission corridor improvement, are to be minimized and consistent with County natural forest community standards and requirements (Section 4.3).

As described in Section 2.2, Units 6 & 7 would be connected, via underground facilities, to a new 500/230 kV substation known as Clear Sky, which would be constructed in the Units 6 & 7 plant area. As described in Subsection 4.1.1.1, this connection would be on previously disturbed land and no new construction impacts would be anticipated.

The Clear Sky substation would have two 500 kV transmission lines extending west and then north, approximately 43 miles long, connecting it to the existing Levee 500 kV substation in a planned transmission West Preferred/Secondary Corridor. A new 230 kV line, approximately 52 miles long, would be constructed in the same West Corridor between Clear Sky substation and a new 230 kV bay position at the existing Pennsuco substation; the line would share the same right-of-way with the two new 500 kV lines between Clear Sky and Levee substations.

In addition to the planned new transmission line West Corridor, a new 230 kV line, approximately 19 miles long, would be constructed to connect Clear Sky substation to a new 230 kV bay at the existing Davis substation in a planned transmission East Preferred Corridor. In addition, a new 230 kV line, approximately 18 miles long, would be constructed (in a new right-of-way to be selected) to connect the Davis substation to a new 230 kV bay position at Miami substation.

Two access-only corridor laterals would be constructed as part of the West Preferred/Secondary Corridor alignments. These access corridors would be used to access the transmission corridor and eventual right-of-way. No transmission structures would be built in these access corridors, although access roads or road improvements may be required. The two access corridors (Figure 2.2-5) are:

- Tamiami Trail Corridor
- Krome Avenue Corridor

Current land use for the transmission line access corridor at Tamiami Trail is 2.74 acres of streams and waterways, 3.06 acres of freshwater marshes, and 4.70 acres of roads and highways (Table 2.2-4).

Current land use for the transmission line access corridor at Krome Avenue is 85.33 acres of streams and waterways/canals, 56.81 acres of exotic wetland hardwoods, 143.40 acres of freshwater marshes, and 79.17 acres of roads and highways (Table 2.2-4).

The two new 500 kV lines and two new 230 kV lines for Units 6 & 7 would be located within state-approved corridors that would be narrowed to rights-of-way after state certification and before construction. Rights-of-way would be acquired in fee or easement.

The estimated total acreage where land disturbance could occur from the constructed transmission lines from Clear Sky to Pennsuco is 3356 acres (assuming the preferred corridor route) and 1635 acres from Clear Sky to Miami. These disturbed acreages are based on current proposed corridors. The actual disturbed acreage will be less, based on the actual right-of-way width (Table 2.2-3). It should be noted that included in these areas where new land disturbance could occur is acreage in preexisting FPL-owned corridors (e.g., Clear Sky to Davis). Because plans would be to use existing rights-of-way within the corridors to the extent practicable, the areas of new disturbance and use of previously undeveloped land is expected to be relatively minor compared to the total acreage of the corridors.

Construction activities for new transmission structures, tower pads, conductors, and access roads are described in Section 3.7. These activities could result in vegetation loss and temporary habitat disruption in the land types occurring along the final rights-of-way. Land used for structure pads and access roads would no longer be available for use by others, but land located between towers would only be temporarily impacted and would be restored after construction and available, upon approval by FPL, for joint uses that do not jeopardize the safe and reliable operation of the transmission lines. Subsection 4.1.3.2 describes potential impacts from transmission line construction to historical and cultural resources.

FPL construction programs, plans, and procedures routinely use standard industry construction practices, environmental best management practices, and mitigation measures to ensure adverse environmental effects of construction are avoided, minimized, or mitigated. Specific environmental protection and impact mitigation measures (with the associated construction phase) that potentially would be used within the Units 6 & 7 transmission line rights-of-way include:

- Use of restrictive land-clearing processes in forested wetland areas (right-of-way clearing and preparation)
- Use of turbidity screens and erosion-control devices in areas of wetlands and water resources (access road/structure pad construction)
- Use of existing access roads for ingress and egress to rights-of-way where available (access road/structure pad construction)
- Use of standard industry construction practices for foundation and structure excavation and construction (line construction)

As described in Section 1.2, FPL would comply with applicable laws, regulations, and permit requirements for the Units 6 & 7 project. Standard industry construction practices would be used for the transmission line construction, including use of existing rights-of-way, to the extent practicable, and environmental management, including such things as erosion-control devices, matting to reduce compaction caused by equipment, use of wide-track vehicles when crossing wetlands, and restoration activities after construction.

Although impacts to wetlands could potentially occur, they would be limited by careful siting and construction practices to avoid and minimize adverse effects. Where wetland impacts do occur, compensatory mitigation, as required by state and federal agencies, would be provided. Given the careful consideration of land use in the route selection process (Subsection 2.2.2) and the availability of a viable method for mitigation, impacts to offsite land use would be SMALL.

4.1.2.2 Offsite Substations

As described in Subsection 2.2.2, several upgrades and/or expansions would be needed to the Turkey Point, Clear Sky, Levee, Pennsuco, Davis, and Miami substations that could impact current land use (Table 2.2-5). Work at the Pennsuco substation would require acquisition of additional property for expansion on a previously disturbed area.

The existing Turkey Point substation, located on the Turkey Point plant property, would be expanded by 0.9 acre to accommodate a new bay with two new 230 kV line terminals and enlargement of the existing relay vault building. Current land use of the 0.9-acre area of expansion for the onsite Turkey Point substation is electric power facilities (Table 2.2-5).

The existing Levee substation would be expanded by 2.3 acres to accommodate a new bay with two 500 kV line terminals. The interconnection work at Levee substation would include filling, grading, and rocking an expansion area of approximately 130 x 850 feet to the north of the existing 500 kV yard for construction of a new bay and associated equipment. In addition, a new stormwater retention system would be constructed. Current land use of the 2.3 acres area of expansion for the Levee substation is electric power facilities and exotic wetland hardwoods (Table 2.2-5).

The existing Pennsuco substation would be expanded by approximately 2.42 acres to accommodate addition of a stormwater retention system and installation of new equipment. Current land use of the 2.42 acres area of expansion for the Pennsuco substation is rock quarries (Table 2.2-5).

The existing Davis substation would be expanded by approximately 1.12 acres to accommodate addition of two new 230 kV line terminals and installation of equipment to control power flow for the line connecting to the Miami substation. Current land use of the 1.12 acres area of expansion for the Davis substation is tree nurseries (Table 2.2-5).

The Miami substation would be modified to expand and reconfigure the 230 kV section, add a new 230 kV line terminal for connection of the line from the Davis substation, and replace the autotransformer to match the rating with that of the Miami substation. These modifications would involve no expansion of land area of the substation.

Substation facilities would meet all environmental regulatory requirements for their construction and expansion; accordingly, potential land use impacts from construction would be SMALL and not require additional mitigation.

4.1.2.3 FPL-Owned Fill Source

Borrow material for the Units 6 & 7 plant area and associated non-linear facilities, estimated at 10.7 million cubic yards, and offsite transmission and access roads, with a conceptual range of 2.4 to 3.7 million cubic yards, would be obtained from a combination of an FPL-owned fill source, other regional sources, or reused material. Using existing commercial quarries for borrow materials would have no impact on land use and, therefore, would not require mitigation. Additional borrow material would be obtained from the same sources for other construction activities including the FPL reclaimed water treatment facility, road upgrades, transmission tower pads, etc. Any additional fill material needed during operation and maintenance of Units 6 & 7 would be supplied through a commercial provider. Accordingly, the FPL fill source would be expected to cease operation with the completion of Units 6 & 7 construction activities. Future plans are that the 300-acre area and newly created lake would be maintained as a water management feature, under FPL or other local or regional ownership, management, and control.

Using FPL-owned property for borrow material would permanently disturb approximately 300 acres of land classified as tree nurseries, Brazilian pepper, ditches, exotic wetland hardwood, wetland scrub, freshwater marshes and roads and highways. However, this land disturbance represents a small portion of the available land in the surrounding area and would, therefore, be a SMALL impact.

4.1.2.4 Makeup and Potable Water Systems

As described in Sections 3.3 and 3.4, reclaimed water from the Miami-Dade Water and Sewer Department (MDWASD) and/or radial collector wells-supplied water would be used as cooling water makeup for Units 6 & 7. Potential impacts of construction activities for these cooling water systems are described below.

As described in Section 2.2, the reclaimed water pipeline corridor would require approximately 9 miles of pipelines between the Turkey Point plant property and the MDWASD South District Wastewater Treatment Plant to the north (Figure 2.2-5). For about 6.5 miles of their length, the pipelines would be collocated with the existing Clear Sky-to-Davis transmission line right-of-way and adjacent road and canal rights-of-way. For the remaining approximately 2.5 miles, the pipelines would then diverge from the existing right-of-way. The current land use of the 326.9 acres within this corridor, some smaller portion of which could be impacted with the construction of the pipelines and right-of-way. Major land use impacts within this area are shown in Table 2.2-6. Construction activities for the pipelines could result in vegetation loss and habitat disruption. As described in Section 4.3, the pipelines would be trenched beneath/along an existing access road on the west side of the corridor and, upon completion, the disturbed portions of the corridor would be graded to the contours of the surrounding landscape and revegetated or returned to previous land uses. Clearing of new corridors and/or expansion of existing corridors would include use of environmental best management practices to minimize impacts to sensitive habitats. Most of the reclaimed water pipelines would follow existing rights-of-way.

Construction of the radial collector wells would not cause new surface land disturbance to any previously undeveloped property. Also, as described in Subsection 4.1.1.1.2, Miami-Dade County has approved the rezoning of the land for development.

Accordingly, land use impacts from construction of the makeup water systems in the six-mile vicinity would be SMALL and would not require mitigation.

As described in Section 2.2, the radial collector wells would include horizontal laterals extending underground from a collection caisson to a depth of approximately 25 to 40 feet below the bottom of Biscayne Bay. Because construction of the radial collector wells would involve surface land disturbance only on the Turkey Point plant property and no surface land disturbance in offsite areas, there would be no new construction impacts associated with the radial collector wells to offsite land use.

An approximately 9-mile-long pipeline corridor would be constructed to obtain potable water for Units 6 & 7. The new potable water pipelines would deliver potable water from the source facility to a storage tank in the Units 6 & 7 plant area. The route of the pipelines is identified in Figure 3.9-1. Selection of this route was made to minimize environmental impacts from construction of the new pipelines. Other than the north-south section of pipelines along SW 137th Avenue/Tallahassee Road from SW 288th Street to SW 328th Street/N. Canal Drive, most of the route is within the area of already planned roadway improvements to avoid additional congestion with the existing and planned new other utilities on the access road to Units 6 & 7. Because of the commonality of the pipeline route with previous disturbance and/or new disturbance already expected to occur resulting from construction of other Units 6 & 7 project facilities (e.g., roadway improvements), construction of the underground pipelines would have minimal additional environmental impacts.

4.1.2.5 Access Roadways

As described in Section 3.9, the Units 6 & 7 project includes roadway improvements to allow access to the site for construction and operations. The improvements include the widening of three existing roadways and the development of existing unpaved roads to four paved roadways (Figure 3.9-1). The current land use along the roads is summarized in Table 2.2-7.

The improvements for the existing paved roadways consist of the widening from two lanes to four lanes of SW 328th Street/N. Canal Drive, SW 344th Street/Palm Drive, and SW 117th Street, for a total roadway length of approximately 3.25 miles.

Development of the four new paved roadways include (with approximate lengths): SW 359th Street at two locations, three lanes between SW 137th Avenue/Tallahassee Road and SW 117th Avenue (2 miles in length) and four lanes between SW 117th Avenue and Units 6 & 7 (3 miles in length), plus construction of a bridge over the L-31 Canal; three lanes at SW 137th Avenue/ Tallahassee Road between SW 344th Street/Palm Drive and SW 359th Street (1 mile in length); and four lanes at SW 117th Avenue between SW 344th Street/Palm Drive and 359th Street (1 mile in length). The new paved roadway for SW 359th Street from SW 137th Avenue/Tallahassee Road to the Turkey Point plant property would also serve as the access road for the new transmission lines along its route. There is a South Florida Water Management District (SFWMD) canal that crosses the L-31E canal along the SW 359th Street route with FPL-owned property on either side.

Improvements to four existing intersections and the development of two new intersections would also be required to accommodate traffic to and from Units 6 & 7. Each of the intersections would require signalization and/or traffic control personnel depending on the peak traffic period and flow.

The locations for the road improvements were selected to use, to the greatest extent practicable, existing roadways and to minimize environmental impacts. Because of the location of the Turkey Point plant property, the majority of the roadway improvements can be located within an existing FPL-owned right-of-way, which extends from the plant property toward the west (SW 359th Street) and along portions of SW 117th Avenue south of SW 344th Street/Palm Drive (approximately 5 miles). The remaining 4 miles of roadway improvements are along existing paved and unpaved roads.

The roadway improvements would be located in unincorporated Miami-Dade County and in the City of Homestead. The roadway corridor would traverse the following zoning designations: Agricultural District (AU), Interim District (GU), and Planned Unit Development (PUD). With the exception of SW 359th Street, all the roadways have been designated as roads by Miami-Dade County. With the expansion of the roadways, certain easements from governmental agencies may be required depending upon the final design. The paved road for SW 359th Street from SW 137th Avenue/Tallahassee Road to the Turkey Point plant property would be located on FPL property, with the exception of the crossing of the L-31E Canal. The canal crossing would require an easement from SFWMD.

Relevant future land use categories of the Miami-Dade County Comprehensive Development Master Plan allow for utility uses in the proposed corridor for the roadway improvements.

Roadway design standards and construction would follow the requirements of the Miami-Dade County Public Works Department and the Florida Department of Transportation. Construction activities would include the installation of silt fences, removal of vegetation, construction of drainage, removal of unsuitable soils, placement of road base materials, laying layers of asphalt, and striping. The shoulders would be appropriately sloped and surface water runoff would be managed with the installation of swales and culverts at suitable locations.

With local governmental approval for the planning of the roadway improvements, the granting of easements for the roadway use, and the use of environmental best management practices, land use impacts from the improvements associated with the construction of Units 6 & 7 would be SMALL and not require additional mitigation.

4.1.3 HISTORIC PROPERTIES

FPL has initiated consultation with the State Historic Preservation Officer (SHPO) regarding the proposed project and prepared and submitted several reports and work plans, including the following:

- *Cultural Resource Assessment Survey for the Turkey Point Units 6 & 7 Site, Associated Non-Linear Facilities, and Spoils Area on Plant Property* (FPL 2009a).
- *Cultural Resource Assessment Survey Work Plan for the Turkey Point Units 6 & 7 Site and Associated Non-Linear Facilities* (FPL 2009b).
- *Preliminary Cultural Resources Report for the Turkey Point Units 6 & 7 Associated Linear Facilities* (FPL 2009c).
- *Cultural Resource Assessment Survey Work Plan for the Turkey Point Units 6 & 7 Associated Linear Facilities* (FPL 2009d).

The results contained in these reports and work plans are presented in Subsection 2.5.3. A summary of these reports and work plans, specifically in the context of construction impacts, are discussed in the following paragraphs.

4.1.3.1 Onsite Facilities and Construction Areas

Background research and an analysis of aerial photographs from 1938, 1952, and 1963 identified no buildings within one mile of the plant area.

An archaeological field survey, including both pedestrian surveys and archaeological investigations (e.g., shovel testing) was performed at the onsite APEs as documented in the *Cultural Resource Assessment Survey Work Plan for the Turkey Point Units 6 & 7 Site and Associated Non-Linear Facilities* (FPL 2009b). The survey identified no newly or previously recorded archaeological sites or historic resources within or adjacent to the Site or associated non-linear facilities. The Work Plan recommended that no additional field investigations be performed. The Work Plan was submitted to SHPO and concurrence with the recommendation was received by FPL (FDOS Jul. 2009a).

Based on the above findings and SHPO concurrence, there would be no impacts to historic properties from construction of the onsite permanent facilities and the temporary construction facilities and use areas.

4.1.3.2 Offsite Transmission Line Corridors

A Preliminary Cultural Resources Report (FPL 2009c) and *Cultural Resource Assessment Survey Work Plan* (FPL 2009d) were submitted to the SHPO for their review with the preliminary research and recommendations for further field reconnaissance. Specific recommendations made to SHPO regarding offsite transmission corridors involved the following:

- Archaeological Survey and Identification Plan for the Transmission Line Corridors

- Historic Resource Survey and Identification Plan for the Transmission Line Corridors

The Work Plan for the transmission line corridors also included an APE for direct physical effects and an APE for indirect or visual effects. Field assessments within the APEs have been recommended for the corridors. Testing in low potential areas would be judgmental. The Work Plan was submitted to SHPO, and concurrence on the recommendation was received by FPL (FDOS Jul. 2009b). The results of the field assessments and FPL's recommendations on effect to historic properties will be submitted to the SHPO.

4.1.3.3 Other Offsite Areas

A Preliminary Cultural Resources Report (FPL 2009c) and *Cultural Resource Assessment Survey Work Plan* (FPL 2009d) were submitted to the SHPO for their review with the preliminary research and recommendations for further field reconnaissance. The work plan for the reclaimed and potable water pipelines, borrow areas, and access roads included an APE for direct physical effects only. An APE for indirect or visual effects is not needed for this infrastructure because they are at or below the ground surface. Specific recommendations made to SHPO regarding other offsite areas involved the following:

- Archaeological and Historic Survey and Identification Plan for Access Roads and Bridges
- Archaeological Survey and Identification Plan for the Reclaimed Water Pipeline(s) and the Potable Water Pipeline(s)
- Historic Resource Survey and Identification Plan for the Reclaimed Water Pipeline(s) and Potable Water Pipeline(s)

The Work Plan was submitted to SHPO, and concurrence on the recommendations was received by FPL (FDOS Jul. 2009b). The results of the field assessments and FPL's recommendations on effect to historic properties will be submitted to the SHPO.

4.1.3.4 Discovery Provisions

FPL prepared work plans for the onsite and offsite areas, and consulted with the SHPO regarding these plans. The work plans will contain recommendations for development of an Unanticipated Finds Plan and a Contractor Training Program. The plan will outline procedures and identify responsible personnel to be contacted if significant archaeological materials or human remains are encountered during construction. The plan will be included in a contractor training program prior to construction. The goal of the training will be to inform construction personnel, inspectors, and managers of the possibility for human remains and archaeological materials in a given area, and to develop clear understanding of what procedures should be followed if human remains or archaeological materials are identified during earth-disturbing activities.

Section 4.1 References

FPL 2009a. *Cultural Resource Assessment Survey for the Turkey Point Units 6 & 7 Site, Associated Non-Linear Facilities, and Spoils Area on Plant Property*, June 2009.

FPL 2009b. *Cultural Resource Assessment Survey Work Plan for the Turkey Point Units 6 & 7 Site and Associated Non-Linear Facilities*, June 2009.

FPL 2009c. *Preliminary Cultural Resources Report for the Turkey Point Units 6 & 7 Associated Linear Facilities*, June 2009.

FPL 2009d. *Cultural Resource Assessment Survey Work Plan for the Turkey Point Units 6 & 7 Associated Linear Facilities*, June 2009.

FDOS Jul. 2009a. Florida Department of State, Division of Historical Resources, Letter from Laura Kammerer, Deputy State Historic Preservation Officer to Matthew Raffenberg re: *Cultural Resources Assessment Survey Work Plan for the Turkey Point Units 6 & 7 Site and Associated Non-Linear Facilities*, July 13, 2009.

FDOS Jul. 2009b. Florida Department of State, Division of Historical Resources, Letter from Laura Kammerer, Deputy State Historic Preservation Officer to Matthew Raffenberg re: *Cultural Resource Assessment Survey Work Plan for the Turkey Point Units 6 & 7 Associated Linear Facilities*, July 13, 2009.

4.2 WATER-RELATED IMPACTS

Water-related impacts from the construction of Units 6 & 7 could result from (1) hydrologic alteration of local surface water bodies, including streams and wetlands, and groundwater because of diversions, (2) surface elevation changes, and (3) groundwater elevation changes because of local pumping/dewatering. Impacts could also occur to downstream water quality as a result of erosion and sedimentation and to surface water and groundwater resulting from spills of fuels, lubricants, and other construction-related pollutants. Because of this potential for impacting surface water and groundwater resources, applicants are required to obtain a number of permits before initiating construction. Table 1.2-1 lists the consultations, authorizations, and permits required for initiating the construction activities. In addition, FPL is required to comply with Conditions of the Miami-Dade County Resolution Z-56-07.

A description of Preconstruction activities and Construction activities is provided in Section 3.9.

Water bodies and areas that would be affected by construction activities in the Units 6 & 7 plant area are the mudflats (consisting of wet organic soil material) and the remnant canals. Water bodies that could be affected by other construction activities on the Turkey Point plant property include Biscayne Bay, the cooling canals of the industrial wastewater facility (which is not a water of the state or the United States), the truncated portion of the industrial wastewater facility lying to the northwest of the plant area, and numerous named and unnamed surface water drainage canals. As described in Subsections 2.3.1.2 and 2.3.2.2, the surficial aquifer at the Turkey Point plant property is the Biscayne aquifer. Although the Biscayne aquifer is the sole-source aquifer for Miami Dade County, the Biscayne aquifer at is not used as a source of potable water for the existing units.

4.2.1 HYDROLOGIC ALTERATIONS

This subsection identifies onsite and offsite construction activities that could result in impacts to the hydrology on the Turkey Point plant property and offsite areas. Activities include construction of the new units and associated facilities, heavy haul road, equipment barge unloading area modification, transmission facility construction and modification, reclaimed water pipelines, FPL reclaimed water treatment facility, improvements to access roads, potable water pipelines, radial collector wells and pipelines, borrow and spoil areas, nuclear administration and training buildings, security facilities, and laydown/parking areas. Section 3.9 provides a complete summary of land disturbances.

Impacts resulting from the disturbance of surface soils are-regulated under the National Pollutant Discharge Elimination System (NPDES) pursuant Section 402(p) of the Clean Water Act. The Florida Department of Environmental Protection (FDEP) is the NPDES permitting authority for Florida. Implementing its EPA-approved NPDES stormwater program, FDEP has adopted its

Generic Permit for Stormwater Discharge from Large and Small Construction Activities (CGP) which is incorporated by reference under Rule 62-621.300(4), F.A.C. The NPDES CGP applies to construction activities which disturb one or more acres of total land area. Disturbance includes clearing, grading and excavating. The CGP may apply to the disturbance of less than one acre of land if part of a larger common plan of development.

NPDES permit coverage is obtained under the CGP by preparing a Stormwater Pollution Prevention Plan (SWPPP) and filing a Notice of Intent (NOI) to utilize the CGP along with a filing fee. FDEP now allows the NOI to be filed electronically. Permitting coverage is limited to 5 years. The SWPPP must be prepared prior to filing the NOI but is not filed with FDEP. However, the plan must be kept on-site and available for FDEP inspection at all times. The SWPPP must include, among other items: a site plan for managing stormwater runoff; identification of appropriate erosion and sedimentation controls and best management practices (BMPs) that will be employed to minimize the discharge of pollutants off-site during storm events: a schedule for inspection and maintenance of BMPs: and a record keeping process documenting any maintenance or repairs performed and any modifications made to the plan. The SWPPP may include structural or non-structural controls. Structural controls may include retention ponds, silt fencing or berms while non-structural controls might include soil stabilization by sodding, seeding or mulching or scheduling construction during the dry season. Once construction is complete and any disturbed areas are stabilized (usually through sodding, seeding or other means), a Notice of Termination may be filed terminating NPDES permit coverage. If construction exceeds the initial 5-year period, a new Notice of Intent must be filed to reapply for coverage.

4.2.1.1 Onsite Facilities

4.2.1.1.1 Construction and Laydown Areas

Surface Water

Surface water that could be impacted during construction activities at the Units 6 & 7 plant area consists of the cooling canals of the industrial wastewater facility.

Flooding that could occur in the proximity of the plant area would be the result of major storm precipitation events. Overland flow in the proximity of the plant area and Units 3 & 4 currently discharges to the industrial wastewater facility that surrounds the plant area and not to surface water drainage features that drain to Biscayne Bay. During construction, surface water from the plant area would be directed to the cooling canals of the industrial wastewater facility. FPL would seek to modify the existing industrial wastewater facility permit to include Units 6 & 7.

Two remnant canals of the industrial wastewater facility are located in the Units 6 & 7 plant area which would be excavated to remove the muck. The dead-end canal located northwest of the plant area would be permanently backfilled for use as an additional laydown area. The material excavated from approximately the upper 5 feet in the plant area would be deposited in one of the spoils areas described in Section 3.9. Engineered fill would be used to raise the grade level in the plant area to a working grade elevation. Excavation of the power block locations would then begin. Excavated material from the power block locations could eventually be used as fill throughout the plant area. Unsuitable excavated material would be transported to the spoils areas. Stormwater would be managed with the appropriate environmental controls to reduce the amount of sediment in the surface water runoff before release to the industrial wastewater facility. The removal of original soils, replacement with compacted engineered fill material, and change of the elevation at the power block area to approximately 25.5 feet would permanently alter the flow of surface water in the plant area. However, the alterations would be limited to the plant area by the presence of the industrial wastewater facility and the berm east of the return canal, and would not result in impacts to downstream surface water bodies or resources. Therefore, impacts to surface water because of hydrologic alterations would be SMALL and would not warrant additional mitigation.

Groundwater

Curtain wall technology and foundation grouting would be used to isolate the cooling canals of the industrial wastewater facility from the plant area and minimize the amount of dewatering required during power block excavation and construction. Dewatering would not be expected to be required for the first 5 feet depth of excavated material, but would be required for subsequent excavation depths in the power block areas. As described in Subsection 2.3.1.2, the subsurface soils underlying the 5 feet of muck in the vicinity of the power blocks consist of formational material capable of substantial groundwater yield. The placement of engineered fill would alter the permeability of the subsurface material currently at the plant area. As described in Section 3.9, a diaphragm wall would be installed to a depth of approximately -60 feet NAVD 88 around the power blocks during dewatering and excavating subsurface materials. Following completion of the diaphragm wall, a grout plug, approximately 25 feet thick, would be constructed beneath the power block from elevation -35 feet NAVD 88 to elevation -60 feet NAVD 88 by drilling from the ground surface and injecting grout. This barrier, which is integral with the diaphragm wall, would allow any seepage encountered during excavation to be controlled by use of sump pumps, or similar methodologies, located within the excavation. The diaphragm wall and grout plug, which would both be permanent, would alter local horizontal groundwater flow around the power block excavations and would, therefore, alter the hydrologic flow through the power block area. Impacts to the hydrologic flow of groundwater would occur from the presence of the diaphragm wall and the emplacement of the engineered fill material. The impacts would be limited to the vicinity of the diaphragm wall. The use of the diaphragm wall would allow dewatering of the power block areas with minimal impacts to groundwater directly outside of the diaphragm wall containment area. Groundwater flow may also be locally altered as a result of backfilling the dead-end canal.

During foundation excavation and construction, three distinct dewatering phases are anticipated: testing and remedial grouting phase, excavation phase, and foundation construction. Each dewatering phase has an estimated maximum dewatering rate, as discussed below.

The testing and remedial grouting phase, as discussed in Subsection 3.9.1.7, would consist of up to four separate grouting injection events, based on observations made during each grouting injection phase. The estimated duration for this phase is 13 weeks per excavation, with an estimated maximum dewatering pumping rate of 1000 gallons per minute (gpm).

The excavation phase is expected to be three months in duration. As the excavation proceeds, remaining seepages that are revealed by the excavation will be evaluated and remediated as necessary. The estimated maximum dewatering pumping rate for this phase is 1000 gpm.

A groundwater model was used to calculate the dewatering rates anticipated during the foundation construction phase. As discussed previously, a grout plug was placed from elevation -35 feet NAVD 88 to elevation -60 feet NAVD 88 in the model. The groundwater modeling results indicated that the dewatering rates for the Units 6 and 7 excavations were approximately 96 gpm for each excavation, based on a grout plug hydraulic conductivity of 1.0E-04 centimeters/second (cm/sec). For the purpose of this analysis, the total dewatering rate per excavation is assumed to be 200 gpm and 24 months in duration.

For the dewatering impact analysis, it is conservatively assumed that the Unit 7 testing and remedial grouting phase would occur simultaneously with the Unit 6 foundation construction phase. It is further conservatively assumed, for maximum potential impacts, that the timeframe for these simultaneous dewatering phases is one year. Therefore, the estimated maximum dewatering rate would be 1200 gpm (1.73 MGD) for one year in duration.

The circulating water flow rate in the industrial wastewater facility for Units 1 through 4 is 4250 cubic feet per second (2747 MGD). The extracted groundwater from dewatering, which would be released into the cooling canals of the industrial wastewater facility, is approximately 0.06 percent of the circulating water flow rate. As described in Subsection 2.3.1.2.2.5, makeup water for the industrial wastewater facility comes from treated process water, rainfall, stormwater runoff, and groundwater infiltration. This inflow, along with the low amount of predicted water withdrawal from the discharge canal, would result in minimal net effect on the cooling canals of the industrial wastewater facility. The mean annual rainfall and standard deviation for this rainfall for the period 1948–2010 is 59.95 inches and 11.74 inches (Miami International Airport), respectively. Considering a cooling canal area of 4370 acres, the total and standard deviation of this annual rainfall, in total gallons of water added to the cooling canals on an annual basis, is 21,832 acre-feet/year (7114 MG/year) and 4275 acre-feet/year (1393 MG/year), respectively. Conservatively assuming the maximum dewatering rate of 1200 gpm (1.73 MGD) is maintained for one year, the resulting annual dewatering discharge of 631 MG/year into the cooling canals is less than the standard deviation, or natural variability, of the observed annual rainfall added to the cooling canals (1393 MG/year).

Based on the groundwater modeling results for the dewatering simulations, the radius of influence is confined to the Turkey Point Plant.

The net effect on water withdrawal from construction dewatering on Biscayne Bay would also be minimal due to the substantial amount of water in the bay and the relatively temporary nature of the dewatering activities.

The dewatering system would be designed using environmental best management practices to control turbidity of the effluent released to the cooling canals of the industrial wastewater facility. FSAR Appendix 2CC, contains a discussion of the construction dewatering simulation.

Groundwater levels at the Units 6 & 7 plant area would be altered during construction activities, due to the dewatering necessary for the deep foundations. However, these temporary alterations would be mitigated in part by the hydraulic isolation of the plant area with regard to local surface water and the interconnection between the cooling canals of the industrial wastewater facility and the shallow aquifer. Slight changes in percolation rates would have negligible impacts on water levels, because the surface infiltration would affect only a localized area.

During construction of Units 6 & 7, one of the deep injection wells (see Subsection 4.2.1.1.9) could be used for the disposal of construction-related and sanitary wastewater. Injection would be in accordance with the underground injection control permit and would be consistent with the use of deep injection wells in Florida. The anticipated amount of wastewater injected would be less than the amount anticipated during operations. Groundwater quality and hydrologic monitoring would be performed on two wells installed in the upper Floridan aquifer as required by FDEP's underground injection control permit.

For these reasons, the impacts of alterations to the groundwater resource would be SMALL and no further mitigation would be required.

4.2.1.1.2 Spoils Area Establishment

Surface Water

Spoils areas would be established at three locations as described in Subsection 3.9.1.1 and identified in Figure 3.9-1. The spoils areas would be graded and bermed to direct drainage from the spoils to the industrial wastewater facility. Thus, the potential impacts resulting from hydrologic alteration of surface water would be SMALL and would not require additional mitigation.

Groundwater

Adding water to the cooling canals of the industrial wastewater facility from the spoils areas would be minimal when compared to the water normally in the canals. Temporary highs in the groundwater table could occur from drainage from the spoils areas because the canals are hydraulically connected to the underlying groundwater. Therefore, the impacts to groundwater would be SMALL and would not require additional mitigation.

4.2.1.1.3 Access Roads, Heavy Haul Road, Bridges, and Equipment Barge Unloading Area Improvements

Surface Water

Modifications to the existing equipment barge unloading area would be performed under permits issued by the U.S. Army Corps of Engineers (USACE) (Section 404 Permit and Section 10 — Rivers and Harbors Act Permit; Table 1.2-1). Excavation and limited dredging could create turbid waters that could migrate from the vicinity of the equipment barge unloading area into Biscayne National Park. Curtain wall technology would be used to isolate the affected area from the waters of the park.

The equipment barge unloading area would be enlarged to accommodate larger barges. The modification would be performed using sheet piles to isolate the equipment barge unloading area from the barge turning basin. Excavated and dredged soils would be stockpiled in the spoils areas described in Section 3.9. Potential impacts to flow from the use of sheet piles would temporarily impact the surface water flow. Impacts to surface water flow from equipment barge unloading area modifications would be SMALL and would not warrant further mitigation.

As described in Section 3.9, existing roads on the Turkey Point plant property would support the construction activities for Units 6 & 7. The construction of a heavy haul road leading from the equipment barge unloading area to the Units 6 & 7 plant area would follow existing roads and would require the improvement of those roads in several places.

Five new permanent bridges would be built for Units 6 & 7 including a bridge over the L-31 canal and one over the northern tip of the interceptor ditch. Two bridges would be built along the heavy haul route where the industrial wastewater facility is crossed. Temporary bridges would also be installed to facilitate construction activities until the permanent bridges are completed. In addition, bridges would be built to access berms within the industrial wastewater facility for construction of transmission towers. Modifications to two existing bridges would be required to support load requirements of transporting excavated material to the spoils areas. Modifications to the existing roads would be required to support the load requirements. The heavy haul road would cross a laydown area that would require filling. Constructing the heavy haul road could alter hydrologic flow in and along the road path by the stockpile of soil, stone, and fill material. Equipment staged along the route could also impede surface water flow. Ditches and the use of culverts would allow surface water drainage to be maintained along the road route. During construction, surface water runoff would be released to the industrial wastewater facility. Construction activities for the heavy haul road would be temporary. Culverts would be used to maintain surface water flows where required. Restoration activities could be necessary along the road right-of-way.

Construction traffic access to the Turkey Point plant property would be via various routes including, SW 117th Avenue, SW 137th Avenue/Tallahassee Road, SW 328th Street/N. Canal Drive, SW 344 Street/Palm Drive, and SW 359th Street. The main road for construction activities would be SW 359th Street. This would allow the access road to be in the existing transmission corridor right-of-way. New construction would be required to connect SW 359th Street with an access road on the Turkey Point plant property. Most of this new construction would be offsite and is described in Subsection 3.9.1.2. The access road on the Turkey Point plant property would be constructed where SW 359th Street currently terminates at the property boundary. This short section of road would cross wetlands. The new road construction would require fill material to be brought in to raise the elevation to the grade of SW 359th Street. Culverts would be used to maintain current natural flow patterns in the area. Road improvements to SW 359th Street would require the existing road to be widened and additional gravel or pavement added to meet projected load specification. Once access to the existing roads on the plant property has been established, construction traffic would flow as described above. Existing roads would be used as much as possible to limit unnecessary construction. Existing drainage features would be used including ditches and detention ponds. New ditches and detention ponds would be constructed as needed. Should modification to the existing draining ditches or drainage features be required, the impacts would be temporary and the disturbed areas would be returned to preconstruction conditions. Revegetation could be required. Work would be performed in accordance with applicable permits. Impacts to surface water hydrologic alteration would be SMALL and would not require additional mitigation other than those described above.

Groundwater

Modifications to the existing equipment barge unloading area would be performed under permits issued by the USACE (Section 404 Permit and Section 10 — Rivers and Harbors Act Permit; Table 1.2-1). The equipment barge unloading area would be enlarged. Unsuitable soils from the operation would be stockpiled in the spoils areas described in Section 3.9. Impacts to groundwater flow from equipment barge unloading area modifications would be temporary and SMALL and would not warrant mitigation.

Soils along the route of the new construction connecting SW 359th Street with an access road on the Turkey Point plant property could require excavation to a suitable base elevation before the placement of fill material. Groundwater could be encountered during these road construction activities. However, potential impacts would be temporary and groundwater levels and flow direction would return to preconstruction conditions.

Hydrologic alteration to groundwater from the improvement of existing roads on the plant property could occur. However, impacts resulting from the hydrologic alteration of groundwater flow, if it occurs, would be temporary and groundwater would return to pre-existing conditions. Therefore, impacts would be SMALL and would not require additional mitigation.

4.2.1.1.4 Security Facilities

Surface Water

Constructing a new security building and infrastructure (see Section 3.9) could result in altering surface water hydrologic flow. Because of the small size and construction methods that would be used for these security facilities, impacts would be localized to the building site. Impacts from constructing fences, gates, and physical barriers (flow through) would also be limited in area and would not disrupt surface water flow as the result of their construction. Impacts to hydrologic alteration of surface water would be SMALL and would not require additional mitigation.

Groundwater

As described above, the building of security facilities would result primarily in impacts from the disturbance of surface soils. Impacts to groundwater from hydrologic alteration could occur. However, impacts would be temporary. Once construction activities cease, any alteration to groundwater would cease. Impacts to groundwater from hydrologic alteration would be SMALL and would not warrant additional mitigation.

4.2.1.1.5 Construction Utilities

Surface Water

As described in Section 3.9, temporary utilities would be constructed that support the entire construction site and associated activities. These would include aboveground and underground infrastructure for power, lights, communications, potable and construction water, wastewater and waste treatment facilities, fire protection, and for constructing gas and air systems.

The potential impacts caused by these activities would include surface water runoff from excavation activities for installing subsurface utilities and for installing the necessary structures for the aboveground utilities. Detention basins used in support of other existing facilities or Units 6 & 7 activities could be used for developing the site utilities. These activities would result in the short-term potential for impacts in a relatively small area. Impacts from hydrologic alterations would be SMALL and would not require additional mitigation other than those specified through permit requirements.

Groundwater

Dewatering for temporary utilities could require the use of detention basins before release to the industrial wastewater facility. Impacts to groundwater from hydrologic alteration while constructing these utilities would be temporary and flow would return to normal when construction activities ceased. Impacts would be SMALL and would not warrant mitigation other than that specified in the required permits.

4.2.1.1.6 Construction Facilities and Preparation Activities

Surface Water

Facilities include parking areas, laydown areas, storage and fabrication areas, measuring and testing facilities, offices, warehouses, workshops, sanitary facilities, locker rooms, training facilities, storage facilities, and site access facilities.

The concrete batch plant would be located in the northern portion of the plant area just north of the power blocks. Wastewater from batch plant operations would be directed to the industrial wastewater facility. The impacts associated with the construction and operations of the batch plant would have no additional impacts from hydrologic alteration than described above for the plant area.

Fill may be added to several areas. Where fill material is added, the alterations would be permanent (e.g., the laydown area just west of the plant area and the dead-end portion of the industrial wastewater facility located northwest of the plant area). However, most of the construction facilities would be in areas where fill would not be needed. Once construction activities were completed, the facilities could be removed and the areas returned to preconstruction conditions.

For these reasons, impacts on surface water would be SMALL and additional mitigation would not be required.

Groundwater

These facilities would not require the deep excavation of soils during their construction and would not directly cause impacts from hydrologic alteration. Impacts from the hydrologic alteration of groundwater from constructing and operating these facilities would be SMALL and would not require additional mitigation.

4.2.1.1.7 Constructing Reclaimed Water Pipelines on Turkey Point Plant Property

Surface Water

The reclaimed water pipelines would enter the Turkey Point plant property at the location of the FPL reclaimed water treatment facility. Following treatment, the reclaimed water would be pumped via pipelines to the makeup water reservoir on the Units 6 & 7 plant area. The pipelines would cross areas previously disturbed and segments of the existing industrial wastewater facility, as described in Section 2.2.

Installation of the reclaimed water pipelines across segments of the industrial wastewater facility would be accomplished via bridging to minimize potential impacts.

Surface disturbance that could affect hydrologic alteration would be short-term and would result in an impact to a limited area. The construction areas would be contoured to facilitate drainage and the area seeded with native species. During construction, water resulting from dewatering and surface water runoff would be released to the industrial wastewater facility. Potential impacts to surface water from hydrologic alteration for constructing the onsite portion of the reclaimed water pipelines would also be of short duration.

The potential impact from hydrologic alteration of surface water as a result of construction of the reclaimed water pipelines would be SMALL and would not warrant additional mitigation.

Groundwater

Installing the onsite portion of the reclaimed water pipelines could alter the flow of groundwater in the proximity of the excavation activity. Once construction activities come to an end, the groundwater hydrologic flow would return to preconstruction conditions. Impacts during construction would be short-term and limited to the area of construction activity. Therefore, impacts would be SMALL and would not warrant additional mitigation.

4.2.1.1.8 Constructing Radial Collector Wells

Surface Water

Radial collector wells would be installed adjacent to Biscayne Bay to provide cooling water for Units 6 & 7 (see Figure 3.1-3). The well caissons would be located on the Turkey Point peninsula, east of the existing units. Each radial collector well would consist of a central reinforced concrete caisson extending below the ground level with laterals projecting from the caisson. The well laterals would be advanced horizontally a distance of up to 900 feet and installed to a depth of approximately 25 to 40 feet below the bottom of Biscayne Bay. Groundwater recharge from Biscayne Bay would flow into the horizontal well laterals and flow by head force to the collection caisson located onshore where the water would be pumped via pipelines to Units 6 & 7.

Seawater from Biscayne Bay would flow downward, recharging the groundwater aquifer. Constructing the delivery pipelines from the radial collector wells to the Units 6 & 7 plant area would be accomplished using surface excavation methods. The location of the pipelines is shown on Figure 3.9-1.

The construction activities would be performed in accordance with the required local, state, and federal guidelines and standard industry practices. Necessary permits would be obtained before beginning construction activities. Constructing the delivery pipelines would alter the surface flow in the vicinity of the pipelines during construction activities. However, the disturbance would be short-term and the routes would be recontoured afterward.

Constructing the radial collector wells, associated facilities, and the delivery pipelines would result in short-term alteration of surface flow patterns in the vicinity of the caissons and the delivery pipelines. Unused excavated material would be placed in the designated spoils areas. Sedimentation barriers or other appropriate measures would be installed to limit potential impacts to surface water bodies. Once construction activities are complete, the drainage would be restored to preconstruction conditions. Impacts from hydrologic alteration of surface water because of construction activities associated with the radial collector wells, associated facilities, and the delivery pipelines would be SMALL and would not warrant mitigation.

Groundwater

Construction could alter groundwater flow, primarily as a result of dewatering from the construction of the radial collector well caissons and laterals. Dewatering during construction could impact wetland areas located near the dewatering activities for the caissons and pipelines. Water from the dewatering activities for the radial collector wells and delivery pipelines would be added to the industrial wastewater facility.

FPL would comply with federal and state requirements regarding the siting of the radial collector wells and delivery pipelines. The use of standard industry construction practices would include the use of existing corridors or roadways on the Turkey Point plant property to the extent practicable. Sheet piles could be used to limit potential impacts during construction dewatering activities. The effects of groundwater drawdown would be minimal because of the relatively small volume of water that would be withdrawn from the source.

Therefore, impacts would be SMALL and would not warrant additional mitigation.

4.2.1.1.9 Deep Injection Wells

Surface Water

Twelve deep injection wells would be installed in the Units 6 & 7 plant area as shown on Figure 3.1-3. The deep injection wells would be installed into the Boulder Zone of the Lower Floridan aquifer in accordance with a permit issued under the FDEP underground injection control program. The deep injection wells would also require the installation of dual zone monitoring wells to monitor the potential impact of the injection process on overlying aquifer units adjacent to the Boulder Zone.

As with other construction activities in the Units 6 & 7 plant area, surface water runoff during well installation would be directed to the cooling canals of the industrial wastewater facility. Impacts to surface water from hydrologic alteration would be SMALL and would not warrant additional mitigation.

Groundwater

The deep injection wells and the required monitoring wells would be installed in accordance with a permit issued under the FDEP underground injection control program. The FDEP underground injection control program stipulates methods and approaches, such as sequential casing installation and isolation of individual aquifers, to protect groundwater resources during the installation and development of the deep injection wells.

During construction of Units 6 & 7, one of the deep injection wells could be used for the disposal of construction-related wastewater. Injection would be in accordance with the underground injection control permit and would be consistent with the use of deep injection wells in Florida. Groundwater monitoring data, including groundwater elevation data and chemical data, would be collected and submitted to FDEP in accordance with the underground injection control permit. Impacts to groundwater from hydrologic alteration would be SMALL and would not warrant additional mitigation measures other than those required by the injection permit. See Subsection 4.2.2.2.1.

4.2.1.1.10 Onsite Connector Transmission Corridors

Surface Water

As described in Sections 2.2 and 3.7, alterations would be required along the existing Turkey Point-to-Davis corridor. New towers would be required to connect to the existing corridor from the new Clear Sky substation. This description is limited to the portion of that corridor from the Clear Sky substation to the Turkey Point-to-Davis corridor on the Turkey Point plant property.

The construction activities associated with new transmission towers would require the excavation and temporary storage of soils and the dewatering of groundwater at the tower locations. These activities would occur on Turkey Point plant property where the surface water runoff patterns have already been established. Existing drainage features would be used including ditches and detention ponds. New ditches and detention ponds would be constructed as needed. Should modification to the existing draining ditches or drainage features be required, the impacts would be temporary and the disturbed areas would be returned to preconstruction conditions. Work would be performed in accordance with applicable permits. The new line along the segment from the Clear Sky substation to the Turkey Point property boundary would cross over a wetland area. Adding the new line would require vehicular traffic in the corridor that could alter surface water flow direction because of rutting of the surface soils by vehicles. Excavated soils would be removed, the affected area recontoured, and the corridor segment restored to preconstruction conditions. Where needed, the vegetative cover would be re-established. For these reasons, impacts to hydrologic flow from adding a new transmission line to the existing Turkey Point-to-Davis transmission corridor would be SMALL and would not require additional mitigation.

The Clear Sky-to-Pennsuco/Levee onsite segment would require constructing new transmission towers. The onsite segment would cross the industrial wastewater facility to the west and follow the existing transmission line corridor to the property boundary and beyond. Constructing towers within the industrial wastewater facility would require stockpiling soils that could alter surface water flow in the vicinity of the activity. Construction methods, controls, and impacts would be similar to those described for the Turkey Point-to-Davis corridor above. For these reasons, impacts to hydrologic flow from adding a new transmission line from Clear Sky to Pennsuco/Levee would be SMALL and would not require additional mitigation.

Groundwater

It could be necessary to dewater the excavations for the foundation of the towers required to make the connection from the Clear Sky substation to the transmission towers offsite. The dewatering effects would be short-term and the water level would return to preconstruction levels. Hydrologic alteration would occur only at the foundations on the Turkey Point plant property. No effects would occur offsite for this segment of the lines. Impacts to groundwater from hydrologic alteration would be SMALL and would not require additional mitigation other than those required in the site-specific permits.

4.2.1.1.11 Potable Water Pipelines

Surface Water

The operation of Units 6 & 7 would require potable water pipelines be constructed from an existing MDWASD supply line near the intersection of SW 288th Street and SW 137th Avenue/

Tallahassee Road to the Turkey Point plant property, connecting to the location of the site meter for the existing Turkey Point potable water supply line (Figure 3.9-1). The route to the Turkey Point plant property would parallel and cross multiple drainage canals and the L131E Interceptor Canal along SW 359th Street. The potable water pipelines would pass just to the north of the cooling canals of the industrial wastewater facility, and turn south before entering the Units 6 & 7 plant area.

Standard pipeline techniques including open trenching and backfilling would be used for most of the installation. Directional drilling could also be used for canal crossings, where site conditions and pipeline size permit. Surface crossings could also be accomplished in the vicinity of the bridge to be located on the cooling canals of the industrial wastewater facility. The onsite portion of the pipelines would cross areas previously disturbed. Surface disturbance that could alter the hydrology would be short-term and would result in an impact to a limited area. Construction areas would be contoured to facilitate drainage and the area seeded with native species, where needed. During construction dewatering, surface water runoff would be released to the industrial wastewater facility. Potential impacts to surface water from hydrologic alteration from the onsite portion of the potable water pipelines would also be of short duration.

The potential impact from hydrologic alteration of surface water as a result of construction of the potable water pipelines would be SMALL and would not warrant additional mitigation.

Groundwater

Installation of the onsite portion of the potable water pipelines could alter the flow of groundwater in the proximity of the excavation activity. Once construction activities come to an end, the groundwater hydrologic flow would return to preconstruction conditions. Impacts during construction would be short-term and limited to the area of construction activity. Therefore, impacts would be SMALL and would not warrant additional mitigation.

4.2.1.2 Offsite Facilities

4.2.1.2.1 Borrow Areas

Surface Water

Borrow material for construction would be obtained from a combination of an FPL-owned fill source, other regional sources, or reused material. The FPL-owned fill source is located just to the southeast of the former location of the Homestead Air Reserve Base. The borrow area would be permitted and operated in accordance with FDEP permit requirements. The facility would be operated as a dragline facility. Therefore, dewatering would not be required during dragline operations. Impacts to surface water could occur as the result of altering surface water flow in the vicinity of the property. A perimeter berm could be used to restrict the flow of surface water onto the property. The berm could also be used in association with detention basins and a truck wash facility to reduce surface water runoff from the site and prevent soils from being unintentionally spread to offsite areas. Drainage ditches could be used to direct surface water flow away from the site and could be reconnected to any drainage features that once flowed through the property to maintain surface flow.

Impacts from operating a borrow area because of hydrologic alteration of surface water would be temporary and SMALL and would not warrant additional mitigation.

Groundwater

Groundwater dewatering that could alter flow direction in the aquifer would not be necessary for operating a borrow pit using a dragline. However, once dragline operations begin, water in the surrounding aquifer would flow toward the quarry to replace the void left from the mined material as the aquifer attempts to equilibrate. Once dragline operations cease, the groundwater level would return to static. Impacts from hydrologic alteration would be temporary and SMALL and would not warrant additional mitigation.

4.2.1.2.2 Transmission Corridors

Surface Water

As described in Subsection 2.2.2.1, new transmission lines would be routed in existing FPL transmission line corridors to the extent practicable. FPL would also pursue several substation upgrades and expansions as part of the proposed project.

<u>Clear Sky-to-Levee Transmission Corridor</u>

The preferred route (West Preferred Corridor) for the transmission line is described in Sections 2.2 and 3.7. Water bodies potentially impacted along the primary route include several unnamed streams or surface water features, including drainage canals and wetlands. The canals include the L-31, C-113 Canal, C-103 Canal, C-102 Canal, the L-31E, and the Tamiami Canal. These water bodies could be impacted by the construction activities along the corridor.

New transmission towers would be required. The construction activities associated with new towers would require the excavation and temporary storage of soils at the tower locations. Construction activities for new transmission structures, tower pads, conductors, and access roads are described in Section 3.7. These activities could result in vegetation loss and land disruption in the land types occurring along the final rights-of-way. The right-of-way for the West Preferred Corridor would be largely along existing public roads or existing rights-of-way. Existing roads could require improvements and/or continued maintenance during construction activities.

FPL construction programs, plans, and procedures routinely use environmental best management practices and mitigation measures to ensure adverse environmental effects of construction are avoided, minimized, or mitigated. Specific environmental protection and impact mitigation measures (with the associated construction phase) that potentially would be used in the Units 6 & 7 transmission line rights-of-way include:

- Use of restrictive land-clearing processes in forested wetland areas (right-of-way clearing and preparation)
- Use of turbidity screens and erosion-control devices in areas of wetlands and water resources (access road/structure pad construction)
- Use of existing access roads for ingress and egress to rights-of-way where available (access road/structure pad construction)
- Use of standard industry construction practices for foundation and structure excavation and construction (line construction)

As described in Section 1.2, FPL would comply with all applicable laws, regulations, and permit requirements. Standard industry construction practices would be used for transmission line construction, including use of existing rights-of-way, to the extent practicable, and environmental management, including erosion-control devices, matting to reduce compaction caused by equipment, use of wide-track vehicles when crossing wetlands, and restoration activities after construction.

Construction activities would require vehicular traffic in the corridor that could alter surface water flow direction because of rutting of the surface soils by vehicles. Excavated soils would be removed and the affected construction areas recontoured as necessary and restore the corridor segment to preconstruction conditions. Where needed, the vegetative cover would be reestablished. Impacts to surface water from altering hydrologic flow would be SMALL and would not require mitigation in addition to those described.

Construction activities at the Levee substation would consist of the expansion of the current facility by approximately 100 feet along the northern portion of the existing facility. The expansion would include the excavation, filling, grading, and the addition of fencing. Additional stormwater retention areas would also be added to the vacant area north of the planned expansion. Similar mitigation measures would be used for the substation construction activities. Impacts would be temporary and limited to the area of construction.

The potential impacts at the substation from hydrologic alteration would be similar to construction impacts along the transmission route, would be SMALL, and not warrant additional mitigation.

Levee-to-Pennsuco Corridor

The 230 kV transmission line terminating at the Pennsuco substation would also follow the Clear Sky-to-Levee corridor identified above, but would not connect at Levee substation.

The new line would continue largely within or along an existing right-of-way from the Levee substation to the Pennsuco substation. The right-of-way would follow along existing drainage ditches and run adjacent (and not across) ponds located along the route. The new line would require the construction of new transmission towers.

Construction activities at the Pennsuco substation would require the expansion of the fenced substation by approximately 0.65 acres (Section 2.2). The expansion could include the excavation, filling, grading, and the addition of fencing. Additional stormwater retention areas could also be added to the vacant area south of the planned facility expansion. Similar mitigation measures would be used for the substation modification activities as would be used for the transmission corridor. Impacts would be temporary and limited to the area of disturbance. Therefore, the impacts would be SMALL and not warrant additional mitigation.

Clear Sky-to-Davis Corridor

The Clear Sky-to-Davis corridor would use existing transmission line rights-of-way. This existing corridor and rights-of-way cross and border a land area that is now a small part of the property of Biscayne National Park just north of the Turkey Point plant property and near the park headquarters, and also crosses the Florida City Canal, the L-31E Canal, the North Canal, an unnamed drainage feature, the Military Canal, the Princeton Canal (C-102), and Black Creek and the Black Creek Canal (C-1) before arriving at the Davis substation.

The expansion of the transmission capacity along the Clear Sky-to-Davis corridor would require the construction of new transmission towers. The potential hydrologic impacts would be similar to those for the Clear Sky to Levee route described above. Access to the existing right-of-way would be via current access locations and under existing access agreements. Mitigation measures for potential impacts would be similar to those for the Clear Sky-to-Levee route.

Construction activities at the Davis substation would take place within the existing facility. Similar mitigation measures would be used for the substation modification activities as would be used for the transmission corridor. Impacts would be temporary and limited to the area of disturbance. Therefore, the impacts to this corridor would be SMALL and not warrant additional mitigation.

The new transmission lines would require constructing new towers, the modification of existing towers, and constructing in existing or new rights-of-way. New transmission lines would be built in Miami-Dade County and the prospective corridors are shown in Figure 2.2-5. The land use along the transmission corridors is presented in Table 2.2-2.

Davis-to-Miami Corridor

As described in Section 3.7, the Davis-to-Miami corridor would follow an existing FPL transmission right-of-way east from the Davis substation until the corridor crosses U.S. Highway 1. The corridor would then follow existing transportation and utility rights-of-way northeast until the corridor reaches the Miami substation. Waterbodies crossed would include the Cutler Drain Canal (C-100), the C-100A Canal, the Snapper Creek Canal (C-2), the Coral Gables Canal, and the Miami River (C-6 Canal).

New single pole towers would be required for the new 230 kV transmission line. For any minor ditches, canals, or wetlands that are crossed, construction activities could include the installation of culverts to maintain flow. The new line would be above ground except where the transmission line would be installed below ground in traditional open-cut trenches in the vicinity of the Miami River with the crossing performed beneath the river by horizontal drilling method. The new line would continue the remaining distance after the crossing via above ground installation until the substation is reached.

No new access roads would be required. Existing public access roads would be used to access the corridor. Construction would be performed to minimize disturbance to natural ground cover. Where surface disturbance is necessary or fill material required, erosion control devices would be used to minimize impacts to wetlands and other waterbodies in accordance with state stormwater regulations and environmental best management practices. Silt fence technology and other stormwater runoff controls would be used to limit the potential impacts to nearby surface waters from stormwater runoff. Disturbed areas would be graded and seeded where necessary with a Florida approved seed mix. In areas where pavement currently exists, the pavement would be replaced in a timely manner to limit the amount of exposure soils would have to possible erosion.

Excavation of trench areas could require dewatering. Water discharged to the surface during dewatering activities could be discharged to catch basins, temporary settling basins, or watercourses if the water is sufficiently free of sediments.

Drilling beneath the Miami River would be performed in accordance with applicable regulations. Impacts to surface water bodies during construction of the Davis-to-Miami transmission line would be similar to those for the other transmission line segments. Impacts would be of short duration and localized to the activities being performed. Therefore, impacts would be SMALL and not warrant additional mitigation.

There would be a need for new facility components within the existing Miami substation in support of the new 230 kV line. No additional land would be required for these activities. Construction activities would include limited excavation and construction activities associated with bring the new aboveground line into the substation. Silt fence technology and other stormwater runoff controls would be used to limit the potential impacts to nearby surface waters from stormwater runoff during construction activities. FPL would obtain any permits necessary for the construction activities associated with the substation alteration.

Impacts to surface water bodies during construction activities within the Miami substation would be similar to those for the other substations. Impacts would be of short duration and localized to the activities being performed. Therefore, the impacts would be SMALL and not warrant additional mitigation.

Groundwater

It could be necessary to dewater the excavations for the foundation of the towers along the rights-of-way. Dewatering during trenching activities and for manhole excavation along the Davis-to-Miami corridor would also be necessary. The dewatering effects would be short term and the water level would return to preconstruction levels. Hydrologic alteration would occur locally at the foundations within the FPL rights-of-way. Dewatering could impact areas off of the right-of-way depending on the duration. However, the impacts would be temporary. Impacts to groundwater from hydrologic alterations would be SMALL and would not require additional mitigation other than those required in the site-specific permits.

4.2.1.2.3 Reclaimed Water Pipelines and FPL Reclaimed Water Treatment Facility

Surface Water

The use of reclaimed water would require constructing delivery pipelines from the Miami-Dade Water and Sewer Department (MDWASD) South District Wastewater Treatment Plant (SDWWTP) and an FPL reclaimed water treatment facility located on the Turkey Point plant property to treat the reclaimed water received from the Miami-Dade system. The location for the reclaimed water pipelines is from the SDWWTP located north of the Turkey Point plant property. The reclaimed water pipelines would cross water bodies including wetlands, the Florida City Canal, the L-31E Canal, the North Canal, the Military Canal, the Princeton Canal (C-102), the Goulds Canal, and the Black Creek Canal (C-1).

Construction activities for the reclaimed water pipelines would be performed in accordance with the required local, state, and federal guidelines, permitting requirements and accepted industry practices for the pipelines and treatment facility construction. Constructing the reclaimed water pipelines and the FPL reclaimed water treatment facility would alter the surface water flow in the vicinity during construction activities. The pipelines and facility excavation, the storage of excavated soils and/or spoils, stockpiling fill material, and the storage of equipment and supplies could impact surface water flow. Use of a stormwater detention basin would also alter the surface water flow.

Construction activities for the pipelines could result in vegetation loss and land disruption. As described in Section 4.3, the pipelines would be trenched beneath an existing access road on the west side of the corridor and, on completion, the disturbed portions of the corridor would be graded to the contours of the surrounding landscape and revegetated or returned to previous land uses. Clearing new corridors and/or expansion of existing corridors would include use of environmental best management practices to minimize impacts to surface waters.

Dewatering could be required during the excavation of the pipelines and the FPL reclaimed water treatment facility. Disposal of the water after it passes through a detention basin could alter the surface drainage downstream of the detention basin. However, impacts would be temporary. The disturbed areas would be recontoured and restored to preconstruction conditions. The disturbance would be short term. Impacts to surface water from hydrologic alteration would be SMALL and would not require additional mitigation other than those described above.

Groundwater

Construction activities could also alter the groundwater flow locally because of the excavations and foundation for the pipelines and treatment facility. The alteration would be permanent, although local to the construction activity. Dewatering activity during construction would also impact groundwater flow local to the pipelines and facility foundation. Alteration to groundwater flow would be temporary and local to the activity. Therefore, impacts from hydrologic alteration because of construction activities along the reclaimed water pipelines and at the FPL reclaimed water treatment facility would be SMALL and would not warrant mitigation other than those required by permit or identified above.

4.2.1.2.4 Offsite Roads

Surface Water

Impacts to surface water from construction activities on offsite roads would be similar to the onsite road impacts. Construction traffic access to the plant property would be via various routes including, SW 117th Avenue, SW 137th Avenue/Tallahassee Road, SW 328th Street/N. Canal Drive, SW 344th Street/Palm Drive, and SW 359th Street. Road improvements are described in Subsection 3.9.1.2.

As part of the road improvements, drainage ditches, culverts, and swales would be installed as appropriate. During construction activities, surface water would be routed to areas that could accept the additional surface flow that would then alter the flow in the vicinity of the road. Impacts from hydrologic alterations would be SMALL for groundwater and would not require mitigation.

Groundwater

Impacts to groundwater from construction activities on offsite roads would be similar to those for the onsite roads. Impacts from hydrologic alterations would be SMALL for groundwater and would not require mitigation.

4.2.1.2.5 Potable Water Pipelines

Surface Water

The operation of Units 6 & 7 would require potable water pipelines be constructed from an existing MDWASD supply line near the intersection of SW 288th Street and SW 137th Avenue/ Tallahassee Road to the Turkey Point plant property, connecting to the location of the site meter for the existing Turkey Point water supply line. The route to the Turkey Point plant property would parallel and cross multiple drainage canals and the L31E Interceptor Canal along SW 359th Street. The potable water pipelines would pass just to the north of the cooling canals of the industrial wastewater facility, and turn south before entering the Units 6 & 7 plant area.

Construction activities would also include the construction of a metering station at the intersection of SW 117th Avenue and SW 359th Street that would be used to monitor and maintain pressure in the pipelines to help meet Units 6 & 7 water requirements. Standard pipeline techniques including open trenching and backfilling would likely be used for most of the installation. Directional drilling could also be used for, road crossings and canal crossings, where site conditions and pipeline size permit. MDWASD would perform construction activities in accordance with industry standards and MDWASD protocols and procedures.

Construction activities for the potable water pipelines would be performed in accordance with the required local, state, and federal guidelines, permitting requirements and accepted industry practices for the pipelines and metering station construction. Constructing the potable water pipelines and the metering station would alter the surface water flow in the vicinity during construction activities. The pipelines and facility excavation, the storage of excavated soils and/or spoils, stockpiling fill material, and the storage of equipment and supplies could impact surface water flow. Use of a stormwater detention basin, if required, could also alter the surface water flow.

Construction and restoration along the pipelines route would be performed by MDWASD in accordance with their protocol and procedures and industry standards. Dewatering could be required during the excavation of the pipelines and the metering station. Disposal of the water after it passes through a detention basin or through other sediment control devices could alter the surface drainage downstream of the detention basin. However, impacts would be temporary. The disturbed areas could be recontoured and restored to preconstruction conditions. The disturbance would be short term. Impacts to surface water from hydrologic alteration would be SMALL and would not require additional mitigation other than those described above.

Groundwater

Construction activities could also alter the groundwater flow locally because of the construction of the potable water pipelines and metering station. The alteration would be local to the construction activities and temporary. Dewatering activity during construction would also impact groundwater flow local to the potable water pipelines and metering station construction. Alteration to groundwater flow would be temporary and local to the activity. Therefore, impacts from hydrologic alteration because of construction activities along the potable water supply pipelines and at the metering station would be SMALL and not require additional mitigation.

4.2.2 WATER USE IMPACTS

4.2.2.1 Surface Water

Construction for Units 6 & 7 and associated onsite and offsite facilities is estimated to require approximately 565 gpm (0.8 MGD) of potable water, used for such activities as fugitive dust control, concrete production, hydrotesting and flushing, and potable water use by the construction workforce. The source of construction water would be the existing units potable water supply and/or potable water brought in from tanker trucks. In addition, freshwater from any constructed stormwater ponds may be used for fugitive dust control during backfill operations. A description of the impacts to public infrastructure is included in Section 4.4. Because surface water would not be used for the construction-related activities, there would be no impacts from surface water use because of construction-related activities.

Wastewater during construction would be released to the industrial wastewater facility or to one of the deep injection wells. The impacts of release of construction wastewater to the industrial wastewater facility would be SMALL due to the small percentage of wastewater when compared to flow within the canals (0.8 MGD is the estimated potable water required for all uses during the construction of Units 6 & 7). Assuming all of the required potable water and water from dewatering activities for Units 6 & 7 would be released to the industrial wastewater facility, this would represent less than 1 percent of 2747 MGD water flow in the industrial wastewater facility. The construction wastewater flow is assumed lower.

4.2.2.2 Groundwater

As previously stated, construction water would be supplied by Miami-Dade County. Therefore, there would be no impact to groundwater use. Impacts to public water supplies is discussed in Section 4.4. However, construction-related dewatering activities would be required at both onsite and potentially offsite areas. A description of these activities, impacts, and potential mitigative measures is provided in the following subsections. Under authority of Chapter 373, State Statutes, 40E-20, F.A.C, the South Florida Water Management District (SFWMD) manages the general water use permitting process within its boundaries. Dewatering activities associated with construction of Units 6 & 7 would require a dewatering water use permit from SFWMD with appropriate regulatory requirements.

Wastewater during construction could be released to one or more of the deep injection wells. The impacts of construction dewatering and wastewater releases are described in the following paragraphs.

4.2.2.2.1 Onsite Areas

Dewatering for the new power blocks would be to depths of approximately 20 to 35 feet below sea level. Dewatering would also be required for the caisson installations for the radial collector wells. This would require dewatering systems to remove subsurface water associated with the shallow water table aquifer. Impacts could also occur to surface water in the vicinity of the dewatering activities. However, in the vicinity of dewatering activities, the closest surface water features that could be impacted are portions of the existing industrial wastewater facility. The industrial wastewater facility and slurry diaphragm wall would act as barriers to localize drawdown. The results of a pumping test to determine the need for dewatering and estimate potential impacts, indicate that impacts to groundwater and surface water would remain local to the Turkey Point plant property. Any impacts associated with the dewatering activities would remain local to the excavation site. Once dewatering ceases, the groundwater level in the surficial aquifer would return to preconstruction conditions. Because of the location chosen for Units 6 & 7, the use of isolation measures, and the presence of the industrial wastewater facility, impacts to offsite groundwater users from dewatering activities would be SMALL and would not require additional mitigation.

The injection of construction wastewater into the Boulder Zone via the deep injection wells would be in accordance with the current usage of the Boulder Zone by the State of Florida and in accordance with FDEP required permits. As described further in Section 5.2, the injectate would be isolated within the Boulder Zone from the overlying drinking water aquifers due to the construction protocols for the wells. In the exploratory well permit application, a radius of influence of up to 3.5 miles was estimated over a 10 year period of time for an assumed maximum injection rate of 90 mgd. The amount of construction wastewater that would be injected would be much less than 90 mgd resulting in a substantially reduced radius of influence. For these reasons, impacts to groundwater hydrology from the injection of wastewater during construction would be SMALL.

4.2.2.2.2 Offsite Areas

Shallow groundwater dewatering may be required during construction of new transmission towers, the reclaimed water pipelines, and new potable water pipelines. During any required dewatering activities along the transmission lines and water pipelines, surface water flow could be affected because of the release of groundwater to the ground surface or to nearby surface water bodies. As a mitigative measure, sheet piles could be used to limit the extent of potential impacts to surrounding areas where needed. Water from potential dewatering activities along the corridors could be released to a detention pond, surface pool, or other type of sediment trap before the release to a permitted outfall under any required NPDES permit requirements and SWPPPs for the construction activities. Therefore, impacts to groundwater along the transmission corridors and pipelines from dewatering activities would be SMALL.

Based on these considerations and their localized and temporary effects during dewatering, groundwater use impacts from construction activities would be SMALL and would not warrant additional mitigation.

The FPL-owned borrow area that would provide fill material is located about 4.5 miles northwest of the Units 6 & 7 plant area. The aggregate mining operation would be conducted in a manner to minimize impacts to groundwater following applicable state and local regulations. Mining operations conducted below the water table would be performed without dewatering the formation. Aggregate removed from the mine would be stockpiled inside the perimeter berm and allowed to drain before it would be transported offsite. While the mine is under construction, the water may become turbid, due to the suspension of solids. This turbidity would not impact groundwater quality away from the mine property.

A lake would be created from the mining activities in the deep cut areas. The depth of the lake would be established to ensure that the mining is performed in the fresh water portion of the aquifer and that it would not induce saltwater intrusion into the aquifer or the lake. Therefore, the impacts to groundwater resources from the mining or construction of the lake would be SMALL.

4.2.3 WATER-QUALITY IMPACTS

Available surface water and groundwater quality data for existing facilities on the Turkey Point plant property is summarized in Subsection 2.3.3. Impacts to the existing surface water and groundwater quality at on the Turkey Point plant property and offsite areas are summarized below.

4.2.3.1 Surface Water

Impacts to surface water quality at both onsite and offsite facilities can occur as the result of soil erosion because of soil disturbance during construction of onsite and offsite facilities that could result in increased surface water sediment loading to nearby water bodies.

Surface water flow from onsite construction activities, including spoils placement, would be to the industrial wastewater facility. Impacts on surface water quality would be minimal because the industrial wastewater facility operates as a closed loop cooling water system for the existing units and it does not discharge to other surface water bodies.

Modifications to the existing equipment barge unloading area would be performed under permits issued by the U.S. Army Corps of Engineers (USACE) (Section 404 Permit and Section 10 — Rivers and Harbors Act Permit; Table 1.2-1). Excavation and limited dredging could create turbid waters that could migrate from the vicinity of the equipment barge unloading area into Biscayne National Park. Curtain wall technology would be used to isolate the affected area from the waters of the park.

The equipment barge unloading area would be enlarged to accommodate larger barges. The modification would be performed using sheet piles to isolate the equipment barge unloading area from the barge turning basin. Excavated and dredged soils would be stockpiled in the spoils areas described in Section 3.9. Impacts to surface water quality from equipment barge unloading area modifications would be SMALL and would not warrant mitigation.

The water quality for the dewatering effluent released to the industrial wastewater facility would be of similar quality as the water in the facility and the flow would be negligible when compared to the total flow in the cooling canals and thus would have a SMALL impact. Ground-disturbing activities that meet federal, state, and local regulations requiring permits, would be permitted and overseen by applicable regulations, and guided by an approved SWPPP. The SWPPP would also contain a plan for the construction activities. Any impacts to surface water quality during construction would be SMALL and would not warrant mitigation beyond those best practices required by permits.

Construction of transmission lines would comply with applicable regulations and standard industry construction practices (including use of existing corridors to the extent practicable) would be used. Accordingly, impacts to surface water sources from transmission line and pipeline construction would be SMALL and would not warrant mitigation.

4.2.3.2 Groundwater

4.2.3.2.1 Onsite Areas

The plant area overlies a surficial saltwater aquifer beneath the plant that is hydraulically connected to both the industrial wastewater facility and Biscayne Bay. Makeup water for the industrial wastewater facility comes from process water, rainfall, stormwater runoff, and groundwater infiltration to replace evaporative and seepage losses. In addition, the surficial aquifer is tidally influenced and unsuitable for potable water uses.

Any spills of diesel fuel, hydraulic fluid, lubricants, or other construction-related pollutants would be cleaned up to prevent them from moving into the groundwater. This would also mitigate impacts to local surface water because spills would be addressed and not allowed to flow to nearby surface water.

In the unlikely event small amounts of contaminants escape into the environment, they would have only a small, localized, temporary impact on the water table aquifer. Impacts to groundwater quality would be SMALL and would not warrant mitigation beyond those described in this section or required by federal and state permits.

4.2.3.2.2 Offsite Areas

Construction of new transmission towers or modification of existing lines, the construction of access roads, potable water pipelines and reclaimed water pipelines could cause potential impacts to surface water and groundwater along the chosen routes. Any spills of diesel fuel, hydraulic fluid, lubricants, or other construction-related pollutants along the routes or at offsite facilities would be cleaned up to prevent spilled fuel or oil from moving into nearby surface waters. This would also mitigate impacts to local groundwater because spills would be quickly attended to and not allowed to penetrate to groundwater. The construction activities would be performed under a new SWPPP or under a modification of an existing SWPPP and associated spill prevention plan.

In the unlikely event small amounts of construction-related pollutants escape into the environment during road, transmission line, or water pipelines construction, they would have only a small, localized, and temporary impact on the water table aquifer. Impacts to groundwater quality would be SMALL and would not warrant mitigation beyond those described in this section or required by permit.

Section 4.2 References

FDEP Mar 2003. Florida Department of Environmental Protection, *The Florida NPDES Stormwater Permitting Program for Construction Activity*. March 2003.

U.S. EPA Oct 1992. (U.S. Environmental Protection Agency), *Stormwater Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices*, Office of Water, Washington, D.C., October 1992.

U.S. EPA Jun 1996. *Overview of the Stormwater Program*, Office of Water, Washington, D.C., June 1996.

4.3 ECOLOGICAL IMPACTS

This section addresses potential impacts to terrestrial and aquatic communities from the construction of Units 6 & 7 and associated onsite and offsite facilities. Details of construction activities and their potential landscape alterations are provided in Sections 3.9 and 3.1, respectively. The FLUCCS land use cover codes for Turkey Point property land disturbance are summarized in Table 4.3-1. The FLUCCS land use cover codes for offsite features in the vicinity and region are summarized in Tables 2.2-1 through 2.2-8.

The Units 6 & 7 plant area is within the industrial wastewater facility and within the larger approximately 9400-acre Turkey Point plant property (Figures 2.4-1 and 2.4-2). The Units 6 & 7 plant area is immediately south of Units 3 & 4 and consists primarily of hypersaline mudflats and other wetland habitats, as well as a few upland habitats established on old spoil deposits. Other onsite habitats (within the Turkey Point plant property) include the industrial wastewater facility, existing facilities associated with Units 1 through 5 (including the barge turning basin), and dwarf mangrove areas. The primary landscape features adjacent to the plant property are Biscayne Bay, Card Sound, and the Everglades Mitigation Bank. The transmission corridors, the reclaimed and potable water pipeline corridors, and expanded access roads cross a variety of land use types, including various kinds of wetlands (marshes, forested wetlands, and canals), agricultural areas, rangelands, and developed/urban areas.

The impacts on terrestrial and aquatic habitats associated with the construction of Units 6 & 7 and the associated infrastructure are primarily permanent disturbances and they are described in this section. Most terrestrial disturbance would occur on previously disturbed/filled land. Onsite wetlands and water bodies that could be impacted by construction activities include:

- Hypersaline mudflats
- Mangrove heads associated with historical tidal channels
- Dwarf mangroves
- Remnant canals

Other water bodies on the plant property that would be impacted by construction activities include:

- Cooling canals of the industrial wastewater facility
- Mangrove wetlands
- Barge turning basin/equipment barge unloading area

Offsite water bodies that could be affected by construction activities include:

- Biscayne Bay
- Canals and wetlands traversed by transmission corridors, reclaimed water pipelines, potable water pipelines, and access roads

Onsite and offsite construction activities that could impact site hydrology are described in Subsection 4.2.1 and include:

- Clearing land on the Turkey Point plant property and constructing infrastructure such as roads, bridges, parking areas, and stormwater drainage systems
- Constructing new power block buildings (reactor containment structure, turbine building, auxiliary building), cooling towers, nuclear administration building, training building, security facilities, Clear Sky substation, roads, FPL reclaimed water treatment facility, laydown areas, parking areas
- Constructing reclaimed water pipelines from the Miami-Dade Water and Sewer Department (MDWASD) South District Wastewater Treatment Plant (SDWWTP) to the FPL reclaimed water treatment facility
- Constructing the radial collector wells and associated pipelines
- Creation of spoils storage areas and sand/soil/gravel stockpiles
- Deep injection wells
- Excavating and removing the upper approximately 5 feet of muck within the plant area
- Dewatering of foundation excavations during construction
- Clearing and construction/modification of transmission ROWs and construction/modification of transmission access roads, towers, access bridges, and pads for transmission lines
- Plant access road construction and expansion
- Installation of potable water pipelines
- Expanding the existing equipment barge unloading area and excavation/dredging in the vicinity of existing barge turning basin
- Mobilizing and demobilizing

4.3.1 TERRESTRIAL ECOSYSTEMS

The terrestrial resources of the Units 6 & 7 plant area, the Turkey Point plant property in general, and the southeastern region of Florida, are described in Subsection 2.4.1. This information provides a baseline from which to gauge potential impacts of construction activities. Potential impacts to plant property areas are discussed in Subsection 4.3.1.1 and potential offsite impacts are discussed in Subsections 4.3.1.2 (reclaimed water pipelines) and 4.3.1.3 (transmission corridors, borrow site, and access roads/potable water pipelines).

4.3.1.1 Potential Impacts to the Units 6 & 7 Plant Area and Other Plant Property Areas

Construction of Units 6 & 7 and associated onsite facilities (Figure 4.3-1) would result in approximately 600 acres being disturbed (and would represent the maximum possible area of soil exposed at one time) during the construction phase. A variety of wetland land cover types, as summarized in Table 4.3-1, would be disturbed by construction activities. Construction of the heavy haul road would result in land disturbance, but would mostly occur on previously disturbed land on the Turkey Point property and, therefore, would not impact terrestrial habitats. Clearing methods, disposal of construction wastes, and methods of limiting erosion, runoff, and siltation are addressed in Section 4.1.

As described in Subsection 2.4.1, the approximately 218-acre Units 6 & 7 plant area consists primarily of hypersaline mudflats and other wetland types (Figure 2.4-2). The area has been impacted by unit operations for three decades. Although the Units 6 & 7 plant area has not been developed directly, it has been impacted by the construction of berms/spoil deposit areas and the adjacent and remnant canals associated with the industrial wastewater facility.

An approximate 52-acre laydown area would be established west of the Units 6 & 7 plant area. This area consists of streams and waterways/canals, reservoirs larger than 500 acres (note: this description applies to the part of the industrial wastewater facility that is within the laydown area), dwarf mangroves, fill area and roads and highways (Table 4.3-1). An approximate 3-acre transmission laydown area would be established and consist of ditches, dwarf mangroves and electric power facilities (Table 4.3-1).

An approximate 44-acre FPL reclaimed water treatment facility would be built on a parcel of land between SW 344th Street/Palm Drive and the test canals (immediately north of the industrial wastewater facility). This facility would be built on sawgrass marsh with scattered dwarf mangroves, mixed wetland hardwoodand roads and highways (Table 4.3-1). Delivery pipelines would extend south from this facility through a variety of land cover types, with the majority consisting of mangroves, mixed wetland hardwoods, and roads/highways (Table 4.3-1), to the makeup water reservoir. The facility is immediately north of land considered crocodile critical habitat.

The existing barge facility would be expanded to allow delivery of large components and modules for Units 6 & 7. The expansion, termed the equipment barge unloading area, would be about 130 feet by 250 feet in size and located on an existing filled area on the northwest edge of the barge turning basin.

Existing roads within the Turkey Point Plant property would be improved to provide a heavy haul road for transportation of large components and equipment from the equipment barge unloading area. This would impact 5.17 acres of streams and waterways/canals, non-vegetated wetlands, disturbed land, fill areas, roads and highways and electric power facilities (Table 4.3-1), and two new bridges would be established over existing canals.

Three separate areas totaling approximately 211 acres would be used for spoils storage. Onetorage area would be about 77 acres and would lie along the west bank of the main north-south canal of the industrial wastewater facility (does not include the existing road). The second area would be about 116 acres and would lie along the eastern bank of the main north-south canal of the industrial wastewater facility (does not include the existing road). The final storage area would be about 18 acres and would be located along the southern bank of the east-west canal at the lower end of the industrial wastewater facility (does not include the existing road). All three storage areas would be established on portions of the Turkey Point property previously disturbed by construction and maintenance of the industrial wastewater facility. The spoils storage areas would be graded and bermed (e.g., lip berm) to minimize the amount of drainage from the spoils into the industrial wastewater facility. While water quality treatment is not required, sediment control devices such as hay bales or gravel filters may be used to ensure sediment from the spoils does not physically impact terrestrial or aquatic species in the cooling canals of the industrial treatment facility.

4.3.1.1.1 Plants and Plant Communities

Plants and plant communities on the Turkey Point plant property are sparse resulting from harsh conditions (hypersaline soils and fluctuating water levels) and disturbed soils. Common plants include red mangrove (*Rhizophora mangle*), white mangrove (*Laguncularia racemosa*), saltwort (*Batis maritima*), and glasswort species (*Salicornia spp.*). Listed, rare, or unusual plant species have been observed in the Clear Sky to Levee transmission corridor within the Turkey Point plant property but not in other areas within the Turkey Point plant property. Listed (state threatened) plant species observed in the Clear Sky to Levee transmission corridor are locustberry (*Bysonima lucida*), mullein nightshade (*Solanum donianum*), and West Indian trema (*Trema lamarkianum*). These species would be avoided to the maximum extent practical. Because the majority of habitats to be disturbed have a previous history of disturbance or alteration, construction impacts to plants and plant communities would be SMALL and no further mitigation measures would be warranted. Construction activities would not significantly reduce the regional diversity of plants or plant communities.

4.3.1.1.2 Threatened and Endangered Species

Important wildlife species, as defined by NUREG-1555, do exist and/or have existed within the Turkey Point plant property. These important species include four federally listed species: American crocodile (*Crocodylus acutus*), wood stork (*Mycteria americana*), Florida manatee (*Trichechus manatus latirostris*), and eastern indigo snake (*Drymarchon corais couperi*) (see Subsection 2.4.1.2).

Existing Turkey Point facilities and new Units 6 & 7 are within the area designated as critical habitat for the crocodile (see Figure 2.4-4), and crocodiles reside and breed within the industrial wastewater facility (see Figure 2.4-5). The harsh environment (mudflats with little cover/shade) within the construction footprint of the Units 6 & 7 plant area is poor habitat for the crocodile, although crocodiles occasionally use the adjacent canals as travel corridors. Adjacent canals may be temporarily impacted (erosion, sedimentation, turbidity) by construction activities (see Subsection 4.3.1.3.1), including transmission line construction. However, these potential impacts would be limited by standard industry construction practices (silt fences, mulching, slope texturing, vegetated buffer strips, reseeding areas of disturbed soils) and the canals would continue to provide crocodile habitat during and after construction. There are a small number of crocodile nests (three in 2008) in the northern end of the return canals (see Figure 2.4-5) within approximately 300-650 feet of the Units 6 & 7 plant area. It is possible that these nesting crocodiles may be disturbed by construction noise and increased activity on the roadways and berms (e.g., trucks carrying spoil/muck, construction materials, transmission line construction, etc.) in the industrial wastewater facility, and could possibly leave the area. Also, 359th Street will be improved immediately adjacent to the northern end of the industrial wastewater facility. Traffic on this road may pose a threat to crossing crocodiles. Project-specific management plans for crocodiles and other listed species have been created by FPL for all recent facility additions and would be created for this construction activity as well. These management plans include monitoring for species occurrence and mitigation measures. Although the affected land is considered of marginal quality for the crocodile, it is still considered “potential” habitat. The loss of potential habitat would be mitigated by the creation of additional freshwater refugia for juvenile crocodiles on selected berms and vegetation restoration (removing exotics and managing for native plants). To mitigate for hazards associated with increased traffic on the road between the northern end of the industrial wastewater facility and the test canals, four wildlife underpasses would be installed to allow safe travel between the two sites. All current aspects of the crocodile research and monitoring programs would be continued. These aspects include education of on-site workers about status of and threats to crocodiles, constraints on vehicular traffic within the industrial wastewater facility at night and during critical periods of the nesting season, and constraints on road maintenance and construction activities at night and during nesting as well as at/near crocodile crossings.

Construction activities for Units 6 & 7 would not impact crocodile populations in southern Florida or hinder continued recovery of this species. However, given that the industrial wastewater facility hosts a significant crocodile population and given the proximity of small numbers of nesting crocodiles to the construction area and to roadways that would be used during construction, impacts to the local population as a result of increased traffic and construction noise would be MODERATE and would require mitigation such as that described above.

Small numbers of wood storks have been observed in shallow water within the laydown area immediately west of the Units 6 & 7 plant area. Wetlands within this laydown area and the plant area would be eliminated by construction of Units 6 & 7. However, wood storks and other wading birds also use shallow waters within the industrial wastewater facility and, therefore, the loss of these wetlands within the construction areas would not significantly impact local or regional wood stork populations, and impacts would be SMALL (also see Subsection 4.3.1.3.1).

One Florida burrowing owl (*Athene cunicularia floridana*), a species of special concern, had been observed in the southern portion of the industrial wastewater facility. Florida burrowing owls typically inhabit open, well drained landscapes such as pastures and mowed areas. Given that the Florida burrowing owl has not been observed within the construction footprint or in areas likely to be impacted by construction activities, construction impacts on the Florida burrowing owl would be SMALL.

Manatees have been observed within the barge turning basin, but this area is not designated as critical habitat for the species (see Figure 2.4-4). Construction of Units 6 & 7 would result in additional barge traffic (80 deliveries per unit over 6 years) delivering large components and modules to Turkey Point and thus could result in an increased probability of manatee/barge interactions. A management plan would be implemented for in-water activities to avoid and/or limit potential impacts to manatees. This plan would include the use of observers to spot manatees during in-water activities and reduction of in-water activities if manatees were observed within the basin. Given that the construction activities relative to the equipment barge unloading area (including barge traffic) are modifications/increases of existing activities and that a management plan would be implemented to avoid and/or limit potential impacts on manatees, the impacts of construction activities on manatees would be SMALL.

There have been occasional sightings of the eastern indigo snake on and near the Turkey Point plant property. None of these sightings occurred within the construction footprint or on areas likely to be impacted by construction activities. Given the limited number of sightings of this species on plant property (see Subsection 2.4.1.2), construction impacts on eastern indigo snakes would be SMALL.

4.3.1.1.3 Other Important Species

Other important wildlife species under NUREG-1555 are state-listed species and game animals. Wildlife observed on the Turkey Point plant property includes two state-threatened species: the least tern (*Sterna antillarum*) and the white-crowned pigeon (*Columba leuccephala*). Six wading birds designated as species of special concern have been observed on and/or adjacent to the Units 6 & 7 plant area: little blue heron (*Egretta caerulea*), roseate spoonbill (*Ajaia ajaja*), reddish egret (*Egretta rufescens*), snowy egret (*Egretta thula*), tricolored heron (*Egretta tricolor*), and white ibis (*Eudocimus albus*). Given the use of other higher-quality habitats within Turkey Point plant property by these state-listed species, the impacts of construction on these species would be SMALL. Game species observed within the Turkey Point plant property include white-tailed deer (*Odocoileus virginianus*), rabbits (*Silvilagus sp.*), and mourning doves (*Zenaida macroura*). Habitat for these terrestrial game animals is generally limited on the Turkey Point plant property and, therefore, their onsite populations are likely to be small. Therefore, the impacts of construction activities on game species would be SMALL.

4.3.1.1.4 Wetlands

Wetlands function as breeding habitat, foraging habitat, protective cover, and water sources for a variety of wildlife species and are considered “important habitats” under NUREG-1555. Wetlands and remnant canals within the approximately 218-acre Units 6 & 7 plant area were delineated in 2008 using standard methods documenting hydrology, hydrophytic plants, and hydric soils. Approximately 250 acres of wetlands in the plant area would be eliminated by construction, with mudflats (187.5 acres) the primary wetland type converted (see Subsection 2.4.1.3 and Figure 2.4-2). As hypersaline, ephemeral water bodies, the value of these wetlands to local wildlife is limited to those species that can tolerate harsh environmental conditions [e.g., sheepshead minnow (*Cyprinodon variegatus*), killifish (*Fundulus sp.*)] and the species that prey upon them (e.g., snowy egret, tricolored heron). Thus, the primary species found within the construction areas are hardy fish and invertebrate species and the piscivorous birds which use them as forage.

Excavation for the power block foundations would be on top of the hard Key Largo formation, approximately 35 feet below MSL, requiring dewatering to remove subsurface water associated with the shallow, water table aquifer. Additional construction impacts could also occur to surface water in the vicinity of the dewatering activities, including portions of the industrial wastewater facility. The cooling canals would act as a barrier limiting the impacts to the area being dewatered. The results of a pumping test determined that dewatering impacts to groundwater and surface water would/would not alter water levels within the industrial wastewater facility.

A laydown area would be established west of the Units 6 & 7 plant area. The FLUCCs land use description of this area consists of streams and waterways/canals, reservoirs larger than 500 acres (note: this description applies to the part of the industrial wastewater facility that is within the laydown area), dwarf mangroves, fill area and roads and highways (Table 4.3-1). An approximate 3-acre transmission laydown area would be established and consist of ditches, dwarf mangroves and electric power facilities (Table 4.3-1). After construction activities are completed, this land could be regraded.

A nuclear administration building, training building, and parking areas would be built on two adjacent parcels of land north of the Units 6 & 7 plant area. These areas total approximately 32 acres, consisting of a variety of land cover types including mangrove swamps, fill areas, and roads/highways (Table 4.3-1).

The FPL reclaimed water treatment facility would be built on a parcel between SW 344th Street/ Palm Drive and the test canals (immediately north of the industrial wastewater facility). This facility would be built on sawgrass, dwarf mangroves, mixed wetland hardwoods and roads and highways (Table 4.3-1). Pipelines would extend south from this facility through a variety of land cover types, with the majority consisting of mangroves, mixed wetland hardwoods, and roads/ highways (Table 4.3-1) to the makeup water reservoir. The facility would be immediately north of land considered crocodile critical habitat. Any required mitigation for wetland loss would likely include wetland enhancement, restoration, and/or purchase of Everglades Mitigation Bank credits (see description in Subsection 4.3.1.1.4).

There would be approximately 10.8 total miles of roadway improvements and new road construction to create better access to the Turkey Point plant property for construction workers and trucks delivering fill and other material. The majority of these improvements would occur along existing paved and non-paved roads and transmission corridors, thus reducing potential impacts to the environment. Land uses/covers associated with these roadway corridors include a variety of land cover types, with the majority consisting of wetlands, farms, roads, and disturbed areas (Table 2.2-7). The new construction would occur between the existing road on the northern end of the cooling canals and SW 359th Street and would require the construction of a bridge to cross the L31E canal.

Construction/expansion of the roadways would follow the design standards of FDEP and the Miami-Dade County Public Works Department. Activities to reduce impacts to water and wetlands would include use of silt fences and floating turbidity curtains. Culverts would be installed and placed to maintain hydrologic flows through the area, based on hydrologic studies. Unavoidable wetland impacts resulting from roadway improvements would be mitigated in consultation with FDEP and USACE.

Potable water pipelines approximately 9 miles long would bring potable water from MDWASD to the Units 6 & 7 plant area. The pipelines would generally follow existing roadways/corridors. Much of the pipelines would be installed by trenching adjacent to or within the corridors containing the access road improvements and construction along SW 328th Street/N. Canal Drive to SW 117th Avenue to SW 359th Street to the plant area. Crossings of major canals would be established by horizontal directional drilling. The habitats/land covers associated with this corridor include a variety of land cover types, including wetlands, disturbed areas, water, and roads (Table 2.2-6).

Three bridges would need to be built along the heavy haul route where the industrial wastewater facility is crossed. Modifications to the existing roads would be required to support the load requirements. The heavy haul road would cross a laydown area that would require filling. Constructing the heavy haul road could alter hydrologic flow in and along the road path by the stockpile of soil, stone, and fill material. The heavy haul road would then extend generally south and cross over two new heavy haul bridges, one at the main cooling discharge canal and the other at the main cooling return canal.

Three spoils storage areas would be established on land bordering the cooling canals within the industrial wastewater facility. Waters within the industrial wastewater facility are not waters of the state or the United States, but still provide habitat for regional fauna including the endangered American crocodile. Soil from the spoil piles could be carried into the cooling canals with stormwater, increasing sediment levels and turbidity. Environmental best management practices such as silt fences, mulching, slope texturing, and avoiding wetlands and other sensitive habitats to the extent practicable, would be employed to minimize these potential impacts to canal waters.

Wetland habitats would be impacted by construction of Units 6 & 7 and ancillary facilities as indicated in Tables 2.2-2 through 2.2-7 and Table 4.3-1. Additional wetland acres may be impacted, although these impacts would be temporary and mitigated to the extent practical by environmental best management practices. Although much of this wetland habitat exists as harsh, hypersaline mudflats with minimal value as wildlife habitat, the impacts of construction on wetland habitats would be MODERATE. A three-pronged approach to wetland mitigation would be used. The first option would be active mitigation (e.g., creation of crocodile habitat, establishment of culverts under existing roadbeds to allow sheet flow of water, etc.). The second option would be wetland enhancement, restoration, and preservation. The third option would be purchase of wetland credits from the Everglades Mitigation Bank.

4.3.1.1.5 Other Construction Impacts

Construction noise is another potential impact on wildlife at the Units 6 & 7 plant area, although wildlife utilizing Turkey Point should be acclimated to the operational noise from operation and maintenance of the existing facilities (see Subsection 4.4.1.4). Measures to reduce noise and vibration levels during construction may include staggering work activities, and use of noise dampeners and noise control equipment on vehicles and equipment. Noise levels in construction areas can be as high as 100 dBA at 100 feet from the noise source, but the noise attenuates over a relatively short distance. For example, at a distance of 400 feet from a 100-dBA construction noise source, noise levels will typically drop to within the 60-80 dBA range (Golden et al. 1980). This is generally below noise levels known to startle waterfowl and small mammals. Even with attenuation, some noise-associated displacement of wildlife is expected during construction activities, with the displacement being permanent for some species and temporary for others. Given the limited number of wildlife species present due to existing harsh conditions, likely acclimation to existing facility operational noise, attenuation of construction noise and the limited displacement of local species, impacts to wildlife due to construction noise would be SMALL.

Avian collisions with equipment (cranes), structures (buildings, fences, etc.) and new transmission lines during construction could result in mortalities. Cranes would be the tallest equipment that would be used, potentially reaching up to 460 feet high. The buildings in the power block would range from approximately 36 to 228 feet above grade. The likelihood of avian collisions depends on the height and positioning of the man-made structures as well as the size and behavior of the birds, general landscape features, and weather conditions (Brown 1993). Construction activities and noise can also affect avian movements and increase the probability of collisions. Weather conditions resulting in poor visibility can result in avian mortalities because of collisions; however, these losses have not been found to significantly impact common or abundant species. Therefore, avian collisions during construction of Units 6 & 7 would be negligible and any impacts from these collisions would be SMALL.

Direction and intensity of lighting during facility construction and operation can alter the behavior of birds and bats. However, lighting for the existing units is necessary for their safe operation and would be required for safe construction of Units 6 & 7 (see Subsection 4.4.1.3). To the extent practicable, unnecessary lights would be turned off at night, lights would be turned downward or hooded (directing light downward), and lower-powered lights would be used during construction to minimize impacts on wildlife. Given the sparseness of wildlife populations in the construction areas, impacts of lights would be SMALL.

4.3.1.2 Potential Impacts of Makeup Water Systems

Cooling water for Units 6 & 7 would originate from two sources. One source is reclaimed water from the nearby MDWASD South District Wastewater Treatment Plant and the other source is water obtained from radial collector wells.

4.3.1.2.1 Reclaimed Water Pipelines

Reclaimed water pipelines (72-inch diameter or equivalent) would extend approximately 9 miles to bring reclaimed water from the SDWWTP to the FPL reclaimed water treatment facility. For about 6.5 miles of their length, the pipelines would be collocated with the existing Clear Sky-to-Davis transmission line right-of-way and adjacent road and canal rights-of-way. Specific land cover types affected are described in Table 2.2-6. The pipelines would generally be trenched beneath an existing access road on the west side of the transmission line right-of-way. Upon completion, the disturbed portions of the corridor would be graded to the contours of the surrounding landscape and allowed to revegetate or returned to previous land uses where appropriate. Clearing of new corridors and/or expansion of existing corridors would include use of standard industry construction practices to reduce impacts to sensitive habitats. Standard industry construction practices would include employing silt fences, mulching, slope texturing, vegetated buffer strips, reseeding areas of disturbed soils, and avoiding wetlands and other sensitive habitats to the extent practical. Endangered manatees may exist in any of the SFWMD canals crossed by this pipeline corridor. Temporary wetland impacts associated with pipeline installation will be restored in situ. Any required additional mitigation for the time lag associated with in situ restoration would likely include wetland enhancement, preservation, and/or purchase of Everglades Mitigation Bank credits (see description in Subsection 4.3.1.1.4).

In summary, given that the pipelines would be collocated with existing rights-of-way along much (approximately 6.5 miles) of its route, disturbed soils would be revegetated, wetlands would be restored, and standard industry construction practices would be employed during the clearing/expansion of the corridors and construction of the pipelines, impacts of the reclaimed water pipelines on terrestrial resources would be SMALL.

4.3.1.2.2 Radial Collector Wells

Radial collector wells would be installed adjacent to Biscayne Bay to provide cooling water for Units 6 & 7 (see Figure 3.1-3). The wells would be located on the Turkey Point peninsula, east of the existing units. Each radial collector well would consist of a central reinforced concrete caisson extending below the ground level with laterals projecting from the caisson. The well laterals would be advanced horizontally a distance of up to 900 feet and installed to a depth of approximately 25 to 40 feet below the bottom of Biscayne Bay. The lateral screens under Biscayne Bay would be installed by horizontal drilling. Water from the wells would flow by head force to a collection caisson where the water would be pumped via pipelines to Units 6 & 7, thereby limiting surface disturbance to the bottom of Biscayne Bay.

Installation of the lateral screens by horizontal direct drilling could possibly produce noise/vibrations during this phase that potentially could disturb local aquatic biota (e.g., manatees, sea turtles, fish, etc.) sensitive to such disturbance. Given the depth (approximately 25 to 40 feet) of these screens, such disturbance is unlikely. However, if this procedure does result in disturbance, it would be temporary and at worst should only result in departure from the area for the duration of the event.

The radial collector wells would be located within 3 acres of previously filled lands on the northern edge of Turkey Point. Habitats adjacent to the filled lands include coastal mangroves and

Biscayne Bay. The pipelines would cross the following habitat types: streams and waterways/canals, mangrove swamps, and fill areas (Table 4.3-1). Another 3 acres of industrial/filled habitat would be required for the construction laydown area.

Wildlife species existing near the well sites and the associated pipelines would be similar to those observed on the Turkey Point plant property. Concerning "important" species (under NUREG-1555), the pipelines would cross critical habitat of the threatened American crocodile. Of the land disturbed by well and pipeline construction, only 4.5 acres may provide habitat for crocodiles. Increased vehicle traffic during construction would pose a threat to individual animals at crossing sites. No other areas designated by the U.S. Fish and Wildlife Service as critical habitat for endangered or threatened species would be crossed by these pipelines, nor would it cross any state or federal parks, wildlife refuges or preserves, or wildlife management areas. Approximately 19 acres of land would be impacted by radial collector well and pipeline construction.

Clearing for the well sites and new pipelines and/or modification of existing roadways and berms would include use of environmental best management practices to reduce impacts to sensitive habitats such as wetlands and critical habitat.

In summary, the pipelines would follow the existing roadway to the extent practicable and environmental best management practices would be employed during clearing/modification and construction of the pipelines and wells. Given the small amount of wetlands habitat disturbed and the potential impacts on crocodiles, the impacts of construction of the radial collector wells (including pipelines) on terrestrial resources would be SMALL. Mitigation to minimize impacts to crocodiles would include educating construction personnel concerning occurrence of and hazards to crocodiles, enforcing reduced speed limits near potential habitats, and potentially limiting nighttime work.

4.3.1.3 Potential Impacts to Offsite Areas

4.3.1.3.1 Transmission Corridors

Construction activities associated with new transmission lines would include clearing of new corridors (to the extent necessary), adding new transmission facilities and expanding existing substations. Existing linear corridors would be used, to the extent practicable, to limit the disturbance of wooded or sensitive habitats. Clearing of wooded areas would be accomplished using heavy equipment (bulldozers, cranes, tractors, bucket trucks, light trucks) to clear the entire corridor, establish access roads, facilitate tower and line installation, and right-of-way restoration (see Subsection 3.7.3.5). For tower and line installation in open landscapes (e.g., existing transmission corridor, agricultural fields, pasture, marsh), the installation of transmission tower pads and corridor land uses are generally permitted to continue outside of the tower footprint unless activities interfere with existing uses.

Wetlands of various types are crossed by the existing corridors and would be crossed by the proposed lines. The transmission corridors traverse regional canals in several locations, but construction activities would not impact these aquatic habitats. Portions of the Clear Sky-to-Levee corridors would require the installation of pads and towers within wetland habitats (Figure 2.2-5). Further, the West Secondary Option of the Clear Sky-to-Levee corridor would impact wetland habitats in Everglades National Park (see Subsection 2.4.1). Additional wetlands would be crossed within the West Preferred Option of the corridor. Construction impacts on adjacent wetlands could include erosion-caused sedimentation and increased turbidity. Standard industry construction practices would be used to reduce these impacts, including employing silt fences, mulching, and avoiding wetlands and other sensitive habitats to the extent practicable. Pending discussions with regulatory agencies, some mitigation for wetland loss may be required. Mitigation could include habitat enhancement, restoration, preservation, or purchasing credits from a regional wetland mitigation bank.

The initial component of the Clear Sky-to-Levee corridor would cross the industrial wastewater facility, most of which is considered critical habitat for the crocodile. Small areas of habitat within the industrial wastewater facility would be lost for transmission tower pads and bridges to access the pads and crocodiles may be disturbed temporarily during tower installation. Potential mitigation for construction impacts to crocodiles are described in Subsection 4.3.1.1.2, including enhancement of other portions of their habitat and construction constraints during sensitive periods of activity (nesting season and nocturnal period).

Eastern indigo snakes have been observed at two locations in the Eastern Preferred corridor. This snake inhabits a variety of habitats in Florida, ranging from mangrove swamps and wet prairies to xeric pinelands and scrub, so it is reasonable to conclude that appropriate habitats along other corridors exist. Construction of new corridors, modification of existing corridors, and construction/modification of access roads would result in temporary disturbance during the activity and some alteration of potential habitat. Given that the Eastern indigo snakes could continue to use habitats within any transmission corridor after construction is complete, construction impacts on the Eastern indigo snakes would be SMALL.

Florida panthers have been observed historically within the area containing the two Clear Sky-to-Levee transmission corridor options. Construction of either corridor would result in temporary disturbance during the activity and some loss of potential panther habitat. Construction of the preferred route along an existing access road would result in less habitat loss that the alternate route (see discussion in Section 2.2). Construction of new corridors, modification of existing corridors, and construction/modification of access roads will result in the alteration of panther habitat within the primary and secondary Panther Focus Area zones rather than a loss of habitat. Radio-collared panthers are known to use existing linear habitats (e.g., powerline ROWs, access roads, etc.) for travel. Pending finalization of the corridor route, the potential impacts of this construction are likely SMALL, although discussions with regulatory agencies after route selection may result in mitigation actions such as habitat enhancement and/or purchase of panther mitigation credits.

Wood storks have nested in four Everglades National Park colonies near Tamiami Trail and the two alternative transmission corridors between the Clear Sky and Levee substations. Two colonies are within 1 mile of the West Preferred corridor, and both colonies are within the 2500-foot-radius primary zone for the colony where most activities are restricted (USFWS 1990). The other two colonies are within 3 miles of the corridor. Three of the colonies are within 1 mile of the West Secondary Corridor and all four are within 3 miles. Only two colonies fall within the 2500-foot-radius primary zone. The habitat management guidelines for this species recommend restriction of “high-tension power lines” within 1 mile of wood stork colonies and “tall transmission towers” within 3 miles of colonies (USFWS 1990). These recommendations stem from the concern that low-flying and/or inexperienced (e.g., recently fledged young) wood storks may collide with tall objects. Also, both the West Preferred and West Secondary Corridors are within the core foraging area of nine wood stork colonies (18.6-mile-radius around colonies where flight activities by storks are common) and there are concerns about loss of their wetland foraging habitats. Whereas collisions with transmission lines and resulting mortalities of storks have been documented, they are not common occurrences. Therefore, the impacts of establishing new transmission corridors on storks would be SMALL, but may still warrant discussions with regulatory agencies and result in mitigation activities. Mitigation actions could include marking new transmission lines and/or tower guy-wires to make them more visible and thus avoidable to the storks and possibly wetland enhancement to replace potential foraging habitat losses.

Surveys of the transmission corridors for threatened or endangered plants found approximately 36 listed species (see Table 2.4-4). Three were federally-listed candidate species: Florida brickell-bush (*Brickellia mosieri*), pineland deltoid spurge (*Chamaesyce deltoidea* ssp. *pinetorum*), and sand flax (*Linum arenicola*). All three are endemic to fire maintained, pine rockland habitats. One 9-acre pine rockland area (maintained by fire, not mowing) contained 23 listed plant species, although several species occurred on disturbed habitats (e.g., spoil areas). Impacts to rare plants found near the transmission corridors may require mitigation, pending discussions with regulatory agencies, such as avoidance (to the extent practicable), possible movement of plant populations, and/or habitat enhancement.

Given that the sensitive plants discovered within the transmission corridor already exist within managed and/or maintained habitats and an avoidance policy (to the extent practicable), impacts of installation and/or expansion of transmission corridors on listed plants would be SMALL.

4.3.1.3.2 Borrow Material

Borrow material for construction would be obtained from a combination of an FPL-owned fill source, other regional sources, or reused material. The FPL-owned fill source is located about

4.5 miles northwest of the Units 6 & 7 plant area (see Subsection 4.1.2.3). The borrow area (approximately 300 acres) consists primarily of tree nurseries, Brazilian pepper, ditches, exotic wetland hardwoods, wetland scrub, freshwater marshes and roads and highways (Table 4.3-1). Fill material would be brought to the Turkey Point plant property along new and existing roads, although some modifications of existing roads to support this traffic would be necessary. Because the fill would be taken from existing quarries or a palm tree nursery, impacts on terrestrial resources would be SMALL and would not warrant mitigation.

4.3.1.3.3 Access Roads and Potable Water Pipelines

Approximately 11 miles of access road expansions and construction and 9 miles of potable water pipelines would traverse existing roadways, urban/disturbed, agriculture, and various canals and wetlands. Most of the potable water pipelines would be trenched within the corridor associated with the roadway enhancements: SW 328th Street/N. Canal Drive to SW 117th Avenue to SW 359th Street to the plant area. Wildlife species within the areas impacted by these projects would be those typical to southern Florida. Listed species would likely include wading birds (e.g., egrets, ibis, and possibly storks) and possibly crocodiles in adjacent wetland habitats and plants within the SW 359th Street corridor (see Subsection 4.3.1.3.3). Potential impacts to wetlands and mitigation methods are discussed in Subsection 4.3.1.1.4. Given that mobile species (birds and crocodiles) would likely move to nearby similar habitat and plant species found in this habitat tend to be those that inhabit disturbed soils, impacts of these projects on wildlife species would be SMALL. As of April 21, 2009, the FWC panther mortality database contains no records of panther mortality within 2 miles of the proposed roadway improvements. The FWC panther den database contains no records of panther dens within 2 miles of the proposed roadway improvements. Florida panthers have not been recorded as occurring in the vicinity of the proposed roadway improvements or in the surrounding panther Primary Zone since 1988. Nevertheless, portions of the access roads will be located within the primary zone of the Panther Focus Area and some habitat will be altered.

The proposed road improvements will result in the loss of panther habitat within the Primary Zone. The roadways are proposed through an area that is at the urban fringe of the panther Primary Zone, and there are very few acres of habitat that could be accessed in the future by panthers moving north or east of the proposed roadways. Disturbance during construction would be temporary, but the activity could possibly result in minor habitat loss and increased traffic. Mortality risk to panthers is expected to be extremely small; thus, impacts to the panther of access road expansion would be SMALL.

4.3.1.4 Summary

Construction activities would result in the permanent loss of some wetland habitats and the potential temporary disturbance to other wetland habitats. The temporary disturbance would be

SMALL and mitigated by standard industry construction practices, but the impacts resulting from wetland loss would be MODERATE and may warrant mitigation. Impacts to other terrestrial resources, including “important” species (as defined by NUREG-1555), would be SMALL. However, given the location of the construction activities within the designated critical habitat of the American crocodile, the proximity to active breeding habitat, and the increased construction-related traffic on roads within the industrial wastewater facility, impacts to this species would be MODERATE. Management/conservation plans would be implemented to avoid and/or limit the impacts of construction activities on protected species such as the crocodile and manatee.

4.3.2 AQUATIC ECOSYSTEMS - CONSTRUCTION IMPACTS

4.3.2.1 General Impacts to Aquatic Resources

Roads, bridges, and spoils areas, described in Subsection 4.3.1.1, would be placed so as to minimize impacts to aquatic resources. However, construction on land would result in impacts to nearby onsite and offsite aquatic ecosystems, including sedimentation and increased turbidity (as a result of erosion of surface soil) and, although less likely, spills of petroleum products. Aquatic habitat would be lost in areas that would be dewatered and backfilled to support construction of Units 6 & 7. Each of these impacts is described below.

4.3.2.1.1 Sedimentation

Three major groups of aquatic organisms are typically affected by the deposit of sediment in wetlands: (1) aquatic plants, (2) benthic macroinvertebrates, and (3) fish. The effects of excess sediment in wetlands, including sediment generated by construction activities, are influenced by particle size. Finer particles may remain suspended, blocking the light needed for photosynthesis, and initiating a cascade of effects from the primary producers. Suspended particles may also interfere with respiration in invertebrates and newly hatched fish, or reduce their feeding efficiency by lowering visibility (Waters 1995).

Construction sites are subject to erosion, which can then lead to sedimentation in adjacent areas. The land in the construction areas is flat and characterized by sheet flow and rapid infiltration of surface water. Much of the surface water runoff would simply be absorbed by the soil, and any sediment it carried would be deposited in place; excess runoff would be directed toward retention ponds, as described below.

Construction-related activities such as excavation, grading for drainage during and after construction, temporary storage of soil piles, and use of heavy machinery all disturb vegetation and expose soil to erosive forces. Reducing the length of time that disturbed soil is exposed to the weather is one of the most effective ways of controlling excess erosion and sedimentation (Waters 1995).

Construction impacts to water resources would be avoided or minimized through environmental best management practices and standard industry construction practices such as stormwater retention basins and silt screens, under a Generic Permit for Stormwater Discharge from Large and Small Construction Activities, (Rule 62-621.300(4)(a), Florida Administrative Code) (FDEP 2008b). Other practices that would be used to minimize impacts to aquatic habitats during construction include mulching, slope texturing, creating vegetated buffer strips, and reseeding areas of disturbed soil. Preventing erosion by covering disturbed areas is a preferred method of controlling sedimentation, especially when constructing bridges, which are necessarily near surface water. When erosion cannot be prevented entirely, intercepting and retaining sediment before it reaches surface waters can reduce impacts (Waters 1995). Given the preventative measures employed, impacts from sedimentation would be SMALL.

4.3.2.1.2 Turbidity

Sedimentation can cause a temporary increase in turbidity as the imported sediment settles to the bottom. If high turbidity persists for several days in an area that is generally clear, the photosynthetic process can be reduced (FDEP 2008a). However, most aquatic and wetland habitats in south Florida are buffeted by frequent high-energy storms that cause temporary increases in turbidity. Such temporary disturbances are part of the natural environmental dynamic experienced by the aquatic species that occur in both the onsite and offsite project areas. No crystalline springs are in the area. The Guide to Living with Florida's Wetlands (FDEP 2008a) states that the damaging effects of construction on wetlands can be minimized by good planning and design. To control sedimentation, a variety of measures would be implemented to limit the effects of increased turbidity resulting from construction activities. Impacts would be temporary and SMALL. Onsite and offsite construction would use standard industry construction practices, described in Section 4.2, to minimize impacts to aquatic resources resulting from increased turbidity.

4.3.2.1.3 Petroleum Spills

Spill prevention techniques would include locating storage areas for petroleum products at a safe distance from surface waters. For example, heavy equipment would be driven to a bermed and drained location for refueling. Any spills of diesel fuel, hydraulic fluid, or lubricants during construction would be cleaned up to prevent spilled fuel or oil from impacting aquatic resources. A Spill Prevention, Control, and Countermeasure (SPCC) Plan would be implemented in accordance with EPA regulations (40 CFR Part 112). Spills would be attended to and not allowed to flow to nearby surface water. Any impacts to aquatic resources as a result of spills would be SMALL.

4.3.2.1.4 Habitat Disturbance

Construction of Units 6 & 7 would result in the unavoidable destruction of wetlands and man-made canals, most of it hypersaline mudflats, as described in Subsection 2.4.2.1.1 and shown in Figure 2.4-2. Specific impacted habits (land cover types) are shown in Table 4.3-1. The area contains marginal habitat which has been impacted by unit operations for at least 30 years. The aquatic species in the impacted wetlands are widely distributed across similar habitats in south Florida. No rare or specially protected species exist there.

An approximately 52-acre laydown area west of the Units 6 & 7 plant area has streams and waterways/canals, reservoirs larger than 500 acres (note: this description applies to the part of the industrial wastewater facility that is within the laydown area), dwarf mangroves, fill area and roads and highways (Table 4.3-1). An approximate 3-acre transmission laydown area would be established and consist of ditches, dwarf mangroves and electric power facilities (Table 4.3-1).

An approximately 44-acre FPL reclaimed water treatment facility would be built immediately north of the industrial wastewater facility on sawgrass marsh with scattered dwarf mangroves, mixed wetland hardwoods and roads and highways (Table 4.3-1). Reclaimed water pipelines would extend south from this facility through a variety of land uses, including dwarf mangroves and disturbed areas, to the makeup water reservoir (Table 4.3-1). The open water and dwarf mangrove habitats do not support any specially protected species. Only ubiquitous, hardy aquatic species are expected to occur there.

Other aquatic habitats in the plant area and on the Turkey Point plant property may be temporarily impacted, but would not be destroyed. Specific areas are described in the following sections: Equipment Barge Unloading Area (Subsection 4.3.2.2.1), Drilling Deep Injection Wells (Subsection 4.3.2.2.2), and Staging Areas (Subsection 4.3.2.2.3).

Potential impacts to offsite aquatic resources are described in Subsection 4.3.2.3. Offsite construction that may impact aquatic resources includes installation of pipelines for delivery of reclaimed water (Subsection 4.3.2.3.1) installation of radial collector wells (Subsection 4.3.2.3.2), development of transmission corridors and construction of transmission lines (Subsection 4.3.2.3.3), improvement of roadways (Subsection 4.3.2.3.4), and collection and transport of borrow material to fill the plant area (Subsection 4.3.2.3.5).

4.3.2.2 Potential Impacts to the Units 6 & 7 Plant Area and Other Onsite Aquatic Resources

When a wetland or other surface water body is impacted by construction activities and aquatic organisms are present, impacts to these organisms are expected. If the water body has an outlet, and the disturbance is gradual rather than abrupt, some animals may relocate. However, construction impacts to small wetlands or other surface waters result in loss of the fishes and invertebrates. No important aquatic species are known to exist in onsite construction areas (see Subsection 2.4.2).

Although the habitats onsite that would be impacted do support aquatic life, the aquatic species that exist onsite are common in nearby waters. These species, listed in Subsection 2.4.2.1.1, are expected to exist in similar habitats in the vicinity. Most of these common species tend to be tolerant of salinity and temperature fluctuations, and are common in coastal wetlands throughout south Florida (see Subsection 2.4.2).

The surface water bodies that could be impacted include the cooling canals of the industrial wastewater facility. The power block foundations would be approximately 35 feet below MSL. Portions of the Units 6 & 7 plant area would be dewatered, organic matter removed, and backfilled. Surface waters on the Units 6 & 7 plant area would be permanently altered by the excavation of the surficial soil and the placement of backfill material. No natural aquatic habitat would remain in the plant area. The plant area is isolated from offsite aquatic resources by the cooling canals of the industrial wastewater facility, which lie between the Units 6 & 7 plant area and the Turkey Point plant property boundary. Sheet pile technology may be used to isolate the industrial wastewater facility from the plant area. Stormwater would be managed with the appropriate environmental controls to reduce the amount of sediment in the surface water runoff before release to the industrial wastewater facility, As described in Section 3.9, a slurry diaphragm wall would be installed around the power blocks during dewatering and excavating subsurface materials. The use of the slurry wall would allow dewatering of the power block areas with minimal impacts to groundwater directly outside of the slurry wall containment area.

The impacts to aquatic species onsite would be SMALL and would not warrant mitigation.

As described in Subsection 4.3.1.1, aquatic habitat would be impacted by the construction of Units 6 & 7 and ancillary facilities. The Units 6 & 7 plant area would require the permanent use of approximately 218 acres, as shown in Figure 3.9-1.

In addition to construction of Units 6 & 7, ancillary activities that may affect aquatic resources on the Turkey Point plant property include (1) enlarging the existing equipment barge unloading area, (2) installation of the deep injection wells, (3) parking areas, (4) installing the reclaimed water pipelines from the SDWWTP to the FPL reclaimed water treatment facility and the pipelines from this facility to the plant, (5) installing the radial collector wells and pipelines, (6) nuclear administration and training buildings, and (6) supporting facilities.

4.3.2.2.1 Equipment Barge Unloading Area

Expansion of the equipment barge unloading area may result in some impacts to aquatic resources in the immediate area. The existing barge turning basin currently receives five to seven barge shipments of fuel oil per week throughout the year. The number of weekly shipments of fuel oil would not be expected to change; however, during the 6-year construction period, there would be approximately 80 additional barge trips for delivery of construction equipment and modules per unit. The equipment barge unloading area would be expanded to a total area of about 0.75 acres (32,500 square feet). A survey of the area showed sparse growth of submerged aquatic vegetation, including seagrasses and algal species, within the turning basin. The green algae *Caulerpa paspaloides* var*. laxa* occurs along southern edge of the basin, in an area of approximately 24 square feet (ft^2). Another small area of *C. paspaloides* var*. laxa* and the algae *Acetabularia calyculus* occur in an equal-sized area (approximately 24 ft^2) on the northeastern shore of the basin, extending into Biscayne Bay. Sparse patches of seagrass occur along the northern shore of the basin, in the vicinity of the existing boat slip and equipment barge unloading area. Several small areas with 5 to 20 percent coverage of turtlegrass (*Thalassia testudinum*) and shoal grass (*Halodule wrightii*) were observed, comprising a total of approximately 170 ft^2 (0.004 acres). Temporary, local impacts to aquatic resources during expansion of the equipment barge unloading area would include sedimentation and increased turbidity, as described below.

Enlargement of the equipment barge unloading area would cause some disturbance in the immediate area. As described in Subsection 4.2.1.1.3, enlargement of the equipment barge unloading area would require dredging from a 0.1 acre area (4356 square feet) in the turning basin. The excavation and limited dredging of the equipment barge unloading area could result in increased suspended sediment in the immediate area for a short period of time. Curtain wall technology would be used to isolate the equipment barge unloading area from adjacent areas. Dredging would conform to guidance provided by the Army Corps of Engineers and dredging permit conditions.

The excavation and limited dredging would cause an increase in suspended sediment in the immediate area, and could result in a plume of suspended sediment some distance from the equipment barge unloading area. The ecological effect of the suspended sediment would depend on a variety of factors, including the type of dredge used, the timing and duration of the dredging, the particle size of the suspended sediment, wind direction and speed, the success of environmental controls to contain suspended sediment, and the life stage of the species present. Both short-term direct behavioral effects (such as entrainment and fish injury) and long-term cumulative effects (such as contaminant release and habitat alteration) on marine organisms can result from dredging (Nightingale and Sinenstad, 2001). Although effects may be similar, concern is often greater at the disposal site than at the dredge site. Material dredged from this area would be placed in the spoils areas located on existing berms within the industrial wastewater facility.

When barges move into or out of the barge turning basin, turbulence and turbidity increase for a short time. This is part of the background disturbance related to the standard operation of the existing facility. Increased barge traffic during construction phase of Units 6 & 7 would result in incremental increases in the frequency of these disturbances. The organisms that currently exist in the turning basin would be those that are tolerant of intermittent disturbance in the form of turbulence and turbidity associated with barge activity. No change in the nature of the impacts would occur as a result of increased barge traffic.

Aquatic resources in the barge turning basin that could be temporarily affected by dredging include eggs, larvae, and adults of invertebrates and fishes. Mojarra, grunts, and pinfish were the most common adult fishes reported in a 2008 trawl survey of the nearshore area of Card Sound (see Subsection 2.4.2). Eggs and larvae of clupeids (herring, shad, menhaden, and sardine) were also common in the area, as were larvae of gobies and sleepers. These species could be temporarily affected by high levels of suspended sediment, which can interfere with vision (impacting foraging) and respiration, as well as cause dermal abrasion to delicate fishes. Common larval and adult invertebrates in the nearshore area of Card Sound included blue crab, stone crabs, mantis shrimp, brown shrimp, and several non-commercially important crabs and bivalves (see Subsection 2.4.2). The species typically occurring in Card Sound would be expected to also occur in the barge turning basin. The effects of dredging on these particular species are unknown; however, in a study of dredging in the Chesapeake Bay, benthic communities survived deposits of suspended sediment despite the exceedance of certain water quality standards (Nichols et al. 1990).

No threatened or endangered aquatic species would be affected by the excavation and limited dredging in the equipment barge unloading area.

The assemblage of aquatic species varies throughout the year, because of spawning and migration patterns of individual fish and invertebrate species. The season of the year in which construction occurs would determine to a large extent the impact on specific aquatic resources in the barge turning basin. However, because the area to be excavated and dredged is small and in a protected near-shore area that is already dedicated to barge activity, the overall impact on eggs and larvae of aquatic organisms would be SMALL. No other significant impacts to aquatic habitats on the Turkey Point plant property would occur. Construction activities would not affect important (as defined by NUREG-1555) fish or invertebrates in surface waters, which would be protected from sedimentation and surface runoff by physical separation. Temporary, minimal sedimentation and increased turbidity are possible, as described above.

4.3.2.2.2 Drilling Deep Injection Wells

Wastewater from Units 6 & 7 construction would be discharged to the Boulder Zone of the Lower Floridan aquifer, a deep and highly cavernous zone of saline groundwater that is used for underground injection of industrial and domestic wastes in south Florida. The wells would be installed under an underground injection control permit. Dual zone monitoring wells would also be installed to monitor the potential impact of the injection process on overlying aquifer units adjacent to the Boulder Zone. The wells would be located in the plant area adjacent to new Units 6 & 7. This area would be built up from approximately sea level to an elevation of approximately 25.5 feet. During the construction of the deep injection wells and associated facilities, any surface water runoff would be directed to a detention pond in the vicinity of the drilling operations where sediment would be allowed to settle before being released to the industrial wastewater facility. Construction of the injection wells would not impact any aquatic habitats. Therefore, impacts would be SMALL.

4.3.2.2.3 Staging Areas

Muck removed from the excavated areas would be placed in the spoils storage areas. The construction impacts identified in Subsection 4.3.2.1 (sedimentation, turbidity, chemical spills, habitat destruction) that could result from the placement of muck in upland areas within the industrial wastewater facility would be mitigated by using environmental best management practices designed to prevent movement of soil or to intercept soil before it reaches the canals. Runoff would be controlled through structural and operational measures such as berms, riprap, and sedimentation filters before any water drainage to the cooling canals. Environmental best management practices are described in more detail in Section 4.2.

Construction of Units 6 & 7 and ancillary facilities would eliminate certain aquatic habitats, including wetlands and open water. Because no important aquatic species are present, no critical habitat for aquatic species would be impacted, and the area that would be impacted is relatively small compared to the area of the industrial wastewater facility, construction impacts on aquatic resources on the Turkey Point plant property would be SMALL.

4.3.2.3 Potential Impacts to Offsite Aquatic Resources

Offsite construction that may impact aquatic resources includes (1) installation of pipelines for delivery of potable water and reclaimed water, (2) installation of radial collector wells and pipelines, (3) development of transmission corridors and construction of transmission lines, (4) transport of borrow material to fill the Units 6 & 7 plant area, and (5) roads. Each of these is presented below as well as potential impacts to essential fish habitat (6).

4.3.2.3.1 Reclaimed and Potable Water Pipelines

Reclaimed water pipelines approximately 9 miles long would be constructed to carry water from the SDWWTP to Units 6 & 7. As described in Subsection 4.3.1.2.1, approximately 6.5 miles of the pipelines would be collocated with the existing Clear Sky-to-Davis transmission line right-of-way and adjacent road and canal rights-of-way. The corridor for the reclaimed water pipelines was selected to use, to the greatest extent practicable, existing infrastructure and minimize environmental impacts. Because of the SDWWTP location, the reclaimed water pipeline corridor would be located primarily within and/or adjacent to existing roads and FPL-owned rights-of-way.

The reclaimed water pipelines would cross water bodies including wetlands, the Florida City Canal, the L-31E Canal, the North Canal, the Military Canal, the Princeton Canal (C-102), the Goulds Canal, and the Black Creek Canal (C-1). No significant natural surface water bodies would be crossed by the reclaimed water pipelines.

An approximately 10-mile potable water pipeline would bring potable water from the Miami-Dade County Water and Sewer Department to the Units 6 & 7 plant area. The line would generally follow existing roadways/corridors. Much of the line would be established by trenching adjacent to or within the corridors containing the access road improvements and construction along SW 328th Street/N. Canal Drive to SW 117th Avenue to SW 359th Street to the plant area. Crossings of major canals would be established by horizontal directional drilling. The aquatic habitats associated with this corridor include various canals, ditches, and wetlands.

Other surface water features in the water pipeline corridors include drainage ditches, which typically occur on the borders of roadside ROWs, freshwater marshes, mangroves, and mixed hardwood wetlands. Temporary impacts to wetlands may occur during excavation of the trench for subaqueous pipeline installation. Any temporary impacts to wetlands associated with pipeline installation would be addressed in accordance with FDEP and USACE requirements. Temporary wetland impacts resulting from pipeline installation would be mitigated through restoration of the excavated trench with native wetland soils. Wetland soils removed during trench excavation would be stockpiled and replaced following pipeline installation to allow the natural vegetative community to re-establish on the canal bank. The replacement of native soils at original grade would result in no net loss of wetland acreage or wetland functions following pipeline installation.

Environmental best management practices, such as silt fencing and floating turbidity curtains, would be used to prevent secondary impacts to surface waters or wetlands associated with pipeline installation. Permanent impacts to wetland habitats located within these pipeline corridors would be avoided, and no significant adverse impacts to aquatic resources would be anticipated.

The artificial canals within these corridors contain relatively steep slopes and limited littoral zone vegetation, reducing the quality of wildlife habitat. Canals provide habitat for common native freshwater forage fishes, such as mosquitofish, sailfin molly, least killifish, sunfish, and gar, as well as nonindigenous fishes such as peacock bass, spotted tilapia, blue tilapia, Mayan cichlid, jaguar guapote, and oscar. The only important aquatic species in the reclaimed water pipeline corridor is the native mangrove rivulus. According to the FNAI database, an occurrence of mangrove rivulus was documented within the C-1 Canal in the northwestern portion of the proposed reclaimed water corridor.

Because the pipelines would follow existing corridors along much of their lengths, and erosion and sedimentation would be minimized using environmental best management practices (sediment screens, mulching, revegetation), no impacts to the mangrove rivulus or other aquatic resources would occur. Overall impacts to aquatic resources would be SMALL.

4.3.2.3.2 Radial Collector Wells

Radial collector wells would be installed adjacent to Biscayne Bay to provide cooling water for Units 6 & 7 (see Figure 3.3-1). The wells would be located on the Turkey Point peninsula, east of the existing units. Each radial collector well would consist of a central reinforced concrete caisson extending below the ground level with laterals projecting from the caisson. The well laterals would be advanced horizontally a distance of up to 900 feet and installed to a depth of approximately 25 to 40 feet below the bottom of Biscayne Bay. The lateral screens under Biscayne Bay would be installed by horizontal drilling. Water from the wells would flow by head force to a collection caisson where the water would be pumped via pipelines to Units 6 & 7, thereby limiting surface disturbance to the bottom of Biscayne Bay. The pipelines would cross the following habitat types: streams and waterways/canals, mangrove swamps, and fill areas (Table 4.3-1). Another 3 acres of industrial/filled habitat would be required for a construction laydown area.

Construction of the radial collector wells and supporting infrastructure could affect aquatic resources in the vicinity. The only important aquatic species is the mangrove rivulus, a state and federal species of special concern (described in Subsection 2.4.2.3.1) that is associated with red mangrove communities. Red mangroves exist in the general vicinity of the radial collector wells. Because this species is closely tied to the distribution of red mangrove, any activity that removes red mangrove could have a potential impact on this fish. Construction activities for the radial collector wells and associated pipelines would be controlled so as to minimize any impacts to red mangroves. The radial collector wells would be located within five acres of previously filled lands on the northern edge of Turkey Point. No presently undisturbed mangrove habitat would be disturbed by well construction because standard industry construction practices would reduce the amount of erosion and sedimentation associated with construction, and would limit impacts to aquatic communities in down-gradient water bodies. Because the well laterals would be drilled horizontally beneath Biscayne Bay, and surface water and sediment would not be disturbed, no increases in turbidity or sedimentation would occur.

No other significant impacts to aquatic habitats would result. The construction of the radial collector wells and associated pipelines would not affect any rare or protected aquatic species. Overall, the impacts from construction of the radial collector wells would be SMALL and would not require mitigation beyond that described above.

Any temporary impacts to wetlands associated with pipeline installation would be addressed in accordance with FDEP and USACE requirements. Temporary wetland impacts resulting from pipeline installation would be mitigated through restoration of the excavated trench with native wetland soils. Wetland soils removed during trench excavation would be stockpiled and replaced following pipeline installation to allow the natural vegetative community to reestablish on the canal bank. The replacement of native soils at original grade would result in no net loss of wetland acreage or wetland functions following pipeline installation.

4.3.2.3.3 Transmission Corridors

Construction activities associated with the transmission corridors would include clearing, adding new transmission facilities, access road and pad construction, and expanding existing substations, as described in Subsection 4.3.1.3.1. Some construction activity would occur in areas that support aquatic resources within the transmission rights-of-way and at substations. Certification of the selected transmission line corridors is ongoing pursuant to the Florida PPSA. The impacts to aquatic habitats would be avoided and minimized by using existing corridors whenever practicable, thereby reducing the disturbance to currently undisturbed habitat using environmental best management practices. Wherever towers would be installed in open landscapes (such as marshes), the towers would be built on pads and the land use surrounding the towers would be maintained to the maximum extent practical.

Wetland impacts of transmission corridors are described in Subsection 4.3.1.3.1. Fish in the wetland and open water habitats within the proposed corridors include common freshwater forage fishes native to south Florida, such as mosquitofish (*Gambusia holbrooki*), sailfin molly (*Poecilia latipinna*), least killifish (*Heterandria formosa*), sunfish (*Lepomis* spp.), and gar (*Lepisosteus* spp.). Nonindigenous fishes commonly inhabiting canals of Miami-Dade County include peacock bass (*Cichla ocellaris*), spotted tilapia (*Tilapia mariae*), blue tilapia (*Oreochromis aureus*), Mayan cichlid (*Cichlasoma urophthalmus*), jaguar guapote (*Cichlasoma managuense*), and oscar (*Astronotus ocellatus*). Culverts may be placed in some wetlands, ditches, and smaller canals, resulting in localized temporary increases in turbidity. No rare or protected fish or aquatic invertebrates are known or expected to exist within the proposed corridors. Nevertheless, environmental best management practices would be used to reduce soil erosion and sedimentation to minimize impacts to aquatic resources. No withdrawals or discharges to surface water are planned during the construction of new transmission facilities or modification of existing transmission facilities. Other than the mangrove rivulus described previously, none of the 13 freshwater fishes listed by the Florida Fish and Wildlife Conservation Commission (FWC 2008) as endangered, threatened, or of special concern exist in the impacted areas. Impacts to important aquatic species from the construction of transmission facilities would, therefore, be SMALL.

4.3.2.3.4 Roadway Improvements

The roadway improvements would involve widening of existing paved roads and paving existing unpaved roads. In addition, intersection improvements at six locations would be made to accommodate peak construction traffic. The roadway improvements are about 10.75 miles in length, of which about 5.5 miles would be on the Turkey Point plant property.

Wetlands and terrestrial habitats affected by the roadway improvements are described in Subsection 2.4.1. Aquatic habitats potentially affected by roadway improvements include canals and mangroves, which are described in Subsection 2.4.2 and below.

The new 4-lane roadway planned for SW 359th Street would run along the northern edge of the existing industrial wastewater facility. Construction of this road would be separated from the industrial wastewater facility by the existing berms as well as construction buffers.

Canals exist adjacent to the roadways associated with SW 344th Street/Palm Drive and SW 328th Street/N. Canal Drive. In-stream vegetation is minimal within the man-made canals adjacent to existing roadways, due to the steep slopes and minimal littoral zone. These canals provide habitat for common freshwater forage fishes native to south Florida, as well as for nonindigenous fishes commonly inhabiting canals of Miami-Dade County. Areas of mangroves occur adjacent to SW 359th Street near the L-31 Canal.

Construction of the roadways would follow the Miami-Dade County Public Works Manual and the Florida Department of Transportation Design Standards. Environmental best management practices, such as silt fencing and floating turbidity curtains, would be used to prevent secondary impacts to surface waters or wetlands associated with construction of roadway improvements. No adverse changes to the aquatic habitats near the roadways would be anticipated. The roadway expansions and new roads would be located within existing linear facilities (existing paved and unpaved roads and transmission corridor), reducing required disturbance of habitats during installation.

Any impacts to aquatic habitats associated with roadway improvements would be addressed in accordance with FDEP and USACE requirements. Unavoidable wetland impacts resulting from construction of roadway improvements would be mitigated in consultation with the FDEP and USACE. No fish or other aquatic life in canals or mangroves would be impacted by construction of the roadways because fish can easily move away from the area of construction for the short duration of the disturbance.

Because the roadway improvements would occur in areas that are already disturbed by human activity and existing infrastructure, and environmental best management practices would be followed, direct and indirect impacts to aquatic habitats due to construction would be SMALL and further mitigation would not be warranted.

4.3.2.3.5 Borrow Material

Borrow material for construction would be obtained from a combination of an FPL-owned fill source, other regional sources, or reused material. The FPL-owned fill source is located about 4.5 miles northwest of the Units 6 & 7 plant area (see Subsection 4.1.2.3).

Obtaining borrow material from the FPL-owned fill source would permanently disturb approximately 300 acres of land classified as agricultural. The area consists primarily of tree nurseries, Brazilian pepper, ditches, exotic wetland hardwoods, wetland scrub, freshwater marshes and roads and highways (Table 4.3-1). Fish in the ditches are expected to be species common to south Florida, such as mosquito fish, sailfin molly, least killifish, and sunfish. No aquatic habitats would be impacted by the transport of borrow material from the existing quarries to the Turkey Point plant property.

Given the limited acreage of previously altered (ditching and invasive species) wetlands at the FPL-owned fill source site, impacts on aquatic resources would be SMALL.

4.3.2.4 Summary

Construction of Units 6 & 7 would result in the unavoidable disturbance of wetlands and manmade canals, most of it hypersaline mudflats, as described in Subsection 2.4.1.3 and shown in Figure 2.4-2. The aquatic species in the impacted wetlands and canals are widely distributed across similar habitats in south Florida. Construction impacts to small wetlands or other surface waters result in loss of the fishes and invertebrates. No imperiled aquatic species, as defined by the Florida Fish and Wildlife Conservation Commission (FWC Jun 2006), are believed to exist in the construction areas (see Subsection 2.4.2).

Roads, bridges, and spoils areas, described in Subsection 4.3.1.1, would be placed so as to minimize impacts to aquatic resources. However, construction on land may result in impacts to nearby aquatic ecosystems on the Turkey Point plant property and offsite, including sedimentation and increased turbidity (as a result of erosion of surface soil) and, although less likely, spills of petroleum products. Complete loss of aquatic habitat would occur in areas that would be dewatered and backfilled to support construction of Units 6 & 7.

Construction of the radial collector wells and supporting infrastructure may affect aquatic resources in the vicinity. However, aquatic resources in the area affected by the radial collector wells are common and ubiquitous in south Florida. No rare or protected aquatic species would be affected. Overall, impacts from construction of the radial collector wells would be SMALL.

Important aquatic resources in the barge turning basin that may be temporarily affected by dredging include eggs, larvae, and adults of invertebrates and fishes. Construction activities would not affect important (as defined by NUREG-1555) fish or invertebrates in surface waters, which would be protected from sedimentation and surface runoff by physical separation. Temporary, minimal sedimentation and increased turbidity are possible, as described above.

Offsite construction may impact aquatic resources in manmade canals, including small common fishes of south Florida as well as several species of nonindigenous fishes that have become established in the canals.

The end-use land cover and status (i.e. temporary or permanent) of the disturbed areas associated with Turkey Point Units 6 & 7 are summarized in the paragraphs below.

Turkey Point Property

It has been assumed that all site areas described in Table 4.3-1 will be 100 percent permanently impacted by the proposed activities. The end-use land cover for all disturbed areas is FLUCCS Code 831 — Electric Power Facilities, with the exception of the spoils areas, which are FLUCCS Code 743.

Vicinity

Land disturbances within the vicinity consist of the FPL-owned fill source and several access road upgrades. The end-use land cover for the FPL-owned fill source, which will be 100 percent permanently impacted, is FLUCCS 532 (reservoirs larger than 100 acres but less than 500 acres). Land impacts to the access roads may be temporary as these access roads could be returned to their previous lane configuration and/or impacted area land use type once construction activities are complete. If the access roads are not restored, the end-use land cover is FLUCCS Code 814 — Roads and Highways.

Region

Land disturbances within the region consist of the reclaimed water pipeline, the potable water pipeline, the western and eastern transmission corridors, substation upgrades, and transmission access roads. The end-use land cover for these regional features is discussed in the following paragraphs.

The land disturbed as part of the reclaimed water pipeline installation will be returned to its original land use. Although there will be temporary disturbance during installation activities, there are no permanent impacts to end-use land cover.

The land disturbed as part of the potable water pipeline installation will be returned to its original land use, where applicable. Although a corridor is listed for this pipeline, the installation will most likely follow existing roadway medians and the proposed construction access road installation.

Therefore, the permanent end-use land cover is considered part of the existing roadways and proposed construction access road upgrades.

The western and eastern transmission corridors represent the maximum extent of land presented for certification as part of the Site Certification Application (SCA) state process. The actual required right-of-ways will be determined post-certification, as will the location and amount of actual land requirements/disturbances necessary for transmission line construction. Therefore, the end-use land cover for these transmission corridors cannot be determined at this time. However, where located, the tower pad locations will be FLUCCS Code 832 — Electrical Transmission Lines.

All substation upgrades represent 100 percent permanent impacts to end-use land cover. The end-use land cover for all substation upgrades is FLUCCS Code 831 — Electric Power Facilities.

It has been assumed that all transmission access roads will be 100% permanently impacted by the proposed construction activities. The end-use land cover for all transmission access roads is FLUCCS Code 814 — Roads and Highways.

Apart from the lands that will be permanently modified by construction, impacts to aquatic communities from construction would be SMALL and temporary, and would not warrant mitigation. Construction activities that may cause erosion that could lead to harmful deposits in aquatic water bodies would be (1) of relatively short duration, (2) permitted and overseen by state and/or federal regulators, and (3) guided by an approved stormwater pollution prevention plan. Any small spills of construction-related hazardous fluids, such as petroleum products, would be mitigated according to a spill prevention control and countermeasure plan(s). Some sensitive wetland habitats exist within the areas affected by construction activities; however, no important aquatic species would be affected.

Section 4.3 References

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Table 4.3-1 (Sheet 1 of 3)
Turkey Point Property Disturbed Area FLUCCS Summary

Disturbed Area	Level 3	FLUCCS Land Use Category	Acres	% of Total
Turkey Point Units 6 & 7 Plant Area	510	Streams And Waterways/Canals	0.30	0.14
	511	Ditches	8.38	3.8
	612-A	Mangrove Heads	12.14	5.56
	650	Non-Vegetated Wetlands	182.05	83.41
	743	Spoil Areas	6.35	2.91
	743-WET	Wetland Spoils Areas	9.05	4.15
		Totals	**218.27**	**100.00**
FPL-Owned Fill Source	241	Tree Nurseries	243.78	81.70
	422	Brazilian Pepper	0.25	0.08
	511	Ditches	5.19	1.74
	619	Exotic Wetland Hardwoods	3.02	1.01
	619/631	Exotic Wetland Hardwoods/Wetland Scrub	30.71	10.29
	631	Wetland Shrub	4.42	1.48
	641	Freshwater Marshes	8.76	2.94
	814	Roads And Highways	2.25	0.75
		Totals	**298.39**	**100.00**
Western Laydown Areas	510	Streams And Waterways/Canals	3.31	6.39
	531	Reservoirs Larger Than 500 Acres (202 Hectares)	11.99	23.10
	612-B	Dwarf Mangroves	16.87	32.52
	744	Fill Areas <Highways-Railways>	19.55	37.68
	814	Roads And Highways	0.16	0.31
		Totals	**51.88**	**100.00**
Training Parking	612	Mangrove Swamps	5.61	61.50
	612/618	Mangrove Swamps/Exotic Wetland Hardwoods/Willow and Elderberry	1.85	20.33
	744	Fill Areas <Highways-Railways>	1.64	17.97
	831	Electric Power Facilities	0.02	0.19
		Totals	**9.12**	**100.00**
Nuclear Administration Parking	612	Mangrove Swamps	18.68	82.21
	744	Fill Areas <Highways-Railways>	3.39	14.91
	814	Roads And Highways	0.66	2.89
		Totals	**22.73**	**100.00**

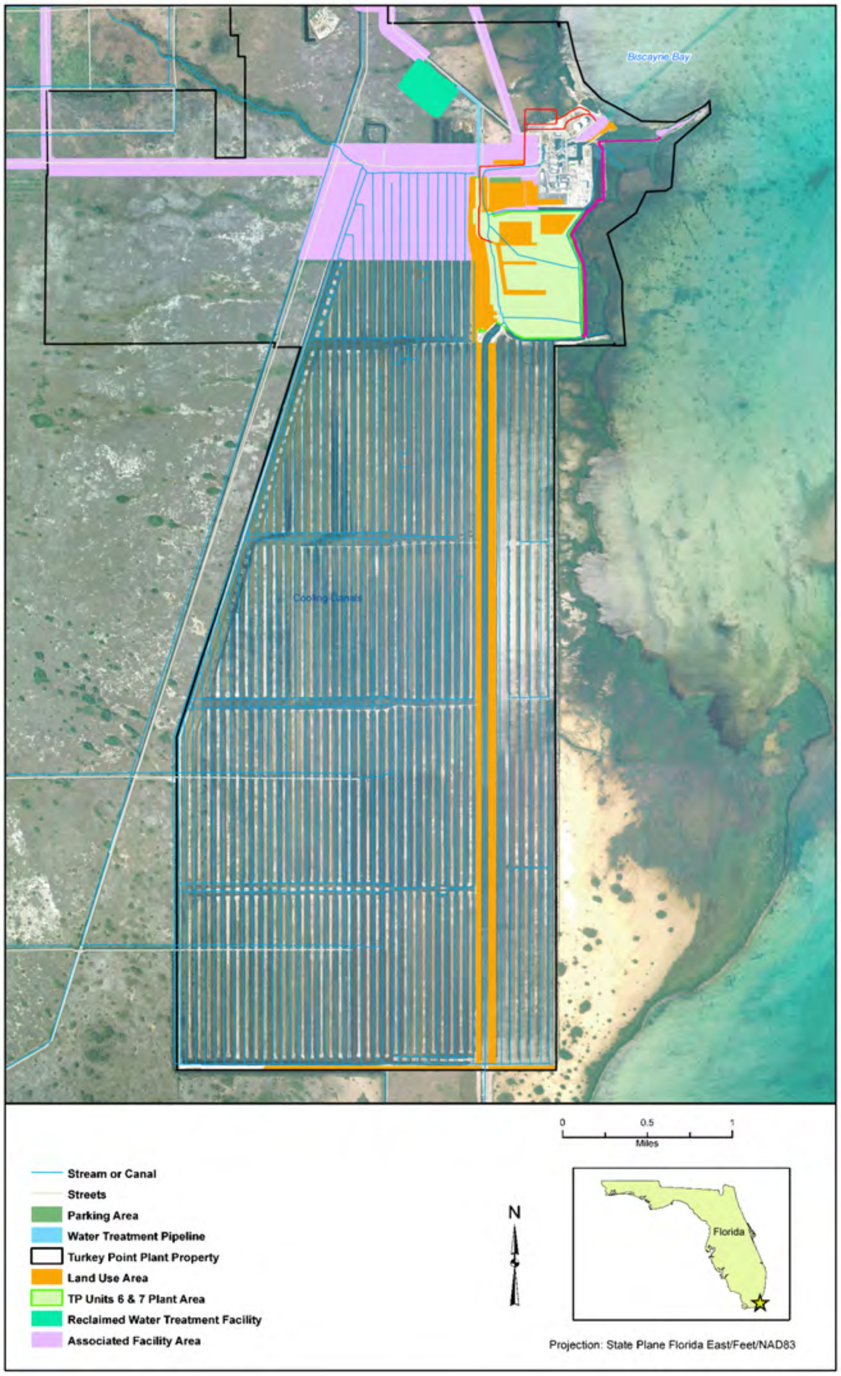
Table 4.3-1 (Sheet 2 of 3)
Turkey Point Property Disturbed Area FLUCCS Summary

Disturbed Area	Level 3	FLUCCS Land Use Category	Acres	% of Total
Heavy Haul Road	510	Streams And Waterways/Canals	0.15	2.99
	650	Non-Vegetated Wetlands	<0.01	0.01
	740	Disturbed Land	0.19	3.64
	744	Fill Areas <Highways-Railways>	0.03	0.59
	814	Roads And Highways	1.05	20.26
	831	Electric Power Facilities	3.75	72.51
		Totals	**5.17**	**100.00**
Transmission Laydown Area	511	Ditches	0.02	0.62
	612-B	Dwarf Mangroves	0.31	10.76
	831	Electric Power Facilities	2.55	88.61
		Totals	**2.88**	**100.00**
Equipment Barge Unloading Area	510	Streams And Waterways/Canals	0.02	2.55
	831	Electric Power Facilities	0.73	97.45
		Totals	**0.75**	**100.00**
Spoils Area A	510	Streams And Waterways/Canals	1.06	1.36
	744	Fill Areas <Highways-Railways>	76.35	98.64
		Totals	**77.41**	**100.00**
Spoils Area B	510	Streams And Waterways/Canals	<0.01	0.03
	542	Embayments Not Opening Directly Into The Gulf Of Mexico Or The Atlantic Ocean	<0.01	0.02
	740	Disturbed Land	10.27	57.40
	744	Fill Areas <Highways-Railways>	4.19	23.42
	814	Roads And Highways	3.42	19.13
		Totals	**17.89**	**100.00**
Spoils Area C	510	Streams And Waterways/Canals	4.39	3.78
	744	Fill Areas <Highways-Railways>	111.64	96.22
		Totals	**116.02**	**100.00**
Radial Collector Well Area	744	Fill Areas <Highways-Railways>	3.28	100.00
Radial Collector Well Laydown Area	744	Fill Areas <Highways-Railways>	2.72	100.00
FPL Reclaimed Water Treatment Facility	6411/612-B	Sawgrass Marsh/Dwarf Mangroves	42.82	97.52
	617	Mixed Wetland Hardwoods	0.78	1.78
	814	Roads And Highways	0.31	0.70
		Totals	**43.91**	**100.00**

Table 4.3-1 (Sheet 3 of 3)
Turkey Point Property Disturbed Area FLUCCS Summary

Disturbed Area	Level 3	FLUCCS Land Use Category	Acres	% of Total
Treated Reclaimed Water Delivery Pipelines	510	Streams And Waterways/Canals	0.45	8.03
	612-B	Dwarf Mangroves	3.06	55.01
	617	Mixed Wetland Hardwoods	0.43	7.79
	650	Non-Vegetated Wetlands	<0.01	0.05
	740	Disturbed Land	0.23	4.06
	743-WET	Wetland Spoils Areas	<0.01	<0.01
	744	Fill Areas <Highways-Railways>	0.08	1.51
	814	Roads And Highways	1.31	23.56
		Totals	**5.56**	**100.00**
Radial Collector Well Delivery Pipelines	510	Streams And Waterways/Canals	0.15	1.14
	612	Mangrove Swamps	3.98	29.83
	744	Fill Areas <Highways-Railways>	9.21	69.02
		Totals	**13.34**	**100.00**

Figure 4.3-1 Turkey Point Disturbed Area



4.4 SOCIOECONOMIC IMPACTS

This section addresses the socioeconomic impacts of the construction of Units 6 & 7 at the Turkey Point plant property in Miami-Dade County, Florida. The evaluation assesses impacts of construction and of demands placed on the region by the workforces. Subsection 4.4.1 describes and addresses an assessment of the physical impacts of construction. Subsection 4.4.2 describes the impacts of construction to the region in the areas of demography, economy, taxes, land use, transportation, recreational resources and aesthetics, housing, public services, and education. Subsection 4.4.3 assesses the construction of Units 6 & 7 with regard to disproportionate adverse impacts to minority and low-income populations.

4.4.1 PHYSICAL IMPACTS OF CONSTRUCTION

This section assesses the potential physical impacts as a result of construction of the new units on the nearby communities or residences. Potential impacts include noise, air emissions, and visual intrusions. These physical impacts would be managed in compliance with applicable federal, state, and local environmental regulations and would not significantly affect the Turkey Point plant property and the vicinity.

As presented in Subsection 2.5.2.4, Miami-Dade County has more than 1946 square miles of land, of which approximately 500 square miles have been developed for urban uses. The predominant existing land uses around the Turkey Point plant property are undeveloped and protected areas. Biscayne Bay and the Atlantic Ocean border the plant property to the east. The closest incorporated communities are Homestead and Florida City. Florida City is located 8 miles west of the plant property and the municipal limits of Homestead are located 4.5 miles west (Subsection 2.2.1.2). Recreational areas in the community include Homestead Bayfront Park, Biscayne National Park, Mangrove Preserve, Everglades National Park and the Homestead Miami Speedway (Subsection 2.5.2.5). There are no residential areas or public roads located within the Turkey Point plant property. Homestead Air Reserve Base is within 6 miles of Units 6 & 7. No significant industrial or commercial facilities other than the Turkey Point units are planned for this area; however, a portion of the former Air Reserve Base (717 acres) is to be set aside for mixed economic uses (commercial, residential, or recreational uses) by Miami-Dade County (Subsection 2.2.1.2).

4.4.1.1 Noise

The noise impacts of Units 6 & 7 construction activities have been evaluated. The evaluation considered construction equipment associated with site preparation and construction of permanent features, such as foundations, buildings, cooling towers and other components of each unit. The noise sources used were typical of conservative noise levels from similar equipment. The highest levels of construction noise from the Units 6 & 7 plant area would be generated by impact wrenches, cranes, backhoes, front-end loaders, trucks, bulldozers and the concrete batch plant. The analysis predicts that the highest onsite construction noise level would be between 70-90 dBA (measured at a distance of 50 ft). The noise level would be 85 dBA at 3 ft, 75 dBA at 200 ft and 65 dBA at 400 ft.

The noise generated during Units 6 & 7 construction activities would be attenuated by distance from the source. As described in Subsection 2.7.7, an ambient noise monitoring survey was performed in June 2008 to assess existing ambient noise in areas adjacent to the existing units. From two monitoring points located at the Turkey Point plant property boundary (monitoring points S2 and S3), current daytime and nighttime noise level equivalent (L_{eq}) readings were recorded. The daytime L_{eq} readings ranged from 60 to 68 dBA and the nighttime L_{eq} readings ranged from 60 to 67 dBA. The L_{eq} includes all noise sources including transient sounds such as traffic that influence observations. In comparison, the maximum noise level generated by construction activities at the nearest permanent private residence would be 64.4 dBA during the daytime and 54.1 dBA during the nighttime.

Other noise generated by the construction of Units 6 & 7 would be the noise levels resulting from construction of new transmission systems and substation expansions. The noise generated from construction of the transmission lines and expansion of substations would include right-of-way clearing, access road and pad construction (where necessary), line construction, and right-of-way restoration. The noise generated from the machinery required for these phases of construction would include bulldozers, shearing machinery, chain saws, trucks, cranes and possibly helicopters. The transmission line construction and expansion within the western corridor would be on primarily wetlands, agricultural or undeveloped land; therefore, any noise from the construction would be attenuated prior to reaching receptors in the urban areas. The transmission line construction and expansion within the eastern corridor would be on primarily urban land. The noise would be attenuated by distance from the source. The transmission lines construction activities would be taking place in both agricultural areas with few people to be impacted by the additional noise and urban settings where people already experience noise from construction, traffic, etc; also this phase of construction would be accelerated, short term and performed during daytime hours. Therefore, noise generated by the construction of the transmission systems and substations would result in SMALL impacts and would not warrant mitigation.

Further noise generated by construction would be due to roadway expansions and improvements and increase in traffic by the construction workforce on access roadways and onsite roads. The noise generated by the roadway improvements and expansions would be associated with jack hammers, bulldozers, road pavers, road scrapers, earth movers and trucks. The road expansions and the new access road would be constructed on agricultural or undeveloped land; therefore, any noise from the construction would be attenuated prior to reaching receptors in the urban areas. Other road improvements would be along existing roadways. The noise generated by construction activities would be short term and during daytime hours. Noise from the increase in traffic by the construction workforce would occur on existing roadways as well as the road extensions once they are completed and on the Turkey Point plant property. Due to the short duration of construction activities in a single location, setting in urban areas or in agricultural or undeveloped areas with few receptors, and limiting construction to daylight hours, the impacts from noise from road construction and traffic would be SMALL and further mitigation would not be warranted.

4.4.1.2 Air

Temporary and minor impacts to the local ambient air quality could occur as a result of construction activities. Fugitive dust and fine particulate matter emissions, including those less than 10 microns (PM_{10}), would be generated during excavation of muck, backfilling, grading and compacting, concrete batching, and vehicular travel over paved and unpaved roads. Construction equipment and offsite vehicles used for hauling debris, soil, construction equipment, and supplies would also produce emissions. Wind erosion over exposed land area may also generate fugitive dust, smoke, and other fine particulate emissions. Open burning associated with clearing laydown areas and site preparation activities could be conducted as needed with proper notification to the Florida Division of Forestry.

Pollutants of primary concern include less than 10 microns of fugitive dust, reactive organic gases, oxides of nitrogen, carbon monoxide, and to a lesser extent, sulfur dioxides. Varying affecting construction emissions have been assessed and the level of PM_{10} emissions estimated to be released during both site preparation and construction of Units 6 & 7 is 97.5 tons. Also, based on the EPA emission factors and estimated maximum numbers of vehicles, the CO, NO_x, VOC, PM_{10}, and SO_2 emissions are estimated to be 63.7, 65.9, 8.3, 3.7, and 0.14 tons per year due to exhaust of construction equipment and diesel engines during both site preparation and construction of Units 6 & 7.

Impacts to air quality could be minimized by compliance with federal, state, and local regulations that govern construction activities and emissions such as the Southeast Florida Intrastate Air Quality Control Region and the Clean Air Act which established the National Ambient Air Quality Standards. These standards include criteria for pollutants such as:

- Sulfur dioxide
- Particulate matter with aerodynamic diameters of 10 microns or less (PM_{10})
- Particulate matter with aerodynamic diameters of 2.5 microns or less ($PM_{2.5}$)
- Carbon monoxide

- Nitrogen dioxide
- Ozone
- Lead

The Southeast Florida Intrastate Air Quality Control Region is in attainment for criteria air pollutants. Attainment areas are areas where the ambient levels of criteria air pollutants are designated as being *better than*, *unclassifiable/attainment*, or *cannot be classified or better than* the EPA-promulgated National Ambient Air Quality Standards (NAAQS).

Aside from the six common “criteria pollutants” for which the EPA has set NAAQS (ozone, particulate matter, carbon monoxide, nitrogen oxides, sulfur dioxide, and lead), heat-trapping greenhouse gases, such as methane, nitrous oxide, and halocarbons would be produced during construction. The greenhouse gas of primary concern is carbon dioxide (CO_2). The total carbon footprint, which is the total set of greenhouse gases (GHG) emissions caused by an organization, event or product, is estimated for single AP1000 reactor to be 185,000 metric tons. Construction equipment CO_2 emissions account for about 19 percent of this total or approximately 35,000 metric tons. Workforce transportation accounts for a majority of the total, approximately 150,000 metric tons (NRC 2010). The estimated equipment usage for a multiple unit facility would be larger, but it is not likely that it would be a factor of 2 larger (NRC 2010). In order to provide a perspective, an International Energy Agency analysis found that nuclear power's life-cycle emissions range from 2 to 59 gram-equivalents of carbon dioxide per kilowatt-hour. Nuclear energy's life-cycle greenhouse gas emissions are lower than wind (7 to 124 grams of carbon dioxide-equivalents), solar photovoltaic (13 to 731 grams of carbon dioxide-equivalents), natural gas-combined cycle (389 to 511 grams carbon dioxide-equivalents) and a modern coal plant (790 to 1182 grams of carbon dioxide equivalents). (NEI 2010)   Based on greenhouse gas life-cycle emissions generated for a nuclear plant compared to a fossil fuel plant's life-cycle greenhouse gas emissions, the atmospheric impacts of greenhouse gases from plant construction would not be noticeable and therefore the impacts would be SMALL.

Specific mitigation measures to control fugitive dust would be identified in a dust control plan, or similar document, prepared before the start of construction. These mitigation measures could include:

- Stabilizing construction roads and unsuitable soils piles
- Limiting speeds on unpaved construction roads
- Using water for dust control
- Periodically watering unpaved construction roads to control dust

- Performing housekeeping (e.g., removing dirt spilled onto paved roads)
- Covering haul trucks when loaded or unloaded
- Minimizing material handling (e.g., drop heights, double handling)
- Ceasing grading and excavating activities during high winds and during extreme meteorological events
- Phasing grading to minimize the area of disturbed soils
- Revegetating road medians and slopes

While emissions from construction activities and equipment would be unavoidable, a mitigation plan would minimize impacts to local ambient air quality and the nuisance impacts to the public close to the project. The mitigation plan would include:

- Phasing construction to minimize daily emissions
- Performing proper maintenance of construction vehicles to maximize efficiency and minimize emissions

Therefore, air quality impacts from construction would be SMALL and would not require mitigation.

4.4.1.3 Aesthetics

The viewscape of the new units from north to south or from south to north would be similar to that of the existing units, except for the additional height of cranes being used for the construction of the cooling towers and plant modules. The cranes could reach approximately 460 feet high and would be removed after the end of construction. As stated in Subsection 2.5.2.5, the tallest structures at the plant property are the existing 400-foot emission stacks. However, the viewscape perpendicular to the Turkey Point plant property, that seen by commercial and recreational boating traffic on the eastern side of the property, would have a broader view of the entire Units 6 & 7 plant area, and would have an open view of Units 6 & 7 construction. This viewscape would be temporarily impacted by the presence of construction equipment and the new reactor modules being installed, after which the viewscape would be similar to that of the existing units. Thus, the visual impact of the construction cranes and other equipment for Units 6 & 7 would be slightly more than the impacts from Units 1 & 2 emission stacks, which would be SMALL and would not warrant mitigation.

Outdoor lighting would be necessary to satisfy NRC and Occupational Safety and Health Administration (OSHA) requirements for security, worker and plant safety, including lighting walkways, parking areas and various equipment areas. Unconstrained lighting can cause light pollution and light trespass. Light pollution or sky glow is the term used to describe sky brightness caused by scattering of light in the atmosphere. Light trespass is the term used to describe light that strays from its intended purpose and becomes an annoyance.

Light pollution and light trespass would be addressed during construction of Units 6 & 7 when working in low light hours. Guidelines specifically addressing potential lighting issues, from the Illuminating Engineering Society of North America (IESNA), would be adhered to. These guidelines would be incorporated into the outdoor lighting design to the extent practicable while meeting NRC and OSHA requirements. Typical features to be incorporated would include: minimize upward light from luminaries, minimize upward light in general so that light reaches its intended target, turn off lighting not needed for safety and security between 11 PM and sunrise, contain light within its intended target area by suitable choice of luminaries for light distribution, by selection of mounting height and physical location, and by minimizing glare in the horizontal or vertical directions.

Outdoor light monitoring was conducted in 2008. The monitoring was performed from ten locations surrounding Turkey Point such as the racetrack, cooling canals, and Biscayne Bay. The results indicate that, while light from the existing units is visible, the light is localized. Sky glow was observed from the major urban areas such as Homestead and Miami. The use of the IESNA guidelines to the extent practicable, while meeting NRC and OSHA security and safety requirements, would result in low lighting impacts from Units 6 & 7 and would not warrant mitigation.

The visual impacts of the construction within the eastern transmission line corridors (Clear Sky to Turkey Point, Clear Sky to Davis, and Davis to Miami) would consist of the clearing and installation of new concrete pads and 80-105 feet concrete poles upon which two 230 kV lines would be spanned. This area would consist of other construction activities and the Clear Sky to Turkey Point line would be fully contained on the Turkey Point plant property. The view would be similar to the existing lines between Turkey Point switchyard and the McGregor switchyard. The Clear Sky to Davis line would also span between 80-105 feet concrete poles in an established transmission corridor that is currently being utilized for seven other power lines. The Davis to Miami line would again span between 80-105 feet concrete poles collocated with the MetroRail and a major transportation highway. A short section of the proposed Davis-Miami 230 kV transmission line, at the crossing of the Miami River adjacent to the existing Miami substation, would be constructed underground. Construction phases would consist of right-of-way clearing (where required), access road and structure pad construction (where necessary), line construction, and right-of-way restoration. The construction of new concrete pads with a single line and new poles within this corridor would be temporary and accelerated and would be similar to the current linear facilities established. Therefore the presence of these new lines would have a SMALL impact and would not warrant mitigation.

The visual impacts of construction within the western transmission line corridor (Clear Sky to Levee and Clear Sky to Pennsuco) would consist of clearing area within the current and preferred corridors to expand the right-of-way to contain new concrete pads and concrete poles for two 500 kV lines and a single 230 kV line. These lines would follow an existing corridor up to the Everglades National Park (ENP), after which, the two 500 kV lines would terminate at the Levee substation and the 230 kV line would continue to the Pennsuco substation. The existing corridor to the ENP is currently utilized by a single transmission line and predates much of the current development along the corridor. The visual impacts of the construction of the addition lines would consist of the installation of new 80-105 feet high concrete poles and new concrete guyed single-circuit structures at heights of 135-150 feet approximately 1000 feet apart. The construction of these new structures would alter and inhibit the viewscape; however, due to the flat topography, the visibility would be reduced with increased distance. The present corridor located within ENP would be visible within the park up to 4 miles away; however, visibility would be reduced with increased distance from the structures and at the furthest distances the image would be faint. There is an option to relocate the corridor along the eastern edge of the park; however, the impacts would be similar to the previous corridor through ENP, except it would be farther away from visitors immediate view within the park. The 230 kV line that continues through Levee substation to Pennsuco substation would be in portions of existing rights-of-way where the line would be collocated with existing transmission lines and would require construction in heavily industrial and urban areas. Impacts to the natural and built environment would be minimized due to the presence of existing facilities and, to the extent feasible through the selection process, engineering options, and construction techniques used. Therefore, the presence of these new lines would have a SMALL impact and would not warrant additional mitigation measures.

4.4.1.4 Traffic

FPL would route construction traffic to a new construction entrance. SW 117th Avenue and SW 137th Avenue/Tallahassee Road would be extended south of SW 344th Street/Palm Drive. SW 359th Street (which runs east-west, south of SW 344th Street/Palm Drive) would be extended east from its current termination to a new construction entrance. As described in Subsection 2.5.2.2.1 for the current workforce, construction traffic could use a number of different routes to reach SW 137th Avenue/Tallahassee Road, SW 117th Avenue, SW 328th Street/North Canal Drive, or SW 344th Street/Palm Drive, and from these roads, access SW 359th Street to the construction entrance (Figure 4.4-2).

Construction materials would arrive at the Turkey Point plant property by truck and barge. Large components and equipment would arrive by barge. Approximately 80 barge trips for large components and modules would be required for each unit over a 6-year period (see

Subsection 3.9.1.3). Materials arriving by barge would then be trucked over the onsite heavy haul road to the Units 6 & 7 plant area. Florida's Intracoastal Waterway traverses the eastern coastline of Florida and intersects with the port of Miami, as shown in Figure 2.5-7. The existing barge turning basin is accessed via the waterway through an existing shipping channel in Biscayne Bay. Modifications to the equipment barge unloading area would be required to accommodate the delivery of large components and modules. These alterations would be limited to the equipment barge unloading area of the turning basin and would not impact Biscayne Bay barge traffic. As explained in Subsection 4.3.1.1, the barge facility is currently active throughout the year, receiving five to seven shipments of fuel oil per week for Units 1 & 2. Because of the infrequent number of trips required to deliver large components and modules by barge, the current frequent number of fuel oil shipments, the impacts to waterborne traffic in Biscayne Bay and the Intracoastal Waterway would be SMALL and would not require mitigation.

4.4.1.5 Conclusion

Physical impacts to the surrounding communities and residences as a result of construction of the new units and linear facilities would be SMALL and would not warrant mitigation. However, the impacts from traffic and transportation would be MODERATE and would require mitigation.

4.4.2 SOCIAL AND ECONOMIC IMPACTS

This section evaluates the impacts to various socioeconomic factors in the region of influence as a result of constructing Units 6 & 7 in Miami-Dade County Florida. These factors are demography and community services. Community services include the economy, transportation, taxes, land use, aesthetics and recreation, housing, public services and community infrastructure (water, wastewater, law enforcement, fire protection, and medical services), and education. The evaluation assesses impacts of construction-related activities and of the construction workforce on the region of influence.

The population data in this section was updated to reflect the American Community Survey Estimates for 2005-2009. The population projections in Table 2.5-1 and FSAR Subsection 2.1.3, however, used the 2010 Census dataset in order to be consistent with the base population used by the Florida Office of Economic Development and Research for the state projected population growth between 2010 and 2030. The 2010 Census dataset was also used in FSAR Subsection 2.1.3 to calculate the same base growth rate multiplier as the state, so that the population projections would be consistent with those projected by the state through 2030.

The construction schedule assumes a 123-month duration from the start of preconstruction activities to the start of commercial operation of Unit 7. Site preparation activities would begin in 2013. The projected commercial operation dates for Units 6 & 7 are 2022 and 2023, respectively. See Table 3.9-1.

A total of 3983 workers are estimated (including 3950 construction and 33 operation workers) at peak construction activity (anticipated to occur in 2019 (Subsection 3.10.1.2). There would be two types of workforces onsite during the construction peak because the operation of Unit 6 would begin before the completion of construction for Unit 7. Figure 3.10-1 illustrates the distribution of the construction workforce over the anticipated construction period, Figure 3.10-2 illustrates the distribution of operation workers during the same period, and Figure 3.10-3 illustrates the distribution of both workforces during the construction period. The nature of the two types of workforces is different and may cause differing impacts. In Subsection 4.4.2, these two workforces are analyzed together and separately.

Major factors in determining socioeconomic impacts are the number of workers and family members that relocate to an area and where they settle. Assumptions regarding workforce characteristics and migration, family characteristics, and workforce retention at Units 6 & 7 are depicted in Table 4.4-1. Assumptions regarding families, children, and the indirect workforce are described in more detail in Subsection 4.4.2.1. As stated in Subsections 3.10.2 and 3.10.3, it is assumed that 50 percent of the total construction workforce would migrate into the region of influence and 50 percent of the operation workforce would migrate into the region of influence. Therefore, the peak number of workers that would migrate into the region of influence would be 1992 (50 percent of 3983 workers). This would include 1975 construction workers and 17 operation workers.

As described in Subsection 2.5.1, the evaluation of the residential distribution of the current workforce for Turkey Point Units 1 through 5 and socioeconomic variables within 50 miles of the Turkey Point plant property has determined that the socioeconomic region of influence for this project includes Miami-Dade County, and specifically, the Homestead and Florida City area. Approximately 83 percent of the current operation workers reside in Miami-Dade County. Approximately 43 percent of Turkey Point's workers reside in the Homestead and Florida City area. For this project, it could be assumed that 83 percent of the in-migrating construction workforce would reside in Miami-Dade County and the remainder would reside in the other counties in or near the 50-mile radius, but Miami-Dade County's population is so large and resources are so plentiful that it can be conservatively assumed that 100 percent of the 1992 workers would migrate to the county. On a more local level, however, it is assumed that, based on the residential distribution of the current operation workforce, approximately 43 percent of the in-migrating workers (845 construction and 7 operation workers) would reside in the Homestead and Florida City area. The impact analyses in Subsection 4.4.2 are based on the socioeconomics of Miami-Dade County in general and the Homestead and Florida City area in particular.

In Subsection 4.4.2.2, incremental increases in resource use caused by the incoming workforces for the new units are compared to the available capacity of those resources in Miami-Dade County and particularly the Homestead and Florida City area.

As stated in Section 1.1, the significance of the impacts as SMALL, MODERATE, or LARGE have been identified in accordance with the NRC-established criteria in 10 CFR Part 51, Appendix B, Table B-1, Footnote 3, as follows:

SMALL — Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.

MODERATE — Environmental effects are sufficient to alter noticeably, but not to destabilize, any important attribute of the resource.

LARGE — Environmental effects are clearly noticeable and are sufficient to destabilize any important attributes of the resource.

These impact significance terms are assigned to both county-level and city-level analyses.

4.4.2.1 Demography

It is estimated that both units would be in commercial operation by 2023. The 2010 population within 50 miles was approximately 3,459,894 and is projected to grow to approximately 3,723,288 by 2020 (Table 2.5-1). The population in Miami-Dade County was 2,496,435 in 2010, and is projected to grow to 2,722,889 by 2020 (Table 2.5-4). The 2000 populations of Homestead and Florida City were 31,909 and 7843, respectively (Subsection 2.5.1). The 2005-2009 estimates for the two cities were 55,036 and 9808, respectively (Subsection 2.5.1). Population projections for the two cities in 2020 are not available.

It is anticipated that 1992 workers (1975 construction workers and 17 operation workers) would migrate into Miami-Dade County to support the construction of the new units (Table 4.4-1). It is anticipated that 852 (845 construction workers and 7 operation workers) of those workers would migrate to the Homestead and Florida City area (Table 4.4-1). The demographic analysis is based on these numbers.

Multipliers are used to estimate how much a one-time or sustained increase in economic activity, such as the construction of Units 6 & 7, in a particular region, such as Miami-Dade County, will impact a defined region. Multipliers are used to estimate the number of indirect jobs created in a region. Indirect jobs are created when new, directly employed workers, spend their earnings and hence, create a greater demand for goods and services than existed before the new worker wages were introduced to the region. The in-migration of 1992 workers would create new indirect jobs because of the multiplier effect.

Under the multiplier effect, each dollar spent on goods and services by an in-migrant becomes income to the recipient, who saves a portion but re-spends the rest. In turn, this re-spending becomes income to someone else, who, in turn, saves part and re-spends the rest. The number of times the final increase in consumption exceeds the initial dollar spent is called the multiplier. The U.S. Department of Commerce's Bureau of Economic Analysis (BEA), Economics and Statistics Division, provides multipliers for industry jobs and earnings (BEA 2009a). Their economic model, RIMS II, incorporates buying and selling linkages among regional industries, and provides multipliers by industry sector to estimate the impacts of changes in that sector to a regional economy. The analysis here uses the detailed employment multipliers for the construction industry and the power generation and supply industry to estimate the number of indirect jobs and the impact of new nuclear plant-related expenditures in Miami-Dade County, as a result of the influx of construction and operation workers during the period of construction. Table 4.4-2 provides direct and indirect employment data for the county.

The multipliers predict that for every in-migrating construction worker, an estimated additional 0.9535 jobs would be created in Miami-Dade County (BEA 2009a). During the construction peak, the influx of 1975 construction workers would generate approximately 1883 indirect jobs, resulting in a total of 3858 new jobs (direct and indirect) in Miami-Dade County (Table 4.4-2). For every in-migrating operation worker (17 during the construction peak), an estimated additional 2.1696 jobs would be created in Miami-Dade County (BEA 2009a). During the construction peak, the influx of 17 operation workers would create approximately 36 indirect jobs, for a total of 52 new jobs (direct and indirect) in Miami-Dade County (Table 4.4-2). Therefore, the total number of indirect jobs created in Miami-Dade County by the construction of Units 6 & 7 would be 1919.

Most indirect jobs are service or retail-related and not highly specialized, so, for this analysis, it was assumed that most indirect jobs would be filled by the existing labor force in the 50-mile region of influence, and, specifically, Miami-Dade County, where there were 156,562 unemployed people in 2011 (Table 2.5-7). The number of indirect jobs, 1919, represents approximately 1.2 percent of the number of unemployed people in Miami-Dade County in 2011.

To estimate the family characteristics of the construction and operation workforces, the NRC study, *Migration and Residential Location of Workers at Nuclear Power Plant Construction Sites* (BMI Apr 1981) and U.S. Census Bureau (USCB) data were evaluated. Published in 1981, the Battelle Memorial Institute (BMI) study was based on 49,000 observations from 28 surveys at 13 nuclear power plant construction sites. The study sought to improve the accuracy of socioeconomic impact assessments by providing an improved methodology for predicting in-migrating workforce sizes and residential distribution patterns at future nuclear power plant construction project sites. Though the study was an analysis of construction workforces in general, information about nuclear plant nonconstruction workers (i.e., managers, engineers, supervisors, clerical, security, and medical personnel who were on the site during construction) was also included. Because nonconstruction workers have many similar characteristics to operation workforces, their data is useful for this analysis. The study is the most current of its nature and there is little evidence that the observations of fundamental worker characteristics and behaviors detailed in the BMI study have changed meaningfully since the study's publication.

Therefore, the worker migration patterns and family characteristics described in the 1981 study are a valid proxy for assumptions made for nuclear power plant construction and operation workforces today.

According to the BMI study, approximately 70 percent of the in-migrating nuclear plant construction workers were likely to bring families (BMI Apr 1981). Therefore, for this project, of 1975 in-migrating construction workers, 1383 would bring families into Miami-Dade County and 592 would not. Approximately 591 workers would bring families into the Homestead and Florida City area. According to the BMI study, the average family size of a nuclear plant construction worker was 3.25 (BMI Apr 1981).

Consequently, it is estimated that the size of the construction worker family for this project would be 3.25. Therefore, 1383 in-migrating construction workers would bring 3111 family members into Miami-Dade County. The 591 workers that would move into the Homestead and Florida City area would bring 1331 family members (Table 4.4-1).

According to the BMI study, the average number of school-age children per construction worker who relocated his/her family was 0.8 (BMI Apr 1981). Therefore, 1383 in-migrating families would include 1106 school-age children. The 591 families that would relocate to the Homestead and Florida City area would include 473 children.

With respect to the operation workers onsite during the construction peak, it is assumed that 100 percent of the 17 in-migrating workers would bring families. Seven of those workers would settle in the Homestead and Florida City area. According to the BMI study, the average family size of a nuclear plant nonconstruction worker (i.e., managers, engineers, supervisors, clerical, security, and medical personnel who were onsite during construction) was slightly less than 3.25 (BMI Apr 1981). According to the USCB (USCB 2010b), the average family size in Miami-Dade County in 2010 was 3.33, while the average family size for the state of Florida was 3.01 (USCB 2010b). Therefore, it is assumed that the average family size of 3.25 used for the construction workforce, would also be a reasonable estimate for the operation workforce. Thus, 17 in-migrating operation workers would bring 37 family members, for a total of 54 additional people in Miami-Dade County (Table 4.4-1). The 7 workers that would migrate to the Homestead and Florida City area would bring 16 family members, for a total of 23 additional people in that area (Table 4.4-1).

The BMI study reported that while construction workers averaged 0.8 school-age children per family, nonconstruction workers had an average of 0.6 children. However, to provide a more conservative impact estimate, it is estimated that, like the construction worker families, each of the 17 operation worker families would bring 0.8 school-age children, for a total of 13 children. The 7 families that would settle in the Homestead and Florida City area would include 6 children (Table 4.4-1).

When the population increases from the two sets of in-migrating workers are totaled, Miami-Dade County's population during the construction peak would grow by 5139 people (Table 4.4-1). This represents an increase of approximately 0.2 percent over Miami-Dade County's projected 2020 population (Table 2.5-4). Therefore, Units 6 & 7-related population impacts to Miami-Dade County during construction would be SMALL.

When approximately 43 percent of the in-migrating workers (construction and operation) settle in the Homestead and Florida City area, the Homestead and Florida City area's population during the construction peak would grow by 2199 people (Table 4.4-1). This represents an increase of approximately 6 percent over the combined 2000 populations of Homestead and Florida City (Table 2.5-3), and approximately 3.4 percent over the combined 2005-2009 population estimates of Homestead and Florida City. Therefore, Units 6 & 7-related population impacts to the Homestead and Florida City area during construction would be SMALL.

Upon construction completion, it is assumed that, based on the BMI study, 50 percent of the in-migrating construction workforce would leave the region of influence and 50 percent would remain (BMI Apr 1981). Essentially, 2543 people, including workers and family members, would migrate back out of the region of influence (Table 4.4-1). One thousand eighty-eight (1088) people would leave the Homestead and Florida City area (Table 4.4-1). Because the Turkey Point project-related impacts to the populations of the region of influence would be small, the impacts of the post-construction population declines would also be SMALL.

4.4.2.2 Impacts to the Community

This section evaluates the economic, infrastructure, and community service impacts to the region of influence, Miami-Dade County, and, specifically, the Homestead and Florida City area, as a result of constructing Units 6 & 7. Site preparation and construction activities would continue for 123 months and employ as many as 3983 workers (3950 construction workers and 33 operation workers) at peak employment, 50 percent of which would migrate into Miami-Dade County.

4.4.2.2.1 Economy

As noted previously, a one-county region of influence—Miami-Dade County—has been identified. The impacts of construction on the local and regional economy depend on the region of influence's current and projected economy and population.

In 2010, there were 31,395 jobs in the construction industry in the region of influence, which represented approximately 3.9 percent of jobs in the region of influence (Table 2.5-11). In 2010, 17.2 percent (5401) of these construction jobs were in heavy and civil engineering construction.[1]

As explained in Subsection 4.4.2 (Table 4.4-1), approximately 1992 construction and operation workers would be expected to migrate into the region of influence during the peak construction period. Table 4.4-3 shows that these workers would represent 0.25 percent of the region of influence's 2010 total employment, 6.3 percent of the region of influence's employment in construction, and 36.9 percent of the region of influence's employment in heavy and civil engineering construction.

Subsection 4.4.2 also addresses employment multipliers, which predict that the in-migrating workers would create 1919 indirect jobs (1883 construction workers and 36 operation workers) in the region of influence, resulting in a total of 3911 (1992 + 1919) new jobs in the region of influence during the construction peak. It is estimated that region of influence residents would be available to fill the 1919 indirect jobs. To the extent that the new indirect jobs would reduce unemployment in the region of influence, the impact would be SMALL and positive.

The BEA's RIMS II program (Subsection 4.4.2.1) calculates earnings multipliers. The analysis here uses the detailed earnings multipliers for the construction industry and the power generation and supply industry sectors to estimate the impacts in the region of influence from earnings by in-migrating construction and operation workers, respectively. For every dollar earned by an in-migrant construction worker, an estimated additional 0.8022 dollars would be injected into the regional economy, while each dollar earned by an in-migrant operation worker would inject an estimated additional 0.788 dollars into the region of influence's economy (BEA 2009).

4.4.2.2.1.1 Construction In-Migrants

To estimate impacts to the region of influence economy by the construction in-migrants, wage data for Industrial Sector 237, Heavy and Civil Engineering Construction, was obtained from the Department of Labor, Bureau of Labor Statistics (BLS), *Quarterly Census of Employment and Wages* (BLS 2012b). As shown in Table 2.5-12, the average annual wage in this sector for Miami-Dade County was $58,662 in 2010. The estimated average monthly wage of $4889 ($58,662 ÷ 12) was multiplied by the number of in-migrating workers for each month and then summed to calculate total dollars earned by the in-migrants. The number of in-migrants is assumed to be 50 percent of the total workforce onsite per month. Table 4.4-4 provides the total construction worker wages for each month during the construction period. The wage total for the 123-month construction period is $637,093,763. The impact of these wages to Miami-Dade County is calculated as follows. The earnings multiplier (1.8022) for the construction industry in

1. The numbers for total employment for all industries, construction, and heavy and civil engineering construction reflect privately owned firms and establishment sizes. These figures do not include government employees.

the region of influence is applied to the wages (BEA 2009a). According to these calculations, the total economic impact of in-migrating construction worker wages on the region of influence would be $1,148,170,379 over the life of the construction project (Table 4.4-5). There are numerous commercial establishments and opportunities scattered throughout the many urbanized areas of the region of influence, but BEA does not report data at the local level for municipalities such as Homestead and Florida City. Therefore, it is not possible to estimate the economic impact from the in-migrating construction worker wages to the Homestead and Florida City area. However, such impacts are expected to be positive and SMALL.

To approximate the magnitude of the impacts in the region of influence, the total wages for each year during the construction period are computed. The multiplier is applied to these values and compared the annual totals to the region of influence's total personal income for 2009. As seen in Table 4.4-6, these estimates predict that wages spent in the region of influence would represent increases to the region of influence's total personal income of 0.01 percent in the first year, 0.23 percent in the eighth year, and 0.01 percent in the final year of construction. Impacts to the region of influence's economy would be positive and SMALL. However, as a result of potential growth in personal income in the region of influence, independent of Units 6 & 7, the construction worker wages could very well represent a decreasing proportion of total income in the future. In this case, impacts to the region of influence's economy would remain SMALL and positive.

Another local economic impact would result from possibly increased earnings by the 50 percent of construction workers who would already reside in the region of influence. The level of this impact would depend on those workers' existing wages and the amount by which their wages would increase when working on Units 6 & 7. While that information cannot be known at this time, it is assumed that such impacts would be SMALL and positive.

4.4.2.2.1.2 Operation In-Migrants

In addition to the in-migrating construction workers, operation workers would also be onsite during the construction period. At the peak construction period, an operation workforce of 33 workers is estimated, but the operation workforce would grow to 806 workers by the end of the construction phase (Section 3.10). As stated previously, it is assumed that 50 percent of operation workers would migrate into the region of influence.

The BLS collects employment and wage data by occupational category. To estimate impacts to the region of influence economy by the operation in-migrants, Florida wage data was obtained for category 51-8011, Nuclear Power Reactor Operators, from the BLS, *Occupational Employment and Wages,* BLS 2010. Although the lower paid Nuclear Technicians, as opposed to Nuclear Power Reactor Operators, would comprise a larger share of the operation workforce, Florida data for the 2010 average annual wage of nuclear technicians is not available. Therefore, to be conservative, the current average annual wage of the higher paid Nuclear Power Reactor Operators was used.

The methodology for predicting in-migrant operation worker impacts was similar to that used for predicting in-migrant construction worker impacts. The average annual wage of $81,980 is divided by 12 to obtain an average monthly wage of $6832, which is then multiplied by the number of in-migrating workers each month, and summed to calculate total dollars earned. Table 4.4-7 provides these calculations, and shows that total operation worker wages during the construction period would total $72,251,707.

The impacts of these wages to Miami-Dade County is calculated as follows. The earnings multiplier for power generation and supply workers (1.7880) is applied. Impacts to the region of influence's economy from operation worker wages would total over $129,186,052 over the construction period (Table 4.4-8). As noted above, it is not possible to predict economic impacts from in-migrating operation worker wages to the Homestead and Florida City area. However, it is likely that local businesses would experience SMALL and positive impacts as a result of expenditures by in-migrating workers and their families.

Total wages are then computed by year. The multiplier is applied to these values, and the annual totals are compared to the region of influence's total personal income for 2009. The results are shown in Table 4.4-9. As noted previously, these impacts could be slightly overstated because of possible growth in the region of influence's total personal income, independent of Units 6 & 7. Operation worker wages would increase steadily through the construction period as new workers arrived onsite, and would represent an increase in the region of influence's total personal income ranging from zero in the first year (when no operation workers are present) to 0.016 percent in the final year of construction. Therefore, impacts to the region of influence's economy during the construction period would be positive and SMALL.

Impacts to the region of influence's economy during the assumed 60-year operation of Units 6 & 7 are explained in Subsection 5.8.2.2.1.

4.4.2.2.1.3 Summary of Combined Impacts of Construction and Operation Workers

In all, in-migrating construction and operation workers during the construction period would earn a total of more than $709 million over the estimated 123-month construction period (Table 4.4-10). The creation of the Units 6 & 7 jobs would inject approximately $1.3 billion into the region of influence's economy during construction. Although large in absolute terms, because of the region of influence's large economy, this would be a SMALL and positive impact.

Annual impacts are conservatively estimated to range from approximately $4.9 million in the first year, to a peak of $211.6 million in the eighth year, to $20.8 million in the final year of construction. As shown in Table 4.4-11, these wages and their multiplied impacts would increase total personal income in the region of influence by 0.01 percent in the first year, by 0.23 percent in the eighth year, and by 0.02 percent in the final year, when compared to the region of influence's total personal income in 2009. Impacts to the region of influence's economy would be positive and SMALL.

In addition, the injection of new income would create jobs in the region of influence's economy and create business opportunities for housing and service-related industries. While the magnitude of those impacts cannot be predicted at this time, it is assumed that impacts would be SMALL in the region of influence overall and could be SMALL to MODERATE in specific communities in the region of influence. All impacts would be positive.

4.4.2.2.1.4 End of Construction Period

It is estimated that after construction is complete, approximately 50 percent of the construction worker in-migrants would leave the region of influence. Operation workers would remain in the region of influence. The loss of construction jobs, population, wage income, and indirect jobs and income (from the multiplier effect), would be considered a negative and SMALL impact to the region of influence, and depending on the worker residence patterns, impacts could be SMALL to MODERATE in specific region of influence communities, such as Homestead or Florida City.

However, as Figure 3.10-1 indicates, the out-migration would occur gradually over the last few years of the construction phase, and the out-migration of construction workers would be partially offset by the incoming operation workers. The gradual nature of the decline in the construction workforce would assist in mitigating the impact to communities in the region of influence from the destabilizing effects of a sudden decrease in households.

Because it cannot be known with certainty where in the region of influence incoming workers would reside, it is not possible to gauge which communities in the region of influence would be most affected by the departing workforce and their families. In some locations where impacts could be MODERATE, mitigation may be warranted. To mitigate these impacts, FPL would maintain timely communication with municipal and county government authorities and nongovernmental organizations to disseminate project information that could have socioeconomic impacts in the community. FPL would also provide timely information to the local media, enabling businesses and individuals to make informed decisions and economic choices.

Even before the construction worker influx, local agencies, organizations, businesses, and individuals could make planning decisions regarding economic choices with the understanding that much of the positive economic impact of the construction project would be temporary, and could disappear when the construction project is complete.

4.4.2.2.2 Taxes

Construction-related activities, purchases, and workforce expenditures would generate several types of taxes, including corporate income taxes, sales and use taxes, and property (also known as *ad valorem*) taxes. Increased tax collections are viewed as a benefit to the state of Florida, the region of influence, and communities in the region of influence.

In the *Generic Environmental Impact Statement (GEIS) for License Renewal of Nuclear Plants* (NUREG-1437), the NRC presents its method for defining the impact significance of tax revenue impacts during refurbishment (i.e., large construction activities). Although these criteria are focused on property taxes, the impact ranges can also be applied to other types of taxes. This methodology was reviewed and it was determined that the significance levels were appropriate to apply to an assessment of tax impacts as a result of construction.

In the GEIS, the NRC concluded that changes in tax revenues at nuclear plants would be:

SMALL — When new tax payments by the nuclear plant constitute less than 10 percent of total revenues for local taxing jurisdictions. The additional revenues provided by direct and indirect plant payments on refurbishment-related improvements result in little or no change in local property tax rates and the provision of public services.

MODERATE — When new tax payments by the nuclear plant constitute 10–20 percent of total revenues for local taxing jurisdictions. The additional revenues provided by direct and indirect plant payments on refurbishment-related improvements result in lower property tax levies and increased services by local municipalities.

LARGE — When new tax payments by the nuclear plant represent more than 20 percent of total revenues for local taxing jurisdictions. Local property tax levies can be lowered substantially, the payment of debt for any substantial infrastructure improvements made in the past can easily be made, and future improvements can continue.

4.4.2.2.2.1 Personal and Corporate Income Taxes

As noted in Subsection 2.5.2.3, Florida has no personal income tax, but does levy a corporate income tax on corporations that conduct business in Florida. The tax liability is computed using federal taxable income, modified by certain Florida adjustments, to determine adjusted federal income. At the present time, FPL is subject to Florida corporate income tax as a result of owning and operating power plants and other properties throughout the state, including the existing Turkey Point generation facility. FPL currently files as a member of a consolidated group for federal and state income tax purposes. At the time when FPL places the units in service, in 2022 for Unit 6 and 2023 for Unit 7, the additional taxable income will be included in the consolidated federal and state income tax filings. Because of the many factors involved in computing the amount of tax liability, it is not possible at this time to estimate an amount by which corporate taxes may increase, and how much of the total would be attributable to Units 6 & 7. In 2011, the state of Florida collected approximately $1.9 billion in corporate income tax revenues. The expectation is that Turkey Point 6 & 7 would have a SMALL and positive impact to the state's overall corporate income tax collections.

Local construction expenditures and purchases by the construction workforce[1] would have a multiplier effect on the local economy, where money would be spent and re-spent in the region of influence (Subsection 4.4.2). Because of this multiplier effect, region of influence businesses, particularly retail and service sector firms, could experience revenue increases, and there may be prospects for new startup firms to service the construction effort as well as workers and their families. Existing and new firms could generate additional profits, which would contribute to increased corporate income taxes, although the exact amount is unknown. Impacts would be positive, and SMALL, relative to overall state corporate income tax revenues.

4.4.2.2.2.2 Sales and Use Taxes

The state of Florida and Miami-Dade County would experience an increase in the amount of sales and use taxes collected. The additional taxes would be generated from construction expenditures for Units 6 & 7 and from retail purchases of goods and services by the construction workforce and visitors. As explained in Subsection 2.5.2.3.2, Florida imposes a 6 percent sales and use tax, and Miami-Dade County adds a 1 percent discretionary sales tax, bringing the total sales tax in the region of influence to 7 percent. Cities and towns in the region of influence do not levy local sales tax.

Florida provides a 100 percent tax exemption for equipment and materials associated with the construction of power plant equipment and for pollution control equipment, leaving purchases of labor and services as the only taxable expenditures directly associated with construction activities. Therefore, FPL’s expenditures for Units 6 & 7 for labor and services from Florida providers would be subject to the state’s sales tax of 6 percent, and purchases from Miami-Dade County providers would also be subject to the 1 percent sales tax levied by the county. FPL estimates that labor and services will make up 34 percent of construction costs. Of this labor and services component, 33 percent would be purchased from out-of-state providers, and 67 percent would be purchased from Miami-Dade County providers. Therefore, 23 percent of the construction expenditures for Units 6 & 7 (67 percent x 34 percent = 22.78 percent, rounded to 23 percent) would generate sales tax (FPL Undated) (Table 4.4-13).

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1. As addressed in Subsection 4.4.2, the “construction workforce” includes both construction workers and operation workers who are onsite during the 123-month construction period.

FPL's *Nuclear Power Plant Cost Recovery For The Years Ending December 2010 and 2011* was submitted to the Florida Public Service Commission on May 3, 2010 (FPL May 2010). In this testimony, two construction cost estimates were developed for the total project cost over a 12-year period[1]. The estimated low total project cost is $12.8 billion and the estimated high total project cost is $18.7 billion (Table 4.4-13).

To estimate the potential sales tax impacts to Miami-Dade County and Florida, the total estimated project cost figures for each scenario were multiplied by 23 percent to obtain the amounts subject to sales tax, and then multiplied by 1 percent and 6 percent, respectively, to calculate the tax revenues for Miami-Dade County and the state. That amount was then divided by 12 years to determine an average yearly amount, which in turn was taken as a percentage of the 2011 total sales tax revenues for each taxing entity. Table 4.4-13 shows the potential sales tax impacts to Miami-Dade County and Florida from the two scenarios. Because of their large economies, both entities have sizable sales tax revenues. Therefore, while the absolute amount of FPL's sales tax payments on Units 6 & 7 would be large, the payments would represent small increases over 2011 revenues, ranging from 4.2 to 6.2 percent for Miami-Dade County and 0.08 percent to 0.11 percent for Florida, a SMALL and positive impact. Note that although this methodology uses a yearly average to estimate the tax impacts, it is highly improbable that expenditures would be evenly distributed during the 12-year period. In fact, if a sufficient proportion of the expenditures occurred within 1 year, it is possible that impacts to Miami-Dade County could be MODERATE in that year. Table 4.4-14 shows that for 2011, taxable purchases exceeding $57,559,000 would yield sales tax payments in the order of $5,755,900 that would increase Miami-Dade County's sales tax revenues by more than 10 percent. However, Miami-Dade County's tax revenues are likely to increase over the construction period, and a corresponding increase in FPL's taxable purchases would be required to exceed the 10 percent threshold.

As explained in Subsection 2.5.2.3, workers and visitors would pay Florida sales or use tax on items purchased in the state (or purchased elsewhere but subject to state use tax), regardless of whether the purchase was made in the region of influence. They would also pay Miami-Dade County sales or use tax on purchases in the county or subject to county taxation. In absolute terms, the amount of state sales and use taxes collected from workers during the construction period could be sizable, but would provide a SMALL and positive impact when compared to the total amount of taxes collected by Miami-Dade County and Florida.

Because Homestead, Florida City, and other cities in the region of influence do not impose a local sales tax, they would not experience direct sales tax impacts as a result of the construction of Units 6 & 7. However, they could benefit indirectly from Florida's and Miami-Dade County's

1. In this report, FPL defined the construction period as 12 years, from the initiation of licensing activities to completion of Unit 7.

increased sales tax revenues if those revenues allowed more services to be provided in their communities. Impacts would be SMALL and positive.

4.4.2.2.2.3 Other Sales and Use-Related Taxes

Units 6 & 7 workers who reside in the state would also be subject to the state's communications services tax on phone, cable, cellular phone, and related services, and the documentary sales tax on deeds and other types of legal documents (Subsection 2.5.2.3.3). If one were to conservatively assume that workers and their families migrating into the region of influence would come from out of state, the in-migrating workers and their families would represent an increase of only 0.03 percent over Florida's 2005-2009 population (Table 4.4-15). Therefore, impacts to Florida's tax revenues for the communications services tax and the documentary sales tax would be SMALL but positive.

4.4.2.2.2.4 Property Taxes — County and Special Districts

In 2010, FPL paid personal property taxes for the Turkey Point Plant totaling $8.8 million to Miami-Dade County, representing 0.9 percent of the county's property tax revenues, and FPL paid $6.6 million to the Miami-Dade County school district, representing 0.35 percent of the school district's local funding (Table 4.4-16a). FPL also paid tangible personal property taxes to four special taxing districts: the Florida Inland Navigation District, the South Florida Water Management District, the Everglades Construction Project, and the Children's Trust Authority (Table 4.4-16a).

According to FPL's Economic Impact Analysis, ad valorem (property) tax is based on the undepreciated book value of the plant through its life, with exemptions for pollution control equipment (FPL Undated). The assessed value of Units 6 & 7 during construction is not known at this time, and the projected amount of tax payments to the various taxing districts cannot be estimated. However, as Table 4.4-16a shows, FPL's payments to these jurisdictions in 2010 represented less than 1.5 percent of each district's total revenues, because of the region of influence's large tax base. Although property tax payments could increase during the construction of Units 6 & 7, the increases would constitute SMALL and positive impacts to each district.

To the extent that new homes were constructed or property values rose, the in-migrating construction period workers and their families could also increase property tax revenues in the jurisdictions where they choose to reside. As Table 4.4-15 shows, if incoming worker families were to reside in Miami-Dade County, they would represent an increase of 0.2 percent over Miami-Dade County's 2005-2009 population. These increases would have a positive and SMALL impact on property tax revenues in Miami-Dade County.

If approximately 43 percent of in-migrants would choose to reside in the Homestead and Florida City area, in accordance with the residence patterns of current Turkey Point workers, incoming workers and families would make up approximately 3.4 percent of the 2005-2009 population of the Homestead and Florida City area (Table 4.4-15). These in-migrating worker families would contribute property taxes to the county and special districts where they reside.[1] It is unlikely that the percentage of tax revenue increase in Homestead or Florida City would be as much as the potential population increase associated with the construction of Units 6 & 7, because much of any jurisdiction's tax base consists of higher-valued industrial or commercial property rather than residential. Therefore, the property tax impacts from new residents would be positive and could be SMALL to MODERATE.

4.4.2.2.2.5 Property Taxes — Independent School District

As stated in Subsection 2.5.2.3, property taxes for Turkey Point are paid to the Miami-Dade County tax collector for the Miami-Dade School District (Tables 2.5-19 and 2.5-20). As shown in Table 4.4-16a, FPL's payments to this district represented 0.35 percent of the district's local revenues in 2010. The amount of property taxes that would be assessed on Units 6 & 7 during construction could increase, but the amount is unknown at this time. However, because of the district's large tax base, FPL's payments for Units 6 & 7 would likely represent a SMALL and positive impact.

In-migrating workers who purchase existing homes or build new residences in Miami-Dade County would also pay property taxes to the Miami-Dade County tax collector for the Miami-Dade School district, resulting in positive but SMALL impacts to the school district's revenues.

4.4.2.2.2.6 Summary of Tax Impacts

The overall potential beneficial impacts of taxes collected during the construction of Units 6 & 7 would be positive and SMALL in the region of influence and the state of Florida. Property tax impacts in smaller entities in the region of influence, such as Homestead or Florida City, could be SMALL to MODERATE and positive, and would thus require no mitigation.

4.4.2.2.3 Land Use

In the GEIS, the NRC provides the methodology for defining the impact significance of land use during refurbishment (i.e., large construction activities).

In the GEIS, the NRC concluded that land use changes during refurbishment at nuclear plants would be:

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1. Even workers who occupy rented housing or lodging contribute indirectly to the property tax payments by the property owner, although in this case, the tax base would not increase unless assessed valuations rose.

SMALL — If population growth results in very little new residential or commercial development compared with existing conditions and if the limited development results only in minimal changes in the area's basic land use pattern.

MODERATE — If plant-related population growth results in considerable new residential and commercial development and the development results in some changes to an area's basic land use pattern.

LARGE — If population growth results in large-scale new residential or commercial development and the development results in major changes in an area's basic land-use pattern.

Further, the NRC defined the magnitude of population changes as follows:

SMALL — If plant-related population growth is less than 5 percent of the study area's total population, especially if the study area has established patterns of residential and commercial development, a population density of at least 60 people per square mile, and at least one urban area with a population of 100,000 or more within 50 miles.

MODERATE — If plant-related growth is between 5–20 percent of the study area's total population, especially if the study area has established patterns of residential and commercial development, a population density of 30 to 60 people per square mile, and one urban area within 50 miles.

LARGE — If plant-related population growth is greater than 20 percent of the area's total population and density is less than 30 people per square mile.

This methodology was reviewed and it was determined that the significance levels were appropriate to apply to an assessment of land use impacts as a result of new construction. Miami-Dade County is the focus of the land use analysis because the new units would be built in Miami-Dade County and it was assumed that the workforce during construction would reside in the county. Impacts to land use would be confined to Miami-Dade County.

4.4.2.2.3.1 Land Use

All or parts of four Florida counties are within 50 miles of the Turkey Point plant property: Broward, Collier, Miami-Dade, and Monroe. The 50-mile radius encompasses over 3168 square miles. However, impacts to land would be confined to the region of influence, Miami-Dade County. As explained in Subsection 2.2.3, most of the land use and land cover in the 50-mile region consist of wetlands (69.1 percent) and urban or built-up area (17.5 percent) (Figure 2.2-6).

As addressed in Subsection 2.5.2.4, Miami-Dade County and the municipalities of Homestead and Florida City use comprehensive land use planning to guide residential and commercial development. There are 35 incorporated cities in Miami-Dade County. Only two of the 35 incorporated communities are within 10 miles of the plant property, Homestead and Florida City.

From the land use perspective, Miami-Dade County and the Homestead and Florida City area are likely to continue to urbanize as the projected population increases. The population-related increases (5139 people) associated with the construction of Units 6 & 7 would create an increase in commercial and residential activity. If the population influx results in new construction, both the region of influence and the Homestead and Florida City area have some undeveloped land currently zoned for residential and commercial uses (Subsection 2.5.2.4). The present housing inventory in Miami-Dade County and in the Homestead and Florida City area can support the in-migrating workers and their families without the addition of new housing units (Subsection 4.4.2.2.6). Miami-Dade County had 135,004 total vacant housing units in 2005-2009. The Homestead and Florida City area had 4046 vacant units in 2005-2009. Because both the region of influence in general, and the Homestead and Florida City area in particular, have well-established residential and commercial districts, little land use conversion, from undeveloped to residential or commercial use, or residential to commercial, would be expected from the construction-related population increase in the area. Any conversion that did occur would be in the areas that are already well-defined and identified in the applicable comprehensive land use plans.

Using the NRC's GEIS guidance, it is concluded that impacts to land use as a result of Turkey Point-related population increases that would cause land use conversions in Miami-Dade County would be SMALL because the population influx would result in very little new residential or commercial development compared with existing conditions and because there would be minimal changes in the area's basic land use pattern.

4.4.2.2.3.2 Construction-Related Population Growth

The 2000 population of Miami-Dade County was 2,253,362 people, with a population density of 1158 people per square mile (USCB 2008). The 2010 population for the region of influence, Miami-Dade County, was 2,496,435 people (USCB 2012), which is 1316 people per square mile. The 2000 population of the Homestead and Florida City area was 39,752 people (USCB 2012) and the area had a population density of 2196 people per square mile. The population for the area in 2012 is 71,757 people (USCB 2012) or 3402 persons per square mile. As a point of reference, the population per square mile in the USA is 87.4 people per square mile (USCB 2012), approximately 1/15th (6.66 percent) of the density of the region of influence.

Units 6 & 7 construction-related growth in Miami-Dade County would consist of 5086 construction workers and family members along with 54 operation workers and family members, for a total of 5139 in-migrants (Subsection 4.4.2.1), which equates to 0.2 percent of the 2000 population and a similar percentage of the 2005-2009 population (Table 4.4-15). Assuming that about 43 percent of the in-migrating workers and families would settle in the Homestead and Florida City area, the increase in population would represent 3.4 percent of the total 2005-2009 population (Table 4.4-15).

Using the GEIS guidance, land use impacts attributed to construction workforce population growth in Miami-Dade County would be SMALL because the county has established patterns of residential and commercial development, there is a population density of at least 60 people per square mile, and there is at least one urban area with a population of 100,000 people or more within 50 miles. The Homestead and Florida City area meets the NRC criteria for a SMALL land use impact because the population increase is 3.4 percent of the 2005-2009 population. The area also has a population density greater than 60 people per square mile, has established patterns of residential and commercial development, and has at least one urban area with a population of 100,000 people or more within 50 miles.

4.4.2.2.3.3 Conclusion

Overall, impacts to land use in the region of influence, Miami-Dade County in general, and in the Homestead and Florida City area in particular, would be SMALL. There would be very little new residential or commercial development and basic land use patterns would remain in place. Existing comprehensive plans would guide development of new residential construction. Population increases would represent less than 5 percent of the 2005-2009 population base and not meaningfully alter land use densities or use.

Therefore, overall land use impacts would be SMALL. To mitigate these impacts, FPL would maintain communication with local and regional governmental and nongovernmental organizations to disseminate project information in a timely manner. This would allow these organizations to be given the opportunity to plan accordingly.

4.4.2.2.4 Transportation

The Units 6 & 7 construction activities were assessed for impacts on transportation infrastructure and traffic from deliveries of materials and commuting workers. The assessment focuses on roadways; however, some components used in construction, such as the reactor vessel, would arrive by barge. The analysis focuses on the likely commuting routes east of the principal arterial roads. FPL believes that the excess capacity of U.S. Highway 1 and Florida's Turnpike is adequate to accommodate construction traffic (Table 4.4-16b).

A peak workforce during construction of 3983 (3950 construction workers and 33 operation workers) workers would exceed the capacity of the local roads in the vicinity of the construction site. As described in Section 4.4.1.4 construction traffic would be routed to a new construction entrance. This will alleviate traffic congestion at the existing entrance to Turkey Point Units 1 through 5. In addition, a traffic study was conducted to determine road improvements to alleviate traffic congestion between the construction site, and the principal arterial roads west of the site, including U.S. Highway 1 and Florida's Turnpike (Traf Tech 2009). The analysis presented below considers the impacts of traffic during the peak morning and evening commute hours and assumes a maximum workforce of 3983 and a conservative vehicle occupancy of 1.0 persons per vehicle. It was assumed that 70 percent of the construction workforce would be assigned to the day shift and would arrive between 5:00 and 6:00 am and leave between 4:30 and 5:30 pm. The evening shift would comprise 30 percent of the workforce and would arrive between 4:00 and 5:00 pm and leave between 3:00 and 4:00 am. The analysis further assumes that half of the shift would arrive in the first half hour of the peak hour and half would arrive in the second half hour.

These assumptions result in the following trip generations for the construction workforce:

Shift 1 (6:00 am to 4:30 pm)

Percent of total workforce	70
Number of vehicles (3983 X 0.7)	2788
Inbound time	5:00 – 6:00 am
Inbound traffic	2788
Traffic distribution (5:00 - 5:30)/(5:30 - 6:00)	1394/ 1394
Outbound traffic (beginning of Shift 1)	None
Outbound time	4:30 – 5:30 pm
Outbound traffic (end of Shift 1)	2788
Traffic distribution (4:30 - 5:00)/(5:00 - 5:30)	1394/ 1394
Inbound traffic	1195 (See Shift 2)

Shift 2 (5:00 pm to 3:00 am)

Percent of total workforce	30
Number of vehicles (3983 X 0.3)	1195
Inbound time	4:00 – 5:00 pm
Inbound traffic	1195
Traffic distribution (4:00 - 4:30)/(4:30 - 5:00)	597/ 597
Outbound traffic (beginning of Shift 2)	2788 (See Shift 1)
Outbound time	3:00 – 4:00 am
Outbound traffic (end of Shift 2)	1195
Inbound traffic	none

The time of maximum construction traffic would be from 4:30 to 5:00 pm when half of each shift was leaving or entering the site, resulting in a maximum construction commuting workforce of

1991. The analysis looks at the hour of greatest traffic (4:30 to 5:30 pm) when all the Shift 1 workforce and half of the Shift 2 workforce would be commuting to or from the site, or 3385 commuters in one hours.

Trip distributions and traffic assignments for construction traffic were based on the traffic patterns of the existing workforce. Most existing traffic arrives from and departs to the north via SW 137th Avenue/Tallahassee Road. The second most traveled access/egress route is SW 344th Street/ Palm Drive to U.S. Highway 1. Most of the remainder of the existing workforce uses SW 328th Street/North Canal Drive.

The Traf Tech conclusions and recommendations (Traf Tech 2009) were further validated for a peak workforce during construction of 3983 (3950 construction and 33 operations) people. The maximum construction workforce is expected to be on site for 12 months.

4.4.2.2.4.1 Deliveries of Construction Materials to the Turkey Point Site

The traffic study assumed that a maximum of 36 trucks per hour would enter and leave the site for a total of 72 trips per hour. The Traf Tech (2009) analysis looked at the impact of 72 truck trips per hour during the peak traffic hours, identified above. Fifty percent of the trucks were assumed to come from a quarry north of the site and access the construction site using SW 117th Avenue and the plant access road. The other 50 percent were assumed to access the site via U.S. Highway 1 to SW 344th Street/Palm Drive to SW 137th Avenue/Tallahassee Road to the plant access road. The discussion of the impacts of the commuting construction workforce includes these trucks.

For delivery of construction materials at other than peak construction commute times, the available capacity of relevant road was compared with estimated truck traffic. Given the flat terrain in Miami-Dade County, a standard of one large truck equivalent to 1.5 passenger cars was used. SW 344th Street/Palm Drive has available peak hour capacity of 2799 vehicles west of SW 137th Avenue/Tallahassee Road and SW 328th Street/North Canal Drive has available peak hour capacity of 2346 west of SW 137th Avenue/Tallahassee Road. If all the trucks arriving and departing the construction site use SW 344th Street/Palm Drive or North Canal Drive, the available peak hour capacity would decrease by 114 (76 trucks X 1.5 passenger vehicles) on each roadway. The remaining available vehicle capacity on SW 344th Street/Palm Drive would be 2685, and on SW 328th Street/North Canal Drive it would be 2232.

The impact from deliveries of fill and construction materials to the Turkey Point site would be SMALL and would not warrant mitigation.

4.4.2.2.4.2 Workers Commuting to the Turkey Point Site

As shown in Table 4.4-16b, the principal arterial roads have adequate surplus capacity to support construction traffic. Therefore the traffic study focused on the streets east of these arterial roads and the intersections that will be most impacted by construction traffic. The analysis considered existing intersection counts and seasonal adjustments (Traf Tech 2009).

The analysis concluded that, in general, the roadways between the plant and the principal arterial roads have adequate capacity to support construction-generated trips, based on a link analysis of the roadways which are part of the Miami-Dade Concurrency Management System (Table 4.4-16c).

The analysis concluded that the six most affected intersections (all within 5 miles of Turkey Point) would need improvements to maintain the Miami-Dade level of service (LOS) standard of D.

LOS is a quality measure describing operating conditions within a traffic stream. LOS classes are assigned from “A” which represents the best operating conditions, to “F”, the worst. Miami-Dade County uses LOS D as their standard for planning and operational analyses. If the LOS is D, Miami-Dade considers options to improve the LOS.

For these analyses, roadway improvements were identified in order to provide acceptable LOS at the six study intersections. Table 4.4-16d provides the LOS at the six intersections with the identified roadway improvements.

In addition to the intersection improvements described in Table 4.4-16d, the following improvements to roadway segments would be required to maintain acceptable operating conditions (FDOT's Generalized Capacity Tables use a link capacity of 1100 vehicles per hour per lane):

- Widen North Canal Drive from two to four lanes between SW 137th Avenue/Tallahassee Road and SW 117th Avenue
- Widen SW 344th Street/Palm Drive from two to four lanes between SW 137th Avenue/ Tallahassee Road (W) and SW 137th Avenue/Tallahassee Road (E)
- Widen SW 117th Avenue from two to four lanes between SW 328th Street/North Canal Drive and SW 344th Street/Palm Drive
- Improve SW 359th Street by constructing two eastbound lanes and one west bound lane between SW 137th Avenue/Tallahassee Road and SW 117th Avenue

- Improve SW 359th Street by constructing four lanes between SW 117th Avenue and the construction entrance
- Improve SW 137th Avenue/Tallahassee Road by constructing two southbound lanes and one north bound lane between SW 344th Street/Palm Drive and SW 359th Street
- Improve SW 117th Avenue by constructing four lanes between SW 344th Street/Palm Drive and SW 359th Street.

Based on the traffic engineering study, the roadway improvements discussed above would result in MODERATE impacts during peak construction traffic. The impacts would be temporary and may warrant mitigation.

4.4.2.2.4.3 Refueling Outage

Refueling outages for the existing units would occur during construction. Of these outages, the outage in month 45 would occur when the most construction and operation staff are onsite. The estimated temporary refueling workforce would be 600. In addition to these temporary staff, the workforce for Units 1 through 5 at that time is estimated to be 1476. The operation workforce at Units 6 & 7 is estimated to be 33. The total workforce accessing Turkey Point during the outage would be 6059. At the time of the outage, access to the site would be available from SW 344th Street/Palm Drive and SW 359th Street. Therefore, impacts associated with this outage would be the maximum workforce impacts during Units 6 & 7 construction and would last approximately 30 days. Mitigation could include staggering the outage shifts to ensure they did not coincide with construction shifts, encouraging outage workers to carpool, or providing van service to remote parking facilities for outage.

4.4.2.2.4.4 Roads in Miami-Dade County (Region of Influence)

As stated in Subsection 2.5.2.2., Miami-Dade County has a well-developed road and transportation infrastructure. The adult population increase of 1992 workers during construction to the region of influence and accompanying licensed drivers (1992) could add 3984 drivers in the region of influence (Table 4.4-1). Miami-Dade County roads support a driving age population in excess of 1.8 million people and the additional traffic generated by 3984 additional drivers represents an increase of approximately 0.2 percent of the adult population and would be dispersed throughout the county. The impact to the region of influence's traffic would be SMALL and not warrant mitigation.

4.4.2.2.4.5 Region of Influence Public Transportation

Miami-Dade County operates public transportation services including rail, express bus, and buses that have multiple stops (Subsection 2.5.2.2.2) and a daily ridership of 300,000 (MDC

2008). The population increase of 5139 into Miami-Dade County (Subsection 4.4.2.1) as a result of the in-migrating construction workers and their families could increase public transportation use in the county, but even if all the workers and their families used public transportation, the increase would be only 1.7 percent (5139/300,000). Impacts to public transportation would be SMALL and would not warrant mitigation.

4.4.2.2.4.6 Evacuation Routes

The severe weather evacuation routes for the Florida City and Homestead area are shown in Figure 2.5-8a. The in-migrating households could add 3984 vehicles to an evacuation of Miami-Dade County if each household evacuated in two vehicles. Approximately 43 percent of the in-migrating construction workforce would live in the Homestead/ Florida City area, for a total of 1704 maximum additional vehicles evacuating from this area. (Table 4.4-1)

4.4.2.2.4.7 Summary

The traffic study assumed maximum numbers of vehicles and represents an upper bounding analysis. In order to minimize impacts, FPL could employ several mitigation measures. Carpooling could be encouraged through multiple programs. Offsite park-and-ride lots have been identified, including the Homestead Speedway. Construction shifts, operations shifts for Units 1 through 5 and outage shifts for Units 3 & 4 could be staggered. During events at the Homestead Speedway that draw large crowds for several days, FPL may consider adjusting the construction schedule to ensure that the construction workforce is not commuting when the most traffic will be arriving or departing the Speedway.

4.4.2.2.5 Aesthetics and Recreation

This subsection describes the aesthetics and use impacts on recreation opportunities of the construction activities for Units 6 & 7 and its associated facilities in the 6-mile vicinity and 50-mile region. Subsection 2.5.2.5.2 presents basic information on recreation in the vicinity and 50-mile region. Section 3.9 describes the construction activities that could cause aesthetic impacts and environmental protection procedures to address the impacts. Subsection 4.4.1.3 analyzes the aesthetic impacts of the construction of Units 6 & 7 and associated facilities.

As stated in Subsection 4.1.1.2, the major land uses within 6 miles are undeveloped and protected wetland and forestland. The topography of the region and the Turkey Point plant property is relatively flat. Construction facilities would include parking areas, laydown and fabrication areas, offices, warehouses, workshops, a concrete batch plant, and cranes. The cranes used during construction could reach a height of approximately 460 feet.

4.4.2.2.5.1 Aesthetic Impacts to Recreation

Aesthetic impacts can be visual, auditory, and/or tactile (vibratory, etc.). With respect to aesthetic impacts to recreation, these impacts can be experienced by humans directly (e.g., visually) and/or indirectly by affecting the flora and fauna used by humans in the pursuit of recreation (e.g., frightening animals from viewing stations).

Changes to the viewscape that would result from construction of the new power block structures, elevation gradient changes, and land cover changes, could be seen from 10 miles because the area is relatively flat. However, trees and vegetation to the west and north screen the view.

People boating on Biscayne Bay are accustomed to seeing the structures of Units 1 through 5. The construction cranes and additional structures associated with Units 6 & 7 would not appreciably alter the plant's appearance as viewed from Biscayne Bay. People using Biscayne Bay could hear the onsite construction activities. Individuals in recreational facilities that are not adjacent to the Turkey Point plant property would be unable to distinguish the noise from construction of Units 6 & 7 from urban and traffic noise.

The private and public recreational facilities and opportunities within 6 miles are Biscayne National Park, Homestead Bayfront Park, Mangrove Preserve, and Homestead Miami Speedway. Therefore, these are the recreational opportunities that are analyzed for aesthetic impacts to recreation.

Property boundaries of Biscayne National Park and Homestead Bayfront Park are within 1 mile of the Turkey Point plant property along the western shore of Biscayne Bay. Recreational users would be able to see the cranes and taller structures on the Units 6 & 7 plant area; however, recreational users are accustomed to seeing Units 1 through 5. Recreational users may hear the onsite construction activities, but they would not experience tactile impacts. Although recreational users would be able to see and hear temporary construction activities, aesthetic impacts to this resource would be SMALL and would not warrant mitigation.

Only a small portion of the Mangrove Preserve is within 6 miles of the Turkey Point plant property. There are three types of mangroves: red, black, and white with tree heights ranging from 20–50 feet (Law and Arny Undated). The privately owned Mangrove Preserve is not open to the public. Recreational users of the preserve would not be able to see the construction activities at the Units 6 & 7 plant area through the mangroves. With only a portion of the preserve approximately 6 miles from the power blocks, recreational users would experience no auditory or tactile impacts. Therefore, aesthetic impacts to this resource would be SMALL and would not warrant mitigation.

As stated in Subsection 2.5.2.5.2, Homestead Miami Speedway is a privately owned auto-racing track approximately 5 miles northwest of the Units 6 & 7 plant area. Subsection 4.4.2.2.4 addresses the potential transportation impacts for Homestead Miami Speedway from Units 6 & 7 traffic, which could affect recreational users of the speedway. Spectators may be able to see the construction cranes; however, they are accustomed to seeing Units 1 through 5. Speedway patrons would not be able to discern the auditory impacts from construction of Units 6 & 7 from the operations of Units 1 through 5 and from the racing vehicles. There would be no induced tactile impacts. Therefore, aesthetic impacts to this resource would be SMALL and would not warrant mitigation.

In summary, aesthetic impacts to recreation would be SMALL and would not warrant mitigation.

4.4.2.2.5.2 Use Impacts to Recreation

While aesthetic impacts to recreation are driven by the recreation user's proximity to the site, use impacts to recreation are driven by how close the recreational facilities and events are to the user's residence. Construction workers and their families would be expected to use recreational facilities near their residences, rather than near their place of work (i.e., the Turkey Point plant site). Some recreational opportunities would be sought out because of their uniqueness, a particular national park for example, independently of recreation area's proximity to the workers' residences.

The influx of 5139 people (Table 4.4-1) during construction could affect the use of recreational areas and participation in recreational events in the 50-mile region. Use impacts to recreation would be the result of the plant-related population growth in the region of influence, and therefore, increased use of recreational facilities and events. Residential distribution of the in-migrating workers in Miami-Dade County is the most important determinant of recreational facility use.

The in-migrating construction workforce and their families would result in a 0.2 percent increase over the 2005-2009 Miami-Dade County's population (Table 4.4-15). Use of recreational facilities and areas would be expected to increase by a similar percentage. For the purpose of this analysis, the recreational facilities are broadly classified into three groups: (1) wildlife management areas, national wildlife refuges, and preserves, (2) state parks, and (3) privately owned recreational facilities expected to be impacted by construction-related population increases. Tables 2.5-29 and 2.5-30 present information about these facilities and events and, where available, information about the current use rates and capacities of those facilities and events.

The wildlife management areas, national wildlife refuges, and preserves could be impacted by the construction-related population increase. There are eight wildlife management areas, national wildlife refuges, and preserves that are open to the public (Table 2.5-29) in the 50-mile region. Generally, agencies managing these properties do not tabulate the number of annual visitors or determine capacity information. All 5139 residents of the project-induced population in the region could use the areas, refuges, and preserves. Because the wildlife management areas, national wildlife refuges, and preserves are so large and have open and wooded lands appropriate for multiple uses (snorkeling/scuba diving, nature walks, picnics, camping, fishing), they can accommodate a large number of people. Impacts to wildlife management areas, national wildlife refuges, and preserves from the in-migrating construction workforce would be SMALL and would not warrant mitigation.

The state park system could be impacted by the construction-related population increase. The 11 state parks in the region (Table 2.5-30) had a total annual visitor count of 2,739,696 from July 2007 to June 2008, and a total daily capacity of 29,147 visitors, or approximately 10,638,655, annually. Thus, the 11 state parks within 50 miles could accommodate an additional 21,641 daily visitors. The construction-related population increase of 5139 people represents approximately 24 percent of the available capacity if the construction-related population were to visit on any single day. Because the state park system has open and wooded lands appropriate for multiple uses (snorkeling/scuba diving, nature walks, picnics, camping, fishing), the state park system can accommodate additional use more readily than local park systems, which often specialize in dedicated use opportunities (tennis courts, swimming pools, baseball fields). Impacts to state parks from the in-migrating construction workforce would be SMALL and would not warrant mitigation.

Homestead Miami Speedway may be impacted by construction of the new units. The commuter traffic and construction vehicles could interrupt traffic flow during the speedway's racing events. Subsection 4.4.2.2.4 addresses traffic impacts. The Homestead Miami Speedway seats 65,000 people. It is unlikely that the in-migrating population increase would meaningfully impact this resource's capacity. Impacts to this recreational facility use would be SMALL, beneficial, and would not warrant mitigation.

As noted in Subsection 2.5.2.5, there are over 400 community, neighborhood, and municipal parks in the 50-mile region. Approximately 22 of these are in the Homestead and Florida City area. Increased use of community, municipal, and neighborhood parks would likely reflect the same rate of project-induced population increase.

In summary, during construction, some employees and their families would use the regional recreational facilities in the region; however, the increase attributable to construction would be small compared to overall use of these facilities. Impacts of facility construction on recreation use would be SMALL and would not warrant mitigation.

4.4.2.2.6 Housing

Impacts on housing from the Units 6 & 7 construction workforce and the operation workers employed during construction would depend on the number of workers that would relocate from outside the region of influence and the type of housing workers would desire. Therefore, it was conservatively assumed that 1992 workers would migrate into the region of influence for construction and require housing (Table 4.4-1).

Approximately 1399 of these workers would bring families and 592 workers would relocate to the region of influence without families (Table 4.4-1). All 1992 in-migrating workers would need housing. Some of the workers would require permanent housing, generally owner-occupied, and others would elect to rent housing. Still others would elect to reside in transitional housing such as residential hotels, motels, rooms in private homes, or to bring their own housing in the form of campers and mobile homes. To present a more realistic analysis, the impacts to housing during construction for the region of influence were analyzed, as well as the Homestead and Florida City area.

Subsection 2.5.2.6 presents data about the existing housing conditions in the region of influence and the Homestead and Florida City area. The sources for data presented in this section are from Subsection 2.5.2.6, except where cited.

4.4.2.2.6.1 Miami-Dade County (Region of Influence)

In 2010, there were 383,478 rental occupied units and about 37,848 additional vacant units for rent (USCB 2010a). Rental units include housing such as single-family units, multifamily units, apartments, or mobile homes that, if occupied are not owner-occupied, and if vacant are “for rent.” Mobile homes, a popular temporary housing option among construction workforces, represent 1.6 percent (or 15,085 units) of the housing in Miami-Dade County (Table 2.5-31). Some temporary workers may transport recreational vehicles (RVs) to facilities near the jobsite. There are nine recreational vehicle (RV) parks in Miami-Dade County, with a capacity of 1587 spaces with full hookup (Table 2.5-34). The RV parks could accommodate up to 80 percent of the in-migrating workforce. There are 47,642 hotel/motel rooms per night throughout Miami-Dade County, which could accommodate the in-migrating workers and their families.

As described in Subsection 2.5.2.6, Miami-Dade County had 135,004 total vacant housing units in 2005-2009. In Miami-Dade County, an additional 110,657 housing units were added to the total inventory between 2000 and 2005-2009, increasing the 2000 housing inventory by 13 percent. Because of the temporary nature of construction, workers often choose not to live in permanent housing. However, permanent housing could accommodate the entire in-migrating peak construction workforce.

If the 1992 workers elected to make the county their home, readily available housing could accommodate them. Miami-Dade County could accommodate the entire construction workforce based on the vacancy of housing units. The entire in-migrating workforce could be accommodated in vacant permanent housing units, in vacant rental units, or in hotel or motels. In addition, the existing RV parks could accommodate up to 80 percent of the in-migrating workforce. If workers elect to build new housing, comprehensive plans are in place to guide development (Subsection 2.5.2.4).

Rental rates for housing units, new and existing housing prices, and short-term and long-term hotel/motel leasing rates, are unlikely to rise as a result of increased demand because of the abundance of available units. In 2000, the median gross monthly rent for a renter-occupied unit in Miami-Dade County was $647, but the estimated median gross monthly rent was $965 in 2005-2009, an increase of 49 percent during that period (Table 2.5-31). Given the potential Units 6 & 7-related increase in demand for housing, purchase prices of existing and newly constructed housing and rental rates could rise with the influx of workers during construction. However, with the uncertainty of the current housing market in Miami-Dade County and the large housing inventory, the housing and rental rates at the time of construction of Units 6 & 7 cannot be predicted. The county government would benefit from any increased real property values.

The current housing inventory is sufficient to accommodate 100 percent of the in-migrating workforce. Impacts to housing in the region of influence would be SMALL.

4.4.2.2.6.2 The Homestead and Florida City Area

As stated in Subsection 4.4.2, approximately 43 percent of the site's current workforce resides in the Homestead and Florida City area. It is assumed that approximately 852 workers could settle in the Homestead and Florida City area.

As described in Subsection 2.5.2.6, the Homestead and Florida City area had 4046 total vacant housing units in 2005-2009 (Table 2.5-32). Because of the temporary nature of construction, workers often choose not to live in permanent housing. In 2010, there were 13,519 renter-occupied units and an additional 2146 vacant units "for rent" (USCB 2010b). Rental units include housing such as single-family units, multi-family units, apartments, or mobile homes that, if occupied are not owner-occupied, and if vacant are "for rent" or "for sale." Vacant permanent housing and vacant rental units could accommodate the entire in-migrating workforce in the Homestead and Florida City area. If workers elect to build new housing, comprehensive plans are in place to guide development (Subsection 2.5.2.4).

Mobile homes, a popular temporary housing option among construction workforces, represent 2.5 percent (or 611 units) of the housing in Homestead and Florida City area (Table 2.5-32). Some temporary workers may transport RVs to facilities near the jobsite, less than 10 miles from the Homestead and Florida City area. There are six RV parks in the Homestead and Florida City area, with a total capacity of 1080 spaces with full hookup (Table 2.5-34). The RV parks could accommodate the in-migrating workforce expected to settle in the Homestead and Florida City area (Table 2.5-35). There are 1928 hotel/motel rooms per night in the South Dade area of Miami-Dade, the area that includes Homestead and Florida City.

If more than 852 workers elected to make the Homestead and Florida City area their home, readily available housing could accommodate them. Vacant units for rent or for sale could be used. Seasonal or occasional use units could be converted to a more traditional use. Additional housing units could be built, additional mobile homes could be set up, and additional hotel/motel rooms and RV spaces could be made available (Subsections 2.5.2.4.4 and 2.5.2.4.5). The in-migrating workforce expected to settle in the Homestead and Florida City area could be accommodated in vacant permanent housing units and in vacant rental units, in hotel/motels, or in the existing RV parks. In addition, the in-migrating workforce expected to settle in the Homestead and Florida City area workforce could bring mobile homes.

Impacts to the housing in the Homestead and Florida City area would be SMALL and not warrant mitigation.

4.4.2.2.6.3 Conclusion

The region of influence has ample existing housing to accommodate the entire in-migrating construction workforce. The existing inventory includes a wide range of housing choice by type, location, and price. The Homestead and Florida City area has the capacity to provide enough housing to accommodate the in-migrating workers expected to settle in the area.

County and local governments in the region of influence, including Homestead and Florida City, would benefit from the increased taxable value of existing housing and from any new residential construction. It is concluded that the region of influence and the Homestead and Florida City area would benefit from positive tax impacts. Therefore, the impact to the Miami-Dade County and the Homestead and Florida City area's housing market would be SMALL and mitigation would not be warranted.

4.4.2.2.7 Public Services

4.4.2.2.7.1 Water Supply Facilities

The South Florida Water Management District (SFWMD) is a regional governmental agency that oversees the water resources in the southern half of Florida, covering 16 counties from Orlando to the Florida Keys and serving a population of 7.5 million residents. It is the largest of Florida's five water management districts and is responsible for water supply planning for each region within its jurisdiction. SFWMD's mission is to manage and protect water resources of the region by balancing and improving water quality, flood control, natural systems and water supply.

The SFWMD serves local governments by supporting efforts to safeguard existing natural resources and meet future water demands through one of the four water supply planning areas. The four water supply planning areas are the Upper East Coast, the Lower East Coast, the Lower West Coast, and the Kissimmee Basin. The planning areas are generally defined by the drainage divides of major surface water systems in South Florida. The Lower East Coast (LEC) Planning Area of the SFWMD encompasses approximately 6100 square miles that includes all of Miami-Dade, Broward and Palm Beach Counties, most of Monroe County, and the eastern portions of Hendry and Collier Counties. The SFWMD, through the LEC planning area, provides regional oversight to these specific counties for water demand projections, assessment of existing and projected resource conditions, and formulation of strategies to meet urban, agricultural and environmental water needs. (SFWMD 2005)

Miami-Dade County is one of ten counties in the LEC planning area. Miami-Dade County's water is provided by five suppliers: the Miami-Dade Water and Sewer Department, the city of North Miami, the city of North Miami Beach, the city of Homestead and the city of Florida City. The Miami-Dade Water and Sewer Department (MDWASD) provides drinking water to approximately two million customers in Miami-Dade County and currently draws drinking water from the Biscayne Aquifer. The MDWASD is composed of three water treatment facilities: the Hialeah-Preston Water and Sewer Department (WASD), serving the northern part of Miami-Dade County, the Alexander Orr, Jr. WASD, serving the central and portions of the southern part of Miami-Dade County and the South Dade WASD, serving the southern part of Miami-Dade County. The MDWASD has plans for the construction and operation of the South Miami Heights (SMH) Water Treatment Plant in the South Dade area, which is scheduled to come online in 2012. The MDWASD has a 20 year water use permit issued by the SFWMD which limits its annual allocation to 149,106 million gallons and its monthly maximum allocation to 13,047 million gallons. These allocations are further limited by a wellfield operational plan, described in Limiting Condition 27 of the water use permit. (MDWASD 2008)

The city of North Miami supplies water within its municipal boundary as well as outside of its municipal boundary to certain northern parts of unincorporated Miami-Dade County. The city of North Miami Beach supplies water within its municipal boundary as well as outside its municipal boundaries to certain northern parts of unincorporated Miami-Dade County. The city of Homestead provides water within its municipal boundary and for a portion of unincorporated Miami-Dade County, including the Redavo development, from 6 city-owned withdrawal wells. The city of Homestead also has an agreement with the MDWASD to provide some water service within portions of Homestead municipal boundary. Florida City also provides water to portions of unincorporated Miami-Dade County as a water supplier. Florida City provides water service within its incorporated boundaries from 4 production wells (MDWASD 2008).

The impacts on local public water resources from both construction demand and population increases during the construction phase were considered. Construction-related impacts are primarily based on the population increase caused by the number of workers and their families migrating into the region of influence. The workers would include construction employees and operation workers. This in-migrating population is estimated to be 5139 people (Table 4.4-1).

Miami-Dade County (Region of Influence)

As explained in Section 3.3, water from Miami-Dade county would provide the necessary water for potable onsite uses during construction. The estimated maximum use during the peak construction period, including personal use (potable), concrete batch plant operation, concrete curing, cleanup activities, dust suppression, placement of engineered backfill, and piping hydrotests and flushing operations is 565 gpm, or 0.8 million gallons per day (mgd) (Section 4.2). The MDWASD system has an operating capacity of 470.35 mgd (Table 4.4-17). The estimated construction water demand represents 0.17 percent of the rated capacity of the MDWASD system. However, not all of the water uses would occur simultaneously. The increased use would not stress the public water supplies or infrastructures. Impacts to the MDWASD system would be SMALL and would not warrant mitigation.

As indicated in Table 4.4-1**,** construction of Units 6 & 7 could bring as many as 5139 workers and family members to the region of influence. As addressed in Subsection 2.5.2.7.1.1, municipal water suppliers in the county have excess capacity. The impact to the local water supply systems from construction-related population growth can be estimated by calculating the amount of water that would be required by the total population increase. People in the United States use an average of approximately 100 gpd (U.S. EPA 2008). The 100 gpd estimate includes all water uses. It provides a conservative estimate of potential water demand from the population increase because a portion of the worker's daily water usage is accounted for in the peak construction demand for the Turkey Point Units 6 & 7 project. The increase of 5139 people could increase consumption by 0.5139 mgd. The increased use would not stress public water supplies or infrastructure.

Collectively, public water suppliers in Miami-Dade County are operating at 74.74 percent capacity (Table 4.4-17). If 5139 construction-related individuals relocated to Miami-Dade County, the population served by these water systems would increase above the 2007 population by 0.2 percent. The additional demand of approximately 0.5139 mgd would increase the Miami-Dade County operating capacity use to 74.84 percent. When the construction-related population increase (0.5139 mgd) is combined with the peak construction water use estimate (0.8 mgd), the total public water usage in Miami-Dade County would be increased by 0.25 percent. Impacts to the public water supply systems in Miami-Dade County, based on the construction-related population increase and the peak construction water demands, would be SMALL and would not warrant mitigation.

Homestead and Florida City Area

The impact to the Homestead and Florida City area, which are likely candidates for the workers to relocate, can be estimated by adding the estimated distribution of likely construction-related population to the area. The increased population would represent approximately 43 percent of the in-migration workforce, or 2199 people, into the Homestead and Florida City area. This population increase would, in turn, increase demand collectively of the public water capacity for Homestead and Florida City systems, respectively, from 70.79 percent capacity usage to 75.73 percent capacity usage (Table 4.4-17).

Therefore, the increased demand from the estimated increase in population as a result of the construction-related workforce would not exceed the available capacity of the municipal water supplies in the entire region of influence. Also, the 43 percent population distribution in the Homestead and Florida City area would not exceed the available capacity of the combined water supplies of the Homestead and Florida City area. Therefore, the impacts to the region of influence and to the Homestead and Florida City area would be SMALL and would not require additional mitigation.

To mitigate impacts, FPL would communicate with local and regional governmental planning organizations such as the Miami-Dade County Department of Planning and Zoning, the MDWASD, and the South Florida Water Management District. FPL could share information such as project activity scheduling and projected workforce in-migration, thus giving these organizations time to prepare for demands on services because of the increased population as a result of Units 6 & 7 construction.

4.4.2.2.7.2 Wastewater Treatment Facilities

Units 1 through 5 use an existing onsite wastewater treatment facility to meet current operational needs.

Sanitary/wastewater treatment during the initial phases of Units 6 & 7 construction would be provided via potable facilities and/or a separate, packaged wastewater treatment facility. Portable toilet facilities would be used until the wastewater treatment facility could be completed. Therefore, onsite construction-related activities for Units 6 & 7 would have no impact on public wastewater services.

Subsection 2.5.2.7.1.2 describes the public wastewater treatment systems in the region of influence, their plant-designed average flows, and monthly average wastewater processed. Wastewater treatment facilities in the region of influence have at least 15 percent available capacity with the exception of the city of Homestead (Table 4.4-18).

Impacts to local wastewater treatment systems would occur as the population increases as a result of the in-migration of the construction-related workers and their families. The magnitude of the impact can be conservatively estimated by assuming that 100 percent of the water used by this population would go to a wastewater treatment facility. As previously described, the construction-related population increase could require 0.5139 mgd of potable water and, by extension, 0.5139 mgd additional wastewater treatment capacity. As described in the following paragraphs, the in-migration of the maximum construction-related workforce and their families would increase the current wastewater treatment system use for the region of influence from approximately 79.85 percent to 79.98 percent.

Miami-Dade County (Region of Influence)

Subsection 2.5.2.7.1.2 describes the public wastewater treatment systems in the region of influence, their plant-designed average flows, and monthly average wastewater processed. Yearly average wastewater processed in the region of influence is 298.62 mgd, with a systems capacity of 374.00 mgd. If an additional 0.5139 mgd were processed in the region of influence, the average daily flow of wastewater to be processed would increase by 0.14 percent. Impacts to wastewater treatment capacity in the region of influence would be SMALL and would not require mitigation.

Homestead and Florida City Area

The Homestead wastewater treatment facilities (WWTFs) are currently operating at approximately 102.20 percent (Table 4.4-18) capacity; however, the city of Homestead WWTF uses the SDWWTP system as backup and excess flows are diverted to the county wastewater treatment facilities. These excess flows are included in the SDWWTP flow reports. The wastewater generated in Florida City falls under the jurisdiction of the SDWWTP. The SDWWTP was operating at 78.54 percent of its capacity in 2009 (Table 4.4-18). If the estimated distribution of construction-related workers (2199 people) settled in the area of Homestead and Florida City, the overall capacity could accommodate 2199 people. This could be accomplished by using both the Homestead WWTF and the SDWWTP because of the remaining capacity of both facilities. Therefore, impacts on wastewater treatment facilities as a result of construction-induced population increases for Homestead and SDWWTP would be SMALL and would not require mitigation.

To mitigate any potential impacts, FPL would initiate early communication with local and regional governmental organizations, including planning commissions and local and regional economic development agencies, such as the Miami-Dade Planning and Zoning Department, to disseminate construction-related information in a timely manner. Local governments and planning groups would have time to plan for the influx. Infrastructure upgrades and expansions could be funded, at least in part, by construction-related property and sales and use tax payments.

4.4.2.2.7.3 Law Enforcement, Fire, and Medical Services

Law Enforcement

With respect to onsite law enforcement, FPL would employ its own security force. Security services and emergency response are addressed in the Emergency Plan.

Miami-Dade County

Residents-to-law enforcement officer ratios for the region of influence are presented in Table 4.4-19. Currently, the region of influence ratio of residents-to-law enforcement officer is 825 to 1.

With respect to the influx of workers and their families during peak construction periods, 5139 people would move into the region of influence (Table 4.4-1), and this population increase would increase the current residents-to-law enforcement officer ratio in the region of influence by 0.21 percent (Table 4.4-19), creating a SMALL impact.

Assuming the region of influence is already near or at its capacity to provide law enforcement protection, maintenance of the current preconstruction ratio would be desirable. Therefore, to accommodate the additional population caused by the construction of Units 6 & 7, six additional law enforcement officers (and associated equipment) would be needed in the region of influence during the peak construction period to maintain the current ratio.

Homestead and Florida City Area

Residents-to-law enforcement officer ratios for the Homestead and Florida City area are presented in Table 4.4-19. Currently, the Homestead and Florida City area ratio of residents-to-law enforcement officer is 480 to 1 (Table 4.4-19). With respect to the influx of workers and their families during the peak construction period, 2199 people would increase the current residents-to-law enforcement officer ratio by 3.4 percent, creating a SMALL impact. The community would need five additional officers to maintain current ratios during construction.

This conclusion and its mitigation are based in part on the GEIS. The NRC selected seven case study plants whose characteristics resembled the spectrum of nuclear plants in the United States today, and reported that public safety services were not disrupted as a result of the construction of new plants. The taxes directed to the local communities as a result of the plant construction enabled the growth of the public safety services in these areas by purchasing new buildings and equipment, and acquiring additional staff.

Moreover, impacts created by the influx of workers and their families could be mitigated by the increased property and sales/use tax revenues that would be generated by the construction project. However, expanding law enforcement services, including the hiring of additional personnel, would likely begin before a sufficient amount of these tax revenues would be available to local governments. Therefore, local governments could access other funding sources or issue bonds until the tax revenues would become available. Additionally, FPL would communicate regularly with local and regional governmental officials regarding Units 6 & 7 and its schedules, allowing local and regional officials ample opportunity to plan for the population influx.

Upon construction completion, the additional law enforcement personnel and equipment needed to support the personnel could be considered in excess. However, some, if not all, of the personnel and equipment could be used to continue to support the Units 6 & 7 operation workforce-related population growth and future non-Units 6 & 7-related population growth in the region of influence. The additional personnel and equipment could also be used to supplement the general provision of law enforcement services in the region of influence. These services could continue to be funded by the plant's property taxes and the sales and use tax revenues generated by Units 6 & 7 and workforce expenditures in the region of influence.

During the peak construction period, to maintain pre-Units 6 & 7 construction ratios, six additional law enforcement officers would be required in the region of influence to maintain preconstruction ratios and five additional officers would be required in the Homestead and Florida City area (Table 4.4-19). The operation workforce would reach its peak in month 77 of construction, well after the construction peak. During the operation period (when the number of workers on the site would drop to 806) fewer officers would be needed than during construction (Figure 3.10-2). Officers could be retained to supplement the general provision of law enforcement services in the region of influence, thereby reducing the ratios. Units 6 & 7-related tax payments, including both property taxes and sales and use taxes made by the Units 6 & 7 and its employees, could continue to assist in funding these services.

Fire Protection Services

Fire protection services and emergency response are addressed in the Emergency Plan.

Miami-Dade County

Residents-to-active firefighter ratios for the region of influence are presented in Table 4.4-20. Currently, the resident-to-active firefighter ratio in the region of influence is 702 to 1. If the number of active firefighters in the region of influence remained at current levels, the additional population of 5139 would increase the residents-to-active-firefighter ratios in the region of influence to 703 to 1, a 0.21 percent increase, creating a SMALL impact. To maintain preconstruction ratios, seven additional active firefighters (and associated equipment) would be needed in the region of influence during peak construction period.

Homestead and Florida City Area

As noted in Subsection 2.5.2.7.2, Miami-Dade County Fire and Rescue provides fire protection services for the Homestead and Florida City area. The residents-to-active firefighter ratio in the Miami-Dade County Fire and Rescue service area is not available for strictly the Homestead and Florida City area. However, if the Homestead and Florida City area experience a population increase of 2199 people, or 3.4 percent of the 2005-2009 population, the ratio of residents-to-active firefighters in the Miami-Dade County Fire and Rescue service area would increase by less than 3.4 percent (because the service area would have a larger population base), creating a SMALL impact.

This impact could be mitigated by the use of the increased property and sales/use tax revenues that would be generated by the construction activities. However, expanding fire suppression services, including the hiring of additional personnel, would likely begin before a sufficient amount of these tax revenues would be available to local governments. Therefore, local governments could access other funding sources or issue bonds until the tax revenues would become available. Also, the peak construction workforce would not be in place until month 42 of construction activities, giving local governments time to plan and budget accordingly. Additionally, FPL would communicate regularly with local and regional governmental officials about the Units 6 & 7 construction activities and schedule, allowing local and regional officials ample opportunity to plan for the population influx.

As with the analysis of the adequacy of law enforcement, this conclusion and its mitigations are also based in part on the GEIS.

Upon construction completion, the additional fire protection personnel and equipment needed to support the population increase during peak construction period could be considered in excess. However, some, if not all, of the personnel and equipment could be used to continue to support the operation workforce-related population growth and future non-Units 6 & 7-related population growth in the region of influence. The additional personnel and equipment could also be used to improve the general provision of fire suppression services in the region of influence. These services would continue to be funded by the plant's property taxes and the sales and use tax revenues generated by Units 6 & 7 and workforce expenditures in the region of influence.

During peak construction period, to maintain pre-Units 6 & 7 construction ratios, seven additional active firefighters would be required in the region of influence. The operation workforce would reach its peak in month 77 of construction, well after the peak construction period (Figure 4.4-1). During the operation period, fewer active firefighters and associated equipment would be required than during construction in the region of influence. Firefighters could be retained to supplement the general provision of fire protection services in the region of influence, thereby reducing the ratios from their pre-Units 6 & 7 construction levels. Units 6 & 7-related tax payments, including both property taxes and sales and use taxes made by Units 6 & 7 and its employees, could continue to assist in funding these services.

Medical Services

Information concerning medical services in the region of influence is provided in Subsection 2.5.2.7.3.

Medical services and emergency response are addressed in the Emergency Plan. Minor injuries to construction workers would be assessed and treated by onsite medical personnel. Other injuries would be treated at hospitals in the region of influence, depending on the severity of the injury. Agreements would be in place with some local medical providers to support emergencies.

The opportunities for medical care in Miami-Dade County are provided in Table 2.5-41. According to information in Table 2.5-41, in 2006, there were 8420 staffed hospital beds in the region of influence. As identified in Table 2.5-3, the 2005-2009 population of the region of influence was 2,457,044. Adding 5139 residents to the region of influence population would increase the population by 0.2 percent (Subsection 4.4.2.1). The 0.2-percent increase in the annual admissions; the average daily census, and the annual outpatient visits would not be noticeable or burden existing medical service capacity. Therefore, the impacts of construction on medical services would be SMALL and mitigation would not be warranted.

4.4.2.2.8 Education

It is estimated that approximately 1119 school-aged children would be part of the in-migration during the construction period. Because the Miami-Dade County Public School District covers the entire region of influence, it was assumed that the school-aged children would reside in Miami-Dade County. This subsection addresses the public and private school system and postsecondary institutions in the region of influence. The source for the data presented is Subsection 2.5.2.8, except where cited.

4.4.2.2.8.1 Miami-Dade County School District

It is assumed that each in-migrating worker with a family, during the construction period, would have 0.8 school-age children. Therefore, the in-migrating construction workforce with families (1399 workers) would bring approximately 1119 school-aged children (Table 4.4-1). This analysis conservatively assumes that school-aged children would attend public schools.

As described in Subsection 2.5.2.8, the district enrolled 347,133 students in 2010–2011. The new and expanded public primary and secondary facilities will provide capacity for an additional 13,746 students by 2015–2016 (Table 2.5-42). The additional 1119 students would represent an increase of 0.3 percent of the 2010–2011 enrollment in the Miami-Dade County Public School District and 8 percent of the additional capacity expected to be available by 2012–2013. Because the additional capacity is greater than the estimated number of in-migrating students and the county public school enrollment has steadily decreased recently, the education system in the county could accommodate students that would accompany the construction workers.

Impacts to public education in the region of influence, Miami-Dade County Public School District, would be SMALL and would not warrant mitigation.

4.4.2.2.8.2 Homestead and Florida City Area

As stated in Subsection 2.5.2.8, the Homestead and Florida City area is part of the District IX region. The number of school-aged children likely to locate in the Miami-Dade County Public School system, District IX region, but outside of the immediate Homestead and Florida City area was not determined. Therefore, the percentage impact to the District IX region could not be specifically determined, but the impact would be approximately 1 percent even if half of the 1119 children in-migrating to Miami-Dade County were to locate in the District IX region. Hence, the impacts to public schools would be SMALL. The construction-related student population in the Homestead and Florida City area could increase by 479 students (Table 4.4-1) and be spread out over the 76 area schools. These students would represent an increase of 0.86 percent of the 55,860 District IX region students enrolled in 2010. Therefore, when spread over pre-K-12 grades, it is unlikely that the school-aged children of the in-migrating construction workforce would affect class size, teacher ratios, or facility capacity in the area schools.

Impacts to public education schools in the Homestead and Florida City area, which are a part of the Miami-Dade County Public School District system, would be SMALL and would not warrant mitigation.

4.4.2.2.8.3 Private Schools – Pre-Kindergarten through 12

Miami-Dade County

The assumption was made that the same percentage of in-migrating school-aged children could attend private school as those who currently attended private school (15 percent). Of the 1119 in-migrating children, 168 may attend private school. As described in Subsection 2.5.2.8.2, there was a total enrollment of 61,161 students in Miami-Dade county private schools. The 168 new students represent less than 0.3 percent of the private school enrollment. Impacts to private education in the region of influence would be SMALL and not warrant mitigation.

Homestead and Florida City

The assumption was made that the same percentage of in-migrating school-aged children could attend private schools in the Homestead and Florida City area as school-age children attending private schools in Miami-Dade County (15 percent). Therefore, of the 479 in-migrating school-aged children expected to reside in the Homestead and Florida City area, 72 may attend private schools. As noted in Subsection 2.5.2.8.2, there was a total of 2263 students in private schools in Homestead and Florida City. The 72 new students represent about 3.2 percent of the enrollment. Impacts to private education in the Homestead and Florida City area would be SMALL and not warrant mitigation.

4.4.2.2.8.4 Conclusion

The Florida Education Finance Program and equalized funding legislation would ensure that the Miami-Dade County Public School District would receive additional funding to support the educational services provided for the new students. However, the legislation also means that the project-related increases in property tax may not go directly to the Miami-Dade County Public School District (Subsections 2.5.2.3 and 4.4.2.2.2). FPL would provide the local communities with timely information regarding the construction activities, giving the school district time to make accommodations for the additional influx of students. It is concluded that impacts to the Miami-Dade County Public School System and to the schools in the Homestead and Florida City area would be SMALL and would not warrant mitigation.

4.4.2.2.8.5 Postsecondary Institutions

Subsection 2.5.2.8.3 addresses postsecondary institutions, colleges and universities, and technical colleges in the region of influence and 50-mile radius. The peak workforce during construction would not be reached until approximately month 42 of construction activities. FPL would provide the local education institutions, including postsecondary institutions, with timely information regarding the construction activities, giving the institutions several years to make accommodations for the influx of construction workers or worker family members that may seek postsecondary education or training. The institutions could also modify curriculum offerings and/or contract with FPL to provide onsite and offsite academic courses and job-specific training.

4.4.3 ENVIRONMENTAL JUSTICE

Environmental justice refers to a federal policy under which federal agencies identify and address, as appropriate, disproportionately high and adverse human health, environmental, or low-income populations. The NRC has a policy on the treatment of environmental justice matters in licensing actions (69 FR 52040).

The USCB 2005-2009 data at the block group level was used to identify concentrations of minority (racial and ethnic) and of low-income populations. Subsection 2.5.4 defines minority and low-income populations, and Figures 2.5-24 through 2.5-31 identify minority and low-income populations within 50 miles. There are 1627 census block groups that are at least partially within 50 miles, 1222 of which are wholly in the region of influence (Miami-Dade County). It is assumed that 100 percent of the in-migrating construction workforce would settle in Miami-Dade County; therefore, the health and environmental impacts and socioeconomic impacts evaluated in this environmental justice analysis are focused on Miami-Dade County. Of the 1222 block groups in Miami-Dade County, 319 have significant Black race populations, 335 have significant racial aggregate populations, and 783 have significant Hispanic ethnic populations. The plant property is in a block group meeting the Other race, the aggregate of races, and the Hispanic ethnicity criteria. Two hundred twelve (212) block groups contain a significant percentage of low-income households in Miami-Dade County. The closest low-income block group is approximately 4.7 miles north of the plant property.

For the environmental justice analysis, two types of impacts were evaluated: health and environmental impacts and socioeconomic impacts. The following paragraphs summarize the magnitude of each type of impact to the general population and address whether minority and low-income populations would experience disproportionately high and adverse impacts. The evaluation identified the most likely pathways by which adverse environmental impacts associated with construction could affect human populations, determined the level of significance of the impact, and assessed whether characteristics of the minority or low-income populations would result in disproportionately high and adverse impacts to those populations. Several socioeconomic resources were also evaluated to determine if construction-related activities could disproportionately, in a high and adverse manner, impact minority or low-income populations. If the impacts to the general population were found to be SMALL, and there were no resource dependencies, preexisting health conditions, or location-dependent reasons that would affect the level of significance of the impact to minority or low-income populations, it was concluded there would be no disproportionately high and adverse impact on low-income or minority populations.

4.4.3.1 Health and Environmental Impacts

Impacts from construction of a nuclear power plant would be similar to impacts from other large construction projects. There are three primary pathways for health and environmental impacts: soil, water, and air.

Construction activities would involve moving large quantities of soil for construction of Units 6 & 7, modification to the equipment barge unloading area, transmission lines, and pipelines. The majority of these impacts would be on the Turkey Point plant property. Water-related health and environmental impacts include sedimentation and, less likely, spills of petroleum products. However, any land-disturbing activities that could adversely affect water quality would be of relatively short duration, would be permitted and overseen by state and federal regulators, and would be guided by an approved stormwater pollution prevention plan. Modifications to the equipment barge unloading area would be performed under permits issued by the USACE. Further, surface flow from the construction areas on the Turkey Point plant property would be to the industrial wastewater facility. Any spills would be mitigated according to a construction phase spill prevention, control, and countermeasures plan. Impacts to surface water quality would be SMALL (Subsection 4.2.3.1). In the unlikely event that small amounts of contaminants escape into the environment, they would have only a small, localized, temporary impact on the aquifer. Any impacts to groundwater quality would be SMALL (Subsection 4.4.3.2).

Construction activities could cause temporary and localized physical impacts such as noise, odors, vehicle exhaust, and fugitive dust emissions. In general, noise during construction activities would not significantly affect offsite areas. Construction of new transmission systems and expansion of substations would take place in agricultural, wetland, undeveloped, or very urban areas. Construction would be short-term, accelerated, and occur only during daytime. Good road conditions and appropriate speed limits would minimize the noise level generated by the workforce commuting to the site. Thus, the noise impacts as a result of construction and the commuting workforce would be SMALL and would not warrant mitigation (Subsection 4.4.1.1).

Temporary and minor impacts to local ambient air quality could occur as a result of normal construction activities. Specific mitigation measures to control fugitive dust would be identified in a dust control plan, or similar document, prepared before the start of construction. Because of the size and population of the surrounding areas, the small emissions from the small increase in local traffic would not noticeably affect the air quality in the area. Air quality impacts from construction and traffic would be SMALL and would not require mitigation (Subsection 4.4.1.2).

Health and environmental impacts to the general population from construction, via the three pathways, would be SMALL. Any soil disturbance, noise, vehicle exhausts, and fugitive dust emissions would not extend offsite. Impacts to groundwater and surface water quality would be SMALL. Any radiological doses to the public would meet public dose criteria. Therefore, it is concluded that there would be no disproportionately high and adverse impacts to minority or low-income populations within 50 miles of the site via soil, water, or air pathways that would affect the health and environment of populations studied in this environmental justice analysis.

4.4.3.2 Socioeconomic Impacts

This analysis estimates the Units 6 & 7 in-migrating construction-related worker households to be 1992. This represents 1.6 percent of the available housing in Miami-Dade County for the in-migrating, direct workforce if existing vacant housing, including seasonal or occasional use housing, were available for the in-migrating workers (Subsection 4.4.2.2.6). The current housing inventory within the region of influence is sufficient to accommodate 100 percent of the in-migrating workforce. Impacts to housing in the region of influence would be SMALL and mitigation would not be warranted. The Homestead and Florida City area is a likely area for some of the workers to live based on the proximity to the site and the current residential distribution of Turkey Point employees. This area's housing market would likely be affected the most. If, as expected, approximately 43 percent of the construction workforce moved into the Homestead and Florida City area, the area could accommodate the workers during peak construction if the vacant housing met workers' requirements for type, size, price, condition, or other characteristics. Therefore, impacts to the housing in the Homestead and Florida City area would be SMALL because the area has enough housing to accommodate the in-migrating workers. New and existing housing prices, rental rates for housing units, and short-term and long-term hotel/motel leasing rates, are unlikely to rise as a result of increased demand because of the abundance of available units. County and local governments would benefit from the increased taxable value of existing housing and any new residential construction. Because the existing housing market in the region of influence could accommodate the expected in-migration, there would be no disproportionately high and adverse impacts to minority or low-income populations (Subsection 4.4.2.2.6).

As presented in Subsection 4.4.2.2.8, it is estimated that 1119 school-aged children would accompany the in-migrating construction workforce. This would represent a 0.3 increase over the 347,133 students that were enrolled in the Miami-Dade County Public School District during the 2010–2011 school year. New and expanded public primary and secondary facilities will provide capacity for an additional 13,746 students by 2015–2016 (Table 2.5-42). The estimated number of in-migrating school-aged children would represent 8 percent of this additional capacity. The number of school-aged children likely to locate in the Miami-Dade County public school system, District IX region, but outside of the immediate Homestead and Florida City area was not determined. Therefore, the percentage impact to the District IX region could not be specifically determined, but the impact would be approximately 1 percent even if half of the 1119 children in-migrating to Miami-Dade County were to locate in the District IX region. Hence, the impacts to public schools would be SMALL. Because the excess capacity is greater than the estimated number of in-migrating students, the education system in the county could accommodate students that would accompany the workers during construction. Therefore, there would be no disproportionately high and adverse impacts to minority or low-income populations.

As stated in Subsection 4.4.2.2.3, minimal land use conversion is anticipated as a result of the construction of Units 6 & 7. From a land use perspective, Miami-Dade County is likely to continue to urbanize. Commercial and residential development in Miami-Dade County is increasing with the demand of the growing population. The construction of Units 6 & 7 would create an additional increase in residential and commercial activity. However, because the county has a 2010 population of approximately 2.5 million and the Homestead and Florida City area is also experiencing growth, this would not create a discernible change in housing availability, change rental rates and housing values, or spur housing construction and/or conversion. Thus, minimal land use conversion is anticipated as a result of construction of Units 6 & 7. Offsite land use changes would be considered SMALL in Miami-Dade County and in the Homestead and Florida City area. Therefore, there would not be disproportionately high and adverse impacts to minority and low-income populations.

Initially, the current workforce and Units 6 & 7 construction workforce would use a number of different routes (SW 137th Avenue/Tallahassee Road, SW 117th Avenue, SW 328th Street/North Canal Drive, or SW 344th Street/Palm Drive) and, from these roads, access the existing entrance to the site. FPL proposes to route construction traffic to a new construction entrance. To do this, SW 117th Avenue and SW 137th Avenue/Tallahassee Road would be extended south of SW 344th Street/Palm Drive. SW 359th Street (which runs east-west, south of SW 344th Street/Palm Drive) would be extended east from its current termination to a new construction entrance. Because the roads are in racial and ethnic minority areas, these populations would be impacted by increased traffic and construction activities. In particular, Black races, Other races, and Hispanic ethnic block groups are along and between SW 117th Avenue and SW 137th Avenue, where the road improvements would be made. As described in Subsection 4.4.2.2, impacts would be SMALL during peak construction. LARGE impacts could occur on the current access roads for a few months before completion of the new access roads. Mitigation measures would be implemented, such as staggering arrival and departure times, to minimize the impacts to transportation.

The construction of Units 6 & 7 could reduce unemployment, create new business opportunities for housing and service-related industries, and increase the personal income of the population in the region of influence. The impacts of construction on the economy of the region of influence would be positive and SMALL (Subsection 4.4.2.2.1). Minority and low-income populations would benefit from these positive impacts just as the general population would. There would be no disproportionately high and adverse impacts to minority or low-income populations; impacts would be positive and SMALL.

The potential impacts from construction on public services in the region of influence (Subsection 4.4.2.2.7) were also assessed. Collectively, Miami-Dade's municipal water supplies are operating at 74.74 percent capacity. The estimated increase in population as a result of in-migrating construction workforce and their families would not exceed the available capacity of the municipal water supplies in the region of influence. When the construction-related population increase (0.5139 mgd) is combined with the peak construction water use estimate at the site (0.8136 mgd), the total public water usage in the Miami-Dade County would be increased by 0.25 percent. Impacts to Miami-Dade County based on the construction-related population increase and the peak construction water demands at the site would be SMALL and would not warrant mitigation. The increased population to the Homestead and Florida City area, which is a likely candidate for the construction workers to relocate, is 2199 people. This demand could increase the public water usage in Homestead and Florida City systems collectively from 70.79 percent capacity usage to 75.73 percent capacity usage. Therefore, the estimated increase in population as a result of the construction-related workforce would not exceed the available capacity of the municipal water supplies in the entire region of influence or in the Homestead and Florida City area (Subsection 4.4.2.2.7.1). Therefore, the impacts to both areas would be SMALL and there would not be disproportionately high and adverse impacts to minority or low-income populations.

Sanitary/wastewater treatment during construction of Units 6 & 7 would initially be provided via potable facilities and/or a separate, packaged wastewater treatment facility. Therefore, there would be no impact on public wastewater facilities during construction. Portable toilet facilities would be used until the site's wastewater treatment facility could be completed. Therefore, onsite construction-related activities for Units 6 & 7 would have no impact on public wastewater services.

Population increase as a result of in-migration of the construction-related workers and their families would impact local wastewater treatment systems. The magnitude of the impact to local wastewater treatment systems is conservatively estimated by assuming 100 percent of the water used by the in-migrating construction population would go to a wastewater treatment facility. The construction-related population increase could require 0.5139 mgd of drinking water, and by extension, 0.5139 mgd of additional wastewater treatment capacity. The additional 0.5139 mgd would increase the wastewater processed by 0.14 percent in the region of influence. Impacts to wastewater treatment capacity in the region of influence would be SMALL and would not require mitigation. As stated in Subsection 2.5.2.7, the Homestead WWTF is currently operating at approximately 102.20 percent of capacity; however, the city of Homestead WWTF uses the SDWWTP system as backup and excess flows are diverted to the county wastewater treatment facilities. These excess flows are included in the SDWWTP flow reports. The wastewater generated in Florida City falls under the jurisdiction of the SDWWTP. The SDWWTP is currently running at 78.54 percent of its capacity. If the expected distribution of construction-related workers (approximately 43 percent or 2199 people) settled in the area of Homestead and Florida City, the overall capacity could accommodate the increased population by using both the Homestead WWTF and the SDWWTP as a result of the remaining capacity of both facilities. There is enough excess capacity to accommodate the estimated in-migrating construction-related workforce population. Impacts on wastewater treatment facilities as a result of Units 6 & 7-induced population increases for the city of Homestead and the SDWWTP would be SMALL and would not require mitigation. Therefore, the estimated increase in population as a result of the construction-related workforce would not exceed the available capacity of the wastewater systems in the entire region of influence or in the Homestead and Florida City area (Subsection 4.4.2.2.7.2). The impacts to both areas would be SMALL. Therefore, there would be no disproportionately high and adverse impacts to minority or low-income populations.

With respect to onsite law enforcement, FPL would employ its own security force. The estimated increase in population as a result of in-migrating construction workforce and their families is 5139. The current resident-to-law enforcement officer ratio for the region of influence is 825 to 1. This population increase would increase the resident-to-law enforcement officer ratio in the region of influence by 0.21 percent, creating a SMALL impact. Currently, the Homestead and Florida City area ratio of residents-to-law enforcement officer is 480 to 1. With respect to the influx of workers and their families into Florida City and Homestead during peak construction period, 2199 people would increase the resident-to-law enforcement officer ratio by 3.4 percent, creating a SMALL impact. To accommodate the additional population caused by Units 6 & 7 construction, six additional active law enforcement officers would be needed in the region of influence during peak construction period; five of which would be required in the Homestead and Florida City area. The impacts to the region of influence and the Homestead and Florida City area would be SMALL (Subsection 4.4.2.2.7.3). There would be no disproportionately high and adverse impacts to minority or low-income populations.

The estimated increase in population as a result of the in-migrating construction workforce and their families is 5139, which would increase the residents-to-active firefighter ratios in the region of influence by 0.21 percent, creating a SMALL impact in the region of influence. The current residents-to-active firefighter ratio in the region of influence is 702 to 1. To maintain pre-construction ratios, seven additional active firefighters would be needed in the region of influence during peak construction period. This impact could be mitigated by the use of the increased property and sales/use tax revenues that would be generated by the construction. As noted in Subsection 2.5.2.7.2, Miami-Dade County Fire and Rescue provides fire protection services for the Homestead and Florida City area. The residents-to-active firefighter ratio in the Miami-Dade County Fire and Rescue service area is not available for strictly the Homestead and Florida City area. However, if the Homestead and Florida City area experience a population increase of 2199 people, or 3.4 percent of the 2005–2009 population, the ratio of residents-to-active firefighters in the Miami-Dade County Fire and Rescue service area would increase by less than 3.4 percent (because the service area would have a larger population base), creating a SMALL impact. The impacts to the region of influence and the Homestead and Florida City area would be SMALL. There would be no disproportionately high and adverse impacts to minority or low-income populations.

Adding 5139 residents to the region of influence population would increase the population by 0.2 percent. The 0.2 percent increase in the annual admissions, average daily census, and the annual outpatient visits to area hospitals would not be noticeable or burden existing medical service capacity. Therefore, the potential impacts of construction on medical services would be SMALL and mitigation would not be warranted. Because the existing medical services in Miami-Dade County could accommodate the expected in-migration, there would be no disproportionately high and adverse impacts to minority populations.

Local government officials, staff of social welfare agencies, and the Miccosukee Indian Tribe were contacted concerning unusual resource dependencies or practices or health conditions that could result in potentially disproportionate impacts to minority and low-income populations. Contacts with multiple government entities in Miami-Dade County were attempted.

Many agencies had no information concerning activities and health issues of minority populations. Interviews were conducted with the Community Action Agency, Miami-Dade Office of Community Advocacy, Miami-Dade County Community and Economic Development, Countywide Healthcare Planning, Metro Miami Action Plan Trust, and the Miami-Dade Black Advisory Board. No agency reported dependencies or practices, such as subsistence agriculture, hunting, or fishing, or preexisting health conditions through which the populations could be disproportionately or adversely affected by the proposed project. Several agencies alluded to the extreme urban nature of the study area and implied that there was no possibility of any subsistence activity on the part of any group.

Contact with the Miccosukee Indian Tribe reported that the Indians residing in the reservation within the 50-mile radius do not depend on hunting, fishing, or gardening for subsistence. The Miccosukee Tribe does lease land from the SFWMD for hunting, fishing, frogging, agriculture, and to carry on the traditional Miccosukee way of life. However, most tribal members rely on modern means to meet their food needs.

In summary, there were no construction-related impacts identified that would have disproportionately high and adverse effects on the human health, environment, or socioeconomics of minority or low-income populations. Therefore, it is concluded that impacts from construction-related activities to minority or low-income populations would reflect impacts to the general population and would be SMALL.

Section 4.4 References

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Table 4.4-1 (Sheet 1 of 2)
Assumptions for Workforce Characterization During Peak Construction Period, Units 6 & 7

	Construction	Operation	Total
Workforce Characterization			
Peak number of workers onsite during construction (month 45) (See Table 3.10-2)	3,950	33	3,983
Workforce Migration			
Percent of workforce migrating into Miami-Dade County	50%	50%	—
Total number of workers migrating into Miami-Dade County during construction peak	1,975	17	1,992
Percent of in-migrating workforce that migrates into Homestead and Florida City area (See Subsection 2.5.1)	42.78%	42.78%	—
Total number of workers migrating into Homestead and Florida City area during construction peak	845	7	852
Families			
Percent of workers who bring families[(a)]	70%	100%	—
Percent of workers who do not bring families	30%	0%	—
Average worker family size (worker, spouse, children)[(a)(b)]	3.25	3.25	—
Number of workers who would move into Miami-Dade County and bring families	1,383	17	1,399
Number of workers who would move into Miami-Dade County and not bring families	592	0	592
Number of workers who would move into the Homestead and Florida City area and bring families	591	7	598
Number of workers who would move into the Homestead and Florida City area and not bring families	254	0	254
Total In-Migration — Families and Unaccompanied Workers			
Total number of workers who would bring families into Miami-Dade County (= total families in Miami-Dade County)	1,383	17	1,399
In-migrating workers family members (Miami-Dade County)	3,111	37	3,148
Total in-migrating workers accompanied by family, plus family members	4,493	54	4,547
Total number of workers who would not bring families into Miami-Dade County	592	0	592
Total number of workers and family members migrating into Miami-Dade County (= new population in Miami-Dade County)	5,086	54	5,139
Total number of workers who would bring families that would migrate into the Homestead and Florida City area (= total families in the Homestead and Florida City area)	591	7	598
In-migrating workers' family members (Homestead and Florida City area)	1,331	16	1,347
Total workers accompanied by family, plus family members, that would migrate into the Homestead and Florida City area	1,922	23	1,945
Total In-Migration — Families and Unaccompanied Workers (cont.)			
Number of workers who would migrate into the Homestead and Florida City area and not bring families	253	0	253
Total number of workers and family members that would migrate into the Homestead and Florida City area (= new population in Homestead and Florida City area)	2,176	23	2,199

Table 4.4-1 (Sheet 2 of 2)
Assumptions for Workforce Characterization During Peak Construction Period, Units 6 & 7

	Construction	Operation	Total
School-age children			
Number of school-age children per family[(a)]	0.8	0.8	—
Number of school-age children in Miami-Dade County (0.8 per family)	1106	13	1119
Number of school-age children in Homestead and Florida City area (0.8 per family that would migrate to the Homestead and Florida City area)	473	6	479
Post-construction workforce retention			
Percent of in-migrating workforces that would leave Miami-Dade County, post-construction[(a)]	50%	—	—
Number of in-migrating workforces that would leave Miami-Dade County, post-construction	988	—	988
Number of in-migrating workforces and their families plus in-migrating workers without families that would leave Miami-Dade County, post-construction	2543	—	2543
Number of school-age children of in-migrating workers that would migrate to Miami-Dade County	1106	13	1119
Number of school-age children of in-migrating workers that would leave Miami-Dade County, post-construction	553	—	553
Percent of in-migrating workforces that would leave the Homestead and Florida City area, post-construction[(a)]	50%	—	—
Number of in-migrating workers that would leave the Homestead and Florida City area, post-construction	422	—	422
Number of in-migrating workers and their families plus in-migrating workers without families that would leave Homestead and Florida City area, post-construction	1088	—	1088
Number of school-age children of in-migrating workers that would migrate to the Homestead and Florida City area	473	6	479
Number of school-age children of in-migrating workers that would leave Homestead and Florida City area, post-construction	237	—	237

Note: Sums may not equal totals because of rounding

(a) Source: BMI Apr 1981.
(b) According to the USCB Table DP-1, Profile of the General Population and Housing Characteristics: 2010 (USCB 2010b), the average family in Miami-Dade County in 2010 was 3.33. The average family size in Florida was 3.01. Therefore, FPL assumes that an average family size of 3.25 for the construction workforce, as presented in the Battelle Memorial Institute Study (BMI April 1981), would also be a reasonable estimate for the operations workforce.

Table 4.4-2
Direct and Indirect Employment, Miami-Dade County, Construction Period

Employment	Units 6 & 7
Construction workforce peak (Table 4.4-1)	3,950
Operations workforce onsite during construction (Table 4.4-1)	33
Number of construction workers who migrate into Miami-Dade County (Table 4.4-1)	1,975
Number of operations workers who migrate into Miami-Dade County (Table 4.4-1)	17
Employment multiplier for construction workers (indirect portion only)[(a)]	0.9535
Employment multiplier for operations workers (indirect portion only)[(a)]	2.1696
Indirect jobs resulting from in-migrating construction workers	1,883
Indirect jobs resulting from in-migrating operations workers	36
Total number of indirect jobs (from both in-migrating workforces)	1,919
Number of persons unemployed in Miami-Dade County, 2011[(b)] (Table 2.5-7)	156,562

(a) Source: BEA 2009.
(b) Source: BLS 2012a.
Note: Sums may not equal totals because of rounding.

Table 4.4-3
Industry Sector Direct and Indirect Employment, Miami-Dade County, Construction Period

Miami-Dade County Total Private Employment, 2010[(a)] (Table 2.5-11)	—	—	803,654
Miami-Dade County Employment, Sector 23 — Construction, 2010[(a)] (Table 2.5-11)	—	—	31,395
Miami-Dade County Employment, Sector 237 — Heavy and Civil Engineering Construction, 2010[(a)] (Table 2.5-11)	—	—	5,401
	Construction Workers	**Operation Workers**	**Total**
Workforce during peak construction period[(b)] (Table 4.4-1)	3,950	33	3,983
Number of workers assumed to migrate into Miami-Dade County (50%) (Table 4.4-1)	1,975	17	1,992
In-migrating workers as a percentage of Miami-Dade County 2010 total private employment	0.25%	0.00%	0.25%
In-migrating workers as a percentage of Miami-Dade County 2010 employment, Sector 23	6.3%	0.1%	6.3%
In-migrating workers as a percentage of Miami-Dade County 2010 employment, Sector 237	36.6%	0.3%	36.9%
Indirect workers during construction period (already residents of Miami-Dade County) (Table 4.4-1)	—	—	1,919
Indirect workers as a percentage of Miami-Dade County total private employment in 2010	—	—	0.2%

(a) Source: BLS 2012b.
(b) Source: Section 3.10.
Note: Sums may not equal totals because of rounding.

Table 4.4-4 (Sheet 1 of 2)
In-migrating Construction Worker Wages, by Construction Month, Miami-Dade County, Construction Period

Construction Month	Number of Construction Workers In-migrating (a),(b)	Earnings of In-Migrating Construction Workforce(c)	Construction Month	Number of Construction Workers In-migrating (a),(b)	Earnings of In-Migrating Construction Workforce (c)	Construction Month	Number of Construction Workers In-migrating (a),(b)	Earnings of In-Migrating Construction Workforce (c)	Construction Month	Number of Construction Workers In-migrating (a),(b)	Earnings of In-Migrating Construction Workforce (c)
-39	20	$97,770	-3	713	$3,483,056	34	1,975	$9,654,788	70	1,300	$6,355,050
-38	23	$109,991	-2	725	$3,544,163	35	1,975	$9,654,788	71	1,250	$6,110,625
-37	28	$134,434	-1	738	$3,605,269	36	1,975	$9,654,788	72	1,200	$5,866,200
-36	30	$146,655	1	750	$3,666,375	37	1,975	$9,654,788	73	1,150	$5,621,775
-35	35	$171,098	2	763	$3,727,481	38	1,975	$9,654,788	74	1,100	$5,377,350
-34	38	$183,319	3	775	$3,788,588	39	1,975	$9,654,788	75	1,050	$5,132,925
-33	45	$219,983	4	800	$3,910,800	40	1,975	$9,654,788	76	950	$4,644,075
-32	50	$244,425	5	813	$3,971,906	41	1,975	$9,654,788	77	850	$4,155,225
-31	55	$268,868	6	825	$4,033,013	42	1,975	$9,654,788	78	750	$3,666,375
-30	65	$317,753	7	838	$4,094,119	43	1,963	$9,593,681	79	650	$3,177,525
-29	75	$366,638	8	850	$4,155,225	44	1,950	$9,532,575	80	550	$2,688,675
-28	90	$439,965	9	863	$4,216,331	45	1,935	$9,459,248	81	400	$1,955,400
-27	115	$562,178	10	875	$4,277,438	46	1,925	$9,410,363	82	275	$1,344,338
-26	140	$684,390	11	888	$4,338,544	47	1,913	$9,349,256	83	225	$1,099,913
-25	160	$782,160	12	900	$4,399,650	48	1,900	$9,288,150	84	187.5	$916,594
-24	195	$953,258	13	913	$4,460,756	49	1,888	$9,227,044	—	—	—
-23	233	$1,136,576	14	925	$4,521,863	50	1,875	$9,165,938	—	—	—
-22	270	$1,319,895	15	950	$4,644,075	51	1,863	$9,104,831	—	—	—
-21	288	$1,405,444	16	975	$4,766,288	52	1,850	$9,043,725	—	—	—
-20	325	$1,588,763	17	1,000	$4,888,500	53	1,838	$8,982,619	—	—	—
-19	370	$1,808,745	18	1,050	$5,132,925	54	1,825	$8,921,513	—	—	—
-18	413	$2,016,506	19	1,125	$5,499,563	55	1,813	$8,860,406	—	—	—
-17	450	$2,199,825	20	1,175	$5,743,988	56	1,800	$8,799,300	—	—	—
-16	500	$2,444,250	21	1,225	$5,988,413	57	1,788	$8,738,194	—	—	—
-15	510	$2,493,135	22	1,300	$6,355,050	58	1,775	$8,677,088	—	—	—
-14	545	$2,664,233	23	1,375	$6,721,688	59	1,763	$8,615,981	—	—	—
-13	590	$2,884,215	24	1,450	$7,088,325	60	1,750	$8,554,875	—	—	—
-12	600	$2,933,100	25	1,525	$7,454,963	61	1,725	$8,432,663	—	—	—
-11	610	$2,981,985	26	1,600	$7,821,600	62	1,700	$8,310,450	—	—	—
-10	620	$3,030,870	27	1,675	$8,188,238	63	1,650	$8,066,025	—	—	—
-9	650	$3,177,525	28	1,750	$8,554,875	64	1,600	$7,821,600	—	—	—
-8	660	$3,226,410	29	1,825	$8,921,513	65	1,550	$7,577,175	—	—	—
-7	670	$3,275,295	30	1,925	$9,410,363	66	1,500	$7,332,750	—	—	—
-6	675	$3,299,738	31	1,975	$9,654,788	67	1,450	$7,088,325	—	—	—
-5	688	$3,360,844	32	1,975	$9,654,788	68	1,400	$6,843,900	—	—	—

Table 4.4-4 (Sheet 2 of 2)
In-migrating Construction Worker Wages, by Construction Month, Miami-Dade County, Construction Period

Construction Month	Number of Construction Workers In-migrating (a),(b)	Earnings of In-Migrating Construction Workforce(c)	Construction Month	Number of Construction Workers In-migrating (a),(b)	Earnings of In-Migrating Construction Workforce (c)	Construction Month	Number of Construction Workers In-migrating (a),(b)	Earnings of In-Migrating Construction Workforce (c)	Construction Month	Number of Construction Workers In-migrating (a),(b)	Earnings of In-Migrating Construction Workforce (c)
-4	700	$3,421,950	33	1,975	$9,654,788	69	1,350	$6,599,475	—	—	—
Grand Total, In-migrating Worker Wages											$637,093,763
Earnings Multiplier, Construction Industry(d)											1.8022

(a) Source: Table 3.10-2.
(b) The number shown represents 50 percent of the total construction workforce because that is the percentage assumed to be migrating into Miami-Dade County (Table 4.4-1)
(c) Source: BLS 2012c. This column equals the number of in-migrating workers times the average monthly wage of $4,889 (average annual wage of $58,662 divided by 12, Table 2.5-12).
(d) Source: BEA 2009.

Table 4.4-5
In-migrating Construction Worker Wages, Miami-Dade County, Construction Period

Construction Workforce Total Wages over 123-month Construction Period (Table 4.4-4)	$637,093,763
Earnings Multiplier for Construction Industry Sector[(a)] (Table 4.4-4)	1.8022
Total Economic Impact to Miami-Dade County (Earning multiplier applied)	$1,148,170,379
Total Personal Income in Miami-Dade County, 2009[(b)]	$90,915,774,000

(a) Source: BEA 2009.
(b) Source: BEA 2011.

Table 4.4-6
In-migrating Construction Worker Wages by Year, Miami-Dade County, Construction Period

Year	Construction Months	Total Annual Wages[(a)]	Dollar Impact to County (earnings multiplier applied)[(b)]	Percentage of Miami-Dade County Personal Income, 2009[(c)]
Year 1	–39 to –28	$2,700,896	$4,867,555	0.01%
Year 2	–27 to –16	$16,901,989	$30,460,764	0.03%
Year 3	-15 to -4	$36,749,299	$66,229,586	0.07%
Year 4	-3 to 9	$46,196,325	$83,255,017	0.09%
Year 5	10 to 21	$58,662,000	$105,720,656	0.12%
Year 6	22 to 33	$99,480,975	$179,284,613	0.20%
Year 7	34 to 45	$115,478,591	$208,115,517	0.23%
Year 8	46 to 57	$108,891,338	$196,243,968	0.22%
Year 9	58 to 69	$93,920,306	$169,263,176	0.19%
Year 10	70 to 81	$54,751,200	$98,672,613	0.11%
Year 11	82 to 84	$3,360,844	$6,056,913	0.01%
TOTAL	—	$637,093,763	$1,148,170,379	1.26%

(a) Source: Table 4.4-4.
(b) Source: BEA 2009. Construction earnings multiplier is 1.8022.
(c) Source: BEA 2011 (Table 4.4-5).

Table 4.4-7 (Sheet 1 of 2)
In-Migrating Operations Worker Wages by Month, Miami-Dade County, Construction Period

Construction Month	Number of Operations Workers In-migrating (a),(b)	Earnings of In-migrating Operations Workforce(c)	Construction Month	Number of Operations Workers In-migrating (a),(b)	Earnings of In-migrating Operations Workforce(c)	Construction Month	Number of Operations Workers In-migrating (a),(b)	Earnings of In-migrating Operations Workforce (c)	Construction Month	Number of Operations Workers In-migrating (a),(b)	Earnings of In-migrating Operations Workforce (c)
-39	0	0	-3	0	0	34	0	$0	70	350	$2,387,668
-38	0	0	-2	0	0	35	0	$0	71	358	$2,445,737
-37	0	0	-1	0	0	36	0	$0	72	366	$2,500,390
-36	0	0	1	0	0	37	0	$0	73	374	$2,555,043
-35	0	0	2	0	0	38	0	$0	74	383	$2,613,113
-34	0	0	3	0	0	39	0	$0	75	391	$2,667,766
-33	0	0	4	0	0	40	0	$0	76	399	$2,725,835
-32	0	0	5	0	0	41	8	$54,653	77	403	$2,753,162
-31	0	0	6	0	0	42	17	$112,723	78	403	$2,753,162
-30	0	0	7	0	0	43	25	$167,376	79	403	$2,753,162
-29	0	0	8	0	0	44	33	$225,445	80	403	$2,753,162
-28	0	0	9	0	0	45	41	$280,098	81	403	$2,753,162
-27	0	0	10	0	0	46	50	$338,168	82	403	$2,753,162
-26	0	0	11	0	0	47	58	$392,821	83	403	$2,753,162
-25	0	0	12	0	0	48	66	$450,890	84	403	$2,753,162
-24	0	0	13	0	0	49	74	$505,543	—	—	—
-23	0	0	14	0	0	50	82	$560,197	—	—	—
-22	0	0	15	0	0	51	91	$618,266	—	—	—
-21	0	0	16	0	0	52	99	$672,919	—	—	—
-20	0	0	17	0	0	53	115	$785,642	—	—	—
-19	0	0	18	0	0	54	132	$898,364	—	—	—
-18	0	0	19	0	0	55	148	$1,011,087	—	—	—
-17	0	0	20	0	0	56	165	$1,123,809	—	—	—
-16	0	0	21	0	0	57	181	$1,236,532	—	—	—
-15	0	0	22	0	0	58	198	$1,349,254	—	—	—
-14	0	0	23	0	0	59	214	$1,461,977	—	—	—
-13	0	0	24	0	0	60	231	$1,574,699	—	—	—

Table 4.4-7 (Sheet 2 of 2)
In-Migrating Operations Worker Wages by Month, Miami-Dade County, Construction Period

Construction Month	Number of Operations Workers In-migrating (a),(b)	Earnings of In-migrating Operations Workforce(c)	Construction Month	Number of Operations Workers In-migrating (a),(b)	Earnings of In-migrating Operations Workforce(c)	Construction Month	Number of Operations Workers In-migrating (a),(b)	Earnings of In-migrating Operations Workforce (c)	Construction Month	Number of Operations Workers In-migrating (a),(b)	Earnings of In-migrating Operations Workforce (c)
-12	0	0	25	0	0	61	247	$1,684,006	—	—	—
-11	0	0	26	0	0	62	263	$1,796,728	—	—	—
-10	0	0	27	0	0	63	280	$1,909,451	—	—	—
-9	0	0	28	0	0	64	296	$2,022,173	—	—	—
-8	0	0	29	0	0	65	309	$2,107,569	—	—	—
-7	0	0	30	0	0	66	317	$2,162,223	—	—	—
-6	0	0	31	0	0	67	325	$2,220,292	—	—	—
-5	0	0	32	0	0	68	333	$2,274,945	—	—	—
-4	0	0	33	0	0	69	342	$2,333,014	—	—	—
										Grand Total	**$72,251,707**
										Operations Earnings Multiplier(d)	1.788

(a) Table 4.4-1.
(b) The number shown represents 50 percent of the operations workforce on site during construction, because that is the percentage assumed to be migrating into Miami-Dade County (Table 4.4-1).
(c) Source: BLS 2010. This column equals the number of in-migrating workers times the average monthly wage of $6,832 (average annual wage of $81,980 divided by 12).
(d) Source: BEA 2009.

Table 4.4-8
In-migrating Operations Worker Wages, Miami-Dade County, Construction Period

In-Migrating Operations Workforce Wages over 123-month Construction Period (Table 4.4-7)	$72,251,707
Earnings Multiplier for Construction Industry Sector[a]	1.7880
Total Economic Impact to Miami-Dade County (Earning multiplier applied)	$129,186,052
Total Personal Income in Miami-Dade County 2009[b]	$90,915,774,000

(a) Source: BEA 2009.
(b) Source: BEA 2011.

Table 4.4-9
In-migrating Operations Worker Wages by Year, Miami-Dade County, Construction Period

Year	Construction Months	Total Annual Wages[a]	Total Dollar Impact to County (earnings multiplier applied)[b]	As a percentage of Miami-Dade County Personal Income in 2009[c]
Year 1	-39 to -28	$0	$0	0.000%
Year 2	-27 to -16	$0	$0	0.000%
Year 3	-15 to -4	$0	$0	0.000%
Year 4	-3 to 9	$0	$0	0.000%
Year 5	10 to 21	$0	$0	0.000%
Year 6	22 to 33	$0	$0	0.000%
Year 7	34 to 45	$840,295	$1,502,447	0.002%
Year 8	46 to 57	$8,594,237	$15,366,495	0.017%
Year 9	58 to 69	$22,896,331	$40,938,640	0.045%
Year 10	70 to 81	$31,661,359	$56,610,510	0.062%
Year 11	82 to 84	$8,259,485	$14,767,959	0.016%
Total	—	**$72,251,707**	**$129,186,052**	**0.142%**

(a) Table 4.4-7.
(b) Source: BEA 2009. The multiplier is 1.7880.
(c) Source: BEA 2011.

Table 4.4-10
In-Migrating Construction and Operations Worker Wages, Miami-Dade County, Construction Period

Combined Workforce Total Wages over 120-month Construction Period (Tables 4.4-5 and 4.4-8)	$709,345,469
Total Economic Impact to Miami-Dade County (Earning multiplier applied)[(a)]	$1,277,356,430
Total Personal Income, Miami-Dade County, 2009[(b)]	$90,915,774,000

(a) This row is the sum of construction worker wages with construction sector earnings multiplier (1.8022) applied (see Table 4.4-5), plus operations worker wages with operations sector earnings multiplier (1.7880) applied (see Table 4.4-8).
(b) Source: BEA 2011.

Table 4.4-11
In-migrating Construction and Operations Worker Wages by Year, Miami-Dade County, Construction Period

Year	Construction Months	Total Annual Wages	Total Dollar Impact to County (earnings multipliers applied) [(a)]	As a percentage of Miami-Dade County Personal Income in 2009[(b)]
Year 1	-39 to -28	$2,700,896	$4,867,555	0.01%
Year 2	-27 to -16	$16,901,989	$30,460,764	0.03%
Year 3	-15 to -4	$36,749,299	$66,229,586	0.07%
Year 4	-3 to 9	$46,196,325	$83,255,017	0.09%
Year 5	10 to 21	$58,662,000	$105,720,656	0.12%
Year 6	22 to 33	$99,480,975	$179,284,613	0.20%
Year 7	34 to 45	$116,318,886	$209,617,965	0.23%
Year 8	46 to 57	$117,485,574	$211,610,464	0.23%
Year 9	58 to 69	$116,816,637	$210,201,815	0.23%
Year 10	70 to 81	$86,412,559	$155,283,123	0.17%
Year 11	82 to 84	$11,620,329	$20,824,872	0.02%
Total	—	**$709,345,469**	**$1,277,356,430**	**1.40%**

(a) This column is the sum of construction and operations worker wages with applicable multiplier applied (Tables 4.4-6 and 4.4-9).
(b) Source: BEA 2011.

Table 4.4-12
Not Used

Table 4.4-13
Estimated Sales Tax Impacts, Miami-Dade County and Florida, Construction Period

Sales Tax Scenarios	Low Construction Cost Estimate	High Construction Cost Estimate
Total Estimated Project Costs, 12-year period[(a)]	$12,811,684,100	$18,694,287,838
Portion of construction costs subject to Florida and Miami-Dade County sales tax[(b)]	22.78%	22.78%
Construction costs subject to Florida and Miami-Dade County sales tax	$2,918,501,638	$4,258,558,769
Miami-Dade County Total Sales Tax Revenue, 2011[(c)]	$57,559,000	
Miami-Dade County Sales Tax Rate[(d)]	1.0%	1.0%
Miami-Dade County Sales Tax Revenue Resulting from Units 6 & 7 Construction	$29,185,016	$42,585,588
Average per year (12 years)	$2,432,085	$3,548,799
as % of 2011 Miami-Dade County Sales Tax Revenues	4.2%	6.2%
Florida Sales Tax Revenue, 2011[(e)]	$19,352,980,000	
Florida Sales Tax Rate[(f)]	6.0%	6.0%
Florida Sales Tax Revenue Resulting from Units 6 & 7 Construction	$175,110,098	$255,513,526
Average per year (12 years)	$14,592,508	$21,292,794
as % of 2011 Florida Sales Tax Revenues	0.08%	0.11%

(a) Source: FPL Undated: FPL uses a 12-year period that encompasses licensing, pre-construction, and construction activities.
(b) FPL Undated: Labor and services = 34% of construction costs; 67% would be from MDC providers, Therefore, 23% (67 percent x 34 percent) would generate sales tax.
(c) Source: MDC 2012.
(d) Source: FDOR 2012a.
(e) Source: FDOR 2011.
(f) Source: FDOR 2012b.

Table 4.4-14
Potential Sales Tax Impacts, Miami-Dade County and Florida

	Miami-Dade County	**Florida**
Year 2011 — Actual Sales Tax Revenues[a][b]	$57,559,000	$19,352,980,000
5% of total	$2,877,950	$967,649,000
10% of total	$5,755,900	$1,935,298,000
20% of total	$11,511,800	$3,870,596,000
Tax rate[c][d]	1.0%	6.0%

(a) Source: MDC 2012.
(b) Source: FDOR 2011.
(c) Source: FDOR 2012a.
(d) Source: FDOR 2012b.

Table 4.4-15
Population Increases Related to In-migrating Workers, Miami-Dade County and the Homestead and Florida City Area, Construction Period

Population Impacts, adjusted for In-migrants, ROI and Comparison Areas, Construction Period	
Population Increase during construction period (In-migrating construction and operations workers and families)[a] (Table 4.4-1)	5,139
Florida Population, 2005-2009[b]	18,222,420
Percentage increase from in-migrating workers and families	0.03%
Miami-Dade Population, 2005-2009 [b] (Table 2.5-3)	2,457,044
Percentage increase from in-migrating workers and families	0.21%
Expected percentage of in-migrating persons expected to locate in Homestead and Florida City Area[a] (Table 4.4-1)	42.78%
Expected number of in-migrating persons to locate in Homestead and Florida City Area	2,199
Homestead and Florida City Area Population, 2005-2009[b] (Table 2.5-3)	64,844
Percentage increase from in-migrating workers and families	3.39%

(a) Source: Table 4.4-1.
(b) Source: USCB 2010a.

Table 4.4-16a
FPL Tangible Personal Property Taxes for Turkey Point Plant, Miami-Dade County, School District, and Special Tax Districts, 2010

Taxing Entity	TPP Taxes Paid by FPL	Percent of FPL Payments	Taxing Entity's Total Property Tax Revenue	FPL Payments as Percent of Taxing Entity's Total Property Tax Revenues
Miami-Dade County School District[(a)(b)]	$6,594,526	40.3%	$1,890,151,904	0.35%
Miami- Dade County[(a)(c)]	$8,833,578	54.0%	$976,737,000	0.90%
State and Others				
Florida Inland Navigation District[(d)]	$27,580	0.2%	$23,948,384	0.12%
South Florida Water Management District[(e)]	$427,377	2.6%	$442,168,909	0.10%
Everglades Construction Project[(f)]	$71,469	0.4%	$5,087,359	1.40%
Children's Trust Authority[(g)]	$399,717	2.4%	$104,402,410	0.38%
Subtotal	$926,144	5.7%	$575,607,062	0.16%
Total	**$16,354,248**	—	—	—

(a) Source: Table 2.5-19.
(b) Source: FDOE 2011 (Table 2.5-19). Revenues for Miami-Dade County School District includes all local funds and, thus, includes revenues other than property taxes.
(c) Source: MDC 2012.
(d) Source: FIND 2010.
(e) Source: SFWMD 2010.
(f) Source: SFWMD 2011.
(g) Source: TCT 2010.
Note: Values reflect taxes levied, FPL paid taxes prior to November 30, 2011 and secured a 4 percent reduction in taxes due.

Table 4.4-16b
Existing Traffic Conditions (peak hour) for U.S. Highway 1 and Florida's Turnpike

Roadway	Existing Traffic	Capacity	Reserved Trips
U.S Highway 1	2,893	4,068[(a)]	1,175
Florida's Turnpike	3,967	6,500[(b)]	2,533

Source: Traf Tech 2009.
(a) The capacity of U.S. highway 1 was obtained from Miami-Dade County's Concurrency Management System.
(b) The capacity of Florida's Turnpike was obtained from FDOT's generalized tables.

Table 4.4-16c
Construction PM Peak Link Analysis

Miami-Dade County Traffic Count Station	Location	Previous Peak Hour Available Capacity[(a)]	Construction Trips During Peak Hour[(b)]	New Available Peak Hour Capacity
9956	SW 344th Street/Palm Drive west of SW 137th Avenue/Tallahassee Road	2,799	1,227	1,572
9952	SW 328th Street/North Canal Drive west of SW 137th Avenue/Tallahassee Road	2,346	488	1,858
9944	Campbell Dr. E of Florida's Turnpike	1,289	856	433

(a) See Table 2.5-16.
(b) Traf Tech 2009, based on traffic patterns of existing workforce.

Table 4.4-16d
Level of Service (LOS) Achieved at Affected Intersections During Peak Construction Period, with Improvements

Intersection	LOS AM Peak Travel Hour	LOS PM Peak Travel Hour	Improvements
SW 328th Street/North Canal Drive /SW 137th Avenue/ Tallahassee Road	C	D	• Signal or police control • One additional southbound left- turn lane • One additional westbound through lane • Two westbound right-turn lanes
SW 328th Street/North Canal Drive /SW 117th Avenue	C	D	• Signal or police control • Two northbound left-turn lanes • One eastbound right-turn lane • Restripe eastbound through lane to a shared through/ right-turn lane
SW 344th Street/Palm Drive/ SW 137th Avenue/ Tallahassee Road (W)	C	B	• Signal or police control (pm only) • One separate eastbound through lane • One additional westbound left-turn lane
SW 344th Street/Palm Drive/ SW 137th Avenue/ Tallahassee Road (E)	B	B	This would be a new intersection • Signal or police control (pm only) • Two eastbound right-turn lanes • Two northbound approach lanes (one as an exclusive left-turn lane and one as a shared left-turn/ right-turn lane
SW 344th Street/Palm Drive/ SW 117th Avenue	C	C	Signal or police control • One eastbound left-turn lane • One eastbound right-turn lane • One westbound right-turn lane • One northbound left-turn lane • Two northbound through lanes • One southbound left-turn lane • One southbound through lane
SW 359 Street/ SW 117th Avenue	C	D	This would be a new intersection • Signal or police control • Two eastbound approach lanes • One westbound through lane • One westbound right-turn lane • Two southbound approach lanes

Source: Traf Tech 2009.

Table 4.4-17
Public Water: Change in Use and Capacity with Population Increase and Construction

Major Suppliers	Service Area Population, 2007	2007 Daily Average Demand (mgd)	Available Facility Capacity (mgd)[a]	Daily Demand as Percent of Capacity, 2007	Adjusted Population during Construction	Daily Average Annual Demand with Adjusted Population (0.5139) and Onsite Use (0.8136)	Demand as Percent of Capacity during Construction	Total Percent Increase, Demand of Capacity, Current vs. Construction
Public Water: Total ROI: Use and Capacity with Population Increase (5139) and Construction (8136)								
Total Miami-Dade County ROI	2,621,70	398.0	532.5	74.74	2,626,8	399.3	74.9	0.25%
Miami-Dade County Water and Sewer Department (WASD) [a][b]	2,250,944	347.81	470.35	73.95%	2,256,083	349.14	74.23%	0.28%
Florida City[c]	15,000	2.33	4.00	—	—	—	—	—
Homestead[c]	71,252	12.47	16.90	—	—	—	—	—
North Miami[c]	97,504	8.50	9.30	—	—	—	—	—
North Miami Beach[c]	187,000	26.93	32.00	—	—	—	—	—
Public Water: Homestead and Florida City: Use and Capacity with Population Increase (2199) and Construction (8136)								
Combined Homestead and Florida City	86,252	14.79	20.90	70.79%	88,451	15.83	75.73%	4.94%
Florida City[c]	15,000	2.33	4.00	—	—	—	—	—
Homestead[c]	71,252	12.47	16.90	—	—	—	—	—

(a) Includes 20 mgd for South Miami Heights water treatment plant scheduled to come online in 2012.
(b) Source: MDWASD 2008, Table 5-4.
(c) Source: SFWMD 2010a, Chapter 2.6 and footnote to Exhibit C-4.

Table 4.4-18
Wastewater Capacity in the Miami-Dade County

System Name (Facility ID#)	Plant Capacity (MGD)	Annual Average Flow (MGD)[(a)]	Current Flow as percent of Design Capacity	Flow as percent of Design Capacity during Peak Construction of Units 6 & 7	Total Change in Percent of Capacity Used During Peak Construction of Units 6 & 7
Total in Miami-Dade County	374	298.62	79.85%	79.98%	0.14%
City of Homestead (FLA013609)	6	6.13	102.20%	—	—
MDWASD South District WWTP (FL0042137)	112.5	88.36	78.54%	—	—
MDWASD North District WWTP (FL0032182)	112.5	87.63	77.89%	—	
MDWASD Central District WWTP (FLA024805)	143	116.5	81.47%	—	—

(a) Average for running 12-month period.
Source: MDWASD 2009

Table 4.4-19
Law Enforcement Needs, Adjusted for Workforce Related Increases in Population, Miami-Dade County and the Homestead/Florida City Area, Construction Period

Area	Population 2005-2009[(a)]	Population adjusted for Workforce related Increases, Peak Construction[(b)]	Law Enforcement Officers (2010)[(c)(d)]	Ratio of Residents per Law Enforcement Officer 2005-2009	Law Enforcement Officers Needed During peak Construction	Additional Law Enforcement Officers Needed
Miami-Dade County	2,457,044	2,462,183	2,980	825	2,986	6
Homestead and Florida City Area	64,844	67,043	135	480	140	5

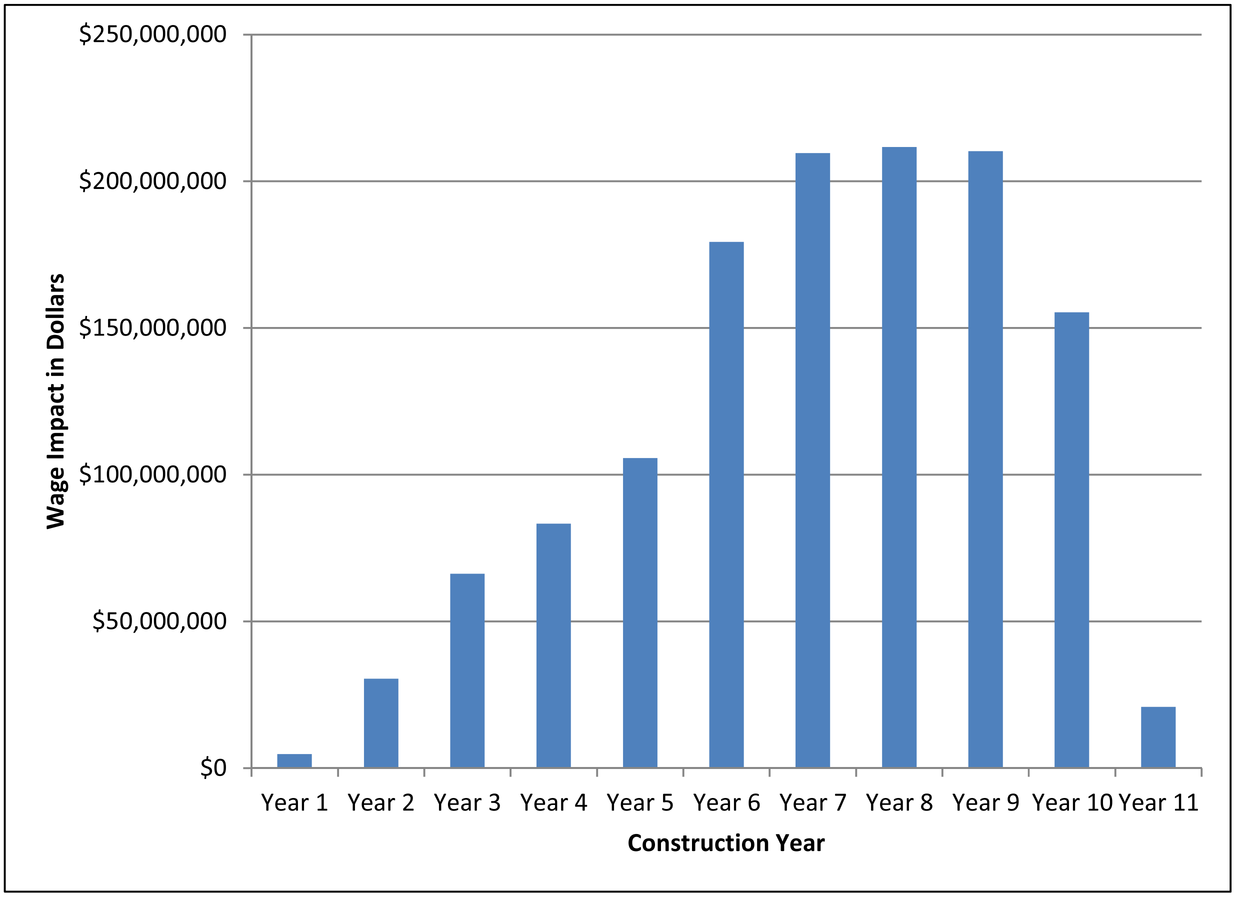
(a) Source: USCB 2010a.
(b) Source: Table 4.4-15.
(c) Source: FBI 2010a and FBI 2010b (Table 2.5-39).
(d) Source: Miami-Dade County number of law enforcement officers excludes officers employed by municipalities within the county.

Table 4.4-20
Fire Protection Needs, Adjusted for Workforce Related Increases in Population, Miami-Dade County and the Homestead/Florida City Area, Construction Period

Area	Population 2005-2009[(a)]	Population Adjusted for Workforce Related Increase, Peak Construction[(b)]	Active Firefighters (2010)[(c)]	Ratio of Residents per Active Firefighters, Currently	Active Firefighters Needed During Peak Construction	Additional Active Firefighters Needed
Miami-Dade County	2,457,044	2,462,183	3,500	702	3,507	7
Miami-Dade County Fire and Rescue service area (includes Homestead and Florida City)[(d)]	64,844	67,043	2,070	N/A	N/A	N/A

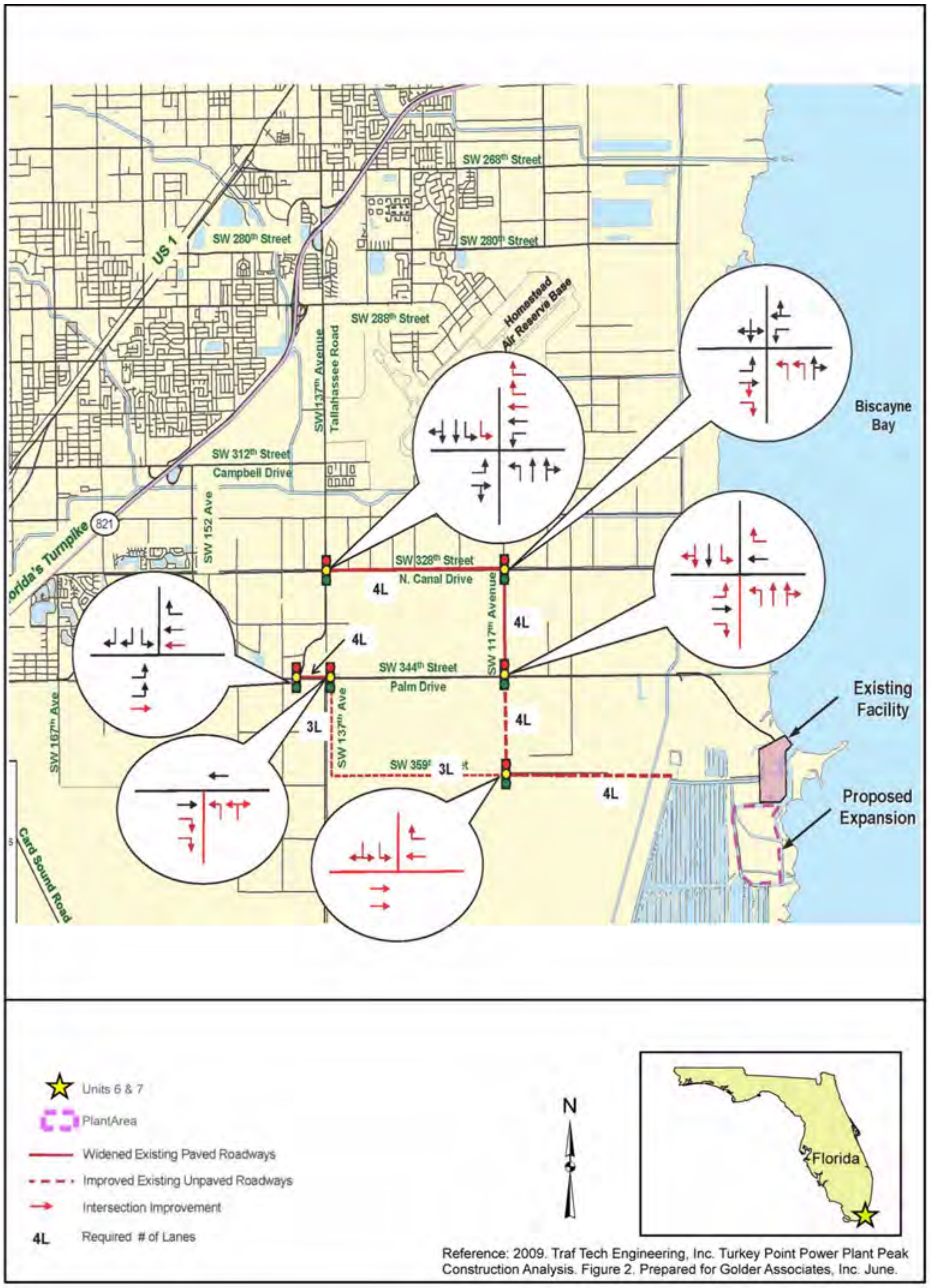
(a) Source: USCB 2010a.
(b) Source: Table 4.4-15.
(c) Source: USFA 2010 (Table 2.5-40).
(d) The Homestead and Florida City area is served by the Miami-Dade Fire and Rescue Department; ratio of residents to firefighter is not available.
N/A — Not Available

Figure 4.4-1 Wage Impact by Year (Multiplier Applied)



Source: Table 4.4-11.

Figure 4.4-2 Traffic Study of Construction Entrance



Reference: 2009. Traf Tech Engineering, Inc. Turkey Point Power Plant Peak Construction Analysis. Figure 2. Prepared for Golder Associates, Inc. June.

4.5 RADIATION EXPOSURE TO CONSTRUCTION WORKERS

During the construction of Units 6 & 7, workers would be exposed to several potential sources of radiation. This section identifies the potential sources of radiation and estimates the doses that workers would receive during the construction of Units 6 & 7 as a result of the operation of Units 3 & 4. In addition, with Unit 6 scheduled to be operational one year earlier than Unit 7, Unit 6 would be a source of radiation for Unit 7 construction workers during that year. Therefore, the dose contribution from Unit 6 sources of radiation is also evaluated.

Three types of sources are considered: liquid effluents, gaseous effluents, and direct radiation. Subsection 4.5.1 presents the site layout. Subsection 4.5.2 identifies the specific sources of each type while Subsection 4.5.3 estimates the maximum annual doses to the individual worker as well as the entire workforce.

4.5.1 SITE LAYOUT

The layout of the Units 6 & 7 plant area is shown in Figure 2.1-1. For the purpose of calculating doses to construction workers, it was assumed that all Unit 7 construction activity would take place inside the Unit 7 power block area. More specifically, it was assumed that over the course of the year that Unit 7 workers would be exposed to radiation from Unit 6, the average location of the Unit 7 worker would be at the center of the Unit 7 reactor.

4.5.2 RADIATION SOURCES

While the new units are being constructed, there would be a potential for construction workers to be exposed to liquid and gaseous effluents as well as direct radiation.

As described in Subsection 3.3.2.3, potable water for Units 6 & 7 would be supplied from the Miami-Dade Water and Sewer Department (MDWASD). Therefore, the drinking water exposure pathway is not considered for the construction workers. Liquid effluents from Units 3 & 4 released into the industrial wastewater facility present a potential source of contamination for workers coming in contact with the wastewater or with soils that come in contact with the wastewater. However, these pathways would be managed to ensure that doses are negligible.

Sources of gaseous effluents at Units 3 & 4 include releases from gas decay tanks, containment purges, and incidental releases from plant operation. Based on the annual effluent reports from 2004 to 2008 (FPL 2004, FPL 2005, FPL 2006, FPL 2007a, FPL 2008), the composite maximum annual release is 35 Curies, primarily as a result of tritium, krypton, and xenon.

The primary sources of gaseous effluents from the operation of Unit 6 would be released from the gaseous radwaste system, the condenser air removal system, and building ventilation systems. The estimated annual isotopic activities in gaseous effluents from an AP1000 unit are shown in DCD Table 11.3-3 (WEC 2011).

Sources of direct radiation at Units 3 & 4 include tanks, filters, and demineralizers associated with fuel and waste storage and handling. However, these components are stored within shielded buildings, rendering dose rates outside to very near background levels and therefore making them negligible (FPL 2007d). Liquid effluents from Units 3 & 4 are released into the industrial wastewater facility, which are a potential source of direct radiation. There is a plan to add an independent spent fuel storage installation (ISFSI) east of Units 3 & 4 at a distance of approximately 3000 feet from the Units 6 & 7 construction area. The impact of all sources of direct radiation is assessed in Subsection 4.5.3.2.

Contained sources of radioactive material from Unit 6, including the refueling water storage tank, will be shielded such that the direct dose rate to Unit 7 is negligible (WEC 2011).

4.5.3 CONSTRUCTION WORKER DOSES

Construction worker doses are estimated from the gaseous effluent and direct radiation pathways. It is assumed that workers are at the construction site for 40 hours per week for 52 weeks a year for an exposure time of 2080 hours per year.

4.5.3.1 Gaseous Effluent Doses

The annual effluent reports for Units 3 & 4 show doses at the Turkey Point plant property boundary from gaseous effluents. Based on the reports from 2004 to 2008 (FPL 2004, FPL 2005, FPL 2006, FPL 2007a, FPL 2008), Table 4.5-1 shows the maximum dose rates at the Turkey Point plant property boundary as a result of inhalation, ground deposition, and plume pathways. These dose rates are based on an atmospheric dispersion factor (X/Q) of 5.8E–07 sec/m^3 (FPL 2007c), while the X/Q from the existing units to the Units 6 & 7 plant area is 2.9E–06 sec/m^3 (FPL 2007c). Since dose is proportional to X/Q, the site boundary dose rates are multiplied by the X/Q ratio of 5.0 (2.9E–06 divided by 5.8E–07) to estimate the dose rates in the construction area, as shown in Table 4.5-1.

The NRC-endorsed GASPAR II computer program (PNL 1987) is used to calculate the doses to construction workers from Unit 6 gaseous effluents. This program implements the radiological exposure models described in RG 1.109, “Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I,” and RG 1.111, “Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors,” to estimate the radioactivity releases in gaseous effluents and the subsequent doses. The following exposure pathways are considered in GASPAR II:

- External exposure to airborne plume
- External exposure to contamination deposited on ground

- Inhalation of airborne activity

The input parameters for the Unit 6 gaseous pathway are presented in Table 4.5-2 and the resulting doses are shown in Table 4.5-3.

The doses from Units 3 & 4 and Unit 6 are summed in Table 4.5-4 to obtain the total gaseous effluent doses. This table also shows the total effective dose equivalent (TEDE), calculated by multiplying the thyroid dose by a weighting factor of 0.03 and adding the product to the total body dose (ICRP 1979). The table indicates that doses from Units 3 & 4 are negligible compared to those from new Unit 6. This is because the doses from Units 3 & 4 reflect realistic operational measurements while those from Unit 6 are based on conservative theoretical calculations.

4.5.3.2 Direct Radiation Doses

Direct radiation measurements at the site indicate exposure rates that are consistent with those observed during the preoperational surveillance program (FPL 2007b). This is supported by an evaluation by the NRC of all existing light water reactors (LWRs), which concludes that: "…because the primary coolant of an LWR is contained in a heavily shielded area, dose rates in the vicinity of light water reactors are generally undetectable and are less than 1 mrem per year at the site boundary" (NUREG-1437, "Generic Impact Statement for License Renewal of Nuclear Plants," Section 4.6.1.2, 1996).

For conservatism, the dose rate in the Unit 7 construction area from Units 3 & 4 is assumed to be 1 mrem per year. Compared to this, the calculated dose rate of 0.009 mrem per year from a fully loaded ISFSI is negligible. When adjusted for an occupancy time of 2080 hours per year, the direct radiation dose from Units 3 & 4 is as follows:

(1 mrem/yr-unit)(2 units)(2080/8760) = 0.47 mrem

As stated in Subsection 4.5.2, the direct radiation dose from Unit 6 would be negligible.

4.5.3.3 Total Doses

The doses to Unit 7 construction workers are summarized in Table 4.5-5. As indicated in Table 3.10-2, the peak workforce during any month that Unit 6 is operational and Unit 7 is under construction is no more than 2800 people. Although this peak is anticipated to last for less than a year, it is conservatively assumed that the peak is maintained over the course of an entire year for the purpose of calculating the maximum annual workforce dose.

Although construction workers would not need to be classified as radiation workers, Table 4.5-6 shows that construction worker doses meet the occupational limits of 10 CFR 20.1201. Tables 4.5-7 and 4.5-8 demonstrate that worker doses are also in compliance with the limits in 10 CFR 20.1301 and 40 CFR 190.10, respectively, for members of the public. Table 4.5-9 shows that the doses would not meet the design objectives of 10 CFR Part 50, Appendix I, for gaseous effluents if the construction area is considered to be an unrestricted area and the construction workers are considered to be members of the public. However, the construction area will not have unrestricted access by the public.

Units 3, 4, and 6 could be operational during the construction of Unit 7. The site would be monitored during the construction period, as described in Section 6.2, and appropriate actions would be taken as necessary to ensure that doses to the construction workers are as low as reasonably achievable (ALARA).

Given that doses to the Unit 7 construction workers meet the public dose criteria of 10 CFR Part 20 and 40 CFR Part 190, it is concluded that the radiological impact on construction workers would be SMALL and no additional mitigation is required.

Section 4.5 References

FPL 2004. *Annual Radioactive Effluent Report*, January 2004 through December 2004, Turkey Point Units 3 and 4.

FPL 2005. *Annual Radioactive Effluent Report*, January 2005 through December 2005, Turkey Point Units 3 and 4.

FPL 2006. *Annual Radioactive Effluent Report*, January 2006 through December 2006, Turkey Point Units 3 and 4.

FPL 2007a. *Annual Radioactive Effluent Report*, January 2007 through December 2007, Turkey Point Units 3 and 4.

FPL 2007b. *2007 Annual Radiological Environmental Operating Report*, Turkey Point Units 3 and 4.

FPL 2007c. *Offsite Dose Calculation Manual for Gaseous and Liquid Effluents from the Turkey Point Plant Units 3 and 4*, Revision 14.

FPL 2007d. *Turkey Point Units 3 and 4 Updated FSAR*, Revision 16.

FPL 2008. *Annual Radioactive Effluent Report*, January 2008 through December 2008, Turkey Point Units 3 and 4.

ICRP 1979. International Council on Radiological Protection, Limits for Intakes or Radionuclides by Workers, Publication 30, Part 1, 1979.

PNL 1987. Pacific Northwest Laboratory, *GASPAR II — Technical Reference and User Guide*, NUREG/CR-4653, April 1987.

WEC 2011. Westinghouse Electric Company, LLC, *AP1000 Design Control Document*, Document No. APP-GW-GL-700, Tier 2 Material, Rev 19, June 2011.

Table 4.5-1
Units 6 & 7 Construction Area Dose Rates from Units 3 & 4 Gaseous Effluents

Organ	Dose Rate (mrem/yr)			
	Site Boundary[(a)]			Construction Area[(b)]
	Unit 3	Unit 4	Total	
Total Body	9.3E–4	9.2E–4	1.9E–3	9.3E–3
Thyroid	9.4E–4	9.3E–4	1.9E–3	9.3E–3
Skin	1.4E–3	1.3E–3	2.6E–3	1.3E–2

(a) Bounding values from 5 years of effluent reports (FPL 2004, FPL 2005, FPL 2006, FPL 2007a, FPL 2008)
(b) Site boundary total dose rate adjusted for construction area atmospheric dispersion factor (FPL 2007c)

Table 4.5-2
Unit 6 Gaseous Effluent Pathway Parameters

Parameter	Value	Basis/Source(s)
Release Source Terms	See AP1000 DCD[(a)] Table 11.3-3	The DCD table shows the activity releases by isotope.
Atmospheric Dispersion and Deposition Factors	See Table 2.7-16	Table 2.7-16 shows the dispersion and deposition data at Unit 7 for releases from Unit 6, based on the centerline distance between the two reactors. This represents the average distance from the Unit 6 release point to the construction worker over the course of a year.
Worker Breathing Rates	8000 m^3/yr	This is the maximum adult breathing rate from RG 1.109, Table E-5.

(a) Source: WEC 2011

Table 4.5-3
Unit 7 Construction Area Dose Rates from Unit 6 Gaseous Effluents

	Dose Rate (mrem/yr)		
Pathway	Total Body	Thyroid	Skin
Plume	12	12	60
Ground	8.7	8.7	10
Inhalation	1.3	13	1.3
Total	22	33	72

Table 4.5-4
Gaseous Effluent Doses to Unit 7 Construction Workers

	Annual Dose (mrem)			
Source	Total Body	Thyroid	Skin	TEDE[c]
Units 3 & 4[a]	0.0022	0.0022	0.0031	0.0023
Unit 6[b]	5.2	7.9	17	5.5
Total	5.2	7.9	17	5.5

(a) Construction area does rates from Table 4.5-1 are adjusted for occupancy of 2080 hr/yr.
(b) Construction area dose rates from Table 4.5-3 are adjusted for occupancy of 2080 hr/yr.
(c) TEDE – Total effective dose equivalent calculated by multiplying the thyroid dose by 0.03 and adding it to total body dose.

Table 4.5-5
Total Doses to Unit 7 Construction Workers

	Annual Worker Dose (mrem)[a]			
Pathway	Total Body	Thyroid	Skin	TEDE[b]
Direct Radiation	0.47	0.47	0	0.47
Gaseous Effluents	5.2	7.9	17	5.5
Total	5.7	8.4	17	6.0
Annual Workforce Dose (person-rem)[c]				
Total	16	23	48	17

(a) Doses from Subsection 4.5.3.2 and Table 4.5-4 are added
(b) TEDE — Total effective dose equivalent
(c) Workforce dose is the product of worker dose and 2800 workers

Table 4.5-6
Comparison of Construction Worker Doses with 10 CFR 20.1201 Criteria for Occupational Doses

	Annual Dose (rem)	
Organ	Worker	Limit
TEDE[a]	0.0060	5
Organ other than lens of the eye	0.0084	50
Lens of the eye[b]	—	15
Skin	0.017	50

(a) TEDE - Total effective dose equivalent
(b) Dose to the lens of the eye is not available.

Table 4.5-7
Comparison of Construction Worker Doses with 10 CFR 20.1301 Criteria for Members of the Public

Criteria	Worker	Limit
Annual Dose (mrem TEDE)[(a)]	6.0	100
Unrestricted area dose rate[(b)] (mrem/hr)	0.0029	2

(a) TEDE — Total effective dose equivalent
(b) Dose rate is obtained by dividing the dose by the occupancy time of 2080 hr/yr

Table 4.5-8
Comparison of Construction Worker Doses with 40 CFR 190.10 Criteria for Members of the Public

	Annual Dose (mrem)	
Organ	Worker	Limit
Total Body	5.7	25
Thyroid	8.4	75
Other Organ — Skin	17	25

Table 4.5-9
Comparison of Construction Worker Doses with 10 CFR Part 50, Appendix I Criteria for Individuals in an Unrestricted Area

	Annual Dose (mrem)	
Criteria	Worker	Limit
Whole body dose from liquid effluents	0	3
Organ dose from liquid effluents	0	10
Whole body dose from gaseous effluents	5.2	5
Skin dose from gaseous effluents	17	15
Organ dose from radioactive iodine and radioactive material in particulate form from gaseous effluents	8.4	15

4.6 MEASURES AND CONTROLS TO LIMIT ADVERSE IMPACTS DURING CONSTRUCTION

Sections 4.1 through 4.5 and 4.8 describe potential environmental impacts that could result from construction of Units 6 & 7. In accordance with NUREG-1555, potential adverse environmental impacts from construction activities are identified and addressed in this section, as well as the specific measures and controls to limit those adverse impacts. Some examples of measures and controls to limit such adverse environmental impacts are:

- Compliance with applicable local, state, and federal ordinances, laws, and regulations intended to avoid and minimize the adverse environmental effects of construction activities on air, water and land, workers, and the public.
- Compliance with existing permits and licenses for the existing Turkey Point units.
- Compliance with existing Turkey Point procedures and processes applicable to construction projects.
- Incorporation of environmental requirements of permits in construction contracts.

Table 4.6-1 summarizes the environmental impacts and corresponding measures and controls presented in Sections 4.1 through 4.5 and 4.8 along with the significance of potential impact. The significance of impact (SMALL, MODERATE, or LARGE) was determined by evaluating the potential effects after any controls or mitigation measures had been implemented. The significance levels used in the evaluation were developed using Council on Environmental Quality guidance, 40 CFR 1508.27, and those identified in 10 CFR 51, and in NUREG-1555. These standards establish three significance levels for characterizing environmental impacts: SMALL, MODERATE, or LARGE. The definitions of the significance levels are as follows:

- SMALL – Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
- MODERATE – Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
- LARGE – Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

In addition to the cumulative impacts attributable to the construction of the entire Units 6 & 7 facility that are summarized in Table 4.6-1, a breakdown or separation of “construction” and “preconstruction” environmental impacts has been estimated in Table 4.6-2 for the purpose of assessing impacts attributable specifically to construction activities as defined in 10 CFR 50.10(a)(1).

Table 4.6-2 provides estimates of the percentage of impacts attributable to “construction” and to “preconstruction,” as well as a summary of the basis for the estimates. The estimated construction related impacts presented in the table were based primarily on two factors, namely the area associated with the construction of SSCs and the labor hours associated with the construction of SSCs. Information related to these two factors is provided as follows:

- Construction Area — The total area that would be developed for Units 6 & 7 is estimated to be approximately 600 acres, exclusive of electric transmission lines. Of these developed areas, approximately 30 acres would be developed for the Units 6 & 7 powerblock (equated with the SSCs). The area that would be developed for the construction of SSCs, therefore, represents approximately 5 percent of the total area that would ultimately be developed (excluding electric transmission lines). Because this estimate does not include electric transmission lines, it is conservative. For the purposes of this assessment, the impacted area associated with SSCs is less than 5 percent.

- Labor Hours — Based on preliminary construction estimates for all phases of development for Units 6 & 7, the estimated labor hours associated with the construction of SSCs is approximately 36 percent of the total labor hours associated with the development of the entire project. For the purpose of this assessment, the labor hours associated with SSC construction is less than 35 percent.

Table 4.6-1 (Sheet 1 of 9)
Summary of Measures and Controls to Limit Adverse Impacts during Construction

Impact	Description of Potential Impact	Significance of Impact[(a)]	Planned Control Program
4.1 Land-Use Impacts			
4.1.1 The Site and Vicinity	Potential impacts from ground-disturbing activities including clearing, grubbing, grading, excavating, backfilling, and stockpiling soils on previously disturbed land	S	Site preparation and construction activities would be conducted in accordance with applicable federal, state, and local regulations. Environmental controls such as storm water management systems, erosion control, fugitive dust control, and spill containment controls would be implemented. Construction practices including controlled plant access for personnel and vehicular traffic, and restriction of construction activities to specified areas to minimize impacts.
4.1.2 Transmission Corridors and Offsite Areas	Potential impacts from constructing new transmission lines in both existing and new corridors (land disturbance includes the loss of some wetland acreage)	S	Restrictive land-clearing processes, in forested wetland areas for right-of-way clearing and preparation would be used. Turbidity screens and erosion control devices in areas of wetlands and water resources for access road/structure pad construction would be used. Existing access roads for ingress and egress to rights-of-way would be used where available. Standard industry construction practices would be used for the transmission line construction, including use of existing right-of-way, to the extent practicable, and environmental management, including such things as erosion control devices, matting to reduce compaction caused by equipment, use of wide-track vehicles when crossing wetlands, and restoration activities after construction.
	Potential impacts from permanently disturbing agricultural land to meet borrow material requirements (using FPL-owned property for borrow material would permanently disturb approximately 300 acres of land classified as agricultural land)	S	This land disturbance represents a small portion of the available agricultural land in the surrounding area, thus no mitigation would be required.
	Potential impacts from disturbing offsite land to install reclaimed water pipelines along both existing and new rights-of-way	S	Clearing of new and/or expansion of existing rights-of-way would include use of environmental best management practices such as those controls listed in Subsection 4.1.1 to minimize impacts to sensitive habitats. Existing rights-of-way and work within previously impacted areas (e.g., road) to the extent practicable would also minimize impacts from land disturbance.
	Potential impacts from disturbing offsite land to expand substations	S	Stormwater retention systems would be installed for expansions.

Table 4.6-1 (Sheet 2 of 9)
Summary of Measures and Controls to Limit Adverse Impacts during Construction

Impact	Description of Potential Impact	Significance of Impact[(a)]	Planned Control Program
4.1.2 Transmission Corridors and Offsite Areas (cont.)	Potential impacts from access road improvements	S	Access road improvements would include the following installation of silt fences, shoulders would be appropriately sloped, and surface water runoff would be managed with the installation of swales and culverts at suitable locations.
4.1.3 Historic Properties	Potential impacts from constructing on previously disturbed land	S	Work plans have been prepared for onsite and offsite areas and contain recommendations for development of an Unanticipated Finds Plan and a Contractor Training Program.
4.2 Water-Related Impacts			
4.2.1 Hydrology Alterations 4.2.2 Water Use Impacts and 4.2.3 Water Quality	Potential impacts from hydrological alterations onsite including excavation, filling, creation of reservoir, and elevating land surface	S	Alterations would be limited by the presence of the industrial wastewater facility and the berm to the east of the return canal, and, therefore, would not result in impacts to down stream surface water bodies or resources.
	Potential impacts from the alteration of groundwater flow beneath Units 6 & 7 construction site due to placement of engineering fill, filling of 2 remnant canals,	S	A slurry diaphragm wall would be installed to a depth of approximately –65 ft NAVD around the power blocks during dewatering and excavating subsurface materials. The impacts would be limited to the vicinity of the slurry wall. The use of the slurry wall would allow dewatering of the power block areas with minimal impacts to groundwater directly outside of the slurry wall. No mitigation would be required.
	Potential impacts from hydrological alterations due to offsite construction of transmission lines, reclaimed water pipelines, and potable water pipeline	S	Construction activities would comply with federal and state regulations to site and construct the transmission lines and pipelines. Environmental best management practices would be used (including use of existing rights-of-way to the extent practicable, erosion control devices, matting to reduce compaction and restoration activities after construction). A storm water pollution prevention plan would be developed (SWPPP) for the construction activities or work would be performed under existing permits/plans.
	Potential impacts from erosion from borrow area and establishment of spoils areas	S	Onsite: Berms would be installed to direct runoff to industrial wastewater treatment system. Offsite: A perimeter berm could be used to restrict the flow of surface water onto the property. The berm could also be used in association with detention basins and a truck wash facility to reduce surface water runoff from the site and prevent soils from being unintentionally spread to offsite areas. Drainage ditches could be used to direct surface water flow away from the site and could be reconnected to any drainage features that once flowed through the property to maintain surface flow.

Table 4.6-1 (Sheet 3 of 9)
Summary of Measures and Controls to Limit Adverse Impacts during Construction

Impact	Description of Potential Impact	Significance of Impact(a)	Planned Control Program
4.2.1 Hydrology Alterations 4.2.2 Water Use Impacts and 4.2.3 Water Quality (cont.)	Potential impacts from enlargement of equipment barge unloading area would introduce sediment	S	Curtain wall technology would be used to isolate the affected area from the waters of the Biscayne National Park. The modification would be performed using cutoff wall technology (sheet piles) to isolate the equipment barge unloading area from the turning basin. Activities would be performed under a permit issued by the U.S. Army Corp of Engineers.
	Potential impacts from hydrological alterations to surface water flow and filling to raise elevation due to construction of roads and bridges	S	Existing roads would be used to the extent practicable. Ditches and the use of culverts would allow stormwater drainage to be maintained along the road route. During onsite construction, stormwater runoff would be directed to retention basins before being discharged to the industrial wastewater facility. Should modification to the existing draining ditches or drainage features be required, the impacts would be temporary and the disturbed areas would be returned to preconstruction conditions. All work would be performed in accordance with site-obtained permits. During offsite construction, surface water would be routed to areas that could accept the additional surface flow that would then alter the flow in the vicinity of the road.
	Potential impacts from excavation dewatering could impact surface water, groundwater, and wetlands	S	Cutoff wall technology including the use of a slurry wall could be used to limit potential impacts during construction dewatering activities. The water from dewatering activities would be discharged into the cooling canals of the industrial wastewater facility.
	Potential impacts from the installation of radial collector wells	S	The construction activities would be performed in accordance with the required local, state, and federal guidelines and accepted industry practices. The necessary permits would be obtained before beginning construction activities. The delivery pipeline routes would be recontoured afterward. Excavated material would be stockpiled in designated spoils areas. Sedimentation barriers would be installed to limit potential impacts to surface water bodies. Sedimentation basins would also be used to minimize the potential for surface water runoff impacts to nearby water bodies in accordance with FDEP regulations. Once construction activities are complete, the drainage would be restored to preconstruction conditions.
	Potential impacts from the installation of radial collector wells could alter groundwater flow primarily as a result of dewatering	S	Sheet piles could be used to limit potential impacts during construction dewatering activities. Water from dewatering activities would be added to the industrial wastewater facility.
	Potential impacts from the installation and use of deep injection wells	S	The deep injection wells and the required monitoring wells would be installed in accordance with an FDEP injection well permit and any local permit requirements. During the construction of the deep injection wells and associated equipment, any surface water runoff would be directed to the cooling canals of the industrial wastewater facility.

Table 4.6-1 (Sheet 4 of 9)
Summary of Measures and Controls to Limit Adverse Impacts during Construction

Impact	Description of Potential Impact	Significance of Impact[(a)]	Planned Control Program
4.2.1 Hydrology Alterations 4.2.2 Water Use Impacts and 4.2.3 Water Quality (cont.)	Potential impacts associated with accidental spills which could adversely impact surface waters and groundwater	S	The necessary construction activities would be performed under a new SWPPP or under a modification of an existing Turkey Point SWPPP and associated spill prevention plan that could include oil and fuel containment. Any minor spills of diesel fuel, hydraulic fluid, lubricants, or other construction-related pollutants during construction of the project would be cleaned up quickly to prevent them from moving into the groundwater or flowing to a nearby surface water.
4.3 Ecological Impacts			
4.3.1 Terrestrial Ecosystems	Potential impacts from construction activities could reduce the regional diversity of plants or plant communities	S	Threatened species would be avoided to the maximum extent practical.
	Potential impacts to nesting crocodiles and listed species could be disturbed by construction activities	M: American crocodiles S: other listed species	A project-specific management plan for crocodiles and other listed species has been created for this construction activity. Mitigation measures may include warning signs and education material (for construction personnel) as to the presence and status of crocodiles and restrictions of nocturnal activities. Traffic access at the north end of the cooling canals of the industrial wastewater facility may pose a threat to crocodiles crossing this road and would be mitigated by installation of a wildlife corridor to provide pathways for crocodiles to travel between wetlands on either side of this road. Construction of transmission facilities within the cooling canals of the industrial wastewater facility may avoid known crocodile nests and be conducted between nesting seasons.
	Potential impacts from equipment barge unloading area enlargement activities, increased barge traffic, and dredging, if needed, could disturb manatees	S	A management plan for in-water activities to minimize potential impacts to manatees would be implemented. This plan would include use of observers to spot manatees during in-water activities and reduction of in-water activities if manatees were observed within the basin.
	Potential impacts to wetland habitat	M	Impacts to wetlands would be mitigated by active mitigation (e.g., installation of culverts under existing road beds to allow sheet flow of water), "land swapping", and/or purchase of wetland credits from the Everglades Mitigation Bank or other regional mitigation opportunities.
	Potential impacts from construction noise and vibration could displace some wildlife	S	Measures to reduce noise and vibration levels during construction may include staggering work activities, and use of noise dampeners and noise control equipment on vehicles and equipment.

Table 4.6-1 (Sheet 5 of 9)
Summary of Measures and Controls to Limit Adverse Impacts during Construction

Impact	Description of Potential Impact	Significance of Impact[(a)]	Planned Control Program
4.3.1 Terrestrial Ecosystems (cont.)	Potential impacts from new tall structures and the use of cranes could lead to avian collisions	S	No mitigation measures would be required.
	Potential impacts from light pollution during facility construction and operation can alter behavior of birds and bats	S	To the extent practicable, unnecessary lights would be turned off at night, lights turned downward or hooded directing light downward, and lower-powered lights used during construction to minimize impacts on wildlife.
	Potential impacts from the construction of new transmission corridors (Wood storks have nested in four colonies near Everglades National Park and the proposed transmission corridors. The transmission corridors are located in the core foraging area of nine wood stork colonies.)	S	Impacts to wetlands within the core foraging area would mitigated as prescribed by regulatory agencies. To mitigate the potential for collisions or electrocutions, avian friendly design standards would be used as provided for in the Avian Protection Plan.
4.3.2 Aquatic Ecosystems	Potential impacts from accidental spills associated with construction activity could adversely impact surface waters and aquatic ecosystems	S	Spill prevention techniques would include locating storage areas for petroleum products at a safe distance from surface waters. Any spills of diesel fuel, hydraulic fluid, or lubricants during construction would be cleaned up to prevent spilled fuel or oil from impacting aquatic resources. A Spill Prevention, Control, and Countermeasure (SPCC) Plan would be implemented in accordance with EPA regulations (40 CFR Part 112). Spills would be attended to and not allowed to flow to nearby surface water.
	Potential impacts associated with the enlargement of the equipment barge unloading area and facilities and dredging, if needed, would temporarily increase suspended sediments and disturb the immediate area	S	The modification would be performed using cutoff wall technology (sheet piles) to isolate the equipment barge unloading area from the turning basin. Dredging, if necessary, will conform to guidance provided by the Army Corp of Engineers and dredging permit conditions.
	Potential impacts from the construction of radial collector wells and supporting infrastructure could impact red mangroves and subsequently the mangrove rivulus, a state and federal species of special concern.	S	Construction activities would be controlled so as to minimize any impacts to red mangroves or mangrove rivulus.

Table 4.6-1 (Sheet 6 of 9)
Summary of Measures and Controls to Limit Adverse Impacts during Construction

Impact	Description of Potential Impact	Significance of Impact[(a)]	Planned Control Program
4.4 Socioeconomic Impacts			
4.4.1 Physical Impacts	Potential impacts associated with noise during construction activities	S	Noise surveys indicate that noise generated from construction activities would be attenuated by distance from the source and, therefore, would not significantly affect offsite areas. Thus, no mitigation would be required.
	Potential impacts from fugitive dust and fine particulate matter emissions	S	Specific mitigation measures such as stabilizing construction roads and unsuitable spoils piles, limiting speeds on unpaved construction roads, using water for dust control, covering haul trucks, and revegetating road medians and slopes would be implemented in a dust control plan.
	Potential impacts from emissions from construction activities	S	Phase construction to minimize daily emissions. Perform proper maintenance of construction vehicles to maximize efficiency and minimize emissions.
	Potential impacts from Greenhouse Gas emissions from construction activities	S	Phase construction to minimize daily emissions. Perform proper maintenance of construction vehicles to maximize efficiency and minimize emissions.
	Potential aesthetic impacts from the construction of transmission corridors	M	Impacts to the natural and built environment would be minimized to the extent feasible through the selection process (i.e., to the extent practicable follow existing corridors), engineering options, and construction techniques used.
	Potential impacts from the delivery of construction materials and from workers commuting to the site that would increase peak hourly traffic on area roads	M	A new entrance and access roads would be constructed to access Units 6 & 7 and existing roads would be improved.
4.4.2 Social and Economic Impacts	Potential impacts from the increase in population due to in-migration of peak workers during construction	MDC: S H&FC: S	No mitigation would be required.
	Potential impacts from the loss of construction jobs, population, wage income, and income due to the out-migrating construction workforce as construction is completed	MDC: S H&FC: S-M	Out-migration would occur gradually over the last few years of the construction phase, and the loss of construction workers would be partially offset by the higher-income incoming operations workers. Timely communication would be maintained with municipal and county government authorities and nongovernmental organizations to disseminate project information that could have socioeconomic impacts in the community. Timely information would be provided to the local media, enabling businesses and individuals to make informed decisions and economic choices.

Table 4.6-1 (Sheet 7 of 9)
Summary of Measures and Controls to Limit Adverse Impacts during Construction

Impact	Description of Potential Impact	Significance of Impact[(a)]	Planned Control Program
4.4.2 Social and Economic Impacts (cont.)	Potential impacts from indirect jobs reducing the unemployment in the region of interest	S, positive	The assumption is that all indirect jobs would be filled by people currently residing within the region of interest. No mitigation would be required.
	Potential impacts from workers' wages on the local economy	MDC: S, positive H&FC: S, positive	No mitigation would be required.
	Potential impacts from the collection of taxes during the construction period of Turkey Point Units 6 & 7	MDC: S, positive H&FC: S-M, positive	No mitigation would be required.
	Potential impacts from new residential or commercial development	MDC: S H&FC: S	Communication would be maintained with local and regional governmental and nongovernmental organizations, including but not limited to the Department of Planning and Zoning and Department of Community and Economic Development, to disseminate project information in a timely manner. This would allow these organizations to be given the opportunity to plan accordingly.
	Potential impacts from increased traffic on roads due to deliveries of fill and construction materials to Units 6 & 7	S	Fill deliveries would not coincide with the peak commuting hour and construction materials deliveries would be made throughout the day and not be concentrated during the peak hour of travel.
	Potential impacts from increased traffic on the roads in the vicinity as a result of construction workers	MDC: S H&FC: M	A new entrance and access roads with three lanes would be constructed. Existing roads would be widened and turning lanes added.
	Potential impacts from increased traffic on roads in the vicinity as a result of outage workers	MDC: S H&FC: S	Impacts are small and temporary. The refueling schedule for Unit 6 would occur after the peak construction period.
	Potential aesthetic impacts from onsite construction structures, and noise and vehicle exhaust impacts from construction activities	MDC: S H&FC: S	No mitigation would be required.
	Potential impacts from the increased use of recreational facilities due to the increase in population	MDC: S H&FC: S	No mitigation would be required.

Table 4.6-1 (Sheet 8 of 9)
Summary of Measures and Controls to Limit Adverse Impacts during Construction

Impact	Description of Potential Impact	Significance of Impact[(a)]	Planned Control Program
4.4.2 Social and Economic Impacts (cont.)	Potential impacts from the decrease in available housing due to the population increase associated with construction	MDC: S H&FC: S	The current housing inventory is sufficient to accommodate 100 percent of the in-migrating workforce.
	Potential impacts from the additional water demand due to in-migrating workers	MDC: S H&FC: S	The increased demand from the estimated increase in population as a result of the construction-related workforce would not exceed the available capacity of the municipal water supplies. Communication would be maintained with local and regional governmental planning organizations such as the Miami-Dade County Department of Planning and Zoning, the Miami-Dade Water & Sewer Department (MDWASD), and South Florida Water Management District. Information could be shared such as project activity scheduling, and projected workforce in-migration, thereby giving the organizations time to prepare for demands on services.
	Potential impacts from additional wastewater requiring treatment due to in-migrating workers' water usage	MDC: S H&FC: S	The increased demand from the estimated increase in population as a result of the construction-related workforce would not exceed the available capacity of the Homestead WWTF and the MDWASD South District Wastewater Treatment Plant. Early communication would be maintained with local and regional governmental organizations, including planning commissions and local and regional economic development agencies, such as the Miami-Dade Planning and Zoning Department, to disseminate construction-related information in a timely manner. Local governments and planning groups would have time to plan for the influx. Infrastructure upgrades and expansions could be funded, at least in part, by construction-related property and sales use tax payments.
	Potential impacts from the increase in the residents-per-law enforcement officer and residents-per-firefighter ratios	MDC: S H&FC: S	Increased property and sales/use tax revenues generated during construction could be used to fund additional law enforcement officers and firefighters. However, expanding fire suppression services, including the hiring of additional personnel, would likely begin before a sufficient amount of these tax revenues would be available to local governments. Therefore, local governments could access other funding sources or issue bonds until the tax revenues would become available. Also, the peak construction workforce would not be in place until month 42 of construction activities, giving local governments time to plan and budget accordingly. Additionally, communication would be held regularly with local and regional governmental officials about the proposed Units 6 & 7 construction and its schedules, allowing local and regional officials ample opportunity to plan for the population influx.
	Potential impacts from the increased demand for medical services	S	No mitigation would be required.

Table 4.6-1 (Sheet 9 of 9)
Summary of Measures and Controls to Limit Adverse Impacts during Construction

Impact	Description of Potential Impact	Significance of Impact[(a)]	Planned Control Program
4.4.2 Social and Economic Impacts (cont.)	Potential impacts from increased student enrollment in public schools	MDC: S H&FC: S	The peak workforce during construction would not be reached sooner than the third year of construction, giving the school district a few years to make accommodations for the additional students. Schools could install modular classrooms, and recruit additional teachers, as the school population would increase between the start of construction activities and the peak of construction in 2019. Local communities would be provided with timely information regarding the proposed activities at Units 6 & 7, giving the school district several years to make accommodations for the additional influx of students.
4.4.3 Environmental Justice	Potential for disproportionately high adverse impacts to low-income and minority populations	Not applicable	No mitigation would be required.
4.5 Radiation Exposure to Construction Workers			
4.5 Radiation Exposure to Construction Workers	Potential radiation exposure to Unit 6 & 7 construction workers due to the operation of Units 3 & 4 and from Unit 6 after it becomes operational. Estimated dose would be within public dose criteria of 10 CFR 20 and 40 CFR 190	S	The plant area would be monitored during the construction period, and appropriate actions would be taken as necessary to ensure the doses to the construction workers are as low as is reasonably achievable.
4.8 Nonradiological Health Impacts			
4.8.2 Occupational Health	Potential for occupational injuries or illnesses due to construction activities	(b)	(b)

(a) The assigned significance levels [(S)mall, (M)oderate, or (L)arge] are based on the assumption that for each impact, the associated proposed mitigation measures and controls (or equivalents) would be implemented (10 CFR 51, Appendix B, Table B-1, Footnote 3).
(b) Impact is potential and estimates are based on national and Florida rates; therefore, impact severity and potential mitigation measures are not assigned.

FDEP = Florida Department of Environmental Protection
H&FC = Homestead and Florida City (area)
MDC = Miami-Dade County
SWPPP = Stormwater Pollution Prevention Plan

Table 4.6-2 (Sheet 1 of 12)
Separation of Preconstruction and Construction[(a)] Impacts

ER Section	Combined Preconstruction and Construction Impact Significance	Separation of Impacts; Significance and Percent		
		Preconstruction	Construction	Basis for Separation
4.1 Land-Use Impacts				
4.1.1 The Site and Vicinity	S	S (100)	S (0)	Impact caused by preparation of site for construction (e.g., clearing, grubbing) and, by definition, is not construction
4.1.2 Transmission Corridors and Offsite Areas				
4.1.2.1 Proposed Transmission Corridors	S	S (100)	NA	Transmission corridors not included in definition of construction
4.1.2.2 Offsite Substations	S	S (100)	NA	Offsite areas not included in definition of construction
4.1.2.3 Fill Borrow Areas	S	S (100)	NA	Offsite areas not included in definition of construction
4.1.2.4 Makeup Water Systems	S	S (100)	NA	Offsite areas not included in definition of construction
4.1.2.5 Access Roadways	S	S (100)	NA	Offsite areas not included in definition of construction
4.1.3 Historic Properties				
4.1.3.1 Onsite Facilities and Construction Areas	S	S (5)	S (95)	View offsite limited to large structures located in powerblock area. Preconstruction includes cranes erection and use. Construction work assembles buildings.
4.1.3.2 Offsite Transmission Line Corridors	S	S (100)	NA	Transmission corridors not included in definition of construction
4.1.3.3 Other offsite areas	S	S (100)	NA	Service facilities not included in definition of construction

Table 4.6-2 (Sheet 2 of 12)
Separation of Preconstruction and Construction[a] Impacts

ER Section	Combined Preconstruction and Construction Impact Significance	Separation of Impacts; Significance and Percent		
		Preconstruction	Construction	Basis for Separation
4.2 Water-Related Impacts				
4.2.1.1.1 Construction and Laydown Areas				
Surface Water	S	S (95)	S (5)	Separation between preconstruction and construction based on acreage[b]
Groundwater	S	S (95)	S (5)	Separation between preconstruction and construction based on acreage[b]
4.2.1.1.2 Spoils Area Establishment				
Surface Water	S	S (100)	NA	Disturbance area located outside powerblock area
Groundwater	S	S (100)	NA	Disturbance area located outside powerblock area
4.2.1.1.3 Access Roads, Heavy Haul Road, Bridges, and Equipment Barge Unloading Area Improvements				
Surface Water	S	S (100)	NA	Disturbance area located outside powerblock area
Groundwater	S	S (100)	NA	Disturbance area located outside powerblock area
4.2.1.1.4 Security Facilities				
Surface Water	S	S (100)	NA	Disturbance area located outside powerblock area
Groundwater	S	S (100)	NA	Disturbance area located outside powerblock area
4.2.1.1.5 Construction Utilities				
Surface Water	S	S (95)	S (5)	Separation between preconstruction and construction based on acreage[b]
Groundwater	S	S (95)	S (5)	Separation between preconstruction and construction based on acreage[b]

Table 4.6-2 (Sheet 3 of 12)
Separation of Preconstruction and Construction[(a)] Impacts

ER Section	Combined Preconstruction and Construction Impact Significance	Separation of Impacts; Significance and Percent		
		Preconstruction	Construction	Basis for Separation
4.2.1.1.6 Construction Facilities and Preparation Activities				
Surface Water	S	S (95)	S (5)	Separation between preconstruction and construction based on acreage[(b)]
Groundwater	S	S (95)	S (5)	Separation between preconstruction and construction based on acreage[(b)]
4.2.1.1.7 Constructing FPL Reclaimed Water Treatment Facility				
Surface Water	S	S (100)	NA	Disturbance area located outside powerblock area
Groundwater	S	S (100)	NA	Disturbance area located outside powerblock area
4.2.1.1.8 Constructing Radial Collector Wells				
Surface Water	S	S (100)	NA	Disturbance area located outside powerblock area
Groundwater	S	S (100)	NA	Disturbance area located outside powerblock area
4.2.1.1.9 Deep Injection Wells				
Surface Water	S	S (100)	NA	Disturbance area located outside powerblock area
Groundwater	S	S (100)	NA	Disturbance area located outside powerblock area
4.2.1.1.10 Onsite Connector Transmission Corridors				
Surface Water	S	S (100)	NA	Disturbance area located outside powerblock area
Groundwater	S	S (100)	NA	Disturbance area located outside powerblock area

Table 4.6-2 (Sheet 4 of 12)
Separation of Preconstruction and Construction[(a)] Impacts

ER Section	Combined Preconstruction and Construction Impact Significance	Separation of Impacts; Significance and Percent		
		Preconstruction	Construction	Basis for Separation
4.2.1.1.11 Potable Water Pipelines				
Surface Water	S	S (100)	NA	Disturbance area located outside powerblock area
Groundwater	S	S (100)	NA	Disturbance area located outside powerblock area
4.2.1.2 Offsite Facilities				
4.2.1.2.1 Borrow Areas				
Surface Water	S	S (100)	NA	Offsite areas not included in definition of construction
Groundwater	S	S (100)	NA	Offsite areas not included in definition of construction
4.2.1.2.2 Transmission Corridors	S	S (100)	NA	Transmission corridors not included in definition of construction
4.2.1.2.3 Reclaimed Water Pipelines				
Pipeline – Surface Water	S	S (100)	NA	Offsite areas not included in definition of construction
Pipeline – Groundwater	S	S (100)	NA	Offsite areas not included in definition of construction
Treatment Facility – Surface Water	S	S (100)	S (0)	Disturbance area located outside powerblock area
Treatment Facility – Groundwater	S	S (100)	S (0)	Disturbance area located outside powerblock area

Table 4.6-2 (Sheet 5 of 12)
Separation of Preconstruction and Construction[(a)] Impacts

ER Section	Combined Preconstruction and Construction Impact Significance	Separation of Impacts; Significance and Percent		
		Preconstruction	Construction	Basis for Separation
4.2.1.2.4 Offsite Roads				
Surface Water	S	S (100)	NA	Offsite areas not included in definition of construction
Groundwater	S	S (100)	NA	Offsite areas not included in definition of construction
4.2.1.2.5 Potable Water Pipeline	S	S (100)	NA	Offsite areas not included in definition of construction
4.2.2 Water Use Impacts				
4.2.2.1 Surface Water	None	None	None	Analysis concludes no impacts because no use
4.2.2.2 Groundwater				
4.2.2.2.1 Onsite Areas	S	S (95)	S (5)	Separation between preconstruction and construction based on acreage[(b)]
4.2.2.2.2 Offsite Areas	S	S (100)	NA	Offsite areas not included in definition of construction
4.2.3 Water-Quality Impacts				
4.2.3.1 Surface Water				
Onsite Areas	S	S (95)	S (5)	Separation between preconstruction and construction based on acreage[(b)]
Offsite Areas	S	S (100)	NA	Offsite areas not included in definition of construction
4.2.3.1 Groundwater				
4.2.3.2.1 Onsite Areas	S	S (95)	S (5)	Separation between preconstruction and construction based on acreage[(b)]
4.2.3.2.2 Offsite Areas	S	S (100)	NA	Offsite areas not included in definition of construction

Table 4.6-2 (Sheet 6 of 12)
Separation of Preconstruction and Construction[(a)] Impacts

ER Section	Combined Preconstruction and Construction Impact Significance	Separation of Impacts; Significance and Percent		
		Preconstruction	Construction	Basis for Separation
4.3 Ecological Impacts				
4.3.1 Terrestrial Ecosystems				
4.3.1.1 Potential Impacts to the Units 6 & 7 Site and other Onsite Areas				
4.3.1.1.1 Plants and Plant Communities	S	S (100)	S (0)	Impact caused preparation of site for construction (e.g., clearing, grubbing) and, by definition, is not construction
4.3.1.1.2 Threatened and Endangered Species				
Crocodile	M	M (50)	M (50)	Impact significance based on combination of level of physical activity and proximity to habitat. 50/50 split is reasonable between preconstruction and construction
Wood storks	S	S (95)	S (5)	Separation between preconstruction and construction based on acreage[(b)]
Manatees	S	S (100)	S (0)	Area of potential impact, barge basin and channel, not in powerblock area
Eastern Indigo Snake	S	S (100)	S (0)	Area of potential impact, uplands, not in powerblock area
4.3.1.1.3 Other Important Species	S	S (95)	S (5)	Separation between preconstruction and construction based on acreage[(b)]
4.3.1.1.4 Wetlands	M	M (100)	S (0)	Impact caused by preparation of site for construction (e.g., clearing, grubbing) and, by definition, is not construction

Table 4.6-2 (Sheet 7 of 12)
Separation of Preconstruction and Construction[(a)] Impacts

ER Section	Combined Preconstruction and Construction Impact Significance	Separation of Impacts; Significance and Percent		
		Preconstruction	Construction	Basis for Separation
4.3.1.1.5 Other Construction Impacts				
Noise	S	S (95)	S (5)	Separation between preconstruction and construction based on acreage[(b)]
Avian collisions	S	S (0)	S (100)	Impacts most likely limited to large structures located above ground in powerblock area
Light pollution	S	S (95)	S (5)	Separation between preconstruction and construction based on acreage[(b)]
4.3.1.2 Potential Impacts of Makeup Water Systems				
4.3.1.2.1 Reclaimed Water Pipelines and Pipelines	S	S (100)	NA	Offsite areas not included in definition of construction
4.3.1.2.1 Radial collector wells	S	S (100)	S (0)	Area of potential impact not in powerblock area
4.3.1.3 Potential Impacts to Off-site Areas				
4.3.1.3.1 Transmission Corridors	S	S (100)	NA	Transmission corridors not included in definition of construction
4.3.1.3.2 Borrow material	S	S (100)	NA	Offsite areas not included in definition of construction
4.3.1.3.3 Access Roads and Potable Water Pipeline	S	S (100)	NA	Offsite areas not included in definition of construction
4.3.2 Aquatic Ecosystems				
4.3.2.1 General Impacts to Aquatic Resources				
4.3.2.1.1 Sedimentation	S	S (95)	S (5)	Separation between preconstruction and construction based on acreage[(b)]
4.3.2.1.2 Turbidity	S	S (95)	S (5)	Separation between preconstruction and construction based on acreage[(b)]

Table 4.6-2 (Sheet 8 of 12)
Separation of Preconstruction and Construction[(a)] Impacts

ER Section	Combined Preconstruction and Construction Impact Significance	Separation of Impacts; Significance and Percent		
		Preconstruction	Construction	Basis for Separation
4.3.2.1.3 Petroleum Spills	S	S (95)	S (5)	Separation between preconstruction and construction based on acreage[(b)]
4.3.2.1 General Impacts to Aquatic Resources (cont.)				
4.3.2.1.4 Habitat Disturbance	S	S (95)	S (5)	Separation between preconstruction and construction based on acreage[(b)]
4.3.2.2 Potential Impacts to the Units 6 & 7 Site and Other On-Site Aquatic Resources				
4.3.2.2.1 Equipment Barge Unloading Area	S	S (100)	S (0)	Area of potential impact, barge basin and access channel, not in powerblock area
4.3.2.2.2 Drilling deep injection wells	None	None	None	No aquatic habitats impacted
4.3.2.2.3 Parking and Laydown Areas	S	S (100)	S (0)	Area of potential impact not in powerblock area
4.3.2.3 Potential Impacts to Off-Site Aquatic Resources				
4.3.2.3.1 Reclaimed Water Pipelines	S	S (100)	NA	Offsite areas not included in definition of construction
4.3.2.3.2 Radial Collector Wells	S	S (100)	S (0)	Area of potential impact not in powerblock area
4.3.2.3.3 Transmission Corridors	S	S (100)	NA	Transmission corridors not included in definition of construction
4.3.2.3.4 Roadway improvements	S	S (100)	NA	Offsite areas not included in definition of construction
4.3.2.3.5 Borrow Material	S	S (100)	NA	Offsite areas not included in definition of construction

Table 4.6-2 (Sheet 9 of 12)
Separation of Preconstruction and Construction[a] Impacts

ER Section	Combined Preconstruction and Construction Impact Significance	Separation of Impacts; Significance and Percent		
		Preconstruction	Construction	Basis for Separation
4.4 Socioeconomic Impacts				
4.4.1 Physical Impacts of Construction				
4.4.1.1 Noise				
Onsite	S	S (95)	S (5)	Separation between preconstruction and construction based on acreage[b]
Transmission corridors	S	S (100)	NA	Transmission corridors not included in definition of construction
Offsite	S	S (100)	NA	Offsite areas not included in definition of construction
Traffic	S	S (65)	S (35)	Labor hours[c]
4.4.1.2 Air	S	S (95)	S (5)	Separation between preconstruction and construction based on acreage[b]
4.4.1.3 Aesthetics				
Onsite	S	S (0)	S (100)	View offsite limited to large structures located in powerblock area. Preconstruction includes cranes erection and use. Construction work assembles buildings.
Offsite, eastern transmission corridors	S	S (100)	NA	Transmission corridors not included in definition of construction
Offsite, western transmission corridors	M	M (100)	NA	Transmission corridors not included in definition of construction

Table 4.6-2 (Sheet 10 of 12)
Separation of Preconstruction and Construction[a] Impacts

ER Section	Combined Preconstruction and Construction Impact Significance	Separation of Impacts; Significance and Percent		
		Preconstruction	Construction	Basis for Separation
4.4.1.4 Traffic				
Commuter	M	M (65)	M (35)	Labor hours[c]
Fill movement	M	M (25)	M (75)	Fill for Units 6 & 7 plant area, most, estimated at 75 percent of work activity, for deepest excavation (powerblock area) to bring to finish grade
Barge	S	S (100)	S (0)	Area of potential impact, barge basin and access channel, not in powerblock area
4.4.2 Social and Economic Impacts				
4.4.2.1 Demography	S	S (65)	S (35)	Labor hours[c]
4.4.2.2 Impacts to the Community				
4.4.2.2.1 Economy				
Unemployment in Region of Influence	S	S (65)	S (35)	Labor hours[c]
4.4.2.2.1.1 Construction In-Migrants	S	S (65)	S (35)	Labor hours[c]
4.4.2.2.1.2 Operations In-Migrants	S	S (0)	S (100)	Assumed that operations workers onsite during peak construction would be training for jobs in powerblock area
4.4.2.2.1.4 End of Construction Period	S-M	S-M (65)	S-M (35)	Labor hours[c]
4.4.2.2.2 Taxes				
4.4.2.2.2.1 Personal and Corporate Income Taxes	S	S (0)	S (100)	Unit 6 operating while Unit 7 construction finishing
4.4.2.2.2.2 Sales and Use Tax	S-M	S-M (65)	S-M (35)	Labor hours[c]

Table 4.6-2 (Sheet 11 of 12)
Separation of Preconstruction and Construction[a] Impacts

ER Section	Combined Preconstruction and Construction Impact Significance	Separation of Impacts; Significance and Percent		
		Preconstruction	Construction	Basis for Separation
4.4.2.2.2 Taxes (cont.)				
4.4.2.2.2.3 Other Sales and Use-Related Taxes	S	S (65)	S (35)	Labor hours[c]
4.4.2.2.2.4 Property Taxes – County and Special Districts	S-M	S (0)	S-M(100)	Plant book value based primarily on power block features
4.4.2.2.2.5 Property Taxes – Independent School District	S	S (0)	S (100)	Plant book value based primarily on power block features
4.4.2.2.3 Land Use				
4.4.2.2.3.1 Land Use	S	S (65)	S (35)	Labor hours[c]
4.4.2.2.3.2 Construction-Related Population Growth	S	S (65)	S (35)	Labor hours[c]
4.4.2.2.4 Transportation	M	M (65)	M (35)	Labor hours[c]
4.4.2.2.5 Aesthetics and Recreation				
4.4.2.2.5.1 Aesthetic Impacts to Recreation	S	S (5)	S (95)	View offsite limited to large structures located in powerblock area. Preconstruction includes cranes erection and use. Construction work assembles buildings.
4.4.2.2.5.2 Use Impacts to Recreation	S	S (65)	S (35)	Labor hours[c]
4.4.2.2.6 Housing	S	S (65)	S (35)	Labor hours[c]
4.4.2.2.7 Public Services				
4.4.2.2.7.1 Water Supply Facilities	S	S (65)	S (35)	Labor hours[c]
4.4.2.2.7.2 Wastewater Treatment Facilities	S	S (65)	S (35)	Labor hours[c]

Table 4.6-2 (Sheet 12 of 12)
Separation of Preconstruction and Construction[(a)] Impacts

ER Section	Combined Preconstruction and Construction Impact Significance	Separation of Impacts; Significance and Percent		
		Preconstruction	Construction	Basis for Separation
4.4.2.2.7 Public Services (cont.)				
4.4.2.2.7.3 Law Enforcement, Fire, and Medical Services	S	S (65)	S (35)	Labor hours[(c)]
4.4.2.2.8 Education	S	S (65)	S (35)	Labor hours[(c)]
4.4.3 Environmental Justice				
4.4.3.1 Health and Environmental Impacts	S	S (95)	S (5)	Separation between preconstruction and construction based on acreage[(b)]
4.4.3.2 Socioeconomic Impacts	S	S (65)	S (35)	Labor hours[(c)]
4.5 Radiation Exposure to Construction Workers	S	S (65)	S (35)	Labor hours[(c)]
4.8 Non-radiological Health Impacts	Not assigned	(65)	(35)	Labor hours[(c)]

(a) "Construction," as defined in 10 CFR 50.2 "Definitions," refers to the construction of "safety-related structures, systems, or components (SSCs) of a facility."
(b) Acreage – Work on powerblock area is assumed to be nuclear safety related and, therefore, construction. As shown in Table 3.9-2 and Figure 3.9-1, the powerblock area would occupy approximately 30 acres, or 5 percent, of a total 600 acres of disturbed land. Preconstruction would occupy the remainder, or 95 percent, of the acreage.
(c) Labor Hours - Work on powerblock area is assumed to be nuclear safety related and, therefore, construction. Preliminary construction estimates for a similar reactor facility (*Levy Nuclear Plant Units 1 and 2 COL Application, Part 3, Environmental Report*), suggest labor hour breakdown would be as follows: preconstruction 65 percent and construction 35 percent.
L = LARGE — For the issue, environmental impacts are clearly noticeable and are sufficient to destabilize important attributes of the resource.
M = MODERATE — Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
NA = Not applicable.
S = SMALL — Environmental effects are not detectable or are so minor they will neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, impacts that do not exceed permissible levels in U.S. Nuclear Regulatory Commission regulations are considered SMALL.

4.7 CUMULATIVE IMPACTS RELATED TO CONSTRUCTION ACTIVITIES

This section addresses cumulative impacts to the region's environment that could result from the construction of Units 6 & 7. A cumulative impact is defined in Council of Environmental Quality regulations (40 CFR 1508.7) as an "impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions."

To determine cumulative impacts, the impacts of the construction of Units 6 & 7, as described in Chapter 4, are combined with other past, present, and reasonably foreseeable future actions at and in the vicinity (within 6 miles of Units 6 & 7) that would affect the same resources, regardless of what agency (federal or nonfederal) or person undertakes such other actions. The cumulative impacts addressed in this section are those expected to overlap with the impacts of the proposed construction as a result of timing and geographic area. The geographic area that was used when considering cumulative impacts for the various resource areas is described in Table 4.7-1. Not all of the impacts of the proposed construction would be cumulative with other past, present, and reasonably foreseeable actions. For example, impacts that would not extend beyond the boundaries of the Units 6 & 7 construction site (the Units 6 & 7 plant area) would not be cumulative with other projects. In addition, the impacts of Units 6 & 7 construction are based on existing environmental conditions, so the construction impact analyses have already accounted for present actions when the existing state of the resource is used as a comparison for impacts. For example, impact analysis for water quality and aquatic ecology resources uses existing conditions as the baseline for determining impacts. The baseline accounts for the discharges to surface and groundwater from the past as well as the present because discharges directly influence water quality parameters. The aquatic ecology resources baseline would account for past and present actions that play a role in the vitality of aquatic populations and their habitat's ability to sustain a viable population.

During the process of identifying potential projects that could contribute cumulative impacts, a detailed search was conducted for all federal, non-federal and private actions within a 50-mile radius of Turkey Point Units 6 & 7 that had requested either an air or water permit/license or had an environmental impact statement completed. The search was accomplished by searching federal (e.g. USCOE, USGS), state (e.g. FDEP, FDOT), and local (e.g. M-D DERM) websites. The list was refined to projects that were within a 6-mile radius of Turkey Point Units 6 & 7, then within the required time frame of preconstruction and construction activities of Turkey Point Units 6 & 7, excluding all brownfield and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites.

The time frame for potential projects that could contribute to cumulative impacts was 2013 to 2022. This time frame was determined using the schedule for preconstruction activities beginning in the third quarter of 2013 with completion of construction in the fourth quarter of 2022.

Other projects in the area considered for cumulative impacts but not retained for analysis are described in Table 4.7-3. Distances listed in Table 4.7-3 are from the Units 6 & 7 plant area unless otherwise noted.

4.7.1 LAND USE

Onsite construction activities are planned for disturbed land and/or land with existing structures. In addition, protective measures are required during construction activities in accordance with applicable permits. Land use impacts to offsite areas as a result of the construction of transmission lines, substations, the reclaimed water pipelines, and potable water pipelines have been characterized as SMALL. Therefore, the impacts to land use from construction would be SMALL and would not require mitigation.

Projects in the vicinity of Homestead and Florida City were considered for cumulative land use impacts. A review of the adopted 2015-2025 Comprehensive Development Plan for Miami-Dade County indicates that land in the immediate vicinity of Turkey Point, in unincorporated Miami-Dade County, would remain protected land, open land, parkland, or agricultural land and would not be subject to development. Land farther to the west in the urban areas of Homestead and Florida City had land use designations that would allow development in accordance with local zoning restrictions (MDC Nov 2007).

The existing facilities at Turkey Point as well as the Units 3 & 4 uprate would not impact land use. The Units 3 & 4 Independent Spent Fuel Storage Installation (ISFSI) would be constructed on land among existing structures near Units 3 & 4 where the ground was disturbed during their construction. The INGENCO Resource Recovery Facility would be constructed at an existing landfill and would not impact land use. Homestead-Miami Speedway improvement project would change the land use designation for a 120-acres plot from “agriculture” to “business and office”. However, the land is currently used for overflow parking during speedway events, and the impact on area land use would be minimal. The Comprehensive Everglades Restoration Plan (CERP) projects would restore wetlands in the vicinity, which would provide a land use benefit. Area parks, nature preserves, and the Everglades Mitigation Bank (EMB) would continue to preserve wetlands and forested areas and would not contribute or detract from land use impacts. The cumulative land use impacts would be SMALL.

The projects discussed above were considered for cumulative impacts to historical properties. Those projects that would disturb land that was not previously disturbed would have the potential for impacts to historical properties. The existing facilities at Turkey Point, including the Units 3 & 4 uprate and the EMB, do not involve land disturbance and would not involve new structures. The Units 3 & 4 ISFSI does involve land disturbance, but it would be constructed among existing structures so its existing location was previously disturbed. The INGENCO Resource Recovery Facility and the Homestead-Miami Speedway improvement project would also be constructed on previously disturbed land. The CERP projects involve land disturbance and, therefore, have the potential to impact historic or cultural sites during construction. The projects' construction activities would be focused in areas where the land is previously disturbed to install the cooling canals of the industrial wastewater facility, thereby decreasing the likelihood of impacts to historic or cultural sites. Should such impacts occur, they could be additions, but temporary, with those of Units 6 & 7 construction. Therefore, cumulative impacts to historic properties would not be more severe than the impact to historic properties posed by the construction of Units 6 & 7.

4.7.2 HYDROLOGY AND WATER USE

4.7.2.1 Surface Water

Subsection 4.2 addresses hydrologic alterations affecting surface water as a result of the construction of onsite and offsite structures. The water bodies and areas that would be affected by the construction of Units 6 & 7 are the mudflats (consisting of wet organic soil material) in the plant area, the remnant canals in the plant area, a dead-end canal located northwest of the plant area, the nuclear administration building, training building, and parking area on land north of the Units 6 & 7 plant area consisting of mangrove swamps/wetlands, and the barge turning basin. Offsite canals, surface drainage features, and wetlands could be affected from crossing by the reclaimed water pipelines, potable water pipelines, transmission lines, access road, and bridges. The analysis concluded that impacts would be SMALL.

Units 1 through 4 use the industrial wastewater facility for heat dissipation. Unit 5 uses mechanical draft cooling towers for heat dissipation. These towers receive water from the Upper Floridan aquifer for use as makeup water and route their blowdown to the industrial wastewater facility. The operations of Units 1 through 5 do not impact surface water beyond the industrial wastewater facility. The construction activities for Units 6 & 7 would impact the industrial wastewater facility, but the impacts would not extend to offsite areas.

The Units 3 & 4 uprate involves construction activities conducted in the interior of existing structures, so hydrologic alterations would not be made and the cooling canals in the industrial wastewater facility would continue to be used after the uprate is completed. The Units 3 & 4 ISFSI would be incorporated into Turkey Point's stormwater management program and would not have the potential to impact surface water.

The INGENCO Resource Recovery Facility and the Homestead-Miami Speedway improvement project would be constructed at sites that have an existing stormwater management program.

The new facilities would be incorporated into the existing stormwater management program and would not have the potential to impact surface water. Area parks, nature preserves, and the EMB would continue to preserve wetlands and would not contribute or detract from surface water and water use impacts. The purpose of the CERP projects is to make beneficial hydrologic alterations that would have large beneficial surface water impacts. Accordingly, the cumulative impacts to surface water would be positive and LARGE owing to the EMB and CERP projects. The hydrologic alterations resulting from construction of Units 6 & 7 would be only a SMALL detractor to this overall beneficial impact of restoring wetlands in the area.

4.7.2.2 Groundwater

Section 4.2 describes hydrologic alterations as a result of the construction of onsite and offsite structures and their potential to affect groundwater in the Floridan and Biscayne aquifers and concludes that these alterations would have a SMALL impact to groundwater resources. In addition, the analysis considered impacts to groundwater from dewatering activities at both onsite and offsite construction locations. The impacts were characterized as localized, temporary, and SMALL.

The other Turkey Point facilities use water supplied by Miami-Dade County and, therefore, do not impact groundwater resources. The EMB and CERP would provide beneficial impacts to groundwater because of their preservation and restoration of wetlands providing recharge to subsurface waters. The INGENCO Resource Recovery Facility and the Homestead-Miami Speedway improvement project would be required to follow state and local guidelines to minimize impacts to groundwater resources. Therefore, these facilities and projects would not contribute to adverse groundwater impacts, so the cumulative impact including the construction of Units 6 & 7 would be SMALL.

4.7.2.3 Water Use

The water needed for Units 6 & 7 construction activities would be supplied by Miami-Dade County from their potable water supply. No water would be withdrawn from surface water or groundwater wells for use in onsite or offsite construction activities. Therefore, there would be no impacts to water resources due to water use aside from the potential impact to public water supplies, which are considered as one aspect of the socioeconomic impacts.

4.7.2.4 Water Quality

The clearing, excavating, filling, grading, dewatering, and soil stockpiling associated with the construction of Units 6 & 7 and offsite facilities (i.e., transmission lines, reclaimed water pipelines, potable water pipelines, the FPL-owned fill source) could potentially impact water quality. However, the impacts of constructing Units 6 & 7 would be minimized from the application of environmental controls that would be part of an erosion, sedimentation, and pollution control plan and implementation of environmental best management practices, including structural and operational controls to prevent the movement of pollutants (including sediments) into wetlands and water bodies via stormwater runoff. The construction activities associated with the enlargement of the equipment barge unloading area would inevitably disturb sediments and soils that could increase turbidity immediately in the turning basin, which could migrate to Biscayne Bay. The water quality impacts that could result from the construction of Units 6 & 7 were characterized as SMALL (Section 4.2).

The other projects previously identified could also impact water quality. The area expected to be disturbed by the other projects is more than one acre. Therefore, those construction activities would also have to implement erosion, sedimentation, and pollution control plan and environmental best management practices in compliance with the EPA's Phase I stormwater regulations. The INGENCO Resource Recovery Facility and the Homestead-Miami Speedway improvement project would be required to follow state and local guidelines to minimize impacts to surface and groundwater resources. The application of the erosion and pollution prevention plans and environmental best management practices to the CERP projects would minimize impacts to water quality to those that are SMALL and temporary. The cumulative impact to surface water quality, should any of these individual SMALL, temporary impacts become additive, would also be SMALL given the application of control measures that protect water quality.

The projects were also assessed for cumulative impacts to groundwater quality. As stated above, the existing units, Units 6 & 7 construction activities, as well as the CERP, INGENCO Resource Recovery Facility, and the Homestead-Miami Speedway improvement project construction activities would be subject to pollution prevention plans. Implementation of such plans would ensure that the impact of any spills would be minimized by quick responses and the use of appropriate spill cleanup equipment. Therefore, cumulative impacts to groundwater quality would be SMALL.

4.7.3 ECOLOGY (TERRESTRIAL AND AQUATIC)

4.7.3.1 Terrestrial

Cumulative impacts to terrestrial resources were assessed for the Turkey Point plant property and offsite areas. The operation of the Units 3 & 4 ISFSI would not impact terrestrial resources. The EMB would have no negative impacts on terrestrial resources. The Units 3 & 4 uprate construction would be to the interior of existing structures, so this project would not contribute to cumulative impacts to terrestrial resources. Existing Turkey Point facilities and operations are subject to management/conservation plans designed to protect important species with a particular focus on the American crocodile. Some of the features of the management/ conservation program are:

- Habitat preservation and creation of habitat suitable for crocodile nesting and basking
- Establishment of exclusion zones at known nesting sites (nest sanctuaries)
- Daytime and nighttime monitoring surveys to document nesting activity and use of the cooling canals
- Capture and tagging of hatchlings using Avid microchip technology
- Relocation of hatchlings to low-salinity habitat during early life stages to increase survival
- Recapture, monitoring, and release of individuals to document growth and survival

As described in Subsection 2.4.1.2, Turkey Point's conservation efforts have contributed to the increase in population of the American crocodile. In addition, other species of special concern are protected with project-specific management plans (Section 4.3) (FPL Jan 2008).

Therefore, the existing Turkey Point facilities would have only a small contribution to the cumulative impact.

The portions of CERP projects that are adjacent to the Turkey Point plant property could potentially lead to temporary cumulative impacts to terrestrial resources. The objective of the project is to restore wetlands and, therefore, restore habitat for terrestrial species that inhabit wetlands. Portions of the CERP projects are in the area designated as critical habitat for the American crocodile (see Figure 2.4-4) and, therefore, would be subject to controls to ensure the protection of local populations. The CERP projects would serve to enhance wetland habitat and would ultimately provide a beneficial impact to local populations. As addressed in Subsection 4.7.2.4, these projects would have to implement measures to protect water quality. Given the temporary nature of the impacts, the objective of the CERP projects to restore and enhance habitat, and the application of measures to protect water quality and crocodile populations, they would have a SMALL impact on terrestrial resources that would contribute to temporary cumulative impacts. The terrestrial impact of Units 6 & 7 construction was characterized as SMALL to MODERATE. The additive and possibly synergetic affect of both Units 6 & 7 construction and the CERP projects construction activities would be temporary. Therefore, the overall cumulative impact to terrestrial resources during Units 6 & 7 construction would be MODERATE.

4.7.3.2 Aquatic

The projects described in Table 4.7-2 were considered for cumulative impacts to the aquatic ecological resources to the north and west of the Turkey Point plant property, as well as the downstream points (i.e., Biscayne Bay and Card Sound). The impact to aquatic resources from the construction of Units 6 & 7 and offsite facilities is characterized as SMALL in Subsection 4.3.2.

Operation of the Units 3 & 4 ISFSI would not result in an impact to aquatic resources because it is a storage facility that does not use water and does not have environmental emissions that would be additive with construction of Units 6 & 7. Likewise, the interior construction activities of the Units 3 & 4 uprate would also not impact aquatic resources. The EMB would not have adverse impacts on aquatic resources. Operating the existing units would have impacts to aquatic ecology through their continued use of the industrial wastewater facility. However, the SMALL aquatic ecology impact from the construction of Units 6 & 7 would be isolated to impacted areas and would not be additive to the impacts of the existing facilities.

Impacts as a result of construction at offsite locations could be cumulative with impacts from the CERP projects, INGENCO Resource Recovery Facility and the Homestead-Miami Speedway improvements. However, as stated in Subsection 4.7.2, these other projects would apply measures to protect surface water resources and aquatic ecological resources. Therefore, impacts would be temporary, occurring during construction activities. The objective of the CERP projects is to restore wetlands, so aquatic ecological resources would benefit from these projects in the long-term. The cumulative impacts to aquatic resources would be SMALL.

4.7.4 SOCIOECONOMIC RESOURCES

Impacts to socioeconomic resources stem from the physical impacts of construction and from demands placed on the region by the workforces needing housing and public services, and also spending their salaries and paying taxes. The other facilities and projects considered for cumulative impacts are described in Table 4.7-2. These facilities and projects would have both positive and negative socioeconomic impacts to the Homestead and Florida City area as well as the wider 50-mile region of influence. These positive and negative socioeconomic impacts stem from physical impacts (noise, air emissions, and visual intrusions), current spending of salaries, payment of taxes, and use of public services.

The offsite physical impacts of constructing Units 6 & 7 would be SMALL with the exception of traffic impacts (Subsection 4.4.1) which would be MODERATE. The other construction projects in the immediate area (i.e., the CERP Project, INGENCO Resource Recovery Facility and Homestead-Miami Speedway improvements) would have physical impacts that are temporary and localized to their immediate area.

The facilities and projects described in Table 4.7-2 were considered for their potential to result in cumulative socioeconomic impacts as a result of workforces. Because the socioeconomic analysis presented in Subsection 4.4.2 uses existing socioeconomic conditions and forecasts based on existing conditions as a baseline, the impacts of the existing facilities would already have been accounted for in the impact analysis that concluded the impacts would be SMALL with the exception of transportation, which would be MODERATE during Units 6 & 7 construction. In addition to normal operations of the existing units, the nuclear units, Units 3 & 4, would also have periodic outages. Previous outages have required 600 to 1000 employees (FPL Jan 2008). These additional workers could temporarily increase traffic and housing demands. As addressed in Subsection 4.4.2.2.4, the existing units and new Units 6 & 7 would be using different entrances into Turkey Point, but would be using portions of the same feeder roadways. Outages could further impact these feeder roads if peak travel times for these workforces overlapped.

Construction workers and delivery vehicles supporting the Homestead-Miami Speedway improvement project would use portions of the same feeder roadways as those used for the existing units and construction of Units 6 & 7. However, the speedway improvements would be completed in the 4th quarter of 2013, just after preconstruction activities for Units 6 & 7 begin. Therefore, the cumulative impacts of the Units 3 & 4 uprate and Units 6 & 7 construction during the overlapping time period, spring to winter 2013, would be less than the impacts at the peak Units 6 & 7 construction activities, as described in previous sections of Chapter 4.

As presented in Subsection 4.4.2.2.6, available housing in the Homestead and Florida City area is more than adequate to accommodate the in-migrating population projected to settle there. In addition, the area has 788 full-hookup recreational vehicle spaces and 1410 hotel/motel rooms (Subsection 4.4.2.2.6). The occupancy rate for hotel/motel rooms in the area varies widely, with 50 percent occupancy rate reported for October 2007 and 89 percent reported for February 2007 (Subsection 2.5.2.6.4). Therefore, the additional demand for temporary housing created by outage workers could be accommodated in the Homestead and Florida City area, but at times temporary housing could be scarce. Miami-Dade County has 41,728 hotel/motel rooms (Subsection 2.5.2.6.4). Although several large construction projects (Port of Miami Tunnel, SR826/SR836 Interchange, Highspeed Passenger Rail, and CERP projects) in the region have schedules that overlap with the Unit 6 & 7 construction activities, most of these projects would either be completed before the peak construction for Units 6 & 7 or they are very long-term projects that would employ a small temporary workforce. So even if hotel/motel rooms become scarce in the Homestead and Florida City area, the additional workers have temporary housing opportunities in the region of interest.

The socioeconomic impact of constructing the Units 3 & 4 ISFSI would peak well before the start of Units 6 & 7 construction because ISFSI construction would be complete in 2011. The operation of the Units 3 & 4 ISFSI would support Units 3 & 4 operations and may require only a limited number of additional workers. Similarly, the socioeconomic impact of construction activities for the Units 3 & 4 uprate would peak well before the start of Units 6 & 7 construction because the uprate would be complete in 2012 and no additional workers would be needed to operate the uprated Units 3 & 4.

The EMB would have socioeconomic benefits to the area that are difficult to quantify as it preserves the natural state of the land. The more tangible socioeconomic benefits would include any taxes paid by FPL on the property and compensation to FPL employees that oversee it. However, these socioeconomic impacts would be accounted for in the baseline used for assessing Units 6 & 7 construction impacts and, therefore, EMB is not further considered for cumulative impacts.

Considering the two CERP projects in the immediate area, the SFWMD project managers indicated, when contacted in February 2009, that workforce estimates have not been developed to date. Given the schedule uncertainty and the lack of socioeconomic information on the Biscayne Bay Coastal Wetlands project, it is not considered for cumulative socioeconomic impacts. The C-111 Spreader Canal project construction activities would take place east of U.S. Highway 1, with the exception of placement of culverts under this highway and Card Sound Road. The most direct route to the construction site for the activities other than the culvert placements and possibly filling activities would be to travel west on SW 344th Street/Palm Drive away from Turkey Point. The route for filling activities could use U.S. Highway 1, but entry points to reach the canals would likely be south of the U.S. Highway 1's junction with SR 997. Given that a worker estimate could not be developed and the transportation routes to these construction activities and Turkey Point would diverge at SW 344 Street/Palm Drive, the C-111 Spreader project is not considered further for cumulative impacts (USACE and SFWMD Aug 2002).

The socioeconomic impacts of the INGENCO Resource Recovery Facility and Homestead-Miami Speedway improvements would occur during their construction when supplies are being purchased and workers are in the area spending their salaries and being accommodated by temporary housing. Construction of these projects would be completed and they would be in service in 2011 long before the peak Units 6 & 7 construction activities.

The positive socioeconomic impacts would be additional local and state revenues from tax collections, both sales tax on construction materials and sales and property taxes paid by workers. These tax revenues would be cumulative with the Units 3 & 4-related tax revenues. In addition, the projects would infuse money into the general economy through the purchase of materials, supplies, fuel, energy, and services and workers spending their salaries.

Other socioeconomic impacts as a result of the additional population in-migration could put a potential strain on community services such as transportation infrastructure, recreational facilities, law enforcement and fire protection, medical services, water supplies, wastewater treatment, and schools.

As presented in Subsection 4.4.3, environmental justice impacts were assessed for the construction of Units 6 & 7 and it was concluded that there were no construction-related impacts identified that would have disproportionately high and adverse effects on the human health, environment, and socioeconomics of minority or low-income populations. Therefore, no cumulative environmental justice impacts are expected.

4.7.5 SUMMARY

Cumulative impacts to land use, hydrology and water use, ecology, and socioeconomics as a result of the construction of Units 6 & 7 along with the operation and maintenance of the existing units, the Units 3 & 4 uprate, the Units 3 & 4 ISFSI, EMB, CERP projects, INGENCO Resource Recovery Facility, Homestead-Miami Speedway improvements, and other projects in the wider 50-mile region of influence were assessed. The cumulative impacts range from SMALL adverse to beneficially LARGE and are summarized in Table 4.7-3.

Section 4.7 References

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Table 4.7-1
Geographic Areas Used in Cumulative Analysis

Resource	Geographic Area
Land Use	Homestead and Florida City area
Hydrology & Water Use	Surface Water: Surface water at, adjacent to, or downstream of proposed action offsite areas and Turkey Point Groundwater: Biscayne aquifer underlying south Miami-Dade County and the Floridan aquifer
Ecology	Terrestrial: immediate surrounding area Aquatic: Surface water to the north of Turkey Point encompassing the reclaimed and potable water pipelines that are part of the proposed action and to the west to U.S. Highway 1 and the downstream points from this land area (i.e., Biscayne Bay and Card Sound).
Socioeconomics	Local: Homestead and Florida City area Regional: 50-mile radius of the Unit 6 & 7 project area

Table 4.7-2 (Sheet 1 of 17)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Turkey Point Site During the Construction Period (2013-2022)

Project Name	Summary of Project	Location	Status	Reference	Retained
Energy Projects					
FPL - Cutler Power Plant	Two-unit, 205-MW gas- and oil-fired plant	14 miles northeast of Turkey Point site	Operational	M-D DERM Feb 2009	No
FPL - Lauderdale Power Plant	Two-unit, 884-MW gas- and oil-fired plant	45 miles northeast of Turkey Point site	Operational	BCEPGMD Jan 2009	No
FPL - Port Everglades Power Plant	Four-unit, 1205-MW oil- and gas-fired plant	47 miles northeast of Turkey Point site	Operational	BCEPGMD Feb 2010	No
FPL - Turkey Point Power Plant	Five-unit, 3,220-MW power plant. Units 1 & 2 are oil- and gas-fired, Units 3 & 4 are nuclear, Unit 5 is gas-fired.	Turkey Point site	Operational	M-D DERM Mar 2009a	Yes
FPL - Turkey Point Power Plant Units 3 & 4 Uprate	The project will increase the net electrical generation for Units 3 & 4 by 104-MW each.	Turkey Point site	Proposed. Site Certification Application approved by FPSC in October 2008. Application to NRC submitted in 2010. Project completion expected 2nd quarter 2012.	FPL Jan 2008	Yes
Homestead City Utilities - Gordon W. Ivey Power Plant	16-unit, 60-MW oil-fired plant	9 miles northwest of Turkey Point site	Operational	M-D DERM May 2009a	No
INGENCO Resource Recovery Facility	24-unit, 8-MW landfill gas-fired power plant	6 miles northwest of Turkey Point site	Proposed. Draft Air Construction Permit issued March 2010	M-D DERM Mar 2010	Yes
Miami-Dade County Resource Recovery Facility	Four-unit 77-MW municipal solid waste-fired power plant	28 miles northwest of Turkey Point site	Operational	M-D DERM Mar 2008a	No
Wheelabrator South Broward, Inc. - Waste to Energy Facility	Three-unit 67.6-MW municipal solid waste-fired power plant	45 miles northeast of Turkey Point site	Operational	BCEPGMD Dec 2009a	No
Florida Gas Transmission Company Phase VIII Expansion Project	The FGT pipeline will be 6.5 miles long and parallel existing FGT pipelines and FPL transmission lines.	The pipeline will be installed along SW 97 Avenue north of Turkey Point and travel south toward Turkey Point site.	Proposed. The pipeline is planned to be in service in 2010 to 2011	FGT Sep 2008	No

Table 4.7-2 (Sheet 2 of 17)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Turkey Point Site During the Construction Period (2013-2022)

Project Name	Summary of Project	Location	Status	Reference	Retained
Transportation Projects					
Dade-Collier Training and Transition Airport	Precision instrument landing and training facility for commercial and general aviation.	46 miles northwest of Turkey Point site	Operational. Future development unlikely.	FDOT 2009	No
Fort Lauderdale/ Hollywood International Airport	Full service airport - commercial airlines, air cargo, and general aviation	46 miles northeast of Turkey Point site	Operational. Expansion and construction would occur in the future, as described in state and local planning documents.	FDOT 2009	No
Homestead Air Reserve Base Airport	Military airfield that is the home station to F-16C and F-15A aircraft.	5 miles northwest of Turkey Point site	Operational. Limited development is likely.	DOD Oct 2007	No
Homestead General Aviation Airport	General aviation airport.	15 miles northwest of Turkey Point site	Operational. Limited expansion would occur in the future, as described in state and local planning documents.	FDOT 2009	No
Kendall-Tamiami Executive Airport	General aviation airport.	17 miles northwest of Turkey Point site	Operational. Limited expansion would occur in the future, as described in state and local planning documents.	FDOT 2009	No
Miami International Airport	Full service airport - commercial airlines, air cargo, and general aviation. Third busiest international passenger airport in the U.S.	26 miles north of Turkey Point site	Operational. Completion of the $6.2 Billion Miami Intermodal Center capital improvement program expected in 2011.	FDOT 2009	No
North Perry Airport	General aviation airport.	40 miles north of Turkey Point site	Operational. Expansion and construction would occur in the future, as described in state and local planning documents.	FDOT 2009	No
Opa Locka Executive Airport	General aviation and reliever airport for Miami International. The airport is also home to a U.S. Coast Guard Air/ Sea Rescue Station.	33 miles north of Turkey Point site	Operational. Limited expansion would occur in the future, as described in state and local planning documents.	FDOT 2009	No

Table 4.7-2 (Sheet 3 of 17)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Turkey Point Site During the Construction Period (2013-2022)

Project Name	Summary of Project	Location	Status	Reference	Retained
Port Everglades	Large full-service deepwater seaport. Florida's main seaport for receiving petroleum products. Current annual throughput of 21.2 million tons of cargo and 128.8 million barrels of petroleum products. Cruise terminal serves 3.1 million passengers annually.	48 miles northeast of Turkey Point site	Operational. Port expansion, dredging, and construction would occur in the future, as described in state and local planning documents.	FSTEDC Mar 2010	No
Port of Miami	Large full-service deepwater seaport. Current annual cargo throughput of 6.8 million tons. Cruise terminal serves 4.1 million passengers annually.	26 miles northeast of Turkey Point site	Operational. Port expansion, dredging, and construction would occur in the future, as described in state and local planning documents.	FSTEDC Mar 2010	No
Port of Miami Tunnel & Access Improvement Project	The project will improve access to and from the Port of Miami, serving as a dedicated roadway connector linking the Port with the MacArthur Causeway (SR A1A) and I-395. The project consists of three primary components: widening of the MacArthur Causeway Bridge; tunnel connections between Watson Island and Dodge Island (the Port of Miami); and connections to the Port of Miami roadway system.	26 miles northeast of Turkey Point site	Planned. Construction began in July 2010 and the project could be operational by 2014.	FHWA Undated, Wallis Jul 2010	No
SR826/SR836 Interchange Reconstruction	The project involves a major upgrade to the interchange. Capacity improvements include the reconstruction and widening along both SR826 (Palmetto Expressway) and SR836 (Dolphin Expressway), construction of a four-level interchange, and modifications of the Flagler Street/SR826 and the Milam Dairy Road/NW 72nd Avenue/SR836 interchanges.	26 miles north of Turkey Point site	Planned. Construction began in October 2009 and is scheduled to be completed by late 2014	FHWA Undated	No

Table 4.7-2 (Sheet 4 of 17)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Turkey Point Site During the Construction Period (2013-2022)

Project Name	Summary of Project	Location	Status	Reference	Retained
Tampa – Orlando – Miami High-Speed Intercity Passenger Rail	This project would provide high-speed rail service from Tampa to Miami (through Orlando) with stops in West Palm Beach and Ft. Lauderdale. The termini for Orlando -Miami corridor are the Orlando International Airport (OIA) and the Miami Intermodal Center at the Miami Airport (MIA).	26 miles north of Turkey Point site	Proposed. Phase 1 (Tampa-Orlando corridor) is ongoing. Project development for Phase 2 (Orlando-Miami corridor) began in May 2010.	FDOT May 2010	No
Big Cypress National Preserve	Over 729,000 acres of valuable habitat for a variety of threatened and endangered species, including the Florida panther, West Indian manatee, red cockaded woodpecker, and wood storks. Public recreational activities include bird watching, camping, canoeing, bicycling, off road vehicles, hunting, hiking, and wildlife observation.	44 miles northeast of Turkey Point site	Development limited within property.	NPS Jun 2009	No
Bill Baggs Cape Florida State Park	The upland areas of Cape Florida have undergone a phenomenal transformation since Hurricane Andrew in 1992. Native plant communities have been recreated through continuous staff and volunteer efforts of planting and exotic plant eradication and control. About three miles beach and shoreline are the main attraction for the majority of the park visitors and provides opportunities for picnicking, swimming, bicycling, fishing, primitive camping and nature appreciation.	20 miles north of Turkey Point site	Development limited within property.	FDEP Mar 2001	No

Table 4.7-2 (Sheet 5 of 17)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Turkey Point Site During the Construction Period (2013-2022)

Project Name	Summary of Project	Location	Status	Reference	Retained
Biscayne National Park	A meld of four distinct ecosystems (mangrove forests, Biscayne Bay, Florida Keys islands, and coral reefs) supporting diverse wildlife including threatened and endangered species such as the West Indian manatee, eastern indigo snake, piping plover, American crocodile, peregrine falcon, Schaus' swallowtail butterfly, least tern, and five species of sea turtle. Public recreational activities include picnicking, hiking, wildlife watching, snorkeling, scuba diving, canoe/ kayaking, and fishing.	Adjacent to eastern edge of Turkey Point site property	Development likely limited within property.	NPS Jul 2010a	No
Crocodile Lake National Wildlife Refuge	The Refuge covers 6,700 acres of land, including 650 acres of open water. It contains a mosaic of habitat types, such as tropical hardwood hammock, mangrove forest, and salt marsh. These habitats are vital for hundreds of plants and animals including six federally listed species. The refuge is closed to the public however there is an interpretive butterfly garden adjacent.	12 miles south of Turkey Point site	Additional land acquisition is planned. Development likely limited within property.	USFWS Feb 2006	No
Curry Hammock State Park	The 970 acres represents the remaining example of the natural communities of the Middle Florida Keys and contains tropical hardwood hammocks, salt marshes, and mangrove wetlands. Public recreation activities include swimming, hiking, canoeing/kayaking, and camping.	26 miles southwest of Turkey Point site	Additional 23 acre land acquisition is planned Development likely limited within property.	FDEP Feb 2005	No

Table 4.7-2 (Sheet 6 of 17)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Turkey Point Site During the Construction Period (2013-2022)

Project Name	Summary of Project	Location	Status	Reference	Retained
Dagny Johnson Key Largo Hammock Botanical State Park	The 2,454 acres of park contain the largest intact West Indian hardwood hammock in the US harboring an extensive list of threatened and endangered plants and animals. In addition a very rare coastal rock barren community, a shoreline dominated by marine tidal swamps, and significant wetland habitat. Public recreation activities include hiking, picnicking, guided nature walks, and educational programs.	12 miles south of Turkey Point site	Development likely limited within property.	FDEP Sep 2004a	No
Everglades National Park	Primarily comprised of internationally important wetlands that cover 1,508,533 acres and are home to rare and endangered species such as the American crocodile, Florida panther, and West Indian manatee.	29 miles west of Turkey Point site	181,000 acres of additional land acquisition is proposed. Development likely limited within property.	NPS Jul 2010b, FNAI 2008, Thomas Reuters 2009	No
Florida Keys Wildlife and Environmental Area	An archipelago of small sites totaling 3,089 acres containing some of the best examples of tropical hardwood hammocks remaining in Florida. These sites protect native plants and animals, many of which are found nowhere else in the US. Recreational facilities or trails have not been developed in order to protect the sites' sensitive natural resources.	31 miles southeast of Turkey Point site	Development of facilities for public use is constrained by the presence of many unique plant and animal species.	USFWS Undated	No
Indian Key Historic State Park	The 110 acre property consists mostly of wetland and water areas that attract boaters for snorkeling and fishing activities. The ruins of the historic settlement on the island are available to the public via guided or self-guided tours.	43 miles southwest of Turkey Point site	Development of facilities for public use limited within property.	FDEP Jun 2000a	No

Table 4.7-2 (Sheet 7 of 17)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Turkey Point Site During the Construction Period (2013-2022)

Project Name	Summary of Project	Location	Status	Reference	Retained
John Pennekamp Coral Reef State Park	Submerged land covers over 98% of the 63,836 acres of the park. The water area contains the only living coral reef in the US and the land area consists of over 80,000 linear feet of shoreline with beaches and tropical hammocks. Public recreation activities include swimming, snorkeling, scuba diving, fishing, canoeing, glass bottom boat tours, hiking, camping, and nature appreciation.	17 miles south of Turkey Point site	Additional land acquisition is proposed. Development of facilities for public use limited within property.	FDEP Sep 2004b	No
John U. Lloyd Beach State Park	The park contains 311 acres on the Atlantic Ocean and Intercoastal Waterway and contains natural communities such as beach dunes, coastal strands, maritime hammocks, and tidal swamps. These provide habitat for 11 imperiled plant species and 20 imperiled animals. Public recreation facilities include two large beach use areas, seven large picnic pavilions, a two-lane boat ramp, a pavilion that provides nature study and environmental education opportunities, and a concession stand that provides; food services, and rentals.	47 miles north of Turkey Point site	Development of facilities for public use limited within property.	FDEP May 2001	No

Table 4.7-2 (Sheet 8 of 17)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Turkey Point Site During the Construction Period (2013-2022)

Project Name	Summary of Project	Location	Status	Reference	Retained
Lignumvitae Key Botanical State Park	Lignumvitae Key is the only Florida Key that is still in its natural state and was chosen as the state's first botanical park. Its rare and delicate ecosystem primarily consists of subtropical hardwood hammock. The smaller island Shell Key is primarily a mangrove island and has been left undisturbed. Islands accessible only by private boat. Public recreation activities include boating, fishing, snorkeling, and diving.	42 miles southwest of Turkey Point site	Development of facilities for public use limited within property.	FDEP Dec 2000	No
Mary Krome Bird Refuge	2.5 acre preserve is bordered on two sides by avocado groves. Public recreation activities include bird and butterfly watching	10 miles northwest of Turkey Point site	Development unlikely in the future.	NABA Undated	No
Oleta River State Park	The park's 1.7 miles of the Oleta River and its associated mangrove wetlands are important habitat for many species The West Indian manatee and golden leather fern are among the 40 designated plant and animal species found in the 1033 acre park. Public recreation activities include picnicking, swimming, canoeing, fishing, bicycling/jogging, and primitive camping.	36 miles north of Turkey Point site	Development of facilities for public use limited within property.	FDEP Dec 2008	No
San Pedro Underwater Archaeological Preserve State Park	The 644 acre preserve consists of the 1733 shipwreck “San Pedro” surrounded by a ring of sandy substrate and seagrass beds. Public recreation activities include snorkeling, scuba diving, and glass bottom boat tours.	45 miles southwest of Turkey Point site	Development unlikely in the future.	FDEP Jun 2000b	No

Table 4.7-2 (Sheet 9 of 17)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Turkey Point Site During the Construction Period (2013-2022)

Project Name	Summary of Project	Location	Status	Reference	Retained
The Barnacle Historic State Park	The historic structures in this 9 acre park were built in the late 1800s and include a boat house, carriage house, and the Barnacle house which was originally built as a wooden bungalow four feet off the ground on pilings. About half of the surrounding land supports a tropical hardwood hammock. The primary public activity on the site is visiting the historic home and touring the grounds.	21 miles north of Turkey Point site	Development unlikely in the future.	FDEP Aug 2003	No
Windley Key Fossil Reef Geological State Park	While the upland area at the 32 acre park contains one of the finest hardwood hammocks in the Florida Keys, the park's main attraction is the fossil coral reef exposed by the keystone quarry operations. Public recreation activities include education and interpretation programs, hiking, and nature appreciation.	36 miles southwest of Turkey Point site	Development unlikely in the future.	FDEP May 2003	No
Everglades Mitigation Bank (EMB)	The EMB is a 13,249 acre site permitted by the state of Florida and the Army Corps of Engineers. The EMB consists of land located between U.S. Highway 1 and Card Sound Road and east of Card Sound Road extending to Card Sound, then north along the L-31E Canal. EMB activities would be in accordance with permit conditions.	Just southwest of the Turkey Point site and east of U.S. Highway 1.	Development unlikely in the future.	FDEP Oct 1996, FDEP Oct 2003, USACE and SFWMD Aug 2002	Yes

Table 4.7-2 (Sheet 10 of 17)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Turkey Point Site During the Construction Period (2013-2022)

Project Name	Summary of Project	Location	Status	Reference	Retained
Comprehensive Everglades Restoration Plan (CERP) Projects					
Biscayne Bay Coastal Wetlands Project - Phase 1	The project would expand and restore wetlands adjacent to Biscayne Bay, and enhance the ecological health of Biscayne National Park. Phase 1 incorporates most of the Deering Estate features, including a spreader canal, culverts, and canal improvements. The Cutler Wetlands features include culverts, a canal and restoration of the Lennar Flow-way. The L-31E Flow-way/ North Canal Flow-way features include a spreader canal and several culverts.	1.5 miles west of Turkey Point site	Proposed. Design and permitting of Phase 1 completed. Construction of L-31E culverts and Deering Estates Flow-way began in 2010. Construction of Cutler Wetlands scheduled to begin in 2011.	SFWMD Jun 2010, USACE Jun 2010	Yes
Broward County Water Preserve Areas	Project serves as a seepage control buffer between developed urban areas and the Everglades. Components include: Water Conservation Areas 3A/3B Levee Seepage Management, C-11 Impoundment, and C-9 Impoundment.	37 miles north of Turkey Point site	Proposed. Basis of Design Report completed. Construction of C-11 Impoundment scheduled to begin in 2012.	SFWMD Jun 2010, USACE Nov 2009	No
C-111 Spreader Canal Western Project	The project would establish more natural water flows in Taylor Slough to improve the timing, distribution and quantity of fresh water flowing into Florida Bay.	6 miles southwest of Turkey Point site	Proposed. Design testing completed. Construction began in 2010.	SFWMD Jun 2010, USACE May 2009	Yes
Central Lake Belt Storage Area	The project would store excess water from Water Conservation Areas 2 and 3 and provide environmental water supply deliveries to Northeast Shark River Slough, Water Conservation Area 3B, and to Biscayne Bay.	30 miles north of Turkey Point site	Proposed. Currently in preconstruction design.	USACE Undated	No

Table 4.7-2 (Sheet 11 of 17)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Turkey Point Site During the Construction Period (2013-2022)

Project Name	Summary of Project	Location	Status	Reference	Retained
Everglades National Park Seepage Management Project	Project to improve water deliveries to Northeast Shark River Slough and restore wetland in Everglades National Park by reducing levee and groundwater seepage and increasing sheetflow. There are three components: L-31N Levee Improvements for Seepage Management, S-356 Structure Relocation and Bird Drive Recharge.	22 miles northwest of Turkey Point site	Proposed. Construction scheduled to begin in 2014.	USACE Mar 2006, USACE Nov 2009	No
L-31N (L-30) Seepage Management Pilot Project	Project evaluates the uncertainty and constructability of seepage management technology for possible full-scale use along Everglades National Park.	19 miles northwest of Turkey Point site	Proposed. Project activities expected to be completed in 2012.	USACE Nov 2009	No
Melaleuca Eradication and other Exotic Plants	Project enhances efforts to control invasive exotic species in south Florida through mass clearing and controlled release of biological agents.	Throughout the region	Proposed. Project is scheduled to begin in 2011.	USACE Nov 2009	No
Miccosukee Tribe Water Management Plan	Project includes providing water storage capacity and water quality enhancement for Miccosukee Tribe's reservation discharge waters and conversion of 900 acres tribally owned cattle pasture into a managed wetland retention/detention area.	45 miles northwest of Turkey Point site	Proposed. Currently in preconstruction design.	USACE Undated	No
North Lake Belt Storage Area	Project will include an in-ground storage reservoir with a total capacity of approximately 90,000 acre feet and associated canals, pumps, and water control structures. It will store a portion of the stormwater runoff from the C-6, C-11, and C-9 basins.	34 miles north of Turkey Point site	Proposed. Currently in preconstruction design.	USACE Undated	No

Table 4.7-2 (Sheet 12 of 17)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Turkey Point Site During the Construction Period (2013-2022)

Project Name	Summary of Project	Location	Status	Reference	Retained
Restoration of Pineland and Hardwood Hammocks in C-111 Basin	This project includes restoring south Florida slash pine and hardwood hammock species on a 200-foot wide strip on each side of two miles of Florida SR 9336 and the establishment of two, one acre hammocks alongside the road. The project will provide water quality treatment for runoff passing through the hammocks and demonstrate techniques required to re-establish native conifer and hardwood forests.	14 miles west of Turkey Point site	Proposed. Currently in preconstruction design.	USACE Undated	No
South Miami-Dade Reuse	Project will include an expansion in the existing South District Wastewater Treatment Plant to provide additional water supply to the South Biscayne Bay and Coastal Wetlands Enhancement Project at sufficient quantity and water quality to meet the ecological goals and objectives of Biscayne Bay. This will require construction of a pretreatment and membrane treatment system.	6 miles north of Turkey Point site	Proposed. Currently in preconstruction design.	USACE Undated	Yes
Water Conservation Area 2B Flows to Everglades National Park	The project purpose is to store excess water from Water Conservation Area 2 in the Central Lake Belt Storage Area through control structures and conveyance features. Additionally, the project will supplement environmental water supply deliveries to North Shark River Slough, Water Conservation Area 3B and Biscayne Bay.	30 miles north of Turkey Point site	Proposed. Currently in preconstruction design.	USACE Undated	No

Table 4.7-2 (Sheet 13 of 17)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Turkey Point Site During the Construction Period (2013-2022)

Project Name	Summary of Project	Location	Status	Reference	Retained
Water Conservation Area 3 Decompartmentalization and Sheetflow Enhancement Project	Construction of new water control structures and modification or removal of levees, canals, and water control structures in Water Conservation Areas 3A and 3B for reestablishment of the ecological and hydrologic connection with Everglades National Park.	25 miles northwest of Turkey Point site	Proposed. EIS currently being drafted.	USACE Nov 2009	No
West Miami-Dade Reuse	The project includes a wastewater treatment plant expansion of a future West Miami-Dade Wastewater Treatment Plant to meet water demands from the Bird Drive Recharge Area, South Dade Conveyance System, and Northeast Shark River Slough.	21 miles northwest of Turkey Point site	Proposed. Currently in preconstruction design.	USACE Undated	No
Modified Water Deliveries to Everglades National Park	Project restores the natural hydrologic conditions in Everglades National Park, which were altered by the construction of roads, levees, and canals. The project includes four major components: an 8.5 mile area flood mitigation, Tamiami trail modifications, conveyance and seepage control features, and a combined operation plan.	22 miles northwest of Turkey Point site	Construction underway. Project Completion anticipated in 2013.	USACE Nov 2009	No
C-111 South Dade Project	Project enhances freshwater wetlands and improves freshwater flows in the Southern Glades and in southern Miami-Dade County. It improves the hydrology of the coastal marshlands of northeastern Florida Bay.	6 miles southwest of Turkey Point site	Proposed. Preliminary design of initial phase completed. Project completion anticipated in 2014.	USACE Nov 2009	Yes

Table 4.7-2 (Sheet 14 of 17)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Turkey Point Site During the Construction Period (2013-2022)

Project Name	Summary of Project	Location	Status	Reference	Retained
Mining Projects					
Card Sound Quarry	Crushed limestone mine	8 miles southwest of Turkey Point site	Operational	USGS 2005	No
Continental Florida Materials Pit #1	Crushed limestone mine	28 miles north of Turkey Point site	Operational	USGS 2005	No
F.E.C. Quarry	Crushed limestone mine	32 miles northwest of Turkey Point site	Operational	USGS 2005	No
Krome Quarry	Crushed limestone mine	21 miles northwest of Turkey Point site	Operational	USGS 2005	No
Lake 6 Quarry	Crushed limestone mine	33 miles north of Turkey Point site	Operational	USGS 2005	No
Miami Quarry	Crushed limestone mine	26 miles north of Turkey Point site	Operational	USGS 2005	No
Pennsuco Quarry	Crushed limestone mine	32 miles north of Turkey Point site	Operational	USGS 2005	No
S.C.L. Quarry	Crushed limestone mine	25 miles northwest of Turkey Point site	Operational	USGS 2005	No
Sawgrass Quarry	Crushed limestone mine	37 miles northwest of Turkey Point site	Operational	USGS 2005	No
Sunshine Rock Quarry	Crushed limestone mine	25 miles northwest of Turkey Point site	Operational	USGS 2005	No
White Rock Quarry	Crushed limestone mine	36 miles north of Turkey Point site	Operational	USGS 2005	No

Table 4.7-2 (Sheet 15 of 17)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Turkey Point Site During the Construction Period (2013-2022)

Project Name	Summary of Project	Location	Status	Reference	Retained
Other Actions/Projects					
Central and Southern Florida Flood Control Project	The C&SF Flood Control Project was intended to provide flood control, water supply, prevention of saltwater intrusion, and protection of fish and wildlife resources. It includes 1000 miles of canals, 720 miles of levees, and almost 200 water control structures. It covers 16 counties over an 18,000-square-mile area. The existing project provides water supply, flood protection, water management and other benefits to South Florida. The project has had unintended negative effects on the Everglades and the entire south Florida ecosystem.	Throughout the region.	Operational	HRA Jun 2006	No
Independent Spent Fuel Storage Facility for Turkey Point Power Plant Units 3 & 4	The Units 3 & 4 ISFSI will be a dry storage facility for spent nuclear fuel that would not have a liquid discharge and would only have limited operational activities.	Co-located on the Turkey Point site	Proposed. Facility currently under construction. Loading expected in 2011.	FDEP Jun 2009 FPL Nov 2010	Yes
AAR Landing Gear Center	Repair and rebuild aircraft landing gears and brakes.	30 miles northwest of Turkey Point site	Operational	M-D DERM Jul 2009	No
Aero Kool Corporation	Overhaul aircraft air cycle equipment and heat exchangers and operation of degreaser baths and paint booths	27 miles northeast of Turkey Point site	Operational	M-D DERM Feb 2006	No
American Whirlpool Products Corporation	Acrylic and fiberglass bath and spa manufacturer	43 miles northeast of Turkey Point site	Operational	BCEPGMD Dec 2003	No
Angler Boat Corporation	Fiberglass boat manufacturer	29 miles northeast of Turkey Point site	Operational	M-D DERM Dec 2006	No
Benada Aluminum of Florida Inc	Extruded aluminum products manufacturer	29 miles northeast of Turkey Point site	Operational	M-D DERM Mar 2006	No
Bertram Yacht Inc	Fiberglass boat manufacturer	26 miles northeast of Turkey Point site	Operational	M-D DERM Sep 2009	No
Blumberg Industries -Fine Art Lamps	Lamp manufacturer	33 miles northeast of Turkey Point site	Operational	M-D DERM Nov 2008	No

Table 4.7-2 (Sheet 16 of 17)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Turkey Point Site During the Construction Period (2013-2022)

Project Name	Summary of Project	Location	Status	Reference	Retained
CEMEX Miami	Cement kiln	25 miles northeast of Turkey Point site	Operational	M-D DERM Mar 2008b	No
Cigarette Racing Team LLC	Fiberglass boat manufacturer	32 miles northeast of Turkey Point site	Operational	M-D DERM Feb 2010	No
Contender Boats Inc	Fiberglass boat manufacturer	6 miles northeast of Turkey Point site	Operational	M-D DERM Aug 2008	No
DM Industries Ltd	Acrylic and fiberglass bath and spa manufacturer	34 miles northeast of Turkey Point site	Operational	M-D DERM Dec 2008	No
Dusky Marine Inc.	Fiberglass boat manufacturer	45 miles northeast of Turkey Point site	Operational	BCEPGMD Jun 2008	No
Dyplast Products, LLC	Polystyrene and polyurethane products manufacturer	32 miles northeast of Turkey Point site	Operational	M-D DERM Aug 2007	No
Eastern Aero Marine, Inc.	Inflatable vest and raft manufacturer	28 miles northeast of Turkey Point site	Operational	M-D DERM Jan 2010	No
Englehard Hex Core	Nomex honeycomb board, and fiberglass honeycomb board and rotor manufacturer	28 miles northeast of Turkey Point site	Operational	M-D DERM Sep 1999	No
Exteria Building Products, LLC.	Polypropylene siding manufacturer	35 miles northeast of Turkey Point site	Operational	M-D DERM Oct 2008, M-D DERM May 2009b	No
Flowers Baking Company of Miami	Commercial bread bakery	36 miles northeast of Turkey Point site	Operational	M-D DERM Mar 2009b	No
Goodrich Corporation Landing Systems Services	Landing gear refurbishing facility	35 miles northeast of Turkey Point site	Operational	M-D DERM May 2010	No
Homestead-Miami Speedway	The 1087 acre speedway hosts a wide variety of national, regional and local motorsport events, including the final races for all three NASCAR national championship series and two Indy Car championship series. The facility has seating capacity for 67,612 spectators.	5 miles northwest of Turkey Point site	Operational	HMS 2010	No
Homestead-Miami Speedway Improvements.	This project would expand the spectator area to include 120 acres currently used for overflow parking add 12,000 spectator seats.	5 miles northwest of Turkey Point site	Proposed. If approved the project is scheduled to be completed in 2013.	HMS 2010	Yes

Table 4.7-2 (Sheet 17 of 17)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Turkey Point Site During the Construction Period (2013-2022)

Project Name	Summary of Project	Location	Status	Reference	Retained
Media Printing Corporation	Commercial printer	29 miles northeast of Turkey Point site	Operational	BCEPGMD Dec 2009b	No
Miami Seaquarium	The 38 acre marine park is an entertainment venue that is dedicated to education, wildlife conservation and community involvement.	23 miles northeast of Turkey Point site	Operational	Miami Seaquarium 2009	No
Miami-Dade Water and Sewer Department - Alexander Orr Water Treatment Plant	Water treatment plant also operates a 150 tpd rotary lime kiln	19 miles northwest of Turkey Point site	Operational	M-D DERM Jul 2008	No
Miami-Dade Water and Sewer Department - Hialeah/ Preston Water Treatment Plant	Water treatment plant also operates a 120 tpd rotary lime kiln and 64 air stripping towers	28 miles northeast of Turkey Point site	Operational	M-D DERM Jan 2006	No
Midnight Express Powerboats	Fiberglass boat manufacturer	46 miles northeast of Turkey Point site	Operational	BCEPGMD Jun 2009	No
Ram Investments of South Florida - Sea Enterprise Adventures	Fiberglass boat manufacturer	28 miles northeast of Turkey Point site	Operational	M-D DERM Jun 2006	No
Titan America, LLC - Pennsuco Cement	Cement kiln	31 miles northwest of Turkey Point site	Operational	M-D DERM Sep 2008	No
US Foundry & Manufacturing Company	Gray iron foundry and cast iron products manufacturer	30 miles northwest of Turkey Point site	Operational	M-D DERM Apr 2010	No
Water Reclamation and Wastewater Treatment Plants	Numerous plants	Within 50 miles of Turkey Point site	Operational	FDEP Aug 2010a, FDEP Aug 2010b	No
Future Urbanization	Construction of housing units and associated commercial buildings; roads, bridges and rail; construction of water and/or wastewater treatment facilities and associated pipelines.	Throughout the region.	Construction would occur in the future, as described in state and local land-use planning documents.	MDC Nov 2007	No

Note: All the projects listed in the table would have impacts on land use, water use, ecology, and socioeconomics within the 50-mile radius of the Turkey Point Units 6 & 7 project.

Table 4.7-3 (Sheet 1 of 4)
Summary of Adverse Cumulative Impacts

Category	Description of Cumulative Impact	Potential Cumulative Impacts Significance
Land Use	1. Units 6 & 7 – construction on previously disturbed land, designated for industrial use 2. Operation and maintenance of existing units – none 3. Units 3 & 4 Uprate – none 4. Units 3 & 4 ISFSI – construction among existing structures, property is designated for industrial use 5. EMB - none 6. CERP – restore wetlands, providing a land use benefit 7. CERP C-111 Spreader Canal – restore wetlands, providing a land use benefit 8. INGENCO Resource Recovery Facility - none 9. Homestead-Miami Speedway improvement project - change land use designation of 120 - acres from “Agriculture” to “business and office”	Small
Historic Properties	1. Units 6 & 7 – work plans submitted 2. Operation and maintenance of existing units – none 3. Units 3 & 4 Uprate – none 4. Units 3 & 4 ISFSI – none 5. EMB – none 6. CERP – not available 7. CERP C-111 Spreader Canal – not available 8. INGENCO Resource Recovery Facility - none 9. Homestead-Miami Speedway improvement project - none	None

Table 4.7-3 (Sheet 2 of 4)
Summary of Adverse Cumulative Impacts

Category	Description of Cumulative Impact	Potential Cumulative Impacts Significance
Hydrology & Water Use	**Surface water:** 1. Units 6 & 7 – hydrologic alterations on the Turkey Point plant property and offsite impacts as a result of crossing of canals, wetlands, and surface drainage features 2. Operation and maintenance of existing units – none 3. Units 3 & 4 Uprate – none 4. Units 3 & 4 ISFSI – none 5. EMB – none 6. CERP – beneficial hydrologic alterations to restore wetlands 7. CERP C-111 Spreader Canal – beneficial hydrologic alterations to restore wetlands 8. INGENCO Resource Recovery Facility - - potential small, temporary 9. Homestead-Miami Speedway Improvement Project - - potential small, temporary	Surface water: Large positive
	Water Use: 1. Units 6 & 7 – none 2. Operation and maintenance of existing units – none 3. Units 3 & 4 Uprate – none 4. Units 3 & 4 ISFSI - none 5. EMB – none 6. CERP – not available 7. CERP C-111 Spreader Canal – not available 8. INGENCO Resource Recovery Facility - none 9. Homestead-Miami Speedway Improvement Project - none	Water Use: None
	Groundwater: 1. Units 6 & 7 – hydrologic alterations at the construction site, dewatering 2. Operation and maintenance of existing units – none 3. Units 3 & 4 Uprate – none 4. Units 3 & 4 ISFSI – none 5. EMB – beneficial 6. CERP – beneficial 7. CERP C-111 Spreader Canal – beneficial 8. INGENCO Resource Recovery Facility - potential small, temporary 9. Homestead-Miami Speedway Improvement Project - potential small, temporary	Groundwater: Small
	Water quality: 1. Units 6 & 7 – land disturbance activities could impact water quality as a result of runoff, potential for spills 2. Existing Turkey Point facilities – potential for spills 3. Units 3 & 4 Uprate – none	Water quality: Small

Table 4.7-3 (Sheet 3 of 4)
Summary of Adverse Cumulative Impacts

Category	Description of Cumulative Impact	Potential Cumulative Impacts Significance
	Water quality (cont.) 4. Units 3 & 4 ISFSI – none 5. EMB – none 6. CERP – land disturbance activities could impact water quality as a result of runoff, potential for spills 7. CERP C-111 Spreader Canal – land disturbance activities could impact water quality because of runoff, potential for spills 8. INGENCO Resource Recovery Facility - land disturbance activities could impact water quality due to runoff, potential for spills 9. Homestead-Miami Speedway Improvement Project - land disturbance activities could impact water quality due to runoff, potential for spills	
Terrestrial Ecology	1. Units 6 & 7 – land disturbance and construction traffic near crocodile population inside critical habitat area, would implement mitigation measures 2. Operation and maintenance of existing units – operate under management/conservation plans 3. Units 3 & 4 Uprate – none 4. Units 3 & 4 ISFSI – none 5. EMB – none 6. CERP – land disturbance in critical habitat area, subject to stormwater requirements to protect water quality and subject to critical habitat requirements to preserve crocodile populations 7. CERP C-111 Spreader Canal – land disturbance in critical habitat area, subject to stormwater requirements to protect water quality and subject to critical habitat requirements to preserve crocodile populations 8. INGENCO Resource Recovery Facility - land disturbance activities outside critical habitat area 9. Homestead-Miami Speedway Improvement Project - land disturbance activities outside critical habitat area	Moderate

Table 4.7-3 (Sheet 4 of 4)
Summary of Adverse Cumulative Impacts

Category	Description of Cumulative Impact	Potential Cumulative Impacts Significance
Aquatic Ecology	1. Units 6 & 7 – hydrologic alterations at the construction site and offsite impacts as a result of crossing of canals, wetlands, and surface drainage features, dredging in equipment barge unloading area 2. Operation and maintenance of existing units – none 3. Units 3 & 4 Uprate – none 4. Units 3 & 4 ISFSI – none 5. EMB – none 6. CERP – beneficial hydrologic alterations to restore wetlands 7. CERP C-111 Spreader Canal – beneficial hydrologic alterations to restore wetlands 8. INGENCO Resource Recovery Facility - potential small, temporary 9. Homestead-Miami Speedway Improvement Project - potential small, temporary	Small
Socioeconomic	1. Units 6 & 7 – physical impacts of construction and in-migrating population of 5139 – no environmental justice impacts 2. Operation and maintenance of existing units – 600 – 900 outage workers 3. Units 3 & 4 Uprate – none (bounded by subsequent Units 6 & 7 peak workforce) 4. Units 3 & 4 ISFSI – none (completed before preconstruction work) 5. EMB – none 6. CERP – estimated in-migrating population of 1950 7. CERP C-111 Spreader Canal – Not available 8. INGENCO Resource Recovery Facility - construction activities prior to Units 6 & 7 9. Homestead-Miami Speedway Improvement Project - construction activities completed during Units 6 & 7 preconstruction	Physical Impacts of Construction: Small Socioeconomic (except transportation): Small; Transportation: Moderate Environmental Justice: None

4.8 NONRADIOLOGICAL HEALTH IMPACTS

4.8.1 PUBLIC HEALTH

Potential nonradiological health impacts of Units 6 & 7 construction are addressed in this section. The potential impacts to the public from water discharges, air emissions, and noise are addressed in Subsections 4.2.3 and 4.4.1.

4.8.2 OCCUPATIONAL HEALTH

Constructing the units and associated transmission lines would involve risks to workers from accidents or occupational illnesses. These risks could result from such incidents as construction accidents (e.g., falls and burns), exposure to toxic or oxygen-replacing gases, and other causes.

The Bureau of Labor Statistics maintains a statistical database that includes national and state-by-state total recordable cases, which is a measure of work-related injuries or illnesses that include death, days away from work, restricted work activity, and medical treatment beyond first aid. The 2008 nationwide total recordable cases rate published by the Bureau of Labor Statistics for utility sector construction was 4.1 per 100 workers (BLS 2010a). The same statistic for Florida is 4.7 per 100 workers (BLS 2010b). These rates were used to estimate the number of total recordable cases for the construction of Units 6 & 7. The national and state total recordable case rates were multiplied by the number of workers (Table 3.10-2) and the resulting estimates are presented in Table 4.8-1. The annual average total recordable cases for the period encompassing preconstruction and construction activities were estimated for both units as well as the peak annual (12 months) total recordable cases.

Section 4.8 References

BLS (Bureau of Labor Statistics) 2010a. *Table 1. Incidence rates of nonfatal occupational injuries and illnesses, 2008.* Available at http://www.bls.gov/iif/home.htm, accessed July 6, 2010.

BLS 2010b. *Table 6. Incidence rates of nonfatal occupational injuries and illnesses by industry and case types, 2008, Florida.* Available at http://www.bls.gov/iif/home.htm, accessed July 6, 2010.

Table 4.8-1
Estimated Total Recordable Cases (TRCs)

Time Frame	TRC Incidence at US Rate[(a)]	TRC Incidence at FL Rate[(a)]
Annual average	86[(b)]	93[(b)]
Peak 12-month period (Months 31–42)	161[(c)]	173[(c)]

(a) Based on nonfatal incidence rates developed by the U.S. Bureau of Labor Statistics (BLS 2010a, BLS 2010b).

(b) Average of monthly TRCs for the preconstruction and construction period. Monthly TRCs = number of employees for month/100 x annual rate per 100 workers/12 months per year. Ex. 1000/100 x 4.1/12 = 3.417 TRCs.

(c) Sum of monthly TRCs for 12-month period of greatest number of construction workers as presented in Table 3.10-2. This 12-month period is Months 34–45.

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5.0 ENVIRONMENTAL IMPACTS OF OPERATION

Chapter 5 presents the potential environmental impacts of operation of Units 6 & 7. In accordance with 10 CFR Part 51, impacts are analyzed, and a single significance level of potential impact to each resource (i.e., SMALL, MODERATE, or LARGE) is assigned consistent with the criteria that NRC established in 10 CFR Part 51, Appendix B, Table B-1, Footnote 3 as follows:

SMALL — Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, NRC has concluded that those impacts that do not exceed permissible levels in NRC's regulations are considered small.

MODERATE — Environmental effects are sufficient to alter noticeably, but not to destabilize, any important attribute of the resource.

LARGE — Environmental effects are clearly noticeable and are sufficient to destabilize any important attributes of the resource.

Mitigation of adverse impacts, if appropriate, is presented. This chapter is divided into 12 subsections:

- Land Use Impacts (Section 5.1)
- Water-Related Impacts (Section 5.2)
- Cooling System Impacts (Section 5.3)
- Radiological Impacts of Normal Operations (Section 5.4)
- Environmental Impacts of Waste (Section 5.5)
- Environmental Impacts of Transmission System (Section 5.6)
- Uranium Fuel Cycle and Transportation Impacts (Section 5.7)
- Socioeconomic Impacts (Section 5.8)
- Decommissioning (Section 5.9)
- Measures and Controls to Limit Adverse Impacts During Operations (Section 5.10)
- Cumulative Impacts Related to Station Operation (Section 5.11)
- Nonradiological Health Impacts (Section 5.12)

5.1 LAND USE IMPACTS

The following subsections describe the impacts of Units 6 & 7 operations on land use at the Turkey Point plant property and the 6-mile vicinity, including impacts to historical properties and cultural resources. Subsection 5.1.1 describes impacts to the site and vicinity. Subsection 5.1.2 describes impacts along transmission corridors and offsite areas. Subsection 5.1.3 describes impacts to historical properties and cultural resources. Table 5.1-1 summarizes the permanent land disturbance.

5.1.1 THE SITE AND VICINITY

5.1.1.1 The Site

Land use impacts from construction are described in Subsection 4.1.1.1. The new Units 6 & 7 power block, cooling towers and reservoir, substation, and associated infrastructure would permanently occupy the 218-acre Units 6 & 7 plant area (Figure 3.9-1). Additional permanent supporting facilities would be located outside of the Units 6 & 7 plant area but on the Turkey Point plant property. These facilities would include the FPL reclaimed water treatment facility, reclaimed water pipelines, radial collector wells and pipelines, nuclear administration and training buildings, parking areas, laydown areas, expanded equipment barge unloading area, security buildings, heavy haul road improvements, transmission infrastructure, sanitary waste pipelines, potable water supply pipelines, access road improvements, and the spoils areas. The radial collector well laterals would be drilled horizontally in the subsurface from the well caisson to locations beneath the floor of Biscayne Bay. Table 5.1-1 identifies the permanent facilities and dedicated areas. Below-grade facilities such as pipelines are not considered permanent facilities since they are underground and the land at grade could be utilized for other uses. The laydown areas are considered permanently dedicated since they may not be fully restored to pre-construction conditions and may be used during the operation of Units 6 & 7.

As addressed in Sections 2.2 and 4.1, the Miami-Dade County Comprehensive Development Master Plan land use designation for the location of Units 6 & 7 is *Environmental Protection, Subarea F*. Necessary electrical generation and transmission facilities are permitted in this area. The Units 6 & 7 plant area and most of the surrounding land is zoned as GU (interim district), with the exception of Units 1 through 5 and the area to the north of the Units 6 & 7 plant area, which are zoned as IU-3 (Industrial, Unlimited Manufacturing District). The GU zoning district allows nuclear reactors, provided that approval by Miami-Dade County of an *Unusual Use* for the site is obtained. FPL applied for *Unusual Use* approval for the proposed Units 6 & 7 site from Miami-Dade County, which was granted in Resolution No. Z-56-07 by the Miami-Dade Board of County Commissioners in December 2007. There would be no additional changes to land use within the Turkey Point plant property for operation of Units 6 & 7.

Land use impacts on the Turkey Point plant property from the operation of Units 6 & 7 could occur from salt and other particulate deposits associated with the operation of the six mechanical draft cooling towers. Salt deposits from cooling tower operation would have a small impact on onsite vegetation, fish, waterbirds, and also critical habitat for crocodiles, including hatchlings and juveniles, in the nearby cooling canals of the industrial wastewater facility, and further afield within the 6-mile vicinity. The potential impacts of salt deposits, fogging, and shadowing are presented in Section 5.3.

Based on the limited and localized impact to permanent land use and the small, localized impacts of the cooling towers with respect to salt deposits, fogging, and shadowing, impacts to land use as a result of operation of Units 6 & 7 would be SMALL and would not warrant mitigation.

5.1.1.2 The Vicinity

As described in Subsection 2.2.1.2, current land use within 6 miles of Units 6 & 7 is described in Table 2.2-2. The vicinity includes areas that have the land use designation Environmental Protection and Open Land in the Miami-Dade County Comprehensive Development Master Plan. Biscayne National Park, Biscayne Bay Aquatic Preserve, Homestead Bayfront Park, the Model Lands Basin, and the Everglades Mitigation Bank are located in the vicinity adjacent to the plant property.

Most permanent facilities associated with the operation of Units 6 & 7 would be contained within Turkey Point plant property boundaries except for portions of the reclaimed water pipelines, potable water pipelines, transmission corridors, public access roads, and the FPL-owned fill source. The reclaimed water pipelines and transmission corridors would follow the existing transmission corridors within the vicinity of Units 6 & 7. The potable water pipelines would follow existing linear facilities (e.g., existing roads). The radial collector wells would be drilled horizontally from the Turkey Point plant property to subsurface positions of the lateral screens located below Biscayne Bay. Pipelines would be below grade, thus having minimal impact on permanent land use.

The FPL-owned fill source and portions of the reclaimed water pipelines, potable water pipelines, transmission corridors, and roads are located within the 6-mile vicinity of Units 6 & 7. The potential land use impacts of these facilities from the operation of Units 6 & 7 are described in Subsection 5.1.2.

No land use impacts from operation of Units 6 & 7 would occur to recreational or protected areas in the 6-mile vicinity. Most permanent facilities associated with Units 6 & 7 are contained within the boundaries of the Turkey Point plant property, and operational activities for these facilities would not impact land use in nearby park areas. Additionally, the Miami-Dade County Unusual Use Approval for Units 6 & 7 stipulates several mitigative actions/plans to minimize impacts to the vicinity. Therefore, impacts to land use in the 6-mile vicinity from the operation of Units 6 & 7 would be SMALL and would not warrant mitigation.

5.1.2 TRANSMISSION CORRIDORS AND OFFSITE AREAS

The preferred transmission corridors, offsite substations, FPL-owned fill source, reclaimed water pipelines, and potable water pipelines are located offsite of the Turkey Point plant property. The potential land use impacts from operation of Units 6 & 7 associated with these offsite facilities and areas are presented in the following subsections.

5.1.2.1 Transmission Corridors and Substations

Transmission Corridors

The land proposed as transmission corridors for Units 6 & 7 is described in Subsection 2.2.2 and Section 3.9. FPL would acquire new transmission line rights-of-way and would restrict incompatible uses in the rights-of-way. FPL requires that the landowners' uses in rights-of-way be compatible with the safe and reliable transmission of electricity. In areas that are in active agricultural cultivation, FPL typically allows farmers to grow feed for livestock and tree crops within the transmission line rights-of-way, subject to height limitations for vegetation and operation. FPL has established rights-of-way vegetation management and line maintenance programs and procedures that would be used to maintain the rights-of-way and transmission lines associated with Units 6 & 7 to minimize impacts. The same procedures establish strict guidelines for use of herbicide application according to federal, state, and local regulations. In addition, environmental best management practices would be used to reduce soil erosion and sedimentation. Vegetation management in forested wetlands would comply with Florida Statute 403.814 General Permits. Accordingly, impacts from the operation of Units 6 & 7 to land use in transmission corridors would be SMALL and would not warrant additional mitigation.

Substations

As described in Sections 3.7 and 4.1, construction and/or expansion of several substations would meet applicable environmental regulatory requirements for their construction and operation; accordingly, potential land use impacts from operations would be SMALL and would not warrant additional mitigation.

5.1.2.2 Makeup Water Sources

As described in Sections 3.3 and 3.4, during normal operation of Units 6 & 7, waste heat would be dissipated by mechanical draft cooling towers. Two sources of makeup water are planned to replace cooling tower blowdown for Units 6 & 7. The primary source would be water reclaimed for reuse after processing by the Miami-Dade Water and Sewer Department, conveyed via pipelines to the Turkey Point plant property. An onsite FPL reclaimed water treatment facility would further treat the reclaimed water for use in the cooling system. When reclaimed water cannot supply the quantity and/or quality of water needed for the circulating water system, a second source for makeup water would consist of radial collector wells that would withdraw saltwater from under Biscayne Bay. The well caissons would be located on the Turkey Point peninsula, east of the existing units. Each radial collector well would consist of a central reinforced concrete caisson extending below the ground level with laterals projecting from the caisson. Potential land use impacts of Units 6 & 7 operational activities for these cooling water sources are described below.

The land that would be used for the below-ground reclaimed water pipelines is identified in Figure 2.2-5. Upon completion of construction activities, the reclaimed water pipelines would be underground, functional, and permanent. Miami-Dade County or FPL would access the right-of-way during operations for maintenance along public roads or through access agreements with adjacent landowners. As a result, impacts to offsite land use from operation of the reclaimed water pipelines for Units 6 & 7 would be SMALL and would not warrant mitigation.

As described in Subsection 2.2.2, upon completion of construction activities, the radial collector well caissons and pumping station would be on Turkey Point plant property and would be functional and permanent. The subterranean lateral screens would be located on the Turkey Point plant property and offsite, with laterals projecting horizontally from a location on the property to positions underneath Biscayne Bay, and would not impact land use of the offsite land area or Biscayne Bay. Accordingly, impacts to offsite land use from operation of the radial collector wells would be SMALL and would not warrant mitigation.

5.1.2.3 FPL-Owned Fill Source

Backfill for the construction of Units 6 & 7 would be obtained from an FPL-owned fill source located on a 300-acre plot near Homestead Air Reserve Base approximately 4.5 miles northwest of the Units 6 & 7 plant area (Figure 3.9-1), other regional sources, or reused material. The FPL-owned fill source area would cease operation with the completion of Units 6 & 7 construction activities. Once its use as a borrow mining facility is completed, plans are that the area would be maintained as a surface water management area, under FPL or other local or regional ownership, management, and control. The land use impact would be SMALL.

Fill borrow material for use during operation and maintenance of Units 6 & 7 would likely be supplied through commercial providers.

5.1.2.4 Access Roadways

As described in Sections 3.9 and 4.1, the Units 6 & 7 project includes road improvements to allow access to the Turkey Point plant property for construction and operations. The improvements include the widening of three existing roadways and the development of existing unpaved roads to four paved roadways (Figure 3.9-1).

The roadways would impact approximately 128 acres of land that would not be available for other uses. However, the locations of the road improvements were selected to use, to the greatest extent practical, existing roadways to minimize environmental impacts. With local government approval for the location of the roadway improvements and the granting of easements for the roadway use, the land use impacts would be SMALL and would not require additional mitigation.

Roadway improvements installed during construction could be removed during operation. If it is determined to remove access roadway improvements, this activity would be conducted with environmental best management practices to reduce impacts to wetlands and canals. Restoration, at a minimum, would result in removal of previous building materials, maintenance of historical hydrology, and regrading to previous contours. Impacts to terrestrial and aquatic flora and fauna, including possible interactions with crocodiles and panthers along remote sections, would be reduced by removal of the road and reduction/cessation of traffic flow. Potential mitigation for impacts of roadway removal would be covered by mitigation associated with roadway improvements (see Subsection 4.3.1).

Waste Management

As described in Sections 3.4 and 3.6, cooling tower blowdown and other site wastewater streams would be collected in a common blowdown sump and injected through deep injection wells.

As described in Section 5.5, Units 6 & 7 would generate radioactive solid wastes that would be disposed of in permitted radioactive waste disposal facilities and nonradioactive solid wastes that would be disposed of in permitted landfills off of the Turkey Point plant property. Both types of solid waste are commonly generated, and permitted disposal facilities and landfills are located throughout the United States. Additionally, Units 6 & 7 would generate spent nuclear fuel, which would be safely and securely stored on the Turkey Point plant property until such time as the DOE constructs, and the NRC licenses, a high-level waste disposal facility.

Because wastewaters and wastes would be properly dispositioned, meeting regulatory permitting requirements, impacts to offsite land use from waste management activities associated with Units 6 & 7 would be SMALL and would not warrant mitigation.

5.1.3 HISTORIC PROPERTIES AND CULTURAL RESOURCES

FPL has initiated consultation with the State Historic Preservation Officer (SHPO) regarding the proposed project. FPL prepared and submitted a *Cultural Resource Assessment Survey for the Turkey Point Units 6 & 7 Site, Associated Non-Linear Facilities, and Spoils Area on Plant Property* (FPL 2009a). In addition, FPL prepared and submitted a *Cultural Resource Assessment*

Survey Work Plan for the Turkey Point Units 6 & 7 Site and Associated Non-Linear Facilities (FPL 2009b). Based on the findings contained in these two reports, which included historical research, pedestrian surveys, and field archaeological investigation (e.g., shovel testing), no further surveys or investigations are warranted at the plant or associated non-linear facilities due to the lack of any cultural resources in these areas. The SHPO has concurred with these recommendations (FDOS Jul 2009a).

FPL also prepared and submitted to SHPO a *Preliminary Cultural Resources Report for the Turkey Point Units 6 & 7 Associated Linear Facilities* (FPL 2009c) and a *Cultural Resource Assessment Survey Work Plan for the Turkey Point Units 6 & 7 Associated Linear Facilities* (FPL 2009d). These reports described (1) areas of potential effects (APEs) for physical disturbance and visual impacts to historic properties from the proposed Units 6 & 7 Project, and (2) what investigations, if any, will be required in those APEs to determine potential effects to historic properties. The SHPO concurred with the recommendations made in these submittals (FDOS Jul 2009b). FPL will proceed with the necessary research and field reconnaissance and/or investigations at the linear facilities once the locations for these facilities are finalized. The results of the field assessments conducted and FPL's recommendations on effects to historic properties will be submitted to the SHPO.

Operational activities, including maintenance, would occur in areas that were previously disturbed during construction of Units 6 & 7. It is unlikely that these areas would contain any intact historic properties once construction has been completed. FPL anticipates that operational activities would have no impacts on historic properties and would not warrant mitigation beyond that being implemented to mitigate any adverse effects associated with construction.

With operational activities, there remains the possibility for inadvertent discovery of previously unknown archaeological materials or human remains. The Unanticipated Finds Plan implemented during construction, as described in Section 4.1.3, would be slightly modified for operational activities and included in the operational procedures for Units 6 & 7.

Section 5.1 References

FDOS Jul. 2009a. Florida Department of State, Division of Historical Resources, Letter from Laura Kammerer, Deputy State Historic Preservation Officer to Matthew Raffenberg re: *Cultural Resources Assessment Survey Work Plan for the Units 6 & 7 Site and Associated Non-Linear Facilities*, July 13, 2009.

FDOS Jul. 2009b. Florida Department of State, Division of Historical Resources, Letter from Laura Kammerer, Deputy State Historic Preservation Officer to Matthew Raffenberg re: *Cultural Resource Assessment Survey Work Plan for the Turkey Point Units 6 & 7 Associated Linear Facilities*, July 13, 2009.

FPL 2009a. *Cultural Resource Assessment Survey for the Turkey Point Units 6 & 7 Site, Associated Non-Linear Facilities, and Spoils Area on Plant Property*, June 2009.

FPL 2009b. *Cultural Resource Assessment Survey Work Plan for the Turkey Point Units 6 & 7 Site and Associated Non-Linear Facilities*, June 2009.

FPL 2009c. *Preliminary Cultural Resources Report for the Turkey Point Units 6 & 7 Associated Linear Facilities*, June 2009.

FPL 2009d. *Cultural Resource Assessment Survey Work Plan for the Turkey Point Units 6 & 7 Associated Linear Facilities*, June 2009.

Table 5.1-1 (Sheet 1 of 2)
Permanent Disturbed Acreage

Disturbed Area	Acreage
Turkey Point Property	
Unit 6 & 7 plant area	218
Western laydown areas	52
Training parking	9
Nuclear Administration parking	23
Heavy haul road	5
Access road upgrades	Note (1)
Transmission infrastructure improvements	Note (1)
Transmission laydown areas	3
Sanitary waste pipeline	Note (1)
Equipment barge unloading area	0.75
“A,” “B,” “C” spoils area	211
Radial collector wells and associated facilities	3
Radial collector well laydown area	3
FPL reclaimed water treatment facility	44
Reclaimed water supply pipeline to Units 6 & 7	6
Radial collector well water supply pipelines	13
Vicinity	
FPL-owned offsite fill source	300
Road Improvements(Note 2)	
SW 117th Ave. North	9
SW 117th Ave. South	8
SW 137th Ave.	7
SW 328th St.	24
SW 344th St.	2
SW 359th Ave. East	47
SW 359th Ave. West	31
Region	
Reclaimed water pipeline corridor	Note (3)
Potable water pipeline corridor	Note (4)
Transmission	
East Preferred Corridor (1635 acres total)	
Clear Sky to Davis	Note (5)
Davis to Miami	Note (5)
West Preferred Corridor (3356 acres total)	
Clear Sky to Levee – 1st leg	Note (5)
Clear Sky to Levee – 2nd leg	Note (5)
Clear Sky to Levee – 3rd leg	Note (5)
Levee to Pennsuco	Note (5)
West Secondary Corridor (2442 acres total)	
Clear Sky to Levee – 1st leg	Note (5)
Clear Sky to Levee – 2nd leg	Note (5)
Clear Sky to Levee – 3rd leg	Note (5)
Levee to Pennsuco	Note (5)
West Corridor Transmission Access Road 1	11

Table 5.1-1 (Sheet 2 of 2)
Permanent Disturbed Acreage

Disturbed Area	Acreage
West Corridor Transmission Access Road 2	365
Levee substation	2
Pennsuco substation	2
Davis substation	1
Turkey Point substation	1

(1) Previously disturbed area.
(2) Road improvements may be removed after Units 6 & 7 are in operation.
(3) Acreage will be restored to pre-existing conditions.
(4) Acreage will be below grade.
(5) Actual disturbed acreage will be based on required right-of-way.

5.2 WATER-RELATED IMPACTS

Water-related impacts from the operation of Units 6 & 7 could result from: (1) hydrologic alteration of local surface water bodies, including streams and wetlands, and groundwater as a result of operational diversions, (2) ground surface elevation changes as a result of subsidence caused by the withdrawal of groundwater, (3) groundwater elevation changes as a result of groundwater withdrawal operations, and (4) groundwater impacts from the deep injection wells. Impacts could also occur to water quality as a result of erosion and sedimentation and to surface water and groundwater resulting from spills of fuels, lubricants, and other operational-related pollutants. Because of this potential for impacting surface water and groundwater resources, applicants are required to obtain a number of permits as outlined in Table 1.2-1.

As described in Subsection 2.3.1, water bodies on the Turkey Point plant property that could be affected by the operation of Units 6 & 7 are the industrial wastewater facility and the barge turning basin. Offsite water bodies that could be impacted by the operational activities include Biscayne Bay, named and unnamed surface water drainage canals, and unnamed surface water drainage features that could be impacted primarily by maintenance activities along the reclaimed water pipelines, potable water pipelines, and the transmission line rights-of-way.

As described in Subsection 2.3.1, the surficial aquifer at the Turkey Point plant property is the Biscayne aquifer. The Biscayne aquifer at the Turkey Point plant property is not used as a source of potable water due to the presence of saline water. However, in Miami-Dade County, the aquifer is used as a sole-source aquifer.

During normal operation of Units 6 & 7, waste heat would be dissipated by mechanical draft cooling towers. Two sources of makeup water are planned to replace cooling tower blowdown for Units 6 & 7. The primary source would be water reclaimed for reuse after processing by the Miami-Dade Water and Sewer Department, conveyed via pipelines to the Turkey Point plant property. An onsite FPL reclaimed water treatment facility would further treat the reclaimed water for use in the cooling system. When reclaimed water cannot supply the quantity and/or quality of water needed for the circulating water system, a second source for makeup water would consist of radial collector wells that would withdraw saltwater from under Biscayne Bay. The well caissons would be located on the Turkey Point peninsula, east of the existing units. Radial collector well operation is described as the makeup water supply throughout this section.

5.2.1 HYDROLOGIC ALTERATIONS AND PLANT WATER SUPPLY

Impacts resulting from surface water runoff are similar for each of the facilities described below. Any impacts resulting from Units 6 & 7 operation would be mitigated, as required by appropriate permitting authorities. Examples of permitting requirements applicable to surface water impacts include Florida Department of Environmental Protection (FDEP) requirements included in the FDEP Industrial Wastewater (IWW) permits.

These subsections identify operational activities on the Turkey Point plant property and offsite that could or would result in impacts to the hydrology at Turkey Point and in the offsite areas. These operations include:

- Operation of Units 6 & 7 and associated support facilities
- Use of the equipment barge unloading area and the heavy haul road to support maintenance activities during operations, such as heavy component replacement
- Transmission line right-of-way maintenance, reclaimed water and potable water pipelines right-of-way maintenance, deep injection well maintenance, and radial collector well maintenance
- The Units 6 & 7 plant property during operations would be subject to stormwater requirements of the existing industrial wastewater (IWW) permit applicable to the industrial wastewater facility.
- The removal of offsite road improvements added during the construction phase and restoration of the area to preconstruction conditions.

For project facilities and areas offsite of the Turkey Point plant property, including roads and transmission line and pipeline corridors, rules and guidance under the authority of FDEP (FAC 62-25) and SFWMD (FAC 40E-4) would apply to operations. Project stormwater sources would also be subject during operations to rules and guidance of the Miami-Dade County (MDC) Department of Environmental Resource Manager under MDC Code, Chapter 24.

5.2.1.1 Facilities on the Turkey Point Plant Property

5.2.1.1.1 Units 6 & 7 Plant Area

Surface Water

The Units 6 & 7 plant area would contain the principal structures, including the power blocks, makeup water reservoir and cooling towers, switchyard, and other infrastructure. Surface water that could be impacted during operation of these facilities is limited to the cooling canals of the industrial wastewater facility. Because the cooling canals of the industrial wastewater facility surround the Units 6 & 7 plant area and the berm located seaward of the eastern segment of the industrial wastewater facility provide a barrier to surface water movement, impacts to Biscayne

Bay would not occur. There is no major surface water body that discharges to Biscayne Bay in the vicinity of Units 6 & 7 where the presence of these facilities could alter hydrologic flow.

Overland flow of stormwater within the Units 6 & 7 plant area during operations would ultimately be to the industrial wastewater facility under a new or modification of the existing IWW facility permit. Overland flow to the industrial wastewater facility when compared to the amount of water circulating in the industrial wastewater facility would be insignificant.

The operation of the makeup water reservoir would alter the surface water hydrologic flow in the vicinity of the reservoir since it is a closed system and would be constructed and lined with concrete. Seepage from the makeup water reservoir could increase the level of flow within the industrial wastewater facility. Seepage could also raise the groundwater level in close proximity to the reservoir and create a greater flow to Biscayne Bay in the immediate area.

Considering all of the above influences to surface water hydrology from operations in the Units 6 & 7 plant area, impacts from hydrologic alteration would be SMALL and would not warrant mitigation.

Groundwater

The operation of the approximately 37-acre makeup water reservoir could slightly alter the groundwater hydrologic flow in the vicinity of the reservoir as a result of installation into the upper portion of the water table aquifer.

Potential seepage from the makeup water reservoir could locally alter the groundwater flow direction in the immediate vicinity of the reservoir. The alteration would depend on the amount of seepage. In the vicinity of the plant area, there are no groundwater users that would be impacted by the potentially altered flow. A local change in flow direction could result in additional groundwater flow to the surrounding industrial wastewater facility and increase locally the amount of groundwater discharging to Biscayne Bay.

Considering the limited influences to groundwater from operations in the Units 6 & 7 plant area, impacts would be SMALL and would not warrant mitigation.

5.2.1.1.2 Spoils Areas

Surface Water

Spoils areas would be established at three locations on the Turkey Point plant property to allow dewatering of materials from clearing, grubbing, and other excavation(s) (see Subsection 3.9.1.6 and Figure 3.9-1). Three separate spoils areas would be established at the southern end of the industrial wastewater facility. The spoils areas would be bermed to direct drainage from the spoils piles to the industrial wastewater facility. The potential impacts resulting from hydrologic alteration of surface water would be SMALL and would not require mitigation.

Groundwater

The spoils piles would be dewatered as part of the construction effort. Surface water runoff from the spoils areas during Units 6 & 7 operation would not result in any additional runoff to the industrial wastewater facility compared to conditions prior to spoils placement. For these reasons, there would be no impacts on groundwater from the spoils areas during operation. Impacts would be SMALL and would not require mitigation.

5.2.1.1.3 Access Roads, Heavy Haul Road, and Equipment Barge Unloading Area

Surface Water

No dredging of the equipment barge unloading area would be required to support the operation of Units 6 & 7.

As described in Section 3.9, a road system is currently in place to support existing unit operations within the Turkey Point property. These roads, especially in the vicinity of Units 3 & 4, would support the operational activities for Units 6 & 7. The heavy haul road leading from the existing equipment barge unloading area location to Units 6 & 7 and other site roads used in support of Units 6 & 7 could require maintenance during operations including repaving or other modifications. Should regrading of graveled roads be required, the impacts would be temporary and limited to the area being serviced. Surface water runoff from road maintenance activities would be managed onsite or routed to the industrial wastewater facility. Potential impacts would be temporary and could be mitigated through the use of silt fencing that would limit runoff. The use of sedimentation control could also temporarily block surface water flow. Impacts to surface water flow from road operational use and maintenance would be SMALL and would not require mitigation other than described above.

The onsite road improvements described in Chapter 4 associated with construction activities could be removed some time after the units are in operation. Should this occur, these locations would be returned to preconstruction conditions by removing the improvements, recontouring the area and reseeded or replanting native plant species. During restoration activities, environmental best management practices would be followed in accordance with the SWPPP for construction activities. Impacts would be similar to those during construction and limited to the area of the road removal activity. Therefore, impacts to surface water hydrology would be SMALL and not require further mitigation.

Groundwater

Operational use or general maintenance of site roads would not alter groundwater flow directions. However, should extensive maintenance be required that would involve the need to excavate along the roads or a portion of the road beds, the groundwater flow direction could be temporarily altered. The potential impacts would be temporary and groundwater levels and flow direction would return to those encountered before maintenance activities began. Therefore, impacts would be SMALL and would not require mitigation.

As discussed in the surface water section above, onsite road improvements made during the construction phase of the project could be removed and the areas restored to preconstruction conditions during the operational phase. Dewatering would not be required during the restoration activities. Therefore, impacts to groundwater from the restoration to preconstruction conditions would be SMALL and not require mitigation.

5.2.1.1.4 Security Facilities

Surface Water

Operation and maintenance of security facilities, through the disturbance of surface soils, could divert surface water flow within the immediate area of the facility. For example, the use of non-flow-through temporary barriers used for security or to direct vehicular traffic could alter the flow of surface water in the vicinity of the barrier. Impacts from permanent structures would be similar to those during construction. Maintenance of security buildings or other permanent security facilities could require temporary construction activities be performed. Potential impacts would be temporary and local to the activity. Because of the relatively small size of these security stations and support infrastructure (fencing, gates, turnouts, etc.), impacts to surface water flow would be SMALL and would not require mitigation.

Groundwater

As described above, the maintenance to security facilities would result primarily in impacts from the disturbance of surface soils. Impacts to groundwater from the alteration of groundwater flow could occur. However, any impacts would be temporary. Once maintenance activities cease, any alteration to groundwater flow would cease. Impacts to groundwater from the alteration of groundwater flow would be SMALL and would not require mitigation.

5.2.1.1.5 Operational Utilities

Surface Water

As described in Section 3.9, permanent utilities would be installed during construction that would support Units 6 & 7 operation. These would include above ground and underground infrastructure for power, lights, communications, potable and cooling water systems, water treatment facilities, wastewater and waste treatment facilities, fire protection, and operational maintenance gas and air systems.

Maintenance requiring the excavation of any of these utilities could impact surface water flow in the vicinity of the maintenance being performed. The use of sedimentation control could also temporarily block surface water flow. Maintenance activities performed on overhead utilities would not alter surface water flow unless the work area becomes rutted and begins to hold or redirect the flow of surface water. Should this situation occur, the area would undergo recontouring to redirect flow to its prior direction. These activities would, therefore, result in the short-term potential for impacts in relatively small areas. Impacts from these activities would be SMALL and would not require mitigation other than those specified through permit requirements.

Groundwater

Groundwater could be encountered during the maintenance excavation for underground utilities requiring the use of curtain drains or other forms of cutoff wall technologies during excavation operations. Dewatering activities, if needed, may require a permit and could require the use of a detention basin or other sedimentation control measures such as check dams, riprap, and sediment barriers based on site-specific permit requirements before discharge to a permitted outfall. Impacts to groundwater from hydrologic alteration during maintenance activities would be temporary and flow would return to normal when maintenance activities cease. Impacts would be SMALL and would not require mitigation other than that specified in the required permits.

5.2.1.1.6 Water and Sanitary Treatment Facilities

Surface Water

The FPL reclaimed water treatment facility would further treat the reclaimed water from Miami-Dade County before use. Sanitary treatment would be provided by a packaged sanitary treatment plant located on the Units 6 & 7 plant area. The sanitary treatment plant would be designed to process sanitary effluent from Units 1 through 7. None of the wastewater streams would be released to surface water bodies or to the ground surface.

Potential operational impacts of these facilities could, however, include those associated with maintenance activities. The disturbance of surface soils during maintenance activities could result in impacts similar to those resulting from the construction of the facility. Soil retention techniques such as silt barriers would be used to reduce impacts in accordance with prescribed environmental best management practices plan developed for Units 6 & 7. Should dewatering be necessary during maintenance activities, the water would be released to sediment control devices before being released in accordance with all state and local requirements. Potential impacts due to maintenance operations would be temporary and limited to the work area.

Impacts to surface water from the operations of the reclaimed water treatment facility and sanitary treatment plant would be SMALL and would not require mitigation.

Groundwater

The routine operational maintenance of the reclaimed water treatment facility and sanitary treatment plant would not result in direct impacts to groundwater. The discharge of treated wastewater and sanitary waste to the deep injection wells is addressed in Subsection 5.2.1.1.9. Maintenance activities performed at the facilities could, however, require limited dewatering. This could temporarily alter the flow of groundwater in the vicinity of the maintenance activity. Once dewatering ceases, the groundwater flow would return to normal.

Impacts to groundwater flow from the operations of reclaimed water treatment facility and the sanitary treatment plant would be SMALL and would not require mitigation.

5.2.1.1.7 Operation of the Reclaimed Water Pipelines

Surface Water

The reclaimed water delivery pipelines would connect to the FPL reclaimed water treatment facility. Therefore, a portion of the pipelines would be located within the Turkey Point plant property. Operational impacts could result from maintenance activities performed along the pipelines that could include maintaining a grassed or graveled/paved surface cover. Maintenance could require the excavation of the pipelines, which would require compliance with the environmental best management practices. The excavation and temporary stockpiling of soils would alter surface water flow. Once the maintenance activities are complete, the excavation would be filled and the area would be restored to its prior condition. The potential impact to surface water during operation of the reclaimed water pipelines would be SMALL and would not require mitigation.

Groundwater

The maintenance of the onsite portion of the reclaimed water pipelines could require the use of cutoff wall technology to limit potential impacts to groundwater flow during dewatering. The use of cutoff wall technology would alter the flow of groundwater in the vicinity of the excavation activity. Impacts would be short term and localized around the point of the dewatering. Once dewatering activities come to an end, the groundwater hydrologic flow would return to its previous conditions. Impacts during maintenance would be short term and limited to the area of maintenance activity. Therefore, impacts would be SMALL and would not require mitigation.

5.2.1.1.8 Operation of the Radial Collector Wells

A groundwater flow model (MODFLOW 2000/Visual MODFLOW) was used to assess the impacts of radial collector well operation to surface water and groundwater. The calibrated and verified groundwater model, as previously discussed in Subsection 2.3.1.2.3, was used as the basis for the predictive runs for radial collector well operation. The radial collector well conceptual model design is summarized as follows:

- The water level in Biscayne Bay was set to the long-term average of -0.81 feet NAVD 88.
- The Unit 6 & 7 plant area was assumed complete and the relevant recharge/evapotranspiration zones were altered to reflect as-built conditions. The muck layer was removed from the plant area, as discussed in Section 3.9, and replaced with backfill.
- Three of the four radial collector wells were operational. To provide a conservative estimate of the source of water from inland areas to the radial collector wells, the three wells closest to the shore were modeled as operational.
- Four pumping wells were placed on the last 300 feet of each lateral to represent the screened intervals. Flows were distributed along the laterals to reflect friction losses and distributed flow along the length.
- The radial collector wells laterals were located within the Upper Higher Flow Zone.
- The simulation was executed at steady-state conditions.

The groundwater drawdown in Model Layer 1 (muck and rock/sandy material) and Model Layer 4 (Upper Higher Flow Zone) is depicted in Figures 5.2-1 and 5.2-2, respectively. The operational impacts of the radial collector wells to groundwater and surface water are discussed in the following sections.

Surface Water

Four radial collector wells would be installed adjacent to Biscayne Bay to provide cooling water for Units 6 & 7 (see Figure 3.1-3). The well caissons would be located on the Turkey Point peninsula, east of the existing units. Each radial collector well would consist of a central reinforced concrete caisson extending below the ground level with laterals projecting from the caisson. The well laterals would be advanced horizontally a distance of up to 900 feet and installed at a depth of approximately 25 to 40 feet below the bottom of Biscayne Bay. The four radial collector wells would provide up to 86,400 gpm (124.4 million gallons per day [mgd]) to supplement the reclaimed water source for cooling water makeup for Units 6 & 7 (Table 3.3-2).

As previously discussed in Subsection 2.3.1, surface water features within the local area of the radial collector wells included Biscayne Bay, Card Sound, the cooling canals of the industrial wastewater facility, and several surface water control canals (e.g., L-31 Canal). The surface water elevation in each of these features was set to known values based on seasonal or long-term data. Notably, the water levels in the predominant surface water features in the site were stipulated as follows: Biscayne Bay/Card Sound (-1.05 feet NAVD 88); cooling canals of industrial wastewater system (discharge side: 1.28 feet NAVD 88; intake structure: -3.38 feet NAVD 88).

As part of the steady-state radial collector well groundwater simulation, the volumetric flow rates were calculated for each of the boundary conditions (e.g., general head at Biscayne Bay/Card Sound, river boundary at the cooling canals of the industrial wastewater facility). Based on this calculation, it was observed that 97.8 percent (121.7 mgd) of the groundwater recharge originated from Biscayne Bay and 2.2 percent (2.7 mgd) originated from inland areas. Notably, 2.0 percent (2.5 mgd) originated from the cooling canals of the industrial wastewater facility. The recharge from Biscayne Bay would be predominately localized in the area of the radial collector wells.

Maintenance activities for the radial collector wells, including such activities as localized dewatering, below grade water pipeline/utility maintenance, above grade mechanical maintenance, etc. could be performed during the operation of Units 6 & 7. Water produced would be released to the industrial wastewater facility or controlled locally though the use of environmental best management practices to mitigate the potential impacts to surface water in the vicinity of the maintenance activities being performed. In summary, impacts to surface water from maintenance activities associated with operation of the radial collector wells would be SMALL and not require mitigation.

Groundwater

As previously discussed, groundwater modeling was performed to simulate the steady-state conditions resulting from operation of the radial collector wells. The cone of depression in Model Layer 1 (onshore — muck; offshore — rock/sand) ranged from 3 to 0.1 feet and was generally confined to the area local to the radial collector wells (areal extent of 211 acres based on the 0.1 foot drawdown contour in Biscayne Bay) and the Units 1 though 5 plant area, as depicted on Figure 5.2-1. The drawdown in Model Layer 4 (Upper High Flow Zone) ranged from 3 to 0.1 feet and was also generally confined to the area local to the radial collector wells (areal extent of 729 acres based on the 0.1 foot drawdown contour in Biscayne Bay) as depicted in Figure 5.2-2.

The model indicates that the uplands could be dewatered on the Turkey Point peninsula during steady-state conditions; however this would be confined to the areas immediately around the radial collector wells. Drawdown in the muck layer on the eastern shoreline, based on the results of the groundwater model, is not anticipated (Figure 5.2-1).

Based on the results of the groundwater modeling, approximately 97.8 percent of groundwater recharge to the radial collector wells would originate from Biscayne Bay and 2.2 percent would come from areas inland, including 2.0 percent from the cooling canals of the industrial wastewater facility. The remaining 0.2 percent will be from boundaries representing precipitation onshore. The 0.2 percent from precipitation recharge represents a relatively small amount of water. Because the precipitation is fresh water, it will tend to remain in the upper layers of the aquifer. Since the radial collector wells draw water at depth, the 0.2 percent is a conservative prediction of the water entering the radial collector wells. Therefore, the amount of fresh water drawn by the radial collector wells will be inconsequential and will not adversely impact the environment. Thus, impacts to the Biscayne Aquifer west of the Turkey Point property would be insignificant.

Typical maintenance on the radial collector well screens to prevent fouling could be required every 15–20 years. The well lateral screen and sand packs around the screens could be cleaned by several techniques including airbursts and jetting. The resulting impacts would be temporary and localized to the radial collector well area. Based on the above analyses, radial collector well operational impacts to groundwater, including groundwater flow and maintenance activities, would be SMALL and not warrant mitigation.

5.2.1.1.9 Operation of Deep Injection Wells

Surface Water

Wastewater, including the treated effluent from the sanitary wastewater generated by the operation of Units 6 & 7 and cooling tower blowdown, would be discharged to the Boulder Zone of the lower Floridan aquifer via twelve deep injection wells. No plant process waste streams would be discharged to surface water.

Surface water impacts could occur from deep injection well pipeline maintenance activities, including excavation to expose the pipeline between the blowdown sump and the deep injection wells, but these effects would be temporary and SMALL. Accordingly, impacts to surface water from underground injection activities would be SMALL and would not require mitigation.

Groundwater

The operation of the deep injection wells was evaluated to estimate the areal extent of groundwater influence (the injectate effective radius) in the Boulder Zone over an assumed operational lifespan of Units 6 & 7. An assumed maximum flow rate of 90 mgd was used, which is slightly higher than the expected maximum flow rate of 85 mgd. It is important to note that as described in Subsection 2.3.2.2.2.2, it is estimated that each deep injection well would have a maximum permitted injection capacity of 18.6 million gallons per day at a peak hourly flow.

However, it is estimated that each well would be operated at an injection rate of approximately 10 million gallons per day. The injectate effective radius was calculated using the equation:

$$\text{Volume} = \text{radius}^2\ \pi\ H\ n\ (7.48\ g/ft^3)$$

Where:

- Volume is the amount of water to be injected in gallons over a given period of years
- Radius (r) is the radius (miles) of injectate
- H is the vertical effective injection thickness
- n is the porosity of the formation through the injection zone

Based on a porosity of 20 percent and an effective injection thickness of 200 feet, the 60-year areal extent of injected fluid created by this injection rate would have a radius of approximately 9 miles. The results assumed the Boulder Zone is homogeneous and capable of exhibiting radial flow.

The effective thickness of the injection zone is at least in part dependent upon the density difference between the wastewater being injected and the groundwater within the Boulder Zone. This is due to stratification that would be caused in the Boulder Zone by this difference in water density. The density of the wastewater injectate is a function of both its temperature and total dissolved solid (TDS) concentration. Injectate that is denser than Boulder Zone water would migrate downward in the formation, thus increasing the vertical effective injection thickness. This would be the scenario during 100 percent saltwater injectate at a lower temperature. Injectate that is less dense than the Boulder zone water would stratify and decrease the vertical effective injection thickness. This would be the scenario during 100 percent reclaimed water injectate at higher temperatures. Based on these differences in Units 6 & 7 operation and the resultant injectate density differences, a range of effective thickness was included in the evaluation.

A sensitivity analysis was performed that varied the porosity and vertical effective injection thickness, as discussed above. As summarized in Table 5.2-1, a change in the porosity across the unit or a change in the estimated vertical effective injection thickness, based on potential density/stratification effects, would change the radius of influence, varying between 3.2 and 12.3 miles for 60 years.

The Underground Source of Drinking Water (USDW), as defined by the Florida Department of Environmental Protection (FDEP), is an aquifer that contains a TDS concentration of less than 10,000 mg/L and contains a sufficient quantity of water to supply a public water system. In the area of the Turkey Point plant property, the base of the USDW is approximately 1450 feet below land surface.

As discussed in Subsection 2.3.1.2, in the area of the Turkey Point plant property, the base of the USDW is below the base of the Upper Floridan aquifer and above the top of the Avon Park Permeable Zone. The top of the Boulder Zone (i.e., the injection zone) is estimated to be approximately 2900 feet below land surface. The Middle Confining Unit, which separates the USDW from the injection zone, is at least 1000 feet thick. Based on reported data from southeast Florida, the vertical hydraulic conductivity of this unit is anticipated to be between 1.3E-04 ft/day and 0.24 ft/day. The effective thickness of the Boulder Zone in the area of the Turkey Point plant property is estimated to be 200 feet for permitting applications; and the transmissivity is reported to be between 3.2E06 ft^2/day and 24.6E06 ft^2/day.

During 2003, the EPA evaluated the Miami-Dade County deep injection wells due to water quality issues. During that evaluation, the EPA regarded the pressure head resulting from injection to be negligible due the Boulder Zone’s high karstification and fracturing. The pressure head buoyancy in the Boulder Zone was determined to be approximately 70 feet when injecting fresh domestic effluent at a rate of 112.5 mgd. That evaluation would indicate that the total head pressure due to injection and buoyancy resulting from deep injection well operation for Units 6 & 7 would be less than 70 feet using reclaimed water as the source for cooling water. The use of seawater as the source of cooling water would result in even less total head pressure than that when using reclaimed water.

The deep injection wells would be installed in accordance with an FDEP underground injection well permit and local permit requirements. The injection casing in the deep injection wells for Units 6 & 7 would be seated at a greater depth than other regional injection wells to maximize the thickness of the confining strata between the injection zone and base of the USDW. The current standard practice of grouting the pilot hole would also be employed to prevent the possible development of the double borehole conditions. The data collected during drilling and testing of the exploratory well would be used to evaluate the proposed system and would be submitted to the FDEP in support of the Class I injection well construction permit application for the Units 6 & 7 deep injection wells.

Water quality and pressure monitoring would be conducted in two separate intervals in the Floridan aquifer as mandated by the UIC permit. General UIC permit requirements include monthly reporting of the average, minimum, and maximum injection pressure, flow rate, volume, and annular pressure. The UIC permit would also require mechanical integrity tests in the deep injection wells to be performed every 5 years. The monitoring program objective would be to detect vertical migration of injected fluids into the Upper Floridan aquifer through the confining layer overlying the Boulder Zone. Sections 6.3 and 6.6 describe the operational monitoring of the deep injection wells.

Based on the above analyses, potential impacts from the operation of the deep injection wells to groundwater would be SMALL and not warrant mitigation beyond that described previously.

5.2.1.1.10 Transmission Rights-of-Way

Surface Water

Potential operational impacts along the proposed transmission rights-of-way would result from maintenance activities. These transmission lines would include the underground lines from Units 6 & 7 to the Clear Sky substation and the overhead lines from the Clear Sky substation to offsite substations. As described in Section 3.7, FPL regularly inspects transmission lines. Vehicular traffic could result in the rutting of the access roads along the rights-of-way that could impact surface flow in the vicinity of the disturbances. FPL would repair any areas of disturbed soils, recontour the area, and reestablish the vegetative cover, if necessary, in a timely manner that would reduce the potential for erosion through surface water runoff.

It could be necessary to perform maintenance that would require excavation and dewatering along the transmission lines. Water from the dewatering process would be routed to a detention basin or other sediment removal process before being released in accordance with FDEP-approved methods and in accordance with FDEP permit requirements.

Impacts to hydrologic flow from operation and maintenance of the transmission lines on the Turkey Point plant property would be SMALL and would not require mitigation in addition to those described.

Groundwater

It could be necessary to perform maintenance that would require excavation and dewatering along the transmission lines. The dewatering activity would create temporary drawdown of the water table. Water from the dewatering process would be routed to a retention basin or other sediment removal process before being released in accordance with approved methods and permit requirements. The water table and flow would return to normal once dewatering has ceased.

Impacts to groundwater hydrologic flow from operation and maintenance of the transmission lines on the Turkey Point plant property would be SMALL and would not require mitigation in addition to those described.

5.2.1.2 Offsite Facilities

5.2.1.2.1 Fill Borrow Areas

Surface Water

Fill borrow material for use during operation and maintenance of Units 6 & 7 would be supplied through a commercial provider. The FPL-owned fill source would not be restored to preexisting conditions. The water management feature that would be created from the excavation activities would be designed to store excess stormwater to complement regional wetland rehydration projects. A perimeter berm could also be used to restrict the flow of surface water onto the property and used to reroute the surface water flow to maintain the original flow direction. Impacts on surface water flow would be SMALL.

Groundwater

Surface water resulting from precipitation routed to the FPL-owned fill source for disposal/storage could increase the elevation of the water in the borrow pit. An increase in elevation of the ponded water could also raise the level of the adjacent groundwater that could alter the groundwater flow direction in the vicinity of the borrow pit. However, the elevation change would be temporary and the water table would return to normal once the storm event ends. The impacts from hydrologic alteration would be SMALL and would not require additional mitigation.

5.2.1.2.2 Transmission Rights-of-Way Maintenance

Surface Water

Potential operational impacts along the offsite portions of the proposed transmission rights-of-way would be similar to the segments on the Turkey Point plant property. During operations, potential impacts from maintaining hydrologic flow could occur. As described in Section 3.7, FPL regularly inspects the transmission lines. Vehicular traffic could result in the rutting of the access roads along the rights-of-way, which could impact surface flow in the vicinity of the disturbances. Should soil disturbance be required during maintenance operations within the rights-of-way, silt fence technology would be used to minimize impacts to nearby surface waterbodies/drainage features.

To reduce the potential for erosion through surface water runoff, areas of disturbed soils would be repaired, areas recontoured, and vegetative cover reestablished, if necessary, in a timely manner. Accordingly, impacts to hydrologic flow from operation of the offsite transmission lines would be SMALL and would not require further mitigation.

Groundwater

It could be necessary to perform maintenance that would require excavating and dewatering along the transmission lines. The dewatering activity could create temporary drawdown of the water table. Dewatering could impact areas off the right-of-way. However, the water table and flow would return to normal once dewatering ceased. Impacts to groundwater hydrologic flow from operation of the offsite transmission lines would be SMALL and would not require mitigation.

5.2.1.2.3 Reclaimed and Potable Water Pipelines

Surface Water

Potential operational impacts along the reclaimed and potable water pipelines would result from maintenance activities. Impacts would be to areas previously disturbed during construction of the pipelines. Vehicular traffic could result in the rutting of the access roads along the rights-of-way which could impact surface flow in the vicinity of the disturbances. Maintenance activities would be accomplished in accordance with established protocols and applicable regulations.

Impacts to surface water hydrologic flow from operation of the reclaimed and potable water pipelines would be SMALL and would not require mitigation.

Groundwater

It could be necessary to perform maintenance that would require excavation and dewatering along the reclaimed and potable water pipelines. The dewatering activity could create temporary drawdown of the water table. Dewatering could impact areas off the right-of-way. However, the water table and flow would return to normal once dewatering ceased. Impacts to groundwater hydrologic flow from operation of the reclaimed and potable water pipelines would be SMALL and would not require mitigation.

5.2.1.2.4 Offsite Roads

Surface Water

Once construction activities cease, the offsite construction access roads would not normally be used by operations workers to access Units 6 & 7. However, the offsite construction access roads could be used, if needed, to access the Turkey Point plant property for special events or for the special delivery of equipment or supplies. Impacts to surface water from the use of the offsite roads during operations would, therefore, be less than that encountered during the period of construction. Impacts could still occur from any necessary maintenance activities to the roadways which would include excavation activities or the addition of surface water culverts should they be needed, but these impacts would be temporary. Impacts to surface water hydrology resulting from these activities during operations would be SMALL and would not require mitigation.

However, the offsite roadway improvements described in Chapter 4 could be removed some time after the units are in operation. Should this occur, these locations would be returned to preconstruction conditions by removing the improvements, recontouring the area, and reseeded or replanting native plant species. During restoration activities, environmental best management practices would be followed in accordance with the SWPPP for construction activities. Impacts would be similar to those during construction, limited to the area of the road removal activity, and be of short duration. Therefore, impacts to surface water hydrology would be SMALL and not require further mitigation.

Groundwater

Once construction activities cease, the offsite construction access roads would not normally be used by operations workers to access Units 6 & 7. The construction access roads could be used, if needed, to access the Turkey Point plant property for special events or for the special delivery of equipment or supplies. Impacts to groundwater from the use of the offsite roads during operations would be less than that encountered during the period of construction. However, impacts could still occur from any necessary maintenance activities. These activities could also require dewatering. Impacts resulting from these activities would be temporary and groundwater levels would return to normal. Impacts to groundwater hydrology resulting from these activities during operations would be SMALL and would not require mitigation.

As described in the surface water section above, offsite road improvements made during the construction phase of the project could be removed and the areas restored to preconstruction conditions during the operation phase. Dewatering would not be required during the restoration activities. Therefore, impacts to groundwater from the restoration to preconstruction conditions would be SMALL and not require mitigation.

5.2.2 WATER USE IMPACTS

As described in Section 3.3, public water in the amount of 936 gpm (1.35 mgd) to 2553 gpm (3.68 mgd) would be supplied by Miami-Dade a new potable water pipelines for the operation of Units 6 & 7. Operational impacts to existing public infrastructure are described in Section 5.8.

Two sources of makeup water are planned to replace cooling tower blowdown for Units 6 & 7. The primary source would be reclaimed water from the Miami-Dade Water and Sewer Department (MDWASD) South District Wastewater Treatment Plant (SDWWTP). When reclaimed water cannot supply the quantity and/or quality of water needed for the circulating water system, a second source for makeup water would consist of radial collector wells that would withdraw saltwater from under Biscayne Bay. The ratio of water supplied by the two makeup water sources would vary based on the availability and/or quality of reclaimed water from MDWASD.

5.2.2.1 Surface Water

5.2.2.1.1 Reclaimed Water and Potable Water

Reclaimed water from the SDWWTP would supply approximately 60 mgd for the operation of Units 6 & 7. Based on MDWASD data from 2006, the MDWASD was disposing of 295 mgd of wastewater by deep well injection and surface water discharge to offshore locations. Of the 295 mgd, 106 mgd was being injected into south Florida aquifers. The South District of the MDWASD alone discharged 94 mgd to the Boulder Zone of the Floridan Aquifer. As of 2006, the MDWASD was treating and reusing 18 mgd of wastewater (SFWMD 2008). The South Florida Water Management District (SFWMD) will require the MDWASD to increase their reuse of treated wastewater to at least 170 mgd during the period of their current permit which will expire in 2030 (SFWMD 2010). The SFWMD estimates that MDWASD will increase the output of water available for reuse to 193 mgd by 2025 which would represent a usage of 51% of the MDWASD's wastewater output (SFWMD 2008). The additional reuse water will be used for a number of proposed projects, which include the discharge of reuse water for Everglade restoration projects (SFWMD 2007).

The Florida legislature recently enacted new legislation that eliminates the option for coastal communities to use ocean outfalls for the disposal of effluent from a wastewater treatment plant. The MDWASD has initiated a review of the changes necessary to the wastewater system to meet the mandates. One result is the addition of high-level disinfection to facilities that currently do not have this level of treatment. These facilities then could either discharge their reclaimed water to injection wells (in the Boulder Zone) or find other reuse options.

Use of reclaimed water was also addressed by the water use permit for the Miami-Dade consolidated public water supply, issued by the South Florida Water Management District (November 1, 2010). The permit contained several limiting conditions (Nos. 39–43) that apply to the reuse of reclaimed water. Condition 39 requires the MDWASD to implement 170 mgd of reuse projects. Exhibit 14 of the permit presents a table of reuse projects and deadlines to meet the permit limiting condition. Also presented in Exhibit 14 and Limiting Condition 41 of the permit is the requirement that MDWASD work with FPL to provide up to 70 mgd of reclaimed water for nuclear projects and 14 mgd for Unit 5. The reuse projects listed in Exhibit 14 for the SDWWTP total 188 mgd of reclaimed water. The largest of the reuse projects planned for the SDWWTP are: (1) furnishing 75.7 mgd of reclaimed water for the Biscayne Bay Coastal Wetlands Project, a component of the Comprehensive Everglades Restoration Plan, scheduled for implementation in 2022, and (2) a proposed well field mitigation project that is projected to need 18.6 mgd of reclaimed water. If the largest reuse projects listed in the exhibit are met as projected, reclaimed water from the SDWWTP may not be sufficient to meet all of the water demand for the operation of Units 6 & 7. To compensate for this potential shortfall, a second source for makeup water would consist of radial collector wells that would withdraw saltwater from under Biscayne Bay.

The potential water use impacts resulting from operation of the radial collector wells are described in Subsection 5.2.2.1.2.

The use of reclaimed water for Units 6 & 7 would be a beneficial and cost-effective means of increasing the use of reclaimed water in Miami-Dade County and would help the County meet its reclaimed water compliance requirements. In the absence of reuse opportunities, this treated domestic wastewater would likely continue to be discharged to the ocean or deep injection wells. Miami-Dade County has challenging water goals to eliminate ocean outfalls and increase the amount of water that is reclaimed for environmental benefit and other beneficial uses. The beneficial use of reclaimed water for Units 6 & 7 would enable the County to meet approximately half of its reclaimed water goal and provide environmental benefits by reducing the volume of wastewater discharged to ocean outfalls or deep injection wells. For these reasons, the use of reclaimed water for Units 6 & 7 would have a positive impact on surface water.

Potable water supplied by Miami-Dade County for Units 6 & 7 operation would be covered under MDWASD's consumptive use permit from the SFWMD. The potable water would come from the Biscayne Aquifer and not from surface water sources. Therefore, there would be no surface water impacts.

5.2.2.1.2 Radial Collector Wells

As described in Subsection 2.3.1, Biscayne Bay is hydrologically connected to the upper zone of the Biscayne aquifer. Based on groundwater modeling described above, the radial collector wells would be recharged at a rate of 97.8 percent (121.7 mgd) from Biscayne Bay. This would be predominately localized in the area of the radial collector wells. The remaining recharge would be from surface water (e.g., cooling canals) and groundwater beneath the plant property. The amount of saltwater used (up to approximately 121.7 mgd if 97.8 percent saltwater) compared to the size of the saltwater resource available would be insignificant. Impacts to Biscayne Bay surface waters would be SMALL and would not require mitigation.

Monitoring of the water quality from the radial collector wells would be performed to determine whether the water being pumped is saltwater by monitoring the groundwater elevation data in the near shore areas adjacent to the radial collector well locations. (See Sections 6.3 and 6.6 regarding planned pilot studies and monitoring associated with the radial collector wells.)

5.2.2.1.3 Offsite Facilities

Water use impacts for off-site facilities during operations would be minimal. Operational water requirements would primarily be for personnel use at these facilities. This could include potable and sanitary water use. Off-site potable and sanitary water use would likely be provided by groundwater supplied by Miami-Dade County where plans are to build facilities to support extended operations; for example switchyard facilities. These would likely support small intermittent work activities and would not likely be a major user of water. Therefore impacts to surface water would be anticipated to be SMALL.

Water requirements during operational maintenance construction activities not associated with personnel use would likely include water associated processes, for example the use of water during the mixing of concrete. Any water use during this type of activity would be associated with the commercial concrete supplier and not directly related to Unit 6 & 7 activities. Any water directly required by FPL during maintenance activities could be transported from an existing FPL facility and would likely be supplied by county potable supply. Therefore, minimal impacts would result from off-site water use to surface water resources at these facilities.

5.2.2.2 Groundwater

5.2.2.2.1 Reclaimed Water and Potable Water

As previously described, the reclaimed water that would be supplied by the Miami-Dade SDWWTP currently is being injected into the Boulder Zone of the lower Floridan aquifer. The Boulder Zone is used in south Florida for industrial and municipal wastewater disposal. MDWASD plans to distribute the reclaimed water once the water has undergone additional treatment. This system is anticipated to be in place by 2013.

The appropriate use of reclaimed water would reduce the rate of increase of groundwater used in the Miami/Dade County area by public water users. A reduction in the amount of wastewater currently being injected by MDWSD would also allow the district to process wastewater currently being discharged offshore.

The use of reclaimed water as makeup water for Units 6 & 7 would reduce the amount of reclaimed water that would be discharged to deep injection wells by 18 mgd to 60 mgd. The use and deep injection of reclaimed water by Units 6 & 7 would represent up to approximately 64% of the wastewater injected by the South District of the MDWSD, approximately 57% of the total wastewater injected by MDWSD, and approximately 19% of the total amount of wastewater treated by the MDWSD during 2006. By the time of Units 6 & 7 operation, MDWSD is projected to be producing up to 193 mgd of reclaimed water for use. Units 6 & 7 usage would represent up to 31 percent of the reclaimed water projected to be available by 2025. As MDWSD increases their ability to raise the quality of wastewater treatment, the availability of reclaimed water for reuse would also increase.

The use of reclaimed water by Units 6 & 7 and injection of the wastewater could increase the current amount of water being injected into the Boulder Zone via deep well injection depending on whether MDWSD service area grows to continue the need to inject or decides to reduce offshore discharges by performing deep injection of these waters. The Boulder Zone is used as a disposal zone and not as a source of water production. The Units 6 & 7 deep injection wells would be in accordance with FDEP permit requirements requiring the installation of multiple surface casings and grouting processes to limit the potential of creating pathways from the Boulder Zone upward to the USDW which could impact use. Therefore, impacts to groundwater use from the use of reclaimed water would be SMALL and would not require mitigation.

5.2.2.2.2 Radial Collector Wells

The radial collector well laterals would be installed beneath Biscayne Bay in areas where the bottom of the bay would readily facilitate the vertical movement of saltwater from the bay to the underlying aquifer formation where the collection screens would be located.

As described in Subsection 5.2.1.1.8, it is estimated that the radial collector wells would be recharged at a rate of 97.8 percent (121.7 mgd) from Biscayne Bay. This would be predominately localized in the area of the radial collector wells. The remaining recharge would be from the inland area west of the radial collector wells, including the cooling canals of the industrial wastewater facility, estimated at 2.5 mgd, and other areas, estimated at 0.2 mgd, including groundwater beneath the plant property. Recharge from groundwater would occur in an area where the groundwater is too brackish for potable use.

Based on the amount of expected recharge from groundwater sources and the non-potable classification of the groundwater at the site (due to its salinity), the predicted impacts to groundwater use due to the operation of the radial collector wells would be SMALL.

Monitoring wells would be installed and used to monitor whether the system is pumping seawater or groundwater by monitoring the groundwater elevation data in the nearshore areas adjacent to the radial collector well locations.

Based on the groundwater modeling of the radial collector wells and the resultant modeled impacts of the influence of the wells on groundwater flow, impacts to groundwater use from the operation of the radial collector wells as a cooling water makeup source would be SMALL and would not require mitigation.

5.2.2.2.3 Offsite Facilities

Water use impacts for off-site facilities during operations would be minimal. Operational water requirements would primarily be for personnel use at these facilities. This could include potable and sanitary water use. Off-site potable and sanitary water use would likely be provided by groundwater supplied by Miami-Dade County where FPL currently has or plans to build facilities to support extended operations; for example switchyard facilities. These would likely support small intermittent work activities and would not likely be a major user of water. Therefore, impacts to groundwater resources would be SMALL.

Water requirements during operational maintenance construction activities not associated with personnel use would likely include water associated processes, for example, the use of water during the mixing of concrete. Any water use during this type of activity would be associated with the commercial concrete supplier and not directly related to FPL activities. Any water directly required during maintenance activities could be transported from an existing FPL facility and would likely be supplied by county potable water supplies. Therefore, minimal impacts would result from off-site water use to groundwater resources at these facilities.

5.2.3 WATER QUALITY IMPACTS

Surface water and groundwater quality data are summarized in Subsection 2.3.3. Impacts to the existing water quality from the operations of Units 6 & 7 are described below.

5.2.3.1 Surface Water

5.2.3.1.1 Onsite Operations

The surface water bodies that could be impacted by operation of Units 6 & 7 are Biscayne Bay, wetlands, and the cooling canals of the industrial wastewater facility. Because of the existing operational layout of the Turkey Point plant property, surface water flow is primarily to the industrial wastewater facility, which would limit impacts to offsite areas.

Impacts to surface water quality could occur from soil disturbance and erosion from maintenance activities, which could result in increased sediment loading to nearby water bodies. Also, pollutants associated with vehicular traffic and equipment operation and maintenance could impact nearby surface water bodies. The use of environmental best management practices along with a spill prevention plan would prevent or minimize the potential impacts of releases to the environment.

Any ground-disturbing activities that meet federal, state, and local regulations requiring approval permits would be permitted and overseen by state and federal regulators, and guided by environmental best management practices and spill prevention plans. Any impacts to surface water quality during operations would be SMALL and would not require mitigation beyond environmental best management practices and other permit requirements.

The onsite roadway improvements described in Chapter 4 could be removed some time after the units are in operation. Should this occur, these locations would be returned to preconstruction conditions by removing the improvements, recontouring the area, and reseeding or replanting native plant species. During restoration activities, environmental best management practices would be followed in accordance with the SWPPP for construction activities and a spill prevention plan. Impacts to water quality would be similar to those during construction and limited to the area of the road improvement removal activity. Therefore, impacts to onsite surface water quality would be SMALL and not require further mitigation.

5.2.3.1.2 Radial Collector Wells

Operation of radial collector wells installed beneath Biscayne Bay would not impact the water quality of the bay. Although recharge would occur from the bay, it is estimated to be a small percentage of natural freshwater recharge. Additionally, although 2.0 percent of recharge (2.5 mgd) is predicted to originate from the cooling canals of the industrial wastewater facility, which are hypersaline, this recharge water drawn towards the radial collector wells will remain at depth within the aquifer due to the placement of the radial collector well laterals below the seabed and due to the higher density of this hypersaline water relative to seawater. Effects on salinity of the bay, based on the predicted amount of withdrawal versus the natural recharge, would be minimal.

Monitoring wells would be installed and used to monitor the groundwater level and water quality at and near the radial collector well locations to ensure impacts to local water quality, particular surface water quality, are minimal.

Impacts to water quality from operation of the radial collector wells would be SMALL and not require mitigation.

5.2.3.1.3 Offsite Facilities

Operational maintenance activities along the transmission rights-of-way, the reclaimed water pipelines, substations, potable water pipelines, and other off-site facilities could result in impacts to surface water quality. These impacts could result from surface water runoff, which could include the transport of chemical releases to the environment or from the transport of sediment to nearby surface water features. Any minor spills of diesel fuel, hydraulic fluid, lubricants, or other construction-related pollutants along the routes or offsite facilities would be cleaned up quickly to prevent potential contaminants from moving into nearby surface waters. Impacts would be small, localized, and temporary. A new SWPPP and a spill prevention plan would be prepared or an existing SWPPP and spill prevention plan would be modified to include the operations and maintenance activities associated with Units 6 & 7.

In the unlikely event small amounts of pollutants escape into the environment during operations and maintenance, because Units 6 & 7 would operation under a SWPPP and spill prevention plan, any impacts to surface water quality would be SMALL and would not require mitigation beyond those described in this subsection or required by permit.

The offsite roadway improvements described in Chapter 4 could be removed some time after the units are in operation. Should this occur, these locations would be returned to preconstruction conditions by removing the improvements, recontouring the area, and reseeding or replanting native plant species. During restoration activities, environmental best management practices would be followed in accordance with the SWPPP for construction activities. Impacts to water quality would be similar to those during construction and limited to the area of the road improvement removal activity. Therefore, impacts to offsite surface water quality would be SMALL and not require further mitigation.

5.2.3.2 Groundwater

5.2.3.2.1 Onsite Operations

The Turkey Point plant property overlies a portion of the Biscayne aquifer, which is saline in this area. The Biscayne aquifer beneath the Turkey Point plant property is connected hydrologically to both Biscayne Bay and the cooling canals of the industrial wastewater facility. As described in Subsection 2.3.1, the Biscayne aquifer in the vicinity of the Turkey Point plant property is not used as a source of drinking water due to the encroachment of saltwater into the aquifer up to 6 to 8 miles inland. Groundwater does provide one of the sources of water for the industrial wastewater facility along with surface runoff and natural precipitation that percolates to the water table and then moves laterally to the industrial wastewater facility. Should the area undergo a period of drought, the lowering of the water table would create flow from the industrial wastewater facility to groundwater. This could allow the water in the canals to recharge groundwater in the area.

In the unlikely event small amounts of contaminants escape into the environment, they would have only a small, localized, and temporary impact on the water table aquifer.

Impacts to groundwater quality would be SMALL and would not require mitigation beyond that described or required by federal and state permits.

The onsite roadway improvements described in Chapter 4 could be removed some time after the units are in operation. Should this occur, these locations would be returned to preconstruction conditions by removing the improvements, recontouring the area, and reseeding or replanting native plant species. During restoration activities, environmental best management practices would be followed in accordance with the SWPPP for construction activities. Impacts to groundwater water quality would be similar to those during construction and limited to shallow groundwater in the area of the road improvement removal activity. Impacts to onsite ground water quality would be SMALL and not require further mitigation.

5.2.3.2.2 Makeup Water Reservoir

Potential seepage from the makeup water reservoir could flow to the Biscayne aquifer within the industrial wastewater facility that discharges hypersaline water to the Biscayne aquifer. The

Biscayne aquifer beneath the Turkey Point plant property consists of saltwater. The makeup water reservoir would not be used for the storage of water from the radial collector wells.

The reclaimed water and radial collector well water would be collected in basins beneath the cooling towers, isolated from the cooling water reservoir. However, cooling tower plumes would impact the water stored in the cooling water reservoir. Water in the cooling water reservoir would dilute the fallout from the cooling tower plumes.

Potential seepage would flow into the Biscayne aquifer which contains saltwater and receives hypersaline water from the industrial wastewater facility. Therefore, impacts to the water quality of the Biscayne aquifer as the result of seepage from the cooling water reservoir would be SMALL and would not require mitigation.

5.2.3.2.3 Radial Collector Wells

As described in Subsection 5.2.2.2, it is estimated that the radial collector wells would be recharged at a rate of 97.8 percent (121.7 mgd) from Biscayne Bay. This would be predominately localized in the area of the radial collector wells. The remaining recharge would be from surface water (e.g., cooling canals) and groundwater beneath the plant property, thereby having minimal effect on the Biscayne aquifer where used as a water source. The majority of recharge flow would come from the local area of the radial collector wells where the groundwater is too brackish for potable water use. As discussed above, any hypersaline water drawn into the aquifer from the cooling canals would not impact potable water supplies, which are further inland, due to the presence of brackish, non-potable water near the coast. Therefore, impacts to groundwater quality as a result of radial collector well operations would be SMALL and not require mitigation.

5.2.3.2.4 Deep Injection Wells

Wastewater generated from the operation of Units 6 & 7, including water from blowdown sump discharge and treated liquid radwaste, would be injected into the Boulder Zone of the lower Floridan aquifer through the use of twelve deep injection wells. The Boulder Zone is used in south Florida for the disposal of industrial and municipal waste. The Units 6 & 7 deep injection wells would be permitted by FDEP and installed in accordance with FDEP requirements which include the installation and grouting to surface a series of well casings designed to prevent the flow of water between the various aquifer units encountered.

The estimated total injection rate would range from approximately 85 mgd for the 100 percent radial collector well supply to 18 mgd for the 100 percent reclaimed water cooling water makeup supply. Operation of Unit 6 & 7 would follow the FDEP permitting process for injection well permits including monitoring requirements for groundwater quality and groundwater elevation data in overlying aquifers. Tables 3.6-2 (as amended in ER Revision 3) and 3.6-3 summarize the expected water quality of the effluent discharged to the deep injection wells based on the reclaimed water and radial collector well cooling water makeup options, respectively.

As discussed in Subsection 5.2.1.1.9, the impacts from hydrologic alterations in the USDW resulting from the use of the deep injection wells would be SMALL. The potential impacts to water quality of the USDW would also be SMALL if there are no hydrologic impacts to the USDW. Within the Boulder Zone, groundwater quality impact from operations would be SMALL. Deep injection well operation would be in accordance with other deep injection waste disposal operations currently taking place in south Florida and in accordance with rules and regulations developed by the state of Florida as represented by the current deep well injection permitting process. The overlying USDW would be monitored for hydrologic impacts and water quality.

5.2.3.3 Offsite

Due to the existence of shallow groundwater at or just below ground surface in south Florida, groundwater impacts are more likely to occur than in areas where the water table is deeper. As described above, Unit 6 & 7 would operate its offsite facilities under a SWPPPs/spill prevention plans or procedures which would include the use of environmental best management practices. Any minor spills of diesel fuel, hydraulic fluid, lubricants, or other operational/maintenance-related pollutants along the proposed routes or at offsite facilities would be cleaned up quickly to prevent potential contaminants from moving into the groundwater.

In the unlikely event small amounts of pollutants escape into the environment during offsite facility operations and maintenance, because of operation under a SWPPPs/spill prevention plans or procedures including environmental best management practices, impacts would have only a small, localized, and temporary impact on the water quality at the release. Any impacts to groundwater quality would be SMALL and would not require mitigation beyond those described in this subsection or required by permit.

The offsite roadway improvements described in Chapter 4 could be removed some time after the units are in operation. Should this occur, these locations would be returned to preconstruction conditions by removing the improvements, recontouring the area, and reseeding or replanting native plant species. During restoration activities, environmental best management practices would be followed in accordance with the SWPPP for construction activities. Impacts to groundwater quality would be similar to those during construction and limited to the area of the road improvement removal activity. Therefore, impacts to offsite groundwater quality would be SMALL and not require further mitigation.

Section 5.2 References

Langevin (Christian D. Langevin) 2003. *Simulation of Submarine Ground Water Discharge to a marine Estuary: Biscayne Bay, Florida*. Ground Water Vol. 41, No. 6 November-December 2003.

FDEP Mar 2003. Florida Department of Environmental Protection, *The Florida NPDES Stormwater Permitting Program for Industrial Activity*, March 2003.

Miller 1978. Geologic and Geophysical Data from Osceola National Forest, Florida: U.S. *Geological Survey Open-File Report 78-799*, 101 p.

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SFWMD (South Florida Water management District) 2008. South Florida Water Management *District Current and 2025 Projected Reuse Summary*. Water Supply Department. April 25, 2008.

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Table 5.2-1
Estimated Injection Radii for 10-Year and 60-Year Periods

10 Year injection Period at 0.2 Porosity						
Injection Rate (gpd)	**90 mgd**	**90 mgd**	**90 mgd**	**90 mgd**	**90 mgd**	**90 mgd**
Vol (gallons over the period of injection)	3.285E+11	3.285E+11	3.285E+11	3.285E+11	3.285E+11	3.285E+11
n, porosity	0.2	0.2	0.2	0.2	0.2	0.2
H, effective thickness (ft)	100	200	300	400	500	600
Time (years)	10	10	10	10	10	10
Radius of Impact (miles)	5.0	3.5	2.9	2.5	2.2	2.0
60 Year injection Period at 0.2 Porosity						
Injection Rate (gpd)	**90 mgd**	**90 mgd**	**90 mgd**	**90 mgd**	**90 mgd**	**90 mgd**
Vol (gallons over the period of injection)	1.971E+12	1.971E+12	1.971E+12	1.971E+12	1.971E+12	1.971E+12
n, porosity	0.2	0.2	0.2	0.2	0.2	0.2
H, effective thickness (ft)	100	200	300	400	500	600
Time (years)	60	60	60	60	60	60
Radius of Impact (miles)	12.3	8.7	7.1	6.1	5.5	5.0
10 Year injection Period at 0.5 Porosity						
Injection Rate (gpd)	**90 mgd**	**90 mgd**	**90 mgd**	**90 mgd**	**90 mgd**	**90 mgd**
Vol (gallons over the period of injection)	3.285E+11	3.285E+11	3.285E+11	3.285E+11	3.285E+11	3.285E+11
n, porosity	0.5	0.5	0.5	0.5	0.5	0.5
H, effective thickness (ft)	100	200	300	400	500	600
Time (years)	10	10	10	10	10	10
Radius of Impact (miles)	3.2	2.2	1.8	1.6	1.4	1.3
60 Year injection Period at 0.5 Porosity						
Injection Rate (gpd)	**90 mgd**	**90 mgd**	**90 mgd**	**90 mgd**	**90 mgd**	**90 mgd**
Vol (gallons over the period of injection)	1.971E+12	1.971E+12	1.971E+12	1.971E+12	1.971E+12	1.971E+12
n, porosity	0.5	0.5	0.5	0.5	0.5	0.5
H, effective thickness (ft)	100	200	300	400	500	600
Time (years)	60	60	60	60	60	60
Radius of Impact (miles)	7.8	5.5	4.5	3.9	3.5	3.2

Figure 5.2-1 Radial Collector Well Drawdown within the Top Layer

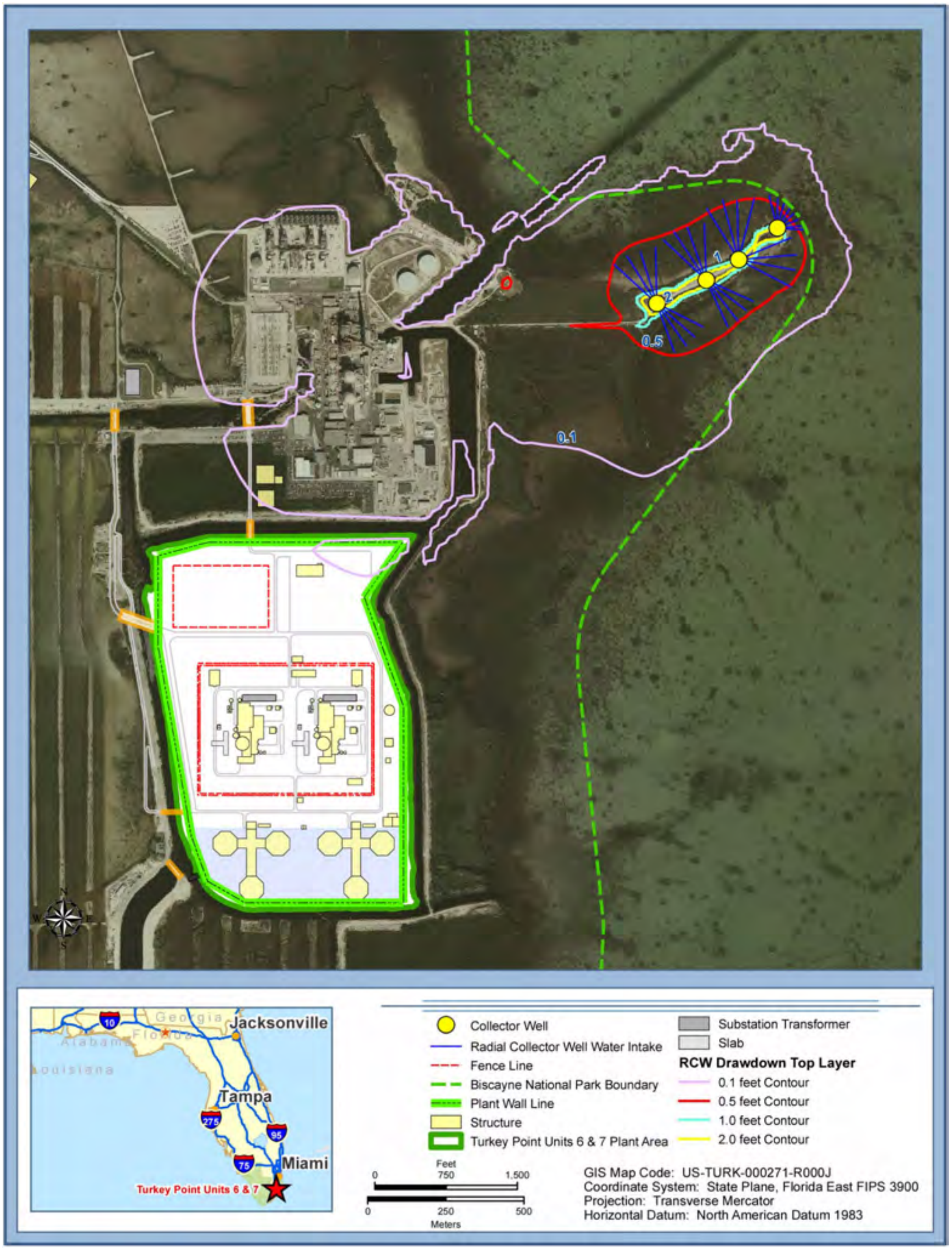
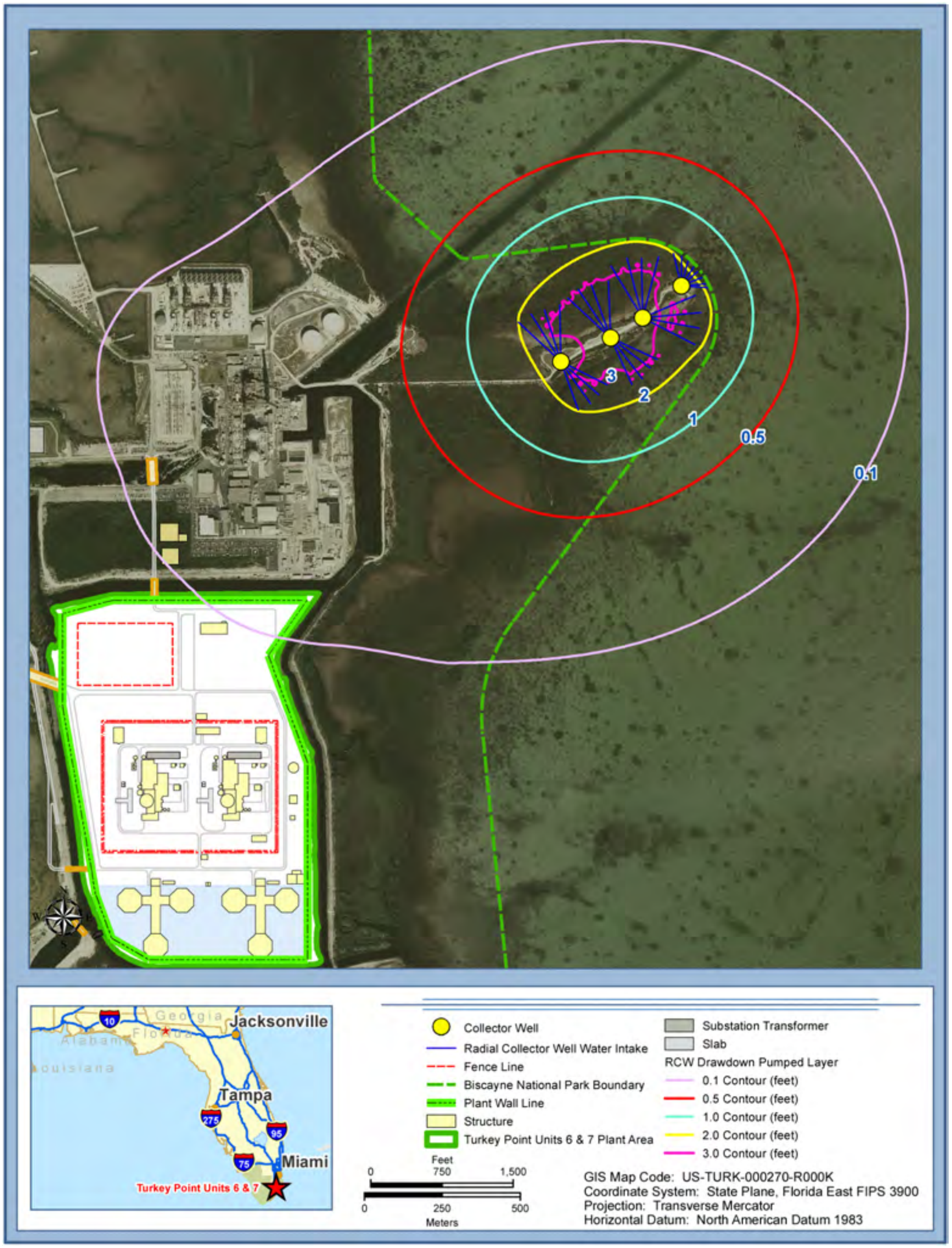


Figure 5.2-2 Radial Collector Well Drawdown in Model 4 (Upper Higher Flow Zone)



5.3 COOLING SYSTEM IMPACTS

This section describes the impacts of the cooling systems associated with operation of Units 6 & 7. The different aspects of cooling system impacts are addressed separately in the following sections:

- Intake system (Subsection 5.3.1)
- Discharge system (Subsection 5.3.2)
- Heat dissipation (Subsection 5.3.3)
- Impacts to members of the public (Subsection 5.3.4)

5.3.1 INTAKE SYSTEM

During normal operations of Units 6 & 7, waste heat would be dissipated by mechanical draft cooling towers. Two sources of makeup water are planned to replace cooling tower blowdown for Units 6 & 7. The primary source would be water reclaimed for reuse after processing by the Miami-Dade Water and Sewer Department (MDWASD), conveyed via pipelines to the Turkey Point plant property. An onsite FPL reclaimed water treatment facility would further treat the reclaimed water for use in the cooling system. When reclaimed water cannot supply the quantity and/or quality of water needed for the circulating water system, a second source for makeup water would consist of radial collector wells that would withdraw saltwater from under Biscayne Bay. The well caissons would be located on the Turkey Point peninsula, east of the existing units. Each radial collector well would consist of a central reinforced concrete caisson extending below the ground level with laterals projecting from the caisson.

Approximately 60 million gallons per day (mgd) of reclaimed water would be delivered to Units 6 & 7 via pipelines from the MDWASD South District Wastewater Treatment Plant (SDWWTP), a distance of approximately 9 miles. An alternate supply of up to 124.4 mgd would be obtained from the radial collector wells.

Hydrodynamic and physical impacts are described in Subsection 5.3.1.1. Potential impacts to important aquatic resources from operation of the cooling water makeup sources for Units 6 & 7 are addressed in Subsection 5.3.1.2.

5.3.1.1 Hydrodynamic Descriptions and Physical Impacts

Reclaimed Water

Treated wastewater from the SDWWTP would be used as cooling tower makeup for Units 6 & 7. The water would undergo secondary treatment and high-level disinfection at the SDWWTP before being piped to Turkey Point, where it would undergo further treatment for use in the mechanical draft cooling towers (see Subsection 3.4.2).

The reclaimed water would not be hydraulically connected to any aquatic habitats. The reclaimed water would be transported via closed pipelines from the SDWWTP to the FPL reclaimed water treatment facility and then to the makeup water reservoir. No hydrodynamic or physical impacts would result from the delivery of reclaimed water to Units 6 & 7.

Radial Collector Wells

As described in Subsection 5.2.1.1.8, four radial collector wells (Figure 3.1-3) with multiple collection screens for each well would be installed in the Biscayne aquifer formation beneath Biscayne Bay to provide up to 124.4 mgd of makeup water. Each radial collector well would consist of a central reinforced concrete caisson extending below the ground level with laterals projecting from the caisson. The well laterals would be advanced horizontally a distance of up to 900 feet and installed at a depth of approximately 25 to 40 feet below the bottom of Biscayne Bay. The radial collector wells would collect groundwater recharged from saltwater through the porous limestone subsurface beneath Biscayne Bay.

The operation of the radial collector wells and the potential impacts on water bodies including Biscayne Bay and the cooling canals in the industrial wastewater facility have been evaluated through groundwater modeling. Based on the evaluation, impacts would be SMALL. Collection of Biscayne Bay water via the radial collector wells would not affect the surface waters of Biscayne Bay. The volume of water drawn into the wells would be minor compared with the volume of water in Biscayne Bay, which is connected directly to the Atlantic Ocean.

5.3.1.2 Aquatic Resources

The use of reclaimed water would not impact any aquatic resources because aquatic organisms would have no contact with this water, which would be subjected to secondary treatment and high level disinfection, then transported via pipelines to the FPL reclaimed water treatment facility. Withdrawal of saltwater from Biscayne Bay through the radial collector wells would not affect aquatic resources in Biscayne Bay. Biscayne Bay, which is connected directly to the Atlantic Ocean, would not experience a noticeable loss of water to the radial collector wells. Also, because the water is not collected directly by the wells, but instead flows through the porous limestone approximately 25 to 40 feet below the bottom of Biscayne Bay, no aquatic organisms in Biscayne Bay would be affected. The flow rate at the sediment-water interface resulting from the radial collector well operation would be approximately 0.00002 feet per second.

Operation of the radial collector wells is not anticipated to result in significant adverse effects on seagrasses. Seagrasses have low nutrient requirements and are able to recycle nutrients efficiently, so that they are strong competitors under low nutrient levels (Koch, 2001; Armitage et al., 2005). *Thalassia testudinum* is the dominant species of seagrass in the area and is more tolerant of low phosphorus/nutrient environments that could potentially result from induced flow through the seabed.

There are several macroinvertebrates and vertebrate species that utilize the seagrass beds of Biscayne Bay, including the areas over which the proposed radial collector well laterals will be located. Based on studies performed in 2009, the fish and invertebrates observed in the area are well adapted to living in areas of relatively swift currents associated with tidal exchange and wind and wave-driven shallow water turbulence. There is little likelihood that they would be affected by the very minor velocity changes at the seabed expected from operation of the radial collector wells.

Therefore, the impacts to aquatic life as a result of radial collector well operation would be SMALL and not warrant mitigation.

The operation of the radial collector wells and the potential impacts on water bodies including Biscayne Bay and the cooling canals in the industrial wastewater facility have been evaluated through groundwater modeling (Section 5.2 and FSAR Appendix 2CC). Based on the model results, the steady-state operation of the radial collector wells could dewater the upland layer (areas above the high water shoreline) on the Turkey Point peninsula. Drawdown in the uplands on the Turkey Point peninsula would range from 1 to 3 feet. Drawdown west of Turkey Point would be generally confined to the shoreline adjacent to Units 1 through 5 and would be approximately 0.1 feet (Figure 5.2-1). Based on the evaluation, impacts with respect to aquatic vegetation (e.g. shoreline mangroves) would be SMALL and not warrant mitigation. Additionally, impacts to important aquatic species from operation of the radial collector wells would be SMALL and would not require mitigation.

A small, localized drop in the water table may affect wetlands in the area; however, no important aquatic species would be impacted. When the elevation of surface water in a wetland is gradually reduced, whether through natural or human causes, most mobile organisms, such as fish and many invertebrates, would simply relocate to deeper, more suitable water. Rooted vegetation may extend their roots to reach the deeper groundwater. Some invertebrates (and even a few types of fish) can produce dormant cysts that can “hatch” or become active later when water levels return to normal. The only aquatic species in the wetlands near the radial collector wells that is afforded special status is the mangrove rivulus. The rivulus is a Florida species of special concern that inhabits crab burrows in mangrove areas (Smithsonian 2008). The rivulus can swim to another location when its habitat becomes unsuitable. In fact, the rivulus is capable of moving across mud even after most surface water has disappeared. This fish can survive for up to 60 days in damp leaves and surface litter (Florida Museum of Natural History 2008). Any potential drawdown of water in mangrove wetlands would not significantly impact the rivulus.

5.3.2 IMPACTS OF COOLING SYSTEM DISCHARGE SYSTEM ON AQUATIC ECOSYSTEMS

The blowdown from the cooling towers would be discharged by way of the blowdown sump to the Boulder Zone, a deep (approximately 2900 feet below grade) and highly cavernous zone of saline groundwater that is used for underground injection of industrial and domestic wastes in South Florida. Radionuclide transport analysis for the deep injection wells was performed to determine impacts (i.e., dose) to potential receptors present at the closest point(s) to the Turkey Point plant property (Section 5.4). Based on the analysis and resulting receptor doses, impacts to the Boulder Zone from cooling system discharge containing radioactive effluent were found to be SMALL. Based on these results, the operation of the deep injection wells would meet the requirements established by the EPA, and imposed by the underground injection control permit.

No aquatic organisms would be exposed to chemical or thermal effects of the blowdown. There is no reasonably foreseeable pathway by which groundwater in the Boulder Zone could reach surficial aquifers or surface waters. No impacts to aquatic resources would result from cooling water discharge.

5.3.3 HEAT DISCHARGE SYSTEM

5.3.3.1 Heat Dissipation to the Atmosphere

As described in Section 3.4, a closed-cycle circulating water system would be used for Units 6 & 7 consisting of three mechanical draft cooling towers for each unit to remove excess heat from the circulating water system. In addition, a single mechanical draft cooling tower would be used for heat removal from the service water system for each unit. The service water system cooling tower would be much smaller than the circulating water system cooling towers. Therefore, the analysis focuses on the circulating water system cooling towers.

Cooling towers evaporate water to dissipate heat to the atmosphere. Evaporation is followed by partial recondensation, which, with the right atmospheric conditions, creates a visible mist or plume. The plume creates the potential for shadowing, fogging, icing, and localized increases in humidity. In addition, small water droplets are blown out of the tops of the cooling towers. These water droplets are referred to as drift and could be deposited, along with any dissolved salts, on vegetation and surfaces surrounding the cooling towers.

For Units 6 & 7, the EPA CALPUFF (U.S. EPA 2007a) and AERMOD (U.S. EPA 2007b) dispersion models were used to evaluate cooling tower plume behavior and to estimate the frequency of occurrence and length of visible cooling tower plumes. These models are the preferred models for calculating deposition and fogging by the Florida Department of Environmental Protection (FDEP) and were used for consistency between the FDEP review and this ER. Five years (2001 through 2005) of hourly meteorological data from the Miami

International Airport (surface and upper air observations) were used. Physical and performance characteristics of the mechanical draft cooling towers (as presented in Table 3.4-2) relevant to the modeling effort are as follows:

Parameter	Value
Number of Towers (Per Unit)	3
Circulating Water flow (Per Tower)	210,367 gpm
Cycle of Concentrations (COC)[a]	1.5 to 4
Approximate Height	67 feet
Approximate Base Diameter	246 feet
Number of cells (Per tower)	12
Number of fans per cell	1
Exit air delivery per fan	1,764,500 actual cubic feet per minute
Design Wet Bulb Temperature	83.9°F
Design Range	24.4°F
Design Approach	7.1°F
Drift Rate	0.0005% (of the flow rate)
Heat Rejection Rate (million BTU/hr)	7,628
Solids Concentration (ppm)	50,000

(a) COC for marine water is 1.5 and COC for reclaimed water is 4

5.3.3.1.1 Length and Frequency of Elevated Plumes for Mechanical Draft Cooling Towers

The analysis of cooling tower plume behavior for the five year simulation period (2001-2005) indicated that the predicted plumes would remain primarily onsite. Visible vapor plumes would occur approximately 1722 hours per year, or about 20 percent of the year. Visible vapor plumes would occur during the winter months (719 hours), the spring (387 hours) and fall (387 hours) months. Only about 13 percent (230 hours) of the total hours with visible vapor plumes occur during the summer. During daylight hours, visible vapor plumes are predicted to occur for only 584 hours/year (7 percent of the time). Visible vapor plumes during daylight hours are predicted to occur at a higher frequency during the winter (213 hours) than other seasons.

Visible vapor plumes from the cooling towers would remain close to each of the towers during the daylight, when the plumes are the mostly visible. The results for daylight hours indicate that for the majority of the time, plume heights would be less than 400 meters and plume lengths would be less than 300 meters. Plume heights greater than 1000 meters are predicted to occur only one hour per year, while plume lengths in excess of 5000 meters would only occur 40 hours per year.

The design of the cooling towers minimizes tower visibility and improves plume dissipation. The additional water and heat released to the atmosphere by the cooling tower plumes would have a SMALL impact on the local environment, and no mitigation would be required.

5.3.3.1.2 Ground-Level Fogging and Icing

Fogging from mechanical draft cooling towers occurs when the visible plume intersects with the ground, appearing like fog to an observer. An analysis of cooling tower fogging and icing was performed using the EPA CALPUFF dispersion model. The results indicated that there were no predicted occurrences of ground-level fogging during the summer season, and minimal localized occurrence of fogging during the autumn and spring seasons at the Units 6 & 7 plant area. During the winter season, fogging was observed to occur for a total maximum of 20 hours during daylight hours (for the 5-year simulation period) at offsite areas on the eastern and southeastern perimeter of the Turkey Point plant property.

Icing from the mechanical draft cooling towers could be the result of ground-level fogging when ambient temperatures are below freezing. However, the CALPUFF model predicted that no ground-level icing would occur as a result of cooling tower operation. Therefore, there would be no ground-level icing impacts as a result of cooling tower operation.

The impacts attributable to fogging and icing as a result of the operation of the Units 6 & 7 cooling towers would be SMALL and no mitigation is required.

5.3.3.1.3 Solids Deposition

Water droplets blown from the mechanical draft circulating water system cooling towers (known as “drift”) would have the same concentration of solids as the water in the makeup water reservoir. As the water droplets blown from the cooling towers evaporate, either in the air or on vegetation or equipment, these solids would be deposited. The dissolved and suspended solid concentrations in the makeup water reservoir would be controlled through use of the makeup and blowdown water lines. As described in Section 3.4, makeup water to the circulating water system cooling towers may be provided via the use of reclaimed water and/or saltwater from radial collector wells installed below Biscayne Bay. For conservatism, the maximum total dissolved solids value was used from the radial collector wells, which would be in the range of 30,000 parts per million (ppm) during normal operating conditions.

The estimated amount of dissolved solids that could potentially escape from all of the cooling towers as drift is 75 kg/hour during normal operation. This amount of material could be released and dispersed over the area surrounding the Turkey Point plant property once both units are operational. A description of the results of an analysis of cooling tower plume drift and deposition is provided in Subsection 5.3.3.2.2.

5.3.3.1.4 Cloud Formation, Cloud Shadowing, and Additional Precipitation

Although there would be visible plumes during some periods of operation, adverse effects attributable to cloud shadowing or additional precipitation would not be significant. Given the large distance from Units 6 & 7 to the boundary of the Turkey Point plant property on the western and northern perimeters, the lack of permanent residences at the eastern and southern perimeters (where fogging is predicted to be most prevalent), and the low profile of the mechanical draft cooling towers, the cooling tower plumes would not be visible from offsite locations except on rare occasions. The impacts of cloud shadowing or additional precipitation, therefore, would be SMALL and no mitigation is required.

5.3.3.1.5 Interaction with Existing Pollution Sources

No synergistic effects of cooling tower plumes mixing with plant radiological (see Section 5.4) or any other gaseous releases (see Subsection 5.5.1.3) would occur. Any gaseous effluents released from the plant during operation would be at a different elevation or at a location well removed from the cooling towers. Any such releases would also be at or near ambient temperature, and no significant plume rise from those releases would occur. The plume from the service water cooling towers would be small when compared to the main cooling towers. The potential for the mixing of the plumes would be minimal and at different locations from where any water droplets in the cooling tower plume would still be present.

Interactions with other sources of air pollution would be SMALL and no mitigation is required.

5.3.3.1.6 Ground-Level Humidity Increase

Increases in the absolute and relative humidity could result from the operation of the mechanical draft cooling towers. Based on CALPUFF modeling, no discernible increase in atmospheric humidity at offsite locations would result from the operation of the Units 6 & 7 cooling towers. Ground-level humidity increases would be SMALL and no mitigation is required.

5.3.3.2 Impacts of Heat Discharge System on Terrestrial Ecosystems

The approximately 9400-acre Turkey Point plant property consists primarily of wetlands, including an approximate 5900-acre industrial wastewater facility as well as wetland areas that were filled for industrial/developed land associated with the existing units (see Subsection 2.4.1). Plant communities within the Turkey Point plant property are those common to disturbed soils in this region (see Subsection 2.4.1). Upland areas are occupied by Australian pine, Brazilian pepper, and buttonwood. Wetland species include mangrove species and salt-tolerant herbaceous plants such as saltwort and glassworts. Four federally listed animal species have been observed within the Turkey Point plant property boundaries (primarily American crocodiles), as well as numerous state-listed species and state species of special concern (primarily water birds). Additional “important” species, as defined in NUREG-1555, found on the plant property include game animals common to this region, whitetail deer, and dove and rabbit species. Given that wetland habitats predominate, impacts to the small number of terrestrial game species found on the Turkey Point plant property would be SMALL.

Impacts of cooling system operation on terrestrial biota could occur from operation of the makeup water reservoir, cooling towers, and the supply of makeup water. Potential impacts of the makeup water reservoir are described in Subsection 5.3.3.2.1. Potential cooling tower operational impacts on terrestrial biota could result from increased salt deposits, vapor plumes, icing, precipitation modifications, noise, and avian collisions with structures (e.g., the cooling towers). Each potential impact of cooling tower operation is addressed in Subsection 5.3.3.2.2.

5.3.3.2.1 Makeup Water Reservoir

The makeup water reservoir at the southern end of the Units 6 & 7 plant area would occupy approximately 37 acres of land currently occupied by hypersaline mudflats, wetland spoil areas, mangrove heads, and a remnant canal (see the habitat descriptions in Subsection 2.4.1; Figure 2.4-2).

The makeup water reservoir would be lined with concrete; thus, no shoreline vegetation would be developed. Potential use of the makeup water reservoir by resting or roosting wintering waterbirds is unknown but likely, given the location of the reservoir within the Atlantic migration pathway and the proximity of the reservoir to other open water habitats (i.e., the cooling canals of the industrial wastewater facility, Biscayne Bay, Card Sound) historically used by migratory waterbirds. Given the sources of makeup water and the treatment of the water before use in the reservoir, fish occurrence in the reservoir is not anticipated and, therefore, use of the reservoir as foraging habitat by piscivorous birds is not anticipated. There are no uses of this reservoir other than providing a source of makeup water.

5.3.3.2.2 Cooling Towers

Salt Drift

Three mechanical draft cooling towers would be associated with each unit, and the six towers would be located within the makeup water reservoir. Habitat surrounding the cooling towers consists of the reservoir, Units 6 & 7 facilities to the north, the cooling canals of the industrial wastewater facility to the south and west, and Biscayne Bay to the east. Vegetation near the cooling towers would be subjected to salt deposits attributable to drift from the towers. Salt deposits could possibly cause vegetative stress, either directly by salts onto foliage or indirectly from accumulation of salts in the soil.

To evaluate the effect of salt deposits on plants, an order-of magnitude approach was used because some plant species are more sensitive to salt deposits than others, and tolerance levels of most species are not well known. Deposits of salt drift at rates of 1 to 2 kilogram/hectare/month (kg/ha/mo) is generally not damaging to plants, while deposition rates approaching or exceeding 10 kg/ha/mo in any month during the growing season could cause leaf damage in many species (NUREG 1437).

The AERMOD model was used to predict the amount of salt deposits from operation of the Units 6 & 7 cooling towers. The simulation was modeled based on the cooling tower operational parameters previously presented, and the 2001 through 2005 Miami meteorological data for upper air and surface data. The monthly depositions rates, based on an annual basis, are depicted in Figure 5.3-1. These monthly deposition rates are a conservative representation of depositional rates calculated for the four seasons (e.g., northeast-southwest bearing of depositional plume). Maximum salt deposition is predicted near the makeup water reservoir (up to 105 kg/ha/mo).

Beyond the makeup water reservoir, the deposition rates are predicted to decrease rapidly. The monthly salt deposition in the cooling canals of the industrial wastewater facility ranges from 1 to 70 kg/ha/month. This depositional rate is considered both conservative and bounding since evaporation of the solution drift has not been considered and it has been assumed that the saltwater is from the radial collector wells, which are assumed to operate on a full time basis. The radial collector wells are a backup water source, reclaimed water is the primary source, and operation of these wells is anticipated to be on an intermittent, as needed basis. Salt deposition of greater than 10 kg/ha/mo would generally be confined to the plant property, with the exception of the adjacent southeastern perimeter, as depicted on Figure 5.3-1. However, the vegetation surrounding the plant property is dominated by coastal mangroves, specifically the salt-tolerant red mangrove (Rhizophora mangle), which has developed physiological characteristics to allow the plants to survive in highly saline soils and areas of salt spray. Due to the mangroves' ability to tolerate elevated salinity, they are often found near monocultures in areas that are uninhabitable by freshwater and/or terrestrial vegetation. Considering the existing salt-tolerant vegetative community surrounding the plant area, the potential impacts of salt drift to vegetation would be SMALL and not warrant mitigation.

The industrial wastewater facility and nearby/adjacent canals and wetlands have been designated as critical habitat for the federally threatened American crocodile. The maximum predicted salt deposition rate to the industrial wastewater facility in the vicinity of the cooling towers ranges from 1 to 70 kg/ha/month (annual basis; see Figure 5.3-1). This annualized salt deposition range of 1 to 70 kg/ha/month was normalized to salinity based on the annual site rainfall (approximately 58 inches annually). The resulting salinity range was calculated to be approximately 0.0008 to 0.06 parts per thousand (ppt). This range in salinity concentration is about 3 orders of magnitude lower than the existing salinity in the industrial wastewater facility. Salt deposited within the industrial wastewater facility would be circulated within the system with subsequent combination with much higher salinity water. Salinity levels within the cooling canals of the industrial wastewater facility are typically 40–50 parts per thousand, a level that could adversely impact young crocodiles. Hatchlings and juvenile crocodiles have underdeveloped osmoregulatory capabilities and need fresh- to brackish water at least once per week to maintain normal growth rates. FPL's crocodile program collects hatchling crocodiles and transfers them to juvenile refugia constructed by FPL, many on the tops of the cooling canal berms. The juvenile crocodile refugia, based on observations performed in 2008 are depicted on Figure 5.3-2. Several types of refugia have been used, including refugia in the test canals north of the cooling canals of the industrial wastewater system, ponds excavated on berms of the active canals and test cooling canals, refugia resulting of dredging of berms, refugia at the Everglades Mitigation Bank, and natural refugia outside of the cooling canals of the industrial wastewater system. As is depicted in Figure 5.3-2, the majority of juvenile crocodile refugia are south of the area where the majority of salt deposition occurs (i.e., areas greater than 10 kg/ha/month).

Salinity levels in these juvenile crocodile refugia vary depending on conditions such as seasonal rainfall and evaporation rates. Additionally, due to precipitation, a freshwater lens typically develops in these refugia during the late summer months, during the post-hatching period when exposure to low-salinity water is necessary. The increase in salinity corresponding to the maximum salt deposition rate is approximately 0.06 ppt. Growth rates of Turkey Point crocodile hatchlings are equal to or greater than those from reference populations. Based on the locations of the juvenile crocodile refugia with respect to the predicted salt deposition, the predicted impact to salinity, and FPL's ongoing management activities that include monitoring and providing habitats for young crocodiles, predicted salt depositions from operation of the Units 6 & 7 cooling towers into the industrial wastewater facility and refugia would not sufficiently alter relevant salinity levels to impact crocodile growth and/or survival rates.

Waterbirds constitute a major component of terrestrial fauna found within the industrial wastewater facility. These birds forage on the fish inhabiting the canals, primarily hardy species of fish that can tolerate the harsh conditions (high salinities and temperatures) within the industrial wastewater facility. Salt deposits would not impact canal salinities sufficiently to eliminate or reduce fish populations and, therefore, would not impact waterbird use of the industrial wastewater facility.

Any impacts from salt drift on local terrestrial ecosystems would be SMALL and would not warrant mitigation beyond the crocodile management program identified above.

Vapor Plumes and Icing

As described in Subsection 5.3.3.1.1, plumes would be visible during daylight hours less than 7 percent of the time during all seasons. Most of the visible plume would be during the winter season.

As described in Subsection 5.3.3.1.2, ground-level fogging as a result of cooling tower operation is predicted to occur for only a maximum of 55 hours (5-year simulation period) at the Units 6 & 7 plant area and less than 5 hours (5-year simulation period) at any offsite areas. Icing resulting from cooling tower operation would not occur. Therefore, the impacts of vapor plumes, fogging, and icing on terrestrial ecosystems would be SMALL and would not warrant mitigation.

Clouds and Precipitation Modification

As described in Subsection 5.3.3.1.4, no significant increase in local precipitation would occur as a result of cooling tower operation. Any additional precipitation would be small in comparison with the average rainfall in the region, which has been shown to range from 45 inches (114 centimeters [cm]) to 66 inches (168 cm) (Refer to Table 2.7-3).

Because operation of the cooling towers would not result in a significant increase in precipitation, the impacts would be SMALL, and no mitigation is required.

Noise

Noise generated from cooling tower operations would be approximately 73 decibels adjusted (dBA) at 200 feet from the tower (Subsection 5.3.4.2). This is below the 80 to 85 dBA level known to startle or frighten some birds and small mammals (Golden et al. 1980). Therefore, noise from the towers would not disturb wildlife at distances greater than 200 feet from the towers. Additionally, the estimated noise level (73 dBA) associated with the new cooling towers at 200 feet would drop below 60–65 dBA, the level the NRC considers of small significance (NUREG-1437), within an additional 200–300 feet due to attenuation. Noise impacts to terrestrial biota would be SMALL and not warrant mitigation.

Avian Collisions

The mechanical draft towers would rise approximately 67 feet above the basin curb (Table 3.4-2). Taller, natural draft cooling towers have been associated with bird kills, but the shorter mechanical draft cooling towers would pose little risk to birds and cause minimal mortality (NUREG-1437). Therefore, impacts to birds from collisions with new cooling towers would be SMALL and would not warrant mitigation.

5.3.4 IMPACTS TO MEMBERS OF THE PUBLIC

This subsection describes the potential health impacts associated with the cooling system for Units 6 & 7. These include impacts to human health from etiological agents and from noise resulting from operation of the cooling system.

As described in Section 3.4, the circulating water system for Units 6 & 7 would use a closed-cycle, wet cooling system with mechanical draft cooling towers for heat dissipation.

5.3.4.1 Etiological Agent Impacts

Etiological agents that are associated with cooling ponds or towers and thermal discharges can have negative impacts on human health. The presence and concentration of these agents can be increased by the addition of heat. These agents include the enteric pathogens *Vibrio* spp., *Salmonella* spp., *Shigella* spp., and *Plesiomonas shigelloides*, as well as *Pseudomonas aeruginosa*, thermophilic fungi, noroviruses, and toxin-producing algae such as *Karenia brevis*, which causes red tide when present in high concentrations. They also include the bacteria *Legionella* spp., which causes Legionnaires' disease, and free-living amoebae of the genera *Naegleria, Acanthamoeba*, and *Cryptosporidium*. Exposure to these agents, or in some cases the endotoxins or exotoxins they produce, can cause illness or death (NUREG-1555).

These agents are the cause of potentially serious human infections, the most serious of which is attributed to *Naegleria fowleri*. *Naegleria fowleri* is a free-living amoeba that occurs worldwide. It is present in soil and virtually all natural surface waters such as lakes, ponds, and rivers. *Naegleria fowleri* grows and reproduces well at high temperatures (104ºF to 113ºF) and has been isolated from waters with temperatures as low as 79.7ºF. *Naegleria fowleri* thrives in warm, fresh water, particularly if the water is stagnant or slow-moving. These protozoa are found in a variety of water bodies, including lakes, ponds, and poorly maintained swimming pools and hot tubs. Since a primary food source for the amoebae is coliform bacteria, the presence of significant numbers of coliform bacteria would promote growth of this amoeba. Although exposure to this organism is very common, the chance is less than 1 in 100 million that a person exposed to water inhabited by *Naegleria* would become infected. Symptoms of these infections include changes in the ability to taste or smell, rapidly followed by headache, fever, nausea, and vomiting. While the disease is not transmissible from person to person, it is usually fatal (GBRA May 2002).

As presented in Section 3.4, makeup water for the circulating water system would be provided from two sources. Reclaimed water would be provided by the MDWASD. This reclaimed water would undergo pretreatment as well as the addition of biocide and algaecide. The Florida Department of Environmental Protection regulations require high-level disinfection prior to MDWASD supplying the reclaimed water for industrial use in open cooling towers. High-level disinfection includes additional total suspended solids control (beyond secondary treatment levels) to maximize disinfection effectiveness to result in reclaimed water in which fecal coliform values (per 100 milliliter of sample) are below detectable limits. These treatments would eliminate or minimize etiological agents from this makeup water source.

Saltwater makeup from radial collector wells could also be supplied for the circulating water system. Since the etiological agents of concern are primarily found in freshwater, they would not be present in the makeup water from the radial collector wells.

The cooling tower blowdown and other plant wastewater streams would be collected in a common blowdown sump and injected underground via the deep injection wells. These waste streams would not be discharged to waters that have the potential for direct contact by members of the public.

The makeup water reservoir would be located within the Turkey Point plant property, precluding access by members of the public. Personnel access to the makeup water reservoir would be strictly controlled by administrative controls and security patrols. Personnel protective measures (i.e., personal protective equipment, personnel monitoring) related to work activities requiring personnel contact with reservoir systems would be controlled by the worker protection plan. The risk to personnel health from etiological agents associated with the makeup water reservoir would be SMALL and would not warrant mitigation.

The risk to public health from etiological agents associated with the cooling system for Units 6 & 7 would be SMALL and would not warrant mitigation.

5.3.4.2 Noise

A noise survery was conducted in June 2008. The highest recorded noise level for onsite measurements was 68 dBA.The noise impacts of Units 6 & 7 were evaluated using the equipment associated with normal operation of the facility. The noise level generated by each cooling tower would be on the order of 88 dBA at 3 feet from the towers, 73 dBA at 200 feet from the towers, and 65 dBA at 400 feet from the towers**,** which is within the Units 6 & 7 plant area.

The design of Units 6 & 7 includes components that mitigate noise from being emitted to the surrounding environment. Most of the noise sources associated with Units 6 & 7 cooling systems would be cooling water pumps and cooling towers. The cooling water pumps would be in buildings that mitigate sounds emitted by equipment. The noise from cooling towers would be mitigated by their inherent design (e.g., splash guards on air inlets to mitigate sounds generated by falling water. stacks on mechanical fans that direct noise vertically).

As reported in NUREG-1437, and referenced in NUREG-1555, noise levels below 65 dBA are considered of small significance. In addition, there are no applicable state or local environmental noise regulations for unincorporated areas of Miami-Dade County, where Turkey Point is located (Subsection 2.7.7). Therefore, noise impacts would be SMALL and would not warrant mitigation.

5.3.4.3 Conclusion

Human health impacts to the surrounding population associated with the operation of the cooling system would be SMALL and would not warrant mitigation.

Section 5.3 References

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Figure 5.3-1 Predicted Monthly Salt Deposition

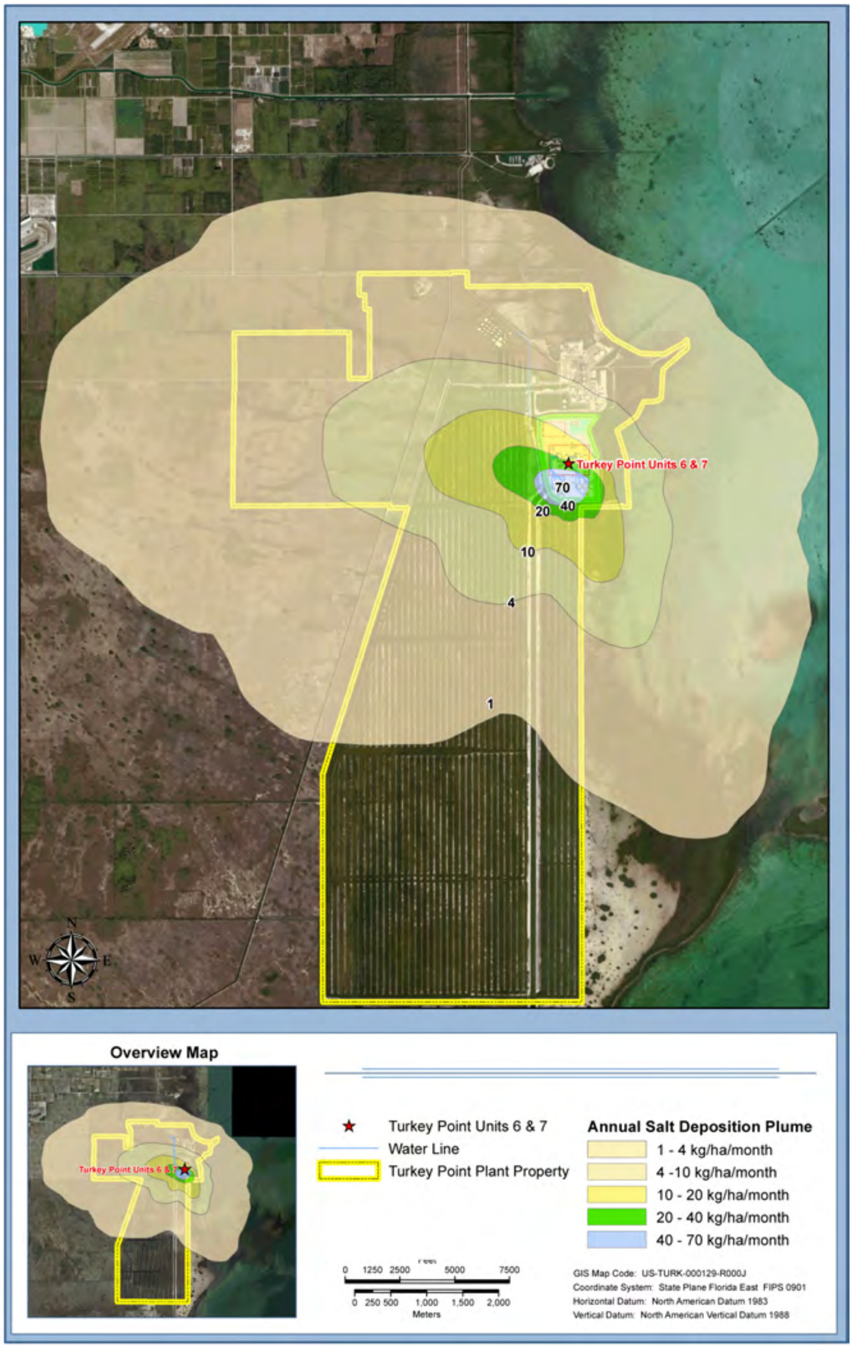
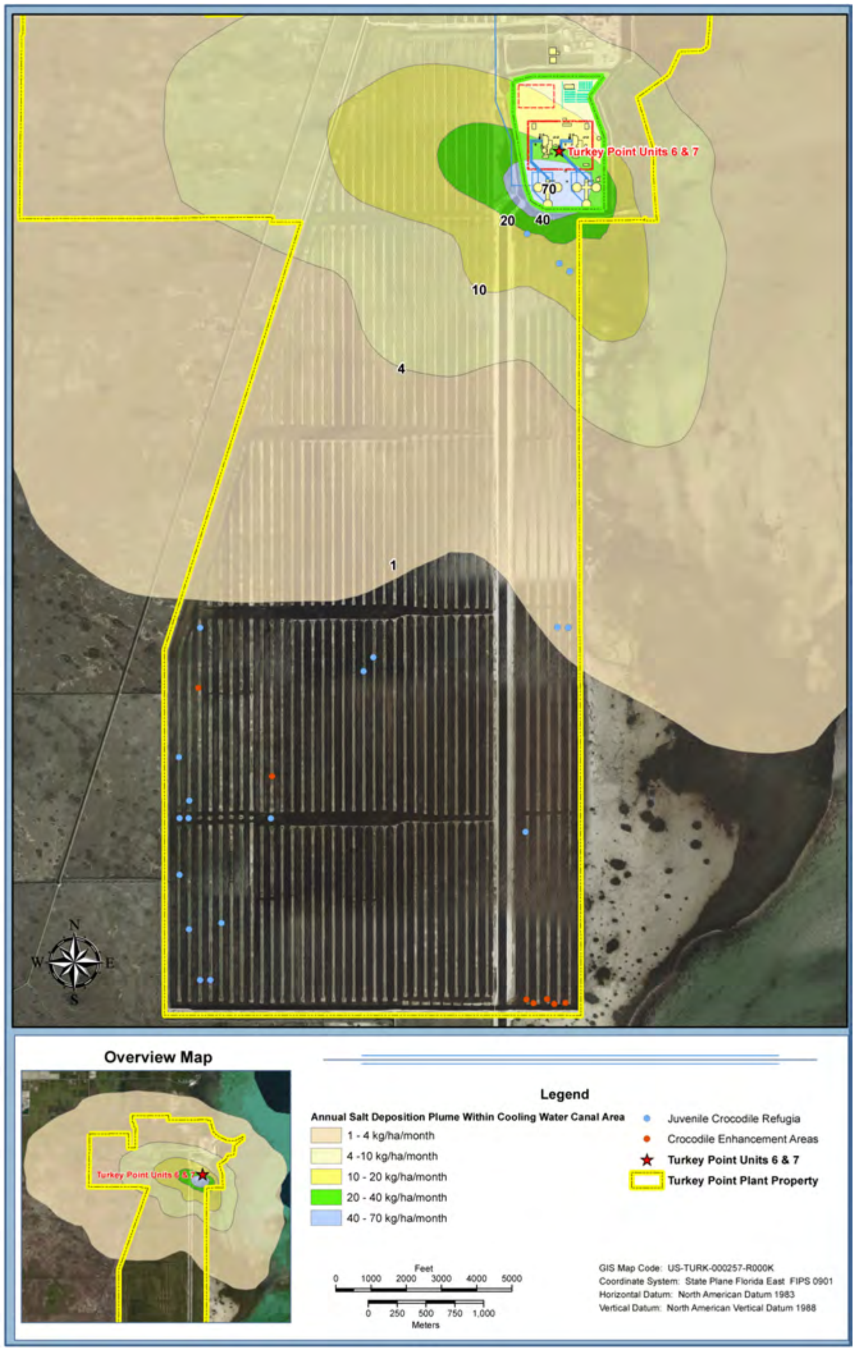


Figure 5.3-2 Crocodile Areas in Relation to Salt Deposition Plume



5.4 RADIOLOGICAL IMPACTS OF NORMAL OPERATION

This section describes the radiological impacts of normal plant operation on members of the public, plant workers, and biota. Subsection 5.4.1 describes the offsite radiological exposure pathways. Subsection 5.4.2 estimates the maximum doses to the public from the operation of each new unit. Subsection 5.4.3 evaluates the impacts of these doses by comparing them to regulatory limits. Subsection 5.4.4 considers the impact to nonhuman biota that are present along the exposure pathways. Finally, Subsection 5.4.5 describes the radiation doses to plant workers.

5.4.1 EXPOSURE PATHWAYS

Small quantities of radioactive liquids and gases would be discharged to the environment during normal operation. The impacts of these releases and any direct radiation to individuals, population groups, and biota in the vicinity of the new units were evaluated by considering the most important pathways from the release points to the receptors of interest. The most important pathways are those that could yield the highest radiological doses for a given receptor. The relative importance of a pathway is based on the type and amount of radioactivity released, the environmental transport mechanism, and the consumption or usage factors of the receptor.

The exposure pathways considered and the analytical methods used to estimate doses to the maximally exposed individual (MEI) and to the population within 50 miles of the new units are based on RG 1.109, *Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I,* and RG 1.111, *Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors.* An MEI is a hypothetical member of the public who receives the maximum possible calculated dose. Use of the MEI allows comparisons with established dose criteria for the public. Population doses were calculated for the year 2090, the assumed end of plant life, when the population is projected to be at its peak after the currently projected 60 years of plant operation. This is based on 40 years of operation under the initial operating license plus one 20-year license renewal. In 2090, food production rates within 50 miles of Units 6 & 7 are projected to increase at the same rate as population growth. Population doses are calculated considering the following three counties located within 50 miles of the plant: Broward, Miami-Dade, and Monroe. The southeast corner of Collier County also falls within 50 miles, but this is less than 10 percent of the total county land area and there is no population in this region. Therefore, the impact on this county would be negligible.

5.4.1.1 Liquid Pathways

Treated liquid radioactive waste from Unit 6 & 7 operation would be diluted with the blowdown sump discharge flow prior to ultimate release to the Boulder Zone via the deep injection wells (see Section 3.5). As discussed in Section 2.3.2, the highly saline Boulder Zone of the Lower Floridan aquifer is used for deep well injection of treated municipal wastewater and reverse osmosis concentrate in Miami-Dade County. Injection occurs below the middle confining layer at depths of approximately 2700 feet or greater, approximately 900 feet below the base of the lowest underground source of drinking water. The Boulder Zone is currently not a source for potable water and there is no viable pathway for the injection well releases to reach potable water. Hence, there is no liquid effluent pathway dose due to normal plant operations.

For off-normal operations, a conceptual receptor exposure scenario has been developed that considers the Boulder Zone for potable water use. Although unrealistic, this scenario is considered to bound any other potential exposure scenarios, such as vertical migration from the Boulder Zone to potable water aquifers despite the presence of dual zone monitoring wells.

The conceptual exposure scenario considers a receptor created by the drilling of a water supply well into the Boulder Zone for potable water use. An initial evaluation of receptor distance from the deep injection wells was performed to determine the most realistic location of the receptor, based on distance from the Turkey Point Plant property and any potential land use constraints at each location. This was performed to determine a realistic scenario for the potential receptor. The results of this initial evaluation are summarized in the paragraphs below.

Receptor 1 is located southeast of the deep injection wells at an approximate distance of 2084 feet. This location is part of Biscayne National Park. The location is not considered a realistic receptor location for a water supply well since it is located on land that is only accessible from Biscayne Bay, would generally not be considered usable for applications that would require a freshwater supply (e.g., residence), and access would not likely be granted by the park. This scenario was therefore determined to be unrealistic and was not further considered.

Receptor 2 is located north of the deep injection wells at an approximate distance of 9824 feet. This location is located in Homestead Bayfront Park. The location is not considered a realistic location for a water supply well since it is located within a county park and therefore is unlikely to be a realistic area usable for applications that would require a freshwater water supply (e.g., residence). This receptor location was therefore determined to be unrealistic and was not further considered.

Receptor 3 is located northwest of the deep injection wells at an approximate distance of 9776 feet. This location is on land not owned by FPL and is considered a realistic location for the installation and use, by a residence, of a water supply well in the Boulder Zone. This location was therefore evaluated for liquid effluent doses.

In order to determine the decay time for the injectate front to reach Receptor 3, an analysis was performed that considered the injection rate, aquifer thickness, and porosity of the Boulder Zone. The resulting time required for the injectate front to reach the receptor (from initiation of Units 6

& 7 operation) is approximately 13.7 years. This horizontal travel time through the Boulder Zone is used in the dose calculation described below.

The NRC-endorsed LADTAP II computer program (PNL Apr 1986) was used to calculate doses to an individual at Receptor 3 from liquid effluents. This program implements the radiological exposure models described in RG 1.109 to estimate the doses. The following exposure pathways are considered in LADTAP II:

- Consumption of contaminated drinking water
- Consumption of meats and vegetables produced with contaminated irrigation water (there are no milk animals within five miles of the plant)

The only site-specific input parameters used in LADTAP II are the following:

- Liquid effluent discharge — A discharge rate of 27.9 cfs was used, corresponding to the reclaimed water dilution flow rate of 12,500 gpm, which bounds the saltwater discharge rate of 58,000 gpm, as it yields less dilution (Section 2.3.2).
- Source terms — The isotopic activity releases are from DCD Table 11.2-7.
- Irrigation rate — The irrigation rate was assumed to be 110 l/m^2-month, corresponding to 1 inch per week.
- Transit time — The transit time from discharge to drinking water and irrigated foods was assumed to be 13.7 years, the time required for the injectate to reach Receptor 3.

The resulting maximum doses per unit are 2.5 mrem to the total body, 2.4 mrem to the thyroid, and 3.1 mrem to the liver of a child. Even though these doses are not due to normal operations, they conform to the 10 CFR 50, Appendix I guidelines of 3 mrem total body and 10 mrem organ.

5.4.1.2 Gaseous Pathways

The NRC-endorsed GASPAR II computer program (PNL Mar 1987) was used to calculate doses to the MEI, the population, and biota from gaseous effluents. This program implements the radiological exposure models described in RG 1.109 to estimate the doses. The following exposure pathways are considered in GASPAR II:

- External exposure to immersion/submersion by an airborne plume
- External exposure to standing on contaminated ground

- Inhalation of airborne radioactivity
- Ingestion of radioactivity in meat and milk
- Ingestion of radioactivity in garden vegetables

The input parameters for the gaseous effluent exposure pathway are presented in Table 5.4-1 and the receptor locations are shown in Table 5.4-2. The receptor locations are those at which the maximum atmospheric dispersion and deposition factors occur for each exposure pathway.

5.4.1.3 Direct Radiation

Contained sources of radiation at Units 6 & 7, including the refueling water storage tank, will be shielded such that the direct dose rate at the Turkey Point plant property boundary is negligible (WEC 2011). Therefore, the impact of direct radiation would be SMALL and would not warrant additional mitigation. No further consideration of direct radiation is provided.

5.4.2 RADIATION DOSES TO MEMBERS OF THE PUBLIC

Based on the parameters in Tables 5.4-1 and 5.4-2, the GASPAR II computer program was used to calculate annual doses from gaseous effluents from one new unit to the MEI, the population, and biota. As stated above, there is no dose due to liquid effluents during normal operations. The MEI doses were determined by considering the maximally exposed adult, teenager, child, and infant at the following locations:

- Nearest site boundary (nearest boundary of the Turkey Point plant property)
- Nearest residence (2.7 miles)
- Nearest vegetable garden
- Nearest meat cow pasture

There are no milk animals within five miles of Units 6 & 7. The maximum total body and organ doses are presented in Table 5.4-3. In this table, the contributions from viable pathways are summed to obtain a total dose for each organ and age group. Although Table 5.4-2 shows the vegetable garden is farther away than the residence and the meat animal, the garden doses were added to the doses from the other two pathways. For comparison, Table 5.4-2 includes dose estimates at the limiting Turkey Point plant property boundary location, where no established human exposure pathways have been identified. In effect, doses were calculated at two locations: Turkey Point plant property boundary and the merged residence/garden/meat animal location. The latter location represents the MEI. Table 5.4-3 shows that the maximum doses from each unit occur at the Turkey Point plant property boundary and that most of the dose is a result of the external exposure pathways. The maximum total body dose is 3.9 mrem/year to the adult, the teen, and the child while the maximum organ doses are 14 mrem/year to the skin and 7.5 mrem/year to the thyroid of the child. These are theoretical doses based on conservative assumptions. Table 5.4-5 shows comparable doses from the operation of Units 3 and 4 are negligible.

5.4.3 IMPACTS TO MEMBERS OF THE PUBLIC

Table 5.4-4 shows that even the site boundary doses, which bound the MEI, are within the design objectives of 10 CFR Part 50, Appendix I. Table 5.4-5 shows that the total site doses from the two new units as well as the two existing units are within the regulatory limits of 40 CFR Part 190. Since the dose limits for members of the public in 40 CFR Part 190 are more restrictive than those in 10 CFR 20.1301(a)(1), demonstration of compliance with the limits of 40 CFR Part 190 is also a demonstration of compliance with the 0.1 rem total effective dose equivalent (TEDE) limit of 10 CFR 20.1301(a)(1). Table 5.4-6 shows that collective doses from the new units to the population within 50 miles of the plant are extremely low compared to collective doses from natural background radiation. Based on the estimated doses from the new units, impacts to members of the public would be SMALL and would not warrant additional mitigation.

5.4.4 IMPACTS TO BIOTA OTHER THAN MEMBERS OF THE PUBLIC

Radiation exposure pathways to biota other than members of the public were examined to determine if these pathways could result in doses to biota greater than those predicted for humans. Immersion and ground deposition doses are largely independent of organism size, and the doses to humans, calculated as described in Subsection 5.4.2, can be applied to biota except that the location of the biota is as shown in Table 5.4-2. The maximum total body dose to a human from inhalation, vegetable, plume, and ground deposition pathways, as calculated by GASPAR II, was applied to biota except that the ground deposition dose was increased by a factor of two to account for the proximity of terrestrial organisms to the ground. The resulting dose to biota species represented by muskrat, raccoon, heron, and duck is 26 mrad/year or 0.07 mrad/day per unit. The International Council on Radiation Protection states that “if man is adequately protected, then other living things are also likely to be sufficiently protected,” (ICRP 1977), and the National Council on Radiation Protection concurs with this conclusion (NCRP 1991). Furthermore, the International Atomic Energy Agency (IAEA) concludes that there is no scientific evidence that chronic dose rates below 100 mrad per day are harmful to plants and animals (IAEA 1992). It is seen that the biota dose is well within the IAEA guideline. Therefore, impacts to biota other than members of the public would be SMALL and would not warrant additional mitigation.

5.4.5 OCCUPATIONAL DOSES

For Units 6 & 7, the estimated annual occupational dose, including outage activities, is 67 person-rem per unit (WEC 2011). By comparison, the annual collective dose per operating PWR in the U.S. was 87 person-rem in 2006 (US NRC, 2007). The health physics program described in FSAR Section 12.5 and the radiation protection features described in FSAR Section 12.3 would ensure that occupational exposures are maintained ALARA. The dose to Unit 7 construction workers during the operation of Unit 6 and the existing units is addressed in Section 4.5. With the collective worker dose smaller than that for existing reactors, the impact on occupational doses would be SMALL and no new mitigation measures or controls would be warranted.

Section 5.4 References

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Table 5.4-1
Gaseous Effluent Exposure Pathway Parameters

Parameter	Value	Basis/Source
Release source terms	See DCD Table 11.3-3	The DCD table shows the expected annual activity releases by isotope.
Atmospheric dispersion and deposition factors	See Tables 2.7-16, 2.7-17, 2.7-18	Table 2.7-16 shows the dispersion and deposition data for the nearest site boundary, residence, vegetable garden, and meat animal. Tables 2.7-17 and 2.7-18 show dispersion and deposition data for 160 sectors representing 16 directions and 10 distance segments out to 50 miles. The dispersion and deposition data at the assumed biota location at a distance of 0.25 mile were obtained from Table 2.7-17.
Individual consumption rates	See RG 1.109	The values from Tables E-5 and E-4 of RG 1.109 were used for the MEI and the average person within the population, respectively.
50-mile population	6.28E06	This is the projected population for the year 2090, the end of plant life. It was used to conservatively maximize population doses. This projection represents an increase of a factor of 1.81 over the 2010 population.
50-mile population distribution	See Table 2.5-1	Table 2.5-1 shows the population distribution in 2090 for 160 sectors representing 16 directions and 10 distance segments out to 50 miles.
50-mile milk production	7.89E04 L/yr	Milk cows in the four counties within 50 miles represent approximately 0.046% of the state total (USDA Jun 2004). The annual production of milk in the state (USDA 2008) was multiplied by 0.046% to estimate the production within 50 miles as 4.36E04 L/yr. Assuming production to increase with the population, this production rate was multiplied by the population growth factor of 1.81 to project the production in 2090.
50-mile meat production	1.18E05 kg/yr	Beef cows and broilers in the four counties within 50 miles represent approximately 0.21% and 0.0017%, respectively, of the state totals (USDA Jun 2004). The annual productions of red meat (USDA 2007) and broiler (USDA 2008) in the state were multiplied by these percentages and summed to estimate the total meat production within 50 miles as 6.53E04 kg/yr. Assuming production to increase with the population, this production rate was multiplied by the population growth factor of 1.81 to project the production in 2090.
50-mile vegetable production	1.09E08 kg/yr	The harvested land area in the four counties within 50 miles represents approximately 2.6% of the state total (USDA Jun 2004). The annual production of vegetables in the state (USDA 2008) was multiplied by 2.6% to estimate the production within 50 miles as 6.04E07 kg/yr. Assuming production to increase with the population, this production rate was multiplied by the population growth factor of 1.81 to project the production in 2090.
Fraction of year leafy vegetables grown	1	This is the most conservative value.
Fraction of year milk cows on pasture	1	This is the most conservative value.
Fraction of maximum individual's vegetable intake from own garden	0.76	This is the default value from RG 1.109, Table E-15.
Fraction of milk-cow feed from pasture	1	This is the most conservative value.
Average absolute humidity for growing season	8 g/m^3	This is the default value in GASPAR II (PNL Apr 1987). It was used when a value of zero is input.
Fraction of year goats at pasture	1	This is the most conservative value.
Fraction of goat feed from pasture	1	This is the most conservative value.
Fraction of year beef cattle at pasture	1	This is the most conservative value.
Fraction of beef cattle feed from pasture	1	This is the most conservative value.

Table 5.4-2
Gaseous Effluent Exposure Pathway Receptor Locations

Nearest Receptor	Direction	Distance (miles)
Site Boundary (Turkey Point plant property boundary)	SSE	0.35
Residence	N	2.7
Vegetable Garden	NW	4.8
Meat Animal	N	2.7
Biota	SSE	0.25

Table 5.4-3
Gaseous Pathway Doses for Maximally Exposed Individuals

	Dose (mrem/year) per Unit							
Pathway	**Total Body**	**GI-Tract**	**Bone**	**Liver**	**Kidney**	**Thyroid**	**Lung**	**Skin**
Site Boundary								
External								
Plume	2.6	2.6	2.6	2.6	2.6	2.6	2.7	13
Ground	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.2
Total	3.6	3.6	3.6	3.6	3.6	3.6	3.8	14
Inhalation								
Adult	0.28	0.28	0.046	0.29	0.29	2.7	0.37	0
Teen	0.28	0.29	0.055	0.29	0.30	3.3	0.42	0
Child	0.25	0.25	0.067	0.26	0.27	3.9	0.36	0
Infant	0.15	0.14	0.034	0.16	0.16	3.5	0.22	0
Total								
Adult	3.9	3.9	3.6	3.9	3.9	6.3	4.1	14
Teen	3.9	3.9	3.7	3.9	3.9	6.9	4.2	14
Child	3.9	3.8	3.7	3.9	3.9	7.5	4.1	14
Infant	3.7	3.7	3.6	3.8	3.8	7.1	4.0	14
Residence								
External								
Plume	0.0067	0.0067	0.0067	0.0067	0.0067	0.0067	0.0074	0.046
Ground	0.0066	0.0066	0.0066	0.0066	0.0066	0.0066	0.0066	0.0077
Total	0.013	0.013	0.013	0.013	0.013	0.013	0.014	0.053
Inhalation								
Adult	0.0012	0.0012	0.00016	0.0012	0.0012	0.0096	0.0015	0
Teen	0.0012	0.0012	0.00019	0.0012	0.0012	0.012	0.0016	0
Child	0.0010	0.0010	0.00023	0.0011	0.0011	0.014	0.0014	0
Infant	0.00059	0.00058	0.00012	0.00063	0.00063	0.012	0.00087	0
Vegetable								
Adult	0.0064	0.0065	0.033	0.0064	0.0061	0.086	0.0055	0
Teen	0.0092	0.0093	0.050	0.0096	0.0091	0.11	0.0083	0
Child	0.020	0.019	0.11	0.021	0.020	0.21	0.018	0
Meat								
Adult	0.0026	0.0036	0.011	0.0027	0.0026	0.0094	0.0025	0
Teen	0.0021	0.0027	0.0095	0.0022	0.0021	0.0070	0.0020	0
Child	0.0038	0.0040	0.018	0.0039	0.0038	0.011	0.0037	0
Total MEI Dose[(a)]								
Adult	0.023	0.025	0.058	0.023	0.023	0.12	0.023	0.053
Teen	0.026	0.026	0.073	0.026	0.026	0.14	0.026	0.053
Child	0.038	0.037	0.15	0.039	0.038	0.24	0.037	0.053
Infant	0.014	0.014	0.013	0.014	0.014	0.025	0.015	0.053

(a) Total MEI dose is the sum of the residence, vegetable, and meat pathways

Table 5.4-4
Comparison of Maximally Exposed Individual Doses with 10 CFR 50, Appendix I Criteria

	Location	Dose per Unit	Dose Limit per Unit
Liquid Effluent			
Total Body (mrem)	None	0	3
Maximum Organ — Bone (mrem)	None	0	10
Gaseous Effluent			
Gamma Air (mrad)	Site Boundary	4.2	10
Beta Air (mrad)	Site Boundary	18	20
Total Body[a] (mrem)	Site Boundary	3.6	5
Skin[a] (mrem)	Site Boundary	14	15
Iodines and Particulates, Maximum Organ[b] — Thyroid (mrem)	Site Boundary	4.9	15

(a) External doses from Table 5.4-3.
(b) From Table 5.4-3, excluding plume contribution from noble gases.

Table 5.4-5
Comparison of Maximally Exposed Individual Doses with 40 CFR 190 Criteria

	Site Dose (mrem/year)			
	Units 6 & 7[a]	Units 3 & 4[b]	Site Total	Limit
Total Body	7.8	0.0029	7.8	25
Thyroid	15	0.0059	15	75
Other Organ – Lung	8.4	0.0059	8.4	25

(a) Double the site boundary doses in Table 5.4-3
(b) Bounding values from five years of annual effluent reports; lung dose assumed to be same as thyroid dose.
Note: Column (b) is actual doses. Column (a) is theoretical doses.

Table 5.4-6
Collective Doses Within 50 Miles

	Dose (Person-rem/year) per Unit		Two-Unit Dose (Person-rem/year)	
	Total Body	Thyroid	Total Body	Thyroid
Liquid Effluents	0	0	0	0
Gaseous Effluents				
Noble Gases	2.1	2.1	4.2	4.2
Iodines and Particulates	1.2	4.7	2.4	9.4
H-3 and C-14	0.69	0.69	1.4	1.4
Total	4.0	7.5	8.0	15.0
Total	4.0	7.5	8.0	15.0
Natural Background[a]	2.5×10^6			

(a) Based on dose rate of 300 mrem/yr (NCRP 1987)

5.5 ENVIRONMENTAL IMPACTS OF WASTE

Operation of Units 6 & 7 would generate several identifiable waste streams. These wastes would be regulated, as appropriate, during all stages including generation, management, handling, treatment, storage, transportation, and disposal. This section describes the potential environmental impacts associated with these wastes. The description is divided into subsections that address both nonradioactive and mixed wastes.

5.5.1 NONRADIOACTIVE WASTE SYSTEM IMPACTS

Descriptions of the Units 6 & 7 nonradioactive waste systems, waste stream discharges, and chemical concentrations are presented in Section 3.6. The following summarizes the impacts resulting from nonradioactive discharges to the environment.

Nonradioactive wastes would be managed in accordance with applicable federal, local laws and regulations, and permit requirements, as identified in Section 1.2. Management practices would include:

- Recyclable wastes, such as scrap metal, lead acid batteries, and paper collected at Units 6 & 7 would be recycled offsite at an approved recycle facility, as is currently performed for the existing units.
- Wastes (e.g., used oil, antifreeze, rags) would be collected and stored temporarily onsite until recovered at an offsite permitted recycling/recovery facility or disposed of at an offsite licensed commercial waste disposal facility, if found to be hazardous.
- Hazardous waste (e.g., paint and solvent wastes) would be disposed of in accordance with 40 CFR Parts 261 and 262.
- Water discharges from cooling and auxiliary systems (e.g., cooling tower blowdown, sanitary wastewater treatment effluent, and other wastewater effluent streams collected in the blowdown sump) from routine plant operations would be discharged to the Boulder Zone via deep injection wells as permitted by the Florida Department of Environmental Protection.
- Storm water would be discharged to the cooling canals of the industrial wastewater facility as permitted by the Florida Department of Environmental Protection.
- Waste sludge generated at the tertiary water treatment plant and sanitary wastewater treatment plant would be disposed of in an offsite landfill.

The assessment of potential impacts resulting from the discharge of nonradioactive wastes is presented in the following subsections.

5.5.1.1 Impacts of Discharges to Land

Operation of Units 6 & 7 would result in the generation of solid wastes, including trash, water treatment resins, water and sanitary treatment residuals, and waste generated from the removal of access roads. Applicable Florida requirements and standards would be met regarding the handling, transporting, and disposal of solid wastes offsite (e.g., Solid Waste Management Facilities Rule 62-701, Florida Administrative Code [F.A.C.]). Onsite disposal of uncontaminated sediment and excavated material would be stockpiled in areas with appropriate engineering controls to limit surface water runoff. The impacts of the disposal of these wastes to land are discussed in the following paragraphs.

As discussed in Section 3.6, Turkey Point Units 6 & 7 would produce approximately 1000 tons annually of nonradioactive, nonhazardous waste requiring disposal in landfills, including spent filters from water and wastewater treatment. In 2008, Miami- Dade County disposed of approximately 2.2 million tons of waste in both commercial and private landfill facilities (Miami-Dade County, undated). The percent of waste requiring disposal in landfills from Turkey Point Units 6 & 7 represents approximately 0.05 percent of the total tons disposed in landfills by Miami-Dade County in 2008. It is likely that the quantities of construction rubble would be low when compared to the overall waste volumes disposed in landfills. Therefore, the potential impacts from land disposal of nonradioactive, nonhazardous solid wastes would be SMALL and not warrant mitigation.

The FPL Reclaimed Water Treatment Facility is expected to produce approximately 435 tons of waste sludge per day, which would be disposed of at an offsite permitted landfill. This amount of waste sludge requiring disposal in landfills per day represents approximately seven percent of the 2.2 million tons of waste disposed in landfills by Miami-Dade County in 2008. Therefore, the potential impacts from land disposal of the Reclaimed Water Treatment Facility waste sludge would be SMALL and not warrant mitigation.

The sanitary wastewater treatment facility will be constructed to treat sanitary waste from Turkey Point Units 1 through 4, Units 6 & 7, Land Utilization Facilities, and the FPL reclaimed water treatment facility. Approximately 1300 gallons per day of 1.5-2 percent residual sludge, or biosolids, are anticipated to be produced daily. The residual sludge will be transported and disposed of offsite by a licensed contractor. Based on the small amount of residual biosolids anticipated to be produced from the Turkey Point Units 1 through 4, Units 6 & 7, Land Utilization Facilities, and the FPL reclaimed water treatment facility, the potential impacts from land disposal of the sanitary wastewater treatment waste sludge would be SMALL and not warrant mitigation.

5.5.1.2 Impacts of Discharges to Water

Nonradioactive wastewater from routine plant operations would include cooling tower blowdown, plant auxiliary systems, and water treatment. Ambient or baseline water quality characteristics are described in Subsection 2.3.3. Table 3.6-1 lists potential water treatment chemicals that would be used. Tables 3.6-2 and 3.6-3 list the estimated constituent and concentrations in the nonradioactive liquid waste stream from Units 6 & 7 that would be discharged to the deep injection wells for the reclaimed water and saltwater water makeup water to the circulating water system, respectively. Sanitary waste would be collected and treated in an onsite sewage treatment plant, the design and operation of which would ensure that the effluents meet the applicable effluent requirements.

The wastewater and sanitary waste treatment effluent would be disposed of using deep injection wells under the provisions of the Underground Injection Control (UIC) Rule in 62-528 F.A.C. Therefore, the effluent limits would be set by the underground injection control permit, thus regulating the effluent concentrations and operation of the deep injection wells. The wastewater would be discharged into the Boulder Zone approximately 2900 feet underground.

Considering the anticipated amount of dilution for wastewater discharged to the Boulder Zone and the limits that would be placed on discharges by the underground injection control permit, the potential impacts from wastewater/sanitary discharge from Units 6 & 7 on groundwater would be SMALL. There would be no impacts on surface water or groundwater from wastewater/sanitary waste discharge. As identified in Section 1.2, the current zero discharge National Pollutant Discharge Elimination System permit (62-620 and 62-621 F.A.C, promulgated by the U.S. EPA to the state of Florida through 403.0885 Florida Statutes) for industrial wastewater identifies the limits on various chemical constituents that can be released to the industrial wastewater facility. The impacts of the addition of impervious surfaces would be negligible because environmental best management practices (e.g., oil-water separators) would be employed to control storm water runoff. Therefore, environmental impacts from storm water discharges would be SMALL and would not warrant mitigation.

5.5.1.3 Impacts of Discharges to Air

Operation of Units 6 & 7 would result in small amounts of gaseous emissions to the air from equipment associated with plant auxiliary systems (e.g., diesel generators, diesel-driven fire pumps, etc.). This equipment would operate only infrequently (e.g., during startup/shutdown or testing), and, thus, the related emissions would be intermittent. Projected emissions from the diesel-fueled equipment are provided in Table 3.6-4.

Under state of Florida prevention of significant deterioration review requirements, all major new or modified sources of air pollutants under the Clean Air Act must be reviewed and a preconstruction permit issued. The EPA has promulgated prevention of significant deterioration regulations under 40 CFR Part 51.166. Florida's prevention of significant deterioration rules, promulgated from EPA CFR Part 51.166, are codified under 62-212.400, F.A.C. The air emission sources as a result of operation of Units 6 & 7 would be permitted under this rule. Included in this rule are limits for regulated pollutants.

Based on the estimated amount of potential air emissions, the intermittent nature of the potential emissions, and the requirement to adhere to prevention of significant deterioration requirements, impacts to air quality would be SMALL and would not warrant mitigation.

5.5.2 MIXED WASTE IMPACTS

The term mixed waste refers specifically to waste that is regulated as both radioactive waste and hazardous waste. Radioactive materials at nuclear power plants are regulated by the NRC under the Atomic Energy Act of 1954 (Atomic Energy Act, 42 USC 2011 et seq.). Hazardous wastes are regulated by the state of Florida, which is an EPA-authorized state (i.e., a state authorized by the EPA to regulate those portions of the federal act) under the Resource Conservation and Recovery Act (RCRA 42 USC 6901 et seq).

Mixed waste generated from the operation of Units 6 & 7 was assessed based on the following laws and regulations. The radioactive component of mixed waste must satisfy the definition of low-level waste in the Low-Level Radioactive Waste Policy Amendments Act of 1985. The hazardous component must exhibit at least one of the hazardous waste characteristics identified in 40 CFR Part 261, Subpart C, or be listed as a hazardous waste under 40 CFR Part 261, Subpart D.

5.5.2.1 Plant Systems Producing Mixed Waste

A 1990 survey conducted by the NRC identified the following types of mixed low-level waste at reactor facilities (NUREG-1437):

- Waste oil from pumps and other equipment.
- Chlorinated fluorocarbons resulting from cleaning, refrigeration, degreasing, and decontamination activities.
- Organic solvents, reagents, compounds, and associated materials such as rags and wipes.
- Metals such as lead from shielding applications and chromium from solutions and acids.
- Metal-contaminated organic sludge and other chemicals.
- Corrosive liquids consisting of organic and inorganic acids.

The types of mixed waste generated by the AP1000 would be consistent with the types identified by the NUREG-1437 survey, and an AP1000 unit would generate a limited volume of mixed waste (i.e., approximately 25 cubic feet annually) per the DCD. However, it is anticipated that little to no mixed waste would be produced by Units 6 & 7. The following paragraphs contain proposed procedures for the handling and minimization of mixed waste, should it be generated as a result of the operation of Units 6 & 7.

5.5.2.2 Mixed Waste Storage and Disposal Plans

The volume of mixed waste would be reduced or eliminated by one or more of the following methods before disposal: decay, stabilization, neutralization, filtration, or chemical/thermal destruction by an outside vendor. Some small quantities of mixed waste, if generated, would be temporarily stored onsite until suitable treatment options or disposal sites are available. Possible options would be shipment to a permitted mixed waste disposal facility, shipment to a treatment facility, or storage onsite. Occupational chemical and radiological exposures could occur during the testing of mixed wastes to determine if the constituents are chemically hazardous. Appropriate hazardous chemical control and radiological control measures would be applied during testing, handling, and storage of mixed wastes, in accordance with 10 CFR Part 20 guidelines, and could include any of the following:

- Segregate mixed wastes from nonhazardous wastes.
- Designate and use an area only for storage of mixed waste and exclude its use for storage of unrelated materials or equipment or for other functions.
- Provide a secondary containment for liquid mixed wastes being stored (for example, berm and line areas where drums are stored).
- Label the containers properly and in accordance with regulatory requirements.
- Post and/or provide applicable material safety data sheets, emergency spill response procedures, and a spill kit in the area.
- Fence and lock the gate to the accumulation area or long-term storage area when authorized personnel are not present.
- Post signs at the entrance to the storage area indicating, for example: “MIXED HAZARDOUS WASTE AREA” and “DANGER—UNAUTHORIZED PERSONNEL—KEEP OUT.”

5.5.2.3 Waste Minimization Plan

A waste minimization program could be developed and implemented, if necessary. The following elements of such a program may include:

- Maintenance Program — Equipment maintenance programs would be periodically reviewed to establish improvements in corrective and preventive maintenance that would reduce equipment failures that could generate mixed waste. Maintenance procedures would be reviewed to address activities that result in the production of waste in the form of process materials, scrap, and cleanup residue. In addition, the need for revising operational procedures, modifying equipment, and segregating and recovering the mixed wastes would be addressed.

- Recycling and Reuse — Opportunities for reclamation and reuse of waste materials would be used whenever feasible. Tools, equipment, and materials would be decontaminated for reuse or recycle whenever practical to minimize the amount of waste for disposal. Impediments to recycling would be challenged to enable generators to recycle whenever practical.

- Segregation — If radioactive or hazardous waste is generated, proper handling, containerization, and separation techniques would be employed. This would minimize cross-contamination and the unnecessary generation of mixed waste.

- Decay in Storage — Some portion of the mixed waste would be radionuclides with relatively short half-lives. The NRC generally allows facilities to store waste containing radionuclides with half-lives of less than 120 days until 10 half-lives have elapsed and the radiation emitted from the unshielded surface of the waste is indistinguishable from background levels. The waste could then be disposed of as a nonradioactive waste. Radioactive waste could also be stored for decay under certain circumstances in accordance with 10 CFR Part 20. For mixed waste, storage for decay would be particularly advantageous because the waste could be managed solely as a hazardous waste after the radionuclides decayed to background levels, thereby simplifying the management of these wastes to meet applicable requirements.

- Work Planning — Pre-job planning would be performed to determine what materials and equipment would be needed to perform the anticipated work. One objective of this planning would be to prevent pollution and minimize the amount of mixed waste that may be generated and to use only the materials necessary to accomplish the work. Planning would also prevent mixing of materials or waste types.

- Tracking Systems — Development of a tracking system to monitor waste generation data and identify waste minimization opportunities to reduce environmental impacts would be considered. This would provide essential feedback to successfully guide future efforts. The data collected by the system would be used for internal reporting. The tracking system would provide feedback on the progress of the waste minimization program, including the results of the implementation of pollution prevention technologies.

- Training and Awareness Programs — Educate employees in the principles and benefits of the waste minimization plan, solutions to current and potential environmental management problems could be found. Details of the training program would be outlined in the Nuclear General Employee Training.

5.5.2.4 Environmental Impacts of Mixed Waste

Industry-accepted chemical handling techniques, pre-job planning, and compliance with an approved facility waste minimization plan (as addressed in Subsection 5.5.2.3) would ensure that only small quantities of mixed wastes would be generated by the new units. Therefore, environmental impacts of mixed waste would be SMALL and would not warrant mitigation.

5.5.3 CONCLUSIONS

Small quantities of chemical constituents would be released to the water and air from operation of the new units. These constituents would be limited and permitted under the Florida Department of Environmental Protection permits. Waste minimization programs would reduce the amount of wastes, including mixed wastes, generated by operation of the new units. To the extent practical, nonradioactive liquids and solid wastes would be recycled. For wastes that cannot be recycled, applicable federal, Florida, and local requirements and standards would be met with regard to the handling, transporting, and disposal of solid wastes offsite. Therefore, the impacts of waste generation would be SMALL and would not warrant mitigation.

5.6 ENVIRONMENTAL IMPACTS OF TRANSMISSION SYSTEMS

The potential environmental impacts of transmission system operation are described in this section. Environmental impacts of transmission facility construction (new rights-of-way and/or modification of existing rights-of-way) are described in Section 4.3. Possible impacts from transmission system operation, including transmission line vegetation management and transmission system maintenance, are described in this section relative to terrestrial and aquatic resources and members of the public.

Power generated at Units 6 & 7 would be transmitted over new circuits using new and existing rights-of-way (see Subsection 2.2.2). To the extent practicable, the proposed transmission lines would be collocated with FPL's existing transmission lines.

As part of the state certification proceeding, FPL is proposing transmission corridors of variable widths up to 3700 feet wide connecting the terminal points of the proposed transmission lines. The new transmission lines would be located in a much narrower right-of-way somewhere within these corridors. Once the certification proceeding is concluded and FPL obtains the property interests required to construct the proposed transmission lines, the boundary of the corridors would narrow to only that land in the transmission line rights-of-way. After constructing the new transmission lines, the proposed transmission corridors would have no further legal significance. Therefore, this section addresses the environmental impacts of operation and maintenance of the transmission lines within the rights-of-way.

The 500 kV and 230 kV rights-of-way are variable in width and total approximately 89 miles in length. All existing and proposed rights-of-way are located in Miami-Dade County. Subsection 2.2 describes the land characteristics of the area contained in these rights-of-way. One short 230 kv (0.4-mile) line, completely within the Turkey Point plant property and traversing previously developed land, would connect the new Clear Sky substation to the existing Turkey Point substation.

FPL conducts routine maintenance in existing rights-of-way in compliance with applicable federal, state, and local laws, regulations, and permit requirements. Right-of-way maintenance activities in new and/or modified rights-of-way also would be the responsibility of FPL and would comply with local, state, and federal requirements.

5.6.1 IMPACTS TO TERRESTRIAL RESOURCES

Line maintenance and vegetation management for the proposed transmission lines would be site-specific, based on location, terrain, and the surrounding environment. Consistent with existing practices, vegetation would be managed by trimming, mowing, and application of approved growth regulators and herbicides, targeting species that are incompatible with the safe access, operation, and maintenance of the transmission system (Subsection 3.7.3.2). In the transmission line rights-of-way, plant species that attain heights greater than 14 feet would typically removed to maintain proper clearance to conductors. The buildup of vegetation in the transmission line rights-of-way would also be monitored and reduced if it reaches levels that may threaten the operation of the transmission lines. Many segments of these transmission line rights-of-way cross cultivated lands and other open land use characteristics (e.g., sawgrass marsh), where the height of the vegetation would not threaten transmission operation. Maintenance operations would be rarely required in these areas.

As identified in Subsection 2.4.1.2, multiple federal- and state-listed endangered and threatened species, candidate species, and state species of special concern are found in Miami-Dade County, the county containing all of the proposed and existing transmission corridors (see Table 2.4-3). During a recent reconnaissance (April and June 2008) of these corridors, a single Everglade snail kite was the only federally listed fauna observed in or near the corridors (ENP segment). These kites feed almost exclusively on apple snails and, thus, use extensive marsh systems or lake littoral zones as foraging habitat.

Subsequent to the 2008 transmission corridor reconnaissance, an Eastern indigo snake was observed at two locations on the Eastern Preferred transmission corridor in 2011. Eastern indigo snakes inhabit a variety of habitats.

Portions of the transmission corridors on the Turkey Point plant property cross canals/wetlands designated as critical habitat for the federally threatened crocodile. State canals crossed by the transmission corridors may be used by the endangered Florida manatee. Wood storks periodically nest in four colonies along Tamiami Trail near the south-to-north leg of the proposed Clear Sky-to-Levee corridor. Critical habitat has not been defined for the stork, but habitat management guidelines (USFWS 1990) for the species include recommendations relating to transmission structures and other construction activities near stork breeding colonies. FPL's commitment to the preservation of the environment led to the development and implementation, in consultation with the U.S. Fish and Wildlife Service (USFWS), of the FPL Avian Protection Plan. This plan provides for guidelines and avian-friendly design standards that minimize the likelihood of collisions and electrocutions of wood storks and other birds from electrical facilities. The Florida panther is an endangered species that inhabits saw palmetto thickets and hardwood areas in the Everglades. There have been approximately 60 sightings of panthers during the last 20 years in the Everglades area crossed by the two alternative corridors for the Clear Sky-to-Levee transmission corridor. Routing the transmission line along either corridor could temporarily disturb Florida panthers, although actual operation of the transmission lines should have little to no impact on panthers. Several species that are state-listed or species of special concern were observed during recent reconnaissance of this area: snowy egret, tricolored heron, and white ibis. Surveys of the transmission corridors for listed plants documented approximately 30 plant species within/adjacent to the corridors. Given that the sensitive plants discovered within the transmission corridor already exist within managed and/or maintained habitats and FPL's practice to avoid these sensitive plants to the extent practicable, impacts of continued operation and maintenance of the transmission lines on sensitive plants would be SMALL.

FPL considers threatened or endangered species in its selection of corridors in transmission line rights-of-way and in its transmission line right-of-way maintenance program. For example, FPL's collocation of the proposed transmission lines in existing transmission line rights-of-way would minimize the impacts on plant and animal populations as a result of construction, maintenance, and operation of the proposed transmission lines. FPL would consult with the USFWS and the Florida Fish and Wildlife Conservation Commission on appropriate avoidance or mitigation methods in a post-certification process pursuant to conditions of the state's certification of the Turkey Point project under the Florida Electrical Power Plant Siting Act.

Other important species, as defined in NUREG-1555, likely to use these transmission line rights-of-way include game species such as white-tailed deer, feral hog, and rabbit and dove species. However, the short-term and infrequent vegetation management activities employed to maintain these transmission lines would only disturb these species for the duration of the maintenance activity and would not permanently disrupt or displace them. Maintaining the rights-of-way in an early stage of vegetative succession may benefit some of these wildlife species.

The NRC evaluated the potential impacts of transmission line maintenance and vegetation management practices on terrestrial biota, including practices similar to those employed by FPL, in the Generic Environmental Impact Statement (GEIS) for License Renewal of Nuclear Plants (NUREG-1437). The GEIS concluded that typical line maintenance and vegetation management practices do not lower habitat diversity or produce significant changes in surrounding habitats, and generally result in impacts to wildlife of SMALL significance. FPL's maintenance procedures are site-specific, based on local terrain and plant communities, and therefore minimize impacts of transmission line maintenance activities on terrestrial resources. Most of the habitats crossed by the proposed transmission corridors are agricultural and/or open (e.g., sawgrass marsh) and will require only infrequent management. Given the types of habitats within the rights-of-way, the infrequency of required maintenance, and the NRC (1996) evaluation of potential impacts, the impacts of maintenance activities on terrestrial biota would be SMALL.

Impacts of maintenance activities on existing transmission line rights-of-way are typically found to be insignificant with only SMALL impacts to floodplains and wetlands (NUREG-1437). Construction and/or clearing of rights-of-way typically have greater potential for impacts than maintenance activities, but they too can be completed with little or no impacts. For example, most herbaceous, shrub-dominated, and open water wetlands would be spanned during maintenance or repair activities and would not be affected by transmission line maintenance.

Even though most of the aquatic habitat between spans will still function as wetlands, pads and foundations built to support transmission poles and access roads for maintenance will replace some wetland habitats and may alter local hydrology. FPL will be required by the Florida Department of Environmental Protection and the U.S. Army Corps of Engineers to avoid and minimize such impacts to the extent practical, and where impacts are unavoidable, to mitigate the value and functions of any wetlands disturbed by construction Given the amount of wetland habitats disturbed during construction in the vicinity of the proposed transmission lines associated with this project, impacts of maintenance and operation of these transmission lines are expected to be SMALL. Mitigation methods pertaining to wetlands in transmission corridors were discussed in Subsection 4.3.1.3.1.

Avian mortalities resulting from collisions with transmission lines, as evaluated in the GEIS (NUREG-1437), are typically insignificant and any associated impacts are SMALL for operating nuclear plants. However, given that a new transmission line right-of-way, including transmission poles, would be established close to four wood stork colonies and the operation of new transmission lines within 3 miles of colonies is not recommended (USFWS 1990), regulatory agencies would be consulted once a corridor is approved and the final right-of-way alignment is chosen. In addition, FPL would employ environmental best management practices and implement the FPL Avian Protection Plan for maintenance activities.

No significant impacts from electromagnetic fields associated with transmission lines were identified in the GEIS for terrestrial resources (NUREG-1437); therefore, such impacts would be SMALL. Florida established limits on electric and magnetic field exposure from electric facilities in 1989. The Florida legislature granted the Florida Department of Environmental Protection (F.A.C. 62-814.100) exclusive jurisdiction to regulate electric and magnetic fields associated with electric facilities and required it to establish rules regulating electric and magnetic field exposure from those facilities. FPL facilities comply with the rules established by the FDEP.

Multiple studies quantified the amount of ozone generated by transmission lines and concluded that the amount produced was insignificant and too low to cause significant effects to terrestrial biota (NUREG-1437).

Based on the maintenance procedures established by FPL and the analysis of transmission system operation impacts on terrestrial resources the NRC completed for the GEIS (NUREG-1437), potential impacts associated with routine right-of-way maintenance activities on terrestrial resources would be SMALL. However, the presence of known populations of certain threatened and endangered species near these rights-of-way would result in agency consultations and possible mitigation actions, as discussed in Subsection 4.3.1.3.1.

5.6.2 IMPACTS TO AQUATIC RESOURCES

Existing transmission lines generally pass through typical habitats associated with the coastal plain region of southeast Florida. These transmission rights-of-way include wetlands, agricultural fields, pasture/rangeland, and residential/developed lands (Table 2.2-2). The proposed transmission line rights-of-way are described earlier in this section. Impacts to wetland habitats are described in Subsection 5.6.1. Aside from wetlands, several SFWMD canals cross or parallel in the proposed rights-of-way, but these canals would not be impacted by transmission line maintenance. Therefore, impacts would be limited to aquatic resources living in wetland habitats.

Other than the mangrove rivulus addressed later in this section, none of the 13 freshwater fish listed as imperiled by the Florida Fish and Wildlife Conservation Commission (FWC 2008) are known to exist in the project area. The only important aquatic resource, as defined in NUREG-1555, that could potentially exist along the proposed transmission corridors, is the mangrove rivulus. The mangrove rivulus is a state and federal species of special concern. The range of the mangrove rivulus closely parallels that of the red mangrove, which is the preferred habitat of this fish (FMNH 2008). This fish species is not known to exist within the proposed transmission corridors.

In Florida, the mangrove rivulus is locally rare (FMNH 2008). This primarily saltwater or brackish water species has limited existence in freshwater. It can tolerate salinities from 0 to 68 parts per thousand. In the Everglades, this fish exists in stagnant seasonal ponds and sloughs as well as in mosquito ditches in mangrove habitats. Along the east coast of Florida, it exists in elevated marsh habitats above the intertidal zone, often in the burrows of the great land crab (*Cardisoma guanhumi*) (FMNH 2008).

Potential impacts on aquatic resources from transmission line maintenance activities include heating of water bodies from removal of shade trees, siltation and turbidity resulting from increased runoff and erosion, and runoff of defoliants and herbicides (NUREG-1555). Access roads built for transmission maintenance crews may be misused by off-road vehicle enthusiasts, creating erosion and sedimentation challenges. FPL's right-of-way maintenance program is customized for each habitat type within the transmission line right-of-way to minimize impacts to living resources. The exact manner in which maintenance would be performed would depend on location, type of terrain, and the surrounding environment. FPL maintains existing transmission rights-of-way using a combination of trimming, mowing, and herbicide application (NUREG-1437). Safe and reliable operation of the transmission lines sometimes requires that vegetation be trimmed, which can reduce shade and indirectly allow temperatures to increase in nearby water. In wet areas, such as mangrove swamps, FPL trims trees at the 14-foot level to maintain clearances required by safety and reliability standards. Typically, FPL only needs to do this at mid-span (NUREG-1437). Growth regulators and herbicides are selectively used in accordance with federal, state, and local regulations.

FPL uses environmental best management practices during right-of-way maintenance activities to reduce erosion and sedimentation to minimize impacts on aquatic resources. For example, siltation resulting from storm water runoff would be controlled by stacked hay bales and silt curtains. Removal of vegetation can also lead to soil erosion and subsequent sedimentation in wetlands. Therefore, maintenance practices leave roots in place to maintain soil structure.

The NRC analyzed transmission system operation impacts on wetland resources for the GEIS (NUREG-1437) and found that routine maintenance practices had little impact on aquatic resources. The routine maintenance procedures established by FPL, which were designed to minimize ecological impacts along the transmission line rights-of-way, would have a SMALL impact on aquatic resources and not require additional mitigation.

5.6.3 IMPACTS TO MEMBERS OF THE PUBLIC

As described in Subsection 3.7.2, the proposed transmission system for Units 6 & 7 would consist of the following transmission lines:

- One 230 kV line from the Clear Sky substation to Davis substation
- Two 500 kV lines from the Clear Sky substation to the Levee substation
- One 230 kV line from the Clear Sky substation to the Pennsuco substation
- One 230 kV line from the Davis substation to the Miami substation
- One onsite 230 kV line from Clear Sky substation to the Turkey Point substation

The proposed transmission corridors have been situated away from densely populated areas when practical. Potential impacts to members of the public resulting from the operation and maintenance of the transmission lines would be visual changes, electric shock hazards, electromagnetic field exposure, noise impacts, or radio and television interference.

5.6.3.1 Visual Impacts

Transmission tower maintenance, vegetation, and rights-of-way management operations would be carried out as necessary by FPL to comply with the requirements of the National Electrical Safety Code (NESC) and the reliability standards of the North American Electrical Reliability Corporation and of Florida statutes. The exact manner in which maintenance would be performed would depend on the location, type of terrain, and surrounding environment. Vegetation removal would be minimized consistent with safe and reliable operation of the transmission lines. For example, when possible to do so safely, natural vegetation could be allowed to grow up to 14 feet within the transmission line rights-of-way to minimize impacts.

Consequently, the visual impacts of transmission line maintenance would be SMALL.

5.6.3.2 Induced Current

Objects near transmission lines can become electrically charged as a result of their immersion in the lines' electric field. This charge results in an induced current that flows through the object to the ground. The current is called induced because there is no direct connection between the line and the object. The induced current can also flow to the ground through the body of a person who touches the object. An object that is insulated from the ground can actually store an electrical charge, becoming capacitively charged. A person standing on the ground and touching a vehicle or a fence can receive an electrical shock because of the sudden discharge of the capacitive charge through the person's body to the ground. After the initial discharge, a steady-state current can develop, the magnitude of which depends on several factors, including:

- Strength of the electric field which depends on the voltage of the transmission line
- Height and geometry of the individual transmission wires
- Size of the object on the ground
- Extent to which the object is grounded

Analysis of this issue, detailed in the GEIS (NUREG-1437), concludes that "potential electrical shock impacts are of small significance for transmission lines that are operated in adherence with the NESC." The NESC describes how to establish minimum vertical clearances to the ground for electric lines having voltages exceeding 98 kV. The clearance must limit the induced current as a result of electrostatic effects to 5 milliamperes if the largest anticipated truck, vehicle, or equipment were short-circuited to ground (IEEE Aug 2006). By way of comparison, the short-circuit setting of ground fault circuit interrupters (used in residential wiring of special breakers for outside circuits or those with outlets in kitchens and bathrooms) is 4–6 milliamperes. FPL is required by Florida statutes to construct (IEEE Aug 2006) its proposed transmission lines in compliance with NESC, C2-2007.

The proposed lines would be built in compliance with the NESC. In addition, all transmission lines constructed by FPL would conform to standards established by ANSI, NESC, and other applicable codes and standards that are generally accepted by the industry, except as modified by Florida statutes. During construction of the lines, FPL would ground existing fences and gates that cross or parallel the right-of-way to mitigate shock hazards. Therefore, the incidence of induced current impacting the public would be rare, and no mitigation measures would be needed.

During the license renewal process for Units 3 & 4, the existing eight 230 kV circuits that extend from Turkey Point to the Davis and Florida City substations were analyzed. Calculation of the maximum induced current was performed based on the methodology described in the Electric

Power Research Institute guidance and assumed the largest vehicle under the lines would be a semi tractor trailer, 13.5 feet high by 8.5 feet wide by 53 feet long. The maximum induced current for these circuits was determined to be 4.3 milliamperes, which is below the allowable 5 milliamperes. The proposed transmission lines for Units 6 & 7 would display similar induced current results because the proposed lines would be built in compliance with the NESC limit.

The impacts to members of the public of induced current would be SMALL and would not warrant additional mitigation.

5.6.3.3 Electromagnetic Field Exposure

Although studies continue to be conducted and additional information is published regarding the effects of exposure to electric and magnetic fields (e.g., WHO Dec 2005), there continues to be no conclusive evidence of a link between electric and magnetic fields and possible health impacts, including the development of cancer, reproductive disorders, or other abnormalities in humans. Florida established limits on electric and magnetic field exposure from electric facilities in 1989. The Florida legislature granted the FDEP exclusive jurisdiction to regulate electric and magnetic fields associated with electric facilities and required it to establish rules regulating electric and magnetic field exposure from those facilities. FPL facilities comply with the rules established by the FDEP.

Therefore, impacts to members of the public attributable to electric and magnetic field exposure from transmission system operations would be SMALL. No additional mitigation measures or controls are warranted.

5.6.3.4 Noise

High-voltage transmission lines can emit noise when the electric field strength surrounding them is greater than the breakdown threshold of the surrounding air, creating a discharge of energy. This energy loss, known as corona discharge, is affected by ambient weather conditions such as humidity, air density, wind, and precipitation, and by irregularities on the energized surfaces. FPL's proposed transmission lines would be designed with hardware and conductors that have features to minimize corona discharge up to their maximum operating voltage.

Corona-induced noise along the existing transmission lines is very low or inaudible, except directly below the line on a quiet, humid day. Under wet conditions, higher noise levels are experienced than would occur under dry conditions. However, background noise from various sources (inclement weather, traffic, agricultural activity, etc.) has the effect of masking transmission line noise. The GEIS (NUREG-1437) concluded that corona discharge resulting in audible noise, radio and television interference, energy losses, and the production of ozone is generally not an issue with transmission lines below 345 kV.

With respect to the 500 kV transmission lines, during wet conditions, the median A-weighted sound pressure level of the noise from the proposed transmission lines would be up to 55 decibels adjusted at the edge of the right-of-way. The noise levels would decrease as one moves away from the edge of the right-of-way. The EPA reports that the average background noise of quiet undeveloped land is between 20 and 30 decibels adjusted and between 59 and 78 for urban or built-up areas (U.S. EPA Mar 1974 and 1979). The potential noise from the 500 kV lines would be louder than the range for undeveloped land but quieter than urban or built-up areas. Such noise would not pose a risk to humans and would likely be masked by background noise unless a person was directly below the transmission line. Additionally, in wet conditions such as rain, the ambient noise levels would be higher, further masking corona noise.

The GEIS (NUREG-1437) indicated that monitoring of ozone levels for 2 years near a Bonneville Power Administration 1200 kV prototype line revealed no increase in ambient ozone levels caused by the line. Therefore, production of ozone from 500 kV lines would be minimal.

Should complaints related to transmission line noise occur, FPL would investigate the cause and, if necessary, take steps to correct the issue.

Complaints regarding nuisance noise from the proposed transmission lines would not be expected and impacts would be SMALL.

5.6.3.5 Radio and Television Interference

Radio interference and television interference can occur from corona, electrical sparking, and arcing between two pieces of loosely fitting hardware or burrs or edges on hardware. This noise occurs at discrete points and can be minimized with good design and maintenance practices. The effect of corona on radio and television reception depends on the radio/television signal strength, the distance from the transmission line, and the transmission line noise level. As described in Subsection 5.6.3.4, the proposed transmission lines would be designed to minimize corona discharge up to their maximum operating voltage.

Should complaints related to radio and television interference occur, FPL would investigate the cause and, if necessary, take steps to correct the issue.

FPL’s transmission lines would have no impact on digital television signals, including cable and satellite television. Television interference occurs only with analog television signals, and as of June 2009, the Federal Communications Commission has mandated the use of digital television signals. Therefore, FPL’s transmission lines would cause no television interference.

Complaints regarding radio and television interference from the proposed transmission lines would not be expected and impacts would be SMALL.

Section 5.6 References

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FMNH 2008. Florida Museum of Natural History, Ichthyology, *Biological Profile: Mangrove Rivulus*. Available at http://www.flmnh.ufl.edu/fish/gallery/descript/mangroverivulus/mangroverivulus.html, accessed July 5, 2008.

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WHO Dec 2005. World Health Organization, *Electromagnetic Fields and Public Health — Electromagnetic Hypersensitivity — Fact Sheet No. 296*, December 2005. Available at www.who.int/mediacentre/factsheets/fs296/en/print.html, accessed August 18, 2008.

5.7 URANIUM FUEL CYCLE AND TRANSPORTATION IMPACTS

Subsection 5.7.1 addresses the environmental impacts from the uranium fuel cycle for the AP1000. Subsection 5.7.2.1 addresses the conditions in subparagraphs 10 CFR 51.52(a)(1) through (5) regarding use of Table S-4 to characterize the impacts of radioactive materials transportation in this environmental report. Because the AP1000 does not meet all of the conditions set forth in 10 CFR 51.52(a), a further analysis of the transportation effects was performed. Subsection 5.7.2.2 addresses the incident-free transportation of radioactive materials to and from Units 6 & 7. Transportation accidents are described in Section 7.4.

5.7.1 URANIUM FUEL CYCLE IMPACTS

This section describes the environmental impacts from the uranium fuel cycle for the AP1000. The uranium fuel cycle is defined as the total of those operations and processes associated with provision, utilization, and ultimate disposal of fuel for nuclear power reactors.

Table S-3 of 10 CFR 51.51(b) was used to assess environmental impacts resulting from the uranium fuel cycle. Its values are normalized for a reference 1000 MWe light water reactor (LWR) at 80 percent capacity factor. The 10 CFR 51.51(b) Table S-3 values are reproduced as the "Reference Reactor" column in Table 5.7-1. The AP1000 was analyzed with an estimated gross electrical output of 1115 MWe[1] operating at 93 percent capacity factor. The results of this analysis for Units 6 & 7 are also included in Table 5.7-1.

Specific categories of natural resource use are included in Table S-3 (and duplicated in the *Reference Reactor* column of Table 5.7-1). These categories relate to land use, water, and fossil fuel consumption; chemical and thermal effluents; radiological releases; disposal of transuranic, high-level, and low-level wastes; and radiation doses from transportation and occupational exposure. In developing Table S-3, the NRC considered two fuel cycle options that differed in the treatment of spent fuel removed from a reactor. "No recycle" treats all spent fuel as waste to be stored at a federal waste repository; "uranium only recycle" involves reprocessing spent fuel to recover unused uranium and return it to the fuel cycle. Neither cycle involves the recovery of plutonium. The contributions in Table S-3 resulting from reprocessing, waste management, and transportation of wastes are maximized for both of the two fuel cycles (uranium only and no recycle). That is, the identified environmental impacts are based on the cycle that results in the greater impact.

The following assessment of the environmental impacts of the fuel cycle for two AP1000s at Turkey Point is based on the values in Table S-3 and the NRC's analysis of the radiological

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1. Gross electrical output for the AP1000 was used to provide conservatism in the estimates of potential fuel cycle impacts, which are obtained by scaling the values for the reference reactor to reflect the increased electrical output of the AP1000.

impacts from Rn-222 and Tc-99 in NUREG-1437. NUREG-1437 and Addendum 1 to the Generic Environmental Impact Statement (GEIS) for License Renewal provide a detailed analysis of the environmental impacts from the uranium fuel cycle. Although NUREG-1437 is specific to those impacts related to license renewal, the information provided insights to this review because the AP1000 design considered here uses the same type of fuel.

The fuel cycle impacts in Table S-3 are based on a reference 1000 MWe LWR operating at an annual capacity factor of 80 percent for an average electrical output of 800 MWe. The evaluation of the environmental impacts of the fuel cycle for the AP1000, assumed a 1115 MWe (gross) reactor with a capacity factor of 93 percent for an average electrical output of 1037 MWe per unit. The two AP1000 units for Units 6 & 7 would have a combined total of 2,074,074 MWe. The output of Units 6 & 7 is approximately 2.6 times greater than the output used to estimate impact values in Table S-3 (reproduced here as the first column of Table 5.7-1) for the reference reactor. The analyses presented here are scaled from the reference reactor impacts to reflect the output of Units 6 & 7.

Recent changes in the fuel cycle may have some bearing on environmental impacts; however, as described below, the contemporary fuel cycle impacts are bounded by impact values in Table S-3. The NRC calculated the impact values in Table S-3 from industry averages for the performance of each type of facility or operation associated with the fuel cycle. They chose assumptions so the calculated impact values will not be underestimated. This approach was intended to ensure that the actual impact values will be less than the quantities shown in Table S-3 for all LWR nuclear power plants within the widest range of operating conditions. Changes in the fuel cycle and reactor operations have occurred since Table S-3 was promulgated. For example, the estimated quantity of fuel required for a year’s operation of a nuclear power plant can now reasonably be calculated assuming a 60-year lifetime (40 years of initial operation plus a 20-year license renewal term). This was done in NUREG-1437 for both BWRs and PWRs, and the highest annual requirement (35 metric tons of uranium [MTU] made into fuel for a BWR) was used in NUREG-1437 as the basis for the reference reactor year. A number of fuel management improvements have been adopted by nuclear power plants to achieve higher performance and to reduce fuel and enrichment requirements, reducing annual fuel requirements. An AP1000 reactor will require approximately 23 MTUs per year, approximately 34 percent less than the BWR refueling requirement evaluated in NUREG-1437, but its electrical output will be approximately 30 percent greater than the reference reactor. Therefore, Table S-3 remains a conservative estimate of the environmental impacts of the fuel cycle fueling nuclear power reactors operating today.

Another change is the elimination of the U.S. restrictions on the importation of foreign uranium. Until recently, the economic conditions of the uranium market favored use of foreign uranium at the expense of the domestic uranium industry. These market conditions forced the closing of most U.S. uranium mines and mills, substantially reducing the environmental impacts in the

United States from these activities. There is renewed interest in uranium mining and milling in the United States. The NRC recently received the first license application for a uranium recovery facility since 1988 (U.S. NRC Oct 2007). The NRC anticipates 20 applications for new facilities—including in-situ operations and conventional uranium mills—through fiscal year 2011. The majority of these applications are expected to be for in-situ leach solution mining that does not produce tailings. (U.S. NRC Aug 2008) Factoring in changes to the fuel cycle suggests that the environmental impacts of mining and milling could drop to levels below those in Table S-3. However, Table S-3 impact estimates have not been reduced for this analysis. Section 6.2.3 of NUREG-1437 describes the sensitivity of these changes in the fuel cycle on the environmental impacts.

5.7.1.1 Land Use

The total annual land requirements for the fuel cycle supporting the two AP1000 Units 6 & 7 would be approximately 300 acres. Approximately 34 acres would be permanently committed land, and 260 acres would be temporarily committed. A “temporary” land commitment is a commitment for the life of the specific fuel cycle plant (e.g., a mill, enrichment plant, or succeeding plants). Following decommissioning, the land could be released for unrestricted use. “Permanent” commitments represent land that may not be released for use after decommissioning because decommissioning does not result in the removal of sufficient radioactive material to meet the limits of 10 CFR Part 20, Subpart E for release of an area for unrestricted use.

In comparison, a coal-fired plant with the same MWe output as two AP1000s using strip-mined coal requires the disturbance of approximately 520 acres per year for fuel alone. Considering common classes of land use in the United States, the fuel cycle impacts on land use would be SMALL and would not warrant mitigation.

5.7.1.2 Water Use

Principal water use for the fuel cycle supporting the two AP1000s would be that required to remove waste heat from the power stations supplying electricity to operate the enrichment process. Scaling the values from Table S-3, of the total annual water use of 2.95E10 gallons for the fuel cycle, approximately 2.87E10 gallons (approximately 97 percent) are required for the removal of waste heat. Evaporative losses from fuel cycle process cooling are approximately 4.15E08 gallons per year and mine drainage accounts for 3.29E08 gallons per year. The NRC estimated the consumptive water use for the uranium fuel cycle to be approximately 2 percent of that from the reference reactor using cooling towers. The maximum consumptive water use (assuming that all plants supplying electrical energy to the nuclear fuel cycle used cooling towers) was estimated to be approximately 6 percent of that for the reference reactor using cooling towers (NUREG-1437). The water consumption attributed to the uranium fuel cycle would be small relative to the water consumption of the two proposed AP1000 units. Impacts on water use would be SMALL and would not warrant mitigation.

5.7.1.3 Fossil Fuel Impacts

Electric energy and process heat are required during various phases of the fuel cycle process. The electric energy is usually produced by the combustion of fossil fuel at conventional power plants. Electric energy associated with the fuel cycle represents approximately 5 percent of the annual electric power production of the reference reactor. Process heat is primarily generated by the combustion of natural gas. This gas consumption, if used to generate electricity, represents less that 0.4 percent of the electrical output of the reference reactor. The direct and indirect consumption of electric energy for fuel cycle operations would be small relative to the power production of the two AP1000s. Therefore, impacts from fossil fuels would be SMALL and would not warrant mitigation.

5.7.1.4 Chemical Effluents

The quantities of liquid, gaseous, and particulate discharges associated with the fuel cycle are given in Table S-3 (Table 5.7-1) for the reference 1000 MWe LWR. The quantities of effluents for two AP1000s would be approximately 2.6 times greater than those in Table S-3 (Table 5.7-1 column 3). The principal effluents are sulfur oxides, nitrogen oxides, and particulates. Based on the EPA's National Air Pollutant Emissions Estimates (U.S. EPA 2006), these emissions constitute less than 0.08 percent of all sulfur dioxide emissions in 2005, and less than 0.02 percent of all nitrogen oxide emissions in 2006.

Liquid chemical effluents produced in the fuel cycle processes are related to fuel enrichment and fabrication and may be released to receiving waters. As stated in Subsection 5.7.1 of NUREG-1555, all liquid discharges into the navigable waters of the United States from plants associated with the fuel cycle operations will be subject to requirements and limitations by an appropriate federal, state, regional, local or affected Native American tribal regulatory agency. Solids are generated during the milling process and are not released in quantities sufficient to have a significant impact on the environment. Impacts from chemical effluents would be SMALL and would not warrant mitigation.

5.7.1.5 Radioactive Effluents

Radioactive gaseous effluents estimated to be released to the environment from waste management activities and certain other phases of the fuel cycle are shown in Table S-3 (Table 5.7-1). Using Table S-3 data, Section 6.2.2.1 of NUREG-1437 estimates the 100-year environmental dose commitment to the U.S. population from the fuel cycle (excluding reactor releases and dose commitments due to Rn-222 and Tc-99) to be approximately 400 person-rem per reference reactor year. The estimated dose commitment to the U.S. population is approximately 1000 person-rem per year of operation for two AP1000s.

Section 6.2.2.1 of NUREG-1437 estimates the additional 100-year whole body dose commitment to the U.S. population from radioactive liquid waste effluents due to all fuel cycle operations (other than reactor operation) to be approximately 200 person-rem per reference reactor year. The estimated dose commitment to the U.S. population is approximately 520 person-rem per year of operation for two AP1000s. Thus, the estimated 100-year dose commitment to the U.S. population from radioactive gaseous and liquid releases from fuel cycle operations would be approximately 1600 person-rem to the whole body per reactor-year for two AP1000s.

The radiological impacts of Rn-222 and Tc-99 releases are not included in Table S-3. Principal radon releases occur during mining and milling operations and as emissions from mill tailings. Principal Tc-99 releases occur as releases from the gaseous diffusion enrichment process. The NRC provided an evaluation of these Rn-222 and Tc-99 releases in NUREG-1437. The NUREG-1437 evaluation was reviewed, it was considered applicable, and has been included as part of the evaluation in this Environmental Report.

Section 6.2 of NUREG-1437 estimates Rn-222 releases from mining and milling operations, and from mill tailings for a year of operation of the reference 1000 MWe LWR. The estimated release of Rn-222 for two AP1000s is 13,500 curies per year. Of this total, approximately 78 percent would be from mining, 15 percent from milling, and 7 percent from inactive tailings before stabilization. Radon releases from stabilized tailings were estimated to be 2.6 curies per year for two AP1000s; that is, approximately 2.6 times greater than the NUREG-1437 estimate for the reference reactor year. The major risks from Rn-222 are from exposure to the bone and lung, although there is a small risk from exposure to the whole body. The organ-specific dose weighting factors from 10 CFR Part 20 were applied to the bone and lung doses to estimate the 100-year dose commitment from Rn-222 to the whole body. The 100-year estimated dose commitment from mining, milling, and tailings before stabilization for two AP1000 units would be approximately 2400 person-rem to the whole body. From stabilized tailing piles, the 100-year estimated dose commitment would be approximately 47 person-rem to the whole body. These values were derived by scaling the reference reactor values provided in the Appendix to Section 5.7.1 of NUREG-1555 to two AP1000s.

NUREG-1437 considered the potential health effects associated with the releases of Tc-99 for the reference reactor. The estimated Tc-99 releases for two AP1000s are 0.018 curies from chemical processing of recycled uranium hexafluoride before it enters the isotope enrichment cascade and 0.013 curies into the groundwater from a high-level waste repository. The major risks from Tc-99 are from exposure of the gastrointestinal tract and kidneys and a small risk from whole-body exposure. Applying the organ-specific dose-weighting factors from 10 CFR Part 20 to the gastrointestinal tract and kidney doses, the total body 100-year dose commitment from Tc-99 was estimated to be 260 person-rem for two AP1000s. This value was derived by scaling the 100-year dose commitment (person-rem per year) for Tc-99 for the reference reactor specified in NUREG-1437 to two AP1000s.

To be conservative, radiation protection experts assume that any amount of radiation may pose some risk of cancer, or a severe hereditary effect, and that higher radiation exposures create higher risks. Therefore, a linear, no-threshold dose response relationship is used to describe the relationship between radiation dose and detrimental effects. Based on this model, risk to the public from radiation exposure can be estimated using the nominal probability coefficient (730 fatal cancers, nonfatal cancers, or severe hereditary effects per 1E06 person-rem) from the International Commission on Radiological Protection Publication 60 (ICRP 1991). This coefficient was multiplied by the sum of the estimated whole-body population doses (from gaseous effluents, liquid effluents, Rn-222, and Tc-99) described above for two AP1000s to estimate that the U.S. population could incur a total of 3.1 fatal cancers, nonfatal cancers, or severe hereditary effects from the annual fuel cycle for two AP1000s. This risk would be small compared to the number of fatal cancers, nonfatal cancers and severe hereditary effects that are estimated to occur in the U.S. population annually from exposure to natural sources of radiation using the same risk estimation methods.

Based on these analyses, the environmental impacts of radioactive effluents from the fuel cycle will be SMALL and will not warrant mitigation.

5.7.1.6 Radioactive Waste

The quantities of radioactive waste (low-level, high-level, and transuranic wastes) associated with fuel cycle processes are presented in Table S-3 (Table 5.7-1). For low-level waste disposal, the NRC notes in 10 CFR 51.51(b) that there will be no significant radioactive releases to the environment. For high-level and transuranic wastes, the NRC notes that these wastes are to be disposed of at a federal repository, such as the candidate repository at Yucca Mountain, Nevada. No release to the environment is expected to be associated with such disposal because it was assumed that all of the gaseous and volatile radionuclides contained in the spent fuel are released to the atmosphere before disposal of the waste.

There is some uncertainty associated with the high-level waste and spent fuel disposal component of the fuel cycle. The regulatory limits for offsite releases of radionuclides for the current candidate repository site were set in September 2008 using a two-tiered approach. The radiation dose for the first 10,000 years has been set to 15 mrem/yr. The radiation dose for the period between 10,000 and 1 million years was set to 100 mrem/yr (Federal Register 73,61256 Oct 2008). These standards would result in doses that are consistent with the 100 mrem /yr or less dose defined in NUREG-1437. Therefore, it is reasonable to conclude that the offsite radiological impacts of spent fuel and high-level waste disposal would not be significant enough to preclude construction of new units at Turkey Point.

If necessary, FPL would take measures to reduce the generation of Class B and C LLW, such as reducing the service run length of resin beds or mixing spent resins to limit radioactivity concentrations. The volume of generated waste would still be bounded by the estimates in Table S-3, and the environmental impacts would likewise be bounded by those shown in Table S-3 (U.S. NRC 2011).

If needed, FPL would also construct additional temporary storage facilities onsite for Class B and C LLW. Such facilities would be designed and operated to meet the guidance in Appendix 11.4-A of the Standard Review Plan, NUREG-0800.

NRC's regulations (10 CFR 50.59) allow licensees operating nuclear power plants to make facility changes, including the construction and operation of certain additional onsite LLW storage facilities, without seeking approval from the NRC, provided licensees evaluate the safety and environmental impacts of such facilities before constructing the facilities. The 10 CFR 50.59 evaluations must be made available to NRC inspectors. Using this regulatory approach, a number of nuclear power plant licensees have constructed and operate such facilities in the United States. Typically, these additional facilities are constructed near the power block inside the security fence on land that has already been disturbed during initial plant construction (U.S. NRC 2011). Therefore, the impacts of constructing the facilities on environmental resources (e.g., land use and aquatic and terrestrial biota) would be SMALL.

All of the NRC (10 CFR Part 20) and EPA (40 CFR Part 190) dose limitations would apply to the additional onsite LLW storage facilities, both for public and occupational radiation exposure. The radiological environmental monitoring programs around nuclear power plants that operate additional onsite LLW facilities show that the increase in radiation dose at the site boundary is not significant; the radiation doses continue to be below 25 mrem/yr, the dose limit of 40 CFR Part 190 (U. S. NRC 2010). The NRC has concluded that doses to members of the public that do not exceed NRC and EPA regulatory limits are SMALL (U.S. NRC 2011). In addition, the NRC in NUREG-1437 assessed the impacts of LLW storage onsite at currently operating nuclear power plants and concluded that the radiation doses to offsite individuals from interim LLW storage are insignificant. The types and amounts of LLW generated by the proposed reactors at Units 6&7 would be similar to those generated by currently operating nuclear power plants and the construction and operation of any additional onsite LLW storage facilities would be similar to the construction and operation of the currently operating facilities. Therefore, the impacts of constructing and operating additional onsite LLW storage facilities would be SMALL.

For the reasons stated above, the environmental impacts of radioactive waste disposal would be SMALL and would not warrant mitigation.

5.7.1.7 Occupational Dose

The estimated occupational dose attributable to all phases of the fuel cycle is approximately 1600 person-rem per year for two AP1000s. This is a scaled value based on a 600 person-rem per year occupational dose estimate attributable to all phases of the fuel cycle for the reference reactor (NUREG-1437). The dose to any individual worker is restricted to the dose limit of 10 CFR Part 20 (5 rem/year). The environmental impacts from this occupational dose would be SMALL.

5.7.1.8 Transportation

The transportation dose to workers and the public is estimated in Table S-3 (Table 5.7-1) to be 2.5 person-rem per year for the reference reactor. This corresponds to a dose of 6.5 person-rem per year for two AP1000s. For comparative purposes, the estimated collective dose from natural background radiation to the population within 50 miles of Units 6 & 7 is 907,000 person-rem per year. On the basis of this comparison, the environmental impacts of transportation from the fuel cycle would be SMALL and would not warrant mitigation.

5.7.1.9 Summary

The environmental impacts of the uranium fuel cycle as given in Table S-3 were evaluated along with the effects of Rn-222 and Tc-99 releases based on the information presented in NUREG-1437. Based on this evaluation, the impacts would be SMALL and mitigation would not be warranted.

5.7.2 TRANSPORTATION OF RADIOACTIVE MATERIALS

Transport of radioactive materials is an important activity associated with operating new reactors at Units 6 & 7. The analysis in this section is based on the AP1000 characteristics described in Section 3.2 and radioactive waste management systems described in Section 3.5. Information regarding preparation and packaging of the radioactive materials for transport offsite can be found in Section 3.8.

5.7.2.1 Transportation Assessment

The NRC evaluated the environmental effects of transportation of fuel and waste for LWRs in *Environmental Survey of Transportation of Radioactive Materials to and From Nuclear Power Plants* (WASH-1238, AEC Dec 1972) and Supplement 1 (NUREG-75/038,) and found the impacts to be SMALL. These NRC analyses provided the basis for Table S-4 in 10 CFR 51.52, which summarizes the environmental impacts of transportation of fuel and radioactive wastes to and from a reference reactor (see Table 5.7-2). The table addresses two categories of environmental considerations: (1) normal conditions of transport, and (2) accidents during transport.

To analyze the impacts of transporting AP1000 fuel and radioactive waste for comparison to Table S-4, the characteristics for the AP1000 were normalized to a reference reactor-year. The reference reactor is an 1100 MWe reactor that has an 80 percent capacity factor, for an electrical output of 880 MWe per year. For Units 6 & 7, two 1000 MWe (net) reactors[1] with a 93 percent capacity factor was assumed. The standard configuration (a single unit) for the AP1000 was used to evaluate transportation impacts relative to the reference reactor.

Subparagraphs 10 CFR 51.52(a)(1) through (5) delineate specific conditions the reactor licensee must meet to use Table S-4 as part of its environmental report. For reactors not meeting all of the conditions in paragraph (a) of 10 CFR 51.52, paragraph (b) of 10 CFR 51.52 requires further analysis of the transportation effects.

The conditions in paragraph (a) of 10 CFR 51.52 establishing the applicability of Table S-4 are reactor core thermal power, fuel form, fuel enrichment, fuel encapsulation, average fuel irradiation, time after discharge of irradiated fuel before shipment, mode of transport for unirradiated fuel, mode of transport for irradiated fuel, radioactive waste form and packaging, and mode of transport for radioactive waste other than irradiated fuel. The following sections describe the characteristics of the AP1000 relative to the conditions of 10 CFR 51.52 for use of Table S-4.

5.7.2.1.1 Reactor Core Thermal Power

Subparagraph 10 CFR 51.52(a) (1) requires that the reactor have a core thermal power level not exceeding 3800 MWt. The AP1000 has a maximum thermal power level of 3400 MWt that meets this condition (WEC 2011).

The core power level was established as a condition because, for the LWRs being licensed when Table S-4 was promulgated, higher power levels indicated the need for more fuel and therefore more fuel shipments. This is not the case for the new LWR designs due to the higher unit capacity factor and higher burnup for these reactors. The annual fuel reloading for the reference reactor analyzed in WASH-1238 was 30 MTU. The annual fuel loading for the AP1000 is approximately 23 metric tons of uranium (MTU). When normalized to equivalent electric output, the annual fuel requirement for the AP1000 is approximately 22 MTU or 73 percent that of the reference LWR.

WASH-1238 states:

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1. Net electrical output for the AP1000 was used to provide conservatism in the estimates of normalized transportation impacts for comparison with the reference reactor and Table S-4.

> The analysis is based on shipments of fresh fuel to and irradiated fuel and solid waste from a boiling water reactor or a pressurized water reactor with design ratings of 3000 MWt to 5000 MWt or 1000 MWe to 1500 MWe.

The AP1000 falls within these bounds for thermal rating.

5.7.2.1.2 Fuel Form

Subparagraph 10 CFR 51.52(a)(2) requires that the reactor fuel be in the form of sintered uranium dioxide pellets. The AP1000 uses a sintered uranium dioxide pellet fuel form (WEC 2011) and, therefore, meets this condition.

5.7.2.1.3 Fuel Enrichment

Subparagraph 10 CFR 51.52(a)(2) requires that the reactor fuel have a U-235 enrichment not exceeding 4 percent by weight. For the AP1000, the enrichment of the initial core is 2.35 percent in Region 1, 3.40 percent in Region 2, and 4.45 percent in Region 3 (WEC 2011). The average fuel enrichment for reloads is 4.54 percent. The AP1000 fuel exceeds the 4 percent U-235 enrichment condition for both initial core load and subsequent reloads.

5.7.2.1.4 Fuel Encapsulation

Subparagraph 10 CFR 51.52(a)(2) requires that the reactor fuel pellets be encapsulated in Zircaloy rods. The AP1000 fuel uses ZIRLO^{TM} cladding, which is a special zircaloy material alloyed with niobium, tin, and iron and is a successor of Zircaloy-4 (WEC 2011) and meets this condition.

5.7.2.1.5 Average Fuel Irradiation

Subparagraph 10 CFR 51.52(a)(3) requires that the average burnup not exceed 33,000 MW-days per MTU. For the AP1000, the average burnup after achieving an equilibrium core is 50,553 MW-days per MTU, which exceeds this condition.

5.7.2.1.6 Time After Discharge of Irradiated Fuel Before Shipment

Subparagraph 10 CFR 51.52(a)(3) requires that no irradiated fuel assembly be shipped until at least 90 days after it is discharged from the reactor. The WASH-1238 analysis for Table S-4 assumes 150 days of decay time before shipment of any irradiated fuel assemblies. NUREG/CR-6703 (Ramsdell et al. 2001), which updated this analysis to extend Table S-4 to burnups of up to 62,000 MW-days per MTU, assumes a minimum of 5 years between removal from the reactor and shipment. Five years is the minimum decay time expected before shipment of irradiated fuel assemblies. The NRC specifies 5 years as the minimum cooling period when it issues certificates of compliance for casks used for shipment of power reactor fuel

(NUREG-1437). As described in Section 3.8, the AP1000 units would have storage capacity exceeding that needed to accommodate 5-year cooling of irradiated fuel before transport offsite. This condition is met.

5.7.2.1.7 Transportation of Unirradiated Fuel

Subparagraph 10 CFR 51.52(a)(5) requires that unirradiated fuel be shipped to the reactor site by truck. Typical shipment of fuel from the Westinghouse fuel fabrication facility in Columbia, South Carolina is by truck. Fuel would be received via truck shipments for Units 6 & 7.

Table S-4 includes a condition that the truck shipments will not exceed 73,000 pounds. The fuel shipments would comply with federal or state weight restrictions. These conditions are met.

5.7.2.1.8 Transportation of Irradiated Fuel

Subparagraph 10 CFR 51.52(a)(5) allows for truck, rail, or barge transport of irradiated fuel. This condition would be met for Units 6 & 7. For the impacts analysis described in Subsection 5.7.2.2, all spent fuel shipments were assumed to be made using legal weight trucks. The DOE is responsible for spent fuel transportation from reactor sites to the repository and will make the decision on transport mode.

5.7.2.1.9 Radioactive Waste Form and Packaging

Subparagraph 10 CFR 51.52(a)(4) requires that, with the exception of spent fuel, radioactive waste shipped from the reactor be packaged and in a solid form. As described in Subsection 3.5.3, the low-level radioactive waste generated by the AP1000 units would be solidified and packaged. Additionally, these shipments would comply with the NRC (10 CFR Part 71) and the DOT (49 CFR Parts 173 and 178) packaging and transportation regulations for the shipment of radioactive material. This condition is met.

5.7.2.1.10 Transportation of Radioactive Waste

Subparagraph 10 CFR 51.52(a)(5) requires that the mode of transport of low-level radioactive waste be either truck or rail. Radioactive waste would be shipped from Units 6 & 7 by truck. Table S-4 specifies the following conditions for shipments of radioactive waste: less than 73,000 pounds per truck over 100 tons per cask per rail car. Radioactive waste from Units 6 & 7 would be shipped in compliance with federal or state weight restrictions. This condition is met.

5.7.2.1.11 Number of Truck Shipments

Table S-4 specifies the following conditions for traffic density: less than one truck shipment per day or three rail cars per month. The number of truck shipments that would be required was estimated assuming that all radioactive materials (fuel and waste) are received at the site or transported offsite via truck.

For the AP1000, the initial core load is estimated at 85 MTU per unit and the reload requirements are estimated at 23 MTU per year per unit. This equates to approximately 157 fuel assemblies in the initial core (assuming 0.5383 MTU per fuel assembly) and 43 fuel assemblies per year for refueling. Westinghouse estimates that a transportation container could accommodate up to seven fuel assemblies for the initial core load and nine fuel assemblies for core reloads.

Table 5.7-3 summarizes the number of truck shipments of unirradiated fuel. The table also normalizes the number of shipments to the electrical output for the reference reactor analyzed in WASH-1238. When normalized for electrical output, the number of truck shipments of unirradiated fuel for the AP1000 is less than the number of truck shipments estimated for the reference LWR.

The numbers of spent fuel shipments were estimated as follows. For the reference LWR analyzed in WASH-1238, the NRC assumed that 60 shipments per year will be made, each carrying 0.5 MTU of spent fuel. This amount is equivalent to the annual refueling requirement of 30 MTU per year for the reference LWR. For this transportation analysis, shipments of spent fuel from the AP1000 were assumed to occur at a rate equal to the annual refueling requirement. As stated above, this would require the shipment of approximately 23 MTU per year per unit. The shipping cask capacities used to calculate annual spent fuel shipments were assumed to be the same as those for the reference LWR (0.5 MTU per legal weight truck shipment). This results in 46 shipments per year for one AP1000. After normalizing for the reference LWR electrical output, the number of spent fuel shipments is 44 per year for the AP1000. The normalized spent fuel shipments (44) for the AP1000 would be less than the reference reactor (60) that was the basis for Table S-4.

Table 5.7-4 presents estimates of annual waste volumes and numbers of truck shipments. The values are normalized to the reference LWR analyzed in WASH-1238. The normalized annual waste volumes and waste shipments for the AP1000 will be less than the reference reactor that was the basis for Table S-4.

The total number of truck shipments of fuel and radioactive waste to and from the reactor are estimated to be 72 per year for the AP1000. Thus, these radioactive material shipment estimates are well below the one truck shipment per day condition given in 10 CFR 51.52, Table S-4. The estimated number of truck shipments remains below the one shipment per day condition, if the number was doubled to account for empty truck return shipments.

5.7.2.1.12 Summary

Table 5.7-5 compares the values for the reference conditions in paragraph (a) of 10 CFR 51.52 used in Table S-4 and the values for the AP1000. The AP1000 does not meet the conditions for fuel enrichment or average fuel irradiation. Therefore, Subsection 5.7.2.2 and Section 7.4 present additional analyses of fuel transportation effects for normal conditions and accidents, respectively.

5.7.2.2 Incident-Free Transportation Impacts Analysis

The environmental impacts of radioactive materials transportation were estimated using the most recent version of the RADTRAN 5 computer code (Weiner et al. Dec 2007). RADTRAN is a nationally accepted standard program and code for calculating the risks of transporting radioactive materials. RADTRAN was used in estimating the radiological doses and dose risks to populations and transportation workers resulting from incident-free transportation and to the general population from accident scenarios. For the analysis of incident-free transportation risks, the code used scenarios for people who would share transportation routes with shipments, people who live along the route of travel, and people exposed at stops. For accident risks, RADTRAN was used to evaluate the range of possible accident scenarios from high probability and low consequence to low probability and high consequence. Environmental impacts of incident-free transportation of fuel are described in this section. Transportation accidents are described in Section 7.4.

5.7.2.2.1 Transportation of Unirradiated Fuel

Table S-4 of 10 CFR 51.52 includes conditions related to radiological doses to transport workers and members of the public along transport routes. These doses, based on calculations in WASH-1238, are a function of the radiation dose rate emitted from the unirradiated fuel shipments, the number of exposed individuals and their locations relative to the shipment, the time of transit (including travel and stop times), and the number of shipments to which the individuals are exposed.

One of the key assumptions in WASH-1238 for the reference LWR unirradiated fuel shipments is that the radiation dose rate at 1 meter from the transport vehicle is approximately 0.1 millirem per hour. This assumption was also used by the NRC to analyze advanced LWR unirradiated fuel shipments for ESP sites (e.g., NUREG-1811, Section G.1.2.4). This assumption is reasonable for all of the advanced LWR types because the fuel materials will all be low dose rate uranium radionuclides and will be packaged similarly (inside a metal container that provides little radiation shielding). The per-shipment dose estimates are “generic” (i.e., independent of reactor technology) because they were calculated based on an assumed external radiation dose rate rather than the specific characteristics of the fuel or packaging. Thus, the results can be used to evaluate the impacts for any of the advanced LWR designs. Other input parameters used in the radiation dose analysis for advanced LWR unirradiated fuel shipments are summarized in Table 5.7-6. The RADTRAN results for this "generic" unirradiated fuel shipment are as follows:

Population Component	Dose
Transport workers	0.00171 person-rem per shipment
General public (Onlookers — people at stops and sharing the highway)	0.00292 person-rem per shipment
General public (Along Route — people living near a highway)	0.0000299 person-rem per shipment

Based on the parameters used in the analysis, these per-shipment doses would conservatively estimate the impacts for fuel shipments to Turkey Point or an alternate site in the region of interest. For example, the average shipping distance of 2000 miles used in the NRC analysis is not expected to exceed the shipping distance for fuel deliveries to Units 6 & 7. The fuel shipments would likely originate at the Westinghouse fuel fabrication facility located in Columbia, South Carolina, and travel approximately 690 miles to Units 6 & 7.

The unit dose values were combined with the average annual shipments of unirradiated fuel to calculate annual doses to the public and workers that can be compared to Table S-4 conditions. The numbers of unirradiated fuel shipments were normalized to the reference reactor analyzed in WASH-1238. The numbers of shipments per year were obtained from Table 5.7-3. The results are presented in Table 5.7-7. As shown, the calculated radiation doses for transporting unirradiated fuel to Units 6 & 7 are within the Table S-4 conditions.

As described in Subsection 5.7.1.5, the risk to the public from radiation exposure is estimated using the nominal probability coefficient for total detriment (730 fatal cancers, nonfatal cancers, and severe hereditary effects per million person-rem) from International Commission on Radiation Protection Publication 60 (ICRP 1991). All the public collective doses presented in Table 5.7-7 are less than 0.1 person-rem per year. Therefore, the total detriment estimates associated with these doses would all be less than 1E–04 fatal cancers, nonfatal cancers, and severe hereditary effects per year. These risks are small compared to the fatal cancers, nonfatal cancers, and severe hereditary effects that the same population will incur annually from exposure to natural sources of radiation.

5.7.2.2.2 Transportation of Spent Fuel

This section provides the environmental impacts of transporting spent fuel from Units 6 & 7 to a spent fuel disposal facility, using Yucca Mountain, Nevada, as a possible location for a geologic repository. The impacts of the transportation of spent fuel to a potential repository in Nevada provide a reasonable bounding estimate of the transportation impacts to a monitored retrievable storage facility because of the distances involved and the representative exposure of members of the public in urban, suburban, and rural areas.

Incident-free transportation refers to transportation activities in which the shipments reach their destination without releasing any radioactive cargo to the environment. Impacts from these shipments would be from the low levels of radiation that penetrate the heavily shielded spent fuel shipping cask. Radiation doses would occur to (1) people residing along the transportation corridors between Units 6 & 7 and the proposed repository; (2) people in vehicles passing a spent-fuel shipment; (3) people at vehicle stops for refueling, rest, and vehicle inspections; and (4) transportation crew workers.

This analysis is based on shipment of spent fuel by legal-weight trucks in casks with characteristics similar to casks currently available (i.e., massive, heavily shielded, cylindrical metal pressure vessels). Each shipment is assumed to consist of a single shipping cask loaded on a modified trailer. These assumptions are consistent with assumptions made in evaluating the environmental impacts of spent fuel transportation in Addendum 1 to NUREG-1437. As described in NUREG-1437, these assumptions are conservative because the alternative assumptions involve rail transportation or heavy-haul trucks, which would reduce the overall number of spent fuel shipments.

The environmental impacts of spent fuel transportation were estimated using the most recent version of the RADTRAN 5 computer code (Weiner et al. Dec 2007). This analysis assumed the spent fuel would be transported by legal weight trucks to the potential Yucca Mountain repository over designated highway route-controlled quantity highway route-controlled quantity routes. A transportation route was evaluated that was consistent with highway route-controlled quantity requirements and traveled a total of approximately 3100 miles.

Although shipping casks have not been designed for the advanced LWR fuels, the advanced LWR fuel designs would be similar to the existing LWR designs. Thus, current shipping cask designs were used for analysis.

Radiation doses are a function of many parameters, including vehicle speed, traffic count, dose rate at 1 meter from the vehicle, packaging dimensions, number in the truck crew, stop time, and population density along the route and at stops. The values of the key variables used in this analysis are presented in Table 5.7-8. Most of the variables are extracted from literature and are considered to be standard values used in many RADTRAN applications, including environmental impact statements and regulatory analyses.

The transportation route selected for a shipment determines the total potentially exposed population and the expected frequency of transportation-related accidents. For truck transportation, the route characteristics most important to the risk assessment include the total shipping distance between each origin-destination pair of sites and the population density along the route.

Representative shipment routes for Turkey Point and alternative sites were identified using the TRAGIS (Version 1.5.4) routing model (Johnson and Michelbaugh Apr 2000). The Highway data network in TRAGIS is a computerized road atlas that includes a complete description of the interstate highway system and of all U.S. highways. The TRAGIS database version used was Highway Data Network 4.0. The population densities along a route are derived from 2000 census data from the U.S. Bureau of the Census. This transportation route information is summarized in Table 5.7-9.

Based on the transportation route information shown in Table 5.7-9, the impacts of spent fuel shipments originating at Units 6 & 7 would be similar to the impacts for the alternative sites (St. Lucie, Martin, Glades, and Okeechobee 2). The radiation dose estimates to the transport workers and the public for spent fuel shipments from Turkey Point and alternative sites are as follows:

	Population Dose (person-rem per shipment)		
Site	**Transport workers**	**General public (Onlookers)**	**General public (Along Route)**
Turkey Point	0.228	0.157	0.0165
St. Lucie	0.218	0.154	0.0141
Martin	0.219	0.145	0.0139
Glades	0.220	0.145	0.0140
Okeechobee 2	0.219	0.145	0.0139

These per-shipment dose estimates are independent of reactor technology because they were calculated based on an assumed external radiation dose rate emitted from the cask, which was fixed at the regulatory maximum of 10 millirem per hour at 2 meters. For the purpose of this analysis, the transportation crew consists of two drivers. The numbers of spent fuel shipments for the transportation impacts analysis were derived as described in Subsection 5.7.2.1. The normalized annual shipment values and corresponding population dose estimates per reactor-year are presented in Table 5.7-10. The population doses were calculated by multiplying the number of spent fuel shipments per year by the per-shipment doses. For comparison to Table S-4, the population doses were normalized to the reference LWR analyzed in WASH-1238.

As shown in Table 5.7-10, population doses to the crew and onlookers for both the AP1000 and the reference LWR exceed Table S-4 values. Two key reasons for these higher population doses relative to Table S-4 are the number of spent fuel shipments and the shipping distances assumed for these analyses relative to the assumptions used in WASH-1238.

- The analyses in WASH-1238 used a “typical” distance for a spent fuel shipment of 1000 miles. The shipping distance used in this assessment is approximately 3100 miles.

- The number of spent fuel shipments are based on shipping casks designed to transport shorter-cooled fuel (i.e., 150 days out of the reactor). This analysis assumed that the shipping cask capacities are 0.5 MTU per legal-weight truck shipment. Newer cask designs are based on longer-cooled spent fuel (i.e., 5 years out of reactor) and have larger capacities. For example, spent fuel shipping cask capacities used in the Yucca Mountain environmental impact statement (U.S. DOE 2002a**,** Table J-2) were approximately 1.8 MTU per legal-weight truck shipment. Use of the newer shipping cask designs will reduce the number of spent fuel shipments and decrease the associated environmental impacts because the dose rates used in the impacts analysis are fixed at the regulatory limit rather than based on the cask design and contents.

If the population doses in Table S-4 are adjusted for the longer shipping distance and larger shipping cask capacity, the population doses from incident-free spent fuel transportation from the site will fall within Table S-4.

Other conservative assumptions in the spent fuel transportation impacts calculation include:

- Use of the regulatory maximum dose rate (10 millirem per hour at 2 meters) in the RADTRAN five calculations. The shipping casks assumed in the Yucca Mountain environmental impact statement (U.S. DOE Feb 2002a) transportation analyses were designed for spent fuel that has cooled for 5 years. In reality, most spent fuel will have cooled for much longer than 5 years before it is shipped to a possible geologic repository. The NRC developed a probabilistic distribution of dose rates based on fuel cooling times that indicates that approximately three-fourths of the spent fuel to be transported to a possible geologic repository will have dose rates less than half of the regulatory limit (Sprung et al. Mar 2000). Consequently, the estimated population doses in Table 5.7-10 could be divided in half if more realistic dose rate projections are used for spent fuel shipments from Units 6 & 7.

- Use of 30 minutes as the average time at a truck stop in the calculations. Many stops made for actual spent fuel shipments are short duration stops (i.e., 10 minutes) for brief visual inspections of the cargo (checking the cask tie-downs). These stops typically occur in minimally populated areas, such as an overpass or freeway ramp in an unpopulated area. Based on data for actual truck stops, recent NRC transportation analyses (e.g., NUREG-1811, Section 6.2.2.1) concluded that the assumption of a 30-minute stop for every 4 hours of driving time used to evaluate potential early site permit sites will overestimate public doses at stops by at least a factor of two. Consequently, the doses to onlookers given in Table 5.7-10 could be reduced by a factor of two to reflect more realistic truck shipping conditions.

5.7.2.2.3 Transportation of Radioactive Waste

As shown in Table 5.7-4, the transportation of radioactive waste meets the applicable conditions in 10 CFR 51.52(a) and no further analysis is required.

5.7.2.2.4 Maximally Exposed Individual

The incident-free radiation doses to maximally exposed individuals for fuel and waste shipments were also considered. A maximally exposed individual is a person who may receive the highest radiation dose from a shipment to and/or from the site. The radiological doses to the workers who would load casks, drive trucks, and inspect vehicles in transit would be higher than doses to individuals in the general public. Radiological protection programs would manage and limit doses to workers whose jobs would cause them to receive the greatest exposures.

Truck crew members would receive the highest radiation doses because of their proximity to the loaded shipping container for an extended period of time. DOE will take title to the spent fuel at the reactor site. Consequently, the DOE administrative control level of 2 person-rem per year (U.S. DOE Mar 2005) is expected to apply to spent fuel shipments from Turkey Point to a disposal facility. Spent fuel represents the majority of the radioactive materials shipments to and from reactor sites, and comprises those shipments with the highest radiation dose rates. Crew doses from unirradiated fuel and radioactive waste shipments would be lower than the spent fuel shipments.

5.7.2.3 Conclusion

The NRC evaluated the environmental effects of transportation of fuel and waste for LWRs in WASH-1238 (AEC Dec 1972) and Supplement 1 (NUREG-75/038) and found the impacts to be SMALL. These NRC analyses provided the basis for Table S-4 in 10 CFR 51.52. Incident-free transportation of unirradiated and spent fuel to and from Units 6 & 7 was evaluated. The Turkey Point results are consistent with the environmental impacts associated with transportation of radioactive materials from current generation reactors presented in Table S-4 of 10 CFR 51.52. Thus, the impacts of accident-free transportation would be SMALL and would not warrant additional mitigation.

Section 5.7 References

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Table 5.7-1 (Sheet 1 of 2)
Uranium Fuel Cycle Environmental Data[a]

Environmental Considerations	Reference Reactor	2 AP1000 Units
Natural Resource Use		
Land (acres)		
Temporarily committed[b]	100	260
Undisturbed area	79	200
Disturbed area	22	57
Permanently committed	13	34
Overburden moved (millions of MT)	2.8	7.3
Water (millions of gallons)		
Discharged to air	160	420
Discharged to water bodies	11,090	28,700
Discharged to ground	127	330
Total	11,377	29,500
Fossil fuel		
Electrical energy (thousands of MW-hour)	323	840
Equivalent coal (thousands of MT)	118	310
Natural gas (millions of standard cubic feet)	135	350
Effluents — Chemical (MT)		
Gases (including entrainment)[c]		
SO_x	4,400	11,400
NO_x[d]	1,190	3,100
hydrocarbons	14	36
CO	29.6	77
particulates	1,154	3,000
Other gases		
F	0.67	1.7
HCl	0.014	0.036
Liquids		
SO_4^-	9.9	26
NO_3^-	25.8	67
fluoride	12.9	33
Ca^{++}	5.4	14
Cl^-	8.5	22
Na^+	12.1	31
NH_3	10	26
Fe	0.4	1.0
Tailings solutions (thousands of MT)	240	620
Solids	91,000	236,000
Effluents — Radiological (curies)		
Gases (including entrainment)		
^{222}Rn	[e]	[e]
^{226}Ra	0.02	0.052
^{230}Th	0.02	0.052
U	0.034	0.088

Table 5.7-1 (Sheet 2 of 2)
Uranium Fuel Cycle Environmental Data[(a)]

Environmental Considerations	Reference Reactor	2 AP1000 Units
Effluents — Radiological (curies) (Continued)		
^{3}H (thousands)	18.1	47
^{14}C	24	62
^{85}Kr (thousands)	400	1,040
^{106}Ru	0.14	0.36
^{129}I	1.3	3.4
^{131}I	0.83	2.2
^{99}Tc	(e)	(e)
Fission products and TRU	0.203	0.53
Liquids		
U and daughters	2.1	5.4
^{226}Ra	0.0034	0.0088
^{230}Th	0.0015	0.0039
^{234}Th	0.01	0.026
fission and activation products	5.90E06	1.5E05
Solids (buried onsite)		
other than HLW (shallow)	11,300	29,000
TRU and HLW (deep)	1.10E07	2.9E07
Effluents — Thermal (billions of Btu)	4063	10,500
Transportation (person-person-rem)		
exposure of workers and the general public	2.5	6.5
occupational exposure	22.6	59

MT = metric tonnes
TRU = transuranic
HLW = high-level waste

(a) In some cases where no entry appears in Table S-3 it is clear from the background documents that the matter was addressed and that, in effect, the table should be read as if a specific zero entry had been made. However, there are other areas that are not addressed at all in the table. Table S-3 does not include health effects from the effluents described in the table, or estimates of releases of Rn-222 from the uranium fuel cycle or estimates of Tc-99 released from waste management or reprocessing activities. Radiological impacts of these two radionuclides are addressed in NUREG-1437, and it was concluded that the health effects from these two radionuclides posed a small significance. Data supporting Table S-3 are given in the *Environmental Survey of the Uranium Fuel Cycle*, WASH-1248 (AEC 1974); NUREG-0116 (Supplement 1 to WASH-1248); NUREG-0216 (Supplement 2 to WASH-1248); and in the record of final rule making pertaining to *Uranium Fuel Cycle Impacts from Spent Fuel Reprocessing and Radioactive Waste Management*, Docket RM-50-3. The contributions from reprocessing, waste management and transportation of wastes are maximized for either of the two fuel cycles (uranium only and fuel recycle). The contribution from transportation excluded transportation of cold fuel to a reactor and of irradiated fuel and radioactive wastes from a reactor which are considered in Table S-4 of § 51.20(g). The contributions from the other steps of the fuel cycle are given in columns A-E of Table S-3A of WASH-1248.

(b) The contributions to temporarily committed land from reprocessing are not prorated over 30 years, because the complete temporary impact accrues regardless of whether the plant services one reactor for 1 year or 57 reactors for 30 years.

(c) Estimated effluents based on combustion of coal for equivalent power generation.

(d) 1.2 percent from natural gas use and processes.

(e) Radiological impacts of Rn-222 and Tc-99 are addressed in NUREG-1437. The GEIS concluded that the health effects from these two radionuclides pose a small risk.

Table 5.7-2
Summary of Environmental Impacts of Transportation of Fuel and Waste to and from One LWR, Taken from 10 CFR 51.52 Table S-4[(a)]

Normal Conditions of Transport			
Environmental Impacts			
Heat (per irradiated fuel cask in transit)		250,000 Btu/hr.	
Weight (governed by Federal or State restrictions)		73,000 lbs. per truck; 100 tons per cask per rail car.	
Traffic density:			
Truck		Less than 1 per day	
Rail		Less than 3 per month	
Exposed Population	**Estimated Number of People Exposed**	**Range of Doses to Exposed Individuals[(b)] (per reactor year)**	**Cumulative Dose to Exposed Population (per reactor year)[(c)]**
Transportation workers	200	0.01 to 300 millirem	4 person-rem.
General pubic:			
Onlookers	1100	0.003 to 1.3 millirem	3 person-rem.
Along Route	600,000	0.0001 to 0.06 millirem	
Accidents in Transport			
Types of Effects		**Environmental Risk**	
Radiological effects		Small[(d)]	
Common (nonradiological) causes		1 fatal injury in 100 reactor years; 1 nonfatal injury in 10 reactor years; $475 property damage per reactor year.	

(a) Data supporting this table are given in the Commission's *Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants,* WASH-1238, December 1972, and Supp. 1 NUREG-75/038, April 1975.

(b) The Federal Radiation Council has recommended that the radiation doses from all sources of radiation other than natural background and medical exposures should be limited to 5000 millirem per year for individuals as a result of occupational exposure and should be limited to 500 millirem per year for individuals in the general population. The dose to individuals due to average natural background radiation is approximately 360 millirem per year (U.S. NRC 2004).

(c) Person-rem is an expression for the summation of whole body doses to individuals in a group. Thus, if each member of a population group of 1000 people were to receive a dose of 0.001 rem (1 millirem), or if 2 people were to receive a dose of 0.5 rem (500 millirem) each, the total person-rem dose in each case will be 1 person-rem.

(d) Although the environmental risk of radiological effects stemming from transportation accidents is currently incapable of being numerically quantified, the risk remains small regardless of whether it is being applied to a single reactor or a multi-reactor site.

Table 5.7-3
Number of Truck Shipments of Unirradiated Fuel

Reactor Type	Number of Shipments per Unit			Unit Electric Generation, MW(e)[(d)]	Capacity Factor	Normalized Shipments Total[(e)]	Normalized Shipments Annual[(f)]
	Initial Core[(a)]	Annual Reload	Total[(c)]				
Reference LWR	18[(b)]	6.0	252	1100	0.8	252	6.3
AP1000	23	4.7	208	1000	0.93	196	4.9

(a) Shipments of the initial core have been rounded up to the next highest whole number.
(b) The initial core load for the reference BWR in WASH-1238 was 150 MTU. The initial core load for the reference PWR was 100 MTU. Both types result in 18 truck shipments of fresh fuel per reactor.
(c) Total shipments of fresh fuel over 40-year plant lifetime (i.e., initial core load plus 39 years of average annual reload quantities).
(d) AP1000 unit net generating capacity from DCD, Rev. 19, Table 1.3-1. |
(e) Normalized to electric output for WASH-1238 reference plant (i.e., 1100 MWe at 80 percent or an electrical output of 880 MWe).
(f) Annual average for 40-year plant lifetime.

Table 5.7-4
Number of Radioactive Waste Shipments

Reactor Type	Waste Generation, ft^3 per yr, per unit	Electrical Output, MWe, per unit	Capacity Factor	Normalized Waste Generation Rate, ft^3 per reactor-year[(a)]	Normalized Shipments per reactor-year[(b)]
Reference LWR	3800	1100	0.80	3800	46
AP1000	1947	1000	0.93	1842	22.3

(a) Annual waste generation rates normalized to equivalent electrical output of 880 MWe for reference LWR analyzed in WASH-1238.
(b) The number of shipments was calculated assuming the average waste shipment capacity of 82.6 ft^3 per shipment (3800 ft^3 per yr divided by 46 shipments per yr) used in WASH-1238.

Table 5.7-5
AP1000 Comparisons to Table S-4 Reference Conditions

Characteristic	Table S-4 Condition	AP1000
Thermal Power Rating (MWt)	not exceeding 3,800 per reactor	3,400
Fuel Form	sintered uranium dioxide pellets	sintered uranium dioxide pellets
U-235 Enrichment (percent)	Not exceeding 4	Region 1 — 2.35% Region 2 — 3.40% Region 3 — 4.45%
Fuel Rod Cladding	Zircaloy rods; NRC has also accepted ZIRLO per 10 CFR 50.46	ZIRLO
Average fuel irradiation (MWd per MTU)	Not exceeding 33,000	50,553
Unirradiated Fuel (Table 5.7-3)		
Transport Mode	truck	truck
No. of shipments for initial core loading		23
(normalized number)		(25)[a]
No. of reload shipments per year		4.7
(normalized number)		(5)[a]
Irradiated Fuel		
Transport mode	truck, rail or barge	truck, rail
Decay time before shipment	Not less than 90 days is a condition for use of Table S-4; 5 years is per contract with DOE	minimum of 5 years
No. of spent fuel shipments by truck		45.9 per year
(normalized number)		(444 per year)
No. of spent fuel shipments by rail		not analyzed
Radioactive Waste (Table 5.7-4)		
Transport mode	truck or rail	Truck
Waste form	solid	Solid
Packaged	yes	yes
No. of waste shipments by truck		23.6 per year
(normalized number)		(23 per year)
Traffic Density		
Trucks per day	Less than 1	Less than 1
(normalized total)		(72 per year)
Rail cars per month	Less than 3	not analyzed

(a) Total shipments of unirradiated fuel averaged over 40-year plant lifetime (Table 5.7-3) were used to calculate the total traffic density.

Table 5.7-6
RADTRAN 5 Input Parameters for Analysis of Unirradiated Fuel Shipments

Parameter	RADTRAN 5 Input Value	Source
Shipping distance, miles[(a)]	2,000	AEC Dec 1972
Travel Fraction — Rural	0.90	NUREG-0170
Travel Fraction — Suburban	0.05	
Travel Fraction — Urban	0.05	
Population Density — Rural, people per square mile	25.9	U.S. DOE Jul 2002b
Population Density — Suburban, people per square mile	904	
Population Density — Urban, people per square mile	5,850	
Vehicle speed, miles per hour	55	Conservative in transit speed of 55 mph assumed; predominantly interstate highways used.
Traffic count — Rural, vehicles per hour	530	U.S. DOE Jul 2002b
Traffic count — Suburban, vehicles per hour	760	
Traffic count — Urban, vehicles per hour	2,400	
Dose rate at 1 meter from vehicle, person-rem per hour	0.1	AEC Dec 1972
Packaging length, feet	24	Approximate length of two LWR fuel element packages placed on end
Number of truck crew	2	AEC Dec 1972, NUREG-0170, U.S. DOE Feb 2002a, DOE 2002b
Stop time, hour per trip	4.0	Based on one 30-minute stop per 250 miles
Population density at stops, people per square mile	77,700	Sprung et al. Mar 2000
Population density surrounding truck stops, people per square mile	881	Sprung et al. Mar 2000

(a) WASH-1238 had a range of shipping distances between 25 and 3000 miles for unirradiated fuel shipments. A 2000-mile “average” shipping distance was used for this analysis consistent with the assumptions in NRC analyses of early site permit sites.

Table 5.7-7
Radiological Impacts of Transporting Unirradiated Fuel to Units 6 & 7 by Truck

Reactor Type	Normalized Average Annual 0Shipments	Cumulative Annual Dose, person-rem per reference reactor year		
		Transport Workers	General Public - onlookers	General Public - along route
Reference LWR	6.3	0.011	0.018	1.9E–04
AP1000	4.9 (Table 5.7-3)	0.008	0.014	1.5E–04
10 CFR 51.52	365	4	3	3
Table S-4 condition[(a)]	(<1 per day)			

(a) Table S-4 conditions apply to all types of radioactive material transportation. The impacts of unirradiated fuel shipments constitute a small fraction of the overall cumulative annual dose limit.

Table 5.7-8
RADTRAN 5 Incident-free Exposure Parameters for Spent Fuel Shipments

Parameter	RADTRAN 5 Input Value	Source
Vehicle speed — Rural (miles per hour)	55	Based on average speed in rural areas given in U.S. DOE Jul 2002b. Because most travel is on interstate highways, the same vehicle speed is assumed in rural, suburban, and urban areas. No speed reductions were assumed for travel at rush hour.
Vehicle speed — Suburban (miles per hour)	55	
Vehicle speed — Urban (miles per hour)	55	
Traffic count — Rural (vehicles per hour)	530	U.S. DOE Jul 2002b
Traffic count — Suburban (vehicles per hour)	760	
Traffic count — Urban (vehicles per hour)	2,400	
Dose rate at 1 meter from vehicle (mrem per hour)	14	Approximate rate at 1 m that is equivalent to maximum dose rate allowed by federal regulations (i.e., 10 mrem per hr at 2 m from the side of a transport vehicle)
Packaging dimensions, m	Length = 5.2 Diameter = 1.0	U.S. DOE Feb 2002a
Number of truck crew	2	U.S. DOE Jul 2002b
Stop time (hour per trip)	3.5 to 4	Route specific
Population density at Stops (person per square mile)	77,700	Sprung et al. Mar 2000
Minimum/Maximum Radii of Annular Area Surrounding Vehicle at Stops (m)	1 to 10	Sprung et al. Mar 2000
Shielding Factor Applied to Annular Area Surrounding Vehicle at Stops	1 (no shielding)	Sprung et al. Mar 2000
Population Density Surrounding Truck Stops (people per square mile)	880	Sprung et al. Mar 2000
Minimum/Maximum Radii of Annular Area Surrounding Truck Stop (m)	10 to 800	Sprung et al. Mar 2000
Shielding Factor Applied to Annular Area Surrounding Truck Stop	0.2	Sprung et al. Mar 2000

Table 5.7-9
Transportation Route Information for Spent Fuel Shipments to the Potential Yucca Mountain Disposal Facility[(a)]

Reactor Site	One-Way Shipping Distance, miles				Population Density, people per square mile			Stop Time per trip, hr[(b)]
	Total	Rural	Suburban	Urban	Rural	Suburban	Urban	
Turkey Point Units 6 & 7	3115	2349	634	133	26.0	940	6270	6.5
St. Lucie	2967	2318	569	80	25.7	888	5975	6
Martin	2990	2350	562	78	25.4	883	5963	6
Glades	3002	2344	585	73	26.2	856	6015	6
Okeechobee 2	2990	2350	562	78	25.4	883	5963	6

(a) Transportation route information obtained from TRAGIS.
(b) Stop time is based on one 30 minute stop per each 4 hours of driving time.

Table 5.7-10
Population Doses from Spent Fuel Transportation, Normalized to Reference LWR

Exposed Population	Cumulative dose limit specified in Table S-4, person-rem per reactor year	Reactor Type	
		Reference LWR	AP1000
		Normalized Number of Spent Fuel Shipments per year	
		60	44
		Environmental Effects, person-rem per reactor year[(a)]	
Transport Workers	4	13.7	10.0
General Public — onlookers	3	9.4	6.9
General Public — along route	3	0.99	0.73

(a) Doses are the product of the RADTRAN dose results along the TRAGIS generated shipment routes multiplied by the number of shipments per year.

5.8 SOCIOECONOMIC IMPACTS

This section addresses the socioeconomic impacts of the operation of Units 6 & 7 at the Turkey Point plant property in Miami-Dade County, Florida. The evaluation assesses impacts from the operation of Units 6 & 7 and from the demands placed on the region by the workforce. Subsection 5.8.1 describes and presents an assessment of the physical impacts of operations. Subsection 5.8.2 describes the impacts of operations to the region in the areas of demography, economy, taxes, land use, transportation, aesthetics and recreation, housing, public services, and education. Subsection 5.8.3 assesses the operation of Units 6 & 7 with regard to disproportionate adverse impacts to minority and low income populations.

The significance of the impacts as small, moderate, or large, has been identified in accordance with the criteria that U.S. NRC established in 10 CFR Part 51, Appendix B, Table B-1, Footnote 3, as follows:

- SMALL — Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, the Commission has concluded that those impacts that do not exceed permissible levels in the Commission's regulations are considered small.

- MODERATE — Environmental effects are sufficient to alter noticeably, but not to destabilize, any important attribute of the resource.

- LARGE — Environmental effects are clearly noticeable and are sufficient to destabilize any important attributes of the resource.

These impact significance terms (SMALL, MODERATE, LARGE) are assigned to both the county-level and combined city-level analyses.

5.8.1 PHYSICAL IMPACTS OF STATION OPERATION

This section assesses the potential physical impacts as a result of the operation of the new units on the nearby communities or residences. Potential impacts include noise, odors, exhausts, thermal emissions, and visual intrusions. These physical impacts would be managed to comply with applicable federal, state, and local environmental regulations and would not significantly affect the Turkey Point plant property and its vicinity.

As presented in Subsection 2.5.2.4, Miami-Dade County has more than 1946 square miles of land, of which approximately 510 square miles have been developed for urban uses. The predominant existing land uses around the Turkey Point plant property are undeveloped and protected areas. Biscayne Bay and the Atlantic Ocean border the plant property to the east. The closest incorporated communities are Homestead and Florida City. Florida City is located 8 miles west of the plant property and the municipal limits of Homestead is located 4.5 miles west (Subsection 2.2.1.2). Recreational areas in the community include Homestead Bayfront Park, Biscayne National Park, Mangrove Preserve, Everglades National Park and the Homestead Miami Speedway (Subsection 2.5.2.5). There are no residential areas or public roads located within the Turkey Point plant property. Homestead Air Reserve Base is within 6 miles of Units 6 & 7. No significant industrial or commercial facilities other than the Turkey Point units are planned for this area; however, a portion of the former Air Reserve Base (717 acres) is to be set aside for mixed economic uses (commercial, residential, or recreational uses) by Miami-Dade County (Subsection 2.2.1.2).

5.8.1.1 Noise

As described in Subsection 2.7.7, an ambient noise monitoring survey was performed in June 2008 to assess existing ambient noise in areas adjacent to the existing units. The highest recorded noise level for onsite measurements was 68 dBA. From two sampling points located at the Turkey Point plant property boundary (monitoring points S2 and S3), daytime noise level equivalent (Leq) readings ranged from 60 to 68 dBA and nighttime L_{eq} readings ranged from 60 to 67 dBA.

The noise impacts from the operation of Units 6 & 7 were evaluated using the equipment associated with normal operation. The noise level generated by the circulating water system cooling towers would be on the order of 88 dBA at 3 feet from the towers, 73 dBA at 200 feet from the towers, and 65 dBA at 400 feet from the towers, which is within the Units 6 & 7 plant area. In contrast, the nearest distance to the Turkey Point plant property boundary from the cooling towers is 1452 feet. At the plant property boundary the estimated noise level would be approximately 35 dBA. This noise level would be below the range of the existing noise levels at the plant property boundary.

The design of Units 6 & 7 would include components that mitigate noise from being emitted to the surrounding environment. The majority of the noise sources associated with Units 6 & 7 would be steam generators, electric generators, compressors, cooling water pumps, and cooling towers. All, except for the cooling towers, would be located within buildings that mitigate sounds emitted by equipment. The noise from electric transformers would be partially shielded by walls that also mitigate noise. The standby and ancillary diesel generators and diesel fire pumps would operate only 4 hours per month for testing and maintenance. The noise from cooling towers would be mitigated by their inherent design (e.g., splash guards on air inlets to mitigate sounds generated by the falling water, mechanical fans with stacks that direct noise vertically).

As reported in NUREG-1437, and referenced in NUREG-1555, noise levels below 65 dBA are considered of small significance. In addition, there are no applicable state or local environmental noise regulations for unincorporated areas of Miami-Dade County, where Turkey Point is located. Therefore, noise impacts would be SMALL and would not warrant mitigation.

Other noise generated by the operation of Units 6 & 7 would be the noise levels resulting from the transmission system, substation operations, and increase in traffic by the operation workforce on access roadways and onsite roads. The noise generated from the transmission lines and substations, called corona noise, would be affected by weather. During dry conditions, the corona discharge is low and is not distinguishable from background or ambient noise. During wet conditions, a louder corona discharge occurs, however, the corona noise is not readily distinguishable from other background noise such as rain or traffic. Noise generated by the operation of the transmission systems and substations would be in accordance with state and local code requirements and, therefore, would be SMALL and would not warrant mitigation. Good road conditions and appropriate speed limits would minimize the noise level generated by the workforce commuting to the plant property. The access roads would be paved and local traffic would be controlled by speed limits. Impacts from the noise of traffic during operation activities would be SMALL and would not require mitigation.

5.8.1.2 Air

The Turkey Point plant property is located in Miami-Dade County, Florida, which is part of the Southeast Florida Intrastate Air Quality Control Region (AQCR). The Clean Air Act establishes National Ambient Air Quality Standards (NAAQS), which include the following criteria pollutants: sulfur dioxide, particulate matter with aerodynamic diameters of 10 microns or less (PM_{10}), particulate matter with aerodynamic diameters of 2.5 microns or less ($PM_{2.5}$), carbon monoxide, nitrogen dioxide, ozone, and lead. Areas of the United States having air quality as good as or better than the NAAQS are designated by EPA as attainment areas. Areas having air quality that is worse than the NAAQS are designated by EPA as non-attainment areas. The entire Southeast Florida Intrastate AQCR is currently classified as an attainment area under the NAAQS criteria (Subsection 2.7.2).

The new units would have standby diesel generators. The diesel generators would be operated periodically on a limited short-term basis and the related emissions would be intermittent. Emissions from these sources are described in Subsection 2.7.2.2. The standby diesel generators would be operated under air permits issued by the state of Florida for cooling tower particulates. The operation of a nuclear power plant involves the emission of some greenhouse gases, primarily carbon dioxide (CO_2). The NRC has conservatively estimated for a 1000 MW(e) nuclear plant that the total carbon footprint for the operation of a plant for 40 years is on the order of 320,000 metric tons of CO_2 equivalent (NRC, 2010). Thus, for two AP1000 reactors, the total carbon footprint would be on the order of 640,000 metric tons (not including uranium fuel cycle). Periodic testing of diesel generators and normal plant operation accounts for about 60 percent of the total or approximately 380,000 metric tons. Workforce transportation accounts for most of the rest or approximately 260,000 metric tons. As a comparison, the total United States annual CO_2 emission rate is 6,000,000,000 metric tons (EPA 2009). Additionally, Subsection 9.2.3.1.1 estimates a yearly CO_2 emission for comparable fossil fuel plants (coal- fired and natural gas-fired) as 14,000,000 metric tons and 5,900,000 metric tons, respectively. Based on the relatively small plant operations carbon footprint compared to the United States annual CO_2 emissions and comparable fossil fuel plants annual CO_2 emissions, the atmospheric impacts of greenhouse gases from plant operation would not be noticeable and therefore impacts would be SMALL. Given the periodic and short-term operation of these pollution sources, the impact from the operation of Units 6 & 7 on air quality would be SMALL and would not warrant mitigation.

The operation of Units 6 & 7 would increase the commuting workforce. Well-maintained access roads and appropriate speed limits would minimize the amount of dust generated by this increase in traffic. As stated in Subsection 5.8.2, approximately 403 new residents, in addition to 403 individuals already residing in, and therefore a part of the area's existing traffic profile, would migrate to the area for the operation of the new units. It is expected that these additional employees would be dispersed into surrounding communities in much the same way as the existing workforce. Because of the size and population of the surrounding areas, the emissions from the small increase in local traffic would not affect the air quality in the area. Air quality impacts from traffic during operation activities would be SMALL and would not require mitigation.

5.8.1.3 Aesthetics

The viewscape from north to south or from south to north would be similar to that of the existing units. However, the viewscape perpendicular to the Turkey Point plant property, that seen by commercial and recreational boating traffic on the eastern side of the plant property, would have a broader view of the entire area of the existing and new units, and would have an open view of Units 6 & 7. However, the viewscape with the new units would be similar to that of the existing plant property. Visual impacts of the new units would be SMALL and would not warrant mitigation.

The visual impacts from the operation of the cooling towers would be the towers themselves and plumes resembling lines of clouds. The plumes from the cooling towers would be seen during the early morning in cool weather generally during the winter months. The average plume lengths and heights would be relatively short. The visible plumes may prevent direct sunlight from reaching the ground, causing shadowing only for a short amount of time in the morning, but dispersing after sunrise. As described in Subsection 5.3.3.1, because of the varying directions and low frequency of the longest plumes and the short average plume lengths, impacts from elevated plumes would be SMALL and would not warrant mitigation.

Outdoor lighting would be necessary to satisfy NRC and Occupational Safety and Health Administration (OSHA) requirements for security, worker, and plant safety, including lighting walkways, parking areas, and various equipment areas. Unconstrained lighting can cause light pollution and light trespass. Light pollution or sky glow is the term used to describe sky brightness caused by scattering of light in the atmosphere. Light trespass is the term used to describe light that strays from its intended purpose and becomes an annoyance.

Light pollution and light trespass would be addressed when designing the outdoor lighting systems. Guidelines specifically addressing potential lighting issues from the Illuminating Engineering Society of North America would be followed. These guidelines would be incorporated into the outdoor lighting design to the extent practicable while meeting NRC and OSHA requirements. Typical features to be incorporated are minimize upward light from luminaries, minimize upward light in general so that light reaches its intended target, turn off lighting not needed for safety and security between 11:00 p.m. and sunrise, contain light within its intended target area by suitable choice of luminaries for light distribution, by selection of mounting height and physical location, and by minimizing glare in the horizontal or vertical directions.

Outdoor light monitoring was conducted in 2008. The monitoring was performed from ten locations surrounding Turkey Point such as the race track, cooling canals, and Biscayne Bay. The results of the outdoor light monitoring indicated that while light from the existing units is visible, the light is localized. Sky glow was observed from the major urban areas such as Homestead and Miami. The use of the Illuminating Engineering Society of North America guidelines to the extent practicable, while meeting NRC and OSHA security and safety requirements, would result in low lighting impacts from Units 6 & 7. Thus, lighting impacts would be SMALL and would not warrant mitigation.

The visual impacts of the eastern transmission line corridors (Clear Sky to Turkey Point, Clear Sky to Davis, and Davis to Miami) would consist of 230 kV lines on 80- to 105-foot-high concrete poles. The Clear Sky to Turkey Point line would be fully contained on the Turkey Point plant property and would be similar to the existing lines between the Turkey Point switchyard and the McGregor switchyard. The Clear Sky to Davis line would be in an established transmission right-of-way that is currently being used for seven other transmission lines. The addition of another single line and new poles collocated within this corridor would be similar to the current linear facilities established. The Davis to Miami line would be collocated in an established transmission line right-of-way that is currently being used for several other transmission lines and collocated with the MetroRail and a major transportation highway. A short section of the proposed Davis-Miami 230-kV transmission line, at the crossing of the Miami River adjacent to the existing Miami substation, would be underground. Therefore, the presence of these new transmission lines would have a SMALL visual impact and would not warrant mitigation.

The visual impacts of the western transmission line facilities (Clear Sky to Levee and Clear Sky to Pennsuco) would consist of two 500 kV lines and a single 230 kV line. These lines would follow an existing right-of-way up to the Everglades National Park (ENP). These lines would then follow a right-of-way in, or adjacent to, the ENP. Then, the two 500 kV lines would terminate at the Levee substation, and the 230 kV line would continue to the Pennsuco substation. The existing right-of-way is currently used by a single 138 kV line. The visual impacts of the additional lines would consist of new 80- to 105-foot-high concrete poles and new galvanized lattice steel or concrete guyed single-circuit structures at heights of 135-150 feet approximately 1000 feet apart. The addition of these new structures would alter and inhibit the viewscape, however, the visibility would be reduced with increased distance. At the present time, most of the views into the park from the Tamiami Trail are obstructed by vegetation growing along the highway. Because opportunities for views into the park from the highway are greatly reduced or eliminated due to the vegetation, the adverse impacts of the transmission lines and structures would be minimal. The 230 kV line that continues past Levee substation to Pennsuco substation would be largely in existing rights-of-way where the transmission line would be collocated with existing transmission lines and would consist of a single line on 80- to 105-foot-high concrete poles through heavily industrial and urban areas. Impacts would be minimized to the natural and built environment to the extent feasible through the selection process, engineering options, and construction techniques used. Therefore, the presence of these new lines would have a MODERATE impact and would warrant mitigation, such as those described above.

5.8.1.4 Traffic

The current road network in the Homestead and Florida City area is detailed in Subsection 2.5.2.2.1. The operation workforce for both units is expected to be 806 persons (Table 5.8-1). The principal arterial roads could accommodate an increase in operation workforce traffic (Table 5.8-10c).

After completion of construction, FPL would remove a portion of the roadway improvements on SW 359th Street and return it to a transmission patrol road. All workforce traffic for Units 1-7, including outage workers, would access the site via SW 344th/Palm Drive. Palm Drive runs east-west. Workers from the west, northwest, north and south can access the west end of SW 344th/ Palm Drive from U.S. Highway 1, Krome Avenue or Florida's Turnpike. Workers from the north can also access Palm Drive by traveling south on SW 137th/Tallahassee Road or SW 117th Avenue, a north-south street east of Tallahassee Road.

SW 328th /North Canal Drive runs east-west several blocks north of SW 344th/Palm Drive, and also can be accessed from Krome Avenue, U.S. Highway 1 or Florida's Turnpike. SW 328th / North Canal Drive intersects with SW 137th/Tallahassee Road, north of SW 137th/Tallahassee Road's intersection with SW 344th/Palm Drive, and therefore provides an alternative access to Turkey Point from the west for part of the commute. Sections of Tallahassee Road, North Canal Drive and Palm Drive would be improved to accommodate construction traffic (Subsection 4.4.2.2.4.2).

Trip distributions and traffic assignments for the new operation workforce traffic were based on the traffic patterns of the existing workforce. Most existing traffic arrives from and departs to the north via SW 137th/Tallahassee Road. The second most traveled access/egress route is SW 344th/Palm Drive to U.S. Highway 1. Most of the remainder of the existing workforce uses SW 328th /North Canal Drive.

5.8.1.5 Conclusion

Physical impacts to the surrounding population as a result of the operation of the proposed units would be SMALL and would not warrant mitigation.

5.8.2 SOCIAL AND ECONOMIC IMPACTS OF STATION OPERATION

This section evaluates the demographic and community impacts to the region as a result of operating Units 6 & 7 in Miami-Dade County, Florida. The evaluation assesses impacts of operation-related activities and of the operation workforce in the region.

The population data in this section was updated to reflect the American Community Survey Estimates for 2005-2009. The population projections in Table 2.5-1 and FSAR Subsection 2.1.3, however, used the 2010 Census dataset in order to be consistent with the base population utilized by the Florida Office of Economic Development and Research for the state projected population growth between 2010 and 2030. The 2010 Census dataset was also used in FSAR Subsection 2.1.3 to calculate the same base growth rate multiplier as the state, so that the population projections would be consistent with those projected by the state through 2030.

The operation of Units 6 & 7 would continue at least 40 years, with the possibility of a 20-year extension, for an operational life of as much as 60 years. The projected operation schedule estimates a commercial operation date of 2022 for Unit 6 and 2023 for Unit 7. A two-unit facility would require approximately 806 onsite employees (Subsection 3.10.3). Refueling outages for each unit would occur every 18 months, last approximately 30 days, and require the addition of approximately 600–1000 temporary workers.

Major factors in determining socioeconomic impacts are the number of workers and family members that relocate to an area and where they settle. Assumptions regarding workforce characteristics, migration, and family characteristics for Units 6 & 7 are presented in Table 5.8-1. Assumptions regarding families, children, and the indirect workforce are described in more detail in Subsection 5.8.2.1. As stated in Subsection 3.10.3, it is assumed that 50 percent of the operation workforce (403 workers) would migrate to Miami-Dade County for this project.

As presented in Table 2.5-3, approximately 83 percent of the 977 current operation workers at Turkey Point reside in Miami-Dade County. Approximately 43 percent or 418 workers reside in the Homestead and Florida City area. For Units 6 & 7, it could be assumed that 83 percent of the in-migrating operation workforce would reside in Miami-Dade County, but the county's population is so large and resources are so plentiful that it can be conservatively assumed that all of the 403 workers would migrate to the county. On a more local level, it could be assumed that, based on the residential distribution of the current operation workforce, approximately 43 percent of the in-migrating workers (172 workers) would reside in the Homestead and Florida City area. Therefore, the impact analyses in Subsection 5.8.2 are based on the socioeconomics of Miami-Dade County, as a whole, and the Homestead and Florida City area, in particular.

In Subsections 2.5.1 and 2.5.2, resource capacity information is presented for Miami-Dade County and the Homestead and Florida City area. The data for Homestead and Florida City was summed to provide a baseline for the Homestead and Florida City area. In Subsection 5.8.2, the incremental increases in resource use caused by the in-migrating workforce for Units 6 & 7 at both the county and combined cities levels are assessed.

5.8.2.1 Demography

Both new units would be operating by 2023 and potentially continue for 60 years, to 2083. The population, as determined by the USCB, within 50 miles of Units 6 & 7 was 3,459,894 in 2010, and is projected to grow to approximately 6,278,881 by 2090 (Table 2.5-1). The population in Miami-Dade County was 2,496,435 in 2010, and is projected to grow to 2,722,889 by 2020 (Table 2.5-4). The 2000 populations of Homestead and Florida City were 31,909 and 7843, respectively (Subsection 2.5.1). The 2005-2009 population for the two cities was 55,036 and 9808, respectively (Subsection 2.5.1). Population projections for the two cities in 2020 are not available.

It is anticipated that 403 workers (Table 5.8-1) would migrate into Miami-Dade County to support the operation of the new units. It is anticipated that 172 (approximately 43 percent) of those workers would migrate to the Homestead and Florida City area.

An in-migration of 403 workers would create additional indirect jobs in the region because of the multiplier effect. Multipliers are used to estimate how much a one-time or sustained increase in economic activity, such as the operation of Units 6 & 7, in a particular region, such as Miami-Dade County, will impact a defined region. Employment multipliers are used to estimate the number of indirect jobs created in a region. Indirect jobs are created when new, directly employed workers spend their earnings and, hence, create a greater demand for goods and services than existed before the new worker wages were introduced to the region. The in-migration of 403 operation workers would create new indirect jobs because of the multiplier effect.

Earnings multipliers are also used to predict the impact of wages spent in the region. The U.S. Department of Commerce's Bureau of Economic Analysis (BEA), Economics and Statistics Division, provides multipliers for jobs and earnings (BEA 2009). Their economic model, RIMS II, incorporates buying and selling linkages among regional industries, and provides multipliers by industry sector to estimate the impacts of changes in that sector to a regional economy. This analysis used the detailed employment and earnings multipliers for the power generation and supply industry to estimate the number of indirect jobs and the impact of Units 6 & 7-related expenditures in Miami-Dade County. Table 5.8-2 provides project-related direct and indirect employment data for Miami-Dade County.

As stated in Subsection 4.4.2.1, for every in-migrating operation worker, an estimated additional 2.1696 jobs would be created in Miami-Dade County (BEA 2009). The influx of 403 operation workers would create approximately 874 indirect jobs in Miami-Dade County, for a total of 1277 new jobs (both direct and indirect) (Table 5.8-2). It is expected that the indirect jobs could be filled by people already residing within Miami-Dade County. As shown inTable 2.5-7, there were 156,562 unemployed individuals in Miami-Dade County in 2011.

To estimate the family characteristics of the operation workforce, the Batelle Memorial Institute (BMI) study, *Migration and Residential Location of Workers at Nuclear Power Plant Construction Sites* (BMI 1981), which was commissioned by the NRC, and U.S. Census Bureau (USCB) data was evaluated. Published in 1981, the BMI study was based on 49,000 observations from 28 surveys at 13 nuclear power plant construction sites. The study sought to improve the accuracy of socioeconomic impact assessments by providing an improved methodology for predicting the number of in-migrating workers and their residential location patterns at future nuclear power plant construction projects. Though the study was an analysis of construction workforce, in general, information about nuclear plant nonconstruction workers (i.e., managers, engineers, supervisors, clerical, security, and medical personnel who were on the site during construction) was also included. Because nonconstruction workers have some similar characteristics to the operation workforce, their data is useful for this analysis. The study is the most current of its nature and there is little evidence that the observations of fundamental worker characteristics and behaviors detailed in the BMI study have changed meaningfully since the study’s publication. Therefore, the worker migration patterns and family characteristics described in the 1981 study are considered a valid proxy for assumptions made for nuclear power plant construction and operation workforce today.

As stated previously, it was assumed that all of the 403 in-migrating workers would migrate to Miami-Dade County and would bring families. According to the BMI study, the average family size of a nuclear plant nonconstruction worker was slightly less than 3.25. According to the USCB (USCB 2010b), the average family size in Miami-Dade County in 2010 was 3.33, while the average family size for the state of Florida was 3.01. Therefore, it was assumed that the average family size of 3.25, the value used for the construction workforce in Subsection 4.4.2.1, would also be a reasonable estimate for the operation workforce. Therefore, 403 in-migrating operation workers would bring 907 family members, for a total of 1310 additional people in Miami-Dade County (Table 5.8-1). The 172 workers that would migrate to the Homestead and Florida City area would bring 387 family members, for a total of 559 additional people to that area (Table 5.8-1).

The BMI study reported that, while construction workers averaged 0.8 school-age children per family, nonconstruction workers had an average of 0.6 children per family. However, to provide a more conservative impact estimate, it was estimated that, like the construction worker families, each of the 403 operation worker families would bring 0.8 school-age children, for a total of 322 additional children in Miami-Dade County (Table 5.8-1). Likewise, it was estimated that the 172 operation workers that would settle in the Homestead and Florida City area would bring 138 additional children to that area (Table 5.8-1).

The Units 6 & 7-related population increase in Miami-Dade County during operation would be 1310 people (Table 5.8-1). This represents an increase of 0.05 percent over the 2005-2009 population for Miami-Dade County and 0.05 percent over Miami-Dade County's projected 2020 population (Table 2.5-4). Therefore, Units 6 & 7-related population impacts to Miami-Dade County would be SMALL.

The Units 6 & 7-related population increase in the Homestead and Florida City area during operations would be 559 people (Table 5.8-1). This represents an increase of 1.4 percent over the 2000 populations of the two cities' areas, combined, and 0.9 percent over the 2005-2009 population estimates of the two cities' areas, combined. Therefore, Units 6 & 7-related population impacts to the Homestead and Florida City area would be SMALL.

5.8.2.2 Impacts to the Community

This section evaluates the social, economic, infrastructure, and community impacts to the region of influence (ROI) which is Miami-Dade County, and, specifically, the Homestead and Florida City area, as a result of operating Units 6 & 7. As many as 806 workers, 50 percent of which would migrate into Miami-Dade County, would be employed.

5.8.2.2.1 Economy

The impact of the operation of Units 6 & 7 on the local and regional economy would depend on the region's current and projected economy and population. The economic impacts of a potential 40-year period of operation plus 20 years of a license renewal period are described below.

The employment of the permanent operation workforce for such an extended period of time would have economic impacts throughout Miami-Dade County. The property tax revenues from the new units would be assessed and distributed throughout Miami-Dade County including the Homestead and Florida City area. It was assumed that incoming workers would choose residences in a similar pattern to the existing Turkey Point workforce (i.e., primarily in Miami-Dade County, with approximately 43 percent electing to live in the Homestead and Florida City area), although the residence patterns of the incoming operation workers may vary somewhat, and therefore the location of some impacts cannot be exactly determined. However, the influx of people spending wages, paying taxes, building new houses or occupying existing houses, and using public services and utilities could have a more noticeable impact on the smaller communities in Miami-Dade County, particularly in the Homestead and Florida City area than in the county as a whole because of their smaller populations.

In addition to the permanent operation workforce of 806, workers would be brought in periodically to support refueling outages (Subsection 5.8.2.2). Regular outages would occur approximately every 18 months for each unit, using 600 workers and lasting 30 days. Extended outages would occur every 5 years per unit, using 1000 workers and lasting 45 days. For this analysis, it was assumed that the two units would not experience simultaneous outages, and therefore, one regular outage would occur every 9 months and one extended outage would occur every 2.5 years for Units 6 & 7. These outages would be in addition to those scheduled for Units 3 & 4. It was further assumed that outages for all four nuclear units would be non-concurrent.

Income Impacts from Permanent Operation Workers

As part of the analysis of income impacts to Miami-Dade County, wages for all industry sectors combined, the utilities industry, and the nuclear electric power generation industry were examined. As available, these wages are presented in Table 2.5-12. Nuclear electric power generation information was not disclosed for Florida or Miami-Dade County. Therefore, Florida data from the Bureau of Labor Statistics for annual average wages for nuclear power reactor operators ($81,980) (BLS 2012b) were obtained. While Technicians, along with administrative and support personnel, would comprise the majority of the operation workforce, Nuclear Technician annual wages are not currently available. As such, the nuclear power reactor operator’s wage was used to revise the impacts analysis. Based on the average annual nuclear power reactor operator’s wage of $81,980, the total annual payroll for the in-migrating operation workers was estimated at $33 million (Table 5.8-3).

The in-migrating operation workforce would purchase goods and services, creating an earnings multiplier effect that would result in an increase in business activity, particularly in the retail and service industries. As noted in Subsection 5.8.2, it was assumed that 50 percent of the operation workforce would migrate into Miami-Dade County, and therefore would spend some portion of their worker wages within Miami-Dade County. To estimate these economic impacts, the regional earnings multiplier of 1.7880 for the power generation and supply industry (BEA 2009) is applied to the annual payroll of the in-migrating workers. According to these calculations, the total impact of in-migrating worker wages in Miami-Dade County would be about $59.1 million (Table 5.8-3). This multiplied impact would represent an increase of 0.06 percent over the total personal income in Miami-Dade County in 2009, a SMALL and positive impact. It is likely that personal income in Miami-Dade County will grow between 2009 and the beginning of the operation of Units 6 & 7, resulting in a smaller percentage increase in county personal income. However, the wage impact would remain positive and SMALL.

It is not possible to accurately predict the magnitude of wages spent within the Homestead and Florida City area, because so many opportunities exist to spend earnings within metropolitan Miami-Dade County. However, some wages would be spent in the Homestead and Florida City area and the impacts would be positive, but likely SMALL.

Employment Impacts from Permanent Operation Workers

As stated in Table 5.8-2, an estimated additional 2.1696 indirect jobs would be created for each of the 403 in-migrating workers (BEA 2009a)[1]. These 403 direct jobs would create an additional 874 jobs, for a total of 1277 (403 direct + 874 indirect) jobs.

In 2011, Miami-Dade County had a total employment of 1.15 million (Table 2.5-7). Therefore, the 1277 jobs would represent a 0.1 percent increase over 2011 employment levels (Table 5.8-4). However, by the time the new units and indirect jobs come into existence, it is likely that the total county employment would be greater, and that the new jobs would comprise a smaller percentage of the total. In any case, this would be a SMALL and positive impact to the Miami-Dade County economy.

Many of the 874 indirect jobs would be in retail or services, and not highly specialized. The operation workforce for both units would reach full staffing in 2022. Available workers to fill the indirect jobs could come from local unemployed workers and construction workers or their family members remaining in Miami-Dade County, or others in the region.

In 2011, the annual average unemployment rate in Miami-Dade County was 12.0 percent, representing 156,562 workers. The unemployment rate had increased from 6.1 percent a decade ago (Table 2.5-7). At a rate of 12.0 percent unemployment in 2011, there would be an ample labor force to fill the indirect jobs created by the incoming operation workers.

The creation of direct and indirect jobs, via the multiplier effect, would have a positive impact on the local economy, and to the extent that jobs were filled by unemployed local workers, would reduce unemployment, an additional beneficial impact. Miami-Dade County would experience SMALL beneficial impacts, and mitigation would not be warranted.

1. Workers currently residing in Miami-Dade County have already generated indirect service jobs, so only in-migrating workers were used to calculate new indirect jobs.

Impacts from Temporary Outage Workers

Regular outages would be approximately 30 days in duration and require 600 workers, and would occur approximately every 18 months per unit. Extended outages would be approximately 45 days in duration and require 1000 workers, and would occur approximately every 5 years per unit. For this analysis, it was assumed that all workers would come from outside Miami-Dade County. To estimate the economic impacts of each outage, the average annual wage for nuclear power reactor operators ($81,980), Table 5.8-5 is divided by 250 workdays per year to obtain a daily average wage of $328.

The wage impacts for regular and extended outages are estimated, with wage totals annualized for comparison to annual total personal income for Miami-Dade County. These calculations are provided in Table 5.8-5, which shows that the total annualized payroll for regular outage workers would be $7,870,080. When the earnings multiplier (1.7880) is applied, impacts to the region would be $14.1 million, representing an increase of 0.015 percent of Miami-Dade County's total personal income in 2009. When the earnings multiplier (1.7880) is applied to the annualized of worker wages during an extended outage, impacts to Miami-Dade County would be $10.6 million, representing an increase of 0.012 percent of the Miami-Dade County total personal income in 2009. Some of the regular and extended outage workers' wages would likely be spent in the Homestead and Florida City area.

Because of the short duration of the routine and extended outage periods, it is unlikely that permanent indirect employment impacts would occur in the region of influence as a result of the worker influx. However, there could be temporary and short-term job opportunities for lodging and restaurant workers to serve the outage workforce, along with SMALL and positive impacts to motels, restaurants, retailers, and other businesses patronized by the outage workers.

5.8.2.2.2 Taxes

Several types of taxes would be generated by the operation of Units 6 & 7. Unit 6 would begin operation in 2022, and Unit 7 in 2023. FPL would pay corporate income tax, sales and use taxes, and property (also known as *ad valorem*) taxes based on the value and power generated by Units 6 & 7 and on operating expenditures. Workers and their families would also contribute sales and property tax revenues to the area.

Subsection 4.4.2.2.2 provides a detailed description of the significance categories applicable to tax impacts, which are derived from the analysis in the Generic Environmental Impact Statement (GEIS), NUREG-1437. This methodology was reviewed and it was determined that the significance levels were appropriate to apply to an assessment of tax impacts as a result of the operation of Units 6 & 7. In summary, significance levels are considered SMALL if new tax payments are under 10 percent of the taxing jurisdiction's revenue, MODERATE if payments are 10 to 20 percent, and LARGE if payments represent more than 20 percent of revenue.

Personal and Corporate Income Taxes

As presented in Subsection 2.5.2.3, Florida has no personal income tax, but does levy a corporate income tax on corporations that conduct business in Florida. The tax liability is computed using federal taxable income, modified by certain Florida adjustments, to determine adjusted federal income.

At the present time, FPL is subject to Florida corporate income tax as a result of owning and operating power plants and other properties throughout the state, including the existing Turkey Point generation facility. FPL currently files as a member of a consolidated group for federal and state income tax purposes. At the time when FPL places the units in service, in 2022 for Unit 6 and 2023 for Unit 7, they will be included in the consolidated federal and state income tax filings. Because of the many factors involved in computing the amount of tax liability, it is not possible at this time to estimate an amount by which corporate income taxes may increase, and how much of the total would be attributable to Units 6 & 7. In 2011, the state of Florida collected approximately $1.9 billion in corporate income tax revenues. The expectation is that Turkey Point 6&7 would have a SMALL and positive impact to the state's overall corporate income tax collections.

In addition to direct taxes paid for Units 6 & 7, local operating expenditures as well as purchases by the operation workforce would have a multiplier effect on the local economy, where money would be spent and re-spent within the region (Subsections 4.4.2.2.1 and 5.8.2.2.1). Because of this multiplier effect, Miami-Dade County businesses, particularly retail and service sector firms, could experience revenue increases, and there may be prospects for new startup firms. Existing and new firms could generate additional profits, which would further contribute to increased corporate income taxes, although the exact amount is unknown. Impacts would be positive, and SMALL relative to overall state corporate income tax revenues.

Sales and Use Taxes

The state of Florida and Miami-Dade County would experience an increase in the amount of sales and use taxes collected. The additional taxes would be generated from operating expenditures of Units 6 & 7, and by retail purchases of goods and services by the operation workforce, their families, outage workers, and plant visitors. As described in Subsection 2.5.2.3, Florida imposes a 6 percent sales and use tax, and Miami-Dade County adds a 1 percent discretionary sales tax, bringing the total sales tax in Miami-Dade County to 7 percent. Cities and towns in the county do not levy sales tax.

The primary taxable expenditures by FPL for Units 6 & 7 would be for purchases of labor and services by Miami-Dade County providers (FPL Undated). At the present time, the amount of local operational expenditures associated with Units 6 & 7 is not known. However, to have more than a small impact on local and state sales tax collections, purchases for Units 6 & 7 that would be subject to tax in Miami-Dade County would have to exceed $575.6 million, while purchases subject to Florida state sales tax would have to exceed $32.3 billion (Table 5.8-7). Although sales tax payments to Miami-Dade County and the state of Florida could be large in absolute terms, it is likely that impacts to both entities would be SMALL and positive.

Workers, their family members, and visitors would pay Florida sales or use tax on items purchased within the state (or purchased elsewhere but subject to state use tax), regardless of whether the purchase was made within Miami-Dade County. They would also pay Miami-Dade County sales tax on purchases within the county. In absolute terms, the amount of state sales and use taxes collected from the expenditures of operation-related wages over a potential 60-year operating period could be large, but would provide a SMALL and positive impact when compared to the total amount of taxes collected by Florida and Miami-Dade County.

Other Sales- and Use-Related Taxes

Units 6 & 7 workers who would reside within the state would be subject to the state communications services tax on phone, cable, cellular phone, and related services, and would have to pay the documentary sales tax on deeds and other types of legal documents (Subsection 2.5.2.3.3). If one were to assume conservatively that all workers and their families migrating into Miami-Dade County would come from out of state, the in-migrants would represent an increase of only 0.007 percent over Florida's 2005-2009 population (Table 5.8-8). Therefore, impacts to Florida's tax revenues for the communications services tax and the documentary sales tax would be SMALL but positive.

Property Taxes — Counties and Special Districts

One of the primary sources of economic impact related to the operation of Units 6 & 7 would be property taxes assessed on the facility. In 2007, as shown in Table 5.8-9b, FPL paid real and tangible personal property taxes totaling $4.4 million to Miami-Dade County, representing 0.39 percent of the county's property tax revenues. FPL also pays tangible personal property taxes to four special taxing districts: the Florida Inland Navigation District, the South Florida Water Management District, the Everglades Construction Project, and the Children's Trust Authority. Table 5.8-9a shows FPL's 2010 payments to each tax district, the district's property tax revenues, and the percent FPL contributed to each district. For each of the special taxing entities, FPL's payments represent well under 1.0 percent of the district's property tax revenues. Those payments would increase when Units 6 & 7 go into operation. However, because of the large tax base for each of these districts, the increases would constitute SMALL and positive impacts to each district.

Table 5.8-8 shows that if all incoming worker families were to reside in Miami-Dade County, they would represent an increase of less than 0.1 percent over Miami-Dade County's 2005-2009 population. If, as expected, approximately 43 percent of the in-migrants choose to reside in the Homestead and Florida City area, they would pay property taxes to the county and special districts where they reside. These increases would have a positive and SMALL impact on tax revenues.

In smaller communities such as Homestead or Florida City, it is unlikely that the percentage of tax revenue increase would be as much as the projected population increase associated with the operation of Units 6 & 7, because much of any jurisdiction's tax base consists of higher-valued industrial or commercial property rather than residences. Therefore, the property tax impacts from new residents would be SMALL but positive.

Property Taxes — Independent School Districts

As described in Subsection 2.5.2.3.5, FPL, the current owner of the Turkey Point units, pays taxes collected by the Miami-Dade county tax collector on behalf on the Miami-Dade County School District. FPL paid $6.6 million in tangible personal property taxes to Miami-Dade schools in 2010 and 2011. However, because of this school district's large tax base (total revenues of $3.5 billion in 2010) (Table 2.5-21), FPL's payments represented less than 0.1 percent of the district's total revenues. In addition, FPL's payment of $6.6 million represents 0.35 percent of the district's locally-sourced tax revenues ($1.9 billion in 2010) (Table 2.5-21). Although property tax payments would increase with the operation of Units 6 & 7, impacts to Miami-Dade County schools would be SMALL but positive.

Summary of Tax Impacts

The overall potential beneficial impacts of taxes collected during the operational period of Units 6 & 7 would be positive and SMALL in Miami-Dade County and the state of Florida. The impacts would also be positive and SMALL in the Homestead and Florida City area. Mitigation would not be warranted.

5.8.2.2.3 Land Use

In the GEIS, the NRC provides the methodology for defining the impact significance of land use during refurbishment (i.e., construction activities) and license renewal (i.e., operations). This methodology was reviewed and it was determined that the significance levels were appropriate to apply to an assessment of land use impacts as a result of operation. Miami-Dade County was the focus of the land use analysis because the new units would be built in Miami-Dade County and it was assumed that all of the workforce during operation would reside in the county. Impacts to land use would be confined to Miami-Dade County. These impacts would be based on:

- The size of plant-related population growth compared to the area's total population
- The size of the plant's tax payments relative to the community's total revenue
- The nature of the community's existing land use pattern
- The extent to which the community already has public services in place to support and guide development

In NUREG-1437, the NRC concluded that land use changes during refurbishment at nuclear plants would be:

- SMALL — If population growth results in very little new residential or commercial development compared with existing conditions and if the limited development results only in minimal changes in the area's basic land use pattern.
- MODERATE — If plant-related population growth results in considerable new residential and commercial development and the development results in some changes to an area's basic land use pattern.
- LARGE — If population growth results in large-scale new residential or commercial development and the development results in major changes in an area's basic land-use pattern.

Further, the NRC defined the magnitude of population changes as follows:

- SMALL — If plant-related population growth is less than 5 percent of the study area's total population, especially if the study area has established patterns of residential and commercial development, a population density of at least 60 people per square mile, and at least one urban area with a population of 100,000 or more within 50 miles.
- MODERATE — If plant-related growth is between 5 percent and 20 percent of the study area's total population, especially if the study area has established patterns of residential and commercial development, a population density of 30 to 60 people per square mile, and one urban area within 50 miles.
- LARGE — If plant-related population growth is greater than 20 percent of the area's total population and density is less than 30 people per square mile.

Land Use

All or parts of four Florida counties are within 50 miles of Turkey Point: Broward, Collier, Miami-Dade, and Monroe. The 50-mile radius encompasses over 3168 square miles. However, impacts to land would be confined to Miami-Dade County. As described in Subsection 2.2.3, most of the land use and land cover in the 50-mile region consists of wetlands (69 percent) and urban or built-up (18 percent) (Figure 2.2-6 and Table 2.2-8).

As stated in Subsection 2.5.2.4, Miami-Dade County and the municipalities of Homestead and Florida City use comprehensive land use planning to guide residential and commercial development. There are 35 incorporated cities in Miami-Dade County. Only two of the 35 incorporated communities are within 10 miles of Units 6 & 7—Homestead and Florida City.

From the land use perspective, Miami-Dade County and the Homestead and Florida City area are likely to continue to urbanize as the projected population increases. The population related increases (1310 people) associated with the operation of Units 6 & 7 would create an increase in commercial and residential activity. Should the population influx result in new construction, both Miami-Dade County and the Homestead and Florida City area have some undeveloped land currently zoned for residential and commercial uses (Subsection 2.5.2.4). However, the present housing inventory in Miami-Dade County and in the Homestead and Florida City area can support all of the in-migrating workers and their families without the addition of new housing units (Subsection 5.8.2.2.6). Miami-Dade County had 135,004 total vacant housing units in 2005-2009 (Table 2.5-31). The Homestead and Florida City area had 4046 vacant units in 2005-2009 (Table 2.5-32). Because both Miami-Dade County in general, and the Homestead and Florida City area in particular, have well-established residential and commercial districts, little land use conversion from undeveloped to residential or commercial use or residential to commercial, would be expected from the operation–related population increase in the area. Any conversion that did occur would be within the areas that are already well-defined and identified in the applicable comprehensive land use plans.

Using the NRC's NUREG-1437 guidance presented above, it is concluded that impacts to land as a result of Turkey Point related population increases that would cause land use conversions in Miami-Dade County would be SMALL and not warrant mitigation since the population influx would result in very little new residential or commercial development compared with existing conditions, and there would be minimal changes in the area's basic land use pattern.

Operation-Related Population Growth

The 2010 population of Miami-Dade County was 2,496,435, with a population density of 1316 people per square mile (USCB 2012). The 2000 population of the Homestead and Florida City area was 39,752 (Table 2.5-3) and the area had a population density of 2311 people per square mile. The population for the area in 2010 was 76,757 or 3402 people per square mile (USCB 2012) (Subsection 4.4.2.2.3.2). As a point of reference based on the 2010 census data, the population per square mile in the USA is 87.4 people per square mile (Subsection 4.4.2.2), approximately 1/15th (6.66 percent) of the density of Miami-Dade County.

Operations-related population growth in Miami-Dade County would consist of 1310 people, (Subsection 5.8.2.1), which equates to less than 0.1 percent of the 2005-2009 population. Assuming that approximately 43 percent of the in-migrating operation workers would reside in Homestead and Florida City area, the increase in population would represent 0.9 percent of the total 2005-2009 population. Because the population in 2020 in Miami-Dade County (including population in the Homestead and Florida City area) is expected to be greater than in 2005-2009, the operations-related population growth would be an even smaller percentage by the start of the operation of Units 6 & 7.

Using NUREG-1437 guidance, land use impacts attributed to operation workforce population growth in Miami-Dade County, would be SMALL since the county has established patterns of residential and commercial development, there is a population density of at least 60 people per square mile, and there is at least one urban area with a population of 100,000 or more within 50 miles. The Homestead and Florida City area meets the NRC criteria for a SMALL land use impact because the population increase would be small and the area has established patterns of residential and commercial development. The area also has a population density of at least 60 people per square mile and at least one urban area with a population of 100,000 or more within 50 miles.

Conclusion

Overall, impacts to land use in Miami-Dade County in general, and in the Homestead and Florida City area in particular, would be SMALL. There would be very little new residential or commercial development and basic land use patterns would remain in place. Existing comprehensive plans would guide development. Project-related population increases would represent 0.1 percent of the 2005-2009 population base and not meaningfully alter land use densities or use.

Therefore, overall land use impacts would be SMALL. To mitigate the potential impacts, FPL would maintain communication with local and regional governmental and nongovernmental organizations, including but not limited to the Department of Planning and Zoning and Department of Community and Economic Development, to disseminate project information in a timely manner. This would allow these organizations to be given the opportunity to plan accordingly.

5.8.2.2.4 Transportation

The effect of the operation of Units 6 & 7 was assessed for impacts on transportation infrastructure and traffic from commuting workers. The analysis focuses on the commuting routes east of the major arterials. FPL believes that the excess capacity of U.S. Highway 1 and Florida's Turnpike is adequate to accommodate additional operational traffic (Table 5.8-10a).

FPL commissioned a traffic study to determine impacts of the additional operation workforce, including temporary outage staff on local traffic (FPL 2010). Numbers of trips generated by the new workforce were estimated from traffic counts at the site entrance of the existing workforce during one week during the peak season. During the traffic counts, the plant had 940 workers. Peak daily traffic volume was 3077 trips, and average daily traffic volume was approximately 2800 vehicles. The peak hour volume occurred during the afternoon commute with peak hour traffic volume of 451 and a peak hour average traffic volume of approximately 400 vehicles. (FPL 2010)

Trip distributions and traffic assignments for operation traffic were based on the traffic patterns of the existing workforce. Most existing traffic arrives from and departs to the north via 137th/ Tallahassee Road. The second most traveled access/egress route is SW 344th/Palm Drive to U.S. Highway 1. Most of the remainder of the existing workforce uses North Canal Drive.

5.8.2.2.4.1 Workers Commuting to the Turkey Point Site

Although not all 806 workers would be present every day, the analysis considered that 806 was 86 percent of the 940 existing unit staff on site during the traffic counts, and considered an increased traffic volume of 86 percent as a good estimate of future traffic generated by Units 6 & 7 commuters.

As provided in Table 5.8-10a, FPL believes that the main arterials have adequate surplus capacity to support additional operations traffic. Therefore the traffic study focused on the streets east of these arterials, and the intersections that will be most impacted by operations traffic. The analysis considered existing intersection counts and seasonal adjustments (FPL 2010).

The analysis concluded that, in general, the roadways between the plant and the major arterials have adequate capacity to support new operation workforce-generated trips, based on a link analysis of the roadways which are part of the Miami-Dade Concurrency Management System (Table 5.8-10b).

The two most critical intersections were evaluated for impacts of the normal operation of Units 6 & 7 (Table 5.8-10c).

The analysis assumed that most improvements to the intersections would remain in place. However, improvements associated with the extension of SW 117th Avenue are not required for the normal operation of Units 6 & 7.

Traffic associated with the Homestead Miami Speedway during one of its major events could further impact traffic on the same routes traveled by Turkey Point workers. However, the peak hours for commuting and visitors arriving at the speedway would not overlap and the Speedway uses a detailed traffic management plan including contra-flow lanes during major events.

5.8.2.2.4.2 Workers Commuting to the Turkey Point Site - Outage

The traffic analysis assumed a maximum temporary outage workforce of 2000 for Units 6 & 7, or an increase of 213 percent over the 940 staff on site during the traffic counts on which this analysis is based. Elsewhere in this document, the number of outage workers is assumed to be 600 for regular outages and 1000 for extended outages. Because 2000 is larger than 1000, the traffic analysis is more conservative and bounds the study. The analysis assumes that access/egress patterns of the outage workforce would be similar to those of the operations workforce. In addition, the normal workforce for Units 1-5 would be estimated to be 1476. The workforce at Units 6 & 7 is estimated to be 806. The total workforce accessing Turkey Point during a regular outage would be 2882 and for an extended outage would be 3282.

The analysis concluded that, in general, the roadways between the plant and the major arterials have adequate capacity to support outage plus new operation workforce-generated trips, based on a link analysis of the roadways which are part of the Miami-Dade Concurrency Management System (Table 5.8-10d). The two most critical intersections were evaluated for impacts of Units 6 & 7 outage operations (Table 5.8-10e).

The trips generated by the Units 6 & 7 workforce and outage workforce meet Miami-Dade County's traffic concurrency standards. With the roadway improvements implemented for construction, the most affected intersections will operate adequately during normal operation and outages.

5.8.2.2.4.3 Roads Miami-Dade County

As stated in Subsection 2.5.2.2, Miami-Dade County has a well-developed road and transportation infrastructure. The population increase of 403 workers to Miami-Dade County (Subsection 5.8.2) and accompanying licensed drivers (403) could add 806 drivers in Miami-Dade County; however, the Miami-Dade County roads support a driving age population in excess of 1.3 million people and the traffic generated by 806 additional drivers represents an increase of less than 1 percent of the adult population, and would be dispersed throughout the county.

5.8.2.2.4.4 Miami-Dade County Public Transportation

Miami-Dade County operates public transportation services including rail, express bus, and buses that have multiple stops (Subsection 2.5.2.2.2) with a daily ridership of 300,000 (MDC 2008). The population increase of 1310 as a result of the in-migrating workers and their families could increase public transportation usage. However, an increase of as many as 1310 passengers daily represents less than 1 percent of the current ridership.

5.8.2.2.4.5 Evacuation Routes

The severe weather evacuation routes of the Florida City and Homestead area are shown in Figure 2.5-8a. The in-migrating families would add 806 vehicles to an evacuation of Miami-Dade County if each in-migrating family evacuated in two vehicles. Approximately forty-three percent (172 families) of the in-migrating operation workforce would live in the Homestead and Florida City area, for a total of 344 maximum additional vehicles evacuating from this area.

5.8.2.2.4.6 Summary

Based on the traffic engineering study, traffic related to the operation of Units 6 & 7 would result in SMALL impacts to all aspects of traffic in the region of interest and no mitigation beyond that provided for construction traffic, and described in this section, would be warranted.

5.8.2.2.5 Aesthetics and Recreation

This subsection describes the impacts to aesthetics and use of recreational opportunities from the operation of Units 6 & 7 and its associated facilities in the 6-mile vicinity and 50-mile region. Subsection 2.5.2.5 presents basic information on recreation in the vicinity and 50-mile region. Section 3.1 details the plant layout and external appearance. Subsection 5.8.1.3 analyzes the aesthetic impacts of the Turkey Point units and associated facilities.

As stated in Section 2.2, the major land uses within 6 miles are wetland and forestland. The topography of the region and the Turkey Point plant property is relatively flat. As stated in Section 3.9, when completed, the tallest building of Units 6 & 7 would be the containment building reaching a height of 229 feet above finished plant grade. The reactor containment buildings for Units 3 & 4 are 210 feet tall. The grade elevation of the Units 6 & 7 power blocks would be 25.5 feet NAVD 88 and slope at a 0.5 percent grade at the perimeter. The aesthetic impact of new Units 6 & 7 would be similar to Units 3 & 4. Therefore, the aesthetic impacts from the operation of Units 6 & 7 would be SMALL.

In addition to the physical structures and infrastructure of the units, operational activities would produce visual and other physical impacts. The operation of Units 6 & 7 would result in visible plumes from the cooling towers (Subsection 5.3.3.1.1). The plumes from the cooling towers would be seen during the early morning in cool weather, generally the winter months. The average plume lengths and heights would be relatively short. The visible plumes may prevent direct sunlight from reaching the ground, causing shadowing only for a short amount of time in the morning. The operation of the cooling towers would produce limited fogging and salt deposits within the Units 6 & 7 plant area. Fogging from the operation of the cooling tower would occur for approximately 5 hours per year on the eastern perimeter of the plant area.

Aesthetic Impacts to Recreation

Aesthetic impacts can be visual, auditory, and/or tactile (vibratory, etc). With respect to aesthetic impacts to recreation, these impacts can be experienced by humans directly (e.g., visually) and/or indirectly by affecting the flora and fauna used by humans in the pursuit of recreation (e.g., frightening animals from viewing stations).

Changes to the viewscape that would result from the new power block structure heights, elevation gradient changes, and land cover changes, could be seen from approximately 10 miles away since the area is relatively flat; however, trees and vegetation to the west and north screen the view.

The visual impact of the new unit structures would be minimized through use of topography, design, materials, and color. People boating on Biscayne Bay are accustomed to seeing the structures of Units 1 through 5. The additional structures associated with Units 6 & 7 would not appreciably alter the plant's appearance as viewed from Biscayne Bay. Individuals in the recreational facilities that are not adjacent to the Turkey Point plant property boundary would be unable to distinguish the noise from Units 6 & 7 from urban and traffic noise.

The private and public recreational facilities within 6 miles are Biscayne National Park, Homestead Bayfront Park, Mangrove Preserve, and Homestead Miami Speedway. Therefore, these are the recreational opportunities that are analyzed for aesthetic impacts.

Property boundaries of Biscayne National Park and Homestead Bayfront Park are located within 1 mile of the Turkey Point plant property boundary along the western shore of Biscayne Bay. Recreational users would be able to see the taller structures on the property; however, recreational users are accustomed to seeing Units 1 through 5. It is also possible that the recreational users would be able to see the cooling tower plumes. Recreational users would not experience auditory, olfactory, or tactile impacts. Therefore, aesthetic impacts to these resources would be SMALL and would not warrant mitigation.

Only a small portion of the Mangrove Preserve is located within 6 miles. Recreational users of the preserve would not be able to see Units 6 & 7 through the mangroves. With only a portion of the preserve located approximately 6 miles from the Units 6 & 7 power blocks, recreational users would experience no auditory or tactile impacts. Therefore, aesthetic impacts to this resource would be SMALL and would not warrant mitigation.

As stated in Subsection 2.5.2.5, Homestead Miami Speedway is a privately owned auto-racing track located approximately 5 miles northwest of Units 6 & 7. Subsection 5.8.2.2.4 describes the transportation impacts for Homestead Miami Speedway from Units 6 & 7 traffic. There would be no visual impact to recreational users because trees and vegetation would shield the units from the speedway. Recreational users would not be able to discern the auditory impacts from Units 6 & 7 from Units 1 through 5 and from the racing vehicles. There would be no plant-induced tactile impacts. Therefore, aesthetic impacts to this resource would be SMALL and would not warrant mitigation.

Use Impacts to Recreation

While aesthetic impacts to recreation are driven by the recreation user's proximity to Turkey Point, use impacts to recreation are driven by the proximity of recreational facilities and events to the user's residence. Operation workers and their families would be expected to use recreational facilities near their residences rather than near their place of work (i.e., the Turkey Point plant property). Some recreational opportunities would be sought out because of their uniqueness, a particular national park for example, independently of the recreation area's proximity to the worker's residence.

The influx of workers during operations could affect the use of recreational areas and participation in recreational events in the 50-mile region. Use impacts to recreation would be the result of the Turkey Point plant-related population growth in Miami-Dade County, and, therefore, increased use of recreational facilities and events. Residential distribution of the in-migrating workers in Miami-Dade County is the most important determinant of recreational facility use.

The in-migrating operation workforce would result in a 0.05 percent increase over the 2005-2009 Miami-Dade County's population. Use of recreational facilities and areas would be expected to increase by a similar percentage. For the purpose of this analysis, the recreational facilities were broadly classified into three groups: (1) wildlife management areas, national wildlife refuges, and preserves, (2) state parks, and (3) privately owned recreational facilities expected to be impacted by the operation of Units 6 & 7. Tables 2.5-29 and 2.5-30 present information about these facilities and, where available, information about the current use rates and capacities of those facilities. Subsection 2.5.2.5.2 discusses these facilities and recreational events in the region.

The wildlife management areas, national wildlife refuges, and preserves could be impacted by the Turkey Point-related population increase. There are eight wildlife management areas, national wildlife refuges, and preserves in the region that are open to the public (Table 2.5-29). Generally, agencies managing these properties do not tabulate the number of annual visitors or determine capacity information. All 1310 residents of the project-induced population increase in the region could use the areas, refuges, and preserves. Because the wildlife management areas, national wildlife refuges, and preserves are so large and have open and wooded lands appropriate for multiple uses (snorkeling/scuba diving, nature walks, picnics, camping, fishing), they can accommodate a large number of people. Impacts to wildlife management areas, national wildlife refuges, and preserves from the in-migrating operation workforce would be SMALL and would not warrant mitigation.

The state park system could be impacted by the Turkey Point-related population increase. The 11 state parks in the region (Table 2.5-30) have a total annual visitors count of 2,739,696 in July 2007 to June 2008 and a total daily capacity of 29,147 visitors, or approximately 10,638,655 annually. Therefore, the 11 state parks within 50 miles could accommodate an additional 21,641 daily visitors. The operations-related population increase of 1310 people represents approximately 6 percent of the available daily capacity. Because the state park system has open and wooded lands appropriate for multiple uses (snorkeling, nature walks, picnics, camping, fishing), the state park system can accommodate additional use more readily than local park systems, which often specialize in dedicated use opportunities (tennis, swimming pools, baseball fields). Impacts to state parks from the in-migrating operation workforce would be SMALL and would not warrant mitigation.

The privately owned Homestead Miami Speedway may be impacted by the operation of the new units. The commuter traffic to Turkey Point is not expected to interrupt traffic flow during the Speedway's main racing events. Subsection 5.8.2.2.4 provides more details. The in-migrating population would not affect the capacity of Homestead Miami Speedway. Recreational impacts would be SMALL and would not warrant mitigation.

The privately owned Mangrove Preserve is not open to the public. Impacts to the preserve were not determined.

Increased use of community, municipal, and neighborhood parks would likely reflect the same rate of project-induced population increase.

In summary, during operation, some employees and their families would use the regional recreational facilities. However, the increase attributable to plant operation would be small compared to overall use of these facilities. Impacts of facility operation on recreation would be SMALL and would not warrant mitigation.

5.8.2.2.6 Housing

Impacts on housing from the operation of Units 6 & 7 would depend on the number of operation workers that would relocate from outside Miami-Dade County and the type and location of housing those workers would desire. As previously described, indirect workers are expected to already reside in the county, so no indirect worker would require additional housing. Therefore, it was conservatively assumed that a maximum of 403 workers would migrate into Miami-Dade County and require housing as a result of the operation of Units 6 & 7.

Forecasting residential distribution patterns in a large geographical area is inherently problematic because workers' preferred housing is driven by many individual variables. Housing options are varied: owner versus rental occupancy; detached versus attached units; single-unit versus multiple-unit complexes; permanent units versus mobile units (mobile homes), and the need for short-term (motel/hotel) accommodations versus more permanent solutions. To present a more realistic analysis, the impacts to housing during the operation of Units 6 & 7 for Miami-Dade County in general were analyzed as well as the Homestead and Florida City area.

The housing required by the operation workforce would be different than the housing required by the construction workforce for the following reasons: the operation workforce is much smaller than the construction workforce; the operation workers would be permanent residents of the county and therefore require permanent housing (as opposed to temporary housing, as required by the construction workers); and the wages of operation workers are estimated to be higher than construction workers and wages are a proxy for type and location of housing sought.

Permanent housing is generally comprised of single-family units that are frequently owner-occupied. Permanent housing represents a long and large financial commitment. Therefore, operation workers may select housing based on its proximity to family-friendly amenities and on lifestyle choices. Operation workers would likely choose to purchase existing housing, in part, because the urbanized character of Miami-Dade County, particularly that portion of the county with convenient access to transportation infrastructure accessing Turkey Point. Little vacant land exists in those areas that could be converted to new housing. As described in Subsection 5.8.2, little land conversion in the county, in general, would be expected to be the result of in-migrating operation workers. The county has well-defined residential neighborhoods and residential and commercial districts.

Housing choices are determined, in part, by occupant wages. The average annual wage of the Units 6 & 7 operation workforce is expected to be higher than the current mean or average wage in the county. As described in Subsection 4.4.2.2.1, the average annual wage of a nuclear reactor power operator, who would be expected to be employed at Units 6 & 7, is $81,980 (Table 5.8-3). The average annual wage for all industries in Miami-Dade County is $44,042 (Table 2.5-12). Because wages are a proxy for the type, price, and location of housing sought, operation workers could seek some of the county's more expensive priced housing. The median price of an owner-occupied house in the county in 2005-2009 was $277,200.Table 2.5-31 displays Miami-Dade County housing data. Should workers elect to erect new residential units, construction location and standards would be guided by the adopted, applicable comprehensive plans described in Subsections 2.5.2.4 and 5.8.2.

Although there are uncertainties in the Florida and Miami-Dade County housing market, prices of existing higher-priced, single-family and multifamily housing could rise as a result of the increased demand from operation workers. The county and local governments in the county would benefit from an increase in taxable value if housing values rose. Conversely, price pressure on owner-occupied units and higher-priced rental units could change the patterns of residency options for families with lower incomes. Subsection 5.8.3 presents impacts to low-income populations. However, given the abundance of rental units and modestly priced owner-occupied housing in the county, rental housing rates and modestly priced owner-occupied units would likely experience little upward pressure on prices.

Subsection 2.5.2.6 presents data about the existing housing conditions in Miami-Dade County and the Homestead and Florida City area. Subsection 4.4.2.2.6 describes housing conditions during the construction period. The sources for all data presented in this section are Subsections 2.5.2.6 and 4.4.2.2.6, except where cited.

Miami-Dade County (ROI)

As described in Subsection 2.5.2.6, Miami-Dade County had 135,004 total vacant housing units in 2005-2009. In Miami-Dade County, an additional 110,657 housing units were added to the total inventory for between 2000 and 2005-2009, increasing the 2000 housing inventory by an additional 13 percent (Table 2.5-31). Permanent and rental housing could accommodate the entire in-migrating operation workforce.

If the 403 in-migrating operation workers elected to make Miami-Dade County their home, readily available housing could accommodate them. Miami-Dade County could accommodate the entire operation workforce, based on the vacancy of housing units of all types. The entire in-migrating workforce could be accommodated in vacant permanent housing units and the entire in-migrating workforce could be accommodated in vacant rental units. Should workers elect to build new housing, comprehensive plans are in place to guide development (Subsection 2.5.2.4).

Refueling outages would occur at least annually, and sometimes semiannually, when Units 3, 4, 6, & 7 are all operational. It is estimated that the maximum increase in workforce would be 1000 for extended outages. These workers would need temporary (45 days) housing (Table 5.8-5). Most of the outage workers would stay in local extended stay hotels, rent rooms in local homes, or bring their own housing in the form of campers and mobile homes. The outage workforce would not affect the permanent housing market in the region.

The current housing inventory would be sufficient to accommodate all of in the in-migrating workforce. Impacts to housing in the ROI would be SMALL.

Homestead and Florida City Area

As stated in Subsection 5.8.2, approximately 43 percent of Turkey Point's current workforce resides in the Homestead and Florida City area. For this analysis, it was assumed that approximately 172 operation workers could settle in the Homestead and Florida City area.

As described in Subsection 2.5.2.6, Homestead and Florida City area had 4096 total vacant housing units in 2005-2009. If 172 workers and their families moved into the area, as would be expected, the required 172 housing units would represent 4.3 percent of the area's vacant units in 2005-2009, if workers' requirements for type, size, price, condition, or other characteristics were met. However, of the 4096 total vacant housing units, 175 units are considered to be for seasonal, recreational, or occasional use and were assumed to be unavailable to operation workers. The Homestead and Florida City area issued 12,637 single-family building permits between 2001 and 2010, nearly doubling the area's 2000 total housing inventory (Table 2.5-38), which suggests that the area is experiencing and anticipating residential growth. This increase in available housing provides more options for the operation workers to live in the Homestead and Florida City area. As described in Subsection 5.8.2, there is some undeveloped land in the Homestead and Florida City area which is zoned for residential development. Areas already developed include well-defined residential neighborhoods and commercial areas. Should operation workers elect to construct new homes in the area, the applicable comprehensive plan would provide guidance.

The current housing inventory would be sufficient to accommodate all of in the in-migrating workforce. Impacts to the housing in the Homestead and Florida City area would be SMALL.

Conclusion

Miami-Dade County has ample existing housing to accommodate the entire in-migrating operation workers. In addition, the issuance of building permits for new homes suggests that the inventory has continued to grow since 2000. The existing inventory includes a wide range of housing choice by type, location, and by price. The Homestead and Florida City area has enough housing to accommodate all the in-migrating workers. Comprehensive plans are in place to guide development should new housing result from the proposed project. Employment resulting from the operation of Units 6 & 7, beginning with the initial arrival of operation workers during the construction period, would increase gradually, allowing market forces to accommodate the new arrivals.

Also, county and local governments in Miami-Dade County, including Homestead and Florida City, would benefit from the increased taxable value of existing housing and from any new residential construction. It is concluded that Miami-Dade County and the Homestead and Florida City area would benefit from positive tax impacts. Therefore, impacts to the Miami-Dade County and the Homestead and Florida City areas housing markets would be SMALL and mitigation would not be warranted.

To minimize any potential impacts to housing availability, FPL could initiate early communications with local and regional governmental organizations, including the Miami-Dade Planning and Zoning Department and the Greater Homestead and Florida City Chamber of Commerce, to disseminate information related to Units 6 & 7, such as the schedule of expected worker influx. County and regional planning organizations, and, ultimately, developers and real estate agencies, could factor the details of the emerging housing market into their decision-making and plan accordingly.

Impacts to the housing in Miami-Dade County and the Homestead and Florida City areas would be SMALL and no mitigation would be warranted.

5.8.2.2.7 Public Services

5.8.2.2.7.1 Water Supply Facilities

The impacts of both operation demand and population increases during the operation of Units 6 & 7 on local public water resources have been considered. Operations-related impacts are primarily based on the population increase caused by the number of workers and their families migrating into Miami-Dade County. This in-migrating population is estimated to be 1310 people (Table 5.8-1).

The South Florida Water Management District (SFWMD) is the regional governmental agency that oversees the water resources in the southern half of Florida. SFWMD covers 16 counties, including Miami-Dade County and serves 7.5 million residents. The SFWMD serves local governments by supporting efforts to safeguard existing natural resources and meet future water demands through one of the four water supply planning areas. The four water supply planning areas are the Upper East Coast, the Lower East Coast, the Lower West Coast, and the Kissimmee Basin. The planning areas are generally defined by the drainage divides of major surface water systems in South Florida. The Lower East Coast (LEC) Planning Area of the SFWMD encompasses approximately 6100 square miles and includes Miami-Dade County (SFWMD 2005).

The largest water supplier within Miami-Dade County is the Miami-Dade Water and Sewer Department (MDWASD). MDWASD provides drinking water to approximately two million customers in Miami-Dade County (Table 5.8-11) and, currently, draws drinking water from the Biscayne aquifer. The MDWASD water service area contains interconnected systems and thus, for the most part, functions as a single service area. The MDWASD service area can be broken down into three subareas by water treatment facilities: the Hialeah-Preston Water and Sewer Department (WASD), serving the northern part of Miami-Dade County, the Alexander Orr, Jr.

WASD, serving the central and portions of the southern part of Miami-Dade County and the South Dade WASD, serving the southern part of Miami-Dade County. The MDWASD has a 20 year water use permit issued by the SFWMD which limits its annual allocation to 149,106 million gallons and its monthly maximum allocation to 13,047 million gallons. These allocations are further limited by a wellfield operational plan, described in Limiting Condition 27 of the water use permit. (MDWASD 2008)

In addition to MDWASD, there are four other water suppliers within Miami-Dade County that provide water to parts of unincorporated Miami-Dade County and within their respective municipal boundaries: city of North Miami, city of North Miami Beach, city of Homestead, and Florida City. The city of North Miami and the city of North Miami Beach supply water within their municipal boundary as well as outside of their municipal boundary to certain northern parts of unincorporated Miami-Dade County. The city of North Miami Beach supplies water within its municipal boundary as well as outside its municipal boundaries to certain northern parts of unincorporated Miami-Dade County. The city of Homestead provides water within its municipal boundary and for a portion of unincorporated Miami-Dade County, including the Redavo development, from 6 city-owned withdrawal wells. The city of Homestead also has an agreement with the MDWASD to provide some water service within portions of Homestead municipal boundary. Florida City provides water service within its incorporated boundaries from 4 production wells (MDWASD 2008) and also provides water to portions of unincorporated Miami-Dade County as a water supplier.

Currently, several of the water suppliers in Miami-Dade County have projects being either proposed, initiated, or under construction to increase drinking water capacity. MDWASD has proposed alternative water supply projects to meet MDWASD's anticipated increased water demands through 2030. Projects include: expanding disinfection systems in the aquifer storage recovery system; constructing a reverse osmosis (RO) water treatment plants to treat Floridan aquifer water, hence providing additional capacity; and adding water reclamation plants to the north, south and west districts. These projects are part of MDWASD's commitment to provide a total of 170 mgd of reuse water in accordance with the county's existing 20 year water use permit. MDWASD is also constructing a new water treatment plant (WTP) in south Miami-Dade County, the South Miami Heights (WTP) and wellfield should be complete by 2012 (MDWASD 2008).

Two other projects involve the city of North Miami Beach and the city of Homestead. The city of North Miami Beach is planning for a future expansion, by 2015, to further increase the capacity of the WTP to a total of 42 mgd and the city of Homestead is considering upgrading the existing well pumping capacity or installing additional wells to supply water to the city owned WTP. Additionally, Florida City plans to increase the city owned WTP capacity by installing additional wells and withdrawing water from the Floridan aquifer, which require further treatment and possible RO facility prior to distribution (MDWASD 2008).

Miami-Dade County (ROI)

As described in Section 3.3, water from the Miami-Dade Water and Sewer Department (MDWASD), which is part of the Miami-Dade County's public water system, would be used to provide the necessary water for potable onsite uses during operation for drinking water, sanitary uses, and fire protection.

It is estimated that Units 6 & 7 would utilize 1.35 mgd of water for normal onsite operational use and a maximum of 3.68 mgd of water for periods of short duration (Table 3.3-1). By the start of the operation of Unit 6 in 2022, the MDWASD system, based on 2007 service area population, should be operating at about 73.95 percent capacity when the 20 mgd South Miami Heights Water Treatment Plant comes online in 2012 (MDWASD 2008). The MDWASD system excess capacity would be reduced by approximately 0.29 percent with normal onsite operations use 0.78 percent under maximum onsite operational demand, for an estimated usage of 74.23 percent (normal operation) to 74.73 percent (maximum use operation) of capacity. The increased use would not stress the public water supplies or infrastructure. Therefore, the impacts would be SMALL and would not warrant mitigation.

As indicated in Table 5.8-1, the operation of Units 6 & 7 could bring as many as 1310 new workers and family members to Miami-Dade County. As described in Subsection 2.5.2.7, municipal water suppliers in the county have excess capacity. The impact to the local water supply systems from operations-related population growth was estimated by calculating the amount of water that would be required by the in-migrating operations-related population and comparing it to the publicly available resources. People in the United States use an average of 100 gpd for all uses (EPA Aug 2008). The increase of 1310 people could increase consumption by 131,000 gpd (0.131 mgd) in Miami-Dade County. The increased use would not stress public water supplies or infrastructure.

Collectively, the major public water suppliers in Miami-Dade County in 2007 are operating at 74.74 percent capacity (Table 5.8-11). If all 1310 operation-related individuals relocated to Miami-Dade County, the service area population would increase by 0.05 percent. The additional demand of approximately 0.1310 mgd would increase the operating capacity to 75.02 percent. The increased use would not stress public water supplies or infrastructure. Impacts to Miami-Dade County would be SMALL and would not warrant mitigation.

Homestead and Florida City Area

The impact to the Homestead and Florida City area, which is a likely area for some of the operation workers to relocate, was estimated by adding the assumed in-migrating operation-related population to the current population in the area. The increased population would represent approximately 43 percent of the total operation workforce, or 559 people, into the Homestead and Florida City area. This population increase would, in turn, increase demand on the public water infrastructure for Homestead and Florida City systems collectively, from 70.79 percent capacity usage to 71.05 percent capacity usage (Table 5.8-11).

Therefore, the increased demand from the estimated increase in population as a result of the operation-related workforce would not exceed the available capacity of the municipal water supplies within Miami-Dade County. Also, the approximately 43 percent population distribution within the Homestead and Florida City area would not exceed the available capacity of the combined water supplies of the Homestead and Florida City area. Therefore, the impacts in Miami-Dade County and to the Homestead and Florida City area would be SMALL and would not require additional mitigation.

Conclusion

Currently, several of the major water suppliers in Miami-Dade County have projects being either proposed, initiated, or under construction to increase drinking water capacity. MDWASD has proposed alternative water supply projects to meet MDWASD's anticipated increased water demands through 2030. Projects include: expanding disinfection systems in the aquifer storage recovery system; constructing a reverse osmosis (RO) water treatment plants to treat Floridan aquifer water, hence providing additional capacity; and adding water reclamation plants to the north, south and west districts. These projects are part of MDWASD's commitment to provide a total of 170 mgd of reuse water in accordance with the county's existing 20 year water use permit. MDWASD is also constructing a new water treatment plant (WTP) in south Miami-Dade County, the South Miami Heights (WTP) and wellfield should be complete by 2012 (MDWASD 2008).

The city of North Miami Beach is planning for a future expansion, by 2015, to further increase the capacity of the WTP to a total of 42 mgd. The city of Homestead is considering upgrading the existing well pumping capacity or installing additional wells to supply water to the city owned WTP. Florida City plans to increase the city owned WTP capacity by installing additional wells and withdrawing water from the Floridan aquifer, which require further treatment and possible RO facility prior to distribution (MDWASD 2008).

The public water infrastructures in Miami-Dade County would not be stressed from the population related increase in the area and the operational demand of Units 6 & 7. The major suppliers are currently using about 74.74 percent of their capacity. With the combined demand from the additional population and the on-site use, the capacity utilization rate will rise to about 75.02 percent (Table 5.8-11), including the South Miami Heights WTP, but excluding planned improvements resulting in capacity expansion likely to be in place prior to Unit 6 startup in 2022 and Unit 7 start in 2023.

5.8.2.2.7.2 Wastewater Treatment Facilities

Sanitary treatment would be provided by a packaged sanitary treatment plant located on the Units 6 & 7 plant area. The sanitary treatment plant would be designed to process sanitary effluent from Units 1 through 7. Therefore, onsite operation for Units 6 & 7 would have a SMALL impact on public wastewater services.

Subsection 2.5.2.7 describes the public wastewater treatment systems in Miami-Dade County, their plan-designed average flows, and monthly average wastewater processed. Wastewater treatment facilities in Miami-Dade County have at least 15 percent available capacity with the exception of the City of Homestead (Table 2.5-38).

Reclaimed water from the MDWASD South District Wastewater Treatment Plant would be used as the primary source of makeup water to the Units 6 & 7 circulating water system. The reclaimed water would be further treated in the FPL reclaimed water treatment facility.

Impacts to local wastewater treatment systems would occur as the population increases as a result of the in-migration of the operation-related workers and their families. The magnitude of the impact can be conservatively estimated by assuming all of the water used by this population would go to a wastewater treatment facility. As previously described, the operations-related population increase could require 0.1310 mgd of drinking water and, by extension, 0.1310 mgd additional wastewater treatment capacity. As described in the following paragraphs, the in-migration of the maximum operations-related workforce and their families would increase the current wastewater treatment system use for Miami-Dade County from approximately 79.85 to 79.88 percent (Table 5.8-12).

Miami-Dade County (ROI)

Subsection 2.5.2.7 describes the public wastewater treatment systems in Miami-Dade County, their plant-designed average flows, and monthly average wastewater processed. Yearly average wastewater processed in Miami-Dade County is 298.62 mgd, with a systems capacity of 374.00 mgd. If an additional 0.1310 mgd were processed in the county, the average daily flow of wastewater to be processed would increase by 0.04 percent, which would increase the capacity use rate by 79.88 percent, in the Miami-Dade County's total capacity (Table 5.8-12). Therefore, impacts to wastewater treatment capacity within Miami-Dade County would be SMALL and would not require mitigation.

Homestead and Florida City Area

The Homestead wastewater treatment facilities (WWTF) are currently operating at approximately 102.20 percent (Table 5.8-12) of capacity; however, the city of Homestead's WWTF use the Miami-Dade Water and Sewer Department (MDWASD) system as backup and excess flows are diverted to the county wastewater treatment facilities. These excess flows are included in the MDWASD South District Wastewater Treatment Plant (SDWWTP) flow reports. The wastewater generated in Florida City falls under the jurisdiction of the SDWWTP. The SDWWTP was operating at 78.54 percent of its capacity in 2009 (Table 5.8-12). If the estimated distribution of operations-related workers (559 people) settled in the area of Homestead and Florida City, the overall capacity could accommodate the increase in population, using both the Homestead WWTF and the SDWWTP due to the remaining capacity at the SDWWTP. Therefore, impacts on wastewater treatment facilities due to operation-induced population increases for Homestead and the SDWWTP would be SMALL and would not require mitigation.

To mitigate any potential impacts, FPL could initiate early communication with local and regional governmental organizations, including planning commissions and local and regional economic development agencies, such as the MDWASD, the Miami-Dade Department of Environmental Resources Management, or the Florida Department of Environmental Protection, to disseminate Unit 6 & 7-related information. Local governments and planning groups would have time to plan for the influx. Infrastructure upgrades and expansions could be funded, at least in part, by Unit 6 & 7-related property and sales and use tax payments.

5.8.2.2.7.3 Law Enforcement, Fire Protection, and Medical Services

Law Enforcement

With respect to onsite law enforcement, FPL would employ its own security force. Security services and emergency response are addressed in the Emergency Plan contained in Part 5 of this COL Application.

Miami-Dade County (ROI)

Residents-to-law enforcement officer ratios for Miami-Dade County are presented in Table 5.8-13. Currently, the ratio of residents-to-law enforcement officer is 825 to 1.

With respect to the influx of workers and their families for operation of Units 6 & 7, 1310 people would move into Miami-Dade County (Table 5.8-1), and this population increase would increase the residents-to-law enforcement officer ratio in the county by 0.05 percent, creating a SMALL impact.

Assuming the county is already near or at its capacity to provide law enforcement protection, maintenance of the current residents-to-law enforcement officer ratio would be desirable. Therefore, to accommodate the additional population caused by Units 6 & 7, two additional law enforcement officers (and associated equipment) would be needed in Miami-Dade County during the operation period to maintain the current ratio.

Homestead and Florida City Area

Residents-to-law enforcement officer ratio for the Homestead and Florida City area is presented in Table 5.8-13. Currently, the Homestead and Florida City area ratio of residents-to-law enforcement officers is 480 to 1. With respect to the influx of workers and their families during operation, approximately 43 percent, or 559 people, would increase the 2007 residents-to-law enforcement officer ratio by 0.86 percent, creating a SMALL impact.

This conclusion and its mitigations are based, in part, on a NRC analysis of nuclear plant refurbishment impacts sustained during original plant construction presented in NUREG-1437. The NRC selected seven case study plants whose characteristics resembled the spectrum of nuclear plants in the United States today. The NRC reported that

> "**…** no serious disruption of public safety services occurred as a result of original construction at the seven case study sites. Most communities showed a steady increase in expenditures connected with public safety departments. Tax contributions from the plant often enabled expansion of public safety services in the purchase of new buildings and equipment and the acquisition of additional staff."

This impact could be mitigated by the use of the increased property and sales/use tax revenues that would be generated by operation of the new units. However, expanding law enforcement services, including the hiring of additional personnel, would likely begin before a sufficient amount of these tax revenues would be available to local governments. Therefore, local governments could access other funding sources or issue bonds until the tax revenues would become available. Also, the full operation workforce would not be in place until approximately month 80 of construction activities (Table 4.4-7), giving local governments time to plan and budget accordingly. Additionally, FPL could communicate regularly with local and regional governmental officials about Units 6 & 7 and its schedules, allowing local and regional officials opportunity to plan for the population influx.

During the peak construction period, in order to maintain pre-Units 6 & 7 construction ratios, six additional law enforcement officers would be required in the ROI (Subsection 4.4.2.2.7.3). The operation workforce would not be in place until approximately month 80 of construction, well after the construction peak (Figure 4.4-1). During the period of operation, two additional law enforcement officers from the current level and associated equipment would be required in the

Miami-Dade County (Table 5.8-13). Therefore, assuming that six additional law enforcement officers were hired in the county during peak construction period, only two of those officers would be required by the end of construction (when the number of workers would drop to 806, Figure 3.10-1) to serve the operations-related population increase. This could cause an overstaffing of four officers and an overstock of equipment. In order to reduce ratios to pre-construction of Units 6 & 7 levels, officers could be attritioned from their duties. Alternatively, officers could be retained to supplement the general provision of law enforcement services in Miami-Dade County, thereby reducing the ratios. Units 6 & 7-related tax payments, including both property taxes and sales and use taxes made by the Units 6 & 7 and its employees, could continue to assist in funding these services.

Fire Protection Services

Fire protection services and emergency response are addressed in the Emergency Plan contained in Part 5 of this COL Application.

Miami-Dade County (ROI)

Residents-to-active firefighter ratios for Miami-Dade County are presented in Table 5.8-14. Currently, the residents-per-active firefighter ratio in the county is 702 to 1. If the number of active firefighters in Miami-Dade County remained at this level, the additional population of 1310 would increase the residents-to-active firefighter ratios in the county by 0.05 percent, creating a SMALL impact. To accommodate the additional population, two additional active firefighters (and associated equipment) would be needed in Miami-Dade County during operation of Units 6 & 7.

Homestead and Florida City Area

As noted in Subsection 2.5.2.7.2, Miami-Dade County Fire and Rescue provides fire protection services for the Homestead and Florida City area. Because the population in the Miami-Dade County Fire and Rescue service area cannot be accurately determined, it is not possible to calculate the current residents-to-active firefighter ratio. However, if the Homestead and Florida City area experiences a population increase of 559 people, or 0.86 percent of the 2005-2009 population, the ratio of residents-to-active firefighters in the Miami-Dade Fire and Rescue service area would increase by less than 1 percent (because the service area would have a larger population base), creating a SMALL impact.

This impact could be mitigated by the use of the increased property and sales/use tax revenues that would be generated by operation of the new units. However, expanding fire suppression services, including the hiring of additional personnel, would likely begin before a sufficient amount of these tax revenues would be available to local governments. Therefore, local governments could access other funding sources or issue bonds until the tax revenues would become available. Also, the operation workforce would not be completely in place until approximately month 80 of construction activities, giving local governments time to plan and budget accordingly. Additionally, FPL could communicate regularly with local and regional governmental officials about Units 6 & 7 and its schedules, allowing local and regional officials opportunity to plan for the population influx.

As with the analysis of the adequacy of law enforcement, this conclusion and its mitigations are also based, in part, on the NRC's nuclear plant refurbishment impact conclusions presented in NUREG-1437.

During the peak construction period, in order to maintain pre-Units 6 & 7 construction ratios, seven additional active firefighters would be required in Miami-Dade County. The operation workforce would reach its peak in month 80 of construction (Table 4.4-7), well after the peak construction period (Figure 4.4-1). During the period of operation, two additional active firefighters and associated equipment would be required in Miami-Dade County to maintain preconstruction ratios (Table 5.8-14). Therefore, assuming that within Miami-Dade County, seven additional active firefighters were hired during the peak construction period (Table 4.4-20), only two of those firefighters would be required by the end of construction (when the number of workers would drop to 403) to serve the operations-related population increase (Figure 3.10-1). This could cause an overstaffing of five firefighters and an overstock of equipment. In order to reduce ratios to preconstruction of Units 6 & 7 levels, firefighters could be attritioned from their duties. Alternatively, firefighters could be retained to supplement the general provision of fire protection services in Miami-Dade County, thereby reducing the ratios. Units 6 & 7-related tax payments, including both property taxes and sales and use taxes made by the Units 6 & 7 and its employees, could continue to assist in funding these services.

Medical Services

Detailed information concerning the medical services in Miami-Dade County is provided in Subsection 2.5.2.7.3.

Medical services and emergency response are addressed in the Emergency Plan contained in Part 5 of this COL Application. Minor injuries to operation workers would be assessed and treated by medical personnel onsite. Other injuries would be treated at hospitals in Miami-Dade County, depending on the severity of the injury. Agreements are in place with some local medical providers to support emergencies.

The opportunities for medical care in Miami-Dade County are provided in Table 2.5-41. According to Table 2.5-41, in 2006, there were 8420 staffed hospital beds in the county. As indicated in Table 2.5-3, the 2005-2009 population of Miami-Dade County was 2,457,044. Adding 1310 residents to the county population would increase the 2005-2009 population by 0.05 percent (Subsection 5.8.2.1). The 0.05 percent increase in the annual admissions and the annual outpatient visits would not be noticeable or burden existing medical service capacity. Therefore, the potential impacts due to the operation of Units 6 & 7 on medical services would be SMALL and mitigation would not be warranted.

5.8.2.2.8 Education

It is estimated that approximately 322 school-aged children would be part of the operations-related in-migration (Table 5.8-1). Since the Miami-Dade County Public Schools District (M-DCPS) covers the entire county, it was assumed that all of the school-aged children would reside in Miami-Dade County. This subsection describes the public and private school systems and accredited post-secondary institutions in Miami-Dade County. The sources for the data presented are Subsections 2.5.2.8 and 4.4.2.2.8, except where cited.

5.8.2.2.8.1 Miami-Dade County Public School District

It is assumed that each in-migrating operation worker would have 0.8 school-age children. Therefore, an in-migrating operation workforce of 403 persons would bring approximately 322 school-aged children. This analysis conservatively assumed that all school-aged children would attend public schools.

As shown in Table 2.5-42, the new and expanded public primary and secondary facilities would provide capacity for an additional 13,746 students. Since the capacity is greater than the estimated number of in-migrating students, the education system within the county could accommodate all students that would accompany the in-migrating operation workers. The school-aged children would increase Miami-Dade County Public School District's 2010-2011 enrollment by 0.09 percent.

5.8.2.2.8.2 Homestead and Florida City Area

As stated in Subsection 2.5.2.8, the Homestead and Florida City area is part of District IX of the Miami-Dade County public school system. The student population in the Homestead and Florida City area could increase by 138 students (Table 5.8-1). The number of school-aged children likely to locate in the Miami-Dade County Public School system, District IX region, but outside of the immediate Homestead and Florida City area, was not determined. Therefore, the percentage impact to the District IX region could not be specifically determined. However, District IX had 55,860 students enrolled in the 2010-2011 school year. Therefore, the impact would be less than 1 percent even if all 322 children in-migrating to Miami-Dade County were to locate in the District IX region. Hence, the impacts to public schools in the Homestead and Florida City area would be SMALL.

5.8.2.2.8.3 Private Schools — Pre-Kindergarten through 12

Miami-Dade County

The assumption was made that the same percentage of in-migrating school-age children would attend private school as those who currently attended private school (15 percent). Of the 322 in-migrating children (Table 5.8-1), approximately 48 may attend private school. As mentioned in Subsection 2.5.2.8.2, there was a total enrollment of 61,161 students in Miami-Dade County private schools. The 48 new students represent less than 0.1 percent of the total private school enrollment. Impacts to private education in the region of influence would be SMALL and not warrant mitigation.

Homestead and Florida City

The assumption was made that the same percentage of in-migrating school-aged children could attend private schools in the Homestead and Florida City area as school-aged children attending private schools in Miami-Dade County (15 percent). Therefore, of the 138 in-migrating school-aged children, 21 may attend private schools. There was a total private school enrollment of 2263 students in the Homestead and Florida City area. The 21 new students represent less than 1.0 percent of the total enrollment. Impacts to private education in the Homestead and Florida City area would be SMALL and not warrant mitigation.

5.8.2.2.8.4 Conclusion

Increased property tax revenues as a result of the increased population, and property taxes on Units 6 & 7, could fund any needed additional teachers and facilities. The Florida Education Finance Program and equalized funding legislation would ensure that the Miami-Dade County Public School District would receive funding to support additional educational services. However, it also means that the property taxes may not go directly to the Miami-Dade County Public School District (Subsections 2.5.2.3 and 5.8.2.2.2). FPL could provide the local communities with information regarding the Units 6 & 7 construction and subsequent operation schedule, giving the school district, particularly Regional District IX, time to make accommodations for the additional influx of students. It is concluded that impacts to Miami-Dade County and Homestead and Florida City area would be SMALL and would not warrant mitigation. Impacts to the private school system would also be SMALL.

5.8.2.2.8.5 Post-Secondary Institutions

Subsection 2.5.2.8.3 describes post-secondary institutions, colleges and universities, vocational schools, and technical colleges within Miami-Dade County and 50-mile radius. The peak operation workforce would not be reached until 2022. FPL could provide the local education institutions, including post-secondary institutions, with information regarding the Units 6 & 7 construction and subsequent operation schedule, giving the institutions time to make accommodations for the influx of operation workers or worker family members that may seek additional post-secondary education or training. The institutions could also modify curriculum offerings and/or contract with FPL to provide onsite and offsite academic courses and job-specific training.

5.8.3 ENVIRONMENTAL JUSTICE IMPACTS

Environmental justice refers to a federal policy under which each federal agency identifies and addresses, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority or low-income populations. The NRC has a policy on the treatment of environmental justice matters in licensing actions (69 FR 52040). The USCB 2010 data at the block group level was used to identify concentrations of minority and of low-income populations. Subsection 2.5.4 defines minority and low-income populations. Figures 2.5-24 through 2.5-30 (Subsection 2.5.4) identify minority and low-income populations within 50 miles. There are 1627 census block groups that are at least partially within 50 miles, 1222 of which are wholly in Miami-Dade County. It was assumed that all of the in-migrating workforce would settle within Miami-Dade County; therefore, the health and environmental impacts and socioeconomic impacts evaluated in this environmental justice analysis are focused on Miami-Dade County. Of the 1222 block groups in Miami-Dade County, 319 have significant Black Race populations, 335 have significant racial aggregate populations, and 783 have significant Hispanic ethnic populations. The Turkey Point plant property is located in a block group meeting the Other race, the aggregate of races, and the Hispanic ethnicity criteria. Two-hundred-twelve block groups in Miami-Dade County contain a significant percentage of low-income households. The closest low-income block group to the proposed site is approximately 4.7 miles north of the plant property.

For the environmental justice analysis, two types of impacts were evaluated: health and environmental impacts and socioeconomic impacts. The following paragraphs summarize the magnitude of each type of impact to the general population and then describe whether minority or low-income populations would experience disproportionately high and adverse impacts. The most likely pathways by which adverse environmental impacts associated with operations could affect human populations were identified, the level of significance of the impact was determined, and the characteristics of the minority or low-income populations would result in disproportionately high and adverse impacts to those populations were assessed. Several socioeconomic resources were also evaluated to determine if operations-related activities could disproportionately, in a high and adverse manner, impact minority or low-income populations. If the impacts to the general population were found to be SMALL, and there were no cultural practices, subsistence living activities, or pre-existing health conditions that would change the significance level of the impact, it was concluded there would be no disproportionately high and adverse impact on low-income or minority populations.

5.8.3.1 Health and Environmental Impacts

There are three primary pathways for health and environmental impacts: soil, water, and air.

Operation activities would not affect soils at Units 6 & 7. There would be no impacts to nearby residents, and, therefore, no disproportionately high and adverse impacts on minority or low-income populations. Impacts to soils from Units 6 & 7 would be SMALL and would not require mitigation.

As described in Section 3.3, operational activities for Units 6 & 7 would use approximately 55 mgd (100 percent reclaimed water) to 124.4 mgd (100 percent radial collector wells) of makeup water for cooling.

As described in Subsection 5.2.2.1, the makeup water for cooling Units 6 & 7 would be provided by the MDWASD SDWWTP from reclaimed water. Currently, SDWWTP disposes of treated wastewater by injection into the Boulder Zone of the lower Floridan aquifer. Use of reclaimed water is addressed by the water use permit for the Miami-Dade consolidated public water supply, issued by the South Florida Water Management District (November 1, 2010). The permit contains several limiting conditions (Numbers 39–43) that apply to the reuse of reclaimed water. Presented in Exhibit 14 and Limiting Condition 41 of the permit is the requirement that MDWASD work with FPL to provide up to 70 mgd of reclaimed water for nuclear projects and 14 mgd for Unit 5 (a combined cycle unit). There are other projects anticipated to make use of SDWWTP wastewater (Exhibit 14). These other water reuse projects listed in Exhibit 14 for the SDWWTP could use a total of 188 mgd of reclaimed water. The largest of the reuse projects planned for the SDWWTP are: (1) furnishing 75.7 mgd of reclaimed water for the Biscayne Bay Coastal Wetlands Project, a component of the Comprehensive Everglades Restoration Plan, scheduled for implementation in 2022, and (2) a proposed wellfield mitigation project that is projected to need 18.6 mgd of reclaimed water. When reclaimed water cannot supply the quantity and/or quality of water needed for the circulating water system, a second source for makeup water would consist of radial collector wells that would withdraw saltwater from under Biscayne Bay.

Four well caissons would be located on the Turkey Point peninsula, east of the existing units. Each radial collector well would consist of a central reinforced concrete caisson extending below the ground level with laterals projecting from the caisson. The well laterals would be advanced horizontally a distance of up to 900 feet and installed at a depth of approximately 25 to 40 feet below the bottom of Biscayne Bay.

The four radial collector wells would provide up to approximately 86,400 gpm (124.4 million gallons per day [mgd]) to supplement the reclaimed water source for cooling water makeup for Units 6 & 7 (Table 3.3-2). Based on groundwater modeling described in Subsection 5.2.1, the radial collector wells would be recharged at a rate ranging from approximately 95 to 99 percent

(118.2 mgd to 123.2 mgd) from Biscayne Bay. This would be predominately localized in the area of the radial collector wells. The remaining recharge would be from groundwater beneath the plant property. The amount of saltwater used (up to a maximum of approximately 123.2 mgd saltwater recharge) compared to the size of the saltwater resource available would be insignificant. Impacts to Biscayne Bay surface waters would be SMALL, and minority and low-income populations would not experience disproportionately high and adverse impacts.

The total liquid and gaseous effluent doses from Units 6 & 7 would be well within the regulatory limits of 40 CFR Part 190. Radiological impacts to members of the public would be SMALL (Subsection 5.4.3). Minority and low-income populations would not experience disproportionately high and adverse impacts.

The operation of Units 6 & 7 would produce noise from the operation of pumps, cooling towers, transformers, turbines, generators, switchyard equipment, and loudspeakers, with the highest level of noise being associated with the operation of the mechanical draft cooling towers. Any noise generated would be attenuated by the distance to the Turkey Point plant property (1452 feet at a minimum) and would be consistent with existing background noise levels. Impacts as a result of noise would be SMALL and would not warrant mitigation (Subsection 5.8.1.1). Minority and low-income populations would not experience disproportionately high and adverse impacts.

Units 6 & 7 would have standby diesel generators that would operate under air permits issued by the state of Florida. This equipment would be operated periodically on a short-term basis; therefore, related emissions would be intermittent. The mechanical draft cooling towers would be equipped with high efficiency drift or mist eliminators to minimize emissions of particulate matter to 0.0005 percent of the circulating water, this is over 99.99 percent control of potential drift emissions based on the circulating water flow. The operation of a nuclear power plant involves the emission of some greenhouse gases, primarily carbon dioxide (CO_2). It is estimated that the total carbon footprint for operation of two AP1000 reactors would be about 640,000 metric tons over the life of the plant. The impact of these emissions on air quality would be SMALL and would not warrant mitigation (Subsection 5.8.1.2). There would be no disproportionately high and adverse impacts to minority or low-income populations.

Health and environmental impacts to the general population from operation of Units 6 & 7 via the three pathways would be SMALL. Therefore, it is concluded that there would be no disproportionately high and adverse impacts to minority or low-income populations within 50 miles via soil, water, or air pathways that would affect the health and environment of populations studied in this environmental justice analysis.

5.8.3.2 Socioeconomic Impacts

Employment as a result from the operation of Units 6 & 7, beginning with the initial arrival of operation workers during the construction period, would increase gradually, allowing market forces to accommodate the new arrivals. Because the in-migrating operation workforce would be much smaller than that of the construction workforce, it is unlikely that the operation workforce would be able to use the entire housing inventory vacated by the construction workforce. As described in Subsection 5.8.2.2.6, it is concluded that the Miami-Dade County could accommodate the entire in-migrating operation workforce and local governments would benefit from positive tax impacts. Therefore, the impact to the region's housing market would be SMALL and mitigation would not be warranted. Minority and low-income block groups are located throughout Miami-Dade County. Low-income block groups are concentrated in the Miami metropolitan area and along U.S. Highway 1 and Florida's Turnpike near Homestead and Florida City. These are also the areas where the current Turkey Point employees reside (Table 2.5-3) and at least a portion of the construction workforce would reside. The excess lower-cost, temporary housing vacated by the construction workforce would come onto the market, driving prices and rents down. The reduction in prices and rents could enable low-income residents displaced by the construction workforce to afford a higher standard of living. Housing for minority and low-income residents in Miami-Dade County would not be adversely or disproportionately impacted by operation of Units 6 & 7.

As presented in Subsection 5.8.2, it is assumed that 322 school-aged children would accompany the in-migrating operation workforce. The public education system within Miami-Dade County will soon have the capacity to seat an additional 13,746 students. Since the capacity is greater than the estimated number of in-migrating students, the education system within the county could accommodate all students that would accompany the operation workers. The school-aged children would increase Miami-Dade County public school's total enrollment by 0.09 percent. As stated in Subsection 2.5.2.8, the Homestead and Florida City area is part of District IX of the Miami-Dade County public school system. The student population in the Homestead and Florida City area could increase by 138 students (Table 5.8-1). The number of school-aged children likely to locate in the Miami-Dade County public school system, District IX region, but outside of the immediate Homestead and Florida City area, was not determined. Therefore, the percentage impact to the District IX region could not be specifically determined. However, District IX had 55,860 students enrolled in the 2010-2011 school year. Therefore, the impact would be less than 1 percent even if all 322 children in-migrating to Miami-Dade County were to locate in the District IX region. Hence, the impacts to public schools in the Homestead and Florida City area would be SMALL and there would be no disproportionately high and adverse impacts to minority or low-income populations.

As described in Subsection 5.8.2.2.3, offsite land use impacts would be concentrated in Miami-Dade County. Impacts would be SMALL within the county because there would be minimal land conversion needed for new housing because the operation workforce and their families would represent less than 0.1 percent of the 2005-2009 population. The Homestead and Florida City area would also experience SMALL impacts for the same reason; population increases in these areas would represent 0.9 percent of the 2005-2009 population. The SMALL impact to offsite land use would not result in disproportionately high and adverse impacts to minority or low-income populations.

The Units 6 & 7 operation workforce would increase traffic on area roadways. As discussed in Subsection 5.8.2.2.4 and provided in Table 5.8-10a, FPL believes that the main arterials have adequate surplus capacity to support additional operations traffic. In general, the roadways between the plant and the major arterials have adequate capacity to support new operation workforce-generated trips, including outage workforce-generated trips, based on a link analysis of the roadways which are part of the Miami-Dade Concurrency Management System (Tables 5.8-10b and 5.8-10d). The two most critical intersections were evaluated for impacts of the normal operation of Units 6 & 7 (Table 5.8-10c). Because portions of these commuting routes are located within minority/low-income areas, these populations would be impacted by increased traffic from normal operation and scheduled outages. In particular, Black Races, Other Races, Hispanic Ethnicity, and Aggregate block groups are located along SW 328th Street/N. Canal Drive, SW 344th Street/Palm Drive, SW 117th Avenue, and SW 137th Avenue/Tallahassee Road. As described in Subsection 5.8.2.2, FPL could implement mitigation measures, such as staggering arrival and departure times, to minimize the impact to transportation. Because of the location of affected roads, some minority block groups would be affected by the traffic congestion. However, these impacts would be at the significance level characterized above and mitigation measures could be implemented.

As presented in Subsection 5.8.2.2.1, the operation of Unit 6 & 7 would result in the creation of direct jobs and 874 indirect jobs, for a total of 1277 new jobs (Subsection 5.8.2). The increase in employment opportunities would be a positive and SMALL impact to Miami-Dade County's economy and could be a beneficial impact to area residents including minority or low-income populations because of the creation of indirect jobs which are often in the retail and service sectors (Subsection 5.8.2.2.1).

The potential impacts from the operation of Units 6 & 7 on public services in Miami-Dade County (Subsection 5.8.2.2.7) were also assessed. Potable water from the Miami-Dade County public water supply would be used for the operation of Units 6 & 7. The Miami-Dade County public water system has excess capacity; current use is at 74.74 percent of capacity. Units 6 & 7 potable water demand would require 0.39 to 1.06 percent of the current Miami-Dade public water supply, which would not stress the system. Likewise, the Homestead and Florida City area, which is a likely candidate for some of the operation workers to relocate, would have enough excess municipal water supply capacity to accommodate the in-migrating operation workforce. Impacts to municipal water suppliers for Miami-Dade County, including the Homestead and Florida City area, would be SMALL (Subsection 5.8.2.2.7.1), and would not disproportionately impact minority or low-income communities.

Onsite sanitary treatment would be provided by a packaged sanitary treatment plant located on the Units 6 & 7 plant area. The sanitary treatment plant would be designed to process sanitary effluent from Units 1 through 7. Therefore, there would be no impact to public wastewater facilities. The increased population in Miami-Dade County from in-migration of the operation workers would impact local wastewater treatment systems. As a whole, the Miami-Dade County wastewater facilities have the total capacity to absorb the increase in population, and county-wide impacts would be SMALL. The Homestead wastewater treatment facility is currently operating at above capacity, but are using the MDWASD SDWWTP as backup because that supplier is operating at approximately 78.54 percent capacity and can assist Homestead. Florida City is served by the MDWASD SDWWTP, and it has enough excess capacity to accommodate the in-migrating operation workforce. Impacts to water supply and wastewater treatment facilities in Miami-Dade County would be SMALL (Subsection 5.8.2.2.7.2). There would be no disproportionately high and adverse impacts to minority or low-income population.

Impacts to law enforcement, fire protection services, and medical facilities would also be SMALL within Miami-Dade County (Subsection 5.8.2.2.7.3). There would be no disproportionately high and adverse impacts to minority or low-income populations.

Local government officials, staff of social welfare agencies, and the Miccosukee Indian Tribe were contacted concerning unusual resource dependencies or practices or health conditions that could result in disproportionately high and adverse impacts to minority and low-income populations.

Many agencies had no information concerning activities and health issues of minority populations. Interviews were conducted with the Community Action Agency, Miami-Dade Office of Community Advocacy, Miami-Dade County Community and Economic Development, Countywide Healthcare Planning, Metro Miami Action Plan Trust, and the Miami-Dade Black Advisory Board. No agency reported dependencies or practices, such as subsistence agriculture, hunting, or fishing, or preexisting health conditions through which minority populations could experience disproportionately high or adverse impacts from the proposed project. Several agencies alluded to the extreme urban nature of the study area and implied that there was no possibility of any subsistence activity on the part of any group.

Contact with the Miccosukee Indian Tribe reported that the tribe member residing on the reservation within the 50-mile radius do not depend on hunting, fishing, or gardening for subsistence. The Miccosukee Tribe does lease land from the SFWMD for hunting, fishing, frogging, agriculture, and to carry on the traditional Miccosukee way of life. However, most tribe members rely on modern means to meet their food needs.

Operation and outage activities would increase traffic along the main routes to the Turkey Point plant property. These routes are located in predominantly Black Races, Other Races and Hispanic Ethnicity, Aggregate, and low-income population areas. Improvements would be made to increase capacities, as described in Subsection 5.8.2.2.4. In summary, it is concluded that impacts from operations-related activities to minority or low-income populations would, with the exception of transportation, reflect impacts to the general population. The disproportionate impacts from operations traffic are location-dependent, rather than occurring through a unique pathway.

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Table 5.8-1
Assumptions for Workforce Migration and Family Composition During the Operation of Units 6 & 7

	Operations
Workforce Characterization	
Peak number of operation workers on-site	806
Workforce migration	
Percent of workforce that would migrate into Miami-Dade County during operations	50%
Total number of workers that would migrate into Miami-Dade County during operations	403
Percent of in-migrating workforce that would migrate into Homestead and Florida City area during operations[(a)]	42.78%
Number of workers that would migrate into Homestead and Florida City area during operations	172
Families	
Percent of workers who would bring families[(b)]	100%
Number of workers who would bring families into Miami-Dade County	403
Average worker family size (worker, spouse, children)[(b), (c)]	3.25
Total workers plus family members that would migrate into Miami-Dade County (= population increase in Miami-Dade County)	1310
Number of workers who would bring families into Homestead and Florida City area	172
Average worker family size (worker, spouse, children)[(b), (c)]	3.25
Total workers plus family members that would migrate into the Homestead and Florida City area (= population increase in Homestead and Florida City area)[(d)]	559
School-age children	
Number of school-age children per family[(b)]	0.8
Total number of school-age children that would migrate into Miami-Dade County (0.8 per family)	322
Total number of school-age children that would migrate into Homestead and Florida City area (0.8 per family)	138

(a) Based on residential distribution of current operation workforce.
(b) Source: BMI 1981
(c) According to the USCB Profile of the General Population and Housing Characteristics: 2010, (USCB 2010b): average family size in Miami-Dade County in 2010 was 3.33. The average family size in Florida was 3.01. Therefore, FPL assumes that an average family size of 3.25 for the construction workforce, as presented in the Battelle Memorial Institute Study (BMI 1981), would also be a reasonable estimate for the operation workforce.
(d) Note: Presented values may not total component values due to rounding.

Table 5.8-2
Direct and Indirect Employment Created During the Operation of Units 6 & 7

Employment	
Direct jobs — In-migrating operation workforce (50% migrating into Miami-Dade County)	403
Employment multiplier for power generation and supply workers in Miami-Dade County (indirect portion only)[(a)]	2.1696
Indirect jobs resulting from in-migration of operation workers (403 x 2.1696)	874
Total number of new, project-related jobs in Miami-Dade County (direct plus indirect)	1,277

(a) Source: BEA 2009a.

Table 5.8-3
Analysis of Annual Impacts to Miami-Dade County from In-migrating Operation Worker Wages

Average annual operation worker wages[(a)]	$81,980
Number of in-migrating operation workers[(b)]	403
Estimated annual payroll from in-migrating workers	$33,037,940
Earnings multiplier for Power Generation and Supply Sector[(c)]	1.7880
Total economic impact to Miami-Dade County (earnings multiplier applied)	$59,071,837
Total personal income in Miami-Dade County, 2009[(d)]	$90,915,774,000
Annual average in-migrating operation worker wages as percent of 2009 personal income in Miami-Dade County	0.06%

(a) BLS 2012a. Average annual wage for a Nuclear Power Operator (51-8011)
(b) The operation workforce achieves full staffing as of construction month 80 (near the end of year 10) of the construction period (Table 3.10-2)
(c) BEA 2009a (Table 4.4-8)
(d) BEA 2011 (Table 4.4-5)

Table 5.8-4
Operation Workforce and Indirect Workers as Percentage in Miami-Dade County

Workforce Characterization, 40-Year Operation Period Plus 20-Year License Renewal Period	Operation Workforce	Indirect Workers	Total
Operation workers	806	—	—
Percentage of workers assumed to migrate into Miami-Dade County	50%	—	—
Number of workers assumed to migrate into Miami-Dade County	403	—	—
Employment multiplier for Power Generation and Supply sector (indirect portion only)[a]	2.1696	—	—
Indirect workers (2.1696 x 403)	—	874	—
TOTAL New project related jobs (direct and indirect)	—	—	1,277
Miami-Dade County employment, 2011[b]	—	—	1,146,823
In-migrating operation workers and indirect workers as percentage of Miami-Dade County labor force, 2011	—	—	0.1%
Number of unemployed persons, Miami-Dade County, 2011[b]	—	156,562	—
Indirect jobs as percent of number of unemployed individuals, Miami-Dade County, 2011	—	—	0.6%

(a) Source: BEA 2009
(b) Source: BLS 2012c (Table 2.5-7)

Table 5.8-5
Analysis of Annual Impacts to Miami-Dade County from Outage Worker Wages[a]

Average annual outage worker wages[b]	$81,980	
Estimated daily wages (annual wage ÷ 250)	$328	
	Regular Outage	**Extended Outage**
Estimated length of outage in days	30	45
Estimated number of outage workers per unit[f]	600	1,000
Estimated annualized payroll, outage workers[c]	$7,870,080	$5,902,560
Earnings multiplier for power generation and supply sector[d]	1.7880	
Personal income in Miami-Dade County, 2009[e]	$90,915,774,000	
Estimated annualized payroll (earnings multiplier applied), outage workers as percent of personal income in Miami-Dade County, 2009	0.015%	0.012%
Economic impact to Miami-Dade County (earnings multiplier applied)	$14,071,703	$10,553,777

(a) To assess potential impacts, the outage workforce is estimated at 600 workers per unit for each regular outage (30 days) and 1000 workers for extended outages (45 days).
(b) BLS 2012b
(c) FPL assumes that regular outages for Units 6 & 7 would occur at 18-month intervals and last for 30 days. It is assumed for this analysis that outages would not occur simultaneously for the two units, and therefore one outage would occur every 9 months. To compare outage worker wages to annual personal income for Miami-Dade County, outage worker wages were divided by 0.75 to achieve an annualized amount (i.e. to increase a 9-month amount to a 12-month amount for purposes of comparison). FPL states that extended outages would occur at 5-year intervals and last for 45 days. It is assumed for this analysis that outages would not occur simultaneously for the two units, and therefore one outage would occur every 2.5 years (30 months). To compare outage wages to annual total income for Miami-Dade County, the outage worker wages were divided by 2.5 to achieve an annualized amount (i.e. to decrease a 30-month amount to a 12-month amount for purposes of comparison).
(d) BEA 2009 (Table 5.8-3)
(e) BEA 2011 (Table 5.8-3)
(f) Assumes 100% of outage workforce migrates into Miami-Dade County

Table 5.8-6 (Deleted)

Table 5.8-7
Estimated Sales Tax Impacts, the Operation of Units 6 & 7 Compared to 2007 Tax Revenue, Miami-Dade County and Florida

	Miami-Dade County	Florida
Year 2011 — Actual Sales Tax Revenues[(a)(b)]	$57,559,000	$19,352,980,000
5% of total	$2,877,950	$967,649,000
10% of total	$5,755,900	$1,935,298,000
20% of total	$11,511,800	$3,870,596,000
Tax rate [(c)(d)]	1.0%	6.0%
Expenditures Required to Exceed Projected Collections by Specified Percentage		
by 5%	$287,795,000	$16,127,483,333
by 10%	$575,590,000	$32,254,966,667
by 20%	$1,151,180,000	$64,509,933,333

(a) Source: MDC 2012 (Table 4.4-14)
(b) Source: FDOR 2011 (Table 4.4-14)
(c) Source: FDOR 2012a (Table 4.4-14)
(d) Source: FDOR 2012b (Table 4.4-14)

Table 5.8-8
Population Increases from Units 6 & 7 Operation Workers over 2005-2009 Populations, Florida, Miami-Dade County, and the Homestead and Florida City Area

Florida population, 2005-2009[(a)]	18,222,420
Percent increase from in-migrating operation workers and families (1310 people[(b)])	0.01%
Miami-Dade County population, 2005-2009[(a)]	2,457,044
Percent increase from in-migrating operation workers and families (1310 people[(b)])	0.05%
Homestead and Florida City area population, 2005-2009[(a)]	64,844
Percent increase from in-migrating operation workers and families (559 people[(b)])	0.86%

(a) Source: USCB 2010a (Table 4.4-15)
(b) Source: Table 5.8-1

Table 5.8-9a
FPL Tangible Personal Property (TPP) Taxes for all Miami-Dade County Properties

Taxing Entity	TPP Taxes Paid by FPL [(a)]	Percent of FPL Payments	Taxing Entity's Total Property Tax Revenue	FPL Payments as Percent of Taxing Entity's Total Property Tax Revenues
Miami-Dade County School District[(b)]	6,594,526	40.3%	1,890,151,904	0.35%
Miami-Dade County[(c)]	8,833,578	54.0%	976,737,000	0.90%
State and Others	—	—	—	—
Florida Inland Navigation District[(d)]	27,580	0.2%	23,948,384	0.12%
South Florida Water Management District[(e)]	427,377	2.6%	442,168,909	0.10%
Everglades Construction Project[(f)]	71,469	0.4%	5,087,359	1.40%
Children's Trust Authority[(g)]	399,717	2.4%	104,402,410	0.38%
Subtotal	926,144	5.7%	575,607,062	0.16%
Total	16,354,248	—	—	—

(a) Source: Table 2.5-19
(b) Source: FDOE 2011 (Table 2.5-21) Revenues for Miami-Dade County School District includes all “local funds” and, thus, includes revenues other than property taxes
(c) Source: MDC 2012
(d) Source: FIND 2010
(e) Source: SFWMD 2010
(f) Source: SFWMD 2011
(g) Source: TCT 2010

Table 5.8-9b
FPL Real and Tangible Personal Property (TPP) Taxes for the Turkey Point Plant, 2007

Taxing Entity	Taxes (Real and TPP) Paid by FPL [a]	Percent of FPL Payments	Taxing Entity's Total Property Tax Revenues	FPL Payments as Percent of Taxing Entity's Total Property Tax Revenues
Miami-Dade School District [b]	$3,316,641	42.8%	$3,742,281,604	0.09%
Miami-Dade County [c]	$4,431,612	57.2%	$1,128,076,000	0.39%
Total	**$7,748,253**	100.0%	**$4,870,357,604**	0.16%

(a) Source: FPL 2008
(b) Source: FDOE May 2008. Revenues for the Miami-Dade County School District includes funds from federal, state, and local governments, and thus include revenues other than property taxes.
(c) Source: MDC Dec 2007

Table 5.8-10a
Existing Traffic Conditions (Peak Hour) for U.S. Highway 1 and Florida's Turnpike

Roadway	Existing Traffic	Capacity	Reserved Trips
Florida's Turnpike	2,893	4,068	1,175
U.S. Highway 1	3,967	6,500	2,533

Source: FPL 2009.
The capacity of U.S. Highway 1 was obtained from Miami-Dade County's Concurrency Management System.
The capacity of Florida's Turnpike was obtained from FDOT's generalized tables.

Table 5.8-10b
Additional Workforce Peak Hour Link Analysis

Miami-Dade County Traffic Count Station	Location	Previous Peak Hour Available Capacity[(a)]	Unit 6 & 7 Trips During Peak Hour[(b)]	New Available Peak Hour Capacity
9956	Palm Dr W of Tallahassee Road	2,799	126	2,673
9952	N. Canal St W of Tallahassee Road	2,346	18	2,328
9944	Campbell Dr E of Florida's Turnpike	1,289	36	1,253

(a) See Table 2.5-16.
(b) FPL 2009, based on traffic patterns of existing workforce.

Table 5.8-10c
Level of Service Achieved at Affected Intersections with Additional Workforce, with Improvements

Intersection	Existing Conditions Level of Service AM peak hour (PM peak hour)	With Units 6 & 7 and Improvements Made to Support Construction Traffic AM peak hour (PM peak hour)	Improvements
Palm Drive / SW 117th Avenue	A (C)	B (B)	• No signal or police control (if the traffic signal remains, it should be set to "Flashing") • One eastbound left-turn lane • One westbound right-turn lane • One southbound left-turn lane
North Canal Drive / SW 117th Avenue	A (B)	A (B)	• No signal or police control (if the traffic signal remains, it should be set to "Flashing") • One separate northbound left-turn lane • One eastbound right-turn lane

Source: FPL 2009, based on traffic patterns of existing workforce.

Table 5.8-10d
Units 6 & 7 Outage Peak Link Analysis

Miami-Dade County Traffic Count Station	Location	Previous Peak Hour Available Capacity[(a)]	Unit 6 & 7 Trips During Peak Hour[(b)]	New Available Peak Hour Capacity
9956	Palm Dr W of Tallahassee Road	2,673	310	2,363
9952	N. Canal St W of Tallahassee Road	2,328	45	2,283
9944	Campbell Dr E of Florida's Turnpike	1,253	89	1,164

(a) See Table 2.5-17.
(b) FPL 2009, based on traffic patterns of existing workforce.

Table 5.8-10e
Level of Service Achieved at Affected Intersections with Outage Workforce, with Improvements

Intersection	Existing Conditions Level of Service AM peak hour (PM peak hour)	With Units 6 & 7 and Improvements Made to Support Construction Traffic AM peak hour (PM peak hour)	Improvements
Palm Drive / SW 117th Avenue	B (B)	B (B)	• Signal or police control (if the traffic signal remains, it should be set to “normal”) • One eastbound left-turn lane • One westbound right-turn lane • One southbound left-turn lane
North Canal Drive / SW 117th Avenue	A (B)	C (B)	• Signal or police control (if the traffic signal remains, it should be set to “normal”) • One separate northbound left-turn lane • One eastbound right-turn lane

Source: FPL 2009, based on traffic patterns of existing workforce.

Table 5.8-11
Public Water — Miami-Dade County: Demand and Capacity with Adjusted Population Increases and Onsite Use

Major Suppliers	Service Area Population, 2007	2007 Daily Average Demand (MGD)	Available Facility Capacity (MGD) (a)	Daily Demand as Percent of Capacity, 2007	Adjusted Population during Operations	Daily Average Annual Demand with Adjusted Population and Onsite Use	Demand as Percent of Capacity during Operations	Percent Increase, Demand of Capacity, Current vs Operations
Public Water: Miami-Dade County: Demand and Capacity with Population Increase (1310 people) and On-site Operations								
Total from major suppliers, Miami-Dade County	2,621,700	398.03	532.55	74.74%	2,623,010	399.51	75.02%	1.48
Miami-Dade County Water and Sewer Department (WASD)(a)(b)	2,250,944	347.81	470.35	73.95%	—	—	—	—
Florida City(c)	15,000	2.33	4.00	58.13%	—	—	—	—
Homestead (c)	71,252	12.47	16.90	73.78%	—	—	—	—
North Miami (c)	97,504	8.50	9.30	91.40%	—	—	—	—
North Miami Beach (c)	187,000	26.93	32.00	84.15%	—	—	—	—
Public Water: Homestead and Florida City Area: Demand and Capacity with Population Increase (559 people)								
Major Suppliers	**Service Area Population, 2007**	**2007 Daily Average Demand (MGD)**	**Available Facility Capacity (MGD)**	**Daily Demand as Percent of Capacity, 2007**	**Adjusted Population during Operations**	**Daily Average Annual Demand with Adjusted Population and On-site Use**	**Demand as Percent of Capacity during Operations**	**Absolute Percent Increase, Demand of Capacity, Current vs Operations**
Homestead and Florida City Area	86,252	14.79	20.90	70.79%	86,811	14.85	71.05%	0.27%
Florida City (b)	15,000	2.33	4.00	58.13%	—	—	—	—
Homestead (b)	71,252	12.47	16.90	73.39%	—	—	—	—

(a) Includes 20 mgd for South Miami Heights water treatment plant scheduled to come online in 2012: SFWMD 2010a.
(b) Source: MDWASD 2008, Table 5-4
(c) Source: MDWASD 2008, Chapter 2.6 and footnote to Exhibit C-4.

Table 5.8-12
Public Wastewater — Miami-Dade County: Demand and Capacity with Adjusted Population Increase

System Name (Facility ID Number)	Permitted Capacity (MGD)	Annual Average Flow (MGD)(a)	Current Flow as Percent of Capacity	Flow as Percent of Capacity, Adjusted Population, Operations	Percent difference Current vs. Operations
Total, Miami-Dade County	**374.00**	**298.62**	**79.85%**	**79.88%**	**0.04%**
City of Homestead (FLA013609)	6	6.13	102.20%	—	—
MDWASD South District WWTP (FLA042137)	112.5	88.36	78.54%	—	—
MDWASD North District WWTP (FLA032182)	112.5	87.63	77.89%	—	—
MDWASD Central District WWTP (FLA024805)	143	116.5	81.47%	—	—

(a) Average for running 12-month period
Source: MDWASD 2009

Table 5.8-13
Law Enforcement Protection in the Miami-Dade County and the Homestead and Florida City Area, Adjusted for the Operation Workforce and Associated Population Increase

Area	Population 2005-2009[(a)]	Population Adjusted for Peak Operations Period[(b)]	Law Enforcement Officers (2010)[(c)(d)]	Ratio of Residents per Law Enforcement Officer, Pre-Construction	Law Enforcement Officers Needed During Peak Operation	Additional Law Enforcement Officers Needed
Miami-Dade County	2,457,044	2,458,354	2,980	825	2,982	2
Homestead and Florida City Area	64,844	65,403	135	480	136	1

(a) Source: USCB 2010a (Table 5.8-8)
(b) Source: USCB 2010a (Tables 5.8-1 and 5.8-8)
(c) Source: FBI 2010a and FBI 2010b (Table 2.5-39)
(d) Source: Miami-Dade County number of law enforcement officers includes officers employed by municipalities within the county.

Table 5.8-14
Fire Protection in the Miami-Dade County and the Homestead and Florida City Area, Adjusted for the Operation Workforce and Associated Population Increase

Area	Population 2005-2009 [(a)]	Population Adjusted for Operations Peak[(b)]	Active Firefighters (2010)[(c)]	Ratio of Residents per Active Firefighters, Pre-Construction	Active Firefighters Needed During Peak Operations	Additional Active Firefighters Needed
Miami-Dade County	2,457,044	2,458,354	3,500	702	3,502	2
Homestead and Florida City Area[(d)]	64,844	65,403	2,070	N/A	N/A	N/A

(a) Source: USCB 2010a (Table 5.8-13)
(b) Source: USCB 2010a (Table 5.8-13)
(c) Source: USFA 2010 (Table 4.4-20)
(d) Source: The Homestead and Florida City area is served by the Miami-Dade Fire Rescue Department; service area population is not available
N/A — Not Available

5.9 DECOMMISSIONING

The NRC defines decommissioning (10 CFR Part 52) as the safe removal of a nuclear facility from service and the reduction of residual radioactivity to a level that permits release of the property for unrestricted use or for use under restricted conditions, and termination of the license. NRC regulation 10 CFR 52.110 specifies the regulatory actions that NRC and a licensee must take to decommission a nuclear power facility. 10 CFR Part 20, Subpart E identifies the radiological criteria that must be met for license termination. These requirements apply to the existing fleet of power reactors and to advanced reactors such as the AP1000.

Decommissioning must occur because NRC regulations do not permit a power reactor licensee to abandon a facility after ending operations. The NRC prohibits licensees from performing decommissioning activities that result in significant environmental impacts not previously reviewed under 10 CFR 52.110. Therefore, the NRC has indicated that licensees for existing reactors can rely on the information in the 2002 Final Generic Environmental Impact Statement (2002 Decommissioning GEIS) on Decommissioning of Nuclear Facilities to determine the environmental impacts of decommissioning for the existing fleet of domestic nuclear power reactors as documented in Supplement 1 to NUREG-0586.

Further, 10 CFR 50.75 delineates the financial requirements for decommissioning. This regulation establishes the requirements for providing reasonable assurance that adequate funds for performing decommissioning are available at the end of plant operations. The DOE funded a study that compares activities and costs required to decommission existing reactors to those required for advanced reactors, including the AP1000 (U.S. DOE May 2004). In addition, the decommissioning cost for Units 6 & 7 has been estimated by calculating the formula in accordance with the provisions of 10 CFR 50.75(c) and the guidance provided in NUREG-1307, Rev. 14 using the DECON alternative.

It is concluded that the generic environmental impacts identified in Supplement 1 to NUREG-0586 bound the impacts that can be reasonably expected from decommissioning the AP1000. The following sections summarize the environmental impacts related to decommissioning, the DOE-funded study on decommissioning costs, general advanced reactor plant design features that would affect eventual decommissioning, the cost estimate for decommissioning, and conclusions regarding the decommissioning of Units 6 & 7 based on this review.

5.9.1 ENVIRONMENTAL IMPACTS RELATED TO DECOMMISSIONING

10 CFR 52.110 specifies the regulatory actions that both the NRC and the licensee must take to decommission a nuclear power facility. These actions include the following:

1. Once the licensee decides to permanently cease operations, it must submit, within 30 days, a written certification to the NRC.

2. The licensee must permanently remove all fuel from the reactor and submit a written certification to the NRC confirming completion of fuel removal.

3. In addition to the certifications, the licensee must submit a post-shutdown decommissioning activities report (PSDAR) to the NRC no later than two years after the date of permanent cessation of operations.

4. The decommissioning process continues until the licensee requests termination of the license and demonstrates that radioactive material has been removed to the levels that permit termination of the license.

NUREG-0586 Supplement 1 was reviewed to determine the environmental impacts during decommissioning. The NRC's stated purpose in developing the 2002 Final Decommissioning generic environmental impact statement (GEIS) was to provide an analysis of environmental impacts from decommissioning activities that can be treated generically so that decommissioning activities for commercial nuclear power reactors conducted at specific sites will be bounded, to the extent practicable, by this and appropriate previously issued environmental impact statements. The 2002 Final Decommissioning GEIS also identifies the decommissioning activities and associated environmental issues that will likely require site-specific analysis before performing a decommissioning activity.

This Supplement incorporated the technological advances in decommissioning operations, experience gained by licensees, and changes made to the NRC regulations since the 1988 Final GEIS on Decommissioning of Nuclear Facilities. In evaluating the environmental impacts arising from those activities included in the scope of the 2002 Final Decommissioning GEIS, the environmental impacts of the following three decommissioning methods were evaluated:

- DECON — The equipment, structures, and portions of the facility and site that contain radioactive contaminants are removed or decontaminated to a level that permits termination of the license shortly after cessation of operations.

- SAFSTOR — The facility is placed in a safe stable condition and maintained in that state (safe storage) until it is subsequently decontaminated and dismantled to levels that permit license termination. During SAFSTOR, a facility is left intact, but the fuel is removed from the reactor vessel and radioactive liquids are drained from systems and components and then processed. Radioactive decay occurs during the SAFSTOR period, thus reducing the quantity of contaminated and radioactive material that must be disposed of during the decontamination and dismantlement of the facility at the end of the storage period.

- ENTOMB — This alternative involves encasing radioactive structures, systems, and components (SSCs) in a structurally long-lived substance, such as concrete. The entombed structure is appropriately maintained, and continued surveillance is carried out until the radioactivity decays to a level that permits termination of the license.

The scope of the 2002 Final Decommissioning GEIS is based on the decommissioning activities performed to remove radioactive materials from the SSCs from the time that the licensee certifies that it has permanently ceased power operations until the license is terminated. Except for decommissioning planning, the activities performed before permanent cessation of operations, including certification that fuel has been removed from the reactor, and impacts related to the decision to permanently cease operations were outside the scope of the 2002 Final Decommissioning GEIS. Further, any potential radiological impacts following license termination that are related to activities performed during decommissioning were also not considered in the 2002 Final Decommissioning GEIS.

The activities and impacts that NRC considered to be within the scope of the 2002 Decommissioning GEIS include:

- Activities performed to remove the facility from service once the licensee certifies that the facility has permanently ceased operations.
- Activities performed in support of radiological decommissioning, including decontamination and dismantlement of radioactive SSCs and any activities required to support the decontamination and dismantlement process.
- Activities performed in support of dismantlement of nonradiological SSCs, such as diesel generator buildings and cooling towers.
- Activities performed up to license termination and their resulting impacts as provided by the definition of decommissioning.
- Activities related to release of the facility or preparation for facility entombment.
- Human health impacts from radiological and nonradiological decommissioning activities.

Each environmental issue within the scope of the 2002 Final Decommissioning GEIS was evaluated to determine whether each issue was considered generic or site-specific. If the issue was considered generic, a significance level of SMALL, MODERATE, or LARGE was assigned. Of the identified environmental issues assessed, the impacts are generic and SMALL for all plants regardless of the activities and identified variables (Table 5.9-1). For activities within the operational area, only two issues were determined to be site-specific—threatened and endangered species and environmental justice. The operational area is defined as the portion of the plant site where most or all of the site activities occur, such as reactor operation, materials and equipment storage, parking, substation operation, facility service, and maintenance. This includes areas within the protected area fences, the intake, discharge, cooling, and associated structures as well as surrounding paved, graveled, maintained landscape, or other maintained areas.

Various activities related to decommissioning that were not considered within the scope of the 2002 Final Decommissioning GEIS are regulated by the NRC or are reviewed by the NRC under other regulatory responsibilities. These activities include:

- Spent fuel storage and maintenance. The NRC has independently made a finding that there is reasonable assurance that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the licensed life for operation (which may include the term of a revised license) of that reactor at its spent fuel storage basin, or at either onsite or offsite independent spent fuel storage installations. This finding is codified in the NRC's regulations in 10 CFR 51.23(a).

- Spent fuel transport and disposal away from the reactor location is governed by regulations in 10 CFR Part 71.

- Low-level waste (LLW) disposal at a licensed LLW site or treatment of LLW at compactor facilities. Regulations related to LLW disposal are in 10 CFR Part 61 and 10 CFR Part 20, Subpart K. A final GEIS supporting the regulations in 10 CFR Part 61, *Final Generic Environmental Impact Statement for 10 CFR Part 61,* was published as NUREG-0945.

- Radiological impacts following license termination. This impact is covered by the Generic Environmental Impact Statement in Support of Rulemaking on Radiological Criteria for License Termination of NRC-Licensed Nuclear Facilities, NUREG-1496.

Definitive plans for decommissioning are required by the NRC after a decision has been made to cease operations. There are three points during the decommissioning process when the licensee performs an evaluation of environmental impacts—during submittal of the PSDAR and during submittal of the license termination plan, and during performance of the final status survey to verify compliance with the license termination plan. When the licensee must submit a PSDAR to the NRC (within two years following permanent cessation of operation), the PSDAR must include a discussion that provides the reasons for concluding that the environmental impacts associated with the licensee's planned site-specific decommissioning activities will be bounded by an appropriate previously issued environmental assessment, including the 2002 Final Decommissioning GEIS. If the licensee identifies environmental impacts that are not bounded by a previous NRC environmental assessment, the licensee must address the impacts in a request for a license amendment regarding the activities and submit a supplement to its environmental report that describes and evaluates the additional impacts. The license termination plan must be a supplement to the FSAR and must include a supplement to the environmental report that describes any new information or significant environmental change associated with the licensee's proposed termination activities.

In summary, the decommissioning of a nuclear facility that has reached the end of its useful life generally has a positive environmental impact. In many instances, the environmental impacts resulting from the activities associated with decommissioning are expected to be substantially smaller than those of power plant construction or operation because the level of activity and the impacts to the environment are expected to be smaller during decommissioning than during construction and operation.

5.9.2 DOE-FUNDED STUDY ON DECOMMISSIONING COSTS

The total cost of decommissioning depends on many factors, including the sequence and timing of the various stages of the program, location of the facility, current radioactive waste burial costs, and plans for spent fuel storage. To ensure that a lack of funds does not result in delays or in improper conduct of decommissioning that may adversely affect public health and safety, 10 CFR 50.75 requires that operating license applicants and licensees provide reasonable assurance that adequate funds for performing decommissioning will be available at the end of operation. To provide this assurance, the regulation requires that two factors be considered: (1) the amount of funds needed for decommissioning, and (2) the method used to provide financial assurance. At its discretion, an applicant may submit a certification based either on the formulas provided in 10 CFR 50.75 or, when a higher funding level is desired, on a facility-specific cost estimate that is equal to or greater than that calculated using the formula in 10 CFR 50.75, consistent with guidance provided by RG 1.159.

To support development of advanced reactors for production of electric power and to establish the requirements for providing reasonable assurance that adequate funds for performing decommissioning will be available at the end of plant operations, a study was commissioned by DOE (U.S. DOE May 2004). The study presents estimates of the costs to decommission the advanced reactor designs following a scheduled cessation of plant operations. Four reactor types were evaluated in this report: the advanced boiling water reactor (ABWR), the economic simplified boiling water reactor (ESBWR), the advanced passive pressurized water reactor (AP1000), and the advanced CANDU reactor (ACR-700). The cost analysis described in the study is based on the prompt decommissioning alternative, or DECON, as defined in NUREG-0586. The DECON alternative is also the basis for the NRC funding regulations in 10 CFR 50.75.

DECON comprises four distinct periods of effort:

1. Pre-shutdown planning/engineering

2. Plant deactivation and transition (no activities are conducted during this period that will affect the safe operation of the spent fuel pool)

3. Decontamination and dismantlement with concurrent operations in the spent fuel pool until the pool inventory is zero

4. License termination

Because of the delays in development of the federal waste management system, it may be necessary to continue operation of a dry fuel storage facility on the reactor site after the reactor systems have been dismantled and the reactor operating license terminated. However, these latter storage costs are considered operational costs and are not considered part of decommissioning.

The cost estimates described in the DOE study were developed using the same cost estimating methodology used by NRC and consider the typical features of a generic site located in the southeast, including the nuclear steam supply systems, power generation systems, support services, site buildings, and ancillary facilities. This is considered to be a valid approach for Units 6 & 7. The estimates are based on numerous fundamental assumptions, including labor costs, low-level radioactive waste disposal costs and practices, contaminated tools and equipment present at the end of operations, regulatory requirements, and project contingencies. The primary cost contributors identified in the study are either labor-related or associated with the management and disposition of the radioactive waste.

Advanced reactors have several design features that will impact the ultimate cost of decommissioning (U.S. DOE May 2004). These principal cost influences include:

- Quantity of plant equipment — The quantity of plant equipment requiring disposition has been reduced in the advanced reactor designs. This reduction will have a noticeable impact on the decommissioning cost, including reduced labor costs associated with removal and radiation protection, reduced decommissioning equipment and material costs, reduced waste processing and disposal costs, as well as reduced equipment survey costs.

- Level of contamination or activation — The advanced reactor designs are expected to have improved material selection and water chemistry resulting in reduced radiation levels during plant operation.

- Extent of building contamination — The level of effort to decontaminate the advanced reactor buildings as part of the decommissioning scope is expected to be less than contemporary reactor designs and is believed to be principally due to plant layout.

Overall, the DOE study concluded that with consistent operating and management assumptions, the total decommissioning costs projected for the advanced reactor designs are comparable to those projected by NRC for operating reactors with appropriate reductions in costs due to reduced physical plant inventories (U.S. DOE May 2004).

5.9.3 UNITS 6 & 7 DECOMMISSIONING COST ESTIMATE

A decommissioning cost estimate has been performed for each of the AP1000 units in order to assess the financial obligations pertaining to the eventual decommissioning of the two units. Part 1 of this COL Application describes the plans for providing financial assurance for the decommissioning of the two units and includes a certification regarding the cost estimate for each unit. The cost estimate or “formula amount” for the minimum certification is calculated in accordance with the provisions of 10 CFR 50.75(c) and the guidance provided in NUREG-1307, Rev. 14, which assumes the DECON decommissioning alternative. The estimate assumes the removal of all contaminated and activated plant components and structural materials such that the owner may then have unrestricted use of the site with no further requirements for an operating license. Similar to the DOE study, the primary cost contributors identified are labor-related or associated with the management and disposition of the radioactive waste.

The projected cost to decommission two AP1000s is estimated to be approximately $956 million, reported in year 2012 dollars. This minimum certification amount for each unit was calculated using the formula delineated in 10 CFR 50.75(c) (1) and appropriate escalation indices, including the waste burial factor provided in NUREG-1307, Rev. 14, for the vendor waste processing option.

5.9.4 CONCLUSIONS

The generic environmental impacts associated with decommissioning the existing fleet of domestic nuclear power reactors presented in the 2002 Final Decommissioning GEIS were analyzed along with the expected decommissioning activities for the AP1000. It was determined that the scope of the activities is the same. Projected physical plant inventories associated with advanced reactor designs will generally be less than those for currently operating power reactors due to advances in technology that simplify maintenance and benefit decommissioning. Based on this comparison, it was concluded that the environmental impacts identified in the 2002 Decommissioning GEIS bound the impacts that can be reasonably expected from decommissioning the AP1000.

A total decommissioning cost estimate using the NRC’s formula amount in accordance with 10 CFR 50.75(c) (1) has been projected. The cost projected to decommission two AP1000s using the DECON alternative is estimated to be $956 million, reported in year 2012 dollars.

Section 5.9 References

U.S. DOE May 2004. *Study of Construction Technologies and Schedules, O&M Staffing and Cost, Decommissioning Costs and Funding Requirements for Advanced Reactor Designs*, Volume 1, U. S. Department of Energy, May 27, 2004.

Table 5.9-1
Summary of the Environmental Impacts from Decommissioning Nuclear Power Facilities

Issue	Generic	Impact
Onsite/Offsite Land Use		
- Onsite land use activities	Yes	SMALL
- Offsite land use activities	No	Site-specific
Water Use	Yes	SMALL
Water Quality		
- Surface Water	Yes	SMALL
- Groundwater	Yes	SMALL
Air Quality	Yes	SMALL
Aquatic Ecology		
- Activities within the operational area	Yes	SMALL
- Activities beyond the operational area	No	Site-specific
Terrestrial Ecology		
- Activities within the operational area	Yes	SMALL
- Activities beyond the operational area	No	Site-specific
Threatened and Endangered Species	No	Site-specific
Radiological		
- Activities resulting in occupational dose to workers	Yes	SMALL
- Activities resulting in dose to the public	Yes	SMALL
Radiological Accidents	Yes	SMALL
Occupational Issues	Yes	SMALL
Socioeconomic	Yes	SMALL
Environmental Justice	No	Site-specific
Cultural and Historic Resource Impacts		
- Activities within the operational area	Yes	SMALL
- Activities beyond the operational area	No	Site-specific
Aesthetics	Yes	SMALL
Noise	Yes	SMALL
Transportation	Yes	SMALL
Irretrievable Resources	Yes	SMALL

Source: NUREG-0586.

5.10 MEASURES AND CONTROLS TO LIMIT ADVERSE IMPACTS DURING OPERATIONS

Sections 5.1 through 5.9 describe potential environmental impacts that could result from construction of Units 6 & 7. Such adverse environmental impacts would be reduced or eliminated through implementation of measures and controls such as:

- Compliance with applicable local, state, and federal ordinances, laws, and regulations
- Compliance with environmental requirements compelled by permits and licenses
- Compliance with site procedures, plans, and programs

In Table 5.10-1, the environmental impacts and corresponding measures and controls described in previous sections of Chapter 5 are summarized along with the significance of potential impacts (i.e., SMALL, MODERATE, or LARGE).

Table 5.10-1 (Sheet 1 of 17)
Summary of Potentially Adverse Impacts of Operation

Reference Section	Description of Potential Impact	Significance of Impact[(a)]	Planned Control Program
5.1 Land Use Impacts			
5.1.1 The Site and Vicinity	Land would be permanently dedicated to Units 6 & 7 infrastructure on the Turkey Point Plant property until decommissioning.	S	No mitigation would be required.
	Potential impacts from salt deposition affecting vegetation and critical habitat for the American crocodile.	S	No mitigation would be required.
	Potential impacts from the reclaimed and potable water pipelines and transmission corridors, located primarily offsite. (Land within the right-of-way would be permanently dedicated until decommissioning, but would be compatible with many uses. In addition, the radial collector wells would be emplaced under Biscayne Bay.)	S	Existing corridors would be used to the extent practical.
5.1.2 Transmission Corridors and Offsite Area	Potential impacts from maintenance practices including mowing and application of herbicides and growth-regulating chemicals for transmission corridors, water pipelines, and access roadways.	S	The right-of-ways would be maintained with management plans designed to protect the land use of contiguous properties. The exact manner in which maintenance would be performed would depend on the location, type of terrain, and surrounding environment. An example of a possible management plan includes cultivation and grazing where compatible.
	Potential impacts to offsite land disposal facilities from disposal of radioactive (low-level radioactive waste and spent nuclear fuel) and nonradioactive wastes that would be generated as a result of operation of Units 6 & 7. (Cooling system blowdown and process wastewaters would be disposed of in deep injection wells.)	S	Disposal area(s) for nonradioactive and low-level radioactive waste would be at a permitted waste disposal facilities with a land use designated for such activities. Disposal area for spent nuclear fuel would be a U.S. Department of Energy facility that is licensed by NRC.

Table 5.10-1 (Sheet 2 of 17)
Summary of Potentially Adverse Impacts of Operation

Reference Section	Description of Potential Impact	Significance of Impact[a]	Planned Control Program
5.1.3 Historic Properties and Cultural Resources	Potential impacts from operational activities, including maintenance activities (e.g. repair/ replacement of underground piping), in areas that were previously disturbed during construction of Units 6 & 7. (It is unlikely that plant operations would uncover historical properties that were not discovered and properly processed during plant construction.)	No Impact	The unanticipated finds plan implemented during construction would be slightly modified for operational activities and included in the operational procedures for Units 6 & 7.
5.2 Water-Related Impacts			
5.2.1 Hydrologic Alterations and Plant Water Supply	Potential impacts from the operation of the principal structures of Units 6 & 7 (power blocks, makeup water reservoir and cooling towers, switchyard, and other infrastructure) and associated facilities (security facility). (The groundwater hydrologic flow in the vicinity of these structures may be slightly altered.)	S	No mitigation would be required.
	Potential impacts from the spoils areas. (The proposed spoils areas would be bermed to direct drainage from the spoils piles to the cooling canals/industrial wastewater treatment facility.)	S	No mitigation would be required.
	Potential impacts from the access roads maintenance, heavy haul road, and equipment barge unloading area. (The roads maintenance would use sedimentation control for surface water control.) (The surface water and groundwater hydrologic flow could be temporarily altered.)	S	Water from the dewatering process would be handled by environmental best management practices. Any areas of disturbed soils would be recontoured and reestablished, if necessary, in a timely manner which would reduce the potential for erosion through surface water runoff. Soil retention techniques such as silt barriers would be used to reduce impacts in accordance with best management practices developed for Units 6 & 7.

Table 5.10-1 (Sheet 3 of 17)
Summary of Potentially Adverse Impacts of Operation

Reference Section	Description of Potential Impact	Significance of Impact[(a)]	Planned Control Program
5.2.1 Hydrologic Alterations and Plant Water Supply (cont.)	Potential impacts from operational utilities maintenance (water and sanitary treatment facilities, reclaimed water pipeline and potable water pipeline.) (The surface water and groundwater hydrologic flow could be temporarily altered.)	S	Water from the dewatering process would be handled by environmental best management practices. Soil retention techniques such as silt barriers would be used to reduce impacts in accordance with best management practices developed for Turkey Point Units 6 & 7.
	Potential impacts from the operation and maintenance of the radial collector wells. (Activities could be necessary that would require drawdown of surface water and screen cleaning of the radials under Biscayne Bay.) (The surface water and groundwater hydrologic flow could be altered.)	S	Water from the localized dewatering process would be handled by environmental best management practices and directed to the industrial wastewater facility.
	Potential impacts from the operation and maintenance of the deep injection wells. (Deep injection wells would be operated according to agency regulations.) (The surface water and groundwater hydrologic flow could be altered.)	S	A monitoring program would be utilized to detect vertical migration of injected fluids into the Upper Floridan aquifer through the confining layer overlying the Boulder Zone.
	Potential impacts from transmission right-of-way, potable and reclaimed water pipelines right-of-way maintenance activities. (Activities could be necessary that would require excavation and dewatering. The dewatering activity would create temporary drawdown of the water table. The disturbance of surface soils during maintenance activities could result in impacts.)	S	Water from the dewatering process would be handled by environmental best management practices. Soil retention techniques such as silt barriers would be used to reduce impacts in accordance with best management practices developed for Turkey Point Units 6 & 7.
	Potential impacts associated with vehicular traffic from right-of-way maintenance activities. (Activities could result in the rutting of access roads along the rights-of-way, which could impact surface flow in the vicinity of the disturbance.)	S	Any areas of disturbed soils would be recontoured and reestablished, if necessary, in a timely manner which would reduce the potential for erosion through surface water runoff.

Table 5.10-1 (Sheet 4 of 17)
Summary of Potentially Adverse Impacts of Operation

Reference Section	Description of Potential Impact	Significance of Impact[(a)]	Planned Control Program
	Potential impacts from FPL-owned fill source. (The proposed fill areas could be bermed to stabilize surface water flow.) (The surface water and groundwater hydrologic flow could be temporarily altered.)	S	Water from the excavation process would be handled by environmental best management practices and groundwater levels would stabilize after storm events end, no further mitigation would be required.
5.2.2 Water Use Impacts	Potential impacts from diverting public water for other beneficial uses. Potable water in the amount of 936 gpm (1.35 mgd) to 2553 gpm (3.68 mgd) would be supplied to the site by Miami-Dade County.	S	No mitigation would be required.
	Potential impacts from the withdrawal of groundwater from Biscayne aquifer and Biscayne Bay.	S	A monitoring well system would be installed near the location of the radial collector well caissons that would be used to monitor the groundwater elevation and quality during operation of the radial collector wells.
5.2.3 Water Quality Impacts	Potential impacts from operational maintenance activities along the transmission rights-of-way, the reclaimed water pipelines, and potable water pipelines. (Maintenance activities could result in impacts to surface water quality. These impacts could result from surface water runoff, which could include the transport of chemical releases (e.g., spills of hydraulic fluid) to the environment or from the transport of sediment to nearby surface water features.)	S	The use of environmental best management practices along with a spill prevention plan would prevent or minimize the potential impacts of sediment transport or releases to the environment.
	Potential impacts from operation of radial collector wells. (Operation of radial collector wells installed beneath Biscayne Bay would have minimal impact the water quality of the bay. A small percentage of recharge water would come from points under the plant property. The aquifer is not used as a potable water supply near the Turkey Point property.	S	Monitoring wells could be installed and used to monitor the groundwater level and water quality inshore of the radial collector well locations.

Table 5.10-1 (Sheet 5 of 17)
Summary of Potentially Adverse Impacts of Operation

Reference Section	Description of Potential Impact	Significance of Impact(a)	Planned Control Program
5.2.3 Water Quality Impacts (cont.)	Potential impacts to water quality from operations. (Any contaminants (e.g., diesel fuel, hydraulic fluid, antifreeze, lubricants, or other pollutant) spilled during operations, and not contained or remediated, could seep, over time, into the water table, affecting the water table if significant in quantity, aquifer and could ultimately over a long period of time move to Biscayne Bay.)	S	Environmental best management practices and a spill prevention plan would be used to minimize and prevent impacts. Any minor spills of diesel fuel, hydraulic fluid, lubricants, or other pollutants would be cleaned up quickly to prevent them from moving into the groundwater.
5.3 Cooling System Impacts			
5.3.1 Intake System	Potential impact from the operation of the radial collector wells.	S – wetlands	Continue FPL crocodile program that mitigates the impacts to American crocodile.
5.3.2 Impacts of Cooling System Discharge System on Aquatic Ecosystems	Potential impacts from the deep injection wells. (Discharge would be via underground injection into the Boulder Zone, which would not afford a pathway for the discharge water to reach surficial aquifers or surface waters.)	S	The FDEP permitting process for the deep injection well permits including monitoring requirements for groundwater quality and groundwater elevation data in overlying aquifers would be adhered to.
5.3.3 Heat Discharge System	Potential impacts from the heat discharge system—mechanical draft cooling towers. (Use of cooling towers would lead to creation of plumes. Plumes have the potential for shadowing, fogging, and increasing humidity and precipitation.)	S	No mitigation would be required.

Table 5.10-1 (Sheet 6 of 17)
Summary of Potentially Adverse Impacts of Operation

Reference Section	Description of Potential Impact	Significance of Impact[(a)]	Planned Control Program
5.3.3 Heat Discharge System (cont.)	Salt deposition was estimated locally at the southern end of the plant area. Salt deposition of 10 Kg/Ha/month is generally confined to the plant property and at the cooling canals, with the exception of the eastern and southeastern perimeters of the site. The terrestrial habitats receiving highest deposits would include the cooling canals of the industrial wastewater facility, industrial/ developed lands, and a narrow band of mangroves along the Biscayne Bay shore immediately east of the facility. The salt deposition to the cooling canals, which are critical habitat for the federally-threatened American crocodile would not impact salinity level significantly to impact existing crocodile growth and/or survival rate.	S	No mitigation would be required beyond the existing crocodile management program that mitigates the impacts to American crocodile hatchlings from the existing elevated salinity levels.
	Potential impacts from the heat discharge system—mechanical draft cooling towers. (Noise from the Units 6 & 7 cooling towers could possibly impact wildlife. Noise from cooling towers would be less than the level the NRC considers of small significance.)	S	No mitigation would be required.
	Potential impacts from the heat discharge system—mechanical draft cooling towers. (The mechanical draft cooling towers would be shorter, 70 feet above grade, than the taller natural draft cooling towers that have been associated with bird kills.)	S	No mitigation would be required.

Table 5.10-1 (Sheet 7 of 17)
Summary of Potentially Adverse Impacts of Operation

Reference Section	Description of Potential Impact	Significance of Impact(a)	Planned Control Program
5.3.4 Impacts to Members of the Public	Potential health impact to workers from contact with human disease-causing thermophilic microorganisms in the makeup water reservoir.	S	Personnel would be strictly controlled by administrative controls and security patrols. The makeup water reservoir would be located within the plant area boundary, precluding access by members of the public. Workers would be subject to the worker protection plan, which would provide for personnel protective measures such as personal protective equipment and personnel monitoring.
	Potential impact to members of the public from noise emitted by Units 6 & 7 cooling towers. (Noise levels at 400 feet from the cooling towers are estimated to be on the order of 65 dBA, a level characterized by the NRC in NUREG-1437 as of small significance.)	S	No mitigation would be required.
5.4 Radiological Impacts of Normal Operation			
5.4.3 Impacts to Members of the Public	Potential health impacts to members of the public from exposure to radiological releases. (Modeling using the design and operational parameters of Units 6 & 7 results in estimated doses to the public that are within the design objectives of 10 CFR Part 50 Appendix I and within regulatory limits of 40 CFR Part 190.) Since the dose limits for members of the public in 40 CFR Part 190 are more restrictive than those in 10 CFR 20.1301, demonstration of compliance with the limits of 40 CFR Part 190 is also considered to be a demonstration of compliance with the 0.1 rem limit of 10 CFR 20.1301.	S	Monitor radiological releases as required by radiological monitoring program. Should adverse conditions be indicated, appropriate Units 6 & 7 operating control procedures would be implemented.

Table 5.10-1 (Sheet 8 of 17)
Summary of Potentially Adverse Impacts of Operation

Reference Section	Description of Potential Impact	Significance of Impact[(a)]	Planned Control Program
5.4.4 Impacts to Biota Other than Members of the Public	Potential impacts to terrestrial and aquatic ecosystems from chronic radiation exposure caused by the small discharges of radioactive liquids and gases from the operation of Units 6 & 7. (The calculated dose rate to biota species, 0.14 mrad/day, is much less than the 100 mrad/day criteria—the level at which the International Atomic Energy Agency concludes there are no harmful effects to plants and animals.)	S	Monitor radiological releases as required by radiological monitoring program. Should adverse conditions be indicated, appropriate Units 6 & 7 operating control procedures would be implemented.
5.4.5 Occupational Doses	Potential health impacts to workers from radiation exposure of an annual maximum of dose of 67 person-rem per unit.	S	Monitor radiological releases as required by radiological monitoring program. Should adverse conditions be indicated, appropriate Units 6 & 7 operating control procedures would be implemented.
5.5 Environmental Impacts of Waste			
5.5.1 Nonradioactive Waste System Impacts	Potential impacts to land and groundwater due to the disposal of solid waste.	S	Recycling and waste minimization programs would be employed at Units 6 & 7. Nonradioactive solid waste would be reused or recycled to the extent possible. Solid wastes appropriate for recycling would be managed through use of approved and appropriately licensed commercial waste disposal facilities. Additionally, applicable Florida requirements and standards would be met with regard to the handling, transporting, and disposal of solid wastes offsite. Any onsite waste disposal (e.g., uncontaminated sediment, dredge material) is not under a state regulated program, but the material would be stockpiled in areas with appropriate engineering controls to limit surface water runoff and comply with U.S. Army Corps of Engineers permit.
	Potential impacts to groundwater quality from discharges from the Units 6 & 7 makeup water reservoir. (Treated wastewater and sanitary waste treatment effluent would be disposed through use of the deep injection wells.)	S	Modify the existing Industrial Wastewater Facility Permit for stormwater releases. Obtain the UIC Permit and comply with its permit limits and monitoring requirements.

Table 5.10-1 (Sheet 9 of 17)
Summary of Potentially Adverse Impacts of Operation

Reference Section	Description of Potential Impact	Significance of Impact(a)	Planned Control Program
5.5.1 Nonradioactive Waste System Impacts (cont.)	Potential impacts to water quality of surface water due to increased volume of storm water resulting from new impervious surfaces.	S	Environmental best management practices initiated through the IWW permit would be used.
	Potential impacts to air quality from emissions of auxiliary systems operated on an infrequent basis.	S	Comply with the state of Florida PSD permit limits and regulations for operating air emission sources.
5.5.2 Mixed Waste Impacts	Potential impacts to workers health and environment from the handling and disposal of mixed waste generated as a result of the operation of Units 6 & 7.	S	Appropriate hazardous chemical control and radiological control measures would be applied during testing, handling, and storage of mixed wastes. A waste minimization program would be developed and implemented.
5.6 Environmental Impacts of Transmission Systems			
5.6.1 Impacts to Terrestrial Resources	Potential impacts to vegetation and wildlife habitat within the transmission line rights of way from routine maintenance of woody vegetative growth by manual and mechanical methods and herbicides.	S	Maintenance procedures have previously been established. Consultations would be held with appropriate federal, state, and local agencies about mitigation actions for the known populations of multiple threatened and endangered species, as needed.
5.6.2 Impacts to Aquatic Resources	Potential water quality impacts and subsequent impacts to populations of important aquatic species from maintenance activities in transmission corridors that lie at or near water bodies, wetlands, and SFWMD canals.	S	Environmental best management practices would be used to reduce soil erosion and sedimentation to minimize impacts to all aquatic resources, including mangrove rivulus species, a State and Federal species of special concern. Corridor vegetation management and line maintenance programs and procedures have been established to minimize impacts. The same procedures establish strict guidelines for use of herbicides application according to federal, state, and local regulations. In addition, environmental best management practices would be used to reduce soil erosion and sedimentation vegetation management in forested wetlands would be in full compliance with Florida Statute 403.814 General Permits.

Table 5.10-1 (Sheet 10 of 17)
Summary of Potentially Adverse Impacts of Operation

Reference Section	Description of Potential Impact	Significance of Impact[a]	Planned Control Program
5.6.3 Impacts to Members of the Public	Potential effects to members of the public resulting from the operation and maintenance of the transmission system. (Impacts may occur as visual impacts, electric shock hazards, electromagnetic field exposure, noise impacts, or radio and television interference.)	S	No mitigation would be required. Transmission lines would conform to standards established by the American National Standards Institute, The National Electrical Safety Code, and such other applicable codes and standards that are generally accepted by the industry, except as modified by Florida statutes.
5.7 Uranium Fuel Cycle and Transportation Impacts			
5.7.1.1 Land Use	Potential impacts to land use from fuel cycle. (Total annual land requirements for fuel cycle support would be approximately 300 acres, 34 acres of which would be permanently committed.)	S	Mitigation would not be required.
5.7.1.2 Water Use	Potential impacts to water resources from fuel cycle. (Total annual water use for the fuel cycle would be 2.95E10 gallons.)	S	No mitigation would be required.
5.7.1.3 Fossil Fuel Impacts	Potential impacts to fossil fuel resources from fuel cycle. (Electric energy needs for fuel cycle would be approximately 5% of the output of one of the proposed units. Natural gas consumption for fuel cycle support if used instead to generate electricity would yield less than 0.4% of the energy output of one of the proposed units.)	S	No mitigation would be required.
5.7.1.4 Chemical Effluents	Potential impacts to air and water quality from fuel cycle. (Gaseous effluents would be less than 0.08% of all 2005 US SO_2 emissions and less than 0.02% of all 2006 US NO_x emissions. Milling process chemical effluents are not released in quantities sufficient to have significant impacts on the environment.)	S	All chemical discharges released into the environment are subject to requirements and limitations set by an appropriate federal, state, local, or Native American tribal regulatory agency.

Table 5.10-1 (Sheet 11 of 17)
Summary of Potentially Adverse Impacts of Operation

Reference Section	Description of Potential Impact	Significance of Impact[a]	Planned Control Program
5.7.1.5 Radioactive Effluents	Potential health impacts to members of the public from radioactive effluents from the fuel cycle. The estimated whole-body population dose commitment to the U.S. population would be approximately 4200 person-rem per year, an estimate that correlates with 3.1 fatal cancers, non-fatal cancers, or severe hereditary effects per year to the U.S. population.	S	No mitigation would be required.
5.7.1.6 Radioactive Waste	Potential environmental impacts from disposal of radioactive wastes generated as a result of the fuel cycle. (No significant radioactive releases to the environment are expected from radioactive waste disposal.)	S	No mitigation would be required.
5.7.1.7 Occupational Dose	Potential health impacts to fuel cycle workers caused by radiation exposure. (The estimated occupational dose, attributable to all phases of the fuel cycle, is approximately 1600 person-rem per year for two AP1000 Units.)	S	The dose to any individual would be maintained within the occupational dose limit of 10 CFR Part 20.
5.7.1.8 Transportation	Potential health impacts to transportation workers and members of the public caused by radiation exposure resulting from the loading, unloading, and transport of radioactive materials associated with the fuel cycle. (The estimated dose to workers and the public from transportation associated with the fuel cycle is 6.5 person-rem per year. For comparative purposes, the estimated collective dose from natural background radiation to the population within 50 miles of Units 6 & 7 is 907,000 person-rem per year.)	S	No mitigation would be required.

Table 5.10-1 (Sheet 12 of 17)
Summary of Potentially Adverse Impacts of Operation

Reference Section	Description of Potential Impact	Significance of Impact[(a)]	Planned Control Program
5.7.2 Transportation of Radioactive Materials	Potential health impacts to the public and workers caused by exposure to radiation emitted during incident-free transportation of radiological materials. (Shipments would be less than the one per day condition of 10 CFR 51.52, Table S-4.)	S	Radiological protection programs would manage and limit doses to workers whose jobs would cause them to receive the greatest exposures.
5.8 Socioeconomic Impacts			
5.8.1 Physical Impacts of Station Operation	Potential noise impacts due to the operation of plant systems. The highest levels of noise would be associated with the operation of the mechanical draft cooling towers. (Noise levels at 400 feet from the cooling towers are estimated to be on the order of 65 dBA, a level characterized by the NRC in NUREG-1437 as of small significance.)	S	No mitigation would be required.
	Potential impacts from the increase in traffic noise from the commuting workforce.	S	Noise levels would be minimized by road improvements, including paving the access roads and controlling speed limits.
	Potential impacts to air quality from emissions of auxiliary systems operated on an intermittent basis.	S	Comply with the state of Florida PSD permit limits and regulations for operating air emission sources.
	Potential impacts to greenhouse gases from emissions during operations.	S	No mitigation would be required.
	Potential impacts to air quality from workforce traffic during operations.	S	No mitigation would be required.
	Potential visual impacts to landscape from reactor buildings, cooling towers, and associated plumes.	S	No mitigation would be required.
	Potential impact to area roads from the increase of commuter traffic.	S	No mitigation beyond road improvements installed during construction would be required.

Table 5.10-1 (Sheet 13 of 17)
Summary of Potentially Adverse Impacts of Operation

Reference Section	Description of Potential Impact	Significance of Impact(a)	Planned Control Program
5.8.2 Social and Economic Impacts of Station Operation	Potential impacts from the increase in population related to plant operations.	S (Miami-Dade County) S (Homestead and Florida City)	No mitigation would be required.
	Potential impacts from workers' wages on the local economy related to plant operations.	S, positive (Miami-Dade County) S, positive (Homestead and Florida City)	No mitigation would be required.
	Potential impacts related to indirect jobs from plant operation. (This will reduce the unemployment in the ROI.)	S, positive	No mitigation would be required.
	Potential impacts from temporary outage workers impact to the local economy.	S, positive	No mitigation would be required.
	Potential impacts from taxes collected during plant operation.	S, positive (Miami-Dade County) S, positive (Homestead and Florida City)	No mitigation would be required.
	Potential impacts on land use from plant operations. (There would be very little new residential or commercial development and basic land use patterns would remain in place.)	S (Miami-Dade County) S (Homestead and Florida City)	Communication with local and regional governmental and nongovernmental organizations would be maintained, including but not limited to the Department of Planning and Zoning and Department of Community and Economic Development, to disseminate project information. This would allow these organizations to be given the opportunity to plan accordingly.
	Potential impacts from increased traffic on area roadways due to plant operations.	S	No mitigation beyond road improvements installed during construction would be required.
	Potential impacts from increased traffic on area roadways due to outage workers commuting to Turkey Point.	S	No mitigation beyond road improvements installed during construction would be required.

Table 5.10-1 (Sheet 14 of 17)
Summary of Potentially Adverse Impacts of Operation

Reference Section	Description of Potential Impact	Significance of Impact[a]	Planned Control Program
5.8.2 Social and Economic Impacts of Station Operation (cont.)	Potential aesthetic impacts from plant operations. (Physical structures and infrastructure of Turkey Point onsite as well as operational activities would produce visual and physical impacts for recreational facilities in the vicinity.)	S	No mitigation would be required.
	Potential aesthetic impacts to recreation from plant operations.	S	No mitigation would be required.
	Potential impacts from increased use of recreational facilities within a 50-mile radius.	S (Miami-Dade County) S (Homestead and Florida City)	No mitigation would be required.
	Potential impacts to housing market affecting prices and rents.	S (Miami-Dade County) S (Homestead and Florida City)	Early communications with local and regional governmental organizations, including the Miami-Dade Planning and Zoning Department and the Greater Homestead and Florida City Chamber of Commerce, could be initiated to disseminate information related to Units 6 & 7, such as the schedule of expected worker influx. County and regional planning organizations, and, ultimately, developers and real estate agencies, could factor the details of the emerging housing market into their decision-making and plan accordingly.
	Potential impacts from the increased water demand due to plant operations-related population increase. (It is estimated that the excess capacity in public water supply will be reduced slightly.)	S (Miami-Dade County) S (Homestead and Florida City)	Communication would be held with local and regional governmental planning organizations such as the Miami-Dade County Department of Planning and Zoning, the Miami-Dade County Water and Sewer Department (MDWASD), and the South Florida Water Management District. FPL could share information such as project activity scheduling, and projected workforce in-migration, thus giving these organizations ample time to prepare for demands on services due to the increased population as a result of Units 6 & 7 operations.

Table 5.10-1 (Sheet 15 of 17)
Summary of Potentially Adverse Impacts of Operation

Reference Section	Description of Potential Impact	Significance of Impact[(a)]	Planned Control Program
5.8.2 Social and Economic Impacts of Station Operation (cont.)	Potential impacts from an increase in wastewater requiring treatment due to operations-related population increase. (It is estimated that the increase in water usage would reduce excess treatment capacity by a small amount.)	S (Miami-Dade County) S (Homestead and Florida City)	Early communication with local and regional governmental organizations, including planning commissions and local and regional economic development agencies, such as the MDWASD, the Miami-Dade Department of Environmental Resources Management (DERM), or the Florida Department of Environmental Protection would be initiated, to disseminate Unit 6 & 7-related information. Local governments and planning groups would have time to plan for the influx. Infrastructure upgrades and expansions could be funded, at least in part, by Unit 6 & 7-related property and sales and use tax payments.
	Potential impacts to police and fire department services due to small increases in the ratio of persons to police and firefighters over pre-construction levels. (The ratio would be less than that during the construction period, which could lead to the dismissal of officers and firefighters hired to provide services at that higher population time.)	S (Miami-Dade County) S (Homestead and Florida City)	Turkey Point-related tax payments, including both property taxes and sales and use taxes made by Turkey Point and its employees, could continue to assist in funding these services.
	Potential impacts to medical services due to medical service needs of operations-related population increase. (This increase remains within current medical service capacity.)	S (Miami-Dade County) S (Homestead and Florida City)	No mitigation would be required.

Table 5.10-1 (Sheet 16 of 17)
Summary of Potentially Adverse Impacts of Operation

Reference Section	Description of Potential Impact	Significance of Impact[(a)]	Planned Control Program
5.8.2 Social and Economic Impacts of Station Operation (cont.)	Potential impacts to schools due to the increase in population from the plant operations workforce resulting in an increase in the student population.	S (Miami-Dade County) S (Homestead and Florida City)	Increased property tax revenues as a result of the increased population, and property taxes on Units 6 & 7, could fund any needed additional teachers and facilities. Florida Education Finance Program and equalized funding legislation would ensure that the M-DCPS receiving the students would receive additional funding to support the educational services; however it also means that the property taxes may not go directly to the M-DCPS. FPL would provide the local communities with timely information regarding the proposed activities at the Turkey Point Plant, giving the school district several years to make accommodations for the additional influx of students.
5.8.3 Environmental Justice Impacts	Potential health and environmental impacts to minority or low-income populations resulting from plant operations. (There would be no disproportionately high and adverse health and environmental impacts to minority or low-income populations within 50 miles via soil, water, or air pathways.)	N/A	No mitigation would be required.
	Potential socioeconomic impacts to minority or low-income populations resulting from plant operations. (There would be no disproportionately high and adverse socioeconomic impacts to minority or low-income populations from operations-related activities. Because portions of commuting routes are located within minority/low-income areas, these populations would experience increased traffic from normal operations and scheduled outages.)	N/A	No mitigation beyond road improvements installed during construction would be required.

Table 5.10-1 (Sheet 17 of 17)
Summary of Potentially Adverse Impacts of Operation

Reference Section	Description of Potential Impact	Significance of Impact[(a)]	Planned Control Program
5.9 Decommissioning			
	Potential impacts from decommissioning the plant. (The decommissioning of a nuclear facility generally has a positive environmental impact, relative to the impacts occurring during operations. In many instances, the environmental impacts resulting from the activities associated with decommissioning are expected to be substantially smaller than those of power plant construction or operation.)	S	Mitigation measures from the operations phase that are applicable to decommissioning would be applied (e.g., radiological control practices).
5.12 Nonradiological Health Impacts			
	Potential nonradiological health impacts from plant operations. (The estimated cases of recordable occupational injuries and illnesses for the onsite worker population of Units 6 & 7 based on U.S., Florida, and Units 3 & 4 incident rates are 25, 31, and 4, respectively.)	[(b)]	Implement existing Turkey Point industrial safety program at Units 6 & 7.

(a) The assigned significance levels ([S]mall, [M]oderate, or [L]arge) are based on the assumption that for each impact, the associated proposed mitigation measures and controls (or equivalents) would be implemented (10 CFR Part 51, Appendix B, Table B-1, Footnote 3.) Note, for those categories where there is no potential impact and thus no significance of impact, none, is assigned as the significance level.
(b) Impact is potential and estimates are based on national and Florida rates; therefore, impact severity was not assigned.

IWW = Industrial Wastewater
N/A = Not applicable
SWPPP = Stormwater Pollution Prevention Plan
USACE = United States Army Corp of Engineers

5.11 CUMULATIVE IMPACTS RELATED TO STATION OPERATION

This section describes cumulative adverse impacts to the region's environment that could result from the operation of Units 6 & 7. A cumulative impact is defined in Council of Environmental Quality regulations (40 CFR 1508.7) as an "impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."

To determine cumulative impacts, the impacts of the operation of Units 6 & 7, as described in Chapter 5, were combined with other past, present, and reasonably foreseeable future actions at and near Turkey Point that would affect the same resources, regardless of what agency (federal or nonfederal) or person undertakes such other actions. The cumulative impacts described in this section are those expected to overlap with the impacts of operation of the new units as a result of timing and geographic area. The geographic area that was used when considering cumulative impacts for the various resource areas is found in Table 5.11-1. Not all the impacts of operation of the new units would be cumulative with other past, present, and reasonably foreseeable actions. In addition, the impacts of operation of the new units were based on existing environmental conditions, so the operations impact analyses have already accounted for present actions when the existing state of the resource is used as a comparison for impacts. For example, impacts analysis for water quality and aquatic ecology resources use existing conditions as the baseline for determining impacts. The baseline accounts for the discharges to surface and groundwater from the past as well as the present since discharges directly influence water quality parameters. The aquatic ecology resources baseline would account for past and present actions that play a role in the vitality of aquatic populations and their habitat's ability to sustain a viable population.

With regard to the timing consideration for cumulative impacts from operations, this analysis considers operations impacts from 2022 to the foreseeable future since the time frame for cumulative impacts analysis for construction (Section 4.7) extends to the end of construction activities at Unit 7 in 2022.

During the process of identifying potential projects that could contribute cumulative impacts, a detailed search was conducted for all federal, non-federal and private actions within a 50-mile radius of Turkey Point Units 6 & 7 that had requested either an air or water permit/license or had an environmental impact statement completed. The search was accomplished by searching federal (e.g. USCOE, USGS), state (e.g. FDEP, FDOT), and local (e.g. M-D DERM) websites. The list was refined to projects that were within a 6-mile radius of Turkey Point Units 6 & 7, then within the required timeframe of operation activities of Turkey Point Units 6 & 7, excluding all brownfield and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites.

The timeframe for potential projects that could contribute to cumulative impacts was 2022 to 2063. This timeframe was determined from the schedule for Unit 6 operation activities beginning in the second quarter of 2022 through the initial 40 years license for Units 6 & 7, which would end in 2062 and 2063 respectively. Therefore, the time frame for on-going and future projects to be considered cumulative to those impacts from Units 6 & 7 operation activities is 2022 to 2063.

Other projects in the area considered for cumulative impacts but not retained for analysis are described in Table 5.11-2. Distances listed in Table 5.11-2 are from the Units 6 & 7 plant area unless otherwise noted.

A review of the adopted 2015–2025 Comprehensive Development Plan for Miami-Dade County indicates that land in the 6-mile vicinity, in unincorporated Miami-Dade County, would remain protected land, open land, park land, or agricultural and would not be subject to development. Land farther to the west in the urban areas of Homestead and Florida City had land use designations that would allow development in accordance with local zoning restrictions (MDC Oct 2009). However, given that the time frame for this cumulative impacts analysis is more than 10 years in the future, any information or plans for development in the urban areas would be too speculative for analysis.

5.11.1 LAND USE

As described in Subsection 2.2.1.2, current land use within 6 miles of Units 6 & 7 is described in Table 2.2-2. The vicinity includes areas that have the Land Use Designation “Environmental Protection” and “Open Land” in the Miami-Dade County Comprehensive Development Master Plan (CDMP). Biscayne National Park is northeast of the Turkey Point plant property. The city of Homestead’s Bayfront Park is adjacent to Biscayne National Park.

Most facilities associated with the operation of Units 6 & 7 would be contained in the Turkey Point plant property boundaries except for the reclaimed and potable water pipelines, the portion of the radial collector wells extending under Biscayne Bay, transmission corridors and substation modifications, and the roads improved for use during construction. The potable water and reclaimed water pipelines would follow existing rights-of-way except for areas near the Miami-Dade Water and Sewer Department South District Wastewater Treatment Plant and on the Turkey Point plant property near the FPL reclaimed water treatment facility. New transmission lines would follow existing power transmission corridors to the extent practicable. The laterals for the radial collector wells would be drilled horizontally from the plant property to positions below Biscayne Bay. These features are further described in Subsection 5.1.2. The radial collector wells and portions of the potable water pipelines, reclaimed water pipelines, and transmission corridors are in the 6-mile vicinity. The improved access road, SW 359th Street, would lie within an existing transmission right-of-way and the road improvements, SW 137th Avenue/Tallahassee Road and SW 117th Avenue, would be to existing roads to link to the access road.

Land would be permanently dedicated for Units 6 & 7 and associated infrastructure on the Turkey Point plant property. Additional land would be permanently dedicated for the right-of-ways for new transmission lines, substation modifications, and the reclaimed water and potable water pipelines. The new transmission lines, expanded substations, and the reclaimed water and potable water pipelines would use existing right-of-ways and disturbed areas to the extent practical and right-of-ways are compatible with many agricultural uses. The land use impact for the operation of Units 6 & 7 is described as SMALL in Section 5.1.

As indicated in Table 5.11-3, projects in the vicinity of Homestead and Florida City were considered for cumulative land use impacts. These projects include the continued operation of Units 1 through 5, the Units 3 & 4 Independent Spent Fuel Storage Facility (ISFSI), the Everglades Mitigation Bank (EMB), the INGENCO Resource Recovery Facility, the Homestead-Miami Speedway Improvement project, and the Comprehensive Everglades Restoration Plan (CERP) projects. None of these projects involve a change in land use or acreage during the operation of Units 6 & 7. Future urbanization in the area could contribute to additional decreases in open areas, forests, and wetlands and would generally result in some increase in residential and industrialized areas. Local land-use planning documents describe future construction of residential and commercial buildings (MDC Oct 2009). These urban development projects would have limited impacts on land use because a small incremental amount of land would be converted to a new land use. Overall, the cumulative impact from operation of Units 6 & 7 in conjunction with the projects described above would be SMALL.

Cumulative impacts to historical properties from these projects were also considered. The operation of these projects may potentially involve earth moving activities during maintenance. FPL will develop procedures addressing the inadvertent discovery of historical, cultural, or archaeological resources (Subsection 5.1.3). The operations activities for the CERP projects are overseeing and maintaining pump stations and stormwater treatment impoundments. These operations would likely employ few workers and operations activities are unlikely to impact historical properties outside of the Biscayne Bay Coastal Wetlands (BBCW) project's (Phase 1) objective of positively impacting the Deering Estate by restoring wetlands on this historical property (URS Sep 2006). No impact to historical properties from operation of Units 6 & 7 is anticipated. (Subsection 5.1.3). Given that the other projects considered for cumulative impacts are unlikely to have a significant impact to historical properties, no cumulative impact to historical properties is anticipated.

5.11.2 HYDROLOGY AND WATER USE

5.11.2.1 Surface Water

As described in Section 5.2, Units 6 & 7 would have two sources of makeup water for plant operations and receive potable water from Miami-Dade County for domestic uses. The sources of makeup water for plant operations would be reclaimed water from Miami-Dade County, via reclaimed water pipelines that would be installed during the construction phase, and water collected in the radial collector wells under Biscayne Bay, where groundwater and the waters of Biscayne Bay are hydrologically connected. Cumulative impacts of using Miami-Dade public water supplies for domestic uses at Units 6 & 7 are considered as a component of overall socioeconomic impacts (Subsection 5.11.4).

Operation of the radial collector wells installed beneath Biscayne Bay would cause a SMALL impact on local hydrology and water use. Based on groundwater modeling, the radial collector wells would be recharged at a rate ranging from approximately 95 to 99 percent (118.2 mgd to 123.2 mgd) from Biscayne Bay. This would be predominately localized in the area of the radial collector wells. The remaining recharge would be from groundwater beneath the plant property. The amount of saltwater used (up to 124.4 mgd if 100 percent saltwater) compared to the size of the saltwater resource available would be insignificant. Impacts to Biscayne Bay surface waters would be SMALL and would not require mitigation. A minimal change in water level elevation would occur.

Operation of Units 6 & 7 would involve cooling towers. The cooling canals of the industrial wastewater facility would be impacted by salt deposition from operation of the Units 6 & 7 cooling towers as described in Subsection 5.3.3. However, the cooling canals already have a high salinity level. Impacts on the American crocodile in the industrial wastewater facility would be mitigated through the existing management/conservation plan that implements measures to protect hatchlings that are more vulnerable to the salinity level. The uprated Units 3 & 4 would have an increased thermal discharge into the cooling canals of a maximum of 2.5°F and would increase salinity by 6 percent. However, the increased temperature and salinity would not adversely impact the thriving American crocodile population. With continued implementation of the management/conservation plan, the cumulative impact on the cooling canals of the industrial wastewater facility would be SMALL.

Cumulative impacts on Biscayne Bay from operation of the radial collector wells and the other projects in the immediate vicinity were considered. The CERP projects would rehydrate wetlands that provide water flow into Biscayne Bay, positively impacting Biscayne Bay. EMB also positively impacts Biscayne Bay by preserving wetlands that provide water flow into Biscayne Bay. Other projects identified in Table 5.11-2 would have no impact on Biscayne Bay. The impact on Biscayne Bay from operation of the radial collector wells would be SMALL (Section 5.1). Therefore, the cumulative impact on Biscayne Bay would be SMALL.

5.11.2.2 Groundwater

As stated above, the operation of Units 6 & 7 would use radial collector wells installed under Biscayne Bay as a makeup water source. Water withdrawals would be a maximum of 86,400 gpm (Section 3.3). The impact of this water withdrawal would be SMALL.

Operation of Units 6 & 7 would also involve injection of plant cooling water and process wastewater into the Boulder Zone of the lower Floridan aquifer via deep injection wells. The operation of these wells is presented in Section 5.2.

Cooling water for Unit 5 and process water for Units 1, 2, and 5 is obtained from the Upper Floridan aquifer (Subsection 2.3.2.2.2.1). The Biscayne aquifer is currently being used for disposal of treated domestic wastewater from the Units 3 & 4 wastewater treatment plant (Subsection 2.3.2.2.2.1). For the new units, sanitary treatment would be provided by a packaged sanitary treatment plant located on the Units 6 & 7 plant area. The sanitary treatment plant would be designed to process sanitary effluent from Units 1 through 7. Units 6 & 7 operations would not lead to cumulative impacts to groundwater resources associated with the existing units, because the uses do not overlap.

The projects described in Table 5.11-3 were considered for cumulative impacts to groundwater. The EMB and CERP projects would not withdraw groundwater and would not have wastewater injection wells. However, the wetland preservation/restoration activities that are included in these projects would likely have a positive impact on groundwater resources since they would promote recharge to groundwater rather than runoff. Other projects identified in Table 5.11-2 would have little to no impact on groundwater resources.

Considering the impact from the radial collector wells and the impacts to groundwater resources from the projects described in Table 5.11-3, the cumulative impact to groundwater resources would be SMALL.

5.11.2.3 Water Quality

Subsection 5.2.3 describes water quality impacts from the operation of Units 6 & 7. The use of environmental best management practices along with a spill prevention plan would prevent or minimize the potential impacts of any releases to the environment. Surface water flow for the existing and new units would primarily be to the cooling canals of the industrial wastewater facility, which would limit impacts to offsite areas. The cumulative impacts to the cooling canals of the industrial wastewater facility are described in Subsection 5.11.2.1.

The non-Turkey Point projects considered for cumulative impacts, CERP projects and EMB, would not withdraw water from surface water or groundwater sources. The CERP projects would provide stormwater treatment to minimize negative impacts to waters ultimately receiving the treated stormwater, such as the Biscayne Bay and underlying groundwater. Therefore, adverse impacts to surface water or groundwater resources from these projects are not expected. With the determination that the non-Turkey Point projects would not contribute to cumulative impacts to surface water quality, the cumulative impact to surface water quality would stem from the cumulative impacts to the cooling canals of the industrial wastewater facility. The cumulative impact would be SMALL.

As a result of the encroachment of saltwater into the aquifer approximately 6 to 8 miles landward from the coast, groundwater in the vicinity of the Turkey Point plant property is not used as a source of drinking water (Subsection 2.3.1). Impacts to groundwater resources with respect to water quality resulting from the operation of the radial collector well laterals installed beneath Biscayne Bay are described in Subsection 5.2.3.2.3 as SMALL.

Wastewater from the operation of Units 6 & 7, including blowdown, would be injected into the Boulder Zone of the Floridan aquifer via deep injection wells. The FDEP permitting process for injection well permits would be followed, including monitoring requirements for groundwater quality and groundwater elevation data in overlying aquifers. The impact to groundwater resources from this wastewater injection was characterized as SMALL (Subsection 5.2.1.1.9).

Considering that the existing units use of groundwater does not overlap with the uses for operation of Units 6 & 7 (Subsection 5.11.2.2) and that the non-Turkey Point projects would have positive impacts to water quality, cumulative impacts to groundwater quality would not result.

5.11.3 ECOLOGY (TERRESTRIAL AND AQUATIC)

5.11.3.1 Terrestrial

The projects described in Table 5.11-2 that are in the immediate vicinity of the Turkey Point site were considered for cumulative impacts to terrestrial resources. The CERP projects and EMB have positive impacts to terrestrial ecology by restoring and maintaining wetlands allowing plants and animals that depend on wetlands to thrive. Similarly, additional land acquisition and continued conservation activities at the various nature preserves and parks in the area would have positive impacts to terrestrial ecology by preserving natural habitats. Operation of the existing Turkey Point facilities (additional description of Units 3 & 4 uprate below) are subject to management/conservation plans designed to protect important species with particular focus on the threatened American crocodile (Subsection 2.4.1). As described in Subsection 2.4.1, Turkey Point's conservation efforts have contributed to the increase in population of the American crocodile. In addition, other species of special concern are protected with project-specific management plans (Section 4.3). For example, U.S. Fish and Wildlife Service guidelines for the protection of the Eastern indigo snake during construction projects were incorporated into the conservation/management plan for the Unit 5 Expansion Project.

As presented in Subsection 5.11.2.1, the cooling canals of the industrial wastewater facility would experience a cumulative impact from salt deposition from operation of the Units 6 & 7 cooling towers and discharges from the uprated Units 3 & 4 that would increase temperature and saline levels. However, the increased temperature and salinity attributable to the uprated Units 3 & 4 are not anticipated to adversely impact the thriving American crocodile population and salt deposits from the Units 6 & 7 cooling towers into the cooling canals also would not impact salinity levels sufficiently to impact existing crocodile growth and/or survival rates (Subsection 5.3.3).

The impacts to terrestrial ecological resources from operation of the Units 6 & 7 cooling water system and operation and maintenance of the transmission line and pipeline corridors are characterized as SMALL, and SMALL to MODERATE. The impacts to terrestrial resources from the projects considered for cumulative impacts would have a SMALL adverse contribution to cumulative impacts or have a beneficial impact. The overall cumulative impact would be SMALL to MODERATE.

5.11.3.2 Aquatic

The impact to aquatic resources from the operation of Units 6 & 7 was characterized as SMALL in Section 5.3. This SMALL impact along with the projects described above was considered for cumulative impacts to aquatic ecological resources. The CERP projects and EMB would have positive impacts to aquatic ecology by restoring and maintaining wetlands allowing plants and aquatic organisms that depend on wetlands to thrive. As presented above in Subsection 5.11.3.1, the cooling canals of the industrial wastewater facility could experience a cumulative impact from Units 6 & 7 and the uprated Units 3 & 4. As stated in Subsection 5.3.1.2, the fish and aquatic invertebrate species that occur in the cooling canals of the industrial wastewater facility are ubiquitous pioneer species with broad physiological tolerances for salinity and temperature extremes. However, this cumulative impact to the cooling canals of the industrial wastewater facility would have a negligible impact on aquatic biota and would not adversely impact the thriving American crocodile population. The cumulative impacts to aquatic resources would be SMALL.

5.11.4 SOCIOECONOMIC RESOURCES

Impacts to socioeconomic resources stem from the demands placed on the region by the workforce. The facilities and projects described in Table 5.11-2 were considered for their potential to result in cumulative socioeconomic impacts. Because the socioeconomic analysis presented in Subsection 5.8.2 uses existing socioeconomic conditions and forecasts based on existing conditions as a baseline, the impacts of the existing facilities (with the exception of outages) have already been accounted for in the operational impact analysis which concluded that impacts would be SMALL with the exception of transportation, which would be MODERATE.

The projects described in Table 5.11-3 would have no or few workers, which would have a negligible socioeconomic impact. The Units 3 & 4 uprate would lead to greater revenues as a result of the sale of the additional electricity and thus lead to increased corporate taxes. As described in Subsection 5.8.2.2, for every $1 million of net taxable revenues, FPL may pay $55,000 in corporate income tax, which represents an increase of 0.002 percent more than Florida's 2007 corporate income tax revenues. The restored and preserved wetlands of the CERP projects and the EMB would have socioeconomic benefits to the area that are difficult to quantify. The more tangible socioeconomic benefits would include any taxes paid by FPL and other property owners on the compensation paid to the few employees that perform maintenance and monitoring.

In addition to normal operations at the existing units, the nuclear-generating units, Units 3 & 4, would also have periodic outages. With outages occurring at all four nuclear units, the frequency of the temporary impacts from outages would increase. These additional workers (approximately 600 workers for Units 6 & 7) could temporarily increase traffic and housing demand. In addition, there could be temporary and short-term job opportunities for lodging and restaurant workers to serve the outage workforce, along with SMALL and positive impacts to motels, restaurants, retailers, and other businesses patronized by the outage workers.

Given the socioeconomic impacts from the operation of Units 6 & 7 and the other projects considered for cumulative impacts, the cumulative impact to socioeconomic resources would be SMALL with the exception of transportation which would be MODERATE.

An assessment of environmental justice impacts for the operation of Units 6 & 7 concluded that impacts from operations-related activities to minority or low-income populations would, with the exception of transportation, reflect impacts to the general population. Operations and outage activities could cause traffic congestion along several of the main routes to the Turkey Point plant property. These routes travel through minority and/or low-income areas. As stated above, the traffic congestion assessment accounted for the existing units. The outage workforce for Units 3 & 4 averages 600 to 900 workers and would not be concurrent. The potentially larger outage workforce (600 workers for Units 6 & 7 and up to 900 for Units 3 & 4) could increase the traffic on outage days. Therefore, the cumulative impacts to transportation would be MODERATE and cumulative impacts to environmental justice with regard to transportation would also be MODERATE.

5.11.5 ATMOSPHERIC AND METEOROLOGICAL

Impacts to air quality would result from equipment associated with plant auxiliary systems (e.g., diesel generators, diesel-driven fire pumps). Emissions of criteria pollutants from Units 6 & 7 would be from fossil-fired equipment, as presented in Subsection 5.5.1.3. Because such equipment would be operated infrequently and usually for short periods of time, they would have a SMALL impact to air quality.

As described in Subsection 2.7.2.2, the impact of existing unit operations on air quality conditions at the nearby Florida Everglades Class I Area can be gauged on the basis of air quality monitoring data collected by the National Park Service at the Florida Everglades air quality monitoring station. The National Park Service reported that, based on data collected during the period 1996 through 2005, the trend in National Ambient Air Quality Standards pollutant concentrations during the period was that of a steady-state (Subsection 2.7.2.2).

The uprate project for Units 3 & 4 and Units 3 & 4 ISFSI would not lead to an increase in air pollutants, and the CERP projects and EMB would not have air release, except possibly from the occasional maintenance vehicle. Operation of the INGENCO Resource Recovery Facility would result in criteria pollutant emissions. However, the Florida Department of Environmental Protection (FDEP) concluded that emissions from the INGENCO Resource Recovery Facility would not significantly contribute to, or cause a violation of, any state or federal ambient air quality standards and the INGENCO Resource Recovery Facility's impact on the Everglades Class I area is less than significant (M-D DERM Mar 2010). Therefore, the air pollutants that would be attributable to these projects would have a SMALL impact to air quality and the cumulative impact to air quality would be SMALL.

Operation of the Units 6 & 7 cooling towers would result in plumes, salt deposition, and noise that would have a SMALL impact to atmospheric conditions. The plumes would remain primarily on the Turkey Point plant property. The shadowing and precipitation associated with the plumes would take place primarily onsite (Subsection 5.3.3.1). Modeling predicts maximum salt deposits (105 kg/ha/month) near the makeup water reservoir of the Units 6 & 7 plant area, and salt deposition of 10 kg/ha/month would generally be confined to the Turkey Point plant property and the industrial wastewater facility, with the exception of the southeastern perimeter of the plant property. Additionally, the estimated noise level associated with the Units 6 & 7 cooling towers would drop below 60 to 65 dBA, the level the NRC considers of SMALL significance, at a distance of 500 feet from the cooling towers as a result of attenuation (Subsection 5.3.3). The uprate project for Units 3 & 4, Units 3 & 4 ISFSI, CERP projects and EMB would not have an impact on atmospheric conditions. The Unit 5 cooling tower has plumes that remain primarily on the Turkey Point plant property with shadowing, precipitation, and fogging also staying primarily on the plant property. The salt deposits from the Unit 5 cooling tower would be a maximum average of 6.34 kg/ha/month at 200 meters. Therefore, the cumulative impact to atmospheric conditions would be SMALL.

5.11.6 RADIOLOGICAL

For the purposes of this analysis, the region of interest is the area within the 50-mile radius of the Turkey Point site. The region of interest includes the existing Units 3 & 4, the Units 3 & 4 ISFSI, and a number of hospitals and industrial facilities that use radioactive materials. There are no other new nuclear facilities planned within 50 miles of the site. Because the analysis of radiological impacts presented in Subsection 5.4 uses existing conditions as a baseline, the impacts of the existing facilities have already been accounted for in the operational impact analysis.

Units 6 & 7 would release small quantities of radioactivity to the environment through both permissible liquid and gaseous releases. The permissible liquid releases would be released into deep injection wells approximately 2900 feet underground. Based on a receptor analysis and liquid exposure dose modeling, the predicted doses from radioactive liquid effluent disposal would be negligible. The existing nuclear units, Units 3 & 4, release small quantities of radioactivity. A small radiological dose would be attributable to the Units 3 & 4 ISFSI. Table 5.4-4 shows that the maximum exposed individual doses are within the design objectives of 10 CFR Part 50, Appendix I. Table 5.4-5 shows that the total site doses from the two new units as well as the two existing nuclear units are within the regulatory limits of 40 CFR Part 190. Table 5.4-6 shows that collective doses from the new units to the population within 50 miles of the plant are extremely low compared to collective doses from natural background radiation.

The fuel cycle specific to Units 6 & 7 would contribute to the cumulative impacts of fuel production, storage, and disposal for nuclear units in the United States, but the impacts of the fuel cycle for Units 6 & 7 would be SMALL and the addition of the impacts of Units 6 & 7 would be a SMALL contribution to the cumulative impacts from the nation's nuclear units. Fuel and waste transportation impacts from Units 6 & 7 would also be SMALL, and would be a minor increase to the cumulative impacts of transportation of nuclear reactor fuel.

5.11.7 WASTE

Units 6 & 7 would generate radioactive and nonradioactive wastes as described in Sections 3.5, 3.6, and 5.5 and implement waste minimization programs and recycling opportunities whenever feasible. The waste management impacts of Units 6 & 7 wastes were characterized as SMALL. The existing units generate nonradioactive wastes that would be disposed of in waste management facilities. In addition, Units 3 & 4 also generate radioactive wastes. Other projects identified in Table 5.11-2 would only generate small quantities of nonradioactive wastes.

Miami-Dade County operates one of the nation's largest integrated solid waste disposal systems, consisting of the Resources Recovery waste-to-energy facility, the North Dade Landfill (a trash-only facility), and the South Dade Landfill (a garbage and trash facility) (MDC 2008). The County managed 3.8 million tons of solid waste in 2008 (FDEP Aug 2010a). The cumulative waste management impact to the waste management facilities in the area would be SMALL.

The radioactive waste generated by Units 6 & 7 as well as Units 3 & 4 would be disposed of in a permitted disposal facility such as a facility in Clive, Utah, that accepts waste from all states. This facility accepts low-level and mixed radioactive wastes. The facility disposed of 3.9 million cubic feet of low-level waste in 2005 (NRC Mar 2007) and the mixed LLW disposal area is 963,020 cubic yards with additional land for development of future mixed LLW disposal cells (UDEQ May 2005). The cumulative impact from management of low-level and mixed radioactive wastes would be SMALL.

5.11.8 HUMAN HEALTH

The potential impacts to human health from the operation of Units 6 & 7 concern etiological agents promoted by thermal discharge (Subsection 5.3.4), electric shock hazards posed by transmission lines (Subsection 5.6.3), and occupational health hazards (Section 5.12). The potential impacts from these sources were SMALL. The existing units also pose risks to human health. The risk posed by exposure to etiological agents at the existing units is SMALL. The occupational hazards are applicable to workers and not the public. Occupational injury rates at Turkey Point are well below the state and national rates (Section 5.12). Activities associated with operation of projects identified in Table 5.11-3 would also carry a small occupational risk. The potential impact to human health as a result of electrical shock from transmission lines to the public is SMALL. The cumulative potential impact to human health would be SMALL.

5.11.9 SUMMARY

Cumulative impacts associated with land use, hydrology and water use, ecology, socioeconomics, air quality, radiological release, waste, and human health from the operation of Units 6 & 7 along with operation of the existing units, the Units 3 & 4 uprate, the Units 3 & 4 ISFSI, EMB, and CERP projects were assessed. The adverse cumulative impacts are summarized in Table 5.11-3.

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Table 5.11-1
Geographic Areas Used in Cumulative Analysis

Resource/Impact	Geographic Area
Land Use	Homestead and Florida City area
Hydrology & Water Use	Surface Water: Surface water at, adjacent to, or downstream of the Turkey Point plant property and offsite areas Groundwater: Biscayne aquifer underlying south Miami-Dade County and the Floridan aquifer
Ecology	Terrestrial: immediate surrounding area Aquatic: Surface water to the north of the Turkey Point plant property encompassing the reclaimed water and potable water pipelines and to the west to U.S. Highway 1 and the downstream points from the Turkey Point plant property (i.e., Biscayne Bay and Card Sound)
Socioeconomics	Local: Homestead and Florida City area Regional: within a 50-mile radius of the Units 6 & 7 project area
Atmospheric and Meteorological	Within a 50-mile radius of the Units 6 & 7 project area
Radiological	Members of the public within a 50-mile radius of the Units 6 & 7 project area
Waste	Nonradiological: Miami-Dade County Radiological: United States
Human Health	Workers and public within a 50-mile radius of the Units 6 & 7 project area

Table 5.11-2 (Sheet 1 of 17)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Turkey Point Site During the Construction Period (2022-2063)

Project Name	Summary of Project	Location	Status	Reference	Retained
Energy Projects					
FPL - Cutler Power Plant	Two-unit, 205-MW gas- and oil-fired plant	14 miles northeast of Turkey Point site	Operational	M-D DERM Feb 2009	No
FPL - Lauderdale Power Plant	Two-unit, 884-MW gas- and oil-fired plant	45 miles northeast of Turkey Point site	Operational	BCEPGMD Jan 2009	No
FPL - Port Everglades Power Plant	Four-unit, 1205-MW oil- and gas-fired plant	47 miles northeast of Turkey Point site	Operational	BCEPGMD Feb 2010	No
FPL - Turkey Point Power Plant	Five-unit, 3,220-MW power plant. Units 1 & 2 are oil- and gas-fired, Units 3 & 4 are nuclear, Unit 5 is gas-fired.	Turkey Point site	Operational	M-D DERM Mar 2009a	Yes
FPL - Turkey Point Power Plant Units 3 & 4 Uprate	The project will increase the net electrical generation for Units 3 & 4 by 104-MW each.	Turkey Point site	Proposed. Site Certification Application approved by FPSC in October 2008. Application to NRC submitted in 2010. Project completion expected 2nd quarter 2012.	FPL Jan 2008	Yes
Homestead City Utilities - Gordon W. Ivey Power Plant	16-unit, 60-MW oil-fired plant	9 miles northwest of Turkey Point site	Operational	M-D DERM May 2009a	No
INGENCO Resource Recovery Facility	24-unit, 8-MW landfill gas-fired power plant	6 miles northwest of Turkey Point site	Proposed. Draft Air Construction Permit issued March 2010	M-D DERM Mar 2010	Yes
Miami-Dade County Resource Recovery Facility	Four-unit 77-MW municipal solid waste-fired power plant	28 miles northwest of Turkey Point site	Operational	M-D DERM Mar 2008a	No
Wheelabrator South Broward, Inc. - Waste to Energy Facility	Three-unit 67.6-MW municipal solid waste-fired power plant	45 miles northeast of Turkey Point site	Operational	BCEPGMD Dec 2009a	No
Florida Gas Transmission Company Phase VIII Expansion Project	The FGT pipeline will be 6.5 miles long and parallel existing FGT pipelines and FPL transmission lines.	The pipeline will be installed along SW 97 Avenue north of Turkey Point and travel south toward Turkey Point site.	Proposed. The pipeline is planned to be in service in 2010 to 2011	FGT Sep 2008	No

Table 5.11-2 (Sheet 2 of 17)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Turkey Point Site During the Construction Period (2022-2063)

Project Name	Summary of Project	Location	Status	Reference	Retained
Transportation Projects					
Dade-Collier Training and Transition Airport	Precision instrument landing and training facility for commercial and general aviation.	46 miles northwest of Turkey Point site	Operational. Future development unlikely.	FDOT 2009	No
Fort Lauderdale/ Hollywood International Airport	Full service airport - commercial airlines, air cargo, and general aviation	46 miles northeast of Turkey Point site	Operational. Expansion and construction would occur in the future, as described in state and local planning documents.	FDOT 2009	No
Homestead Air Reserve Base Airport	Military airfield that is the home station to F-16C and F-15A aircraft.	5 miles northwest of Turkey Point site	Operational. Limited development is likely within property.	DOD Oct 2007	No
Homestead General Aviation Airport	General aviation airport.	15 miles northwest of Turkey Point site	Operational. Limited expansion would occur in the future, as described in planning documents.	FDOT 2009	No
Kendall-Tamiami Executive Airport	General aviation airport.	17 miles northwest of Turkey Point site	Operational. Limited expansion would occur in the future, as described in planning documents.	FDOT 2009	No
Miami International Airport	Full service airport - commercial airlines, air cargo, and general aviation. Third busiest international passenger airport in the U.S.	26 miles north of Turkey Point site	Operational. Completion of the $6.2 Billion Miami Intermodal Center capital improvement program expected in 2011.	FDOT 2009	No
North Perry Airport	General aviation airport.	40 miles north of Turkey Point site	Operational. Expansion and construction would occur in the future, as described in state and local planning documents.	FDOT 2009	No
Opa Locka Executive Airport	General aviation and reliever airport for Miami International. The airport is also home to a U.S. Coast Guard Air/ Sea Rescue Station.	33 miles north of Turkey Point site	Operational. Limited expansion would occur in the future, as described in state and local planning documents.	FDOT 2009	No

Table 5.11-2 (Sheet 3 of 17)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Turkey Point Site During the Construction Period (2022-2063)

Project Name	Summary of Project	Location	Status	Reference	Retained
Port Everglades	Large full-service deepwater seaport. Florida's main seaport for receiving petroleum products. Current annual throughput of 21.2 million tons of cargo and 128.8 million barrels of petroleum products. Cruise terminal serves 3.1 million passengers annually.	48 miles northeast of Turkey Point site	Operational. Port expansion, dredging, and construction would occur in the future, as described in state and local planning documents.	FSTEDC Mar 2010	No
Port of Miami	Large full-service deepwater seaport. Current annual cargo throughput of 6.8 million tons. Cruise terminal serves 4.1 million passengers annually.	26 miles northeast of Turkey Point site	Operational. Port expansion, dredging, and construction would occur in the future, as described in state and local planning documents.	FSTEDC Mar 2010	No
Port of Miami Tunnel & Access Improvement Project	The project will improve access to and from the Port of Miami, serving as a dedicated roadway connector linking the Port with the MacArthur Causeway (SR A1A) and I-395. The project consists of three primary components: widening of the MacArthur Causeway Bridge; tunnel connections between Watson Island and Dodge Island (the Port of Miami); and connections to the Port of Miami roadway system.	26 miles northeast of Turkey Point site	Planned. Construction began in July 2010 and the project could be operational by 2014.	FHWA Undated, Wallis Jul 2010	No
SR826/SR836 Interchange Reconstruction	The project involves a major upgrade to the interchange. Capacity improvements include the reconstruction and widening along both SR826 (Palmetto Expressway) and SR836 (Dolphin Expressway), construction of a four-level interchange, and modifications of the Flagler Street/SR826 and the Milam Dairy Road/NW 72nd Avenue/SR836 interchanges.	26 miles north of Turkey Point site	Planned. Construction began in October 2009 and is scheduled to be completed by late 2014	FHWA Undated	No

Table 5.11-2 (Sheet 4 of 17)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Turkey Point Site During the Construction Period (2022-2063)

Project Name	Summary of Project	Location	Status	Reference	Retained
Tampa – Orlando – Miami High-Speed Intercity Passenger Rail	This project would provide high-speed rail service from Tampa to Miami (through Orlando) with stops in West Palm Beach and Ft. Lauderdale. The termini for Orlando -Miami corridor are the Orlando International Airport (OIA) and the Miami Intermodal Center at the Miami Airport (MIA).	26 miles north of Turkey Point site	Proposed. Phase 1 (Tampa-Orlando corridor) is ongoing. Project development for Phase 2 (Orlando-Miami corridor) began in May 2010.	FDOT May 2010	No
Parks and Nature Preserve Facilities					
Big Cypress National Preserve	Over 729,000 acres of valuable habitat for a variety of threatened and endangered species, including the Florida panther, West Indian manatee, red cockaded woodpecker, and wood storks. Public recreational activities include bird watching, camping, canoeing, bicycling, off road vehicles, hunting, hiking, and wildlife observation.	44 miles northeast of Turkey Point site	Development limited within property.	NPS Jun 2009	No
Bill Baggs Cape Florida State Park	The upland areas of Cape Florida have undergone a phenomenal transformation since Hurricane Andrew in 1992. Native plant communities have been recreated through continuous staff and volunteer efforts of planting and exotic plant eradication and control. About three miles beach and shoreline are the main attraction for the majority of the park visitors and provides opportunities for picnicking, swimming, bicycling, fishing, primitive camping and nature appreciation.	20 miles north of Turkey Point site	Development limited within property.	FDEP Mar 2001	No

Table 5.11-2 (Sheet 5 of 17)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Turkey Point Site During the Construction Period (2022-2063)

Project Name	Summary of Project	Location	Status	Reference	Retained
Biscayne National Park	A meld of four distinct ecosystems (mangrove forests, Biscayne Bay, Florida Keys islands, and coral reefs) supporting diverse wildlife including threatened and endangered species such as the West Indian manatee, eastern indigo snake, piping plover, American crocodile, peregrine falcon, Schaus' swallowtail butterfly, least tern, and five species of sea turtle. Public recreational activities include picnicking, hiking, wildlife watching, snorkeling, scuba diving, canoe/ kayaking, and fishing.	Adjacent to eastern edge of Turkey Point site	Development likely limited within property.	NPS Jul 2010a	No
Crocodile Lake National Wildlife Refuge	The Refuge covers 6,700 acres of land, including 650 acres of open water. It contains a mosaic of habitat types, such as tropical hardwood hammock, mangrove forest, and salt marsh. These habitats are vital for hundreds of plants and animals including six federally listed species. The refuge is closed to the public however there is an interpretive butterfly garden adjacent.	12 miles south of Turkey Point site	Additional land acquisition is planned. Development likely limited within property.	USFWS Feb 2006	No
Curry Hammock State Park	The 970 acres represents the remaining example of the natural communities of the Middle Florida Keys and contains tropical hardwood hammocks, salt marshes, and mangrove wetlands. Public recreation activities include swimming, hiking, canoeing/kayaking, and camping.	26 miles southwest of Turkey Point site	Additional 23 acre land acquisition is planned Development likely limited within property.	FDEP Feb 2005	No

Table 5.11-2 (Sheet 6 of 17)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Turkey Point Site During the Construction Period (2022-2063)

Project Name	Summary of Project	Location	Status	Reference	Retained
Dagny Johnson Key Largo Hammock Botanical State Park	The 2,454 acres of park contain the largest intact West Indian hardwood hammock in the US harboring an extensive list of threatened and endangered plants and animals. In addition a very rare coastal rock barren community, a shoreline dominated by marine tidal swamps, and significant wetland habitat. Public recreation activities include hiking, picnicking, guided nature walks, and educational programs.	12 miles south of Turkey Point site	Development likely limited within property.	FDEP Sep 2004a	No
Everglades National Park	Primarily comprised of internationally important wetlands that cover 1,508,533 acres and are home to rare and endangered species such as the American crocodile, Florida panther, and West Indian manatee.	29 miles west of Turkey Point site	181,000 acres of additional land acquisition is proposed. Development likely limited within property.	NPS Jul 2010b, FNAI 2008, Thomas Reuters 2009	No
Florida Keys Wildlife and Environmental Area	An archipelago of small sites totaling 3,089 acres containing some of the best examples of tropical hardwood hammocks remaining in Florida. These sites protect native plants and animals, many of which are found nowhere else in the US. Recreational facilities or trails have are not developed in order to protect the sites' sensitive natural resources.	31 miles southeast of Turkey Point site	Development of facilities for public use is constrained by the presence of many unique plant and animal species.	USFWS Undated	No
Indian Key Historic State Park	The 110 acre property consists mostly of wetland and water areas that attract boaters for snorkeling and fishing activities. The ruins of the historic settlement on the island are available to the public via guided or self-guided tours.	43 miles southwest of Turkey Point site	Development of facilities for public use limited within property.	FDEP Jun 2000a	No

Table 5.11-2 (Sheet 7 of 17)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Turkey Point Site During the Construction Period (2022-2063)

Project Name	Summary of Project	Location	Status	Reference	Retained
John Pennekamp Coral Reef State Park	Submerged land covers over 98% of the 63,836 acres of the park. The water area contains the only living coral reef in the US and the land area consists of over 80,000 linear feet of shoreline with beaches and tropical hammocks. Public recreation activities include swimming, snorkeling, scuba diving, fishing, canoeing, glass bottom boat tours, hiking, camping, and nature appreciation.	17 miles south of Turkey Point site	Additional land acquisition is proposed. Development of facilities for public use limited within property.	FDEP Sep 2004b	No
John U. Lloyd Beach State Park	The park contains 311 acres on the Atlantic Ocean and Intercoastal Waterway and contains natural communities such as beach dunes, coastal strands, maritime hammocks, and tidal swamps. These provide habitat for 11 imperiled plant species and 20 imperiled animals. Public recreation facilities include two large beach use areas, seven large picnic pavilions, a two-lane boat ramp, a pavilion that provides nature study and environmental education opportunities, and a concession stand that provides; food services, and rentals.	47 miles north of Turkey Point site	Development of facilities for public use limited within property.	FDEP May 2001	No

Table 5.11-2 (Sheet 8 of 17)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Turkey Point Site During the Construction Period (2022-2063)

Project Name	Summary of Project	Location	Status	Reference	Retained
Lignumvitae Key Botanical State Park	Lignumvitae Key is the only Florida Key that is still in its natural state and was chosen as the state's first botanical park. Its rare and delicate ecosystem primarily consists of subtropical hardwood hammock. The smaller island Shell Key is primarily a mangrove island and has been left undisturbed. Islands accessible only by private boat. Public recreation activities include boating, fishing, snorkeling, and diving.	42 miles southwest of Turkey Point site	Development of facilities for public use limited within property.	FDEP Dec 2000	No
Mary Krome Bird Refuge	2.5 acre preserve is bordered on two sides by avocado groves. Public recreation activities include bird and butterfly watching	10 miles northwest of Turkey Point site	Development unlikely in the future.	NABA Undated	No
Oleta River State Park	The park's 1.7 miles of the Oleta River and its associated mangrove wetlands are important habitat for many species The West Indian manatee and golden leather fern are among the 40 designated plant and animal species found in the 1033 acre park. Public recreation activities include picnicking, swimming, canoeing, fishing, bicycling/jogging, and primitive camping.	36 miles north of Turkey Point site	Development of facilities for public use limited within property.	FDEP Dec 2008	No
San Pedro Underwater Archaeological Preserve State Park	The 644 acre preserve consists of the 1733 shipwreck “San Pedro” surrounded by a ring of sandy substrate and seagrass beds. Public recreation activities include snorkeling, scuba diving, and glass bottom boat tours.	45 miles southwest of Turkey Point site	Development unlikely in the future.	FDEP Jun 2000b	No

Table 5.11-2 (Sheet 9 of 17)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Turkey Point Site During the Construction Period (2022-2063)

Project Name	Summary of Project	Location	Status	Reference	Retained
The Barnacle Historic State Park	The historic structures in this 9 acre park were built in the late 1800s and include a boat house, carriage house, and the Barnacle house which was originally built as a wooden bungalow four feet off the ground on pilings. About half of the surrounding land supports a tropical hardwood hammock. The primary public activity on the site is visiting the historic home and touring the grounds.	21 miles north of Turkey Point site	Development unlikely in the future.	FDEP Aug 2003	No
Windley Key Fossil Reef Geological State Park	While the upland area at the 32 acre park contains one of the finest hardwood hammocks in the Florida Keys, the park's main attraction is the fossil coral reef exposed by the keystone quarry operations. Public recreation activities include education and interpretation programs, hiking, and nature appreciation.	36 miles southwest of Turkey Point site	Development unlikely in the future.	FDEP May 2003	No
Everglades Mitigation Bank (EMB)	The EMB is a 13,249 acre site permitted by the state of Florida and the Army Corps of Engineers. The EMB consists of land located between U.S. Highway 1 and Card Sound Road and east of Card Sound Road extending to Card Sound, then north along the L-31E Canal. EMB activities would be in accordance with permit conditions.	Just southwest of the Turkey Point site and east of U.S. Highway 1.	Development unlikely in the future.	FDEP Oct 1996, FDEP Oct 2003, USACE and SFWMD Aug 2002	Yes

Table 5.11-2 (Sheet 10 of 17)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Turkey Point Site During the Construction Period (2022-2063)

Project Name	Summary of Project	Location	Status	Reference	Retained
Comprehensive Everglades Restoration Plan (CERP) Projects					
Biscayne Bay Coastal Wetlands Project - Phase 1	The project would expand and restore wetlands adjacent to Biscayne Bay, and enhance the ecological health of Biscayne National Park. Phase 1 incorporates most of the Deering Estate features, including a spreader canal, culverts, and canal improvements. The Cutler Wetlands features include culverts, a canal and restoration of the Lennar Flow-way. The L-31E Flow-way/ North Canal Flow-way features include a spreader canal and several culverts.	1.5 miles west of Turkey Point site	Proposed. Design and permitting of Phase 1 completed. Construction of L-31E culverts and Deering Estates Flow-way began in 2010. Construction of Cutler Wetlands scheduled to begin in 2011.	SFWMD Jun 2010, USACE Jun 2010	Yes
Broward County Water Preserve Areas	Project serves as a seepage control buffer between developed urban areas and the Everglades. Components include: Water Conservation Areas 3A/3B Levee Seepage Management, C-11 Impoundment, and C-9 Impoundment.	37 miles north of Turkey Point site	Proposed. Basis of Design Report completed. Construction of C-11 Impoundment scheduled to begin in 2012.	SFWMD Jun 2010, USACE Nov 2009	No
C-111 Spreader Canal Western Project	The project would establish more natural water flows in Taylor Slough to improve the timing, distribution and quantity of fresh water flowing into Florida Bay.	6 miles southwest of Turkey Point site	Proposed. Design testing completed. Construction began in 2010.	SFWMD Jun 2010, USACE May 2009	Yes
Central Lake Belt Storage Area	The project would store excess water from Water Conservation Areas 2 and 3 and provide environmental water supply deliveries to Northeast Shark River Slough, Water Conservation Area 3B, and to Biscayne Bay.	30 miles north of Turkey Point site	Proposed. Currently in preconstruction design.	USACE Undated	No

Table 5.11-2 (Sheet 11 of 17)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Turkey Point Site During the Construction Period (2022-2063)

Project Name	Summary of Project	Location	Status	Reference	Retained
Everglades National Park Seepage Management Project	Project to improve water deliveries to Northeast Shark River Slough and restore wetland in Everglades National Park by reducing levee and groundwater seepage and increasing sheetflow. There are three components: L-31N Levee Improvements for Seepage Management, S-356 Structure Relocation and Bird Drive Recharge.	22 miles northwest of Turkey Point site	Proposed. Construction scheduled to begin in 2014.	USACE Mar 2006, USACE Nov 2009	No
L-31N (L-30) Seepage Management Pilot Project	Project evaluates the uncertainty and constructability of seepage management technology for possible full-scale use along Everglades National Park.	19 miles northwest of Turkey Point site	Proposed. Project activities expected to be completed in 2012.	USACE Nov 2009	No
Melaleuca Eradication and other Exotic Plants	Project enhances efforts to control invasive exotic species in south Florida through mass clearing and controlled release of biological agents.	Throughout the region	Proposed. Project is scheduled to begin in 2011.	USACE Nov 2009	No
Miccosukee Tribe Water Management Plan	Project includes providing water storage capacity and water quality enhancement for Miccosukee Tribe's reservation discharge waters and conversion of 900 acres of tribally owned cattle pasture into a managed wetland retention/detention area.	45 miles northwest of Turkey Point site	Proposed. Currently in preconstruction design.	USACE Undated	No
North Lake Belt Storage Area	Project will include an in-ground storage reservoir with a total capacity of approximately 90,000 acre feet and associated canals, pumps, and water control structures. It will store a portion of the stormwater runoff from the C-6, C-11, and C-9 basins.	34 miles north of Turkey Point site	Proposed. Currently in preconstruction design.	USACE Undated	No

Table 5.11-2 (Sheet 12 of 17)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Turkey Point Site During the Construction Period (2022-2063)

Project Name	Summary of Project	Location	Status	Reference	Retained
Restoration of Pineland and Hardwood Hammocks in C-111 Basin	This project includes restoring south Florida slash pine and hardwood hammock species on a 200-foot wide strip on each side of two miles (approximately 50 acres) of Florida SR 9336 and the establishment of two, one acre hammocks alongside the road. The project will provide water quality treatment for runoff passing through the hammocks and demonstrate techniques required to re-establish native conifer and hardwood forests.	14 miles west of Turkey Point site	Proposed. Currently in preconstruction design.	USACE Undated	No
South Miami-Dade Reuse	Project will include an expansion in the existing South District Wastewater Treatment Plant to provide additional water supply to the South Biscayne Bay and Coastal Wetlands Enhancement Project at sufficient quantity and water quality to meet the ecological goals and objectives of Biscayne Bay. This will require construction of a pretreatment and membrane treatment system.	6 miles north of Turkey Point site	Proposed. Currently in preconstruction design.	USACE Undated	Yes
Water Conservation Area 2B Flows to Everglades National Park	The project purpose is to store excess water from Water Conservation Area 2 in the Central Lake Belt Storage Area through control structures and conveyance features. Additionally, the project will supplement environmental water supply deliveries to North Shark River Slough, Water Conservation Area 3B and Biscayne Bay.	30 miles north of Turkey Point site	Proposed. Currently in preconstruction design.	USACE Undated	No

Table 5.11-2 (Sheet 13 of 17)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Turkey Point Site During the Construction Period (2022-2063)

Project Name	Summary of Project	Location	Status	Reference	Retained
Water Conservation Area 3 Decompartmentalization and Sheetflow Enhancement Project	Construction of new water control structures and modification or removal of levees, canals, and water control structures in Water Conservation Areas 3A and 3B for reestablishment of the ecological and hydrologic connection with Everglades National Park.	25 miles northwest of Turkey Point site	Proposed. EIS currently being drafted.	USACE Nov 2009	No
West Miami-Dade Reuse	The project includes a wastewater treatment plant expansion of a future West Miami-Dade Wastewater Treatment Plant to meet water demands from the Bird Drive Recharge Area, South Dade Conveyance System, and Northeast Shark River Slough.	21 miles northwest of Turkey Point site	Proposed. Currently in pre-construction design.	USACE Undated	No
Modified Water Deliveries to Everglades National Park	Project restores the natural hydrologic conditions in Everglades National Park, which were altered by the construction of roads, levees, and canals. The project includes four major components: an 8.5 mile area flood mitigation, Tamiami trail modifications, conveyance and seepage control features, and a combined operation plan.	22 miles northwest of Turkey Point site	Proposed. Construction underway. Project Completion anticipated in 2013.	USACE Nov 2009	No
C-111 South Dade Project	Project enhances freshwater wetlands and improves freshwater flows in the Southern Glades and in southern Miami-Dade County. It improves the hydrology of the coastal marshlands of northeastern Florida Bay.	6 miles southwest of Turkey Point site	Proposed. Preliminary design of initial Phase completed. Project completion anticipated in 2014.	USACE Nov 2009	Yes

Table 5.11-2 (Sheet 14 of 17)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Turkey Point Site During the Construction Period (2022-2063)

Project Name	Summary of Project	Location	Status	Reference	Retained
Mining Projects					
Card Sound Quarry	Crushed limestone mine	8 miles southwest of Turkey Point site	Operational	USGS 2005	No
Continental Florida Materials Pit #1	Crushed limestone mine	28 miles north of Turkey Point site	Operational	USGS 2005	No
F.E.C. Quarry	Crushed limestone mine	32 miles northwest of Turkey Point site	Operational	USGS 2005	No
Krome Quarry	Crushed limestone mine	21 miles northwest of Turkey Point site	Operational	USGS 2005	No
Lake 6 Quarry	Crushed limestone mine	33 miles north of Turkey Point site	Operational	USGS 2005	No
Miami Quarry	Crushed limestone mine	26 miles north of Turkey Point site	Operational	USGS 2005	No
Pennsuco Quarry	Crushed limestone mine	32 miles north of Turkey Point site	Operational	USGS 2005	No
S.C.L. Quarry	Crushed limestone mine	25 miles northwest of Turkey Point site	Operational	USGS 2005	No
Sawgrass Quarry	Crushed limestone mine	37 miles northwest of Turkey Point site	Operational	USGS 2005	No
Sunshine Rock Quarry	Crushed limestone mine	25 miles northwest of Turkey Point site	Operational	USGS 2005	No
White Rock Quarry	Crushed limestone mine	36 miles north of Turkey Point site	Operational	USGS 2005	No

Table 5.11-2 (Sheet 15 of 17)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Turkey Point Site During the Construction Period (2022-2063)

Project Name	Summary of Project	Location	Status	Reference	Retained
Other Actions/Projects					
Central and Southern Florida Flood Control Project	The C&SF Flood Control Project was intended to provide flood control, water supply, prevention of saltwater intrusion, and protection of fish and wildlife resources. Today the CS&F project includes 1000 miles of canals, 720 miles of levees, and almost 200 water control structures. It covers 16 counties over an 18,000-square-mile area. The existing project provides water supply, flood protection, water management and other benefits to South Florida. The project has had unintended negative effects on the Everglades and the entire south Florida ecosystem.	Throughout the region.	Operational	HRA Jun 2006	No
Independent Spent Fuel Storage Facility for Turkey Point Power Plant Units 3 & 4	The Units 3 & 4 ISFSI will be a dry storage facility for spent nuclear fuel that would not have a liquid discharge and would only have limited operational activities.	Co-located on the Turkey Point site	Proposed. Facility currently under construction. Loading expected in 2011.	FDEP Jun 2009 FPL Nov 2010	Yes
AAR Landing Gear Center	Repair and rebuild aircraft landing gears and brakes.	30 miles northwest of Turkey Point site	Operational	M-D DERM Jul 2009	No
Aero Kool Corporation	Overhaul aircraft air cycle equipment and heat exchangers and operation of degreaser baths and paint booths	27 miles northeast of Turkey Point site	Operational	M-D DERM Feb 2006	No
American Whirlpool Products Corporation	Acrylic and fiberglass bath and spa manufacturer	43 miles northeast of Turkey Point site	Operational	BCEPGMD Dec 2003	No
Angler Boat Corporation	Fiberglass boat manufacturer	29 miles northeast of Turkey Point site	Operational	M-D DERM Dec 2006	No
Benada Aluminum of Florida Inc	Extruded aluminum products manufacturer	29 miles northeast of Turkey Point site	Operational	M-D DERM Mar 2006	No
Bertram Yacht Inc	Fiberglass boat manufacturer	26 miles northeast of Turkey Point site	Operational	M-D DERM Sep 2009	No
Blumberg Industries -Fine Art Lamps	Lamp manufacturer	33 miles northeast of Turkey Point site	Operational	M-D DERM Nov 2008	No

Table 5.11-2 (Sheet 16 of 17)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Turkey Point Site During the Construction Period (2022-2063)

Project Name	Summary of Project	Location	Status	Reference	Retained
CEMEX Miami	Cement kiln	25 miles northeast of Turkey Point site	Operational	M-D DERM Mar 2008b	No
Cigarette Racing Team LLC	Fiberglass boat manufacturer	32 miles northeast of Turkey Point site	Operational	M-D DERM Feb 2010	No
Contender Boats Inc	Fiberglass boat manufacturer	6 miles northeast of Turkey Point site	Operational	M-D DERM Aug 2008	No
DM Industries Ltd	Acrylic and fiberglass bath and spa manufacturer	34 miles northeast of Turkey Point site	Operational	M-D DERM Dec 2008	No
Dusky Marine Inc.	Fiberglass boat manufacturer	45 miles northeast of Turkey Point site	Operational	BCEPGMD Jun 2008	No
Dyplast Products, LLC	Polystyrene and polyurethane products manufacturer	32 miles northeast of Turkey Point site	Operational	M-D DERM Aug 2007	No
Eastern Aero Marine, Inc.	Inflatable vest and raft manufacturer	28 miles northeast of Turkey Point site	Operational	M-D DERM Jan 2010	No
Englehard Hex Core	Nomex honeycomb board, and fiberglass honeycomb board and rotor manufacturer	28 miles northeast of Turkey Point site	Operational	M-D DERM Sep 1999	No
Exteria Building Products, LLC.	Polypropylene siding manufacturer	35 miles northeast of Turkey Point site	Operational	M-D DERM Oct 2008, M-D DERM May 2009b	No
Flowers Baking Company of Miami	Commercial bread bakery	36 miles northeast of Turkey Point site	Operational	M-D DERM Mar 2009b	No
Goodrich Corporation Landing Systems Services	Landing gear refurbishing facility	35 miles northeast of Turkey Point site	Operational	M-D DERM May 2010	No
Homestead-Miami Speedway	The 1087 acre speedway hosts a wide variety of national, regional and local motorsport events, including the final races for all three NASCAR national championship series and two Indy Car championship series. The facility has seating capacity for 67,612 spectators.	5 miles northwest of Turkey Point site	Operational	HMS 2010	No

Table 5.11-2 (Sheet 17 of 17)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Turkey Point Site During the Construction Period (2022-2063)

Project Name	Summary of Project	Location	Status	Reference	Retained
Homestead-Miami Speedway Improvements.	This project would expand the spectator area to include 120 acres currently used for overflow parking add 12,000 spectator seats.	5 miles northwest of Turkey Point site	Proposed. If approved the project is scheduled to be completed in 2013.	HMS 2010	Yes
Media Printing Corporation	Commercial printer	29 miles northeast of Turkey Point site	Operational	BCEPGMD Dec 2009b	No
Miami Seaquarium	The 38-acre marine park is an entertainment venue that is dedicated to education, wildlife conservation and community involvement.	23 miles northeast of Turkey Point site	Operational	Miami Seaquarium 2009	No
Miami-Dade Water and Sewer Department - Alexander Orr Water Treatment Plant	Water treatment plant also operates a 150 tpd rotary lime kiln	19 miles northwest of Turkey Point site	Operational	M-D DERM Jul 2008	No
Miami-Dade Water and Sewer Department - Hialeah/ Preston Water Treatment Plant	Water treatment plant also operates a 120 tpd rotary lime kiln and 64 air stripping towers	28 miles northeast of Turkey Point site	Operational	M-D DERM Jan 2006	No
Midnight Express Powerboats	Fiberglass boat manufacturer	46 miles northeast of Turkey Point site	Operational	BCEPGMD Jun 2009	No
Ram Investments of South Florida - Sea Enterprise Adventures	Fiberglass boat manufacturer	28 miles northeast of Turkey Point site	Operational	M-D DERM Jun 2006	No
Titan America, LLC - Pennsuco Cement	Cement kiln	31 miles northwest of Turkey Point site	Operational	M-D DERM Sep 2008	No
US Foundry & Manufacturing Company	Gray iron foundry and cast iron products manufacturer	30 miles northwest of Turkey Point site	Operational	M-D DERM Apr 2010	No
Water Reclamation and Wastewater Treatment Plants	Numerous plants	Within 50 miles of Turkey Point site	Operational	FDEP Aug 2010a, FDEP Aug 2010b	No
Future Urbanization	Construction of housing units and associated commercial buildings; road, bridges, and rail; construction of water and/or wastewater treatment facilities and associated pipelines.	Throughout the region.	Construction would occur in the future, as described in state and local land-use planning documents.	MDC Nov 2007	No

Note: All the projects listed in the table would have impacts on land use, water use, ecology, and socioeconomics within the 50-mile radius of the Turkey Point Units 6 & 7 project.

Table 5.11-3 (Sheet 1 of 4)
Summary of Adverse Cumulative Impacts

Category	Description of Cumulative Impact	Potential Cumulative Impacts Significance
Land Use	1. Units 6 & 7 – land permanently dedicated 2. Existing units – none 3. Units 3 & 4 Uprate – none 4. Units 3 & 4 ISFSI – none 5. EMB – none 6. CERP Projects – none 7. INGENCO Resource Recovery Facility - none 8. Homestead-Miami Speedway Improvement Project - none	None
Historic Properties	1. Units 6 & 7 - none 2. Existing units – none 3. Units 3 & 4 Uprate – none 4. Units 3 & 4 ISFSI – none 5. EMB – none 6. CERP Projects – positive impact on Deering Estate 7. INGENCO Resource Recovery Facility - none 8. Homestead-Miami Speedway Improvement Project - none	None
Hydrology & Water Use	Surface water: 1. Existing units – cooling canals of the industrial wastewater facility 2. Units 3 & 4 Uprate – none 3. Units 3 & 4 ISFSI – none 4. EMB – none 5. CERP Projects – none Groundwater: 1. Units 6 & 7 – use of radial collector wells would be SMALL 2. Existing units – groundwater well withdrawals for non-potable water and single injection well, does not use same sources as new units 3. Units 3 & 4 Uprate – none 4. Units 3 & 4 ISFSI – none 5. EMB – none 6. CERP Projects – none	Surface water: SMALL Groundwater: SMALL

Table 5.11-3 (Sheet 2 of 4)
Summary of Adverse Cumulative Impacts

Category	Description of Cumulative Impact	Potential Cumulative Impacts Significance
Water quality	Surface water: 1. Units 6 & 7 – surface water runoff to cooling canals of the industrial wastewater facility, use of environmental best management practices, and spill prevention plan 2. Existing units – use of cooling canals of the industrial wastewater facility, use of environmental best management practices, and spill prevention plan 3. Units 3 & 4 Uprate – increase in temperature and salinity level in discharge 4. Units 3 & 4 ISFSI – none 5. EMB – none 6. CERP Projects – none	Surface water: SMALL
	Groundwater: 1. Units 6 & 7 – surface water runoff to cooling canals of the industrial wastewater facility, use of environmental best management practices, spill prevention plan, use of radial collector wells on groundwater resources would have a SMALL impact. 2. Existing units –use of environmental best management practices and spill prevention plan 3. Units 3 & 4 Uprate – none 4. Units 3 & 4 ISFSI – none 5. EMB – none 6. CERP Projects – none	Groundwater: SMALL
Terrestrial Ecology	1. Units 6 & 7 – potential impacts to cooling canals of the industrial wastewater facility from use of radial collector wells and salt deposition by cooling towers 2. Existing units – operate under management/conservation plans 3. Units 3 & 4 Uprate – increased thermal and salinity level content discharge to cooling canals of the industrial wastewater facility 4. Units 3 & 4 ISFSI – none 5. EMB – none 6. CERP Projects – positive	SMALL/MODERATE

Table 5.11-3 (Sheet 3 of 4)
Summary of Adverse Cumulative Impacts

Category	Description of Cumulative Impact	Potential Cumulative Impacts Significance
Aquatic Ecology	1. Units 6 & 7 – potential impacts to cooling canals of the industrial wastewater facility from use of radial collector wells and salt deposition by cooling towers 2. Existing units – none 3. Units 3 & 4 Uprate – increased thermal and salinity level content discharge to cooling canals of the industrial wastewater facility 4. Units 3 & 4 ISFSI – none 5. EMB – none 6. CERP Projects – positive	SMALL
Socioeconomic	1. Units 6 & 7 – operations workforce 806 2. Existing units – 600–900 outage workers 3. Units 3 & 4 Uprate – no workers, increased tax payments 4. Units 3 & 4 ISFSI – none 5. EMB – positive 6. CERP Projects - positive	SMALL to MODERATE Environmental Justice: None
Atmospheric and Meteorological	1. Units 6 & 7 – intermittent air pollutant releases from emergency equipment, plumes from cooling towers 2. Existing units – small air quality impact and plumes from Unit 5 cooling tower 3. Units 3 & 4 Uprate – none 4. Units 3 & 4 ISFSI – none 5. EMB – none 6. CERP Projects – none 7. INGENCO Resource Recovery Facility - small air quality impact from air pollutant releases during operation	SMALL
Radiological	1. Units 6 & 7 – releases to air within limits, water release only in deep injection wells 2. Existing units – within limits 3. Units 3 & 4 Uprate – none 4. Units 3 & 4 ISFSI – within limits 5. EMB – none 6. CERP Projects – none	SMALL
Waste	1. Units 6 & 7 – radiological and nonradiological solid waste 2. Existing units – radiological and nonradiological solid waste 3. Units 3 & 4 Uprate – none 4. Units 3 & 4 ISFSI – none 5. EMB – none 6. CERP Projects – none	SMALL

Table 5.11-3 (Sheet 4 of 4)
Summary of Adverse Cumulative Impacts

Category	Description of Cumulative Impact	Potential Cumulative Impacts Significance
Human Health	1. Units 6 & 7 – occupational risk 2. Existing units – occupational risk, injury rate below national and state rates 3. Units 3 & 4 Uprate – included with existing units 4. Units 3 & 4 ISFSI – included with existing units 5. EMB – occupational 6. CERP Projects – occupational	SMALL

CERP = Comprehensive Everglades Restoration Plan
EMB = Everglades Mitigation Bank
ISFSI = Independent Spent Fuel Storage Installation

5.12 NONRADIOLOGICAL HEALTH IMPACTS

5.12.1 PUBLIC HEALTH

Public health impacts from the operation of Units 6 & 7 are presented in Subsection 5.6.3 (from transmission line operation) and Subsection 5.8.1.

5.12.2 OCCUPATIONAL HEALTH

Units 3 & 4 have an industrial safety program and safety personnel to promote safe work practices and respond to occupational injuries and illnesses. The program addresses hearing protection, confined space entry, personal protective equipment, electrical safety, ladders, chemical handling, storage and use, and other industrial hazards. At Units 3 & 4, the training manager is responsible for ensuring workers are trained on these safety procedures. The effectiveness of this industrial safety program is reflected in a statistic known as total recordable cases (TRC). TRCs include work-related injuries or illnesses that include death, days away from work, restricted work activity, medical treatment beyond first aid, and other criteria. The average TRC incidence rate for the Units 3 & 4 workforce for 2004 through 2008 was 0.4 cases per 100 workers. This compares favorably to the nationwide rate for nonfatal occupational injuries and illnesses for electrical power generation workers of 2.7 per 100 workers (BLS 2008a) and to the rate of 2.8 per 100 workers for Florida for electrical power generation, transmission, and distribution (BLS 2008b).

To protect workers during operation of Units 6 & 7, an industrial safety program would be instituted that meets applicable federal and state safety requirements. It is estimated that 806 onsite workers would be needed to operate Units 6 & 7 (see Subsection 3.10.3). In addition, the number of outage workers is assumed to be approximately 600 per outage. Using the number of workers and TRC incidence rates, the number of TRCs per year for Units 6 & 7 can be estimated. The estimated TRC incidences are presented in Table 5.12-1. As indicated in Table 5.12-1, the annual estimate for injuries and illnesses at Units 6 & 7 is 3.1, well under the number that would be expected at an electric power generation facility based on national and state incident rates. The nationwide 2007 fatality rate for workers employed in the utility industry of 3.9 per 100,000 workers (BLS 2008c) was used to estimate fatalities at Units 6 & 7. The annual fatality estimate is 0.03 fatalities using the national rate. The TRC incidences occurring in the Units 3 & 4 workforce for 2004 through 2008 (the records used to estimate TRCs for Units 6 & 7) were all nonfatal. The industrial safety program instituted for Units 6 & 7 would be equally effective.

Section 5.12 References

BLS 2008a. Bureau of Labor Statistics, *Table 1. Incidence rates of nonfatal occupational injuries and illnesses, 2007*. Available at http://www.bls.gov/iif/home.htm, accessed March 27, 2009.

BLS 2008b. *Table 6. Incidence rates of nonfatal occupational injuries and illnesses by industry and case types, 2007, Florida*. Available at http://www.bls.gov/iif/home.htm, accessed March 26, 2009.

BLS 2008c. *Fatal Occupational Injuries, Employment, and Rates of Fatal Occupational Injuries by Selected Worker Characteristics, Occupation, and Industries*, 2007. Available at http://www.bls.gov/iif/home.htm, accessed March 27, 2009.

Table 5.12-1
Estimated Total Recordable Cases per Year

Number of Workers	TRC Incidence at US Rate	TRC Incidence at Florida Rate	TRC Incidence at Turkey Point Rate
Operations: 806	22	23	3.1
Outage: 600	1.3[(a)]	1.4[(a)]	0.19

a) Outage estimates are per 30-day outage.

CHAPTER 6: ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS
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6.0 ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS

This chapter evaluates the environmental measurements and monitoring related to the construction and operation of Units 6 & 7. This section describes the monitoring programs that were initiated for Units 6 & 7 during the pre-Application phase and would be continued during construction, preconstruction, and operation phases.

This chapter is divided into the following sections:

- Section 6.1 — Thermal Monitoring
- Section 6.2 — Radiological Monitoring
- Section 6.3 — Hydrological Monitoring
- Section 6.4 — Meteorological Monitoring
- Section 6.5 — Ecological Monitoring
- Section 6.6 — Chemical Monitoring
- Section 6.7 — Summary of Monitoring Programs

Information about these six environmental measurements and monitoring programs is summarized in Section 6.7. Additional information on specific permit requirements described throughout Chapter 6 is outlined in Table 1.2-1.

6.1 THERMAL MONITORING

6.1.1 PRE-APPLICATION THERMAL MONITORING

The Units 6 & 7 pre-application thermal monitoring program was performed to establish background water temperatures for the Biscayne aquifer at the plant area prior to construction and operation of Units 6 & 7. As presented in Subsection 2.3.1, there are no freshwater streams, lakes, or impoundments on the Turkey Point plant property. In addition, no lakes or impoundments considered to be waters of the state or the U.S. would be used or affected by the construction or operation of Units 6 & 7. This phase of the monitoring is designed to establish background conditions and support the thermal descriptions that are presented in Section 2.3.

Temperatures at the Units 6 & 7 plant area were reported at twelve monitoring wells at the upper and lower screened intervals (Table 2.3-21) of the Biscayne aquifer and two surface water monitoring locations in the return canals of the industrial wastewater facility to establish baseline temperature conditions. Figure 2.3-25 shows the locations of the monitoring wells and surface water monitoring locations.

6.1.2 CONSTRUCTION AND PREOPERATIONAL THERMAL MONITORING

The construction and preoperational thermal monitoring program is designed to continue monitoring activities during the development stages (site preparation and construction) of Units 6 & 7 until they are operational. The monitoring activities are described in the following paragraphs.

6.1.2.1 Surface Water

Thermal monitoring at the existing units' release to the industrial wastewater facility will continue in accordance with the IWW Facility Permit (FL0001562).

As part of the planned uprates of Units 3 & 4, thermal monitoring of Biscayne Bay will be performed.

No construction or pre-operational thermal monitoring of Units 6 & 7 stormwater releases to the cooling canals of the industrial wastewater facility would be performed because the stormwater would not be thermally altered.

Specific monitoring would be developed as part of the National Pollutant Discharge Elimination System (NPDES) permit process for construction activities that would occur offsite (e.g. linear facilities such as transmission corridors). The need for modifications to the monitoring program would be regularly assessed and implemented as necessary over the duration of the construction and preoperational thermal monitoring program.

6.1.2.2 Groundwater

As part of construction activities, an exploratory deep injection well would be installed to investigate the geology and hydrogeology of the site for the feasibility of disposal of fluids via deep well injection. The deep injection well and a dual zone monitoring well would be installed on the eastern perimeter of the Units 6 & 7 plant area. If the deep injection well is used for the disposal of wastewater during construction, thermal monitoring at the dual zone monitoring well would be performed on a weekly, then monthly (after operational testing) sampling interval in accordance with the UIC permit requirement. Thermal monitoring of the waste stream would likely be performed monthly.

A total of six dual zone monitoring wells would be installed at the Units 6 & 7 plant area to monitor groundwater as part of the operation of the 12 deep injection wells. Preoperational groundwater monitoring using selected zone monitoring wells would begin prior to plant operation to establish a baseline for water temperatures in the aquifers that would be affected by deep well injection from Units 6 & 7.

6.1.3 OPERATIONAL THERMAL MONITORING

The operational thermal monitoring program is designed to monitor surface and groundwater thermal impacts due to the operation of Units 6 & 7. The monitoring activities are described in the following paragraphs.

6.1.3.1 Surface Water

Thermal monitoring at the existing units' release to the industrial wastewater facility will continue in accordance with the IWW Facility Permit (FL0001562).

As part of the planned uprates of Units 3 & 4, thermal monitoring of Biscayne Bay will be performed.

No operational thermal monitoring of Units 6 & 7 stormwater releases to the industrial wastewater facility would be performed because the stormwater would not be thermally altered.

Since the radial collector wells would be a secondary cooling water source for Units 6 & 7, the monitoring frequency would be dependent upon operation. During operation, field measurements of temperature would be collected from the return canal of the industrial wastewater facility and Biscayne Bay in the area of the Turkey Point barge slip.

6.1.3.2 Groundwater

A total of six dual zone monitoring wells would be installed at the Units 6 & 7 plant area to monitor groundwater as part of the operation of the 12 deep injection wells. Thermal monitoring at the dual zone monitoring wells would be performed on a monthly sampling interval in accordance with the UIC permit requirement. Thermal monitoring of the waste stream in the deep injection wells would likely be performed monthly.

The water pumped from the radial collector wells would be monitored for temperature. Groundwater could also be monitored for temperature at monitoring wells located adjacent to the radial collector wells and along the shoreline.

6.2 RADIOLOGICAL MONITORING

The general features of the Turkey Point radiological monitoring program, currently in place for Units 3 & 4, would not change as a result of the operation of Units 6 & 7. Some additional measurement locations would be identified in support of Units 6 & 7 construction and operations. The current and planned radiological monitoring program is described in the following paragraphs.

6.2.1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM BASIS

The existing Radiological Environmental Monitoring Program (REMP) is described in the Turkey Point Offsite Dose Calculation Manual (ODCM) (FPL 2007) and is summarized in the following subsections.

6.2.2 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM CONTENTS

Preoperational data collected in the early 1970s provides a baseline for the existing units and Units 6 & 7. The measurement of radiation levels, concentrations (including surface area), and/or other quantities of radioactive material are used to evaluate potential exposures and doses to members of the public and the environment.

The following exposure pathways to radiation are monitored:

- Direct (dosimeters)
- Airborne (iodine and particulates)
- Waterborne (surface water, groundwater, and shoreline sediment)
- Aquatic (fish and crustacea tissue)
- Ingestion (fish and crustacea tissue)
- Vegetation (broadleaf vegetation)

The ODCM provides a detailed description of the monitoring program including number and location of sample collection points and measuring devices and the pathway sampled or measured, sample collection frequency and sampling duration, type and frequency of analysis, general types of sample collection and measuring equipment, and lower limit of detection for each analysis. Sampling media and sample size are defined in environmental monitoring and laboratory standard operating procedures.

Sampling results and locations are evaluated to determine effects from seasonal yields and variations. Figures 6.2-1 and 6.2-2 show the existing remote and local radiological sampling locations near the site, respectively. Table 6.2-1 provides details of the radiation exposure pathways monitored and the frequency of monitoring. Tables 6.2-2 and 6.2-3 provide remote and local sample descriptions and locations, respectively. Trending and comparison reviews provide information regarding changes in background levels and determine the adequacy of analytical techniques in light of program results and changes in technology, when compared to baseline measurements. Changes in program implementation (including sampling techniques, frequencies, and locations) may occur as a result of monitoring results.

FPL conducts a supplemental monitoring program in addition to the required program. The sample sites, frequency, and analyses have been agreed to with the Florida Department of Health. These samples are not required to be performed, but based on this agreement, are performed to provide a broader database for the REMP. Sample descriptions and locations are shown in Table 6.2-4.

FPL participates in a voluntary industry initiative on groundwater protection, developed by the Nuclear Energy Institute. Currently, nine wells are sampled quarterly. Samples are analyzed for tritium and principal gamma emitters. Sample results are included in the Annual Radiological Environmental Operating Report and the Annual Radiological Effluent Release Report. This groundwater sampling program is described in Appendix B of the REMP. Sample locations are shown in Table 6.2-5.

6.2.2.1 Preoperational and Operational Radiological Monitoring Programs

The existing Units 3 & 4 radiological monitoring program would serve as the preoperational radiological monitoring program. The existing REMP would be modified for Units 6 & 7 and would be based on *Offsite Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Pressurized Water Reactors*, 1991 (NUREG-1301) and the NRC’s Branch Technical Position Paper, *An Acceptable Radiological Environmental Monitoring Program, Revision 1*, 1979.

The ODCM would be modified for Units 6 & 7 based on the Technical Specifications and would address the requirements of 10 CFR Part 50, Appendix I. One of the requirements is the publication of the Annual Radiological Environmental Operating Report. As noted in the DCD (WEC June 2011) Chapter 16 — Technical Specifications, Section 5.6, a single report can be prepared for a multiple-unit station. Therefore, the Turkey Point REMP would address the releases from the Turkey Point site as a whole. This modified REMP would retain compliance with the Units 3 & 4 Technical Specifications and ODCM.

Additional direct radiation monitoring thermoluminescent dosimeter (TLD) locations would be added at the exclusion area boundary around Units 6 & 7. For preconstruction and construction monitoring, TLDs would be placed at the Units 6 & 7 reactor locations to determine the external radiation exposure levels.

As described in Sections 3.4 and 3.5, small amounts of radioactivity, well below regulatory limits, would be discharged from Units 6 & 7 to the Lower Floridan aquifer (Boulder Zone) through the deep injection wells. The well casings would be installed to a depth of approximately 2900 feet below grade. Each deep injection well pair would be equipped with a dual zone monitoring well. The upper monitoring zone would extend from approximately 1400 to 1420 feet below grade, and the lower monitoring zone would extend from approximately 1850 to 1870 feet below grade. These monitoring wells would serve as sample points for groundwater monitoring. These new groundwater pathway sample locations are shown on Figure 3.1-3.

The existing REMP is conducted in accordance with RG 4.15, *Quality Assurance for Radiological Monitoring Programs (Normal Operations) — Effluent Streams and the Environment, Revision 1*, 1979. Quality assurance is provided in the existing NRC-approved REMP through quality training, program implementation by periodic tests, the Inter-laboratory Comparison Program, and administrative and technical procedures. The modified REMP would be conducted in accordance with RG 4.15, *Quality Assurance for Radiological Monitoring Programs (Normal Operations) — Effluent Streams and the Environment, Revision 2*, 2007.

6.2.3 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM REPORTING

An Annual Radiological Environmental Operating Report for Turkey Point is submitted in accordance with the existing units' ODCM. Results from REMP implementation and evaluation are compared to results from previous years for measurement trends, methodology consistency, and indications that the program is adequate and does not need revisions.

A land use census is conducted annually within a designated distance of the site, currently five miles, to determine sampling yields and locations, and to ascertain if changes to the REMP are warranted. Information collected includes locations of nearest residence, milk-producing animal, and garden with broadleaf vegetation in each of the 16 compass directions. The radius of this land use census would be expanded to include the area within six miles of the mid-point between Units 3 & 4 and Units 6 & 7.

Section 6.2 References

FPL 2007. *Offsite Dose Calculation Manual for Gaseous and Liquid Effluents from the Turkey Point Plant Units 3 and 4*, Revision 14, June 2007.

WEC June 2011. Westinghouse Electric Company, LLC, *AP1000 Design Control Document*, Revision 19, Pittsburgh, Pennsylvania, June 13, 2011.

Table 6.2-1
Pre-Application, Construction/Preoperational, and Operational Radiological Monitoring Program[(a)]

Exposure Pathway and/or Sample	Number of Representative Samples and Sample Locations[(b) (c)]	Sampling and Collection Frequency[(d)]	Type and Frequency of Analysis[(d)]
1. Direct Radiation[(e)]	21 Monitoring Locations	Continuous monitoring with sample collection quarterly[(f)]	Gamma exposure rate - quarterly
2. Airborne Radioiodine and Particulates	Five Locations	Continuous sampler operation with sample collection at least weekly or more frequently if required by dust loading	Radioiodine Filter- Analysis for I-131 weekly Particulate filter - Gross beta radioactivity analysis ≥24 hours following filter change[(g)]; Gamma isotopic analysis[(h)] of composite[(g)] (by location) quarterly
3. Waterborne[(i)]			
a. Surface[(h)]	Three Locations[(j)]	Monthly	Gamma isotopic[(h)] and tritium analysis monthly
b. Sediment from shoreline	Three Locations	Semiannually	Gamma isotopic analysis[(h)] semiannually
4. Groundwater	6 Locations (1 upper zone and one lower zone monitoring well for each injection pair site)	Monthly (Gamma isotopic and tritium) Monthly/Quarterly (Gross Alpha, Radium-226, Radium-228)	Gamma isotopic[(h)], Gross Alpha, Radium-226, Radium-228 and tritium analysis.
5. Ingestion			
a. Fish and Invertebrates			
1. Crustacea	Two Locations	Semiannually	Gamma isotopic analysis[(h)] semiannually
2. Fish	Two Locations	Semiannually	Gamma isotopic analysis[(h)] semiannually
b. Food Products			
1. Broadleaf Vegetation	Three Locations[(k)]	Monthly when available	Gamma isotopic analysis[(h)] and I-131 analysis monthly

Source: FPL 2007

(a) Deviations are permitted from the required sampling schedule if specimens are unobtainable due to circumstances such as hazardous conditions, seasonal unavailability, and malfunction of automatic sampling equipment or other legitimate reasons. If specimens are unobtainable as a result of sampling equipment malfunction, corrective action shall be taken before the end of the next sampling period. All deviations from the sampling schedule will be documented in the Annual Radiological Environmental Operating Report pursuant to Control 1.4.

(b) Specific parameters of distance and direction sector from the centerline of the plant vent stack and additional description where pertinent, will be provided for each and every sample location in tables and figure(s) in the ODCM.

(c) At times, it may not be possible or practicable to continue to obtain samples of the media of choice at the most desired location or time. In these instances, suitable alternative media and locations may be chosen for the particular pathway in question and appropriate substitutions made within 30 days in the Radiological Environmental Monitoring Program given in the ODCM.

(d) The following definition of frequencies shall apply to Table 6.2-1 only:
Weekly — Not less than once per calendar week. A maximum interval of 11 days is allowed between the collection of any two consecutive samples.
Semimonthly — Not less than 2 times per calendar month with an interval of not less than 7 days between sample collections. A maximum interval of 24 days is allowed between collection of any two consecutive samples.
Monthly — Not less than once per calendar month with an interval of not less than 10 days between collection of any two consecutive samples.
Quarterly — Not less than once per calendar quarter.
Semiannually — One sample each between calendar dates (January 1–June 30) and (July 1– December 31). An interval of not less than 30 days will be provided between sample collections.
The frequency of analyses is to be consistent with the sample collection frequency.

(e) One or more instruments, such as a pressurized ion chamber, for measuring and recording dose rate continuously may be used in place of, or in addition to, integrating dosimeters. For the purposes of this table, a TLD is considered to be one phosphor; two or more phosphors in a packet are considered as two or more dosimeters.

(f) Refers to normal collection frequency. Most frequent sample collection is permitted when conditions warrant it.

(g) Airborne particulate sample filters are analyzed for gross beta radioactivity 24 hours or more after sampling to allow for radon and thorium daughter decay. In addition to the requirement for a gamma isotopic on a composite sample, a gamma isotopic is also required for each sample having a gross beta radioactivity which is >1.0 pCi/m3 and which is also >10 times that of the most recent control sample.

(h) Gamma isotopic analysis means the identification and quantification of gamma-emitting radionuclides that may be attributable to the effluents from the facility.

(i) Discharges do not influence drinking water or groundwater pathways.

(j) Offshore grab samples.

(k) Samples of broadleaf vegetation grown nearest each of two different offsite locations of highest predicted annual average ground level D/Q, and one sample of similar Broadleaf vegetation at an available location 15–30 kilometers distant in the least prevalent wind direction based upon historical data in the ODCM.

Table 6.2-2 (Sheet 1 of 2)
Remote Radiological Monitoring Program Sample Description and Location

Pathway	Location	Description	Samples Collected	Sample Collection Frequency	Approx. Distance (miles)	Direction Sector
Direct Radiation	N-7	Black Point Marina parking lot on siren pole	TLD	Quarterly	7	N
Direct Radiation	N-10	Old Cutler Rd across from Perdue Med. Ctr. on siren pole	TLD	Quarterly	10	N
Direct Radiation	NNW-10	Bailes Rd. E. of US 1 on siren pole	TLD	Quarterly	10	NNW
Direct Radiation	NW-5	Intersection of Mowry Dr. & 117th Ave. on siren pole	TLD	Quarterly	5	NW
Direct Radiation	NW-10	On Newtown Rd. N. of Coconut Palm Drive on siren pole	TLD	Quarterly	10	NW
Direct Radiation	W-5	Palm Drive 0.3 mi. west of Tallahassee Rd	TLD	Quarterly	5	W
Direct Radiation	WNW-10	NW 2nd Ave. S. of Campbell Dr. at Hmstd. Middle School on siren pole	TLD	Quarterly	10	WNW
Direct Radiation	W-9	Card Sound Rd. 0.6 mi. SSE of US 1 on siren pole	TLD	Quarterly	9	W
Direct Radiation	WSW-8	Card Sound Rd. 3.4 mi. SSE of US 1 on siren pole	TLD	Quarterly	8	WSW
Direct Radiation	SW-8	Card Sound Rd. 5 mi. SSE of US 1 at entrance to Navy facility	TLD	Quarterly	8	SW
Direct Radiation	SSW-5	On site, southwest corner of cooling canals	TLD	Quarterly	5	SSW
Direct Radiation	SSW-10	At Card Sound Bridge on siren pole	TLD	Quarterly	10	SSW
Direct Radiation	S-5	On site, south east end of cooling canals	TLD	Quarterly	5	S
Direct Radiation	S-10	Card Sound Road at Steamboat Creek	TLD	Quarterly	10	S
Direct Radiation	SSE-10	Ocean Reef	TLD	Quarterly	10	SSE
Direct Radiation	NNE-22[(a)]	Natoma Substation	TLD	Quarterly	22	NNE
Airborne	T57	Siren pole 27, intersection of SW 112th Ave and SW 304th St.	Radioiodine and Particulate	Weekly	4	NW
Airborne (Alternate to T57)	T52	Florida City Substation	Radioiodine and Particulate	Weekly	7	W

Table 6.2-2 (Sheet 2 of 2)
Remote Radiological Monitoring Program Sample Description and Location

Pathway	Location	Description	Samples Collected	Sample Collection Frequency	Approx. Distance (miles)	Direction Sector
Airborne	T64[(a)]	Natoma Substation	Radioiodine and Particulate	Weekly	22	NNE
Waterborne	T67[(a)]	Biscayne Bay, vicinity of Cutler Plant north to Matheson Hammock Park	Surface Water Shoreline Sediment	Monthly Semiannually	13–18	N,NNE
Waterborne	T81	Card Sound, near mouth of old discharge canal	Surface Water Shoreline Sediment	Monthly Semiannually	6	S
Food Products	T67[(a)]	Biscayne Bay, vicinity of Cutler Plant north to Matheson Hammock Park	Crustacea Fish	Semiannually Semiannually	13-18	N,NNE
Food Products	T81	Card Sound near mouth of old Discharge Canal	Crustacea Fish	Semiannually Semiannually	6	S
Food Products	T40	South of Palm Dr. on SW 117th St extension	Broadleaf vegetation	Monthly	3	W/WNW
Food Products	T67[(a)]	Near Biscayne Bay, Vicinity of Cutler Plant North to Matheson Hammock Park	Broadleaf vegetation	Monthly	13–18	N, NNE

(a) Denotes control sample

Source: FPL 2007

Table 6.2-3
Local Radiological Monitoring Program Sample Description and Location

Pathway	Location	Description	Samples Collected	Sample Collection Frequency	Approx. Distance (miles)	Direction Sector
Direct Radiation	N-2	Convoy Point	TLD	Quarterly	2	N
Direct Radiation	NNW-2	East end of N. Canal Dr. on siren pole E. of 117th Ave.	TLD	Quarterly	2	NNW
Direct Radiation	NW-1	Turkey Point Entrance Rd	TLD	Quarterly	1	NW
Direct Radiation	W-1	On site north side of Discharge Canal.	TLD	Quarterly	1	W
Direct Radiation	SW-1	On site near land utilization offices	TLD	Quarterly	1	SW
Direct Radiation	SSE-1	On site South East side of cooling canals at "Turtle Point"	TLD	Quarterly	1	SSE
Airborne	T51	Entrance to Homestead Bayfront Park	Radioiodine and Particulate	Weekly	2	NNW
Airborne (Alternate to T51)	T71	Red Barn/Beach Area	Radioiodine and Particulate	Weekly	0.5	NNE
Airborne	T58	Turkey Point Entrance Rd	Radioiodine and Particulate	Weekly	1	NW
Airborne	T72	Turkey Point Land Utilization Entrance	Radioiodine and Particulate	Weekly	<1	WSW
Groundwater	6 total	Deep Injection Monitoring Wells	Groundwater	Monthly/Quarterly	<1	Multiple
Waterborne	T42	Biscayne Bay, at Turkey Point	Surface Water Shoreline Sediment	Monthly Semi-annually	<1	ENE
Food Products	T41	Palm Dr. west of FPL wellness center near the site boundary	Broadleaf vegetation	Monthly	2	WNW

Source: FPL 2007

Table 6.2-4 (Sheet 1 of 3)
Supplemental Radiological Monitoring Program Sample Description and Location

Pathway	Location	Description	Samples Collected	Sample Collection Frequency	Approx. Distance (miles)	Direction Sector
Direct Radiation	NNW-6	Siren S29 pole, NE corner Moody Dr. (SW 268 St) & Allapattah (SW 112 Av)	TLD	Quarterly	6	N
Direct Radiation	NW-7	Siren S28 pole, E side Pine Island Rd (SW 132 Av) & N of Waldin Dr (SW 280 St.)	TLD	Quarterly	7	N
Direct Radiation	NW-8	Siren S7 pole, SW 152 Av at E end of SW 248 St	TLD	Quarterly	8	NNW
Direct Radiation	WNW-2	FPL Satellite School, cement pole in school yard	TLD	Quarterly	2	NW
Direct Radiation	WNW-3	Siren S21 pole, NW corner Palm Dr and Allapattah Rd (SW 117 Av)	TLD	Quarterly	3	NW
Direct Radiation	W-8	Siren S25 pole, W side Tallahassee Rd (SW 137 Av), N of Moody Dr	TLD	Quarterly	8	W
Direct Radiation	ENE-1	E end of Turkey Point, past Ranger Station	TLD	Quarterly	1	WNW
Direct Radiation	T71	On Site "Red Barn" picnic area	TLD	Quarterly	0.5	NNE
Direct Radiation	T72	On Site, just outside LU entrance	TLD	Quarterly	<1	On Site
Airborne	T41	FPL Satellite School, cement pole in school yard	Radioiodine and Particulate	Weekly	2	WNW
Airborne	T52	Florida City Substation	Radioiodine and Particulate	Weekly	8	W
Airborne	T56	SW corner parking lot @ Black Point Marina	Radioiodine and Particulate	Weekly	7	NNW
Airborne	T71	On Site "Red Barn" picnic area	Radioiodine and Particulate	Weekly	0.5	NNE
Waterborne	T75	Florida City Canal (~ cross-street from satellite school)	Surface Water	Monthly	1.2	NW

Table 6.2-4 (Sheet 2 of 3)
Supplemental Radiological Monitoring Program Sample Description and Location

Pathway	Location	Description	Samples Collected	Sample Collection Frequency	Approx. Distance (miles)	Direction Sector
Waterborne	T84	Cooling canal, discharge, ~ by bridge to parking lot	Surface Water	Monthly	0.5	WSW
Waterborne	T97	Cooling Canal, intake, ~ Air Force school area	Surface Water	Monthly	0.2	E
Waterborne	T08	Southern shore of canal system, west of Grand Canal Bridge	Surface Water	Monthly	5.5	S
Waterborne	T84	‘Seaweed’ from any location in the cooling canal	Waterborne Seaweed	Quarterly	0.5	WSW
Waterborne	T01	Cooling Canals	Surface Water Shoreline Sediment	Annual	<1	WSW
Waterborne	T02	Cooling Canals	Surface Water Shoreline Sediment	Annual	<1	WSW
Waterborne	T03	Cooling Canals	Surface Water Shoreline Sediment	Annual	<1	WSW
Waterborne	T04	Cooling Canals	Surface Water Shoreline Sediment	Annual	<1	WSW
Waterborne	T05/T84	Cooling Canals	Surface Water Shoreline Sediment	Semiannual	<1	WSW
Waterborne	T06/T85	Cooling Canals	Surface Water Shoreline Sediment	Semiannual	<1	WSW
Waterborne	T07	Cooling Canals	Surface Water Shoreline Sediment	Annual	<1	WSW

Table 6.2-4 (Sheet 3 of 3)
Supplemental Radiological Monitoring Program Sample Description and Location

Pathway	Location	Description	Samples Collected	Sample Collection Frequency	Approx. Distance (miles)	Direction Sector
Waterborne	T08	Cooling Canals	Surface Water Shoreline Sediment	Annual	<1	WSW
Waterborne	T09	Cooling Canals	Surface Water Shoreline Sediment	Annual	<1	WSW
Waterborne	T10	Cooling Canals	Surface Water Shoreline Sediment	Annual	<1	WSW
Ingestion	T99	183rd block of SW 262nd St.	Milk	Semiannual	12	WNW
Ingestion (alt)	-	134th block of SW 224th St.	Milk	Semiannual	10	W
Ingestion	T84	Cooling canal, discharge, ~ by bridge to parking lot	Fish	Semiannual	0.5	WSW
Ingestion	T43	Various locations: “truck farm” point of sale growing fields, miscellaneous other sources locally grown food crops (e.g., corn, potato, sugarcane, greens, etc.		Annual	Various locations N through NW to W typically 2 to 10 miles from plant	
Ingestion	T44					
Ingestion	T45					

Source: FPL 2007

Table 6.2-5
Groundwater Sampling Program to Support the Industry Initiative on Groundwater Protection

Well	Location
G-21	Tallahassee Road extension, west of FPL property. Sample from top and bottom.
G-28	Tallahassee Road extension, west of FPL property. Sample from top and bottom.
L-3	West of Interceptor Canal, on Land-U property. Sample from top and bottom.
L-5	West of Interceptor Canal, on Land-U property. Sample from top and bottom.
STP-1	Northeast of Turkey Point Sewage Plant.
P-94-2	North of Solids Settling Basin, east of Turkey Point intake.
P-94-4	East of Dress-out Building, in the RCA.
PTPED-9	Northeast Corner of Neutralization Basin.
CD-1	Northeast Corner of Neutralization Basin.

Source: FPL 2007

Figure 6.2-1 Units 6 & 7 Remote REMP Sample Locations

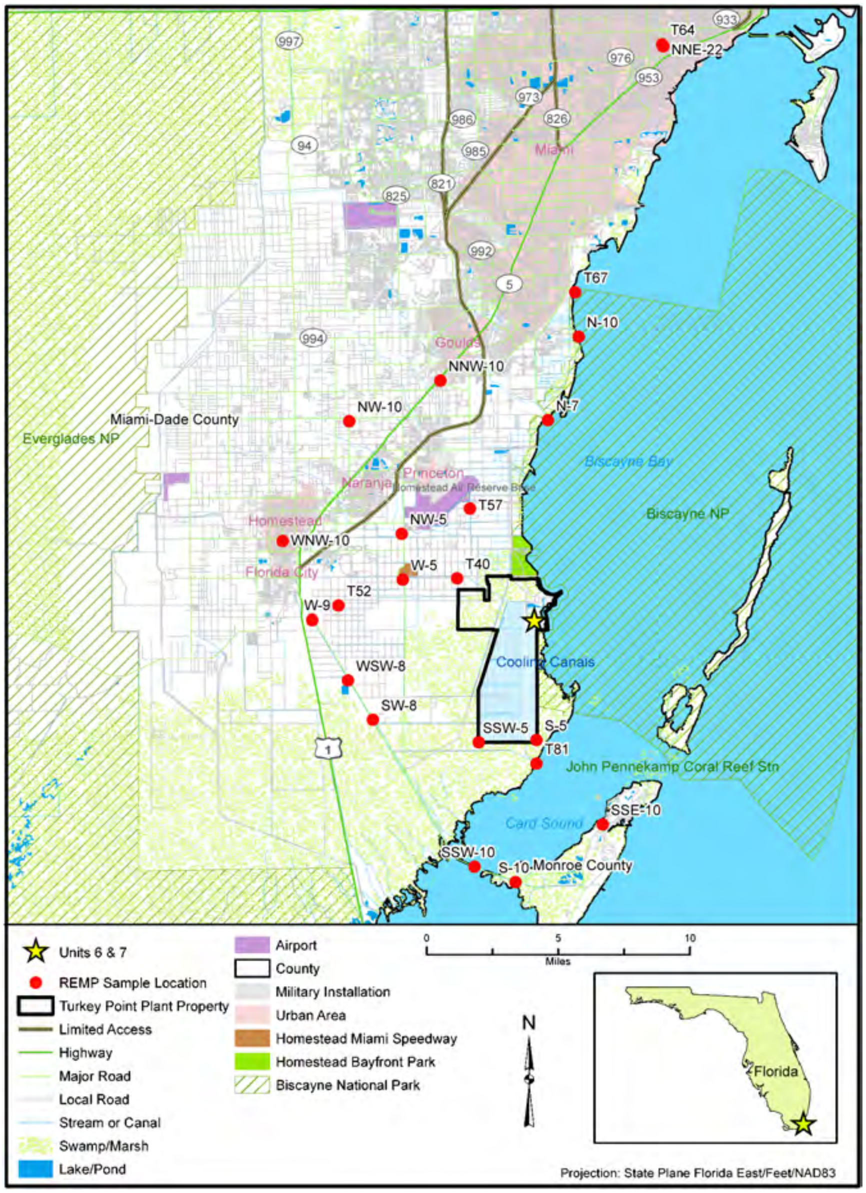
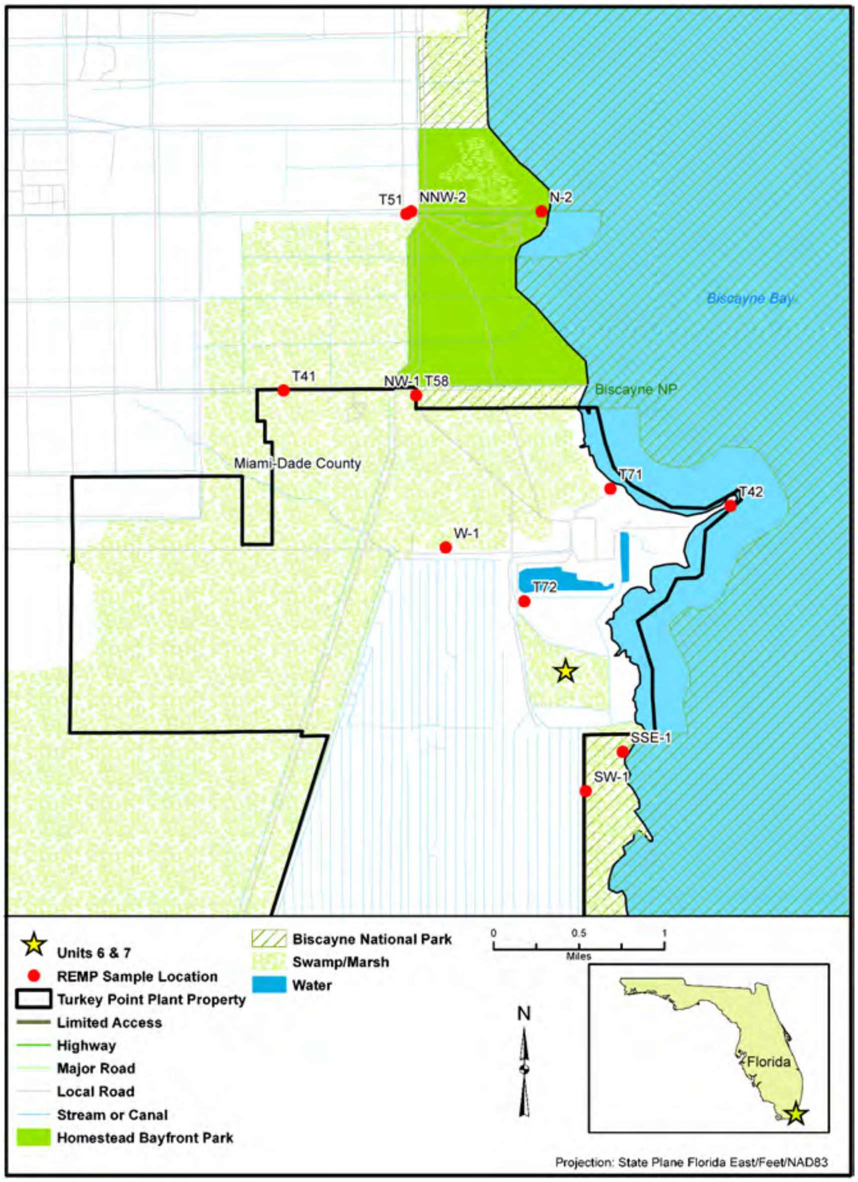


Figure 6.2-2 Units 6 & 7 Remote REMP Sample Locations



6.3 HYDROLOGICAL MONITORING

This section addresses the hydrologic monitoring program that would be implemented to monitor the effects of Units 6 & 7 on the local hydrology. The hydrological monitoring includes baseline (pre-application) groundwater monitoring, field studies for the radial collector wells and deep injection wells, monitoring of construction dewatering activities and surface water discharge, and operational monitoring of the deep injection wells and radial collector wells.

6.3.1 PRE-APPLICATION HYDROLOGICAL MONITORING

This phase of the monitoring supported the background hydrologic descriptions presented in Section 2.3. The objective of the pre-application hydrologic monitoring program is to document background conditions of local groundwater before the construction and operation of the Units 6 & 7. Additional monitoring was performed during pumping tests at the Units 6 & 7 plant area to provide design-level hydrogeologic data for construction dewatering. The pre-application monitoring is described in the following sections.

6.3.1.1 Groundwater Monitoring — Units 6 & 7 Plant Area

This data consisted of groundwater level measurements obtained from shallow and deep monitoring wells installed at the Units 6 & 7 plant area. The monitoring wells and water level measurements are summarized in Table 2.3-15. Figure 2.3-25 depicts the location of the monitoring wells. In addition, water levels were monitored at several monitoring wells using pressure transducers on an hourly (first month) and continuous 36-hour period per month (remainder of year).

6.3.1.2 Groundwater Monitoring — Pumping Tests

Groundwater pumping tests were performed at the Units 6 & 7 plant area to collect hydrogeologic information to determine the design level data for construction dewatering. Monitoring included baseline water levels to determine tidal influences before and during the pumping tests.

Monitoring of the pumping test included discharge rates at each pumping well and water level measurements at multiple, temporary monitoring wells screened at several levels from approximately 10 feet below grade to 110 feet below grade. Subsection 2.3.1.2.2.3 describes the results of these tests.

6.3.2 CONSTRUCTION HYDROLOGICAL MONITORING

The objective of the construction hydrologic monitoring program is to monitor and control potential effects caused by site preparation and construction. Controls and mitigation measures for anticipated construction effects are presented in Section 4.2.

6.3.2.1 Surface Water

As addressed in Section 4.2, the construction activities for Units 6 & 7 would be performed as required under the existing Florida Department of Environmental Protection (FDEP) National Pollutant Discharge Elimination System (NPDES) permit. FDEP adopted the *Generic Permit for Stormwater Discharge from Large and Small Construction Activities* under Rule 62-621.300(4) of the Florida Administrative Code (F.A.C.). Construction activities would be in accordance with any new permit requirements for Units 6 & 7, including any monitoring requirements. As required, a stormwater pollution prevention plan would be developed or the work would be performed under existing FPL permits/plans for construction activities that would require dewatering. The potential effects of groundwater drawdown on surface water features in the vicinity of the construction would be monitored.

Hydrologic monitoring of surface water during the construction of Units 6 & 7 would include monitoring of the cooling canals (e.g., water level, turbidity) to ensure no adverse impacts on the operations of Units 1 through 4.

In addition, hydrologic monitoring of surface water would be established at surface water monitoring points most likely to be potentially impacted by construction activities. These locations could include the barge turning basin and Biscayne Bay and would be monitored for applicable hydrologic parameters including turbidity to ensure no adverse impacts to surface water.

Specific monitoring would be developed as part of the NPDES permit process for construction activities that would occur offsite (e.g., roadway improvements, transmission substation expansion, and linear facilities such as transmission line rights-of-way, reclaimed water pipelines, and potable water pipelines). The need for modifications to the monitoring program would be regularly assessed and implemented as necessary over the duration of the construction hydrological monitoring program to ensure no adverse impacts.

6.3.2.2 Groundwater

As addressed in Section 4.2, the dewatering required for site preparation and the excavation of the Units 6 & 7 power block area could impact groundwater in the area. Several pre-application monitoring wells (Figure 2.3-25) are located within the construction area for Units 6 & 7, and therefore, would have to be abandoned in accordance with FDEP or South Florida Water Management Department regulatory guidelines before construction activities. Several replacement wells may require installation at appropriate locations to ensure adequate monitoring continues during construction. During dewatering activities associated with the construction of the power blocks, temporary monitoring wells may be installed near construction areas to monitor changes in the water table.

As presented in Section 4.2, construction-related wastewater may be discharged to a deep injection well. As previously described in Section 6.1, an exploratory deep injection well would be constructed, along with a dual zone monitoring well. Once permitted, the deep injection well and dual-zone monitoring well would be operated to monitor the injection process and ensure that no adverse effects occur to the overlying aquifer units. Table 6.3-1 summarizes the monitoring of this deep injection well. The data would be collected and submitted to FDEP in accordance with the underground injection control well permit.

Hydrologic alteration to groundwater from the improvement of existing site roads could occur. However, impacts resulting from the hydrologic alteration of groundwater flow, if it occurs, would be temporary and groundwater would return to pre-existing conditions. Therefore, no hydrologic monitoring of groundwater in these areas would be required during construction activities.

Impacts to groundwater flow from equipment barge unloading area modifications would be temporary and groundwater would return to pre-existing conditions. Therefore, no hydrologic monitoring of groundwater in these areas would be required during construction activities.

Any dewatering activities related to construction activities that would occur offsite (e.g., roadway improvements, transmission substation expansion, and linear facilities such as transmission line rights-of-way, reclaimed water pipelines, and potable water pipelines) would be localized and temporary, therefore, no hydrologic monitoring of groundwater in these areas would be required.

6.3.3 PREOPERATIONAL HYDROLOGICAL MONITORING

The preoperational hydrological monitoring program would be designed to provide the baseline for evaluating hydrologic changes arising from the operation of Units 6 & 7. The preoperational hydrological monitoring program would begin approximately 1 year before Unit 6 operation to establish a refined baseline. Additional monitoring wells may be installed following construction activities and before plant operation.

Surface water monitoring during the preoperational phase would be similar to the construction phase. The water level elevation of the existing cooling canals would continue to be monitored during this phase until groundwater levels in the vicinity of the power blocks return to normal. Once this occurs, surface water elevation data for the cooling canals in the vicinity of Units 6 & 7 would be collected to reestablish a baseline for the operations of the radial collector wells.

6.3.3.1 Surface Water

Surface water monitoring for the cooling canals of the industrial wastewater facility during the preoperational phase would be addressed using the existing surface water monitoring program and would suffice as the preoperational hydrologic baseline.

Pre-operational hydrological monitoring for the radial collector wells could include surface water stage within the return canal of the industrial wastewater facility and in Biscayne Bay in the area of the equipment barge unloading area.

During the preoperational phase, it could be necessary to perform routine maintenance on the offsite facilities (e.g., transmission lines, reclaimed and potable water pipelines, access roads). Any disturbances to surface water flow as a result of the activities would be temporary and would not require hydrologic monitoring.

6.3.3.2 Groundwater

Monitoring would be conducted to reestablish baseline conditions for groundwater levels and flow direction after construction is complete. Permanent monitoring wells at the Units 6 & 7 plant area would continue to be monitored to determine the effects of the construction activities on local groundwater.

Initial startup and monitoring plans would be developed and executed as necessary to demonstrate the operational effectiveness of the radial collector wells and the effects on the local groundwater flow regime and surface water bodies such as the industrial wastewater facility and Biscayne Bay.

As previously described in Section 5.2, the operation of the deep injection wells would consist of 12 deep injection wells and 6 dual zone monitoring wells to monitor the potential impact of the injection process on overlying aquifer units. It is anticipated that hydraulic monitoring would be similar to the construction monitoring summarized in Table 6.3-1. Groundwater monitoring data would be collected and submitted to the FDEP in accordance with the underground injection control well permit.

Preoperational testing of the deep injection wells would be performed to validate the initial construction and monitor the effects on local groundwater at the site. Preoperational startup testing and monitoring plans for the deep injection wells would be developed and implemented.

During the preoperational phase, it could be necessary to perform maintenance that would require excavation and dewatering at offsite facilities (e.g., transmission lines, reclaimed and potable water pipelines, access roads). The dewatering activity could create temporary drawdown of the water table. However, the water table and flow would return to normal once dewatering ceased. No hydrologic monitoring of these offsite facilities is required during preoperation.

6.3.4 OPERATIONAL HYDROLOGICAL MONITORING

This phase of the monitoring would document observable effects from Units 6 & 7 operation. The operational hydrologic monitoring program would be designed to document the effects of the operation of the units and detect any unexpected effects that arise from facility operation. The operational hydrological monitoring program is anticipated to extend preoperational monitoring for the duration of the Units 6 & 7 operation. Modifications to the monitoring program (for example, changes in monitoring stations or collection procedures) would be regularly assessed over the duration of the operational hydrological monitoring program.

6.3.4.1 Surface Water

As addressed in Section 5.2, the FDEP has delegated authority of the NPDES permitting program for the state of Florida. Florida adopted the federal storm water general permit for industrial activities as specified in Rule 62-621.300(5) (a), F.A.C., and operates the permit as the *State of Florida Multi-Sector Generic Permit for Stormwater Discharge Associated with Industrial Activity*. Stormwater from Units 6 & 7 would be released to the industrial wastewater facility under a requested modification of the site's non-discharge IWWF permit.

It is anticipated that surface water monitoring of the existing cooling canals would continue to be performed similar to the preoperational monitoring activities.

Since the radial collector wells would be a secondary cooling water source for Units 6 & 7, the monitoring frequency would be dependent upon their operation. Surface water stages would be measured within the return canal of the industrial wastewater facility and in Biscayne Bay in the area of the equipment barge unloading area.

6.3.4.2 Groundwater

Specifics related to the operational monitoring are anticipated to be similar to the specifics for the preoperational hydrological monitoring program. An operational plan for hydrologic monitoring may be implemented to identify changes in groundwater hydrology from the pumping of water from the radial collector wells. The groundwater level monitoring program would consist of extending preoperational monitoring for the duration of the Units 6 & 7 operation. The need for modifications to the monitoring program (for example, changes in monitoring stations or frequency of collection) would be regularly assessed over the duration of the operational hydrological monitoring program.

As presented in Section 5.2, wastewater and cooling tower blowdown would be discharged to the Boulder Zone of the Lower Floridan aquifer via deep injection wells. Twelve deep injection wells and six dual-zone monitoring wells would be operated. It is anticipated that the hydraulic monitoring program would be similar to the exploratory well monitoring program and is summarized in Table 6.3-1.

During operation, the volume of water pumped by the radial collector wells would be monitored. Groundwater could be also monitored at monitoring wells adjacent to the collector wells and along the shoreline to collect field measurements of water elevation.

During the operational phase, it could be necessary to perform routine maintenance on the offsite facilities (e.g., transmission lines, reclaimed and potable water pipelines, access roads). Any disturbances to surface water flow as a result of the activities would be temporary and would not require hydrologic monitoring.

Table 6.3-1
Hydrological Monitoring of the Deep Injection Wells

Monitoring Station	Parameter	Frequency
Deep Injection Wells	Flow Rate	Continuous
Dual Zone Monitoring Wells	Water Level	Continuous

6.4 METEOROLOGICAL MONITORING

The meteorological monitoring program is the same throughout the pre-application, preconstruction, construction, and operational phases. The monitoring program is a continuation of the ongoing meteorological monitoring program for Units 3 & 4.

The purpose of this section is to establish that the onsite meteorological measurements program used by Units 6 & 7 would be adequate to: (1) describe local and regional atmospheric transport and diffusion characteristics, (2) ensure environmental protection, and (3) provide an adequate meteorological database for evaluation of the effects of plant operation. This description includes an analysis of the meteorological monitoring system that provides an evaluation of:

- Tower location and instrument siting
- Meteorological parameters measured
- Meteorological sensors
- Data recording and transmission
- Instrument surveillance
- Data acquisition and reduction
- Data validation and screening
- Data display and archiving
- System accuracy
- Data recovery rate and annual and joint frequency distribution of data
- Need for additional data sources for airflow trajectories

This evaluation demonstrates that the meteorological monitoring program meets the requirements of 10 CFR Part 50, Appendix I and 10 CFR 51.45(c), 51.50, and 100.20(c)(2) and the guidance in Section C of RG 1.23, Revision 1, with the exception of humidity measurements; Section C.4 of RG 1.111, Revision 1; RG 1.21, Revision 1 and ANSI/ANS 3.11, Dec 2005.

6.4.1 GENERAL DESCRIPTION — ONSITE METEOROLOGICAL MEASUREMENTS PROGRAM

The location at which meteorological measurements would be necessary in order to characterize the dispersion conditions depends largely on the complexity of the terrain in the vicinity of the site. The following briefly describes the topographic features of the Turkey Point vicinity. This description, together with the description in Section 2.7 regarding the topographic features and the dispersion characteristics of the Turkey Point plant property, forms the basis for assessing the adequacy of the meteorological monitoring program for Units 6 & 7.

As a peninsula, Florida receives sea breezes from both the Gulf of Mexico and the Atlantic Ocean. The major local influence on onsite meteorology is the presence of the Atlantic Ocean. Units 6 & 7 would be located less than 0.4 miles west from the shore of Biscayne Bay. Figures 2.7-1 and 2.7-15 provide 50-mile and 5-mile radius maps, respectively. As shown in Figure 2.7-1, terrain within 50 miles is generally flat and rises gently from sea level at the shore to approximately 86 feet MSL northeast of the site and 8 to 10 miles west of the site. Additional images presenting terrain variations by downwind sector are shown in Figure 2.7-14.

6.4.2 PREOPERATION MONITORING PROGRAM

Unit 3 began operation in 1972 and Unit 4 in 1973. Renewed operating licenses for both units were issued by the NRC in 2002 (NUREG-1437). The onsite meteorological measurement program includes the South Dade 60-meter guyed meteorological tower that serves as the primary data collection system and the land utilization (LU) 10-meter tower with engineered guy wires that serves as a backup to the primary system. The 10-meter tower is used for emergency situations at Turkey Point. The South Dade tower was rebuilt in 1994. Meteorological data from the South Dade tower was used for pre-application analysis. The backup meteorological system is an independent system installed and maintained for the purpose of providing redundant site-specific meteorological information (10-meter wind speed, wind direction, and sigma theta), representative of the local environment.

The onsite meteorological measurement program for both the primary and backup towers was upgraded in 2007 to support the new Units 3 & 4 Distributed Control System (DCS) installation. Existing data loggers and radio communication equipment were replaced with improved instrumentation to enhance the maintainability and reliability of the system. The upgraded system included meteorological tower communication hardware and computer software.

The monitoring system is equipped with lightning protection and redundant power supplies.

For preparation of the COL Application, the adequacy and accuracy of the meteorological collection system were assessed based on the recommendations contained in NUREG-1555. The areas assessed include tower locations, siting of sensors, sensor performance specifications, methods and equipment for recording sensor output, data acquisition and reduction procedures, and the quality assurance program for sensors, recorders, and data reduction. The findings, as summarized in Tables 6.4-1 through 6.4-4 conclude that the instrument heights, location of the South Dade tower, relocation of the LU tower, system accuracies, methodologies for data acquisition and reduction, and procedures for instrumentation surveillance conform to RG 1.23 Revision 1 (except for humidity measurements as previously noted) and industry standard ANS/ANSI 3.11 (Dec 2005). Data collected by the South Dade tower for Units 3 & 4 provides a suitable data set for Units 6 & 7.

Because the South Dade tower and instrument siting conform to RG 1.23, Revision 1, data collected by the tower is representative of the overall site meteorology. Instrumentation surveillance and data validation in accordance with the applicable regulatory and industry guidance has routinely been performed to ensure data quality as well as to achieve the acceptable annualized data recovery rate of 90 percent.

Data collected from the South Dade tower has been used for Units 6 & 7 to:

- Describe local and regional atmospheric transport and diffusion characteristics
- Calculate the dispersion estimates for both postulated accidental and expected routine airborne releases of effluents
- Evaluate environmental risk from the radiological consequences of a spectrum of accidents
- Provide an adequate meteorological database for evaluation of the effects of construction and operation, including radiological and nonradiological impacts and real-time predictions of atmospheric effluent transport and diffusion.

6.4.2.1 Location, Elevation, and Exposure of Instruments

Factors that were considered in determining how well the measurement instrument locations would represent the conditions for Units 6 & 7 include the prevailing wind direction, topography, and location of man-made and vegetation obstructions.

Findings, as presented below, indicate that the data collected from the South Dade tower is suitable for use in characterizing atmospheric dispersion conditions for Units 6 & 7.

6.4.2.2 Tower Siting and Instrument Conformance

The geographic coordinates for the South Dade tower are: 25º 21' 05.74120" north latitude and 80º 22' 45.54962" west longitude. The geographical coordinates for the LU tower are: 25º 25' 35.072" north latitude and 80º 20' 15.536" west longitude.

As shown in Figure 2.7-15, the area within five miles of Units 6 & 7 is generally flat with terrain variation of approximately seven feet. The locations of the South Dade and LU meteorological towers with respect to the existing and new units are shown in Figure 6.4-1 and 6.4-2, respectively. The South Dade tower is approximately 5.8 miles southwest of Units 6 & 7, at elevation 0.8 feet MSL, while the LU tower is currently approximately 0.30 miles northwest of Units 6 & 7, at elevation 3 feet MSL. The finished grade at the Units 6 & 7 power blocks would be approximately 25.5 feet MSL.

Although the base of the South Dade tower is approximately 25 feet below the elevation of the finished plant grade of Units 6 & 7, there would be minimal terrain variations between the Units 6 & 7 plant area and the South Dade tower. The locations of the South Dade meteorological tower and Units 6 & 7 have similar meteorological exposures.

The base of the LU tower would be approximately 22 feet below the finished plant grade of Units 6 & 7. Based on the relatively close distance (0.30 miles) of the LU tower to Units 6 & 7, the LU tower would have different meteorological exposures than Units 6 & 7 and would require relocation.

6.4.2.3 Obstructions

The wind sensors should be located over level, open terrain at a distance of at least 10 times the height of any nearby natural and man-made obstructions (e.g., terrain, trees, and buildings), if the height of the obstruction exceeds one-half the height of the wind measurements (RG 1.23, Revision 1). Therefore, an assessment regarding whether the wind measurements made at locations and heights on the South Dade and LU towers would avoid airflow modifications by obstructions was made and the findings are described below.

Equipment shelters, housing the data acquisition system for tower measurements and a backup diesel generator, are located adjacent to both the South Dade and LU towers. The shelters are located on raised mounds to protect them from tidal surges and hurricanes.

The South Dade equipment shelter mound (the built up area on which the shelter rests) is approximately 21.5 feet north of the South Dade tower and the equipment shelter building is approximately 36.8 feet north of the tower. The roof height of the shelter (relative to 60-meter tower base elevation) was measured; the shelter mound at approximately 9.6 feet above ground level north of the tower and the shelter roof at approximately 10.8 feet above the base, for a total height of approximately 20.4 feet.

Possible obstruction interference on the South Dade meteorological measurement was evaluated. The azimuth angles of each side of the shelter were sighted and measured from the tower base. These form the basis of defining a sector of possible influence. This sector extends from approximately 353 degrees to 28 degrees in the 360-degree tower wind measurement field.

A frequency of occurrence analysis of wind direction for one year (January–December 2003) of wind data from the 10-meter level from the sector of possible influence occurred 6.8 percent of the time during 2003. It was concluded that the effects of the building mound/shelter at the 10-meter wind measurement were minimal.

There have been no changes to obstructions in relation to the South Dade tower. As previously stated, potential wake effects are not considered to have influenced wind measurements from the South Dade tower during the period of record used to support preparation of this COL Application.

The surrounding terrain, nearby trees, and plant structures (existing and planned) were also evaluated to determine whether they could affect the meteorological measurements. As shown in Figure 6.4-1, surrounding terrain of the South Dade tower, located in an open field, is generally flat with low profile plants. No terrain-induced airflow influence on the meteorological measurement would result. The tallest existing and planned buildings (both Units 3 & 4 and Units 6 & 7) would be approximately 5.8 miles northeast from the South Dade tower. No building-induced obstructions to airflow would result from Units 6 & 7.

Finally, wind sensors are mounted on a boom extending six feet outward on the upwind side of the tower to minimize tower structure influence.

The LU meteorological tower equipment shelter is currently located approximately 35 feet (10.7 meters) west of the 10-meter LU tower. With an obstruction height of approximately 20 feet, according to the 10 times the height of the obstruction convention, the tower should be 200 feet away. Since tower separation from the obstruction is approximately 35 feet, the site does not meet conventional specifications for the measurement of an obstruction. A utility pole is located northwest of the LU tower. It should be noted however, that similar to the South Dade tower, the obstructions are not in the path of prevailing east wind direction flow.

Due to increased traffic during Units 6 & 7 construction and the raised elevation of the finished plant grade (25.5 feet MSL) and associated structures, the LU tower would need to be relocated to an appropriate location on the plant property to ensure tower/instrument operation is in conformance with relevant regulations and guidance documents.

6.4.2.4 Heat and Moisture Sources

Based on the structure layout as shown in Figure 6.4-3, the ambient temperature measurements on the South Dade tower were assessed to determine whether they avoid air modification by any heat and moisture sources (e.g., ventilation sources, cooling towers, water bodies, large parking lots). A brief description is also included for the LU tower.

The South Dade tower is in a field with grassy surfaces. There are no large concrete or asphalt parking lots or temporary land disturbances such as plowed fields or storage areas nearby. The closest large concrete or asphalt parking lots and ventilation sources are at Units 3 & 4, which is approximately 6.5 miles from the South Dade tower.

The cooling system for Units 6 & 7 would include six mechanical draft cooling towers. As shown in Figure 6.4-1, the cooling canals of the industrial wastewater facility are approximately 4500 feet northeast of the South Dade tower at their closest point, while the Units 6 & 7 cooling towers would be located approximately 5.5 miles northeast of the South Dade tower. The location of the South Dade tower is not directly downwind of the cooling canals or the Units 6 & 7 cooling towers under the prevailing downwind wind direction (i.e., easterly). Therefore, there would be no influence on the South Dade heat sensors. In addition, the tower temperature sensors are mounted in fan-aspirated radiation shields, which are horizontal to minimize the impact of thermal radiation and precipitation. The monitoring functions on the South Dade tower would be maintained.

The LU tower is located immediately adjacent to the main return canal in the industrial wastewater facility (Figure 6.4-2). Although the proximity to the canals could impact temperature measurements, temperature is not measured at the LU tower. The LU tower is used for emergency situations only (short-term) and not for normal data collection/reporting. The LU tower is located near an asphalt road, however the road has very little traffic and again, temperature is not measured at the LU tower. The potential effects from temperature would not be a factor for tower relocation.

No parameters related to atmospheric moisture are currently measured on the Turkey Point plant property.

6.4.2.5 Wind Loss

Both precipitation gauges are equipped with funnel screens, but not equipped with wind shields to prevent wind-caused under-recording of precipitation. However, wind effects on precipitation catch losses are known to be much greater during snowfall than rainfall, and snowfall is not a factor at the Turkey Point plant property.

6.4.2.6 Meteorological Parameters Measured

Meteorological instrumentation includes two levels of measurements on the South Dade tower, and a single level on the LU tower. The meteorological data collected for NRC reporting take all of their data from the South Dade tower. The LU 10-meter data would be used as backup, if needed. The meteorological instrumentation on these towers is summarized in Table 6.4-3.

The actual height of the sensors for wind direction and speed at the 10-meter elevation of the South Dade tower (height from bottom of concrete pad base is 11.58 meters (38.0 feet). The Units 6 & 7 reactor buildings would have no stacks. Power block accident atmospheric release points for the AP1000 are at ground level, 25.5 feet above sea level, below the upper wind measurement height (i.e., 60 meters). Ground level releases include all release points or areas that are lower than two and one-half times the height of adjacent solid structures. Because the ground level release scenario provides a bounding case, and none of the release heights is higher than 2.5 times the height of the associated reactor containment shield building, elevated releases were not considered. Meteorological parameters measured for these releases are consistent with RG 1.23, Revision 1, Section 2.

Ambient temperature is monitored both at the 10- and the 60-meter levels. The actual height of temperature sensors A and B at the 10-meter elevation of the South Dade tower (height from bottom of concrete pad base is 10.36 meters (34 feet) above ground level. Vertical differential temperature (i.e., ΔT) is calculated as the difference between the temperatures measured at the 10-meter and 60-meter levels. Precipitation is measured using a tipping bucket precipitation gauge mounted at ground level but away from the tower shelter to prevent any interference in precipitation capture. The precipitation gauge is located 24.5 feet (7.5 meters) southeast from the base of the 60-meter tower. Solar radiation is measured approximately 23 feet (7 meters) southeast from the base of the 60-meter tower at 4 feet (1.2 meters) above ground, but the data collected was not used in preparing this COL Application.

On the LU tower, wind speed, wind direction, and wind direction standard deviation (i.e., sigma theta for atmospheric stability class determination), are obtained at the 10-meter level.

6.4.2.6.1 Meteorological Sensors

A description of the meteorological sensors including sensor type, manufacturer model, sensor specifications (including sensor starting threshold, range, and measurement resolution), and system accuracy for the Units 3 & 4 data collection system during the preoperational monitoring period for the current configuration are provided in Table 6.4-4.

As presented in Subsection 6.4.2, the existing meteorological data collection system was upgraded in 2007 to support the new DCS system installation, which included upgrading data logger and radio communication equipment in the control buildings for both the primary and backup towers to enhance maintainability and reliability of the system. Climatronics cup sets and bi-vane are used for wind measurements. Climatronics temperature sensors are used for ambient temperature and ΔT calculations. Campbell Scientific added bridge circuits to the thermistor to provide a voltage input directly to the data loggers. A Climatronics 8-inch rain gauge (tipping bucket) is located approximately 24.5 feet southeast from base of the South Dade tower.

Meteorological sensors used on both the primary and backup meteorological towers are designed to operate in the environmental conditions found at Turkey Point. Specifically, these instruments are capable of withstanding the following environmental conditions as provided in the specification of the upgraded meteorological monitoring system:

- Ambient temperature range of –40.0°F (–40°C) to +120.0°F (49°C).
- Wind load up to 100 mph (45 meters per second) (The wind sensors were damaged at 100 mph when tested by Hurricane Andrew).

The instruments on the towers, past and present, are off-the-shelf components that are used universally throughout the nuclear industry and other industries for meteorological measurement. Based on operating experience, the only adverse operational effects that have been noted were the susceptibility of the rotating cup and weather vane instruments to bearing wear and degradation as a result of the site environmental conditions that required the instruments to be replaced approximately every six months.

6.4.2.6.2 Instrumentation Surveillance

Calibration and maintenance of the onsite meteorological monitoring system is in accordance with RG 1.23, Revision 1, Section C.5, Regulatory Position, Instrument Maintenance and Servicing Schedules, and ANS/ANSI 3.11, Section 7, System Performance (ANS/ANSI Dec 2005).

The meteorological equipment is kept in proper operating condition by staff that are trained and qualified for the necessary tasks. The existing meteorological monitoring system is calibrated semiannually at both the primary and backup towers, and channel checks are performed daily in order to achieve maximum data recovery. System operability is also checked by using the system's three radio frequencies, one which is exclusive to the land utilization building. Two other radio frequencies are exclusive to the Units 3 & 4 plant computers to remotely monitor the system status. More frequent calibrations and/or replacement intervals for individual components may be conducted, on the basis of the operational history of the component type.

Detailed instrument calibration procedures and acceptance criteria are followed during system calibration. Calibrations verify and, if necessary, reestablish accuracies of sensors, associated signal processing equipment, and displays. Routine calibrations include obtaining both as-found (before maintenance) and as-left (final configuration for operation) results. The end-to-end results are compared with expected values. Any observed anomalies that may affect equipment performance or reliability are reported for corrective action. If any acceptance criteria are not met during performance of calibration procedures, timely corrective measures (e.g., adjusting response to conform to desired results by qualified personnel on site or returning the sensor to vendor for calibration) are initiated.

Inspection, service, and maintenance, including preventive and/or corrective maintenance on system components for transmitting, manipulating, and/or processing meteorological data for computer display or storage, are performed according to the instrument manuals and plant surveillance program procedures to maintain at least 90 percent data recovery.

6.4.2.7 Meteorological Data Processing

The data processing procedure for Units 6 & 7 meteorological data involves three basic steps:

- Data acquisition
- Data processing
- Data analysis

6.4.2.7.1 Data Acquisition

Following an upgrade of the meteorological program in 2007 to accommodate the DCS installation, data has been collected and electronically transmitted to various plant computers for display. The LU computer is used for QC checks, but reports are done only from manual data collection from the towers directly. Archives of this data are held in hard copy in document control and digitally on the network drive.

The recorders were removed when the DCS system was installed. A modbus radio modem to a data logger transmits across fiber optic link to the plant computer.

Running 15-minute averages are performed at the towers and are transmitted to the plant. This is because of the risk of reconstruction error in the VHF radio modems; however, data from the meteorological tower is transmitted to a computer at the LU office, capable of reading the meteorological tower data real time. Refer to Figures 6.4-3 and 6.4-4 for the system block diagrams for the current configuration.

6.4.2.7.2 Data Processing

The processing equipment is housed in environmentally controlled (air conditioned) shelters. A direct readout capability from these microprocessors during routine system inspection is included.

The microprocessors sample the meteorological processor modules once per second for each parameter measured. Rainfall is monitored for pulse counts and calculated to a 15 minute total and hourly total. Water collected by the rain gauge is automatically drained and counted each time an internal bucket fills with 0.01 inch of rainfall.

The microprocessors provide current sampling values as well as the 15- and 60-minute averages. Sigma theta is computed for each wind direction channel in the microprocessor. These calculated averages are output to the data logger. Data can be stored to a diskette by plugging in a laptop and downloading it for subsequent system monitoring, data verification, and processing uses.

6.4.2.7.3 Data Analysis

Meteorological data is generally reviewed every workday to identify possible data problems and notify appropriate personnel. Meteorological data is validated before it is placed into permanent archival storage to verify that the amount of valid data in the master record meets regulatory requirements for minimum data collection.

Meteorological validations are performed to ensure accurate data transmission from the sensors and include checks such as minimum wind speed, minimum wind direction, wind speed, and wind direction comparisons between the 10- and 60-meter levels, temperature ranges, and hourly ΔT limits.

Computer software is used in the screening process to identify recurring types of data errors, including the following items:

- Missing data (out-of-range values) and unchanging data for the 10-meter wind speed, wind direction, and ΔT for the primary tower.
- The daily average difference between the primary and backup tower wind speeds and wind directions measured at 10 meters.
- Periods of daytime stable and nighttime unstable conditions.
- The parameter and the date(s) and time(s) requiring adjustment or correction are accurately identified. The reasons that the data is to be edited (missing or questionable) are indicated as well as the basis for the corrections or adjustments. Methods for data substitution include using the following:
    - — Alternate monitor (e.g., backup tower instrument or sigma theta to estimate atmospheric stability)
    - — Extrapolation for short durations if the observations before and after the missing/questionable data is consistent (persistence)

— Seasonal average data

The quality of the adjusted data is reviewed, and suspected data is flagged. Any data adjustments or corrections are documented and archived. In addition, visual scanning of the 10-meter wind speed and direction data will be routinely performed for abnormal values or inconsistency.

Routine hourly average data would be downloaded and formatted monthly for review and editing. Acceptable data editing methods have been established and implemented. Typically, missing or invalid primary tower 10-meter wind speed, wind direction, and ΔT data are manually replaced with backup tower data. Upon completion of the validation and editing, the meteorological data constitute quality records.

6.4.2.7.4 Data Display and Archiving

In order to identify rapidly changing meteorological conditions for use in performing emergency response dose consequence assessments, 15-minute average values would be compiled for real-time display in the Units 6 & 7 control rooms, technical support center, and emergency operations facility. The meteorological channels required for input to the dose consequence assessment models are available and presented in a format compatible for input to these dose assessment models in RG 1.97.

An additional feature of the data acquisition system is the storage of the 15- and 60-minute averaged meteorological data. At a minimum, the latest 12 months of averaged data resides on the system hard-drive. The historical data can be retrieved, archived, displayed, or printed.

6.4.2.7.5 System Accuracy

Sources of error for time-averaging digital systems include sensors, cables, signal conditioners, temperature environments for signal conditioning and recording, equipment, recorders, processors, data displays, and data reduction process.

The system accuracies of the meteorological data collection system are compared to the regulatory requirements and the findings are summarized in Table 6.4-4. As shown in Table 6.4-4, the system accuracies meet the regulatory guidance in RG 1.23, Revision 1 and ANS/ANSI 3.11 (ANS/ANSI Dec 2005).

6.4.2.7.6 Meteorological Instrumentation

Currently, meteorological parameter data signals from the primary and backup towers are read directly by the dataloggers and transmit across serial links to the radio modems. The data logger converts, tracks, trends, and transmits the data via wireless antenna to the DCS, where the data is available to DCS workstations in Units 3 & 4 and emergency facilities. Each meteorological tower has its own dedicated communication link to the DCS of Units 3 & 4 and, therefore, the backup tower is the duplicate communication link for the primary tower.

The meteorological monitoring system block diagrams for Units 6 & 7 are provided in Figures 6.4-3 and 6.4-4 for the primary and backup towers, respectively.

6.4.2.8 Meteorological Data Used for Application

6.4.2.8.1 Data Recovery Rate and Annual Joint Frequency Distribution of Data

As described in RG 1.23, the minimum amount of onsite meteorological data to be provided at the time of application is a consecutive 24-month period of data that is defendable, representative, and complete, but not older than 10 years from the date of the application. However, 3 or more years of data are preferable and, if available, should be submitted with the application. Based on review of 10 years of data from Units 3 & 4, the 2005–2006 dataset was determined to be the best available (using validated data with the least data substitution), representative (tower and sensor siting in accordance with RG 1.23, Revision 1), and complete. However, as a result of data recovery issues at the 60-meter level, a third year of data was used (2002) to ensure a composite recover of at least 90 percent.

The annualized data recovery rates for 2002, 2005, and 2006 are presented in Table 6.4-5 for the individual parameters (i.e., wind speed, wind direction, ambient temperature, and temperature difference) and the composite parameters. As shown in the table, composite data recovery rates meet the RG 1.23, Revision 1 requirement of at least 90 percent.

The required joint frequency distributions are presented in Tables 2.7-10 and 2.7-11 in the format described in RG 1.23, Revision 1 for wind speed and wind direction by stability class and by all stability classes combined for the 10- and 60-meter level measurements. It should be noted that no calms were reported during the 2002, 2005, and 2006 annual periods. Wind speeds greater than 0.5 mph (starting threshold of sensor) are considered non-calm winds. Forty two hours of calm winds (less than 0.5 mph) were recorded. These hours, however, were not considered valid and not included in the dataset.

6.4.2.8.2 Need for Additional Data Sources for Airflow Trajectories

Because the Turkey Point area is generally flat with airflow dominated mostly by large-scale weather patterns as concluded in Section 2.7, data collected by the Units 3 & 4 collection system can be used for the description of atmospheric transport and diffusion characteristics within 50 miles of Units 6 & 7.

The modeling methodology used to calculate dispersion estimates out to 50 miles, XOQDOQ, does not use offsite data. The XOQDOQ model, an NRC-sponsored computational model based on RG 1.111, is a constant mean wind direction model using meteorological data from a single station. In the model, application of the terrain-induced airflow recirculation factor options are provided to account for the effects of airflow recirculation phenomenon occurring within the area of interest when the meteorological data from a single station is used to represent the entire modeling domain. However, application of the airflow recirculation factor for sites located within open terrain is not required. This methodology implies that the meteorological data from an onsite station is reasonably representative of the entire modeling domain and adjustment to the dispersion estimates calculated by the model out to 50 miles of a site located within open terrain is not required.

For coastal sites in open terrain such as Turkey Point, an airflow recirculation factor provided in the XOQDOQ model is used to account for potential airflow recirculation as a result of sea breeze and land breeze effects and during the infrequent stagnation conditions that could lead to more restrictive dispersion estimates. With application of the appropriate airflow recirculation factor, data collected from an onsite meteorological monitoring station for making dispersion estimates out to 50 miles is adequate. Therefore, no offsite data collection systems were used to determine the dispersion characteristics of the Turkey Point area.

6.4.2.8.3 Supplemental Data for Environmental Impact Evaluation

Supplemental data from the NWS, Miami International Airport, Florida, is suitable for making impact predictions resulting from operation of the Units 6 & 7 cooling towers, regarding visible plume, drift deposits, fogging, and icing. In particular, the AERMOD and CALPUFF models used for predicting cooling tower salt deposits and fogging impacts, respectively, require such data as twice daily mixing height, cloud ceiling, cloud cover, dry bulb, wet bulb, wind speed, and wind direction that are routinely measured at Miami but not at Turkey Point for all parameters. Furthermore, long-term meteorological data at Miami is available that allowed for the year-to-year variation in meteorological data to be factored into the cooling tower plume impact predictions. The 2001–2005 Miami meteorological data was used for this modeling.

6.4.3 OPERATIONAL MONITORING

The Units 3 & 4 meteorological monitoring program is conducted in accordance with the applicable regulatory guidance and the existing system would be used during Units 6 & 7 operation.

Although the current system, including both the tower and meteorological sensors, may be upgraded periodically or replaced before Units 6 & 7 operation, the functional requirements of the operational program for Units 6 & 7 are described based on the current system.

The LU tower would need to be relocated because of potential construction impacts. The relocated LU tower would be equipped with instrumentation that satisfies applicable regulations and regulatory guidance.

6.4.4 EMERGENCY PREPAREDNESS SUPPORT

The 10-meter wind speed/direction data from the LU 10-meter tower would be the primary data used in emergencies. The data from the South Dade tower would be used as backup during an actual plant emergency if required.

The Units 6 & 7 onsite data collection system would provide representative meteorological data for use in real-time atmospheric dispersion modeling for dose assessments during and following any accidental atmospheric radiological releases. The data would be also used to represent meteorological conditions within the 10-mile emergency planning zone radius (NUREG-0696, NUREG-0737, and NUREG-0654).

Similar to the Units 3 & 4 meteorological monitoring program, the microprocessors would sample the meteorological processor modules once per second for wind speed, wind direction, and ambient temperature for calculations of vertical temperature difference in order to provide near real-time meteorological data for use in atmospheric dispersion modeling. Dose assessment calculations would be performed using the most recent 15-minute average of data, in accordance with RG 1.97.

To identify rapidly changing meteorological conditions for use in performing emergency response, 15-minute average values would be compiled for real-time display in the Units 6 & 7 control rooms, technical support center, and emergency operations facility. The meteorological channels required for input to the dose assessment models would be available and presented in a format compatible for input to these dose assessment models, in accordance with the requirements in RG 1.97.

Provisions are currently in place to obtain representative regional meteorological data from the National Weather Service in Miami during an emergency if the existing meteorological system is unavailable. The current (or similar) emergency plan procedures and the monitoring system arrangement would be used for Units 6 & 7.

Section 6.4 References

ANS/ANSI 2005. *American National Standard for Determining Meteorological Information at Nuclear Facilities, ANS/ANSI 3.11-2005, December 2005.*

Table 6.4-1
Meteorological Tower Siting Conformance Status

RG 1.23, Revision 1 Criteria	Conformance Status	Remarks
Tower Siting		
The meteorological tower sites and the Units 6 & 7 location have similar meteorological exposure.	Yes	The Turkey Point plant property is generally flat land.
The base of the tower is at approximately the same elevation as the finished plant grade of Units 6 & 7.	No No	The South Dade tower is below the approximately 25.5 feet finished plant grade. However, due to the similarity of the landscape, there would be minimal effects. The finished plant grade of Units 6 & 7 and associated buildings would produce different meteorological exposures than at the current LU tower location. The LU tower would need to be relocated.
Location of the tower is not directly downwind of the plant cooling systems (i.e., cooling canals in the industrial wastewater facility and mechanical draft cooling towers) under the prevailing downwind wind direction.	Yes No	The South Dade tower is not located near preexisting or planned cooling systems. The LU tower is located near existing cooling canals on both the east and west sides; however, the majority of the cooling canals are located west of the LU tower, while the path of the prevailing downwind wind direction is from the east. The LU tower would need to be relocated because of construction impacts and operational concerns (i.e., height of the Units 6 & 7 finished plant grade and structures).
Tower is not located on or near permanent man-made surface.	Yes No	There are no large concrete or asphalt parking lot or temporary land disturbance, such as plowed fields or storage areas nearby the South Dade tower. The closest large concrete or asphalt parking lots are at Units 3 & 4, which is approximately 6.5 miles from the South Dade tower. The LU tower is located near an asphalt roadway and temperature is not measured. Temperature concerns would not be an issue in the siting of the LU tower at a new location.

Table 6.4-2
Meteorological Sensor Siting Conformance Status

RG 1.23, Revision 1 Criteria	Conformance Status	Remarks
Sensor Siting		
Wind sensors should be located away from nearby obstructions to airflow (e.g., plant buildings, other structures, trees, nearby terrain) by a distance of at least 10 times the height of any such obstruction that exceeds one-half the height of the wind measurement level to avoid any modifications to airflow (i.e., turbulent wake effects).	Yes No	The South Dade tower is located near a raised mound/equipment shelter. However, the effects were found to be minimal on the South Dade tower. The LU tower would need to be relocated because of construction impacts and operational concerns (i.e., height of the finished plant grade and buildings).
Wind sensors are located at heights that avoid airflow modifications by nearby obstructions with heights exceeding one-half of the wind measurement.	Yes	See remark above.
Wind sensors are located extended outward on a boom to reduce airflow modification and turbulence induced by the supporting structure itself. Wind sensors on the side of a tower should be mounted at a distance equal to at least twice the longest horizontal dimension of the tower (e.g., the side of a triangular tower).	Yes	Tower booms (6 feet long) are oriented into the prevailing winds to reduce tower effects on the measurements. The wind sensors are boom-mounted more than approximately 6.5 feet from the tower (more than twice the tower's width of 3 feet).
The sensors should be on the upwind side of the mounting object in areas with a dominant prevailing wind direction.	Yes	The wind speed/direction boom is pointed southeast into the dominant wind direction.
Air temperature and dew point sensors are located in such a way to avoid modification by the existing and proposed heat and moisture sources, such as ventilation systems, water bodies, or the influence of large parking lots or other paved surfaces.	Yes (see remark) No	The South Dade tower is not located near any heat or moisture sources. The LU tower is located near the cooling canals. Dew point is not measured at either the South Dade or LU towers.
Temperature sensors should be mounted in fan-aspirated radiation shields to minimize adverse influences of thermal radiation and precipitation. Aspirated temperature shields should either be pointed downward or laterally towards the north. The shield inlet should be at least 1.5 times the tower horizontal width away from the nearest point on the tower.	Yes	Temperature is measured only on the South Dade Tower. Temperature sensors are mounted in fan-aspirated radiation shields. Aspirated temperature shields are horizontal. The shield inlet is situated approximately 2.5 feet from the tower (slightly less than 1.5 times the tower's width of 3 feet).
Precipitation measured at ground level near the base of the tower. Precipitation gages should be equipped with wind shields to minimize wind-caused loss of precipitation and, where appropriate, equipped with heaters to melt frozen precipitation.	Yes (see remark)	Precipitation is measured at ground level near the base of each of the towers, but the gauge is located away from the tower shelter to prevent any interference in precipitation capture. Neither precipitation gauge is equipped with wind shields to minimize the wind-caused loss of precipitation, but each gauge has a funnel screen.

Table 6.4-3
Units 6 & 7 System Meteorological Instrumentation

Parameter	Primary Tower Level (meters)	Backup Tower Level (meters)
Wind Speed	10, 60	10
Wind Direction	10, 60	10
Temperature	10, 60	None
Vertical Temperature Difference	(10–60)	None
Sigma Theta	10, 60	10
Precipitation	1.37[a]	1.37
Solar Radiometer	1.2[b]	None
Barometric Pressure	[c]	None
Humidity	None	None

(a) Located approximately 7.5 meters (24.5 feet) southeast from base of 60-meter tower
(b) Located approximately 7 meters (23 feet) southeast from the base of the 60-meter tower
(c) Located outside the equipment shelter on the south wall

Table 6.4-4 (Sheet 1 of 3)
Units 6 & 7 Meteorological System — Preoperational/Operational Configuration

Sensed Parameter	Sensor Type	Range	System Accuracy	System[(a)] Accuracy NRC RG 1.23, Revision 1	System[(b)] Accuracy ANSI/ANS-3.11-2005	Starting Thresholds	Starting[(a)] Threshold NRC RG 1.23, Revision 1	Measure-ment Resolution	Measure-[(a)] ment Resolution NRC RG 1.23, Revision 1	Measure-[(b)] ment Resolution ANSI/ANS-3.11-2005	Elevation (Relative to Tower)
South Dade Tower Instruments											
Wind Speed	3 Cup Anemometer	0 to 100 mph (0 to 45 m/s)	0.5 mph (±0.22 m/s) or ±1.0% of true air speed (whichever is greater)	±0.45 mph (±0.2 m/s) or 5% of observed wind speed	±0.45 mph (0.2 m/s) or 5% of observed wind speed	0.5 mph (0.22 m/s)	1 mph (<0.45 m/s)	—	0.1 mph or 0.1 m/s	0.1 mph or 0.1 m/s	10 m, 60 m
Wind Direction	Wind Vane	0 to 360 degrees — mechanical	±5 degrees	±5°	5°azimuth	0.5 mph (0.22 m/s)	1 mph (<0.45 m/s)	<1 degree	1.0 degree	1.0 ° azimuth	10 m, 60 m
Ambient Temperature	Epoxy Coated Thermistor	–40.0° to +120.0°F (–40.0° to 49°C)	±0.27°F (±0.15°C)	±0.9°F (±0.5°C)	±0.9°F (0.5°C)	—	—	—	0.1°F or 0.1°C	0.1°F or 0.1°C	10 m
Differential Temperature[(a)]	N/A	—	—	±0.18°F (±0.1°C)	±0.18°F (±0.1°C)	—	—	—	0.01°F or 0.01°C	0.01°F or 0.01°C	60 m–10 m
Precipitation[(b)]	Tipping Bucket	—	+/-3% (Rates of 1 to 6 inches per hour)	±10% for a volume equivalent to 0.1 in (2.54 mm) of precipitation at a rate <2 in/h (<50 mm/h)	±10% for a volume equivalent to 0.1 in (2.54 mm) of precipitation at a rate <2 in/h (<50 mm/h)	—	—	—	0.01 in or 0.25 mm	0.01 in or 0.25 mm	Tower base

Table 6.4-4 (Sheet 2 of 3)
Units 6 & 7 Meteorological System — Preoperational/Operational Configuration

Sensed Parameter	Sensor Type	Range	System Accuracy	System[(a)] Accuracy NRC RG 1.23, Revision 1	System[(b)] Accuracy ANSI/ANS-3.11-2005	Starting Thresholds	Starting[(a)] Threshold NRC RG 1.23, Revision 1	Measure-ment Resolution	Measure-[(a)] ment Resolution NRC RG 1.23, Revision 1	Measure-[(b)] ment Resolution ANSI/ANS-3.11-2005	Elevation (Relative to Tower)
South Dade Tower Instruments (cont.)											
Solar Radiometer	Pyranometer	0.3-3um	±0.008 Langley/ min[(c)]	—	—	—	—	—	—	—	Tower base
Barometric Pressure	—	—	Consistent with current state-of-the-art	—	3 hPa	—	—	—	—	0.1 hPa	Instrument Building
Sigma-Theta[(d)]	N/A	N/A	N/A	—	—	N/A	—	1 degree	—	0.1 degrees azimuth	10 m, 60 m
Humidity	N/A	N/A	N/A	±4%	N/A	N/A	N/a	N/A	0.1%	N/A	N/A
LU Tower Instruments											
Wind Speed	Cup 3 Cup Anemometer	0 to 100 mph (0 to 45 m/s)	0.5 mph (±0.22 m/s) or ±1.0% of true air speed (whichever is greater)	±0.45 mph (±0.2 m/s) or 5% of observed wind speed	±0.45 mph (0.2 m/s) or 5% of observed wind speed	0.5 mph (0.22 m/s)	1 mph (<0.45 m/s)	—	0.1 mph or 0.1 m/s	0.1 mph or 0.1 m/s	10 m
Wind Direction	Wind Vane	0 to 360 degrees	±5°	±5°	5°azimuth	0.5 mph (0.22 m/s)	1 mph (<0.45 m/s)	<1 degree	1.0 degree	1.0 degree azimuth	10 m
Precipitation[(b)]	Tipping Bucket	—	+/-3% (Rates of 1 to 6 inches per hour)	±10% for a volume equivalent to 0.1 in (2.54 mm) of precipitation at a rate <2 in/h (<50 mm/h)	±10% for a volume equivalent to 0.1 in (2.54 mm) of precipitation at a rate <2 in/h (<50 mm/h)	—	—	—	0.01 in or 0.25 mm	0.01 in or 0.25 mm	Tower base

Table 6.4-4 (Sheet 3 of 3)
Units 6 & 7 Meteorological System — Preoperational/Operational Configuration

Sensed Parameter	Sensor Type	Range	System Accuracy	System[(a)] Accuracy NRC RG 1.23, Revision 1	System[(b)] Accuracy ANSI/ANS-3.11-2005	Starting Thresholds	Starting[(a)] Threshold NRC RG 1.23, Revision 1	Measure-ment Resolution	Measure-[(a)] ment Resolution NRC RG 1.23, Revision 1	Measure-[(b)] ment Resolution ANSI/ANS-3.11-2005	Elevation (Relative to Tower)
Sigma-Theta	N/A	N/A	N/A	—	—	N/A	—	1 degree	—	0.1 degrees azimuth	10 m

(a) The differential temperature value is a calculated value based on arithmetic differences in the ambient temperature measurements at 60-meter and 10-meter locations.
(b) Water is collected and drained each time an internal bucket fills with 0.01 inches of water.
(c) As measured at the output of primary equipment rack.
(d) The sigma theta value is a calculated value based on the wind direction variation measurements, and, therefore, has the same resolution as the wind direction measurements.

Table 6.4-5
Annual Data Recovery Rate (in percent) for Units 3 & 4 Meteorological Monitoring System (2002, 2005, and 2006)

Parameter	2002	2005	2006	3-Year Composite
Wind Speed (10 m)	100.0	98.9	99.6	99.5
Wind Speed (60 m)	99.9	90.8	100.0	96.9
Wind Direction (10 m)	99.6	98.6	99.6	99.2
Wind Direction (60 m)	99.9	89.6	100.0	96.5
∆T (60 m–10 m)[a]	94.0	98.9	99.6	97.5
Ambient Temperature (10 m)	95.0	99.7	99.9	98.2
Ambient Temperature (60 m)	95.9	99.8	99.8	98.5
Composite Parameters				
WS/WD (10m), ∆T (60m–10m)[a] (10–60)	93.6	97.2	99.2	96.7
WS/WD (60m), ∆T (60m–10m)[a] (10–60)	94.0	79.7	99.6	91.1
WS/WD (10m)	99.6	98.2	99.6	99.1
WS/WD (60m)	99.9	80.6	100.0	93.5

(a) ∆T between 60-meter and 10-meter levels.

Figure 6.4-1 Location of the South Dade Meteorological Tower

Figure 6.4-2 Location of the Land Utilization Meteorological Tower

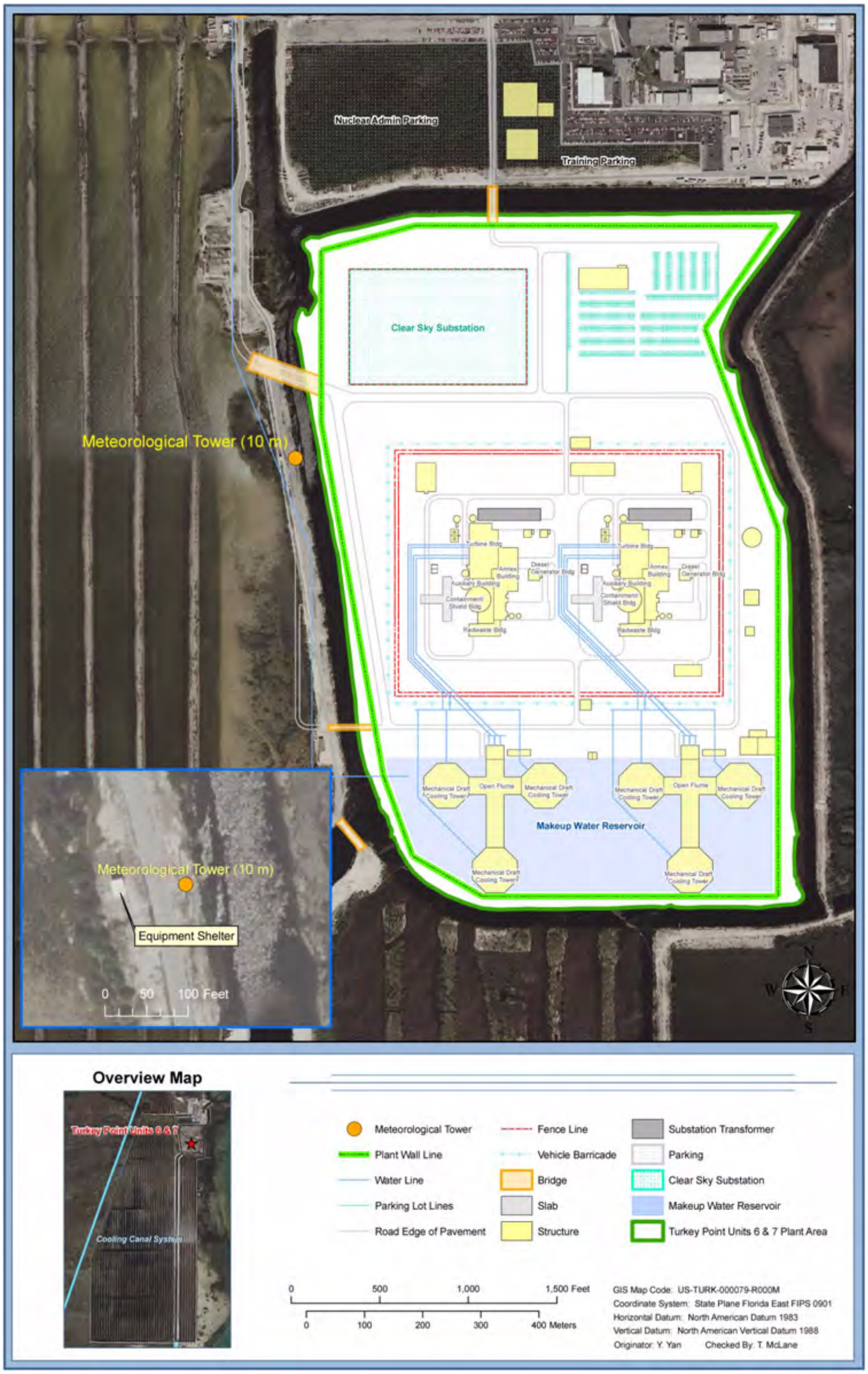


Figure 6.4-3 Meteorological System Block Diagram (South Dade Tower)

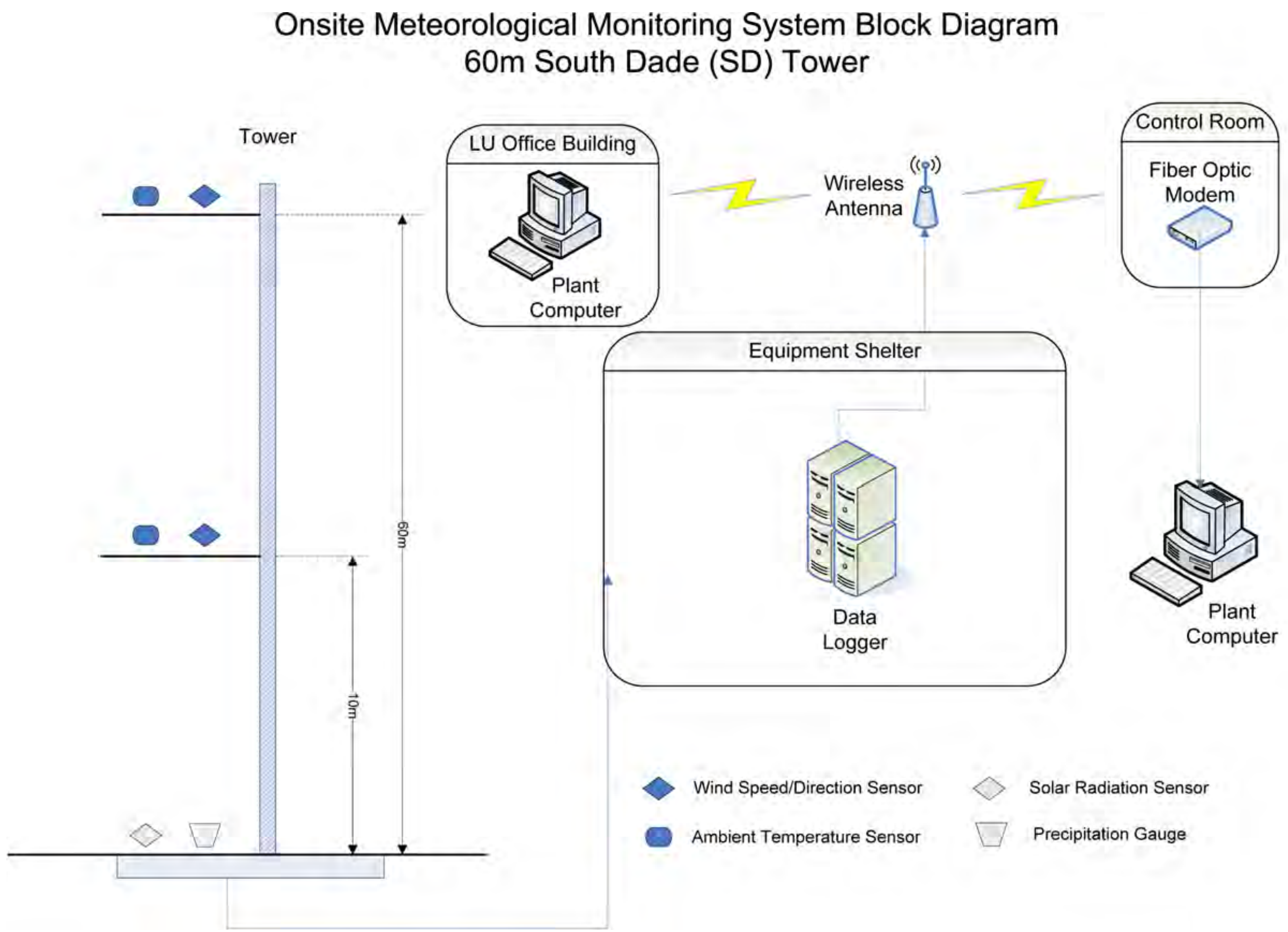
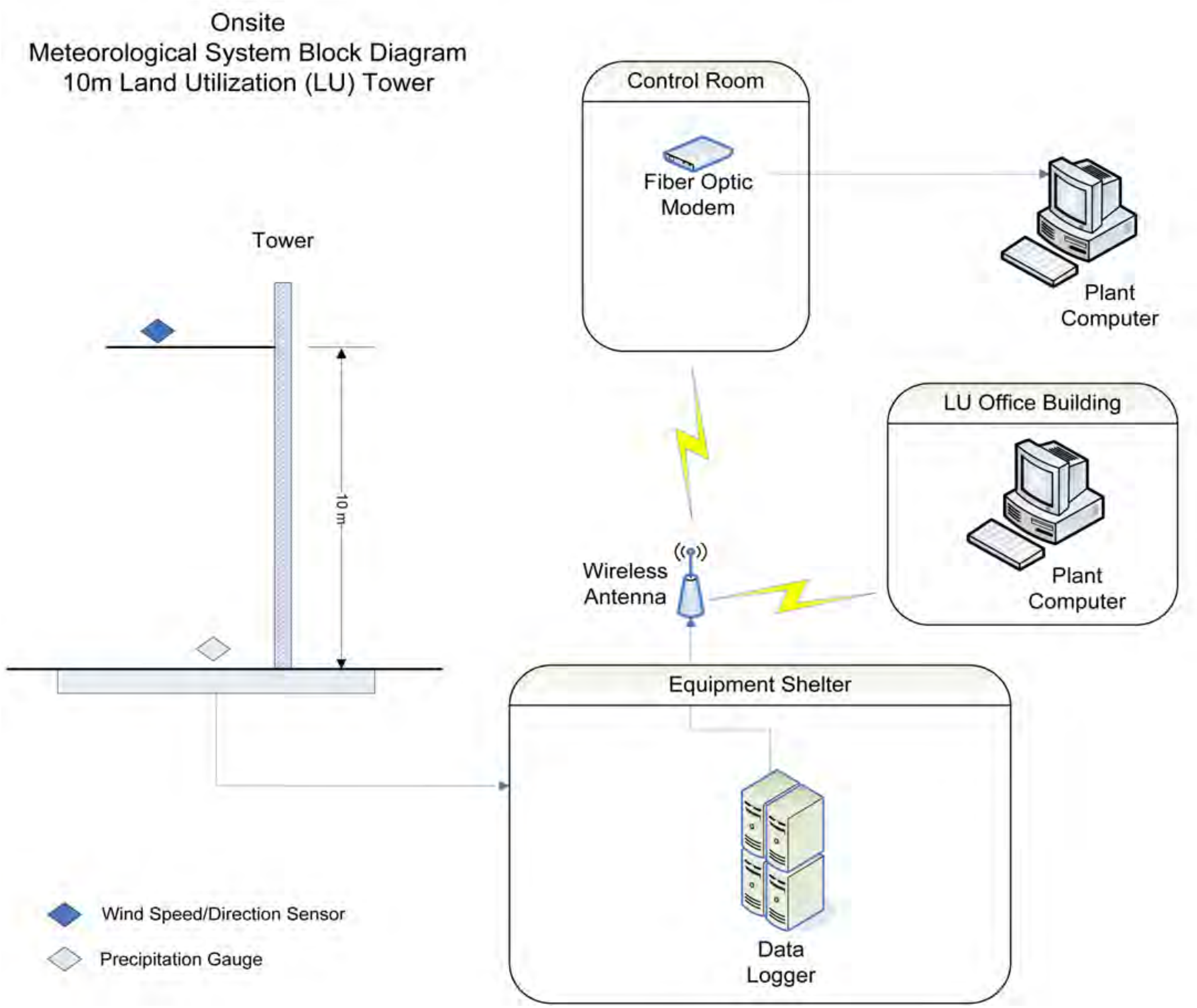


Figure 6.4-4 Meteorologic System Block Diagram (Land Utilization Tower)



6.5 ECOLOGICAL MONITORING

Ecological monitoring programs are typically implemented to address the elements of the ecosystem for which a causal relationship between new unit construction and/or operational activities and adverse change is established or strongly suspected. The following is a description of ecological monitoring for terrestrial resources (Subsection 6.5.1) and aquatic resources (Subsection 6.5.2) associated with Units 6 & 7. The results of the monitoring are described in Section 2.4.

6.5.1 TERRESTRIAL ECOLOGY AND LAND USE

6.5.1.1 Pre-Application Terrestrial Ecological Monitoring

Ecological monitoring includes the determination of the occurrence and relative abundance of terrestrial fauna, including “important” (NUREG-1555) species.

Wildlife presence and habitat occurrence were determined during a series of pre-application surveys documenting the amphibians, birds, mammals, and reptiles on site. Seasonal surveys for birds on the Turkey Point plant property were conducted in March 2009 and June 2009. The avian monitoring consisted of timed, pedestrian surveys of the various habitats within the Turkey Point plant property (Figure 2.4-3a) to determine their seasonal species composition and relative abundance. Approximately 90 species of birds have been documented during these and earlier surveys.

Surveys for small mammals, reptiles, and amphibians on the Units 6 & 7 plant area and other project construction areas, were conducted in April 2009. These one-time surveys were conducted during the peak period of activity of these species to document presence and relative abundance. Three, nine, and six species of amphibians, reptiles and mammals were documented during these surveys, respectively (see Table 2.4-2).

As reported in Subsection 2.4.1, several important species (as defined in NUREG-1555) exist or have been observed within the Turkey Point plant property including the American crocodile, American alligator, wood stork, Florida manatee, eastern indigo snake, little blue heron, snowy egret, reddish egret, tricolored heron, white ibis, white-crowned pigeon, roseate spoonbill, least tern, Florida burrowing owl, and game species such as deer, rabbits, waterfowl, and dove. Many other species are also listed as occurring in Miami-Dade County by federal and/or state agencies, but their habitats typically do not occur within the Turkey Point plant property and thus they have not been observed onsite. The monitoring programs were proposed for the crocodile, stork, and manatee because (1) they are federally listed, (2) construction activities could result in loss of critical habitat (crocodile), disturbance near breeding colonies (stork), or possible endangerment of individuals due to increases in vehicle/boat traffic (crocodile/manatee). Other important species generally do not require monitoring programs due to a less-threatened status (e.g., species of special concern rather than endangered), abundance of nearby habitats for them to utilize, or generally low numbers on plant property (e.g. upland game species).

Construction-related areas associated with Units 6 & 7 within the Turkey Point plant property have been surveyed for threatened and endangered species. Portions of the transmission, reclaimed and potable water pipeline corridors, and improved access roads, were surveyed for terrestrial threatened and endangered species during the pre-application phase.

The construction period will generally be the most sensitive period for all important species due to increased disturbance (e.g., noise, vibrations, traffic, human presence) and thus is the period in need of most monitoring. Given that crocodiles breed in the industrial wastewater facility adjacent to construction areas and the importance of this population to overall population recovery, regulatory agencies will likely suggest continuation of existing FPL crocodile monitoring and may require additional monitoring in support of the proposed action. Much of the Turkey Point plant property has been designated as critical habitat for the American crocodile (Figure 2.4-4). FPL has maintained a program to manage crocodile habitat since 1978 in response to the colonization of the industrial wastewater facility by this species in the late 1970s. A monitoring component was added to the program in subsequent years. The program activities are addressed in detail in Subsection 2.4.1.2, and include creation and enhancement of nesting habitat, nest monitoring, relocation of hatchlings to freshwater sanctuaries, managing vegetation in the nesting areas (cooling canals), and the education of site personnel and onsite workers on the occurrence of the species on site and their protection and conservation. Given that crocodiles are still federally listed (threatened), the Turkey Point crocodile population has grown over the last three decades and the industrial wastewater facility is classified as critical habitat for the crocodiles. The existing FPL crocodile monitoring program will be continued within the Turkey Point plant property through the pre-application period. Protected avian species, primarily wading birds, have been documented foraging and roosting within the Turkey Point plant property (Subsection 2.4.1). However, no nests for these species have been observed within the plant boundary. If these species are impacted during construction, their foraging and/or roosting activities would likely shift to other areas within the plant property or other nearby shallow water sites. Therefore, monitoring beyond the aforementioned seasonal avian surveys would not be necessary. Similarly, a few rare waterbirds have been observed along the proposed transmission and reclaimed and potable water pipeline corridors during recent reconnaissance, as described in Subsection 2.4.1. Additional pre-application surveys would not be necessary.

No rare plants have been observed during most surveys of construction-related areas within the Turkey Point plant property. However, recent surveys (2008-2009) of transmission corridors associated with Units 6 & 7 documented approximately 30 existing or proposed state and federally listed plant species, including three species within the segment of Clear Sky-to-Levee corridor within the plant property boundary. These three species are typically found on or near disturbed soils, such as spoil piles (see Subsection 2.4.1.2).

FPL has initiated discussions with the appropriate federal and state agencies regarding endangered and threatened species. Jurisdictional and non-jurisdictional wetland habitats would be impacted by construction activities, although the extent of this impact within the transmission and the reclaimed water pipeline corridors is pending finalization of those routes and wetland delineation projects within those corridors.

White-tailed deer, rabbits, waterfowl, and doves are game species that exist on the Turkey Point plant property and are classified as important species. There are no site-specific management activities for these species and they are not hunted on site. The construction and operation of Units 6 & 7 would not alter the conditions for these game species on the Turkey Point plant property. No hunting or management would occur, and no monitoring of these species is warranted.

Although specific monitoring of other important species is not performed, site personnel and onsite workers are trained on the protection and conservation of wildlife species.

6.5.1.2 Construction, Preoperational, and Operational Monitoring

Given the harsh environment (e.g., hypersaline mudflats) being altered and the limited flora and fauna inhabiting the Turkey Point plant property, general terrestrial ecology surveys (amphibians, birds, mammals, reptiles) are not planned for the Units 6 & 7 plant area and other impacted construction areas during the construction, preoperational, and operational stages. Possible exceptions include monitoring pertaining to American crocodiles and manatees. FPL's ongoing crocodile monitoring and management will continue, but may need to be expanded to examine for potential construction-related impacts to crocodiles nesting in the northern portion of the return canals and potential construction traffic-related impacts on crossing crocodiles throughout the industrial wastewater facility. The presence of manatees would be monitored during barge turning basin and equipment barge unloading area modifications and barge deliveries of components and equipment.

Important species other than the crocodile and manatee will likely shift to other areas when disturbed and thus would not require monitoring during the construction, preoperational, and operational stages.

Offsite areas include the reclaimed and potable water pipelines and transmission corridors to the Davis, Levee, Miami, and Pennsuco substations (Figure 2.2-5). As presented in Subsection 2.4.1, construction of the new corridors and potential modifications (expansion, new towers, etc.) to existing transmission corridors would not impact most protected wildlife species or critical habitats. However, wood storks nest near a segment of the Clear Sky-to-Levee transmission corridor; construction of these lines could potentially disturb these birds and affect their nesting. Similarly, this same segment of the corridor contains habitats used by both Florida panthers and

Everglade snail kites. Habitat impacts would be avoided to the extent practicable and potential impacts of the new lines on wood storks, Florida panthers, and/or Everglade snail kites would be monitored. Rare plants within the transmission corridors would be avoided to the extent practicable during construction and should not require additional monitoring.

6.5.2 AQUATIC ECOLOGICAL MONITORING

The aquatic communities within and adjacent to the areas proposed for development, as well as important offsite aquatic resources, are described in Subsection 2.4.2. Existing and proposed monitoring of aquatic resources are described in this section.

6.5.2.1 Pre-Application Aquatic Ecological Monitoring

Surveys of the Units 6 & 7 plant area were conducted in August and November 2007. The onsite surface water habitats that may be affected by construction and operation of Units 6 & 7 include hypersaline mudflats, remnant canals, channels, dwarf mangrove wetlands, and open water. All of these habitats support only a limited number of aquatic species because of the harsh conditions of water level fluctuations, high water temperatures, and high salinities. Other than the American crocodile, described in Subsection 6.5.1, no listed aquatic or semi-aquatic species exist within the Units 6 & 7 plant area.

Fish were surveyed during summer 2009 in seven areas that would be potentially impacted by construction of Units 6 & 7. These sample areas included the two remnant canals on the plant area, the dead-end canal (laydown area), pools within the mangrove areas (nuclear administration building, training building, and parking area), an area adjacent to SW 344th Street/ Palm Drive (in the area of the FPL reclaimed water treatment facility), a portion of the return canal, shallow flats in the east-central part of the nuclear island, and two locations along the cooling canals of the industrial wastewater facility.

Fish were collected using (8-foot diameter) cast nets, a 20-foot-long minnow seine, and standard “Gee” type minnow traps. All fish collected were hardy species common in estuarine habitats in south Florida. No rare, unusual, sensitive, or protected species were collected. One additional species, the Atlantic needlefish (*Strongylura marina*), was observed in the return canal but not captured. The Atlantic needlefish is a common inhabitant of coastal waters from New England to the Florida Keys and west to Mexico.

The primary open water habitat found on the Turkey Point plant property is the industrial wastewater facility, which supports a variety of aquatic species typical of a shallow, subtropical, hypersaline environment, including phytoplankton, zooplankton, marine algae, rooted plants, crabs, and estuarine fish. Historically, the most abundant fish in the industrial wastewater facility have been killifish (Family Cyprinodontidae) and live-bearers. Some game species, such as the common snook *(Centropomus undecimalis)* and tarpon *(Megalops atlanticus),* have been observed in the cooling canals, but the presence of self-sustaining populations has not been documented.

In summer 2008, a survey for the presence of seagrasses in the barge turning basin was performed in anticipation of the need to modify the equipment barge unloading area to accommodate delivery of modules and components for Units 6 & 7. Sparse patches of seagrass occur along the northern shore of the turning basin, in the vicinity of the existing boat slip and equipment barge unloading area. Several small areas with 5 percent to 20 percent coverage of turtlegrass (*Thalassia testudinum*) and shoal grass (*Halodule wrightii*) were observed, comprising a total of approximately 170 ft^2 (0.004 acres).

A one-year baseline aquatic biological characterization study was completed in March 2009. Five sampling stations were selected to characterize aquatic biota in Card Sound Canal and Card Sound. Sampling was conducted every other week for a total of 26 sampling events. Each sampling event consisted of three components: trawling for juvenile and adult fish and shellfish, towing nets for ichthyoplankton and meroplankton, and monitoring for water quality. Each station was sampled for each component once during the daytime and once at night for a total of 10 collections per sampling event (two sampling events per 24 hours at each of five stations). Sampling both daytime and nighttime photoperiods provided information on potential diel movements and changes in species composition and aggregations within the sampling area.

A baseline aquatic biological characterization of Card Sound was completed in March 2009. Plankton samples collected in Card Sound during the study may reasonably be assumed to represent plankton present in nearshore habitats of Biscayne Bay in the general area of the radial collector wells. Plankton were sorted and specimens assigned to one of four categories: fish eggs, fish larvae (ichthyoplankton), commercially important meroplankton, and non-commercially important meroplankton). The commercially important meroplankton are represented primarily by decapod crustaceans with commercial value, such as edible shrimps (penaeid species), lobster, blue crabs, and stone crabs, but also include some mollusks (e.g., clams, oysters, squid) and several other organisms used as bait or in medical research (e.g., mole crabs, horseshoe crabs, and mantis shrimps). The non-commercially important taxa represent a variety of other decapod crustaceans, such as grass shrimp, hermit crabs, and mud crabs (Xanthidae).

Benthic macroinvertebrates were sampled and seagrasses were surveyed from Biscayne Bay near the Turkey Point peninsula in March 2009. Sediment samples collected from 250 to 750 feet offshore in 3 feet of water were passed through a 0.5 mm sieve to collect macroinvertebrates. The majority of the 123 taxa identified from the Biscayne Bay samples were polychaetes and crustaceans. Abundance, species richness, and diversity were greatest at the station nearest to the shore.

Seagrasses were surveyed in approximately 49-hectares around the Turkey Point peninsula. Essentially the entire survey area was found to contain turtle grass or shoal grass. Turtle grass coverage was densest immediately surrounding the peninsula, but densities were variable. Shoal grass was less widespread, occurring most often in shallow waters along or near the peninsula shoreline. The two species often co-occurred, but shoal grass was absent at many sampling locations.

6.5.2.2 Construction, Preoperational and Operational Monitoring

Important aquatic habitats include Lower Biscayne Bay, Card Sound, Biscayne National Park, Biscayne Bay Park Aquatic Preserve, and Everglades National Park. A number of federally-listed and state-listed plants and animals are associated or potentially associated with these areas including two fish: the mangrove rivulus and the smalltooth sawfish (Subsection 2.4.2). Radial collector wells would be constructed as a source of makeup water to the circulating water system cooling towers. Because the radial collector well laterals would be advanced a lateral distance of up to 900 feet and installed at a depth of approximately 25 to 40 feet below the bottom of Biscayne Bay, construction and operation of the radial collector wells would not adversely impact these important aquatic habitats. Therefore, no preoperational or operational monitoring of fish or other aquatic species is warranted.

Aquatic species in the regional canals along the roads and transmission and reclaimed and potable water pipeline corridors include common freshwater forage fishes native to south Florida, such as mosquitofish (*Gambusia holbrooki*), sailfin molly (*Poecilia latipinna*), least killifish (*Heterandria formosa*), sunfish (*Lepomis* spp.), and gar (*Lepisosteus* spp.). Nonindigenous fish commonly inhabiting canals of Miami-Dade County include peacock bass (*Cichla ocellaris*), spotted tilapia (*Tilapia mariae*), blue tilapia (*Oreochromis aureus*), Mayan cichlid (*Cichlasoma urophthalmus*), jaguar guapote (*Cichlasoma managuense*), and oscar (*Astronotus ocellatus*).

Cooling water would be discharged via deep injection wells to the Boulder Zone of the Lower Floridan aquifer. No aquatic species would be exposed to the discharged water; therefore no pre-operational or operational monitoring is warranted.

Because no rare or sensitive aquatic species are expected to occur in the construction areas, and because construction activities would be conducted under stormwater permits that require the use of environmental best management practices, additional monitoring is not warranted.

6.6 CHEMICAL MONITORING

6.6.1 PRE-APPLICATION CHEMICAL MONITORING

The objective of the pre-application chemical monitoring program is to establish existing (baseline) water chemistry conditions to further support descriptions presented primarily in Subsection 2.3.1 and to assist in the determination of potential impacts during construction and operation in Chapters 4 and 5, respectively. Data was obtained for surface water and groundwater as explained below.

6.6.1.1 Surface Water

Water quality monitoring was performed at five locations in conjunction with the ecological characterization effort on a bi-weekly basis for one year. The sampling stations are located at the Card Sound Canal and Card Sound. Table 6.6-1 summarizes the analytical parameters included in the surface water quality monitoring. Figure 2.4-3a depicts the sampling locations.

6.6.1.2 Groundwater

Table 6.6-1 summarizes the analytical parameters included in the groundwater chemical monitoring program. The wells monitored and analytical/field results are summarized in Tables 2.3-22 and 2.3-23. Remote monitoring was also conducted at several monitoring wells for conductivity using transducers.

6.6.2 CONSTRUCTION AND PREOPERATIONAL MONITORING

The chemical monitoring of surface water and groundwater would be conducted to provide data necessary to evaluate changes in water quality that might result from construction of Units 6 & 7 up to initial operations. This evaluation would be completed using the pre-application baseline dataset and the results documented for periodic evaluation of operations impacts.

6.6.2.1 Surface Water

Surface water monitoring would be established at surface water monitoring points most likely to be potentially impacted by construction activities.

Table 6.6-2 summarizes the current surface water quality monitoring required by the IWWF permit before release into the cooling canals of the industrial wastewater facility. No changes to this monitoring are planned.

In addition, chemical monitoring of surface water would be established at other surface water monitoring points most likely to be potentially impacted by construction activities. These locations could include the barge turning basin and Biscayne Bay and would be monitored for applicable chemical parameters to ensure no adverse impacts to surface water.

Specific monitoring would be developed as part of the NPDES permit process for construction activities that would occur offsite (e.g., roadway improvements, transmission substation expansion, and linear facilities such as transmission line rights-of-way, reclaimed water pipelines, and potable water pipelines). The need for modifications to the monitoring program would be regularly assessed and implemented as necessary over the duration of the construction chemical monitoring program to ensure no adverse impacts.

6.6.2.2 Groundwater

The deep injection well and its associated dual zone monitoring well would be sampled and analyzed for the parameters and frequencies summarized in Table 6.6-3.

Pre-application monitoring wells located within the Units 6 & 7 plant area would be abandoned in accordance with applicable regulatory requirements during construction. Chemical measurements would be collected from newly installed monitoring wells to monitor the effects of construction, particularly dewatering, on groundwater. These newly installed wells may be temporary and would be later abandoned.

Initial startup and monitoring plans would be developed and executed as necessary to demonstrate the operational effectiveness of the radial collector wells and the effects on the local groundwater flow regime and surface water bodies such as the industrial wastewater facility and Biscayne Bay.

Any dewatering activities related to construction activities that would occur offsite (e.g., roadway improvements, transmission substation expansion, and linear facilities such as transmission line rights-of-way, reclaimed water pipelines, and potable water pipelines) would be localized and temporary, therefore, no chemical monitoring of groundwater in these areas would be required.

6.6.3 OPERATIONAL MONITORING

The operational chemical monitoring program would be designed to document effects from the operation of the Units 6 & 7 and detect any unexpected effects that arise from facility operation. The operational chemical monitoring program is anticipated to be an extension of the preoperational monitoring program. Modifications to the monitoring program (for example, changes in monitoring stations or collection procedures) would be assessed regularly over the duration of the operational hydrological monitoring program. Adjustments to the program would be made in consultation with FDEP.

6.6.3.1 Surface Water

The specific procedures of the operational monitoring requirements for the industrial wastewater facility are anticipated to be similar to the existing chemical monitoring program. The program may be modified in response to data collected and consultations with the FDEP. The current sampling requirements and frequencies for the IWWF permit are summarized in Table 6.6-2.

In addition, chemical monitoring of surface water could be established at other surface water monitoring points most likely to be potentially impacted by maintenance activities during operation. These locations could include the barge turning basin and Biscayne Bay and would be monitored for applicable chemical parameters to ensure no adverse impacts to surface water.

Since the radial collector wells would be a secondary cooling water source for Units 6 & 7, the monitoring frequency would be dependent upon operation. During operation, the radial collector well water would be monitored for conductivity, salinity, and total dissolved solids (TDS). Surface water locations located at the return canal of the industrial wastewater facility and in Biscayne Bay in the area of the equipment barge unloading area would be measured for conductivity and salinity.

During the operational phase, it could be necessary to perform routine maintenance on the offsite facilities (e.g., transmission lines, reclaimed and potable water pipelines, access roads). Any disturbances to surface water flow as a result of the activities would be temporary and would not require chemical monitoring.

6.6.3.2 Groundwater

The operational monitoring program for the deep injection wells, both at the injectate discharge and six dual-zone monitoring wells, would be similar to that described in Table 6.6-3.

Groundwater could be monitored at monitoring wells adjacent to the radial collector wells and along the shoreline for field measurements of conductivity and salinity.

During the operational phase, it could be necessary to perform maintenance that would require excavation and dewatering at offsite facilities (e.g., transmission lines, reclaimed and potable water pipelines, access roads). The dewatering activity could create temporary drawdown of the water table. However, the water table and flow would return to normal once dewatering ceased. No chemical monitoring of these offsite facilities is required during operation.

Table 6.6-1
Pre-Application Chemical Monitoring of Surface Water and Groundwater at the Units 6 & 7 Plant Area

Parameter	Units
Surface Water	
Dissolved Oxygen	mg/L
Specific Conductance	milliSiemens per centimeter
Salinity	ppt
pH	Standard Units
Groundwater	
pH	Standard Units (SU)
Dissolved Oxygen	mg/L
Specific Conductance	milliSiemens per centimeter
Turbidity	Nephelometric Turbidity Units
Oxidation- Reduction Potential	millivolts
Iron, Total Recoverable	mg/L
Total Dissolved Solids	mg/L
Calcium	mg/L
Iron	mg/L
Magnesium	mg/L
Manganese	mg/L
Potassium	mg/L
Silica	mg/L
Silicon	mg/L
Sodium	mg/L

mg/L – milligrams per liter
ppt – parts per thousand

Table 6.6-2
Current Chemical Monitoring in the Industrial Wastewater Facility[(a)]

Parameters (units)	Daily Maximum	Daily Minimum	Monitoring Frequency	Sample Type
Solids, Total Suspended (mg/L)	Report	—	Monthly	Grab
pH (SU)	Report	Report	Quarterly	Grab
Salinity (ppt)	Report	—	Quarterly	Grab
Specific Conductance (µmho/cm)	Report	—	Quarterly	Grab
Copper, Total Recoverable (µg/L)	Report	—	Semiannually	Grab
Iron, Total Recoverable (mg/L)	Report	—	Semiannually	Grab
Zinc, Total Recoverable (µg/L)	Report	—	Semiannually	Grab

(a) Industrial Wastewater Treatment Facility Permit No. FL0001562.

Table 6.6-3
Deep Injection Well Construction and Preoperational Chemical Monitoring

Parameters (units)	Monitoring Frequency
Dual Zone Monitoring Well	
Specific Conductance (μmho/cm)	Weekly[(a)]
pH (SU)	Weekly[(a)]
Chloride (mg/L)	Weekly[(a)]
Solids, Total Dissolved (mg/L)	Weekly[(a)]
Total Phosphorous (mg/L)	Weekly[(a)]
Sulfate (mg/L)	Weekly[(a)]
Sodium (mg/L)	Weekly[(a)]
Calcium (mg/L)	Weekly[(a)]
Magnesium (mg/L)	Weekly[(a)]
Potassium (mg/L)	Weekly[(a)]
Carbonate (mg/L)	Weekly[(a)]
Bicarbonate (mg/L	Weekly[(a)]
Waste stream	
Solids, Total Dissolved (mg/L)	Weekly[(a)]
Chloride (mg/L)	Weekly[(a)]
Specific Conductance (μmho/cm)	Weekly[(a)]
pH (SU)	Weekly[(a)]

(a) Frequency decreased to monthly following operational testing and FDEP approval.

6.7 SUMMARY OF MONITORING PROGRAMS

The Units 6 & 7 monitoring programs are described in detail in Sections 6.1 through 6.6 and are summarized in the following subsections. Table 6.7-1 identifies key elements of the monitoring programs to be implemented during the pre-application, construction, preoperational, and operational phases.

6.7.1 PRE-APPLICATION MONITORING

The current Units 3 & 4 ecological, radiological, chemical, hydrological, and meteorological monitoring programs have been used as a baseline to characterize the conditions for new Units 6 & 7. No additional pre-application radiological monitoring was performed.

Thermal monitoring was performed in the upper portion of the Upper Floridan and the Biscayne aquifers in the Units 6 & 7 plant area, as described in Sections 2.3 and 6.1.

Ecological surveys were performed during the pre-application phase at the Units 6 & 7 plant area, other impacted areas on the Turkey Point plant property, along the transmission corridors, along the route for the reclaimed and potable water pipelines, including both terrestrial and aquatic surveys, Card Sound, Biscayne Bay and Card Sound Canal. The results of these surveys were used to characterize environmental conditions. These surveys were described in Section 2.4 and 6.5.

Hydrological studies included the initiation of a groundwater investigation program described in Subsection 2.3.1, Section 6.3, and Section 6.6 at the Units 6 & 7 plant area. Monitoring also occurred during pumping tests at the Units 6 & 7 plant area.

Pre-application meteorological monitoring consisted of the continuation of the existing Units 3 & 4 program. Data from this program and a description of its use are provided in Sections 2.7 and 6.4.

Baseline water quality studies for chemical monitoring were conducted in the Biscayne aquifer and Card Sound. The results and monitoring are described in Subsections 2.3.2, 2.3.3 and Section 6.6.

6.7.2 PRECONSTRUCTION/CONSTRUCTION MONITORING

Historical information and current data formed the basis from which to assess the impacts of Units 6 & 7 preconstruction and construction activities.

The radiological monitoring currently being performed for Units 3 & 4 would be continued and enhanced to include Units 6 & 7 during construction and would overlap with the more comprehensive preoperational and operational monitoring programs (see Section 6.2). Additional thermoluminescent dosimeters would be installed for Units 6 & 7 before construction and the existing radiological monitoring program expanded to include these dosimeters.

Hydrological surface water monitoring would be performed as required by the NPDES permit. Groundwater elevation monitoring would be performed to measure the effects of dewatering during construction of the power blocks. Hydrologic and chemical monitoring would be performed in the dual zone monitoring wells designed to monitor potential impacts from operation of the deep injection wells. Planned environmental hydrological monitoring is described in Section 6.3. Chemical monitoring is outlined in Section 6.6.

Meteorological monitoring during plant construction is not planned because no significant air quality and meteorological-related construction impacts have been identified that would warrant site-specific onsite monitoring. However, the existing meteorological monitoring program would continue through this phase.

Ecological monitoring would be performed during the modification of the barge turning basin and equipment barge unloading area. Monitoring would also be conducted during barge deliveries.

Crocodile monitoring would continue to be performed during this phase of the project and may be increased due to the increased construction vehicular traffic in the Units 6 & 7 plant area.

Although sampling frequency would be dictated by site conditions, it is expected that surface water and groundwater would be monitored during portions of the construction phase to provide data for assessing potential changes in surface water or groundwater quality. This potential monitoring is described in Section 6.6.

6.7.3 PREOPERATIONAL MONITORING

Thermal monitoring of water would continue as outlined in Table 6.7-1. Areas to be monitored would include the Units 6 & 7 plant area, the radial collector well area, dual zone monitoring wells in the Upper Floridan aquifer, and potential areas of stormwater releases.

Radiological monitoring that would be expanded over the preconstruction/construction monitoring to include the features listed in Table 6.2-2 would continue. The preoperational radiological monitoring program would begin up to 2 years before operation of Unit 6, as identified in Table 6.2-1.

Hydrological preoperational monitoring would be a continuation of construction-phase monitoring.

Preoperational meteorological monitoring would be a continuation of the preexisting monitoring program.

Preoperational ecological monitoring would be a continuation of the preexisting ecological monitoring at Turkey Point.

Chemical monitoring would be a continuation of preconstruction/construction groundwater and surface water monitoring, as applicable. These activities would include characterization monitoring of the wells in the Upper Floridan aquifer to monitor the potential hydrologic, thermal, and chemical impacts from the deep injection wells. Preliminary frequency and chemical criteria are outlined Section 6.3 and 6.6.

6.7.4 OPERATIONAL MONITORING

Thermal, chemical, and hydrologic monitoring would be required for the dual zone monitoring wells associated with the deep injection wells. Thermal monitoring would continue to be performed on wells in the vicinity of the power blocks and would also be performed on wells associated with monitoring the potential impact of the radial collector wells on the industrial wastewater facility. The existing Units 3 & 4 radiological monitoring program would be expanded to include Units 6 & 7. Monitoring during this phase would be the same as for preoperational monitoring in accordance with the revised radiological monitoring program. Hydrological monitoring would include continued collection of groundwater elevation measurements during the course of implementing the radiological monitoring program. Monitoring would potentially include that of the deep injection dual zone monitoring wells in the Upper Floridan aquifer and wells associated with the radial collector wells, as well as those in the vicinity of the power blocks.

Meteorological monitoring would be a continuation of the preoperational monitoring program described in Section 6.4. No new specific ecological monitoring associated with operation of the new units is proposed. The existing crocodile monitoring program would continue. The chemical monitoring program would be that specified in the underground injection control permit and any permit requirements associated with operational permits issued by FDEP, including storm water permits and National Pollutant Discharge Elimination System (NPDES) permits, as well as any sampling required to monitor the operation of the radial collector wells. Currently, FPL does not release water under stormwater or NPDES permits. All current site water releases are to the industrial wastewater facility.

Table 6.7-1 (Sheet 1 of 4)
Summary of Monitoring Programs

Resource	Program	Scope/Content	Status
PRE-APPLICATION			
Ecology	Ecological Monitoring	Bird surveys	Complete
		One-time surveys for small mammals, reptiles, and amphibians	Complete
		Use of existing crocodile monitoring program through pre-application	Existing
		Performance of a seagrass survey in the equipment barge unloading area. Visual survey of dead-end canal northeast of Units 6 & 7 plant area.	Complete
		Performance of a 1-year baseline aquatic biological characterization	Complete
		Performance of a benthic invertebrate survey and seagrass survey in the area of the radial collector wells	Complete
Human Health	Radiological Monitoring	No additional radiological monitoring was performed	N/A
Water	Hydrological Monitoring	Monitoring was conducted during groundwater pumping tests in the Units 6 & 7 plant area to establish design level criteria.	Complete
		Groundwater monitoring was conducted to provide groundwater level data for baseline analyses	Ongoing[1]
	Thermal Monitoring	Thermal monitoring was performed as part of baseline groundwater and surface water monitoring	Complete
	Chemical Monitoring	Chemical monitoring was performed as part of baseline groundwater and surface water monitoring	Complete
Air Quality and Meteorology	Meteorological Monitoring	The existing meteorological monitoring program for Units 3 & 4 was used for pre-application analyses	Existing
PRECONSTRUCTION/CONSTRUCTION			
Ecology	Ecological Monitoring	Expansion of crocodile monitoring through this phase due to increased traffic	Existing
		Monitoring of manatees during construction activities in the barge turning basin, equipment unloading area modifications, and during barge deliveries	Complete
Human Health	Radiological Monitoring	Radiological monitoring program for Units 6 & 7 is planned to monitor for construction worker dose	To be developed
Water	Hydrological Monitoring	Surface water monitoring at the barge turning basin and Biscayne Bay for applicable hydrologic parameters including turbidity, as required	To be developed
		Groundwater flow/level monitoring during deep injection well pilot testing and use for construction discharges and full well installation	To be developed

**Table 6.7-1 (Sheet 2 of 4)
Summary of Monitoring Programs**

Resource	Program	Scope/Content	Status
Water (cont.)	Hydrological Monitoring (cont.)	Specific monitoring as part of the NPDES permit process for construction activities that would occur offsite (e.g., roadway improvements, transmission substation expansion, and linear facilities such as transmission line rights-of-way, reclaimed water pipelines, and potable water pipelines).	To be developed
		Groundwater and surface water level monitoring during dewatering activities at the power block	To be developed
		Surface water level monitoring during radial collector well installation	To be developed
	Thermal Monitoring	Stormwater discharges would continue to be monitored in accordance with an FDEP permit, as required	To be updated
		Groundwater thermal monitoring during deep injection well pilot testing and use for construction discharges and full well installation	To be developed
PRECONSTRUCTION/CONSTRUCTION			
Water	Chemical Monitoring	Monitoring at stormwater outfall and/or release points would be performed in accordance with permit requirements, as applicable	To be updated
		Groundwater monitoring would continue during portions of construction and preoperation to ascertain the chemical effects of construction and/or dewatering on local groundwater	To be developed
		Chemical monitoring would be performed for the deep injection well as part of the deep injection well permit requirements	To be developed
Air Quality and Meteorology	Meteorological Monitoring	The existing meteorological monitoring program for Units 3 & 4 would be used to monitor during these project phases	Existing
PREOPERATIONAL			
Ecology	Ecological Monitoring	Expand crocodile monitoring through this phase due to increased traffic	Existing
		Monitor for manatees during construction activities in turning basin, equipment unloading area modifications, and during barge deliveries	To be developed
Human Health	Radiological Monitoring	Radiological monitoring program for Units 6 & 7 would be incorporated into existing program	Update to existing
Water	Hydrological Monitoring	Existing surface water monitoring for the cooling canals of the industrial wastewater facility during the preoperational phase will suffice as the preoperational hydrologic baseline	To be developed
		Monitor groundwater in the vicinity of the deep injection wells	To be developed

Table 6.7-1 (Sheet 3 of 4)
Summary of Monitoring Programs

Resource	Program	Scope/Content	Status
Water (cont.)	Thermal Monitoring	Monitoring of groundwater in the Upper Floridan aquifer in the vicinity of the deep injection wells	To be developed
	Chemical Monitoring	Ongoing surface water monitoring could continue to identify potential impacts of site construction, if warranted by site conditions	Ongoing
		Monitoring at stormwater outfall and/or discharge points would be performed in accordance with permit requirements, as applicable	To be developed
		Groundwater monitoring would continue during portions of preoperation to ascertain the chemical effects on local groundwater during this period	Ongoing
		Chemical monitoring would be performed if required by FDEP wastewater deep injection well permit to discharge cooling water to the Boulder Zone of the Lower Floridan aquifer	To be developed
		Surface water monitoring at the barge turning basin and Biscayne Bay for applicable chemical parameters, as required	To be developed
Air Quality and Meteorology	Meteorological Monitoring	The existing meteorological monitoring program for Units 3&4 would be used to monitor during those project phases.	Existing/modified
OPERATIONAL			
Ecology	Ecological Monitoring	Expanding current monitoring through this phase due to increased traffic	Existing
		Monitoring manatees during maintenance activities in barge turning basin, equipment unloading area modifications, and during barge deliveries	To be developed
Human Health	Radiological Monitoring	The monitoring program specified in Section 6.2 would be conducted	Existing/modified
Water	Hydrological Monitoring	Existing surface water monitoring for the cooling canals of the industrial wastewater facility during the preoperational phase will suffice as the preoperational hydrologic baseline	To be developed
		Potential monitoring of groundwater in radial collector wells	To be developed
		Monitoring groundwater in vicinity of FDEP deep injection wells	To be developed

Table 6.7-1 (Sheet 4 of 4)
Summary of Monitoring Programs

Resource	Program	Scope/Content	Status
Water (cont.)	Chemical Monitoring	Monitoring at stormwater outfall and/or discharge points would be performed in accordance with permit requirements, as applicable	
		Groundwater monitoring would continue during portions of operations to ascertain the chemical effects during this period on local groundwater	To be developed
		Chemical monitoring would be performed to monitor the Upper Floridan aquifer as part of the deep injection well permit requirements	To be developed
		Specific monitoring as part of the NPDES permit process for operational activities that would occur offsite (e.g., roadway improvements, transmission substation expansion, and linear facilities such as transmission line rights-of-way, reclaimed water pipelines, and potable water pipelines)	To be developed
Air Quality and Meteorology	Meteorological Monitoring	The existing meteorological monitoring program for Units 3 & 4 would be used to monitor during these project phases	Existing

[1] Groundwater levels will be monitored for one year
N/A – Not applicable
FWC – Florida Fish and Wildlife Commission
MDC – Miami-Dade County
NMF – National Marine Fisheries
NOAA – National Oceanic & Atmospheric Administration
SFWMD – South Florida Water Management District
USFWS – U.S. Fish and Wildlife Service

CHAPTER 7
ENVIRONMENTAL IMPACTS OF POSTULATED ACCIDENTS INVOLVING RADIOACTIVE MATERIALS
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CHAPTER 7 LIST OF TABLES

CHAPTER 7 LIST OF TABLES (CONTINUED)

CHAPTER 7 ENVIRONMENTAL IMPACTS OF POSTULATED ACCIDENTS INVOLVING RADIOACTIVE MATERIALS

This chapter assesses the environmental impacts of postulated accidents involving radioactive materials. Section 7.1 evaluates design basis accidents. Section 7.2 considers the impact of severe accidents, Section 7.3 addresses severe accident mitigation alternatives, and Section 7.4 addresses transportation accidents.

7.1 DESIGN BASIS ACCIDENTS

This section evaluates the radiological consequences of design basis accidents. Subsection 7.1.1 lists the accidents considered, Subsection 7.1.2 outlines the evaluation methodology, Subsection 7.1.3 describes the source terms, and Subsection 7.1.4 presents the resulting consequences.

7.1.1 SELECTION OF ACCIDENTS

The design basis accidents considered in this section are from the DCD (WEC 2011). Table 7.1-1 lists the design basis accidents having the potential for releases to the environment, and shows the NUREG-0800 Standard Review Plan (SRP) section numbers and accident descriptions as well as the corresponding accidents as defined in the DCD. The radiological consequences of the accidents listed in Table 7.1-1 are assessed to demonstrate that new units can be sited at Turkey Point without undue risk to the health and safety of the public.

7.1.2 EVALUATION METHODOLOGY

The DCD presents the radiological consequences of the accidents identified in Table 7.1-1. The DCD design basis analyses are updated with site data to demonstrate that the DCD analyses are bounding for the Turkey Point site. The basic scenario for each accident is that some quantity of activity is released at the accident location inside a building and this activity is eventually released to the environment. The transport of activity within the plant is independent of the site and specific to the AP1000 design. Details about the methodologies and assumptions pertaining to each of the accidents, such as activity release pathways and credited mitigation features, are provided in the DCD.

The dose to an individual located at the exclusion area boundary (EAB) or the low population zone (LPZ) is calculated based on the amount of activity released to the environment, the atmospheric dispersion of the activity during the transport from the release point to the offsite location, the breathing rate of the individual at the offsite location, and activity-to-dose conversion factors. The only variable parameter is atmospheric dispersion. Site-specific doses were obtained by adjusting the DCD doses to reflect site-specific atmospheric dispersion factors (X/Q) values. Since the site-specific X/Q values are bounded by the DCD X/Q values, this approach demonstrates that the site-specific doses are within those calculated in the DCD.

The DCD uses conservative assumptions to perform bounding safety analyses that substantially overstate the environmental impact of the identified accidents. Among the conservative assumptions in the DCD is the use of time-dependent X/Q values corresponding to the top 5th percentile meteorology during the 2-hour accident period that yields the maximum dose, meaning that conditions would be more favorable for dispersion 95 percent of the time. In this environmental report, the maximum 2-hour dose is calculated based on the 50th percentile site-specific X/Q values, reflecting more realistic meteorological conditions.

The X/Q values were calculated using the methodology of RG 1.145, *Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants,* (Rev. 1, Nov. 1982) with site-specific meteorological data. As described in Subsection 2.7.5, the methodology of RG 1.145 is implemented in the NRC-sponsored PAVAN computer program. This program computes X/Q values at the EAB and the LPZ for each combination of wind speed and atmospheric stability for each of the 16 downwind direction sectors and then calculates overall (nondirection-specific) X/Q values. For a given location, either the EAB or the LPZ, the initial maximum X/Q value is the 50th percentile overall value calculated by PAVAN. For the LPZ, the X/Q values for all subsequent times were calculated by logarithmic interpolation between the 50th percentile X/Q value and the annual average X/Q value. Releases were assumed to be at ground level, and the shortest distances between the power block and the offsite locations were selected to conservatively maximize the X/Q values.

The accident doses are expressed as total effective dose equivalent (TEDE), consistent with 10 CFR 50.34. The TEDE consists of the sum of the committed effective dose equivalent (CEDE) from inhalation and the effective dose equivalent from external exposure. The CEDE is determined using the dose conversion factors in Federal Guidance Report 11 (U.S. EPA 1988), while the effective dose equivalent is based on the dose conversion factors in Federal Guidance Report 12 (U.S. EPA 1993). Appendix 15A of the DCD provides information on the methodologies used to calculate CEDE and effective dose equivalent values. As described in RG 1.183, *Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors* (Rev. 0, Jul 2000) the dose conversion factors in Federal Guidance Reports 11 and 12 are acceptable to the NRC Staff.

7.1.3 SOURCE TERMS

The design basis accident source terms in the DCD were calculated in accordance with RG 1.183, based on 102 percent of the rated core thermal power of 3400 MW (WEC 2011). The time-dependent isotopic activities released to the environment from each of the evaluated accidents are presented in Tables 7.1-2 to 7.1-10.

7.1.4 RADIOLOGICAL CONSEQUENCES

For each of the accidents identified in Table 7.1-1, the site-specific dose for a given time interval was calculated by multiplying the DCD dose by the ratio of the site X/Q value from Subsection 2.7.5.2 to the DCD X/Q value. The time-dependent DCD X/Q values and the time-dependent site X/Q values and their ratios are shown in Table 7.1-11. As all site X/Q values are bounded by DCD X/Q values, site-specific doses for all accidents are also bounded by DCD doses. The total doses are summarized in Table 7.1-12, based on individual accident doses presented in Tables 7.1-13 to 7.1-22. For each accident, the EAB dose shown is for the 2-hour period that yields the maximum dose, in accordance with RG 1.183.

The results of the site analysis contained in the referenced tables demonstrate that all accident doses meet the site acceptance criteria of 10 CFR 50.34. The acceptance criteria in 10 CFR 50.34 apply to accidents of exceedingly low probability of occurrence and low risk of public exposure to radiation. For events with a higher probability of occurrence, more restrictive dose limits are specified in RG 1.183. Where applied, the more restrictive dose limit is either 10 percent or 25 percent of the 10 CFR 50.34 limit of 25 rem TEDE. Although conformance to these more restrictive dose limits is not required for an environmental report, they are included in the tables for comparison purposes, and shown to result in doses that meet the more restrictive limits.

The TEDE dose limits shown in Tables 7.1-12 to 7.1-22 are from RG 1.183, Table 6, for all accidents except reactor coolant pump shaft break (NUREG-0800 SRP Section 15.3.4, Rev. 3, Mar 2007) and failure of small lines carrying primary coolant outside containment (NUREG-0800 SRP Section 15.6.2, Rev. 2, Jul 1981). Although RG 1.183 does not address these two accidents, NUREG-0800 identified a dose limit of 2.5 rem for these accidents. All doses are within the acceptance criteria. Because the dose criteria of 10 CFR 50.34 are intended to provide assurance of low risk to the public under postulated accidents, any health effects resulting from the design basis accidents are negligible.

Section 7.1 References

U.S. EPA 1988. U.S. Environmental Protection Agency, *Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion*, Federal Guidance Report No. 11, EPA-520/1-88-020, 1988.

U.S. EPA 1993. *External Exposure to Radionuclides in Air, Water, and Soil*, Federal Guidance Report No. 12, EPA-402-R-93-081, 1993.

WEC 2011. Westinghouse Electric Company, LLC, *AP1000 Design Control Document*, Document No. APP-GW-GL-700, Tier 2 Material, Rev. 19, June 2011.

Table 7.1-1
Selection of Accidents

SRP/DCD Section	SRP Description	DCD Description	Identified in NUREG-1555[(a)] Section 7.1 Appendix A	Comment
15.1.5A	Radiological Consequences of Main Steam Line Failures Outside Containment of a PWR	Steam System Piping Failure	Yes	Addressed in DCD Section 15.1.5
15.2.8	Feedwater System Pipe Breaks Inside and Outside Containment (PWR)	Feedwater System Pipe Break	Yes	In the DCD, this is bounded by Section 15.1.5 accident
15.3.3	Reactor Coolant Pump Rotor Seizure	Reactor Coolant Pump Shaft Seizure (Locked Rotor)	Yes	
15.3.4	Reactor Coolant Pump Shaft Break	Reactor Coolant Pump Shaft Break	Yes	In the DCD, this is bounded by Section 15.3.3 accident
15.4.8	Spectrum of Rod Ejection Accidents (PWR)	Spectrum of Rod Cluster Control Assembly Ejection Accidents	No	Evaluated for completeness
15.6.2	Radiological Consequences of the Failure of Small Lines Carrying Primary Coolant Outside Containment	Failure of Small Lines Carrying Primary Coolant Outside Containment	Yes	
15.6.3	Radiological Consequences of Steam Generator Tube Failure (PWR)	Steam Generator Tube Rupture	Yes	
15.6.5A	Radiological Consequences of a Design Basis Loss of Coolant Accident Including Containment Leakage Contribution	Loss-of-Coolant Accident Resulting from a Spectrum of Postulated Piping Breaks Within the Reactor Coolant Pressure Boundary	Yes	Addressed in DCD Section 15.6.5
15.6.5B	Radiological Consequences of a Design Basis Loss of Coolant Accident: Leakage From Engineered Safety Feature Components Outside Containment	Loss-of-Coolant Accident Resulting from a Spectrum of Postulated Piping Breaks Within the Reactor Coolant Pressure Boundary	Yes	Addressed in DCD Section 15.6.5
15.7.4	Radiological Consequences of Fuel Handling Accidents	Fuel Handling Accident	Yes	

(a) Oct 1999

Table 7.1-2
Activity Releases for Steam System Piping Failure with Preexisting Iodine Spike

Isotope	Activity Release (Ci)				
	0-2 hr	2-8 hr	8-24 hr	24-72 hr	Total
Kr-85m	6.86E-02	1.14E-01	6.80E-02	6.20E-03	2.57E-01
Kr-85	2.82E-01	8.47E-01	2.25E+00	6.68E+00	1.01E+01
Kr-87	2.76E-02	1.34E-02	5.20E-04	0.00E+00	4.15E-02
Kr-88	1.12E-01	1.37E-01	4.04E-02	8.00E-04	2.90E-01
Xe-131m	1.28E-01	3.79E-01	9.81E-01	2.70E+00	4.19E+00
Xe-133m	1.59E-01	4.51E-01	1.04E+00	2.05E+00	3.70E+00
Xe-133	1.18E+01	3.45E+01	8.65E+01	2.16E+02	3.49E+02
Xe-135m	3.04E-03	1.30E-05	0.00E+00	0.00E+00	3.05E-03
Xe-135	3.10E-01	6.90E-01	8.35E-01	3.39E-01	2.17E+00
Xe-138	3.99E-03	1.10E-05	0.00E+00	0.00E+00	4.00E-03
I-130	3.59E-01	1.42E-01	2.09E-01	1.33E-01	8.43E-01
I-131	2.40E+01	1.21E+01	3.10E+01	8.21E+01	1.49E+02
I-132	3.05E+01	4.14E+00	8.07E-01	6.00E-03	3.55E+01
I-133	4.34E+01	1.90E+01	3.53E+01	3.98E+01	1.38E+02
I-134	6.74E+00	1.63E-01	1.40E-03	0.00E+00	6.90E+00
I-135	2.60E+01	8.16E+00	7.54E+00	1.71E+00	4.34E+01
Cs-134	1.90E+01	1.95E-01	5.19E-01	1.54E+00	2.13E+01
Cs-136	2.82E+01	2.86E-01	7.42E-01	2.06E+00	3.13E+01
Cs-137	1.37E+01	1.41E-01	3.74E-01	1.11E+00	1.53E+01
Cs-138	1.01E+01	1.02E-03	0.00E+00	0.00E+00	1.01E+01
Total	2.15E+02	8.15E+01	1.68E+02	3.56E+02	8.21E+02

Table 7.1-3
Activity Releases for Steam System Piping Failure with Accident-Initiated Iodine Spike

Isotope	Activity Release (Ci)				
	0-2 hr	2-8 hr	8-24 hr	24-72 hr	Total
Kr-85m	6.86E-02	1.14E-01	6.80E-02	6.20E-03	2.57E-01
Kr-85	2.82E-01	8.47E-01	2.25E+00	6.68E+00	1.01E+01
Kr-87	2.76E-02	1.34E-02	5.20E-04	0.00E+00	4.15E-02
Kr-88	1.12E-01	1.37E-01	4.04E-02	8.00E-04	2.90E-01
Xe-131m	1.28E-01	3.79E-01	9.81E-01	2.70E+00	4.19E+00
Xe-133m	1.59E-01	4.51E-01	1.04E+00	2.05E+00	3.70E+00
Xe-133	1.18E+01	3.45E+01	8.65E+01	2.16E+02	3.49E+02
Xe-135m	3.04E-03	1.30E-05	0.00E+00	0.00E+00	3.05E-03
Xe-135	3.10E-01	6.90E-01	8.35E-01	3.39E-01	2.17E+00
Xe-138	3.99E-03	1.10E-05	0.00E+00	0.00E+00	4.00E-03
I-130	4.15E-01	9.95E-01	1.58E+00	1.01E+00	4.00E+00
I-131	2.57E+01	5.73E+01	1.56E+02	4.13E+02	6.52E+02
I-132	4.57E+01	9.74E+01	2.23E+01	2.00E-01	1.66E+02
I-133	4.85E+01	1.14E+02	2.27E+02	2.55E+02	6.45E+02
I-134	1.33E+01	1.86E+01	2.60E-01	0.00E+00	3.22E+01
I-135	3.20E+01	7.74E+01	7.83E+01	1.77E+01	2.05E+02
Cs-134	1.90E+01	1.95E-01	5.19E-01	1.54E+00	2.13E+01
Cs-136	2.82E+01	2.86E-01	7.42E-01	2.06E+00	3.13E+01
Cs-137	1.37E+01	1.41E-01	3.74E-01	1.11E+00	1.53E+01
Cs-138	1.01E+01	1.02E-03	0.00E+00	0.00E+00	1.01E+01
Total	2.50E+02	4.03E+02	5.79E+02	9.19E+02	2.15E+03

Table 7.1-4
Activity Releases for Reactor Coolant Pump Shaft Seizure

	Activity Release (Ci)		
	No Feedwater	With Feedwater	
Isotope	0-1.5 hr	0-6 hr	6-8 hr
Kr-85m	8.15E+01	2.37E+02	4.10E+01
Kr-85	7.58E+00	3.03E+01	1.01E+01
Kr-87	1.20E+02	2.05E+02	5.28E+00
Kr-88	2.07E+02	5.16E+02	5.94E+01
Xe-131m	3.77E+00	1.50E+01	4.94E+00
Xe-133m	2.02E+01	7.85E+01	2.48E+01
Xe-133	6.67E+02	2.63E+03	8.57E+02
Xe-135m	3.19E+01	3.25E+01	0.00E+00
Xe-135	1.59E+02	5.39E+02	1.31E+02
Xe-138	1.27E+02	1.28E+02	0.00E+00
I-130	8.44E-01	8.79E-01	5.64E-01
I-131	3.78E+01	4.60E+01	3.46E+01
I-132	2.80E+01	1.42E+01	3.90E+00
I-133	4.87E+01	5.34E+01	3.65E+01
I-134	2.87E+01	5.43E+00	2.03E-01
I-135	4.18E+01	3.72E+01	2.03E+01
Cs-134	2.99E+00	4.42E+00	3.32E+00
Cs-136	1.43E+00	1.55E+00	1.03E+00
Cs-137	1.81E+00	2.61E+00	1.95E+00
Cs-138	8.30E+00	1.29E+00	4.11E-03
Rb-86	2.95E-02	4.89E-02	3.78E-02
Total	1.63E+03	4.58E+03	1.24E+03

Table 7.1-5
Activity Releases for Spectrum of Rod Cluster Control Assembly Ejection Accidents

Isotope	Activity Release (Ci)					
	0-2 hr	2-8 hr	8-24 hr	24-72 hr	96-720 hr	Total
Kr-85m	1.12E+02	6.48E+01	3.87E+01	1.77E+00	2.51E-05	2.17E+02
Kr-85	5.01E+00	5.60E+00	1.49E+01	3.35E+01	2.88E+02	3.47E+02
Kr-87	1.82E+02	2.60E+01	1.03E+00	8.37E-05	0.00E+00	2.09E+02
Kr-88	2.91E+02	1.18E+02	3.49E+01	3.59E-01	8.41E-09	4.44E+02
Xe-131m	4.94E+00	5.46E+00	1.42E+01	2.86E+01	1.16E+02	1.69E+02
Xe-133m	2.67E+01	2.81E+01	6.49E+01	8.45E+01	5.31E+01	2.57E+02
Xe-133	8.79E+02	9.58E+02	2.40E+03	4.27E+03	8.45E+03	1.70E+04
Xe-135m	7.34E+01	5.30E-02	4.33E-09	0.00E+00	0.00E+00	7.35E+01
Xe-135	2.15E+02	1.72E+02	2.09E+02	4.35E+01	1.79E-01	6.40E+02
Xe-138	2.99E+02	1.38E-01	3.19E-09	0.00E+00	0.00E+00	2.99E+02
I-130	4.90E+00	7.28E+00	4.32E+00	2.03E-01	2.95E-04	1.67E+01
I-131	1.36E+02	2.45E+02	2.31E+02	3.10E+01	1.68E+01	6.60E+02
I-132	1.53E+02	9.94E+01	9.85E+00	8.24E-03	0.00E+00	2.62E+02
I-133	2.72E+02	4.40E+02	3.18E+02	2.28E+01	2.41E-01	1.05E+03
I-134	1.66E+02	2.85E+01	1.37E-01	4.48E-08	0.00E+00	1.95E+02
I-135	2.39E+02	2.97E+02	1.19E+02	2.39E+00	7.32E-05	6.57E+02
Cs-134	3.10E+01	6.22E+01	6.03E+01	7.76E+00	5.16E+00	1.66E+02
Cs-136	8.89E+00	1.75E+01	1.67E+01	2.05E+00	6.58E-01	4.58E+01
Cs-137	1.80E+01	3.62E+01	3.51E+01	4.52E+00	3.05E+00	9.69E+01
Cs-138	1.09E+02	7.05E+00	1.68E-03	0.00E+00	0.00E+00	1.16E+02
Rb-86	3.63E-01	7.27E-01	6.96E-01	8.67E-02	3.42E-02	1.91E+00
Total	3.23E+03	2.62E+03	3.57E+03	4.53E+03	8.93E+03	2.29E+04

Table 7.1-6
Activity Releases for Failure of Small Lines Carrying Primary Coolant Outside Containment

Isotope	Activity Release (Ci) 0–2 hr
Kr-85m	1.24E+01
Kr-85	4.40E+01
Kr-87	7.05E+00
Kr-88	2.21E+01
Xe-131m	1.99E+01
Xe-133m	2.50E+01
Xe-133	1.84E+03
Xe-135m	2.59E+00
Xe-135	5.20E+01
Xe-138	3.65E+00
I-130	1.89E+00
I-131	9.26E+01
I-132	3.49E+02
I-133	2.01E+02
I-134	1.58E+02
I-135	1.68E+02
Cs-134	4.16E+00
Cs-136	6.16E+00
Cs-137	3.00E+00
Cs-138	2.21E+00
Total	3.02E+03

Table 7.1-7
Activity Releases for Steam Generator Tube Rupture with Preexisting Iodine Spike

Isotope	Activity Release (Ci)			
	0-2 hr	2-8 hr	8-24 hr	Total
Kr-85m	5.50E+01	2.14E+01	7.00E-03	7.64E+01
Kr-85	2.19E+02	1.24E+02	1.30E-01	3.43E+02
Kr-87	2.40E+01	3.76E+00	0.00E+00	2.78E+01
Kr-88	9.20E+01	2.90E+01	0.00E+00	1.21E+02
Xe-131m	9.90E+01	5.56E+01	6.00E-02	1.55E+02
Xe-133m	1.23E+02	6.75E+01	6.00E-02	1.91E+02
Xe-133	9.13E+03	5.09E+03	5.00E+00	1.42E+04
Xe-135m	3.51E+00	5.00E-03	0.00E+00	3.52E+00
Xe-135	2.44E+02	1.15E+02	7.00E-02	3.59E+02
Xe-138	4.66E+00	4.20E-03	0.00E+00	4.66E+00
I-130	2.19E+00	7.48E-02	2.79E-01	2.54E+00
I-131	1.47E+02	7.02E+00	3.21E+01	1.86E+02
I-132	1.75E+02	1.42E+00	1.96E+00	1.78E+02
I-133	2.64E+02	1.04E+01	4.24E+01	3.17E+02
I-134	3.41E+01	3.19E-02	4.38E-03	3.41E+01
I-135	1.56E+02	3.94E+00	1.22E+01	1.72E+02
Cs-134	2.10E+00	2.52E-01	6.32E-01	2.98E+00
Cs-136	3.14E+00	3.70E-01	9.20E-01	4.43E+00
Cs-137	1.52E+00	1.82E-01	4.56E-01	2.16E+00
Cs-138	7.33E-01	4.80E-04	1.00E-06	7.33E-01
Total	1.08E+04	5.53E+03	9.63E+01	1.64E+04

Table 7.1-8
Activity Releases for Steam Generator Tube Rupture with Accident-Initiated Iodine Spike

Isotope	Activity Release (Ci)			
	0-2 hr	2-8 hr	8-24 hr	Total
Kr-85m	5.50E+01	2.14E+01	7.00E-03	7.64E+01
Kr-85	2.19E+02	1.24E+02	1.30E-01	3.43E+02
Kr-87	2.40E+01	3.76E+00	0.00E+00	2.78E+01
Kr-88	9.20E+01	2.90E+01	0.00E+00	1.21E+02
Xe-131m	9.90E+01	5.56E+01	6.00E-02	1.55E+02
Xe-133m	1.23E+02	6.75E+01	6.00E-02	1.91E+02
Xe-133	9.13E+03	5.09E+03	5.00E+00	1.42E+04
Xe-135m	3.51E+00	5.00E-03	0.00E+00	3.52E+00
Xe-135	2.44E+02	1.15E+02	7.00E-02	3.59E+02
Xe-138	4.66E+00	4.20E-03	0.00E+00	4.66E+00
I-130	9.80E-01	2.19E-01	8.95E-01	2.09E+00
I-131	4.92E+01	1.54E+01	7.57E+01	1.40E+02
I-132	1.66E+02	8.36E+00	1.40E+01	1.88E+02
I-133	1.05E+02	2.71E+01	1.20E+02	2.52E+02
I-134	6.32E+01	3.02E-01	6.33E-02	6.36E+01
I-135	8.58E+01	1.41E+01	4.84E+01	1.48E+02
Cs-134	2.10E+00	2.52E-01	6.32E-01	2.98E+00
Cs-136	3.14E+00	3.70E-01	9.20E-01	4.43E+00
Cs-137	1.52E+00	1.82E-01	4.56E-01	2.16E+00
Cs-138	7.33E-01	4.80E-04	1.00E-06	7.33E-01
Total	1.05E+04	5.57E+03	2.66E+02	1.63E+04

Table 7.1-9 (Sheet 1 of 2)
Activity Releases for Loss-of-Coolant Accident Resulting from a Spectrum of Postulated Piping Breaks within the Reactor Coolant Pressure Boundary

Isotope	Activity Release (Ci)						
	1.4-3.4 hr	0-2 hr	2-8 hr	8-24 hr	24-96 hr	96-720 hr	Total
I-130	5.64E+01	3.24E+01	7.95E+01	5.24E+00	6.28E-01	6.00E-03	1.18E+02
I-131	1.68E+03	9.19E+02	2.57E+03	2.56E+02	1.92E+02	5.79E+02	4.52E+03
I-132	1.23E+03	8.79E+02	1.26E+03	1.62E+01	6.00E-03	0.00E+00	2.16E+03
I-133	3.23E+03	1.82E+03	4.72E+03	3.71E+02	8.40E+01	7.80E+00	7.00E+03
I-134	6.60E+02	7.09E+02	4.29E+02	3.07E-02	0.00E+00	0.00E+00	1.14E+03
I-135	2.56E+03	1.54E+03	3.36E+03	1.56E+02	4.80E+00	0.00E+00	5.06E+03
Kr-85m	1.42E+03	6.32E+02	3.14E+03	1.87E+03	8.60E+01	0.00E+00	5.73E+03
Kr-85	8.31E+01	3.22E+01	2.65E+02	7.06E+02	1.59E+03	1.36E+04	1.62E+04
Kr-87	1.10E+03	6.88E+02	1.26E+03	5.00E+01	0.00E+00	0.00E+00	2.00E+03
Kr-88	3.11E+03	1.50E+03	5.76E+03	1.70E+03	1.70E+01	0.00E+00	8.98E+03
Xe-131m	8.26E+01	3.21E+01	2.62E+02	6.79E+02	1.37E+03	5.57E+03	7.91E+03
Xe-133m	4.43E+02	1.74E+02	1.37E+03	3.15E+03	4.11E+03	2.58E+03	1.14E+04
Xe-133	1.47E+04	5.71E+03	4.62E+04	1.16E+05	2.06E+05	4.07E+05	7.81E+05
Xe-135m	1.06E+01	3.33E+01	2.62E+00	0.00E+00	0.00E+00	0.00E+00	3.59E+01
Xe-135	3.15E+03	1.31E+03	8.33E+03	1.01E+04	2.10E+03	1.00E+01	2.19E+04
Xe-138	3.11E+01	1.14E+02	6.90E+00	0.00E+00	0.00E+00	0.00E+00	1.21E+02
Rb-86	3.04E+00	1.72E+00	4.60E+00	2.80E-01	1.00E-03	8.00E-03	6.61E+00
Cs-134	2.58E+02	1.46E+02	3.92E+02	2.40E+01	1.00E-01	1.20E+00	5.63E+02
Cs-136	7.33E+01	4.14E+01	1.11E+02	6.70E+00	0.00E+00	2.00E-01	1.59E+02
Cs-137	1.51E+02	8.49E+01	2.28E+02	1.41E+01	0.00E+00	7.00E-01	3.28E+02
Cs-138	1.50E+02	2.60E+02	6.96E+01	0.00E+00	0.00E+00	0.00E+00	3.30E+02
Sb-127	2.42E+01	1.14E+01	3.67E+01	2.14E+00	1.00E-02	1.00E-02	5.03E+01
Sb-129	5.10E+01	2.71E+01	6.23E+01	1.48E+00	0.00E+00	0.00E+00	9.09E+01
Te-127m	3.15E+00	1.47E+00	4.83E+00	2.95E-01	2.00E-03	1.30E-02	6.61E+00
Te-127	2.05E+01	1.02E+01	2.81E+01	1.11E+00	0.00E+00	0.00E+00	3.94E+01
Te-129m	1.07E+01	5.01E+00	1.64E+01	1.00E+00	1.00E-02	3.00E-02	2.25E+01
Te-129	1.88E+01	1.39E+01	1.45E+01	3.00E-02	0.00E+00	0.00E+00	2.84E+01
Te-131m	3.17E+01	1.51E+01	4.69E+01	2.51E+00	0.00E+00	1.00E-02	6.45E+01
Te-132	3.23E+02	1.52E+02	4.89E+02	2.84E+01	1.00E-01	1.00E-01	6.70E+02
Sr-89	9.23E+01	4.31E+01	1.42E+02	8.60E+00	1.00E-01	3.00E-01	1.94E+02
Sr-90	7.95E+00	3.71E+00	1.22E+01	7.50E-01	0.00E+00	4.00E-02	1.67E+01
Sr-91	9.68E+01	4.79E+01	1.33E+02	5.30E+00	0.00E+00	0.00E+00	1.86E+02
Sr-92	6.83E+01	3.91E+01	7.40E+01	1.00E+00	0.00E+00	0.00E+00	1.14E+02
Ba-139	5.44E+01	3.74E+01	4.56E+01	1.50E-01	0.00E+00	0.00E+00	8.32E+01
Ba-140	1.63E+02	7.61E+01	2.49E+02	1.51E+01	0.00E+00	4.00E-01	3.41E+02
Mo-99	2.15E+01	1.01E+01	3.24E+01	1.86E+00	1.00E-02	0.00E+00	4.44E+01
Tc-99m	1.47E+01	7.54E+00	1.91E+01	5.90E-01	0.00E+00	0.00E+00	2.72E+01
Ru-103	1.73E+01	8.08E+00	2.65E+01	1.62E+00	1.00E-02	6.00E-02	3.63E+01
Ru-105	8.18E+00	4.33E+00	1.00E+01	2.40E-01	0.00E+00	0.00E+00	1.46E+01
Ru-106	5.70E+00	2.66E+00	8.75E+00	5.40E-01	0.00E+00	3.00E-02	1.20E+01
Rh-105	1.03E+01	4.88E+00	1.53E+01	8.30E-01	0.00E+00	0.00E+00	2.10E+01
Ce-141	3.89E+00	1.82E+00	5.96E+00	3.64E-01	2.00E-03	1.20E-02	8.16E+00
Ce-143	3.46E+00	1.64E+00	5.14E+00	2.78E-01	1.00E-03	0.00E+00	7.06E+00

Table 7.1-9 (Sheet 2 of 2)
Activity Releases for Loss-of-Coolant Accident Resulting from a Spectrum of Postulated Piping Breaks within the Reactor Coolant Pressure Boundary

Isotope	Activity Release (Ci)						
	1.4-3.4 hr	0-2 hr	2-8 hr	8-24 hr	24-96 hr	96-720 hr	Total
Ce-144	2.94E+00	1.37E+00	4.51E+00	2.76E-01	2.00E-03	1.30E-02	6.17E+00
Pu-238	9.16E-03	4.28E-03	1.41E-02	8.60E-04	0.00E+00	4.00E-05	1.93E-02
Pu-239	8.06E-04	3.76E-04	1.24E-03	7.60E-05	1.00E-06	3.00E-06	1.70E-03
Pu-240	1.18E-03	5.52E-04	1.81E-03	1.11E-04	1.00E-06	5.00E-06	2.48E-03
Pu-241	2.65E-01	1.24E-01	4.08E-01	2.50E-02	1.00E-04	1.20E-03	5.58E-01
Np-239	4.48E+01	2.12E+01	6.75E+01	3.84E+00	2.00E-02	1.00E-02	9.26E+01
Y-90	8.08E-02	3.81E-02	1.22E-01	7.00E-03	0.00E+00	0.00E+00	1.67E-01
Y-91	1.19E+00	5.54E-01	1.82E+00	1.11E-01	1.00E-03	4.00E-03	2.49E+00
Y-92	7.89E-01	4.32E-01	9.19E-01	1.80E-02	0.00E+00	0.00E+00	1.37E+00
Y-93	1.21E+00	6.00E-01	1.68E+00	6.80E-02	0.00E+00	0.00E+00	2.35E+00
Nb-95	1.59E+00	7.46E-01	2.44E+00	1.49E-01	1.00E-03	5.00E-03	3.34E+00
Zr-95	1.59E+00	7.41E-01	2.43E+00	1.49E-01	0.00E+00	6.00E-03	3.33E+00
Zr-97	1.43E+00	6.89E-01	2.05E+00	9.80E-02	0.00E+00	0.00E+00	2.84E+00
La-140	1.67E+00	7.92E-01	2.50E+00	1.39E-01	0.00E+00	0.00E+00	3.43E+00
La-141	1.03E+00	5.54E-01	1.23E+00	2.70E-02	0.00E+00	0.00E+00	1.81E+00
La-142	5.38E-01	3.57E-01	4.74E-01	2.00E-03	0.00E+00	0.00E+00	8.33E-01
Nd-147	6.16E-01	2.89E-01	9.42E-01	5.70E-02	0.00E+00	1.00E-03	1.29E+00
Pr-143	1.39E+00	6.50E-01	2.13E+00	1.28E-01	1.00E-03	3.00E-03	2.91E+00
Am-241	1.20E-04	5.59E-05	1.84E-04	1.13E-05	0.00E+00	6.00E-07	2.52E-04
Cm-242	2.82E-02	1.32E-02	4.33E-02	2.65E-03	2.00E-05	1.20E-04	5.93E-02
Cm-244	3.46E-03	1.62E-03	5.32E-03	3.26E-04	1.00E-06	1.60E-05	7.28E-03
Total	3.53E+04	1.72E+04	8.14E+04	1.35E+05	2.16E+05	4.29E+05	8.79E+05

Table 7.1-10
Activity Releases for Fuel Handling Accident

Isotope	Activity Release (Ci) 0–2 hr
Kr-85m	8.40E+00
Kr-85	1.10E+03
Kr-88	3.00E-01
Xe-131m	5.52E+02
Xe-133m	2.30E+03
Xe-133	8.88E+04
Xe-135m	1.02E+02
Xe-135	5.68E+03
I-130	7.00E-01
I-131	3.47E+02
I-132	2.44E+02
I-133	1.08E+02
I-135	3.20E+00
Total	9.92E+04

Table 7.1-11
Atmospheric Dispersion Factors

Location	Time (hr)	χ/Q (sec/m^3)		Ratio
		DCD	Site	(Site/DCD)
EAB	0–2	5.1E-04	1.89E-04	3.71E-01
LPZ	0–8	2.2E-04	5.29E-06	2.40E-02
	8–24	1.6E-04	4.02E-06	2.51E-02
	24–96	1.0E-04	2.21E-06	2.21E-02
	96–720	8.0E-05	9.39E-07	1.17E-02

Table 7.1-12
Summary of Design Basis Accident Doses

DCD/SRP Section	Accident	Site Dose (rem TEDE)		Limit[(a)] (rem TEDE)	Dose Table
		EAB	LPZ		
15.1.5A	Steam System Piping Failure				
	Preexisting Iodine Spike	1.9E-01	8.8E-03	25	7.1-13
	Accident-Initiated Iodine Spike	2.2E-01	2.4E-02	2.5	7.1-14
15.2.8	Feedwater System Pipe Break[(b)]				
15.3.3	Reactor Coolant Pump Shaft Seizure				
	No Feedwater	1.9E-01	4.3E-03	2.5	7.1-15
	Feedwater Available	1.5E-01	9.1E-03	2.5	7.1-16
15.3.4	Reactor Coolant Pump Shaft Break[(c)]				
15.4.8	Spectrum of Rod Cluster Control Assembly Ejection Accidents	6.7E-01	6.0E-02	6.3	7.1-17
15.6.2	Failure of Small Lines Carrying Primary Coolant Outside Containment	4.1E-01	1.1E-02	2.5	7.1-18
15.6.3	Steam Generator Tube Rupture				
	Preexisting Iodine Spike	5.2E-01	1.6E-02	25	7.1-19
	Accident-Initiated Iodine Spike	2.2E-01	1.0E-02	2.5	7.1-20
15.6.5A,B	Loss-of-Coolant Accident Resulting from a Spectrum of Postulated Piping Breaks within the Reactor Coolant Pressure Boundary	9.1E+00	5.6E-01	25	7.1-21
15.7.4	Fuel Handling Accident	1.0E+00	2.6E-02	6.3	7.1-22

(a) NUREG-1555 specifies a dose limit of 25 rem TEDE for all design basis accidents. The more restrictive limits shown in the table apply to safety analysis report doses, but are shown here to demonstrate that even these more restrictive limits are met.
(b) Feedwater System Pipe Break is bounded by Steam System Piping Failure, as indicated in the DCD.
(c) Reactor Coolant Pump Shaft Break is bounded by Reactor Coolant Pump Shaft Seizure, as indicated in the DCD.

Table 7.1-13
Doses for Steam System Piping Failure with Preexisting Iodine Spike

Time	DCD Dose (rem TEDE)		X/Q Ratio (Site/DCD)	Site Dose (rem TEDE)	
	EAB	LPZ		EAB	LPZ
0–2 hr	5.0E-01	—	3.71E-01	1.9E-01	—
0–8 hr	—	2.6E-01	2.40E-02	—	6.3E-03
8–24 hr	—	3.8E-02	2.51E-02	—	1.0E-03
24–96 hr	—	7.2E-02	2.21E-02	—	1.6E-03
96–720 hr	—	0	1.17E-02	—	0
Total	5.0E-01	3.7E-01	—	1.9E-01	8.8E-03
Limit	—	—	—	25	25

Table 7.1-14
Doses for Steam System Piping Failure with Accident-Initiated Iodine Spike

Time	DCD Dose (rem TEDE)		χ/Q Ratio (Site/DCD)	Site Dose (rem TEDE)	
	EAB	LPZ		EAB	LPZ
0–2 hr	6.0E-01	—	3.71E-01	2.2E-01	—
0–8 hr	—	4.5E-01	2.40E-02	—	1.1E-02
8–24 hr	—	2.0E-01	2.51E-02	—	5.0E-03
24–96 hr	—	3.6E-01	2.21E-02	—	8.0E-03
96–720 hr	—	0	1.17E-02	—	0
Total	6.0E-01	1.0E+00	—	2.2E-01	2.4E-02
Limit	—	—	—	2.5	2.5

Table 7.1-15
Doses for Reactor Coolant Pump Shaft Seizure with No Feedwater

Time	DCD Dose (rem TEDE)		X/Q Ratio (Site/DCD)	Site Dose (rem TEDE)	
	EAB	LPZ		EAB	LPZ
0–2 hr	5.0E-01	—	3.71E-01	1.9E-01	—
0–8 hr	—	1.8E-01	2.40E-02	—	4.3E-03
8–24 hr	—	0	2.51E-02	—	0
24–96 hr	—	0	2.21E-02	—	0
96–720 hr	—	0	1.17E-02	—	0
Total	5.0E-01	1.8E-01	—	1.9E-01	4.3E-03
Limit	—	—	—	2.5	2.5

Table 7.1-16
Doses for Reactor Coolant Pump Shaft Seizure with Feedwater Available

Time	DCD Dose (rem TEDE)		X/Q Ratio (Site/DCD)	Site Dose (rem TEDE)	
	EAB	LPZ		EAB	LPZ
6–8 hr	4.0E-01	—	3.71E-01	1.5E-01	—
0–8 hr	—	3.8E-01	2.40E-02	—	9.1E-03
8–24 hr	—	0	2.51E-02	—	0
24–96 hr	—	0	2.21E-02	—	0
96–720 hr	—	0	1.17E-02	—	0
Total	4.0E-01	3.8E-01	—	1.5E-01	9.1E-03
Limit	—	—	—	2.5	2.5

Note: Maximum 2-hour EAB dose occurs between 6 and 8 hours.

Table 7.1-17
Doses for Spectrum of Rod Cluster Control Assembly Ejection Accidents

Time	DCD Dose (rem TEDE)		X/Q Ratio (Site/DCD)	Site Dose (rem TEDE)	
	EAB	LPZ		EAB	LPZ
0–2 hr	1.8E+00	—	3.71E-01	6.7E-01	—
0–8 hr	—	2.0E+00	2.40E-02	—	4.8E-02
8–24 hr	—	4.2E-01	2.51E-02	—	1.1E-02
24–96 hr	—	4.2E-02	2.21E-02	—	9.3E-04
96–720 hr	—	2.1E-02	1.17E-02	—	2.5E-04
Total	1.8E+00	2.5E+00	—	6.7E-01	6.0E-02
Limit	—	—	—	6.3	6.3

Table 7.1-18
Doses for Failure of Small Lines Carrying Primary Coolant Outside Containment

Time	DCD Dose (rem TEDE)		X/Q Ratio (Site/DCD)	Site Dose (rem TEDE)	
	EAB	LPZ		EAB	LPZ
0–2 hr	1.1E+00	—	3.71E-01	4.1E-01	—
0–8 hr	—	4.5E-01	2.40E-02	—	1.1E-02
8–24 hr	—	0	2.51E-02	—	0
24–96 hr	—	0	2.21E-02	—	0
96–720 hr	—	0	1.17E-02	—	0
Total	1.1E+00	4.5E-01	—	4.1E-01	1.1E-02
Limit	—	—	—	2.5	2.5

Table 7.1-19
Doses for Steam Generator Tube Rupture with Preexisting Iodine Spike

Time	DCD Dose (rem TEDE)		X/Q Ratio (Site/DCD)	Site Dose (rem TEDE)	
	EAB	LPZ		EAB	LPZ
0–2 hr	1.4E+00	—	3.71E-01	5.2E-01	—
0–8 hr	—	6.2E+01	2.40E-02	—	1.5E-02
8–24 hr	—	4.1E-02	2.51E-02	—	1.0E-03
24–96 hr	—	0	2.21E-02	—	0
96–720 hr	—	0	1.17E-02	—	0
Total	1.4E+00	6.6E+01	—	5.2E-01	1.6E-02
Limit	—	—	—	25	25

Table 7.1-20
Doses for Steam Generator Tube Rupture with Accident-Initiated Iodine Spike

Time	DCD Dose (rem TEDE)		X/Q Ratio (Site/DCD)	Site Dose (rem TEDE)	
	EAB	LPZ		EAB	LPZ
0–2 hr	6.0E-01	—	3.71E-01	2.2E-01	—
0–8 hr	—	3.2E-01	2.40E-02	—	7.7E-03
8–24 hr	—	1.0E-01	2.51E-02	—	2.5E-03
24–96 hr	—	0	2.21E-02	—	0
96–720 hr	—	0	1.17E-02	—	0
Total	6.0E-01	4.2E-01	—	2.2E-01	1.0E-02
Limit	—	—	—	2.5	2.5

Table 7.1-21
Doses for Loss-of-Coolant Accident Resulting from a Spectrum of Postulated Piping Breaks within the Reactor Coolant Pressure Boundary

Time	DCD Dose (rem TEDE)		X/Q Ratio (Site/DCD)	Site Dose (rem TEDE)	
	EAB	LPZ		EAB	LPZ
1.4–3.4 hr	2.46E+01	—	3.71E-01	9.1E+00	—
0–8 hr	—	2.2E+01	2.40E-02	—	5.3E-01
8–24 hr	—	7.5E-01	2.51E-02	—	1.9E-02
24–96 hr	—	2.9E-01	2.21E-02	—	6.4E-03
96–720 hr	—	5.5E-01	1.17E-02	—	6.5E-03
Total	2.46E+01	2.4E+01	—	9.1E+00	5.6E-01
Limit	—	—	—	25	25

Note: Maximum 2-hour EAB dose occurs between 1.4 and 3.4 hours.

Table 7.1-22
Doses for Fuel Handling Accident

Time	DCD Dose (rem TEDE)		X/Q Ratio (Site/ DCD)	Site Dose (rem TEDE)	
	EAB	LPZ		EAB	LPZ
0–2 hr	2.7E+00	—	3.71E-01	1.0E+00	—
0–8 hr	—	1.1E+00	2.40E-02	—	2.6E-02
8–24 hr	—	0	2.51E-02	—	0
24–96 hr	—	0	2.21E-02	—	0
96–720 hr	—	0	1.17E-02	—	0
Total	2.7E+00	1.1E+00	—	1.0E+00	2.6E-02
Limit	—	—	—	6.3	6.3

7.2 SEVERE ACCIDENTS

Severe accidents are defined as accidents with substantial damage to the reactor core and degradation of containment systems. Because the probability of a severe accident is very low for the AP1000, such accidents are not part of the design basis for the plant. However, the NRC requires, in its *Policy Statement on Severe Reactor Accidents Regarding Future Designs and Existing Plants* (50 FR 32138), the completion of a probabilistic risk assessment for severe accidents for new reactor designs. This requirement is codified in 10 CFR 52.47, *Contents of Applications*.

Westinghouse completed a probabilistic risk assessment for the AP1000 design (WEC 2004) as part of their application for design certification. The AP1000 design was reviewed by the NRC, and the review was documented in NUREG-1793, *Final Safety Evaluation Report Related to Certification of the AP1000 Standard Design*. Subsequently, the NRC certified the design, concluding that this advanced design meets the NRC's safety goals and represents an improvement in safety over currently operating reactors in the United States.

The Westinghouse analysis used generic, but conservative, meteorology and regional characteristics. FPL presents in this section an update of the generic probabilistic risk assessment analysis of severe accidents to include Turkey Point site-specific characteristics and impacts over the entire life cycle of a severe accident. The purpose of this section is to show the complete impacts of a severe accident, demonstrate that the impacts are less than NRC safety goals, and support the severe accident mitigation alternatives analyses in Section 7.3.

7.2.1 WESTINGHOUSE METHODOLOGY

The Westinghouse probabilistic risk assessment for the AP1000 established an event tree that defined the possible functional end states of the containment following a severe accident initiated by internal events. These end states are grouped into three categories: (1) an intact containment with normal leakage or a larger leak with a containment isolation failure, (2) a containment breach, possibly a result of high containment pressure or a hydrogen detonation, and (3) containment bypass such as a steam generator tube rupture. Using the EPRI code Modular Accident Analysis Program, Westinghouse determined that six source term categories would represent the entire suite of potential severe accidents from these three end state categories. An accident frequency was assigned to each of the six categories (Table 7.2-1).

The six source term categories or accident categories are:

1. Intact Containment — Containment integrity is maintained throughout the accident. The release of radioactivity to the environment is a result of nominal design leakage.

2. Containment Bypass — Radioactivity is released from the reactor coolant system to the environment via the secondary system or other interfacing system bypass. Containment failure occurs before the onset of core damage. This accident category contributes to the large, early release frequency.

3. Containment Isolation Failure — Radioactivity is released through a failure of the valves that close the penetrations between containment and the environment. Containment failure occurs before the onset of core damage. This accident category contributes to the large, early release frequency.

4. Early Containment Failure — Radioactivity release occurs through a containment failure caused by some dynamic severe accident phenomenon after the onset of core damage but before core relocation. Such phenomena could include hydrogen detonation, hydrogen diffusion flame, steam explosions, or vessel failures. This accident category contributes to the large, early release frequency.

5. Intermediate Containment Failure — Radioactivity release occurs through a containment failure caused by some dynamic severe accident phenomenon after core relocation but before 24 hours have passed since initiation of the accident. Such phenomena could include hydrogen detonation and hydrogen deflagration. This accident category contributes to large releases but does not occur early in the accident life cycle.

6. Late Containment Failure — Radioactivity release occurs through a containment failure caused by some dynamic severe accident phenomenon more than 24 hours after initiation of the accident. Such phenomena could include the failure of containment heat removal. This accident category contributes to large releases but does not occur early in the accident life cycle.

Westinghouse then used the NRC code MACCS2 (Chanin and Young May 1997) to model the environmental consequences of the severe accidents described above. The MELCOR Accident Consequence Code System (MACCS) and its successor MACCS2 were developed specifically for the NRC to evaluate severe accidents at nuclear power plants. The meteorology Westinghouse used to represent a generic AP1000 site is specified in EPRI's Utility Requirements Document (EPRI Mar 1999). The meteorology is from a database selected because it is expected to result in calculated impacts greater than those that would be expected at 80 to 90 percent of U.S. operating plants. The population considered also was selected to provide impacts greater than those that would be expected at 80 to 90 percent of the plants. The Westinghouse analysis focused on 24 hours following core damage as a measure of the consequences from a large release and, therefore, did not address the chronic exposure pathways such as ingestion, inhalation of resuspended material, or groundshine subsequent to plume passage.

Additional details on the Westinghouse analysis are found in (WEC 2004) and reported in the DCD (WEC 2011).

7.2.2 FPL METHODOLOGY

FPL also used the MACCS2 computer code to evaluate consequences of severe accidents. The exposure pathways modeled include external exposure to the passing plume, external exposure to material deposited on the ground, inhalation of material in the passing plume or resuspended from the ground, and ingestion of contaminated food and surface water. The MACCS2 code primarily addresses dose from the air exposure pathway, but also calculates dose from surface runoff and deposits on surface water. The code also evaluates the extent of contamination. A difference between the Westinghouse generic analysis and the Turkey Point site-specific analysis is that FPL used site-specific meteorology and population data and extended the analysis to include long-term exposure pathways, such as ingestion, over the life cycle of the accident. Ingestion exposure was determined using the COMIDA2 food model option of MACCS2.

To assess human health impacts, FPL determined the collective dose to the 50-mile population, number of latent cancer fatalities, and number of early fatalities associated with each severe accident category. Economic costs were also determined, including the costs associated with short-term relocation of people, decontamination of property and equipment, interdiction of food supplies, and indirect costs resulting from loss of use of the property and incomes derived as a result of the accident.

Five files provide input to a MACCS2 analysis. One file provides data to calculate the amount of material released to the atmosphere that is dispersed and deposited. The calculation uses a Gaussian plume model. Important inputs in this file include the core inventory, release fractions, and geometry of the reactor and associated buildings. A second file provides inputs to calculations regarding exposure in the time period immediately following the release. Important site-specific information includes emergency response information such as evacuation time. A third input file provides data for calculating long-term impacts and economic costs and includes region-specific data on agriculture and economic factors. These three files access both a meteorological file, which uses actual Turkey Point meteorological monitoring data and a site characteristics file which is built using SECPOP2000 (NUREG/CR-6525) as a template.

Three years of meteorological data (2002, 2005, and 2006) from the existing Units 3 and 4 60-meter meteorological tower were analyzed. MACCS2 requires an entire calendar year of meteorological data. The year 2002 meteorology data was selected for subsequent analyses because it resulted in the largest consequences of the years analyzed, and, therefore, is the most conservative meteorological dataset of the 3 years.

For this analysis, the census data were modified to include transient populations and projected to the year 2080, as described in Subsection 2.5.1. MACCS2 also requires the spatial distribution of certain agriculture and economic data (fraction of land devoted to farming, annual farm sales, fraction of farm sales resulting from dairy production, and property value of farm and nonfarm land) in the same manner as the population. Agricultural production and economic parameters were taken from the 2007 National Census of Agriculture. Nonfarm land property values were taken from 2010 Florida property tax records for the portion of the counties within 50 miles of Turkey Point.

The resultant MACCS2 calculations and accident frequency information was used to determine risk. The consequence risk is the product of frequency of an accident times the consequences of the accident. The consequence can be either radiation dose or economic cost. Dose-risk is the product of the collective dose times the accident frequency. Because the AP1000's severe accident analysis addressed a suite of accidents, the individual risks were summed to provide a total risk. Similarly, cost-risk is the product of economic cost times the accident frequency, and the individual risks were summed to provide a total cost-risk. Therefore, risk can be reported as person-rem per reactor year or dollars per reactor year.

A ground-level release height and no release heat for each accident release hypothesized was assumed. A sensitivity analysis was performed on each of those assumptions; release heights of middle and top of containment and release heat of 1 and 10 megawatt per release segment were considered. The dose-risk varied by less than 3.3 percent for each of the sensitivity calculations.

An evacuation time estimate for the population surrounding the Turkey Point site which assumed evacuation to a 10-mile radius was also performed. The evacuation time estimate was used in the MACCS2 analysis to estimate the evacuation of transient and resident populations within the 10-mile radius.

As described above, the resulting MACCS2 calculations include only internally initiated events, consistent with the Westinghouse analysis. The external event core damage frequencies are slightly greater than the internal event core damage frequencies. An approach to qualitatively estimate the total event core damage frequency (internal and external events) could be to double the internal event core damage frequency, which would double the resulting dose-risk or cost-risk.

7.2.3 CONSEQUENCES TO POPULATION GROUPS

The exposure pathway consequences to population groups including air exposure pathways, surface water exposure pathways, and groundwater exposure pathways are addressed in the following sections.

7.2.3.1 Air Exposure Pathways

Each of the six accident categories was analyzed with MACCS2 to estimate population dose, number of early and latent cancer fatalities, cost, and farmland requiring decontamination. The analysis assumed that 95 percent of the population was evacuated following declaration of a general emergency. For each accident category, FPL calculated the risk for each analytical endpoint (population dose, fatalities, cost, and contaminated land) by multiplying it by the accident category frequency. The results are provided in Table 7.2-1.

7.2.3.2 Surface Water Exposure Pathways

People can be exposed to radiation when deposited airborne radioactivity runs off into or is deposited onto surface water. The exposure pathway can be from drinking the water, external radiation from submersion in the water, external radiation from human activities near the shoreline, or ingestion of fish or shellfish. MACCS2 only calculates the dose from drinking the water. The MACCS2 severe accident dose-risk to the 50-mile population from drinking water is 0.0079 person-rem per year of AP1000 operation. This value is included with the air exposure pathways dose and is the sum of all six accident category risks.

Surface water exposure pathways involving swimming, fishing, boating, and performing activities near the shoreline are not modeled by MACCS2. Surface water bodies within the 50-mile region of Turkey Point include the Biscayne Bay, Atlantic Ocean, Card Sound, the Everglades, canals, ponds, and other smaller water bodies. NUREG-1437 does not provide specific data on submersion and shoreline activities; however, it does indicate that these contributors to dose are much less than for drinking water and consuming aquatic foods, especially at estuary sites. NUREG-1437 evaluated doses from the aquatic food exposure pathway (fishing) for the existing licensed power reactors. For sites near large water bodies, the NRC evaluation estimated the uninterdicted aquatic food exposure pathway dose risk which ranged from 270 person-rem per reactor year (Hope Creek on the Delaware Bay) to 5500 person-rem per reactor year (Calvert Cliffs on the Chesapeake Bay). The Units 6 & 7 site would more likely be similar to Calvert Cliffs on the Chesapeake Bay. Actual dose-risk values would be expected to be much less (by a factor of 2 to 10) due to interdiction of contaminated foods (NUREG-1437). Furthermore, because the AP1000 atmospheric exposure pathway doses are lower than those of the existing licensed power reactors, it is reasonable to conclude that the doses from surface water sources would be considerably lower than those reported above for the surface water exposure pathway.

7.2.3.3 Groundwater Exposure Pathways

Radioactivity released during an accident can directly and indirectly enter groundwater that serves as a source of drinking water or irrigation, or can move through an aquifer that eventually discharges to surface water. NUREG-1437 evaluated the groundwater exposure pathway dose, based on the analysis in NUREG-0440, *Liquid Pathway Generic Study*. NUREG-0440 analyzed a core meltdown that contaminated groundwater which subsequently contaminated surface water. However, NUREG-0440 did not analyze direct drinking of groundwater because of the limited number of potable groundwater wells and limited accessibility.

The *Liquid Pathway Generic Study* results provide conservative, uninterdicted population dose estimates for six generic categories of plants. These dose estimates were one or more orders-of-magnitude less than those attributed to the atmospheric exposure pathway. The Units 6 & 7 site is represented by one of these categories and would be bounded by this analysis. Therefore, the doses from the Units 6 & 7 site groundwater exposure pathway would be much less than the doses from the atmospheric exposure pathway.

7.2.4 COMPARISON TO NRC SAFETY GOALS

FPL compared the severe accident risks from Units 6 & 7 against two risk goals identified by the NRC (51 FR 30028) as described below. The results are presented in Table 7.2-2.

7.2.4.1 Individual Risk Goal

The risk of prompt fatalities that might result from reactor accidents to an average individual in the vicinity of a nuclear power plant should not exceed 0.1 percent of the sum of “prompt fatality risks” resulting from other accidents to which members of the U.S. population are generally exposed. As noted in the Safety Goals Policy statement (51 FR 30028), “vicinity” is defined as the area within 1 mile of the plant site boundary. “Prompt Fatality Risks” are defined as those risks to which the average individual residing in the vicinity of the plant is exposed to as a result of normal daily activities. Such risks are the sum of risks that result in fatalities from such activities as driving, household chores, occupational activities, etc. For this evaluation, the sum of prompt fatality risks was taken as the U.S. accidental death risk value of 39.1 deaths per 100,000 people per year for 2005 (CDC Apr 2008).

7.2.4.2 Societal Risk Goal

The risk of cancer fatalities that might result from nuclear power plant operations to the population in the area near a nuclear power plant should not exceed 0.1 percent of the sum of the cancer fatality risks resulting from all other causes. As noted in the Safety Goal Policy Statement (51 FR 30028), “near” is defined as within 10 miles of the plant. The cancer fatality risk from all other sources was taken as 186.6 deaths per 100,000 people per year for 2003 to 2005 (CDC Apr 2008).

7.2.5 CONCLUSIONS

The total calculated dose-risk to the 50-mile population from airborne releases from an AP1000 reactor at Turkey Point would be 0.27 person-rem per reactor year (Table 7.2-1). This value is greater than the 0.043 person-rem per reactor year reported by Westinghouse in the DCD (WEC 2011). The FPL analysis included long-term (chronic) exposure pathways in the dose-risk. The equivalent short-term exposure pathway dose from a single AP1000 reactor at Turkey Point would be 0.083 person-rem per reactor year. This value is also greater than the dose-risk reported in the DCD. This is a result of the large population within 50 miles surrounding Units 6 & 7.

The AP1000 dose-risk at the Units 6 & 7 site is less than the population risk for all current reactors that have performed severe accident mitigation alternatives (SAMA) analysis through 2008 as part of license renewal, and less than that for the five reactors analyzed in NUREG-1150, *Severe Accident Risks: An Assessment for Five U.S. Nuclear Power Plants*.

Comparisons with the existing licensed power reactors indicate that risk from the surface water exposure pathway is small. Under the severe accident scenarios, surface water is primarily contaminated by atmospheric deposition. The AP1000 atmospheric exposure pathway doses are significantly lower than those of the existing licensed power reactors. Therefore, it is reasonable to conclude that the doses from the surface water exposure pathway at the Units 6 & 7 site would be consistently lower than those for the currently licensed power reactors.

The risks of groundwater contamination from a severe AP1000 accident (see Subsection 7.2.3.3) would be much less than the risk from currently licensed power reactors. Additionally, interdiction could substantially reduce the groundwater exposure pathway risks.

For comparison, as reported in Section 5.4, the total collective dose from Units 6 & 7 normal operations is expected to be 4.0 person-rem per year. As previously described, dose-risk is dose times frequency. Normal operations have a frequency no greater than one. Therefore, the dose-risk for normal operations is 4.0 person-rem per reactor year. Comparing this value to the severe accident dose-risk of 0.27 person-rem per reactor year indicates that the dose-risk from severe accidents is approximately 7 percent of the dose-risk from normal operations.

The risk of cancer fatalities from a severe accident for the Units 6 & 7 site is reported in Table 7.2-2 as 2.1E-10 for early fatality risk per reactor year and 2.6E-12 late (cancer) fatalities per year per reactor year. Comparing these values to the NRC safety goals indicates that the risk is less than 0.1 percent of the NRC safety goals.

The impacts from an AP1000 reactor at the Units 6 & 7 site would be SMALL because the probability-weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to groundwater, and societal and economic impacts from severe accidents are small and because the early and late fatality risks meet the NRC safety goals.

Section 7.2 References

CDC Apr 2008. Centers for Disease Control, *Deaths: Final Data for 2005*, National Vital Statistics Reports, Volume 56, Number 10, April 24, 2008.

Chanin and Young May 1997. *Code Manual for MACCS2: User's Guide*, NUREG/CR-6613, Volume 1, SAND97-0594, May, 1997.

EPRI Mar 1999. Electric Power Research Institute, *Advanced Light Water Reactor Utility Requirements Document*, Volume III, ALWR Passive Plant, Revision B. Palo Alto, California. March, 1999.

WEC 2004. *AP1000 Probabilistic Risk Assessment*, Revision 8. Pittsburgh, Pennsylvania, 2004.

WEC 2011. *Design Control Document,* Revision 19, Appendix 1B, "Severe Accident Mitigation Design Alternatives." June 2011.

Table 7.2-1
Impacts to the Population and Land from Severe Accidents Analysis

	Environmental Risk					
Accident Category	Accident Frequency (per reactor year)[a]	Population Dose-Risk (person-rem/ reactor year)	Number of Fatalities (per reactor year) Early	Number of Fatalities (per reactor year) Late	Cost-Risk in Dollars[b] (per reactor year)	Land Requiring Decontamination (acres/reactor year)
Intact containment	2.2E-07	4.0E-03	0.0E+0	2.4E-06	0.78	1.6E-07
Containment bypass	1.1E-08	2.0E-01	3.0E-07	1.4E-04	497	2.8E-04
Containment isolation failure	1.3E-09	8.3E-03	1.3E-09	5.4E-06	18	1.3E-05
Early containment failure	7.5E-09	5.0E-02	2.5E-08	3.4E-05	116	7.9E-05
Intermediate containment failure	1.9E-09	1.5E-03	5.0E-11	9.9E-07	4.2	3.5E-06
Late containment failure	3.5E-13	4.3E-06	0.0E+0	2.7E-09	0.014	9.0E-09
Total	**2.4E-07**	**2.7E-01**	**3.2E-07**	**1.8E-04**	**636**	**3.8E-04**

(a) (WEC 2004).
(b) Presented in 2012 dollars.

Table 7.2-2
Comparison to NRC Safety Goals

	Safety Risk	
	Early Fatality Risk (individual 0-1 mile) (deaths per reactor year)	Late Fatalities (0-10 mile cancers) (deaths per year per reactor year)
Safety Goal[a]	3.9E-07	1.9E-06
Unit 6 or 7	2.0E-10	2.6E-12

(a) (CDC Apr 2008)

7.3 SEVERE ACCIDENT MITIGATION ALTERNATIVES

As described in Section 7.2, Westinghouse performed a generic severe accident analysis for the AP1000 as part of the design certification process (WEC 2011). The Westinghouse analysis determined that severe accident impacts are small and that no potential mitigating design alternatives are cost-effective, that is, appropriate mitigating measures are already incorporated into the plant design. Section 7.2 extends the Westinghouse generic severe accident analysis to examine the proposed new nuclear units at Turkey Point and determined that the generic conclusions remain valid for the Units 6 & 7 site. The analysis in this section provides assurance that there are no cost-beneficial design alternatives that would need to be implemented at the Units 6 & 7 site to mitigate these small impacts.

7.3.1 THE SEVERE ACCIDENT MITIGATION ALTERNATIVE ANALYSIS PROCESS

Design or procedural modifications that could mitigate the consequences of a severe accident are known as severe accident mitigation alternatives (SAMAs). In the past, SAMAs were known as severe accident mitigation design alternatives (SAMDAs) that primarily focused on design changes and did not consider procedural modification SAMAs. The Westinghouse DCD analysis is an SAMDA analysis. For an existing plant with a well-defined design and established procedural controls, the normal evaluation process for identifying potential SAMAs includes four steps:

1. Define the base case — The base case is the dose-risk and cost-risk of a severe accident before implementation of any SAMAs. A plant's probabilistic risk assessment is a primary source of data in calculating the base case. The base case risks are converted to a monetary value to use for screening SAMAs. Section 7.2 presents the base case for a single AP1000 unit at the Units 6 & 7 site, without the monetization step.

2. Identify and screen potential SAMAs — Potential SAMAs can be identified from the plant's individual plant examination, the plant's probabilistic risk assessment, and the results of other plants' SAMA analyses. This list of potential SAMAs is assigned a conservatively low implementation cost based on historical costs, similar design changes, and/or engineering judgment, then compared to the base case screening value. SAMAs with higher implementation cost than the base case are not evaluated further.

3. Determine the cost and net value of each SAMA — Each SAMA remaining after Step 2 has a detailed engineering cost evaluation developed using current plant engineering processes. If the SAMA continues to pass the screening value, Step 4 is performed.

4. Determine the benefit associated with each screened SAMA — Each SAMA that passes the screening in Step 3 is evaluated using the probabilistic risk assessment model to

determine the reduction in risk associated with implementation of the proposed SAMA. The reduction in risk benefit is then monetized and compared to the detailed cost estimate. Those SAMAs with reasonable cost-benefit ratios are considered for implementation.

The base case benefit value is calculated by assuming the current dose-risk of the unit could be reduced to zero and assigning a defined dollar value for this change in risk. Any design or procedural change cost that exceeded the benefit value would not be considered cost-effective. The dose-risk and cost-risk results (Section 7.2 analyses) are monetized in accordance with methods established in NUREG/BR-0184, *Regulatory Analysis Technical Evaluation Handbook*. NUREG/BR-0184 presents methods for determining the value of decreases in risk using four types of attributes: public health, occupational health, offsite property, and onsite property. Any SAMAs in which the conservatively low implementation cost exceeds the base case monetization would not be expected to pass the screening in Step 2. If the FPL baseline analysis produces a value that is below that expected for implementing any reasonable SAMA, no matter how inexpensive, the remaining steps of the SAMA analysis are not necessary.

7.3.2 THE AP1000 SAMDA ANALYSIS

The Westinghouse SAMDA analysis is presented in Appendix 1B of the DCD. Westinghouse compiled a list of potential SAMDAs based on the AP600 analysis and other plant designs and suggestions from the AP600/AP1000 design staff. Some SAMDAs were then screened out based on their inapplicability to the AP1000 or the fact that they were already included in the AP1000 design. Rough implementation costs that far exceeded any reasonable benefit were also excluded. The 13 SAMDAs that passed the screening process are as follows and are described more fully in the DCD.

- Chemical volume and control system upgrade to mitigate small loss-of-coolant accidents
- Filtered containment vent
- Self-actuating containment isolation valves
- Passive containment spray
- Steam generator shell-side passive heat removal system
- Steam generator safety valve flow directed to in-containment refueling water storage tank

- Increased steam generator secondary side pressure capacity
- Secondary containment filtered ventilation
- Diverse in-containment refueling water storage tank injection valves
- Diverse containment recirculation valves
- Ex-vessel core catcher
- High-pressure containment design
- Improved reliability of diverse actuation system

These remaining SAMDAs were quantified by the probabilistic risk assessment model to determine the reduction in risk for implementing the SAMDA. Each SAMDA was assumed to reduce the risk of the accident sequences that they address to zero, a conservative assumption. Using the cost-benefit methodology of NUREG/BR-0184, the maximum averted cost risk was calculated for each SAMDA. The maximum averted cost risk calculation used the dose-risks and cost-risks calculated for the severe accidents described in Subsection 7.2.1. Westinghouse calculated the base case maximum averted cost risk to be $21,000 (2007 dollars) using a 7 percent discount rate.

Westinghouse next compared the implementation costs for each SAMDA to the $21,000 value and found that none of the SAMDAs would be cost-effective. The least costly SAMDA, self-actuating containment isolation valves, had an implementation cost of approximately $30,000, with the others having costs at least an order of magnitude greater. The one potential SAMDA was further evaluated but not found to be cost-effective.

In its *Finding of No Significant Impact* relating to the certification of the AP1000 design, the NRC (U.S. NRC Jan 2005) concluded, "none of the potential design modifications evaluated are justified on the basis of cost-benefit considerations. The NRC further concludes that it is unlikely that any other design changes would be justified in the future on the basis of person-rem exposure because the estimated core damage frequencies are very low on an absolute scale."

Pursuant to 10 CFR 51.55(b), it was confirmed that the design changes that are incorporated into the referenced DCD, as defined in Section 1.1, did not change the SAMDA screening or evaluation results or conclusions. Specifically, the SAMDAs assessed as being rejected for the certified AP1000 design, as documented in DCD Revision 19, Appendix 1B, have not become cost-beneficial for Units 6 & 7, nor have any new SAMDAs been identified for Units 6 & 7.

7.3.3 MONETIZATION OF THE UNITS 6 & 7 BASE CASE

The principal inputs to the calculations are the core damage frequency (reported in Section 7.2), dose-risk and cost-risk (reported in Table 7.2-1), dollars per person-rem ($2000 as provided by NRC in NUREG/BR-0184), plant operating life (60 years), and economic discount rate (7 percent and 3 percent are NRC precedents). Both the Westinghouse and FPL severe accident analyses described in Section 7.2 calculate risks from internal events. For this SAMDA analysis, the base-case core damage frequency, dose-risk, and cost-risk for internal events were escalated to account for external events, both at power and at shutdown. As explained in the DCD, dose-risk and cost-risk were scaled up by the ratio of the total (internal and external events) frequency divided by the internal events frequency (5.0E-07/2.4E-07 per reactor year). With these inputs, the monetized value of reducing the base case core damage frequency to zero is presented in Table 7.3-1. The monetized value, known as the maximum averted cost-risk, is conservative because no SAMA can reduce the core damage frequency to zero.

The maximum averted cost risk of $55,513 for a single proposed AP1000 at Turkey Point is so low that FPL does not believe there are any design changes, over those already incorporated into the advanced reactor design, that could be determined to be cost-effective. With a 3 percent discount rate, the valuation of the averted risk is $123,602. The least costly SAMDA, the self-actuating containment isolation valves, had an implementation cost of approximately $30,000. The maximum averted cost risk of $55,513 is the total cost risk benefit from the implementation of every SAMDA, and the benefit from implementation of the least costly SAMDA is only a portion of the total (maximum) cost risk benefit. The cost risk benefit from the implementation of the least costly SAMDA is only $994. Each of the remaining SAMDA implementation costs are much greater than the maximum averted cost risk of $55,513.

As demonstrated in WEC 2011, and confirmed for Turkey Point, the benefit of any SAMDA is much less than its implementation cost. The Turkey Point analysis resulted in slightly higher values than the Westinghouse generic analysis results of $21,000 for the 7 percent discount rate and $43,000 for the 3 percent discount rate. This is a result of the larger population and higher property values surrounding the Units 6 & 7 site.

Accordingly, further evaluation of design-related SAMAs is not warranted. FPL does not believe that administrative SAMAs, such as those relating to procedures or training, are appropriate for evaluation at this time because the procedures and training have not been developed. The purpose of this analysis is to demonstrate that the maximum averted cost risk for an AP1000 at the Units 6 & 7 site are not cost-beneficial. Evaluation of administrative SAMAs would not be appropriate until a plant design is finalized and plant administrative processes and procedures are being developed. At that time, appropriate administrative controls on plant operations would be incorporated into the plants' management systems as part of the baseline.

Section 7.3 References

U.S. NRC Jan 2005. *Environmental Assessment by the U.S. Nuclear Regulatory Commission Relating to the Certification of the AP1000 Standard Plant Design*. Docket No. 52-006, SECY 05-0227 (accession number ML053630176). Washington D.C., January 24, 2005.

WEC (Westinghouse Electric Corporation) 2011. *Design Control Document*, Revision 19, Appendix 1B, "Severe Accident Mitigation Design Alternatives," June 2011.

Table 7.3-1
Monetization of the Turkey Point AP1000 Base Case (2012 Dollars)

	7% Discount Rate	3% Discount Rate
Offsite exposure cost	15,821	31,283
Offsite economic cost	18,859	37,289
Onsite exposure cost	253	582
Onsite cleanup cost	7,711	18,317
Replacement power cost	12,869	36,131
Total	**55,513**	**123,602**

7.4 TRANSPORTATION ACCIDENTS

Subsection 5.7.2.1 addresses the conditions in subparagraphs 10 CFR 51.52(a)(1) through (5) regarding use of Table S-4 to characterize the impacts of radioactive materials transportation in this environmental report. Because the AP1000 does not meet all of the conditions set forth in 10 CFR 51.52(a), a further analysis of the transportation effects was required. Subsection 5.7.2.2 describes the methodology used to analyze the impacts of transporting radioactive materials and addresses the incident-free transport of radioactive materials to and from Units 6 & 7. Subsection 7.4.1 describes the radiological impacts of transportation accidents. The nonradiological impacts of transportation accidents are addressed in Subsection 7.4.2.

7.4.1 RADIOLOGICAL IMPACTS OF TRANSPORTATION ACCIDENTS

7.4.1.1 Transporting Unirradiated Fuel

Accidents involving unirradiated fuel shipments are addressed in Table S-4 of 10 CFR 51.52. Unirradiated fuel would be transported to the site via truck. Accident risks are calculated as frequency multiplied by consequence. Accident frequencies for transporting fuel to future reactors are expected to be lower than those used in the analysis in WASH-1238 (AEC Dec 1972), which forms the basis for Table S-4 of 10 CFR 51.52, because of improvements in highway safety and security. Traffic accident, injury, and fatality rates have decreased over the past 30 years. Because fuel form, cladding, and packaging for the AP1000 are similar to those of current generation light water reactors (LWRs), the consequences of accidents that are severe enough to result in a release of radioactivity to the environment would also be similar. Accordingly, the risks of accidents during transporting unirradiated fuel to Units 6 & 7 would be expected to be smaller than the reference LWR consequences listed in Table S-4.

7.4.1.2 Transporting Spent Fuel

The RADTRAN 5 computer code was used to estimate impacts of transportation accidents involving spent fuel shipments. RADTRAN 5 considers a spectrum of potential transportation accidents, ranging from those with high frequencies and low consequences (i.e., fender benders) to those with low frequencies and high consequences (i.e., accidents in which the shipping container is exposed to severe mechanical and thermal conditions).

The radionuclide inventory of AP1000 spent fuel after 5 years of decay was estimated using the ORIGEN code (Version 2.1). A screening analysis was performed to select the dominant contributors to accident risks and to simplify the RADTRAN 5 calculations. This screening identified the radionuclides that would collectively contribute more than 99.999 percent of the dose from inhalation of radionuclides released following a transportation accident (NUREG-1811). The spent fuel inventory used in this analysis for the AP1000 is presented in Table 7.4-1. The specific quantities and characteristics of the crud deposited on AP1000 spent fuel from corrosion products generated elsewhere in the reactor coolant system are unknown at this time because of insufficient operating experience. The spent fuel transportation accident risks were calculated assuming the entire Co-60 inventory (Table 7.4-1) is in the form of crud. Assuming a minimum decay period of 5 years, the expected Co-60 activity is approximately 4.09 Ci/metric tons uranium (MTU). Sb-125 was also included in the crud analysis. However, the total activity of Sb-125 reported as crud was less than 0.003 percent of the total Sb-125 inventory in the fuel. These crud values were included as a separate group in the RADTRAN 5 calculations. The total activity of the crud components is roughly five orders of magnitude lower than the fission and activation products of the fuel. Therefore, from a radiological dose standpoint, the crud contribution is negligible.

Massive shipping casks are used to transport spent fuel because of the radiation shielding and accident resistance features required by 10 CFR Part 71, *Packaging and Transportation of Radioactive Material*. Spent fuel shipping casks must be certified Type B packaging systems, meaning they must withstand a series of severe hypothetical accident conditions with essentially no loss of containment or shielding capability.[1] As stated in NUREG/CR-6672 (Sprung et al. Mar 2000), the probability of encountering accident conditions that would lead to shipping cask failure is less than 0.01 percent (i.e., more than 99.99 percent of all accidents would result in no release of radioactive material from the shipping cask). The analysis presented in this ER assumed that shipping casks for AP1000 spent fuel would provide equivalent mechanical and thermal protection of the spent fuel cargo, in accordance with the requirements of 10 CFR Part 71.

For the spent fuel from the AP1000, the RADTRAN 5 accident risk calculations were performed using an assumption of 0.5 MTU per shipment for radionuclide inventories. The resulting risk estimates were multiplied by the expected annual spent fuel shipment amounts (in MTU per year) to derive estimates of the annual accident risks associated with spent fuel shipments from the AP1000. The amount of spent fuel shipped per year was assumed to be equivalent to the annual discharge quantity: 23 MTU per year for the AP1000. (This discharge quantity has not been normalized to the reference LWR. The normalized value is presented in Table 7.4-2.) The release fractions for current generation LWR fuels were used to approximate the impacts from the advanced LWR spent fuel shipments. This assumes that the fuel materials and containment systems (i.e., cladding and fuel coatings) behave similarly to current LWR fuel under applied mechanical and thermal conditions.

Using RADTRAN 5, the population dose from the released radioactive material was calculated for four possible exposure pathways:

- External dose from exposure to the passing cloud of radioactive material.

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1. Requirements for Type B packaging are set forth in 49 CFR 173.413 and 10 CFR 71.41 through 51.

- External dose from the radionuclides deposited on the ground by the passing plume (the radiation exposure from this pathway was included even though the area surrounding a potential accidental release would be evacuated and decontaminated, thus preventing long-term exposures from this pathway).
- Internal dose from inhalation of airborne radioactive contaminants.
- Internal dose from resuspension of radioactive materials that were deposited on the ground (the radiation exposures from this pathway were included even though evacuation and decontamination of the area surrounding a potential accidental release would prevent long-term exposures).

External doses from increased radiation fields surrounding a shipping cask with damaged shielding were also considered. It is possible that shielding materials incorporated into the cask structures could become damaged because of an accident; however, the loss of shielding events was not included in the analysis because their contribution to spent fuel transportation risk is much smaller than the dispersal accident risks from the pathways listed above.

Calculations were performed to assess the environmental consequences of transportation accidents when shipping spent fuel from Units 6 & 7 to a spent fuel repository assumed to be at Yucca Mountain, Nevada. The shipping distances and population distribution information for the route were the same as those used for the incident-free transportation impacts analysis described in Subsection 5.7.2.2. Table 7.4-2 presents accident risks associated with transporting spent fuel from Units 6 & 7 to the proposed Yucca Mountain repository. The accident risks are provided in the form of a collective population dose (i.e., person-rem per year over the shipping campaign). The table also presents estimates of accident risk per reactor year normalized to the reference reactor analyzed in WASH-1238. The transportation accident impacts were also calculated for the alternative sites (St. Lucie, Glades, Martin, and Okeechobee 2) in the region of interest.

The risk to the public from radiation exposure was estimated using the nominal probability coefficient for total detrimental health effects (730 fatal cancers, nonfatal cancers, and severe hereditary effects per 1E+06 person-rem) per reference reactor year from the International Commission on Radiological Protection Publication 60 (ICRP 1991). These values are presented in Table 7.4-2. These estimated risks are quite small compared to the fatal cancers, nonfatal cancers, and severe hereditary effects that would be expected to occur annually in the same population from exposure to natural sources of radiation. Therefore, negligible increases in environmental risk effects are expected from accidents that may result during shipping spent fuel from the site to a spent fuel disposal repository. The risks of accidents during transporting spent fuel from Units 6 & 7 or an alternate site would be consistent with the environmental impacts presented in Table S-4.

7.4.1.3 Transporting Radioactive Waste

As shown in Table 5.7-4, transporting radioactive waste meets the applicable conditions in 10 CFR 51.52(a) and no further analysis is required.

7.4.2 NONRADIOLOGICAL IMPACTS OF TRANSPORTATION ACCIDENTS

Nonradiological impacts would include the projected number of accidents, injuries, and fatalities that could result from shipments of radioactive materials to or from the Units 6 & 7 site and return of empty containers. Nonradiological impacts were estimated using accident, injury, and fatality rates from Table 4 of *State-Level Accident Rates for Surface Freight Transportation: A Reexamination* (Saricks and Tompkins Apr 1999). This data is representative of the traffic accident, injury, and fatality rates for heavy truck shipments similar to those that would be used to transport radioactive materials to and from the site. These rates (measured in impacts per vehicle-mile traveled) are multiplied by the annual numbers of shipments and estimated travel distances for the shipments to estimate annual impacts. These estimates include the human health impacts projected to result from traffic accidents involving shipments of radioactive materials; they do not consider the radiological or hazardous characteristics of the cargo.

7.4.2.1 Transporting Unirradiated Fuel

The nonradiological accident impacts that could result from shipments of unirradiated fuel to Units 6 & 7 and return of empty containers from the site are presented in Table 7.4-3. The nonradiological impacts for the reference LWR analyzed in WASH-1238 are also shown for comparison. Nationwide median rates for interstate highway transportation from Saricks and Tompkins (1999) were used to estimate the annual impacts. Consistent with the incident-free transportation analysis described in Subsection 5.7.2, an average round-trip shipping distance of 4000 miles was used to evaluate the unirradiated fuel shipments. The differences between the reference LWR and AP1000 results are because of the lower number of shipments per year (when normalized for electrical output) projected for the AP1000 units at Units 6 & 7. The values presented in Table 7.4-3 would be doubled for a two-unit plant.

7.4.2.2 Transporting Spent Fuel

The general approach to calculating the nonradiological impacts for spent fuel shipments is similar to that for other radioactive materials shipments. The primary difference is the spent fuel shipping route characteristics and are better defined allowing the state-specific accident statistics in Saricks and Tompkins (1999) to be used in the analysis. State-by-state shipping distances and road types were obtained from the TRAGIS output file (see Subsection 5.7.2.2.2 for a description of the TRAGIS routing model). The shipping distances were doubled to allow for return shipments of empty containers to Units 6 & 7. This information, the annual number of shipments, and state-specific accident statistics were used to estimate the nonradiological impacts presented in Table 7.4-4.

7.4.2.3 Transporting Radioactive Waste

Nonradiological impacts of radioactive waste shipments were calculated using the same general approach as the unirradiated fuel shipments. A shipping distance of 500 miles was assumed consistent with the analysis in WASH-1238. Because the destination of the waste shipments is not known, the national median accident, injury, and fatality rates from Saricks and Tompkins (1999) were used to calculate the values presented in Table 7.4-5. The nonradiological impacts for the reference LWR analyzed in WASH-1238 are also shown for comparison. The differences between the reference LWR and AP1000 are because of the lower number of radioactive waste shipments projected for the AP1000. The values presented in Table 7.4-5 would be doubled for a two-unit plant.

7.4.3 CONCLUSION

The transportation accident risk results for the AP1000 for unirradiated and spent fuel and radioactive waste are less than the nonradiological effects of accidents in transportation (one fatal injury in 100 reactor years and one nonfatal injury per ten reactor years) indicated in Table S-4. Based on this analysis, the overall transportation accident risks associated with unirradiated fuel, spent fuel, and radioactive waste shipments from the proposed AP1000 units at Units 6 & 7 are consistent with the risks associated with transporting the radioactive materials from current generation reactors presented in Table S-4 of 10 CFR 51.52 (reproduced in Table 5.7-2) and thus would be SMALL.

Section 7.4 References

AEC Dec 1972. U.S. Atomic Energy Commission, *Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants*, WASH-1238, December 1972.

ICRP 1991. International Commission on Radiological Protection, *1990 Recommendations of the International Commission on Radiological Protection*, ICRP Publication 60, 1991, Pergamon Press.

Saricks and Tompkins Apr 1999. Saricks, C. L. and M. M. Tompkins, *State-Level Accident Rates for Surface Freight Transportation: A Reexamination*, ANL/ESD/TM-150, April 1999, Argonne National Laboratory.

Sprung, J.L., Ammerman, Breivik, N.L., Dukart, R.J., Kanipe, F.L., Koski, J.A., Mills, G.S., Neuhauser, K.S., Radloff, H.D., Weiner, R.F., and Yoshimura, H.R. *Reexamination of Spent Fuel*

Shipment Risk Estimates, NUREG/CR-6672, Volume 1, Office of Nuclear Material Safety and Safeguards, U.S. NRC, Washington, D.C., March 2000.

Table 7.4-1
Radionuclide Inventory Used in Transportation Accident Risk Calculations for One AP1000

Radionuclide	AP1000 Inventory (curies per MTU)
Am-241	7.27E+02
Am-242m	1.31E+01
Am-243	3.34E+01
Ce-144	8.87E+03
Cm-242	2.83E+01
Cm-243	3.07E+01
Cm-244	7.75E+03
Cm-245	1.21E+00
Co-60	4.09E+00 (all as crud)
Cs-134	4.80E+04
Cs-137	9.31E+04
Eu-154	9.13E+03
Eu-155	4.62E+03
Pm-147	1.76E+04
Pu-238	6.07E+03
Pu-239	2.55E+02
Pu-240	5.43E+02
Pu-241	6.96E+04
Pu-242	1.82E+00
Ru-106	1.55E+04
Sb-125	1.12E-01 (as crud)
Sr-90	6.19E+04
Y-90	6.19E+04

Table 7.4-2
Spent Fuel Transportation Accident Risks for One AP1000

Site	Unit Population Dose (person-rem per MTU)[(a)]	MTU per Reference Reactor Year	Population Dose (person-rem per reference reactor year)[(a)]	Total Detrimental Health Effects per Reference Reactor Year
Turkey Point	1.72E-06	22	3.75E-05	2.74E-08
St. Lucie	1.48E-06	22	3.22E-05	2.35E-08
Glades	1.46E-06	22	3.17E-05	2.31E-08
Martin	1.47E-06	22	3.20E-05	2.34E-08
Okeechobee 2	1.47E-06	22	3.20E-05	2.34E-08

(a) Value presented is the product of probability multiplied by collective dose.

Table 7.4-3
Nonradiological Impacts of Transporting Unirradiated Fuel for One AP1000

Reactor	Total Shipments Normalized to Reference LWR	One-Way Shipping Distance (miles)	Total Round-Trip Shipping Distance (miles)	Annual Impacts		
				Fatalities per Year	Injuries per Year	Accidents per Year
Reference LWR	252	2000	1.01E+06	3.7E-04	7.8E-03	1.1E-02
AP1000	176	2000	7.88E+05	2.9E-04	6.1E-03	9.0E-03

Table 7.4-4
Nonradiological Impacts of Transporting Spent Fuel for One AP1000 from Turkey Point to Yucca Mountain

State	Highway Type	One-Way Shipping Distance (miles)	Fatalities per Year	Injuries per Year	Accidents per Year
Alabama	Primary	7	4.0E-05	3.0E-04	5.0E-04
	Interstate	73	8.9E-05	1.5E-03	2.9E-03
Arizona	Interstate	357	4.8E-04	5.9E-03	6.7E-03
California	Interstate	265	2.6E-04	4.7E-03	6.0E-03
Florida	Primary	37	5.6E-05	3.0E-04	4.0E-04
	Interstate	714	7.8E-04	5.6E-03	7.0E-03
Louisiana	Interstate	372	4.9E-04	9.7E-03	1.16E-02
Mississippi	Interstate	77	2.7E-05	4.0E-04	5.0E-04
Nevada	Primary	79	1.9E-04	2.8E-03	4.3E-03
	Interstate	61	5.7E-05	1.3E-03	1.9E-03
New Mexico	Interstate	371	6.2E-04	6.0E-03	5.9E-03
Oklahoma	Interstate	278	5.2E-04	1.14E-02	1.06E-02
Texas	Interstate	423	7.8E-04	3.28E-02	3.59E-02
Totals		3115	4.4E-03	8.27E-02	9.43E-02

Table 7.4-5
Nonradiological Impacts of Transporting Radioactive Waste for One AP1000

Reactor	Shipments per Year Normalized to Reference LWR	One-Way Shipping Distance (miles)	Annual Impacts		
			Fatalities per Year	Injuries per Year	Accidents per Year
Reference LWR	46	500	6.8E-04	1.4E-02	2.1E-02
AP1000	24	500	3.3E-04	7.0E-03	1.0E-02

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CHAPTER 8 NEED FOR POWER

The environmental report should include consideration of the benefits of the proposed action [10 CFR 51.45(c)]. To accurately characterize the benefits associated with the proposed action, the NRC must assess the need for power (NRC 2003). NRC guidance NUREG-1555 provides detailed instructions for NRC to use in reviewing the need for power. However, the guidance also identifies the NRC expectation that states may perform an evaluation of the need for power. NUREG-1555 indicates that if the state's evaluation is (1) systematic, (2) comprehensive, (3) subject to confirmation, and (4) responsive to forecasting uncertainty, no additional independent review by NRC is needed. This chapter describes the state of Florida process for determining need for power, the evaluation that it performed for Turkey Point Units 6 & 7, and how the evaluation meets the NRC criteria for not performing an additional review.

8.1 STATE OF FLORIDA PROCESS FOR DETERMINING NEED FOR POWER

Florida has a traditional system for regulating electric service in which utilities have a defined service territory and customers within a service territory purchase their electricity from the local utility. The state regulates rates and services of the utilities, electric grid reliability, and planning for and meeting electric needs. FPL is a regulated Florida electric utility and Figure 8.1-1 shows FPL's service territory. Descriptions of the FPL service territory, FPL's power system and resources, and the role of Florida Reliability Coordinating Council (FRCC) are provided in Subsections 8.1.3, 8.1.4, and 8.1.5, respectively.

The state has charged the Florida Public Service Commission (FPSC) with the responsibility of regulating electric utilities (FS 2007a, FS 2007b). In addition, the state has established the Florida Office of Public Counsel (FOPC) to advocate for utility customers before regulatory agencies such as the FPSC. Both state agencies have roles in the process of determining need for power. Finally, the FRCC, one of the North American Electric Reliability Corporation (NERC) regional councils, plays a role.[1]

The FPSC is the sole forum for determination of the need for power within Florida. By statute and by its own regulations, there are two key components to FPSC's evaluation of need for power:

- Ten-year site plans
- Determinations of need

The following sections describe each component and how each has addressed the need for power from Turkey Point Units 6 & 7.

1. There is no independent system operator or regional transmission organization within Florida.

8.1.1 TEN-YEAR SITE PLANS

Florida 10-year site plans are comparable to what other states call integrated resource plans. Florida requires the following:

(1) Each electric utility shall submit a 10-year site plan which shall estimate its power-generating needs and the general location of its proposed power plant sites [FS 186.801(1)]. The FPSC has made this an annual submittal requirement for utilities having generating capacity of 250 megawatts or greater and requires addressing fuel requirements [FAC 25-22.071(1)(a)].

(2) The FPSC must make a preliminary study of the plan and classify it as “suitable” or “unsuitable.” The FPSC study must review:

a. The need, including the need as determined by the Commission, for electrical power in the area to be served

b. The effect on fuel diversity with the State

c. Anticipated environmental impact of each proposed site

d. Possible alternatives to the proposed plan

e. Views of appropriate local, state, and federal agencies

f. The extent to which the plan is consistent with the state comprehensive plan

g. State information on energy availability and consumption [FS 186.801(2)]

(3) Utilities shall compile and submit to the FPSC aggregate data derived from individual plans. The FRCC prepares and submits these data for the utilities to the state of Florida and NERC.

As an example, in 2008 11 utilities submitted 10-year site plans. The FPSC held a public workshop to facilitate discussion of the plans. The FPSC made supplemental requests of reporting utilities and reviewed data from other sources, including the following documents prepared by the FRCC:

The 2008 *Regional Load and Resource Plan* contains aggregate data on demand and energy, capacity and reserves, and proposed new generating unit and transmission line additions for Peninsular Florida as well as statewide (FPSC 2008a).

The 2008 *Reliability Assessment* is an aggregate study of generating unit availability, forced outage rates, load forecast methodologies, and gas pipeline availability (FPSC 2008a).

The *Long Range Transmission Reliability Study* is an assessment of the adequacy of Peninsular Florida's bulk power and transmission system. The study includes both short-term (2009–2012) detailed analysis and long-term (2013–2017) evaluation of developing trends that would require transmission additions or other corrective action (FPSC 2008a).

The FPSC found the plans to be suitable and, in reporting on its annual review, addressed energy demand; energy generation; fuel price, supply, and transportation; transmission plans; and state, regional, and local comments. The FPSC uses the annual review report to meet its statutory requirement for reporting to the Florida legislature and for providing electricity forecasts to the Florida Energy and Climate Commission (FPSC 2008a).

FPL annually submits 10-year plans to the FPSC. The FPL plan includes an estimate of the utility's electric power generating needs, a projection of how those needs will be met, and disclosure of information pertaining to the utility's preferred and potential power plant sites.

Chapter I of the FPL 10-year plan provides an overview of FPL's current generating facilities and other resources including purchased power, demand side management (DSM), and FPL's transmission system. Chapter II presents FPL's load forecasting methodology and its forecast of seasonal peaks and annual energy usage. Chapter III discusses FPL's integrated resource planning process and outlines FPL's projected resource additions based on FPL's integrated resource planning work. Chapter IV discusses environmental information as well as preferred and potential site locations for additional electric generation facilities. Chapter V addresses 12 "discussion items" which pertain to additional information that is to be included in a site-plan filing. Table 8.1-2 presents excerpts from the table of contents of the 2010 plan.

Site plans are long-term planning documents and should be reviewed in this context. A site plan contains tentative information, especially for the latter years of the 10-year time horizon, and is subject to change at the discretion of the utility. Detailed evaluation of the need for power takes place during the second of the Florida three-component system, determination of need. Although not specifically presented in the FPL 2010 10-year plan because the reporting period ends in 2019, the plan notes that FPL had petitioned the FPSC for a determination of need for two new nuclear units at its existing Turkey Point power plant site. Subsection 8.1.2 addresses the FPL petition and the FPSC determination of need in detail.

8.1.2 DETERMINATION OF NEED

In 1973, the Florida Legislature enacted the Power Plant Siting Act (PPSA). The PPSA provides clear timelines and regulatory requirements for utilities seeking to build new power plants and directly associated facilities (such as transmission lines) in the State. Pursuant to the requirements of Chapter 25-22.080 (F.A.C. 1997) and contained within the Florida PPSA, an applicant for a new plant that exceeds 75 MW of steam generating capacity must file a petition for a Determination of Need with the FPSC. As provided in F.S. Section 403.519, the FPSC is the sole forum for determining the need for construction of an electrical power plant in the state. This section of the statute further provides that in making its determination, the FPSC should take into account the need for electric system reliability and integrity, the need for adequate electricity at a reasonable cost, the need for fuel diversity and supply reliability, whether the proposed plant is the most cost-effective alternative available, and whether renewable energy sources and technologies as well as conservation measures are used to the extent reasonably available (FS 2007b).

In October 2007, FPL submitted to the Florida Public Service Commission (FPSC) its Petition to Determine Need for Units 6 & 7 (FPL 2007a) and the supporting documents, including the Need Study for Electrical Power (FPL 2007b) and the testimony of 15 witnesses. Table 8.1-1 presents the table of contents of the FPL Petition to Determine Need.

In the Petition to Determine Need for Units 6 & 7, FPL, proposed to add two new units, Units 6 & 7, at its existing Turkey Point generating plant site. These proposed units would collectively add between 2200 and 3040 MW (approximately 2234 MW with selection of two AP1000 reactors) baseload generating capacity to FPL's service area.

Several interested parties intervened in the need determination proceeding, including the FOPC, the independent ratepayer advocate appointed by the Legislature; five utilities, Florida Municipal Electric Association (FMEA), Florida Municipal Power Agency (FMPA), JEA, Orlando Utilities Commission (OUC), and Seminole Electric Cooperative, Inc.; and a private citizen.

In addition to the pre-filed testimony, the public was provided the opportunity to provide testimony at two public hearings. Topics of interest voiced in the public testimony portion of the hearings included system reliability and integrity; fuel diversity; environmental compliance costs; conservation, DSM and renewables; and cost-effectiveness.

FPSC Staff reviewed the information provided by FPL, the intervening parties, and public testimony, and performed an independent analysis of the information presented in FPL’s petition, which concluded that the FPSC should determine that there was a need for FPL’s proposed new nuclear units at Turkey Point. After conducting several days of hearings and upon a full review of an extensive administrative record, the FPSC determined that there was a need for FPL’s proposed new nuclear units at Turkey Point and granted FPL’s petition by a final order in April 2008 (FPSC 2008b). In its final order, the FPSC found:

<u>Need for Electric System Reliability and Integrity</u>

> “FPL has a need for 8350 MW of additional capacity beginning in the 2011 through 2020 period. Turkey Point 6 and 7 will provide only a portion of FPL’s need for capacity. … If FPL’s load forecast dramatically declines or the amount of DSM or renewable generation available

substantially increases, the most likely result will be the cancellation of some gas-fired combined cycle plants that have not yet been certified. Based on this record, FPL has shown that it has a reliability need for either the 1100 MW or 1520 MW units (referring to the AP1000 or ESBWR designs respectively considered) in 2018 and 2020."

Need for Fuel Diversity

"…[T]he addition of nuclear generation will maintain FPL's fuel diversity and security. In 2006, FPL generated approximately 50% of its power from natural gas, approximately 21% from nuclear power, and 18% from coal. Without the addition of Turkey Point 6 and 7, FPL's fuel mix is projected to climb to approximately 75% from natural gas while the amount of nuclear generation would drop to approximately 16%. The addition of 2200 to 3040 MW of capacity (referring to the 2 - AP1000 or 2 - ESBWR designs respectively considered) associated with Turkey Point 6 and 7 would increase nuclear generation to approximately 26% and natural gas to 65% by the year 2021, the first full year of operation for both units."

Need for Baseload Generating Capacity

"…[B]y 2010 FPL will have approximately 15,235 MW of existing or certified base-load generation capacity which consists of coal (902 MW), gas-fired combined cycle (10,979 MW), and nuclear generation facilities (3354 MW). As mentioned previously, FPL's peak load is expected to increase by over 6000 MW by the year 2020. FPL's base-load needs are also projected to increase by approximately the same amount. Even with the addition of Turkey Point 6 and 7, FPL's base-load needs will continue to be met primarily with natural gas-fired combined cycle generators."

Need for Adequate Electricity at a Reasonable Cost

"…[W]e believe the cost estimate information presented in the record is appropriate. Accordingly, we find that construction of Turkey Point 6 and 7 will not only provide adequate electricity, but also ensure the most reasonable costs to ratepayers."

No Mitigating Renewable Energy Sources and Technologies or Conservation Measures

"…[W]e find that there are no additional cost-effective conservation measures available that might mitigate FPL's need for Turkey Point 6 and 7. FPL has identified an incremental increase of 1899 MW of DSM summer peak demand reduction by the year 2020, as well as over 280 MW of renewable energy from purchased power contracts. As previously discussed, FPL has demonstrated a reliability need in excess of these values for the years 2018 through 2020. A reduction in peak demand or an increase in renewable generation would likely result in the deferral of uncertified natural gas units. In addition, it is unrealistic to assume that FPL could achieve the amount of energy savings through DSM in ten years, that took 26 years to

> accomplish. As such, we find that there are no additional renewable energy sources or conservation measures which could effectively mitigate FPL's need for Turkey Point 6 and 7."

Most Cost-Effective Source of Power

> "Turkey Point 6 and 7 will provide the most cost-effective source of power…. The results of FPL's break-even analysis indicate that Turkey Point 6 and 7 are projected to produce savings in 17 of the 18 scenarios considered. Such results indicate a high likelihood of FPL's ratepayers realizing net benefits over the life of the project. Turkey Point 6 and 7 are projected to produce annual fuel savings of over $1 billion dollars starting in 2021 and about $94 billion over the life of the units when compared to a combined cycle alternative. As environmental compliance costs increase, so do the benefits associated with Turkey Point 6 and 7 because nuclear generation is considered a "non-emitting" technology for GHG (Greenhouse Gas) emissions. Nuclear power plants have an initial licensed operating life of 40 years with the potential to renew the operating license for another 20 years. Therefore, the fuel and environmental benefits of Turkey Point 6 and 7 could continue beyond the analysis presented in this proceeding."

Regarding the information provided by FPL and its forecasting methodologies, the FPSC stated in its order granting FPL's Petition to Determine Need for Turkey Point Units 6 & 7 Electrical Power Plant:

> "We reviewed FPL's forecast assumptions, regression models, and the projected system peaks demands, and find that they are appropriate for use in this docket. The forecast assumptions were drawn from independent sources which we have relied upon in prior cases. The regression models used to calculate the projected peak demands conform to accepted economic and statistical practices. Finally, the projected peak demands produced by the models appear to be a reasonable extension of historical trends" (FPSC 2008b).

The Florida Public Service Commission approval of the Petition for Need Determination can be found at their website (FPSC 2008b).

8.1.3 DESCRIPTION OF SERVICE AREA

As provided in its Ten Year Power Plant Site Plan, FPL's service area contains approximately 27,650 square miles and has a population of approximately 8.7 million people. FPL served an average of 4,499,067 customer accounts in 35 counties during 2009 (FPL Apr 2010). FPL's service area is shown in Figure 8.1-1. These customers were served from a variety of resources including: FPL-owned fossil and nuclear generating units, nonutility-owned generation, DSM, and interchange/purchased power (FPL Apr 2010). FPL's customer categories include:

- Residential

- Commercial
- Industrial
- Railroad and railways, and street and highway lighting
- Other public authorities
- Sales for resale (wholesale)

8.1.4 FPL-OWNED RESOURCES

The existing FPL generating resources are located at 16 generating sites distributed geographically around its service territory and also include partial ownership of one unit located in Georgia and two units in Jacksonville, Florida (Figure 8.1-1). The current FPL-owned generating facilities consist of 4 nuclear units, 3 coal units, 14 combined-cycle units, 17 fossil steam units, 48 combustion gas turbines, 1 simple-cycle combustion turbine, and 1 photovoltaic facility (FPL Apr 2010).

FPL's bulk transmission system comprises 6727 circuit miles of transmission lines. Integration of the generation, transmission, and distribution system is achieved through FPL's 585 substations in Florida (FPL Apr 2010).

The existing FPL power system, including generating plants, major transmission stations, and transmission lines, is shown in Figure 8.1-2. Figure 8.1-3 shows FPL's interconnection ties with other utilities.

8.1.5 FLORIDA RELIABILITY COORDINATING COUNCIL

FPL is a member of the Florida Reliability Coordinating Council (FRCC). The FRCC is one of the (NERC) regional councils and has approximately 25 members. These members include investor-owned utilities, such as FPL, cooperative systems, municipal utilities, power marketers, and independent power producers (FRCC 2007). There are no Independent System Operators or Regional Transmission Organizations operating in Florida (FERC 2009). The FRCC annually produces an annual Load and Resource Plan, which is a compilation of operating entities' 10-year site plans projecting the next 10 years, addressing, among other subject matter, regional firm peak demand, available capacity, and reserve margin. This information is provided to the FPSC each July, and a Commission workshop is held in August for a more intensive review by the Commission.

Table 8.1-1
Table of Contents, Florida Power and Light Company Ten Year Power Plant Site Plan

Table 8.1-2
Table of Contents, Florida Power and Light Company Petition to Determine Need for Turkey Point Nuclear Units 6 & 7

Figure 8.1-1 FPL Service Territory

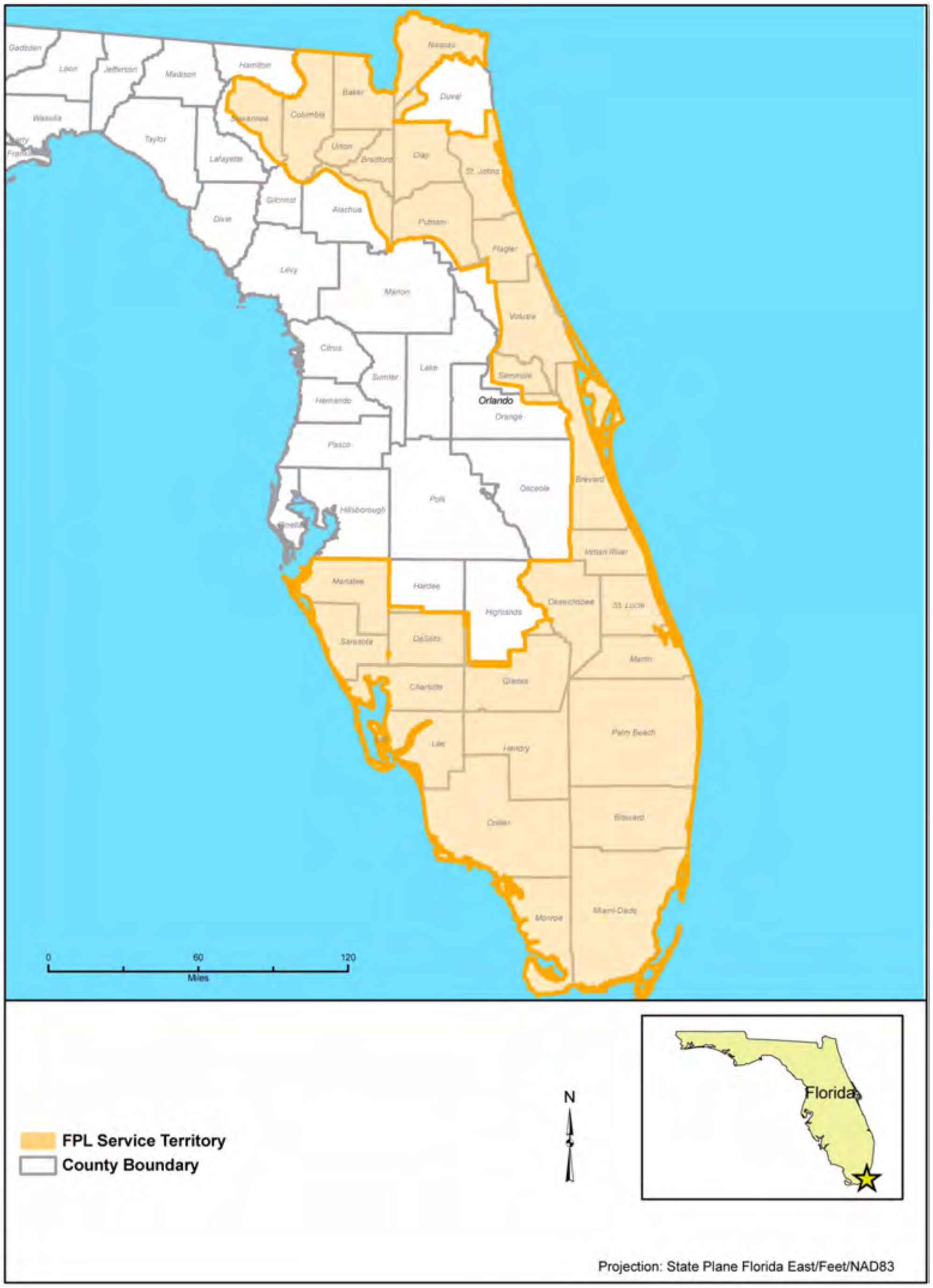


Figure 8.1-2 FPL Substation and Transmission System Configuration

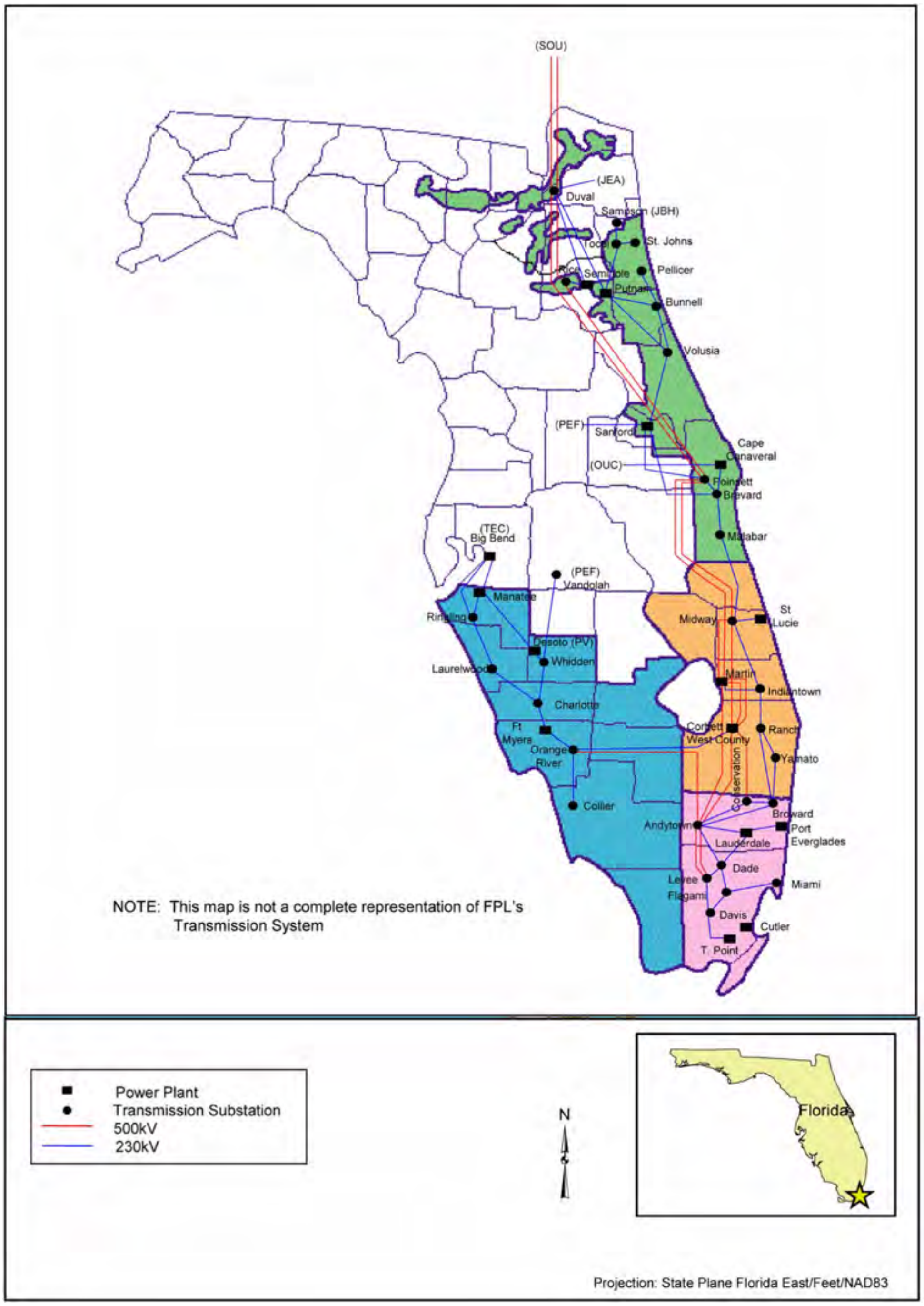
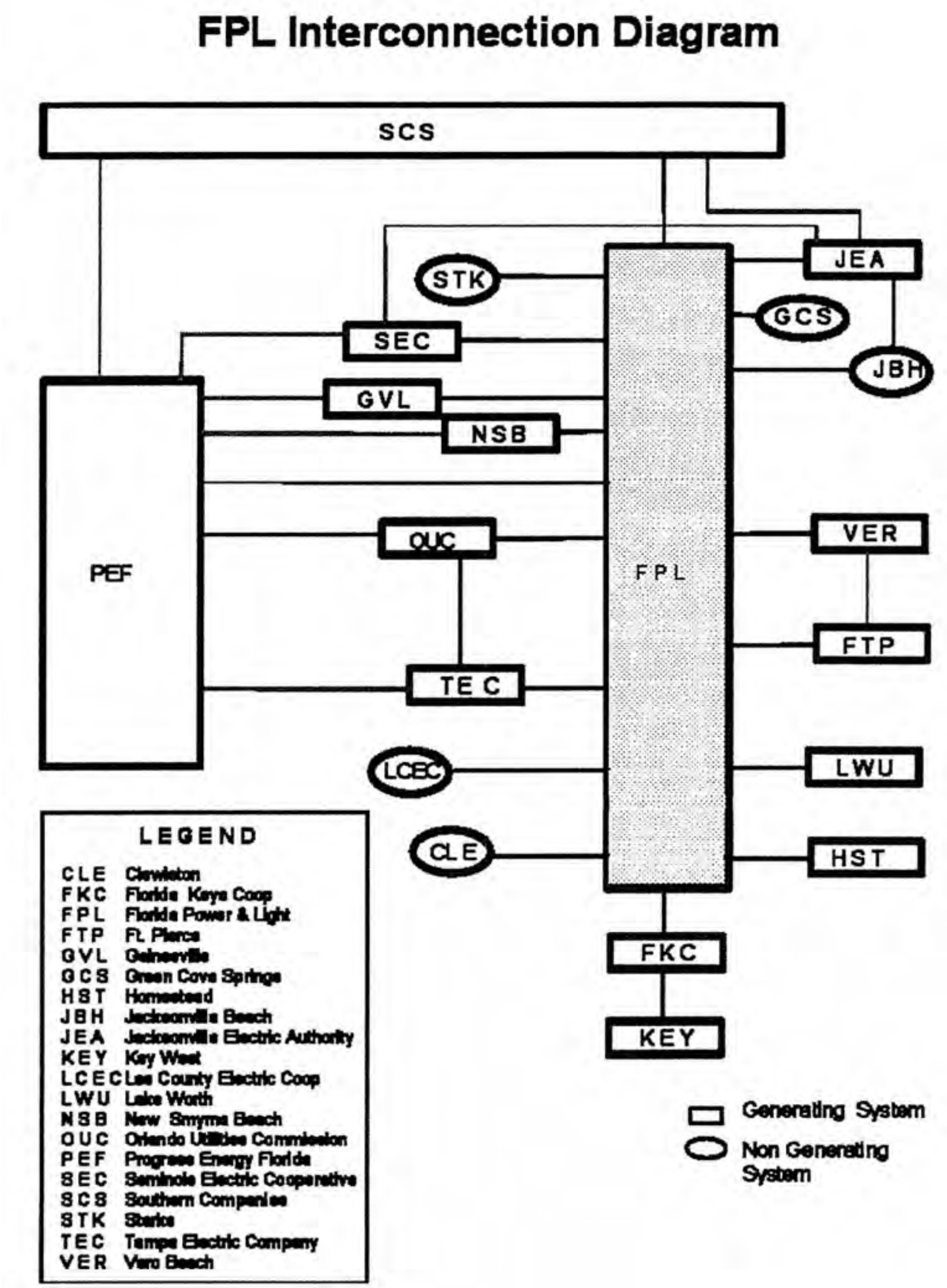


Figure 8.1-3 FPL Interconnection Diagram



8.2 POWER DEMAND

This section describes the NRC requirements and how the Florida Statutes along with the approved Petition to Determine Need for Units 6 & 7 Electrical Power Plant fulfills those requirements that are provided in NUREG-1555, Sections 8.2 through 8.4.

8.2.1 ENVIRONMENTAL STANDARD REVIEW PLANS (ESRPS)

The ESRP 8.2.1 (Power and Energy Requirements), ESRP 8.2.2 (Factors Affecting Growth of Demand), ESRP 8.3 (Power Supply) and ESRP 8.4 (Assessment of Need for Power) data and informational needs are fulfilled by the state processes required by Florida Statutes (F.S.) Chapter 186 with Rules 25-22.070, 25 22.071, and 25-22.072, Florida Administrative Code (F.A.C.) along with F.S. Section 403.519 and the Petition to Determine Need for Turkey Point Units 6 & 7 Electrical Power Plant, all of which are described below.

8.2.2 POWER AND ENERGY REQUIREMENTS

As described in FPL's Ten Year Power Plant Site Plan (FPL Apr 2010), there are four fundamental steps to FPL's resource planning process. These are summarized as follows:

Step 1: Determine the magnitude and timing of FPL's new resource needs

Step 2: Identify which resource options and resource plans can meet the determined magnitude and timing of FPL's resource needs (i.e., identify competing options and develop competing resource plans)

Step 3: Evaluate the competing options and resource plans regarding system economics and non-economic factors

Step 4: Select a resource plan and commit, as needed, to near-term options

The first step, often referred to as a reliability or resource adequacy assessment for the utility system, is essentially a determination of the amount of capacity or megawatts of load reduction, new capacity additions, or a combination of both load reduction and new capacity additions that are needed and when. This step starts with an updated load forecast. Several databases are also updated with the new information regarding forecasted loads, delivered fuel price projections, current financial and economic assumptions, and power plant capability and reliability assumptions, among other information. FPL also includes key assumptions regarding three specific resource areas: (1) near-term construction capacity additions, (2) firm capacity power purchases, and (3) DSM implementation.

These key assumptions, plus other updated information, are applied in determining the magnitude and the timing of FPL's resource needs. These determinations are accomplished by system reliability analyses that are typically based on a dual planning criteria of a minimum peak period reserve margin of 20 percent (FPL applies this to both summer and winter peaks) and a maximum loss-of-load probability of 0.1 day per year. Both of these criteria are commonly used throughout the regulated utility industry.

The result of this first fundamental step of the resource planning process is a projection of how many new megawatts of resources are needed to meet both reserve margin and loss-of-load probability criteria and, thus, maintain system reliability, and when the megawatts are needed. Information regarding the timing and magnitude of these resource needs is used in the second fundamental step: identifying resource options and resource plans that can meet the determined magnitude and timing of FPL's resource needs.

During Step 2, feasibility analyses of new capacity options are conducted to determine which new capacity options appear to be the most competitive on FPL's system. These analyses also establish capacity size (MW) values, projected construction/permitting schedules, and operating parameters and costs. In similar analyses, feasibility evaluations of new DSM options and/or continued growth in existing DSM options are typically conducted. Resource plans are created by combining individual resource options so that the timing and magnitude of FPL's new resource needs are met. The creation of these competing resource plans is typically carried out using spreadsheet, dynamic programming, and/or linear and non-linear programming techniques. At the conclusion of this second fundamental resource planning step, a number of different combinations of new resource options (i.e., resource plans) of a magnitude and timing necessary to meet FPL's resource needs are identified.

In Step 3, FPL performs, among other evaluations, economic analyses of the competing resource plans focusing on total system economics. These analyses are performed using the following:

- Various spreadsheets/models such as the P-M Area model, which is used by FPL to develop the fuel cost budget and to conduct other production cost-related analyses
- FPL's DSM cost-effectiveness spreadsheet model for analyzing the cost-effectiveness of individual DSM measures/programs, and then utilizes its linear programming model to develop DSM portfolios
- FPL's nonlinear programming model for analyzing the potential for lowering system peak loads through additional load management capacity

The standard basis for comparing the economics of competing resource plans is their relative impact on FPL's electricity rate levels, with the intent of minimizing FPL's leveled system average rate (i.e., a Rate Impact Measure or RIM methodology).

The results of the above three steps are used to develop the future generation plan, which would include incremental resource additions/changes.

Key inputs to these planning steps are discussed below.

Load Forecast

Long-term (20-year) forecasts of sales, net energy for load (NEL)[1], and peak loads are typically developed on an annual basis for resource planning work at FPL, and new forecasts were developed by FPL every year for use in the Ten Year Power Plant Site Plan for FPL's ongoing analyses. These forecasts are a key input to the models used in FPL's integrated resource planning process. The primary drivers to typically develop these forecasts are economic conditions and weather.

The projections for the national and Florida economies are obtained from IHS Global Insight. Global Insight is a privately held company that provides comprehensive economic data to entities such as FPL for application and in-depth analysis. Population projections are obtained from the Bureau of Economic and Business Research of the University of Florida. These inputs are quantified and qualified using statistical models in terms of their impact on the future demand for electricity.

Two sets of weather variables are developed and used in FPL's forecasting models:

- Cooling and Heating Degree-Hours are used to forecast energy sales
- Temperature data is used to forecast summer and winter peaks

The Cooling and Heating Degree-Hours are used to capture the changes in the electric usage of weather-sensitive electric appliances such as air conditioners and electric space heaters. A composite temperature hourly profile is derived using hourly temperatures across FPL's service territory. Miami, Fort Myers, Daytona Beach, and West Palm Beach are the locations from which temperatures are obtained. In developing the composite hourly profile, these regional temperatures are weighted by regional energy sales. This composite temperature is used to derive Cooling and Heating Degree-Hours which are based on starting point temperatures of 72°F and 66°F, respectively. Similarly, composite temperatures and hourly profiles of temperatures are used for the summer and winter peak models.

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1. NEL is determined as the sum of all energy sales plus utility use and losses.

Long-Term Sales Forecasts

Long-term forecasts of electricity sales were developed for each of the six revenue classes for the most recent forecasting period of 2011–2026. The first five classes represent retail sales and the sixth represents wholesale sales. These six revenue classes, based on customer categories listed in Subsection 8.1.3, are:

- Residential
- Commercial
- Industrial
- Railroad and railways, and street and highway lighting
- Other public authorities
- Sales for resale (wholesale)

These forecasts were adjusted to match the NEL forecast. The results of these sales forecasts for the years 2011–2026, along with historical data, are presented in Table 8.2-1.

Energy Sales Forecasts

<u>Rural and Residential Sales</u>

Residential electric usage per customer is estimated by using an econometric model. The model contains Cooling Degree-Hours, Heating Degree-Hours, lagged Cooling Degree-Hours, lagged Heating Degree-Hours, real price of electricity (a 12-month moving average), Florida real household disposable income, a variable designed to reflect the impact of empty homes, and a dummy variable for the specific month of November 2005. The price of electricity plays a role in explaining electric usage because electricity, like all other goods and services, will be used in greater or lesser quantities depending on its price. To capture economic conditions, the model includes Florida’s real personal disposable income. The degree of economic prosperity can, and does, affects residential electricity sales. The impact of weather is captured by the Heating and Cooling Degree-Hours. Residential energy sales are forecast by multiplying the residential use per customer forecast by the number of residential customers forecasted. A dummy variable for November 2005 was included because an analysis of residuals identified that data point as an outlier.

Commercial Sales

The commercial sales forecast is also developed using an econometric model. Commercial sales are a function of the following variables: Florida real household disposable income, commercial real price of electricity (a 12-month moving average), Cooling Degree-Hours, Heating Degree-Hours, lagged Cooling Degree-Hours, a variable designed to reflect the impact of empty homes, seasonal dummy variables for the months of February and December, a dummy variable for the specific month of January 2007, and an autoregressive term. Cooling degree-hours are used to capture weather-sensitive load in the commercial sector.

Industrial Sales

The industrial category is comprised of two groups; very small accounts (those with less than 20 kW of demand) and large, traditionally industrial customers. The forecast is developed using a separate econometric model for each group of industrial customer. The small industrial sales model utilizes the following variables: Florida Housing Starts, Cooling Degree-Hours, lagged Cooling Degree-Hours, industrial real price of electricity, and an autoregressive and seasonal autoregressive terms. The large industrial sales model utilizes the following variables: Florida Housing Starts, industrial real price of electricity, dummy variables for October and November 2004, and an autoregressive term.

Railroad and Railways Sales and Street and Highway Lighting Sales

The projections for railroad and railways sales are based on historical average use per customer because the number of customers is projected to remain the same. This class consists solely of Miami-Dade County's Metrorail system.

The forecast for street and highway lighting sales is developed using historical usage patterns and multiplying these usage levels by the number of forecasted customers.

Other Public Authority Sales

Other public authority sales are developed using historical usage characteristics.

Sales for Resale (Wholesale)

Resale (wholesale) customers are municipalities and/or electric co-operatives. These customers differ from jurisdictional customers in that they are not the ultimate users of the electricity they buy. Instead, they resell this electricity to their own customers.

Currently, there are four customers in this class: the Florida Keys Electric Cooperative (Florida Keys), City of Key West, Florida Metro- Miami-Dade County, and Lee County Electric

Cooperative. Starting in June 2014, Seminole Electric Cooperative will also be a customer in this category.

Net Energy for Load

An econometric model is developed to produce an NEL forecast. The key inputs to the model are the real price of electricity, heating and cooling degree-hours, and Florida real household disposable income. In addition, the model also includes variables for mandated energy efficiency and a variable designed to capture the impact of empty homes, along with seasonal dummies.

The NEL forecast is developed by multiplying the NEL per customer forecast by the total number of customers forecasted. Once the NEL forecast is obtained, total billed sales are computed using a historical ratio of sales to NEL. The sales by class forecast previously discussed are then adjusted to match the total billed sales. The forecasted NEL values 2011–2026, along with historical peak loads, are presented in Table 8.2-1.

8.2.3 FACTORS AFFECTING GROWTH OF DEMAND

As previously addressed, both FPL’s Ten Year Power Plant Site Plan (FPL 2008), and the Need Study for Electrical Power (FPL 2007b) were based on FPL’s integrated resource planning process. This process was used to determine the timing and magnitude of need for construction and operation of Turkey Point Units 6 & 7. The Need Study for Electrical Power was also part of FPL's filing with the FPSC for approval of Turkey Point Units 6 & 7 (which was approved by the FPSC). Consideration and application of basic factors affecting growth and demand for power, as detailed in the Site Plan and Need Study, are summarized in this section.

System Peak Forecasts

The rate of absolute growth in FPL system peak load has been a function of a growing customer base, varying weather conditions, continued economic growth, changing patterns of customer behavior (including an increased stock of electricity-consuming appliances), and more efficient heating and cooling appliances. FPL developed the peak forecast models to capture these behavioral relationships. The forecasting methodology of summer, winter, and monthly system peaks is presented below. The forecasted values for summer and winter peak loads for the years 2011–2026, along with historical summer and winter peak loads, are presented in Table 8.2-2.

System Summer Peak

The summer peak forecast is developed using an econometric regression model. This econometric model uses the following explanatory variables: total average customers, the real price of electricity, Florida real personal income, average temperature on peak day, and a heat buildup weather factor consisting of the sum of the cooling degree-hours during the peak day and 3 days before.

System Winter Peak

The winter peak forecast is developed using the same econometric regression methodology as is used for summer peak forecasts. The winter peak model is a per customer model that contains the following explanatory variables: the square of the minimum temperature on the peak day and heating degree-hours for the day before as well as for the morning of the winter peak day. The model also includes an economic variable—Florida real personal income.

FPL forecasts continued growth of customers in its service territory. At the time that FPL filed for FPSC approval of Units 6 & 7, they were projecting an annual average increase of approximately 85,000 new customers for the next 14 years. Annualized retail customer growth was projected to be 2.1 percent for 2008 and an average of 1.7 percent for the next 12 years. In addition to significant projected customer growth, significant increases in per customer electrical load and energy were also forecast. Energy use per customer was forecast to increase 1.7 percent in 2008, with a compound annual average growth rate of 1.2 percent thereafter. Combining the growth in customers and the growth in energy use per customer yields a growth in energy sales estimated at 3.8 percent in 2008, and then an average of 2.9 percent for the next 13 years.

FPL also projected that summer peak demand would grow from approximately 21,700 MW in 2011 to approximately 30,200 MW in 2026. Similarly, the winter peak was forecast to grow from approximately 21,400 MW in 2011 to approximately 26,300 MW in 2026.

As stated in Subsection 8.1.2, in the FPSC's order approving FPL's Petition to Determine Need, it found:

> "We reviewed FPL's forecast assumptions, regression models, and the projected system peaks demands, and find that they are appropriate for use in this docket. The forecast assumptions were drawn from independent sources which we have relied upon in prior cases. The regression models used to calculate the projected peak demands conform to accepted economic and statistical practices. Finally, the projected peak demands produced by the models appear to be a reasonable extension of historical trends" (FPSC 2008b)

In the May 3, 2010 filing for the Nuclear Power Plant Cost Recovery Clause, FPL informed the FPSC of a revised in-service date for Turkey Point Units 6 & 7. The revised in-service dates of 2022 for Unit 6 and 2023 for Unit 7 were derived from sequencing the preparation and construction phase activities. In addition, although FPL's demand growth rate has slowed from the time of the need filing, FPL currently projects that it will have a need for new resources beginning in 2016 and increasing every year thereafter.

Demand Side Management

As described in FPL's Ten Year Power Plant Site Plan (FPL Apr 2010), FPL has required and implemented cost-effective DSM programs since 1978. These programs include both conservation/energy efficiency and load management programs. FPL's DSM efforts through 2009 have resulted in a cumulative summer peak reduction of approximately 4257 MW at the generator and an estimated cumulative energy saving of approximately 51,055 gigawatt hour at the generator. Accounting for reserve margin requirements, FPL's DSM efforts through 2009 have eliminated the need to construct the equivalent of approximately 13 new 400 MW generating units. FPL offers a wide variety of DSM programs and a DSM-based renewable energy option to its customers. In addition, FPL is actively engaged in DSM research and development.

DSM Programs

The DSM programs include residential and business programs. At the time FPL filed for FPSC approval of the determination of need for Turkey Point Units 6 & 7, residential DSM programs included:

- Residential Building Envelope: Offers incentives to customers to install energy efficient roof and ceiling insulation measures.
- Duct System Testing and Repair: Provides reduced cost air-conditioning duct system testing to identify leaks, and encourages the repair of those leaks by qualified contractors.
- Residential Air-Conditioning: Offers incentives to customers to purchase higher efficiency heating, ventilating, and air-conditioning equipment.
- Residential Load Management (On Call Program): Offers load control of major appliances/ household equipment to residential customers in exchange for monthly electric bill credits.
- Residential New Construction (BuildSmart): Encourages the design and construction of energy-efficient homes by offering education to contractors on energy efficiency measures, and providing construction design reviews and home inspections.
- Residential Low-Income Weatherization: Combines energy audits and incentives to encourage low-income housing administrators to retrofit homes with energy efficiency measures.
- Residential Conservation Service: Offers a walkthrough energy audit, a computer generated Class A audit, and a customer-assisted energy audit.

Business DSM programs at that time included:

- Business HVAC: Offers business customers financial incentives to upgrade to higher efficiency HVAC equipment that exceed the minimum efficiencies mandated by the DOE.
- Business Efficient Lighting: Offers business customers financial incentives to install high-efficiency lighting measures at the time of replacement.
- Business Building Envelope: Offers financial incentives to business customers to install high-efficiency building envelope measures such as roof/ceiling insulation and reflective roof coatings.
- Business Custom Incentive: Serves as a “catch-all” program for cost-effective business efficiency measures that are not included in other FPL programs.
- Business On Call: Offers load control of central air-conditioning units to both small nondemand-billed and medium demand-billed business customers in exchange for monthly electric bill credits.
- Commercial Industrial Demand Reduction: Reduces peak demand by allowing the direct control of customer loads of 200 kW or greater during periods of extreme demand or capacity shortages.
- Business Energy Evaluation: Offers free standard level energy evaluations onsite and online, as well as more detailed shared costs evaluations.
- Commercial/Industrial Load Control: Reduces peak demand by controlling customer loads of 200 kW or greater during periods of extreme demand or capacity shortages in exchange for monthly electric bill credits. (This program was closed to new participants in 2000.)
- Business Water Heating: Encourages the installation of energy-efficient heat recovery units or heat pump water heaters.
- Business Refrigeration: Encourages the installation of controls and equipment to reduce the usage of electric strip heat for defrosting purposes.
- Cogeneration and Small Power Production: Facilitates FPL compliance with regulatory requirements concerning qualifying facilities and small power producers. One role of the program is to assist customers in the evaluation of potential cogeneration projects, including self-generation.

DSM goals were first set for FPL by an FPSC Order in 1994 (FPSC Oct 1994). The latest DSM goals were set for FPL by an FPSC Order in 2009 (FPL Apr 2010). In this latest order, the Commission established an FPL goal significantly higher (approximately 225 percent) than the amount of DSM that was projected in 2009 to meet 100 percent of FPL's remaining resource needs through 2019. The FPSC ordered FPL to have a cumulative summer MW DSM goal of 1498 by 2019. FPL expects to provide a description of its approved DSM programs in its 2011 Site Plan (FPL Apr 2010). FPL assumed a continuation of DSM signups at currently projected trends (see Table 8.2-2). In determining its future capacity, FPL forecasts that it will achieve its DSM plan through the above DSM programs.

Greater DSM would not eliminate the need for baseload power from Units 6 & 7. As stated in Subsection 8.1.2, in the FPSC's order approving FPL's Petition to Determine Need, it found:

> "…[W]e find that there are no additional cost-effective conservation measures available that might mitigate FPL's need for Turkey Point 6 and 7. FPL has identified an incremental increase of 1899 MW of DSM summer peak demand reduction by the year 2020, as well as over 280 MW of renewable energy from purchased power contracts. As previously discussed, FPL has demonstrated a reliability need in excess of these values for the years 2018 through 2020. A reduction in peak demand or an increase in renewable generation would likely result in the deferral of uncertified natural gas units. In addition, it is unrealistic to assume that FPL could achieve the amount of energy savings through DSM in ten years, that took 26 years to accomplish. As such, we find that there are no additional renewable energy sources or conservation measures which could effectively mitigate FPL's need for Turkey Point 6 and 7."

DSM Research and Development Programs

FPL's research and development programs include the Conservation Research and Development (CRD) Program and the Residential Thermostat Load Control Pilot Project. The CRD Program is an umbrella research project under which new DSM technologies are analyzed. Several FPL DSM programs have emerged from the CRD Program which has also resulted in the addition of cost-effective measures to existing programs. FPL operates the CRD Program based on DSM plan approval, or for 6 years, whichever occurs first, with a spending cap of $2,500,000 for the period.

In June 2007, FPL filed a petition with the FPSC for the Residential Thermostat Load Control Pilot Project. Under the project, FPL is proposing to evaluate whether the benefits of the existing On-Call Program can be expanded through use of a new generation of communication and control technologies that put residential customers in charge of decisions that could lower energy costs, while allowing customers to override FPL control of their heating and air-conditioning appliances. The FPSC approved FPL's request in August 2007.

Table 8.2-1
FPL History and Forecast of Energy Consumption, Capacity, and Peak Demand

Year	Energy Consumption (gigawatt-hours)									
	Residential	Commercial	Industrial	Railroads and Railways	Street and Highway Lighting	Other Public Authorities	Total Sales	Sales For Resale	Utility Use and Losses	Net Energy for Load
Historical										
2001	47,588	37,960	4,091	86	419	67	90,212	970	7,222	98,404
2002	50,865	40,029	4,057	89	420	63	95,523	1,233	7,443	104,199
2003	53,485	41,425	4,004	93	425	64	99,496	1,511	7,386	108,393
2004	52,502	42,064	3,964	93	413	58	99.095	1.531	7,467	108,093
2005	54,348	43,468	3,913	95	424	49	102,296	1,506	7,498	111,301
2006	54,570	44,487	4,036	94	422	49	103,659	1,569	7,909	113,137
2007	55,138	45,921	3,774	91	437	53	105,415	1,499	7,401	114,315
2008	53,229	45,561	3,587	81	423	37	102,919	933	7,092	111,004
2009	53,950	45,025	3,245	80	422	34	102,755	1,155	7,394	111,303
2010	56,343	44,544	3,130	81	431	28	104,557	2,049	7,768	114,373
Forecast										
2011	53,364	44,188	3,152	82	442	30	102,257	2,142	6,776	111,175
2012	54,932	44,496	3,082	91	452	30	103,083	2,142	7,292	112,517
2013	56,399	45,134	3,037	92	463	30	105,155	2,047	7,445	114,647
2014	58,257	46,214	3,018	92	475	30	108,085	4,935	8,014	121,035
2015	59,326	47,089	3,013	92	487	30	110,038	5,566	8,006	123,610
2016	60,382	47,869	3,015	92	500	30	111,888	5,599	8,106	125,593
2017	61,118	48,660	3,004	92	514	30	113,418	5,625	8,208	127,251
2018	61,828	49,456	2,992	92	529	30	114,928	5,672	8,310	128,910
2019	62,480	50,385	2,987	92	544	30	116,518	5,717	8,443	130,679
2020	63,575	51,512	2,981	92	560	30	118,749	5,770	8,601	133,121
2021	64,716	52,695	2,973	92	576	30	121,081	5,821	8,979	135,881
2022	66,123	54,033	2,952	92	592	30	123,823	5,872	9,177	138,872
2023	67,592	55,353	2,945	92	609	30	126,621	5,923	9,379	141,923
2024	69,121	56,665	2,975	92	627	30	129,510	5,973	9,587	145,070
2025	70,702	58,104	3,006	92	645	30	132,578	6,022	9,806	148,406
2026	72,010	59,344	3,019	92	663	30	135,157	6,077	9,994	151,229

Table 8.2-2 (Sheet 1 of 2)
Projection of FPL's Resource Needs Through 2026 (Assuming No EPU, Turkey Point 6 & 7, or Other Capacity Additions)[(a)]
Summer

August of the Year	Projections of FPL Unit Capacity (MW)	Projections of Firm Purchases (MW)	Projections of Scheduled Maintenance (MW)	Projection of Total Capacity (MW)	Peak Load Forecast (MW)	Summer Demand Side Management Forecast (MW)	Forecast of Firm Peak (MW)	Forecast of Summer Reserves (MW)	Forecast of Summer Reserve Margins w/o Additional (%)	MW Needed to Meet 20% Reserve Margin[(b)] (MW)
2011	22,445	2,056	350	24,151	21,679	1,981	19,698	4,452	22.6	(513)
2012	23,206	1,956	1,064	24,098	21,853	2,141	19,712	4,386	22.2	(443)
2013	23,655	1,956	1,176	24,435	22,155	2,317	19,838	4,597	23.2	(629)
2014	24,867	1,956	1,176	25,647	23,452	2,534	20,918	4,728	22.6	(545)
2015	24,867	2,046	350	26,563	24,172	2,710	21,462	5,100	23.8	(808)
2016	24,867	740	350	25,257	24,605	2,871	21,734	3,523	16.2	824
2017	24,867	740	350	25,257	25,025	3,016	22,009	3,248	14.8	1,154
2018	24,867	740	350	25,257	25,266	3,149	22,117	3,139	14.2	1,284
2019	24,867	740	350	25,257	25,690	3,271	22,419	2,837	12.7	1,647
2020	24,867	740	350	25,257	26,193	3,371	22,822	2,434	10.7	2,130
2021	24,867	740	350	25,257	26,830	3,471	23,359	1,897	8.1	2,775
2022	24,867	740	350	25,257	27,523	3,571	23,952	1,304	5.4	3,486
2023	24,867	740	350	25,257	28,208	3,671	24,537	719	2.9	4,188
2024	24,867	740	350	25,257	28,849	3,771	25,078	178	0.7	4,838
2025	24,867	490	350	25,007	29,525	3,871	25,654	(648)	-2.5	5,779
2026	24,867	160	350	24,677	30,213	3,904	26,309	(1,633)	-6.2	6,895

Table 8.2-2 (Sheet 2 of 2)
Projection of FPL's Resource Needs Through 2026 (Assuming No EPU, Turkey Point 6 & 7, or Other Capacity Additions)[(a)]
Winter

January of the Year	Projections of FPL Unit Capacity (MW)	Projections of Firm Purchases (MW)	Projections of Scheduled Maintenance (MW)	Projection of Total Capacity (MW)	Peak Load Forecast (MW)	Winter Demand Side Management Forecast (MW)	Forecast of Firm Peak (MW)	Forecast of Winter Reserves (MW)	Forecast of Winter Reserve Margins w/o Additional (%)	MW Needed to Meet 20% Reserve Margin[(b)] (MW)
2011	23,987	2,089	1,276	24,800	21,443	1,711	19,732	5,067	25.7	(1,121)
2012	24,383	2,089	2,942	23,530	21,491	1,802	19,689	3,840	19.5	97
2013	23,618	1,964	1,372	24,210	21,683	1,909	19,774	4,435	22.4	(481)
2014	24,973	1,964	1,382	25,555	22,584	2,065	20,519	5,036	24.5	(932)
2015	26,317	1,964	550	27,731	23,048	2,182	20,866	6,864	32.9	(2,691)
2016	26,317	1,123	550	26,890	23,302	2,288	21,014	5,876	28.0	(1,673)
2017	26,317	740	550	26,507	23,543	2,382	21,161	5,345	25.3	(1,113)
2018	26,317	740	550	26,507	23,794	2,464	21,330	5,176	24.3	(910)
2019	26,317	740	550	26,507	24,044	2,536	21,508	4,999	23.2	(697)
2020	26,317	740	550	26,507	24,305	2,596	21,709	4,797	22.1	(455)
2021	26,335	740	550	26,525	24,595	2,656	21,939	4,585	20.9	(197)
2022	26,335	740	550	26,525	24,898	2,716	22,182	4,342	19.6	94
2023	26,335	740	550	26,525	25,246	2,776	22,470	4,054	18.0	440
2024	26,335	740	550	26,525	25,606	2,836	22,770	3,754	16.5	800
2025	26,335	490	550	26,275	25,972	2,896	23,076	3,198	13.9	1,417
2026	26,335	160	550	25,945	26,316	2,916	23,400	2,544	10.9	2,136

(a) Assumes no new generation capacity additions after the following FPSC-approved projects: West County 3 (2011 in-service date), Cape Canaveral modernization (2013), and Riviera modernization (2014). These projections are consistent with information filed with the Florida Public Service Commission on April 1, 2011 in FPL's 2011 Ten-Year Site Plan, and on May 2, 2011 in FPL's 2011 NCRC filing.

(b) FPL has resource needs beginning in the Summer of 2016 and increasing every year thereafter. (FPL's resource needs are driven by its Summer reserve margin criterion of 20% which is projected to be violated years earlier than its Winter reserve margin criterion of 20% would be as shown above. Through the year 2026, FPL's projected resource need is approximately 6,900 MW driven by the Summer reserve margin criterion.

8.3 SATISFACTION OF NRC CRITERIA

The following analysis describes how the state and regional evaluations satisfy the NRC criteria for Units 6 & 7 that the evaluation of the need for power was: (1) systematic, (2) comprehensive, (3) subject to confirmation, and (4) responsive to forecasting uncertainty (NUREG-1555).

8.3.1 SYSTEMATIC

The state of Florida and the FRCC approaches to determining need for power include processes that are systematic. The state of Florida has established its processes by statute, creating the FPSC to oversee need-for-power planning by public utilities such as FPL and the Office of Public Counsel to serve as a public interest advocate before the FPSC. The need-for-power planning must be reflected in annually updated Ten Year Power Plant Site Plans and, for Units 6 & 7 specifically, is subjected to a further detailed analysis at the Petition for a Determination of Need stage before the FPSC. These processes, created through statutes and implemented by regulations, provide for a transparent, systematic means by which interested parties may participate in a legal process that assures the state of Florida adequately addresses the expected electricity demands within the state.

The FRCC process is a national one, set up by the NERC to comply with the Energy Information Administration (EIA) data-gathering requirements. The FRCC gathers the data on an annual basis, compiles it, and submits it to the NERC as a region-specific composite. The NERC submits the data to the EIA as a national composite together with region-specific information. The statutory, regulatory, and administrative requirements that make up the Florida and FRCC processes comprise methodical state and regional processes for systematically reviewing the need for power that FPL is responsible for satisfying.

8.3.2 COMPREHENSIVE

Florida imposes requirements on FPL for annual comprehensive integrated resource planning and Petition for a Determination of Need that includes:

- Demand and energy forecast for at least a 10-year period
- Supplier's or producer's program for meeting the requirements shown in its forecast in an economic and reliable manner, including demand-side and supply-side options
- Brief description and summary of cost-benefit analysis, if available, of each option that was considered, including those not selected

- Supplier's or producer's assumptions and conclusions with respect to the effect of the plan on the cost and reliability of energy services, and a description of the external environmental and economic consequences of the plan to the extent practicable

FPL follows industry practices in performing its integrated resource planning, breaking its analyses down by types of customers, identifying economic inputs to modeling, performing more detailed analyses for short-term forecasts, and accounting for supply and demand uncertainties. This is further described in Subsection 8.2.3.

FRCC regional planning includes:

- Historical and projected peak demand and energy
- Existing capacity
- Historical and projected demand and capacity
- Historical and projected capacity purchases, sales, and transfers
- Bulk electric transmission system description
- Projected changes to bulk electric transmission system

The Florida and FRCC need-for-power planning processes comprise comprehensive state and regional processes that encompass all of the components that the NRC would cover if the NRC had to perform a detailed review, covering the subject completely. These processes take into account a vast amount of data from varied sources and are subject to judicial review and challenge.

8.3.3 SUBJECT TO CONFIRMATION

FPL need-for-power planning is subject to FPSC, FOPC, and public and other stakeholder review, particularly regarding its petition for need for Units 6 & 7. These processes each result in publicly reviewable data and forecasts in the Ten Year Power Plant Site Plans and Petition for a Determination of Need. The Florida need-for-power planning processes are also confirmable by comparing FPL forecasts to FRCC composite forecasts.

The Florida and FRCC need-for-power analyses are subject to corroboration at the level of the generator or supplier (e.g., FPL) and, by way of comparison, to overall regional data.

8.3.4 RESPONSIVE TO FORECASTING UNCERTAINTY

As described previously, FPL's integrated resource planning incorporates a number of steps to select a resource plan to address forecasted capacity needs. FPL incorporates key assumptions in the reliability assessment of its system and, in developing long-term load forecasts, uses statistical modeling to quantify and qualify data inputs, such as economic projections and population trends in terms of their impact on the future demand for electricity. FPL uses econometric modeling that enables it to perform analyses of the sensitivity of results to changes in model inputs and to create high- and low-range forecasts. This econometric modeling is described in Subsection 8.2.3. Uncertainty analysis is also used in establishing planning reserve margins, themselves an acknowledgement of uncertainty.

The results of FPL's most recent planning effort are represented in FPL's Ten Year Power Plant Site Plan (FPL Apr 2010) and Need Study for Electrical Power (FPL 2007a) that have been approved by the FPSC. Importantly, the Florida Statutes require that FPL submit a Ten Year Power Plant Site Plan annually. This requires FPL to annually review its forecasted power needs and data inputs to its resource planning. Consequently, under this robust requirement, forecasting uncertainty is addressed on an annual basis by FPL, with adjustment forecasts made annually, as required, based on the most recent and up-to-date historical data.

It should be noted that despite the downturn in the economy, and negative growth in Florida's population during 2009, FPL experienced a near record Summer peak of 22,351 MW, and an all-time peak of 24,339 MW during the 2009-2010 Winter peak period. These peaks were driven by extreme weather. (FPL Apr 2010)

8.3.5 CONCLUSION

NRC guidance identified the expectation that if the states perform an evaluation of need for power and the evaluation is (1) systematic, (2) comprehensive, (3) subject to confirmation, and (4) responsive to forecasting uncertainty, no additional NRC review is needed. This chapter demonstrates that the state of Florida process meets these criteria. Therefore, no additional review by the NRC is needed.

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CHAPTER 9: ALTERNATIVES TO THE PROPOSED ACTION
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9.0 ALTERNATIVES TO THE PROPOSED ACTION

The proposed action is for the NRC to issue a COL to authorize construction and operation of two approximately 1200 gross MWe nuclear power units to address future baseload generation needs.

Chapter 9 describes the alternatives to construction and operation of new nuclear units at the Turkey Point plant property, as well as alternative plant and transmission systems. The descriptions provide sufficient detail to assess the impacts of the alternative generation options or plant and transmission systems relative to those of the proposed action. The chapter includes four subsections:

- No-Action Alternative (Section 9.1)
- Energy Alternatives (Section 9.2)
- Site Selection Process (Section 9.3)
- Alternative Plant and Transmission Systems (Section 9.4)

The Florida Reliability Coordinating Council is a not-for-profit company incorporated in the state of Florida whose purpose is to ensure and enhance the reliability and adequacy of bulk electricity supply in Florida.

As described in Chapter 8, FPL’s service territory is located within the Florida Reliability Coordinating Council region.

9.1 NO-ACTION ALTERNATIVE

The no-action alternative is the decision not to proceed with construction and operation of Units 6 & 7 due to such factors as: the denial of the necessary federal, state, regional, and/or local permits; financing; or some other factor unrelated to the need for power. Under the no-action alternative, Units 6 & 7 would not be constructed or operated at Turkey Point, the environmental impacts and benefits from construction and operation of Units 6 & 7 would not occur, and the benefits, including electricity and economic benefits, associated with construction and operation of Units 6 & 7 would be lost.

The no-action alternative also presupposes that no additional conservation measures (e.g., demand side management, renewable energies such as solar energy, etc.) would be enacted to decrease the amount of electrical capacity that would otherwise be required in the FRCC Region.

As described in Chapter 8, there is a demonstrated need for additional baseload generation capacity in the FRCC Region to meet future energy demands. As such, the Florida Public Service Commission (FPSC) granted FPL's Petition to Determine Need for Units 6 & 7 by a final order in April 2008 (FPSC Apr 2008). The FPSC considered the following factors prior to issuance of the order: (1) the need for electric system reliability and integrity; (2) the need for adequate electricity at a reasonable cost; (3) the need for fuel diversity and supply reliability; (4) whether the proposed plant is the most cost effective alternative available; and (5) whether renewable energy sources and technologies as well as conservation measures are used to the extent reasonably available.

The addition of nuclear generation capacity would address these needs and would also support national and international goals to reduce the generation of greenhouse gases as outlined in the Energy Policy Act of 2005 (Public Law 109-58) and the state of Florida’s Executive Orders regarding climate change (Executive Order Nos. 7-126, -127, and -128).

Other benefits associated with the operation of Units 6 & 7 would include the direct employment of 403 people. The creation of 403 permanent Units 6 & 7 operations jobs would inject $9,489,828 to $94,898,279 per year into the regional economy. Additionally, for every new operations job, an estimated additional 2.1696 indirect jobs would be created, which means that the 403 direct jobs would result in an additional 874 jobs in the region, for a total of 1277 new jobs.

The environmental impacts of Units 6 & 7 would not occur if the new units were not constructed and operated. However, there would be substantial financial and environmental benefits to the local community, state of Florida, and the nation from the construction and operation of Units 6 & 7. Thus, the no-action alternative is not preferable to the construction and operation of Units 6 & 7, which would provide a net output of approximately 2200 MW of baseload generation.

Section 9.1 References

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9.2 ENERGY ALTERNATIVES

This section provides an analysis of several energy alternatives relating to the proposed project to determine whether any of these options are competitive. A competitive alternative is defined as one that is feasible, is capable of supplying baseload power, and compares favorably with the proposed project in terms of environmental and health impacts.

Subsection 9.2.1 provides an assessment of alternatives that do not require new generation capacity. This assessment includes the economic and technical feasibility of (1) supplying electrical energy from the proposed units without constructing new generating capacity, or (2) initiating energy conservation measures that would avoid the need for the units.

Subsection 9.2.2 provides an analysis of alternative energy sources that provide new generation capacity which could reasonably be expected to meet the demand from both a load and economic standpoint for additional generating capacity determined for the proposed project. Some of the alternatives that require new generation capacity in Subsection 9.2.2 were eliminated from further consideration and discussion based on their availability in the region, overall feasibility, or ability to supply baseload power.

In Subsection 9.2.3, the alternatives that were not previously eliminated, those determined to be potentially competitive, are investigated in further detail relative to specific criteria regarding environmental and health impacts. If any alternative is deemed to be environmentally preferable to the proposed project, an economic cost comparison is provided.

9.2.1 ALTERNATIVES THAT DO NOT REQUIRE NEW GENERATION CAPACITY

In accordance with NUREG-1555, this subsection is intended to provide an assessment of the economic and technical feasibility to meet the demand for energy without constructing new generation capacity. Potential options are to:

- Purchase power from other utilities or power generators
- Reactivate or extend the service life of existing plants within the power system, or extend the capacity through power uprates or other efficiency improvements
- Implement demand side management actions (including conservation measures)
- Use an existing peaking facility to provide baseload power

Further, as presented in Chapter 8, the structure of the current generating supply system in the relevant region of the proposed project is as follows:

- The Florida Public Service Commission has the power and jurisdiction to supervise and regulate rates and services of Florida's public utilities, including establishing service territories (FS 2007a and FS 2007b).
- FPL is an investor-owned electric utility that generates, transmits, and distributes electric power. FPL is subject to Florida Public Service Commission regulation as a traditional utility (FS 2007b).
- FPL has a state-designated service territory. Customers have no choice of alternative electric service providers, and the state would have approval authority for the need for the electric power to be generated. FPL provides electric service to more than 4.5 million customer accounts in 35 of Florida's counties along the eastern seaboard and the southern and southwestern portions of Florida (FPL Apr 2010).

Florida statutes require that each electric utility in the state of Florida with a minimum existing generating capacity of 250 MW annually submit a ten-year power plant site plan to the Florida Public Service Commission (FS 2007c). Part of the development of this plan includes an integrated resource planning process to determine the need for power.

As part of FPL's efforts to meet its projected resource needs, FPL considered and documented in its 2010 Ten-Year Plan:

- Purchase of power from other utilities
- Existing resources—upgrading and possibly repowering existing units
- Demand side management programs
- New generation sources—these sources are expected to meet objectives outlined in FPL's 2010 Ten-Year Plan, that include, in part:
    - Providing a diverse fuel mix
    - Lowering greenhouse gas emissions to comply with the 2017 carbon dioxide emission targets outlined in the Governor's 2007 Executive Order 07-127
    - Increasing renewable energy contribution

9.2.1.1 Purchase Power from Other Utilities or Power Generators

In formulating plans to meet the determined capacity needs, FPL accounted for purchases from other utilities or power generators. Firm capacity power purchases are an important part of FPL's resource mix. FPL currently has contracts with five qualifying facilities to purchase firm capacity and energy. FPL has a unit power sales contract to purchase 931 MW, with a minimum of 380 MW, of coal-fired generation from the Southern Company (Southern) through May 2010. An additional contract with Southern will result in FPL receiving 930 MW from June 2010 through the end of December 2015. This capacity will be supplied by Southern from a mix of gas-fired and coal-fired units. In addition, FPL has contracts with the Jacksonville Electric Authority for the purchase of 381 MW (summer) and 375 MW (winter) of coal-fired generation from the St. John's River Power Park. However, due to Internal Revenue Service (IRS) regulations, the total amount of energy that FPL may receive from this purchase is limited. FPL currently assumes, for planning purposes, that this limit will be reached in the first half of 2016.

FPL has other firm capacity purchase contracts with a variety of non-qualifying facility suppliers. FPL currently purchases non-firm (as available) energy from several cogeneration and small power production facilities. (FPL Apr 2010)

These capacity purchase amounts are incorporated in FPL's integrated resource planning work. While purchase power will remain a source of power for FPL, it is not adequate to provide the projected baseload capacity required to maintain its summer reserve margin criterion of 20 percent throughout the ten year period. Therefore, purchasing power from other generators is not considered a competitive option to the proposed baseload generation capacity of this project.

9.2.1.2 Reactivate or Extend Service Life of Existing Plants, or Extend the Capacity

The existing FPL generating resources consist of 88 generating units located at 16 generating sites distributed geographically around its service territory and also include partial ownership of one unit located in Georgia and two units located in Jacksonville, Florida. The current generating facilities consist of four nuclear units, three coal units, 14 combined cycle units, 17 fossil steam units, 48 combustion gas turbines, one simple cycle combustion turbine, and one photovoltaic facility (FPL Apr 2010).

Reactivating or extending the service life of existing plants or extending the capacity through power uprates or other efficiency improvements could theoretically reduce the need for a new nuclear power station. FPL has plans to provide power uprates at FPL's four existing nuclear units (Turkey Point Units 3 & 4 and St. Lucie Units 1 & 2). (FPL Apr 2010) The proposed capacity uprates will add approximately 450 MW of capacity to FPL's system in the 2011–2012 time frame. (FPSC May 2010) FPL has committed to extending the capacity of all four of its current nuclear units prior to the in-service dates of 2022 for Turkey Point Unit 6 and 2023 for Turkey Point Unit 7.

Thus, there exists no further opportunity for FPL to extend the capacity of its existing nuclear fleet.

Another potential strategy is repowering one or more of FPL' s existing generating plants. FPL's repowering plan consists, in part, of replacing an existing steam plant with a heat rate of approximately 10,000 Btu/kWh, with a new state-of-the-art advanced combined cycle unit that uses natural gas as the primary fuel, with a heat rate of less than 6600 Btu/kWh. FPL plans to repower two existing generating plants, Cape Canaveral and Riviera Beach, each consists of two older fossil fired steam generating units which will be converted into new highly efficient combined cycle units. The existing two-unit plant at FPL's Cape Canaveral site will be replaced by a new combined cycle unit with a projected output of approximately 1210 MW in 2013. This new unit will be called the Cape Canaveral Next Generation Clean Energy Center. The existing two-unit plant at FPL's Riviera site will also be replaced by a new combined cycle unit with a projected output of approximately 1210 MW in 2014. This new unit will be called the Riviera Beach Next Generation Clean Energy Center. These conversions were approved by the FPSC in September 2008 and were incorporated in FPL's recent integrated resource plan. (FPL Apr 2010) Any repowering of FPL's existing fossil fired generating plants would likely be fossil fueled; i.e., natural gas. As determined in Subsection 9.2.2, the environmental impact and feasibility of fossil fuel generation is not environmentally preferable to Turkey Point Units 6 & 7. In addition, additional natural gas-fired capacity will further increase FPL's dependence on natural gas. Conversely, Turkey Point Units 6 & 7 will significantly lower FPL's dependence on natural gas.

An evaluation of placing/removing existing facilities from inactive reserve was also included in FPL's 2010 Ten-Year Plan. When FPL developed its integrated resource plan as part of their 2010 Ten-Year Plan, relatively recent developments influenced FPL's resource planning efforts. One of these is the Executive Orders directive issued in 2007 calling for reduction in greenhouse gas emissions and greater contribution from renewable energy sources. The lower resource need projection allowed FPL to include in its resource plan the temporary removal of a number of its existing, older, less efficient generating units from active service starting in 2010. Inactive Reserve units continue to be maintained so that they can be returned to service as needed. The following older, less efficient units will be placed on Inactive Reserve status in 2010: Cutler Units 5 & 6, Port Everglades Units 1 & 2, Sanford Unit 3, and Turkey Point Unit 2. In 2011, Port Everglades Units 3 & 4 are also projected to be placed on Inactive Reserve. FPL's 2010 Ten-Year Plan resource planning indicates that those plants on Inactive Reserve status will begin to be returned to operation starting in 2018. While FPL's 2010 Ten-Year Plan allows for the “temporary retirement” of some of its older, less efficient generating units, these units will begin to be brought back into service in order for FPL to meet its 20 percent summer reserve margin criteria. (FPL Apr 2010) Thus, the return to active service of these existing facilities has been included in FPL's resource plan and along with other measures will still not be adequate to meet its 20 percent reserve margin criteria.

Therefore, reactivating or extending the service life of existing plants or extending the capacity is not considered a potentially competitive option to the proposed baseload non-fossil-fueled generation capacity of the proposed project.

9.2.1.3 Demand Side Management

Demand side management is the practice of reducing customers' demand for energy through programs such as energy conservation, efficiency, and load management so that the need for additional generation capacity is eliminated or reduced. Demand side management can minimize environmental effects by avoiding the construction and operation of new generating facilities.

As described in FPL's 2010 Ten-Year Plan, FPL has sought out and implemented cost-effective demand side management programs since 1978 (FPL Apr 2010). These programs include both conservation/energy-efficiency and load management.

FPL's demand side management efforts through 2009 have resulted in a cumulative summer peak reduction of approximately 4257 MW at the generator and an estimated cumulative energy saving of approximately 51,055 gigawatt hours at the generator. Accounting for reserve margin requirements, FPL's demand side management efforts through 2009 have eliminated the need to construct the approximate equivalent of 13 new 400 MW generating units (FPL Apr 2010).

Representative examples of residential demand side management programs that FPL had implemented to achieve such reductions include:

- Residential building envelope: offers incentives to residential customers to install energy efficient reflective roof and ceiling insulation measures.
- Residential air conditioning: offers incentives to customers to purchase higher efficiency heating, ventilating, and air conditioning equipment.
- Residential load management (On-Call Program): offers load control of major appliances/ household equipment to residential customers in exchange for monthly electric bill credits.
- Residential new construction (BuildSmart): encourages the design and construction of energy efficient homes by offering education to contractors.
- Residential low income weatherization: combines energy audits and incentives to encourage low income housing administrators to retrofit homes with energy efficiency measures.
- Residential conservation service: offers a walk-through energy audit, a computer generated Class A audit, and a customer-assisted energy audit.

Representative examples of business demand side management programs that FPL had implemented include:

- Business heating, ventilation, and air conditioning: offers business customers financial incentives to upgrade to higher efficiency equipment.
- Business efficient lighting: offers business customers financial incentives to install high efficiency lighting measures at the time of replacement.
- Business building envelope: offers incentives to business customers to install high efficiency building envelope measures such as roof/ceiling insulation, reflective roof coatings, and window treatments.
- Business On Call: offers load control of central air conditioning units to both small and non-demand-billed, and medium demand-billed, business customers in exchange for monthly electric bill credits.
- Business energy evaluation: offers free standard level energy evaluations on-site and on-line.
- Business water heating: provides financial incentives to encourage the installation of energy-efficient heat recovery units or heat pump water heaters. (FPL Apr 2009)

FPL has consistently been among the leading utilities nationally in demand side management achievement. For example, according to the U.S. Department of Energy's 2007 data (the last year for which the Department of Energy's data was available), FPL ranked number 1 nationally in energy efficiency demand reduction and number 2 nationally in load management demand reduction. Notwithstanding this effective program, in late 2009, the Florida Public Service Commission imposed new goals for demand side management for the period 2010 through 2019. The Florida Public Service Commission-imposed demand side management goals for FPL were significantly higher (approximately 225 percent) than the amount of demand side management that was projected in 2009. In addition, the Florida Public Service Commission ordered FPL to spend $15.5 million per year to promote demand side management-based applications of solar water heating and photovoltaics. Thus, a rigorous demand side management effort will be in place many years prior to the in-service dates of 2022 for Unit 6 and 2023 for Unit 7. It is not expected that a further increase in demand side management goals would be practicable or cost-effective. Therefore, implementing further demand side management programs is not considered a potentially competitive option to the baseload generation capacity of the proposed project.

9.2.1.4 Use an Existing Peaking Facility to Provide Baseload Power

Baseload facilities are normally used to satisfy all or part of the baseload of the system and, as a consequence, operate at full power continuously throughout the year. Peaking facilities usually run for short periods when demand on the grid exceeds baseload generation capacity in the region. Continuously running a peaking facility to provide baseload power would not reduce the need for a new nuclear power station. Peaking facilities are small facilities, generally fueled by oil or natural gas, that quickly can be turned on and off according to swings in demand. Because they have a relatively low installed capital cost, simple cycle combustion turbines and diesel generators are the most prevalent peaking technologies. Peaking technologies are generally less fuel efficient and release more air pollutants than baseload technologies using similar fuels. Consequently, peaking technologies are more expensive to operate, and their impact on the environment per unit of generation is greater than the impact from baseload technologies using similar fuels. Therefore, using existing peaking facilities to provide baseload power is not considered a potentially competitive alternative for the proposed project.

9.2.1.5 Conclusion

Based on the analysis, there are no potentially competitive alternatives that do not require new generation. That is, in each of the above analyses, there are no alternatives or combinations of alternatives which include purchased power, the reactivation, and extended service life of plants within the regional system that have the potential to supply the required baseload capacity that are feasible, and have the potential to compare favorably with the proposed project.

9.2.2 ALTERNATIVES THAT REQUIRE NEW GENERATION CAPACITY

9.2.2.1 Introduction

In accordance with NUREG-1555, this subsection provides an analysis of alternative energy sources that could reasonably be expected to meet the demand from both a load and economic standpoint for additional generating capacity determined for the proposed nuclear project. This COL Application is premised on the construction and operation of Units 6 & 7 that would serve as large baseload generators. Therefore, as defined in NUREG-1555, any potentially competitive alternative would also need to be able to provide baseload power.

To generate a set of alternative energy sources for analysis, NUREG-1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*, provides a starting point. The NRC analysis of alternative energy sources in NUREG-1437 includes commonly known generation technologies and various state energy plans were consulted to identify alternative generation sources typically being considered by state authorities across the country. Although NUREG-1437 is specific to license renewal, the alternatives analysis contained there can be applied to the proposed nuclear project applying for a COL to determine if an alternative technology represents a reasonable or potentially competitive alternative to the proposed project. Accordingly, the following energy sources were identified as alternatives to the proposed project:

- Wind (Subsection 9.2.2.2)

- Solar — photovoltaic cells (Subsection 9.2.2.3.1)
- Solar — solar thermal systems (Subsection 9.2.2.3.2)
- Hydroelectric power (Subsection 9.2.2.4)
- Geothermal (Subsection 9.2.2.5)
- Fuel cells (Subsection 9.2.2.6)
- Biomass (Subsection 9.2.2.7)
- Municipal solid wastes/landfill gas (Subsection 9.2.2.8)
- Coal (Subsection 9.2.2.9)
- Natural gas (Subsection 9.2.2.10)
- Petroleum (Subsection 9.2.2.11)
- Integrated gasification combined cycle (Subsection 9.2.2.12)
- Combination of alternatives (Subsection 9.2.3.3)

The alternative technologies considered in this analysis have been determined to be consistent with national policy goals for energy use, and are not prohibited by federal, state, or local regulations.

To be considered competitive, an alternative energy source must satisfy the following criteria:

- The alternative energy conversion technology is developed, proven, and available in the relevant region in the life of the proposed nuclear project.
- The alternative energy source provides baseload generating capacity equivalent to the capacity of the proposed nuclear project.
- The alternative energy source does not result in environmental or health impacts in excess of a nuclear plant.

As mentioned, this subsection identifies whether the selected alternative sources of energy could reasonably be expected to meet the demand from a load and economic standpoint in accordance with NUREG-1555. Although environmental and health impacts are assessed in Subsection 9.2.3 for those alternatives deemed potentially competitive, a brief summary of potential environmental impacts is presented in this subsection in accordance with the data needs described in NUREG-1555. Based on the inability to meet one or more of these criteria, several of the alternative energy sources were determined to be noncompetitive and were not considered further. Alternatives that were considered to be potentially competitive are assessed in greater detail with respect to environmental and health impacts in Subsection 9.2.3.

9.2.2.2 Wind

9.2.2.2.1 Overview

The terms *wind energy* or *wind power* describe the process by which wind is used to generate mechanical power or electricity. Wind turbines convert the kinetic energy in wind into mechanical power. A generator can convert this mechanical power into electricity. Wind turbines work in the following fashion: the wind turns the blades, which spin a shaft, which connects to a generator, and makes electricity (U.S. DOE Nov 2006).

The amount of power generated by this process depends on the average wind speed and the area swept by the turbine blades. Areas are classified across the country in reference to their potential to supply wind energy. The energy potential of wind is expressed by wind generation classes that range from one (least energetic) to seven (most energetic). In a Class 1 region, at a height of 164 feet (50 meters), the average wind speed is less than 12.5 mph and offers a wind power of less than 200 watts per square meter. A Class 7 region has an average wind speed of more than 19.7 mph and offers a wind power of more than 800 watts per square meter at a height of 164 feet (AWEA 2008b).

9.2.2.2.2 Current Technology Status

Onshore wind power is a fully commercialized technology. According to the DOE, wind-powered capacity in the United States increased 46 percent in 2007, and had the fastest growing wind-power capacity in the world in 2005, 2006, and 2007. Despite this rapid growth, wind energy only makes up approximately 0.72 percent of the nation’s electricity consumption and 0.77 percent of the net electricity generation (U.S. DOE May 2008).

Wind power systems produce power intermittently because they can only be fully operational when the wind blows at sufficient velocity and duration. Although advances in technology have improved wind turbine reliability to 98 percent, modern utility-scale wind turbines typically operate 65 to 90 percent of the time and often run at less than full capacity (AWEA 2008a and NRRI Feb 2007). Therefore, the capacity factors for wind power systems generally range from 25 to 40 percent (AWEA 2008a). This low capacity factor, resulting from wind’s intermittent ability to produce electricity, prevents wind power from providing baseload power.

For wind energy to supply baseload power, wind power would need to provide continuous power. Wind power systems that combine wind turbine generation with energy storage may overcome these obstacles and provide a source of power that is functionally equivalent to a conventional baseload electric power plant. By storing the power produced from wind power systems and releasing it when the wind facilities are not generating power, energy storage in combination with the wind facilities would be able to generate electricity continuously. Energy storage technologies include batteries, flywheel storage, superconducting magnetic energy storage, compressed air, pumped hydropower, and supercapacitors. However, large-scale energy storage is either not available or not economically viable (Schainker Dec 2006).

Until recently, the offshore wind energy potential in the United States was ignored because vast onshore wind resources have the potential to fulfill the electrical energy needs for the entire country. However, development of onshore wind resources has mainly focused on remote areas of the western United States with Class 6 or greater wind regimes and on a few ridgelines in the eastern United States. The challenge of transmitting the electricity from these remote areas to large load centers may limit wind grid penetration for land-based turbines. Offshore wind turbines can generate power closer to large coastal load centers than land-based turbines. Reduced transmission constraints, steadier and more energetic winds, and European success have made offshore wind energy more attractive for the United States. However, U.S. waters are generally deeper than those on European coasts and will require new technology to use those resources (NREL Jun 2004).

Environmental conditions at sea are more severe than on land, and the sea poses saltwater corrosion concerns and additional loads from waves. In the past, turbine manufacturers have taken conventional land-based turbine designs, upgraded their electrical and corrosion-control systems to facilitate a marine service environment, and placed them on concrete bases or steel monopiles to anchor them to the seabed. This type of approach is only acceptable in water depths of 15 to 40 feet. Experience with offshore wind power development in Europe indicates that the use of conventional land-based turbine designs in a marine environment leads to reliability issues and increased maintenance costs. New turbine designs would be needed to withstand harsh offshore conditions (NREL Jun 2004).

9.2.2.2.3 Ability to Serve Regional Needs

According to the DOE, National Renewable Energy Laboratory, while there are no Class 3 or greater wind energy classes located inland in Florida, Florida has a resource wind energy potential (Class 3) along its coastline (U.S. DOE Jan 2008). Areas designated Class 3 or greater are suitable for most wind turbine applications, whereas Class 2 areas are marginal. Currently, wind regimes of Class 4 or higher are potentially economical for the advanced utility-scale wind turbine technology currently under development.

FPL's strong commitment to renewable energy includes building a new 13.8 MW capacity wind generation facility at FPL's St. Lucie nuclear power plant site on Hutchinson Island, located along Florida's coastline. Hutchinson Island's average annual wind speeds of 13.8 mph are strong enough for FPL's proposed wind farm to generate electricity (FPL Apr 2008b). Florida is not an ideal location for mass wind energy production and sites such as the St. Lucie site are limited in Florida and are not capable of producing the same baseload as the proposed project.

9.2.2.2.4 Potential Environmental Impacts

Wind energy is a renewable energy source that produces electricity without releasing air or water pollutants; however, there are some disadvantages relating to environmental impacts such as aesthetic and noise concerns, large land requirements, potential harm to birds and bats, and radar interference (AWEA 2008c).

NUREG-1437 identifies the large land requirements for wind energy as a potential environmental impact. The land use requirement for utility-scale wind plants in open and flat terrain is approximately 60 acres per MW of installed capacity. Approximately 5 percent (3 acres) of this area is occupied by turbines, access roads, and other equipment. The remaining land area can be used for compatible activities such as farming or ranching (AWEA 2008c).

Another potential environmental impact relating to wind power is its impact on birds. Wind energy production may affect birds in three ways:

- The most widely noted are fatalities resulting from collisions with rotors, towers, power lines, or with other related structures. Electrocution on power lines is also possible.
- Birds may avoid wind turbines and the habitat surrounding them.
- The direct impacts on bird habitat from the footprint of turbines, roads, power lines, and auxiliary buildings.

Measures, such as monitoring, eliminating guy wires, and minimizing lighting, can be taken to prevent/minimize avian and other wildlife impacts at each wind energy project (AWEA May 2004).

There are two potential sources of noise associated with wind plants: the turbine blades passing through the air as the hub rotates and the gearbox and generator. Standing next to the turbine, it is usually possible to hear a swishing sound as the blades rotate and the whir of the gearbox and generator may also be audible. However, as distance from the turbine increases, these effects are reduced. Well-designed wind turbines are generally quiet in operation and, compared to the noise of road traffic, trains, aircraft, and construction activities, the noise from wind turbines is very low. At 130 feet, the noise level from a wind turbine is 50 dBA to 60 dBA or about as noisy as a conversational speech or a busy office. A wind farm at 1640 feet would have a noise level of 35 dBA to 45 dBA (the level of a quiet bedroom) (BWEA 2008).

Experience has shown that wind turbines can degrade performance of air traffic control or air defense radar. The phenomenon can include sudden or intermittent appearance of radar contacts at the location of the wind turbine caused by blade motion or rotation of the turbine to face the wind. Air traffic control radar interference is generally limited to wind turbines that are in the radar line of sight. Studies indicate that this problem may be minimal for turbines more than 5 nautical miles (5.75 miles) from the radar. In September 2006, the Department of Defense report titled *The Effect of Windmill Farms on Military Readiness* identified similar conflicts with air defense radar. According to this report, these conflicts can extend for tens of miles from the radar facility as a result of atmospheric refraction (MTC 2008a).

9.2.2.2.5 Conclusions

Based on this analysis, offshore wind technology has not matured sufficiently to support production for a baseload facility. Although land-based wind energy is developed and proven, it would only be available along Florida's coastline where siting issues exist. Additionally, the capacity factor for wind energy is inadequate to provide baseload power. Because wind power alone cannot generate baseload power, it cannot serve the purpose of the proposed project and therefore is not a potentially competitive alternative. However, land-based wind power could be included in a combination of alternatives to the proposed nuclear project. However, it is questionable how much, if any, of the capacity of wind facilities in Florida would be considered firm capacity due to the intermittent nature of wind resources in Florida. Therefore, wind facility capacity in Florida may contribute little, or not at all, to meeting FPL's reserve margin requirements. Therefore, wind technology is retained for further consideration. Combinations of alternatives, including wind, are described in Subsection 9.2.3.3.

9.2.2.3 Solar Technologies

There are two basic types of solar technologies that produce electrical power: photovoltaics and solar thermal systems, evaluated in Subsections 9.2.2.3.1 and 9.2.2.3.2, respectively.

9.2.2.3.1 Photovoltaic Cells

Overview

Photovoltaic cell technology involves converting sunlight directly into electricity. Photovoltaic cells are primarily made of the semiconductor material silicon. Light particles from the sunlight called photons penetrate the solar cell and knock electrons free from a semiconductor material, usually silicon, to create an electric current. As long as an adequate amount of light flows into the cell, electrons flow out of the cell. The cell does not consume its electrons and lose power like a battery. Instead, it operates as a converter that turns one kind of energy (sunlight) into another (electrical current). Individual photovoltaic cells are typically combined into modules that hold approximately 40 cells, and modules are then mounted into photovoltaic arrays. A large number of arrays can be combined to create a power generation plant (U.S. DOS Apr 2005).

Current Technology Status

Electric power generation from photovoltaic cells has been commercially demonstrated. However, only sunlight of certain energies will work efficiently to create electricity, and much of it is reflected or absorbed by the material that makes up the cell. Consequently, a typical commercial solar cell has an energy conversion efficiency of 15 percent. Low efficiencies mean that larger arrays are required, resulting in higher capital costs (NREL Jul 2008b). Additional research is needed in semiconductor materials, device properties, and fabrication processes to improve the efficiency, stability, and cost of photovoltaic solar energy conversion (NREL Jul 2008a).

Because photovoltaic cells rely on a fuel source that is intermittent, capacity factors are relatively low. The average annual capacity factor for photovoltaic systems is 24 percent, much lower than the 90 percent or better for a baseload plant, such as a nuclear plant (NREL Jul 2002).

Ability to Serve Regional Needs

When sunlight passes through the earth’s atmosphere, a portion of the light is scattered or absorbed by haze, particles, or clouds (NREL Jan 2003). Sunlight can, therefore, be categorized as either direct or diffused. Photovoltaic cells can use any form of sunlight, direct or diffused, to generate power. Photovoltaic systems typically use flat-plate collectors fixed in a tilted position correlated to the latitude of the location. This allows the collector to best capture the available sunlight. The average solar radiation for a flat-plate collector in Florida ranges from 5000 watt-hour to 5500 watt-hour of solar radiation per square meter per day (EERE Feb 2008). Therefore, Florida has a good available resource throughout the state. In fact, FPL has completed construction of the nation's largest photovoltaic power generation facility in the country, the 25 MW DeSoto Next Generation Solar Energy Center. In addition a second photovoltaic power generation facility is also in operation in Brevard County. It is named the Space Coast Next Generation Solar Energy Center and has a nameplate rating of 10 MW. These two facilities are in addition to the Rothenbach Park Solar Array in Sarasota. This photovoltaic facility was commissioned in October 2007 as the first large-scale photovoltaic facility with a nameplate rating of 250 kW. (FPL Apr 2009). However, because of the intermittent nature of the solar resource, FPL currently considers photovoltaic output as non-firm capacity and energy. Therefore, photovoltaic facilities do not contribute to meeting FPL’s reserve margin as do firm capacity resources such as nuclear units, i.e., Turkey Point Units 6 & 7.

Potential Environmental Impacts

The environmental advantages of photovoltaic cells are that they have near-zero emissions and have an unlimited supply of free fuel. Water use is much less than other technologies that require cooling water and is reduced to minimal amounts used to wash dust from panel faces. Environmental disadvantages of photovoltaic cells are sizeable land use requirements, aesthetic intrusion, and potential use of hazardous materials (lead) to store energy.

The amount of land required depends on the available solar insolation and ranges from approximately 3.8 to 7.6 acres per MW for photovoltaic systems (NREL Jul 2002). Assuming an average capacity factor of 24 percent, a photovoltaic facility generating a net output equivalent to the proposed nuclear project of approximately 2200 MW is estimated to require at least 34,599 acres (approximately 54.1 square miles). Because of the relatively large land area requirements, a large photovoltaic facility would pose aesthetic concerns. In addition, retired system components (e.g., batteries) would likely require disposal as hazardous waste.

Conclusions

Based on this analysis, photovoltaic technology is developed and proven, and viable sites with adequate insolation levels are available in Florida at the start of commercial operation of the proposed nuclear project. However, as a result of its intermittent nature, the capacity factor for photovoltaic technology is inadequate to provide firm capacity. Because photovoltaics alone cannot provide firm baseload capacity, it cannot serve the purpose of the proposed project and, therefore, is not a potentially competitive alternative.

9.2.2.3.2 Solar Thermal

Overview

Solar thermal systems capture the sun's heat and transform it into electricity or steam. Solar thermal systems include lenses or mirrors that concentrate the thermal power of sunlight into a fluid system to induce motion. The fluid is then routed through a turbine to generate electricity (NREL Jul 2002). This is basically the same type of system that is used to generate electricity from combustion of coal, except the thermal energy comes from the sun instead of from coal combustion. For this reason, solar thermal systems provide easy integration into the transmission grid. Solar thermal systems can also be equipped with a thermal storage tank to store the energy in the heat transfer fluid. This allows a solar thermal plant to provide dispatchable electric power. These plants can be hybridized with fossil fuels because it is heat, not light as in photovoltaic, that powers the plant, and that heat can come from any source of power allowing these plants to operate during periods of peak demand, even when the sun is not shining (NREL Jul 2002).

Current Technology Status

There are three types of solar thermal systems: parabolic trough, dish-Stirling, and power tower. Parabolic trough systems have been deployed in major commercial installations. The other solar thermal technologies have less commercial experience, but all have seen significant pre-commercial development in the past two decades. Parabolic trough plants 30 MW to 80 MW in size are in commercial operation, with a total of 354 MW in the California Mojave Desert demonstrating reliable operation and excellent performance since 1985, which is operated and partially owned by FPL's parent company, NextEra Energy, Inc. (which previously operated as FPL Group, Inc.). Additional trough systems are under development in Arizona, Nevada, and Spain. Dish-Stirling systems are currently in an aggressive commercialization program by industry centered on a 25 kW dish system unit for modular production of over 100 MW plants. Recently, two California utilities signed power purchase agreements for dish-Stirling projects that could provide as much as 1750 MW capacity by 2014. A prototype 10 MW power tower that was successfully operated in California demonstrated efficient thermal energy storage and 24-hour-per-day electric production (WGA Jan 2006).

Generating capacity factors for solar thermal are too low to meet baseload requirements. Current solar thermal systems are as large as 200 MW, with capacity factors that range from 30 to 50 percent (NRRI Feb 2007). This range is relatively low compared to capacity factors of 90 percent or better for a baseload plant, such as a nuclear plant. Furthermore, the intermittent nature of the solar resource in Florida results in solar thermal systems, located in Florida, providing non-firm capacity and energy. Consequently, such systems contribute little, if any, to meeting FPL's reserve margin requirements.

Ability to Serve Regional Needs

Solar thermal plants can only use the direct component of the sunlight but focus the energy to achieve higher temperatures. Solar thermal technologies produce more electricity on clear, sunny days with more intense sunlight and when the sunlight is at a more direct angle (i.e., when the sun is perpendicular to the collector). To work effectively, solar thermal installations require consistent levels of sunlight (solar insolation).

The average amount of solar energy reaching the ground needs to be at least 6 kWh per square meter per day for solar thermal systems (NREL Jul 2002). Solar thermal systems use tracking, concentrating collectors so they always face the sun. For concentrating collectors, Florida could pursue some types of technologies, but large-scale thermal utility systems are not effective with this immature technology because the solar resource map for concentrating collectors shows a maximum of 4.5 kWh per square meter per day for Florida (EERE Feb 2008). Even with the immaturity of the technology, FPL has decided to pursue and has completed construction of a new solar thermal facility located at the Martin plant site. This facility is a “hybrid” energy center, coupling solar thermal technology with an existing combined cycle generation unit and produces steam that replaces steam that would have otherwise have been produced by burning natural gas in one of the existing combined cycle units at the site, Martin Unit 8. This solar thermal facility, named the Martin Next Generation Solar Energy Center, is projected to produce up to 75 MW of steam capability, thus allowing reduced use of fossil fuels by FPL when the solar thermal facility is producing steam. (FPL Apr 2010) As previously mentioned, this solar thermal facility adds no additional firm capacity to FPL's system.

Potential Environmental Impacts

The environmental advantages of solar thermal technology are that it has near-zero emissions and it uses free fuel. Cooling water requirements for solar thermal systems that use wet cooling towers are similar to that of conventional boiler power technology. Parabolic trough plants and power towers use approximately 740 gallons of water per megawatt hour (MWh). Dish-Stirling plants are air-cooled and do not use any water for cooling. All solar thermal technologies require a minimal amount of water, approximately 37 gallons per MWh, to wash dust from mirror surfaces (NREL Apr 2006).

Environmental disadvantages of solar thermal technologies are sizeable land use requirements and the associated aesthetic intrusion. The land area required for solar thermal technologies is around four acres per megawatt for dish-stirling, 5 acres per MW for parabolic trough, and 8 acres per MW for power tower systems (NREL Jul 2002).

Conclusions

Based on this analysis, solar thermal technology is developed and proven (EERE Feb 2008). However, because of its intermittent nature, the capacity factor for solar thermal technology is inadequate to provide firm capacity. Therefore, it cannot serve the purpose of the proposed project and, therefore, is not a potentially competitive alternative.

9.2.2.4 Hydroelectric Power

9.2.2.4.1 Overview

Hydroelectric power plants (also called hydropower plants) use the kinetic energy of falling water to produce electricity. The flowing water turns a turbine that is connected to a generator. The amount of power generated by this process depends on several variables: the volume of water, the flow rate, and the distance the water is falling. Hydropower is a proven energy source that can be used to provide baseload power, but its use is limited to locations that have both a large volume of flowing water and a change in elevation.

9.2.2.4.2 Current Technology Status

Hydropower is a fully commercialized technology that has provided baseload power for more than a century. Hydropower is currently the leading renewable energy source used by electric utilities to generate electric power (EIA Jul 2008b). In 2007, hydroelectric power plants accounted for 7.8 percent of the nation's power net summer capacity and 6.0 percent of the power generated (EIA Apr 2009). However, hydropower's estimated capacity factor of 40 to 50 percent is below the nominal nuclear power facilities' capacity factors of 90 percent or better, and the National Hydropower Association forecasts a decline in large-scale hydropower use through 2020 as a result of increased environmental regulation (INL Jul 2005 and U.S. DOE Sep 2005).

There are two types of hydropower facilities: impoundment and diversion. The most common type is an impoundment facility, where river water is contained behind a dam to form a reservoir. The water can be released to meet changing demands for electricity or to maintain the reservoir level. These systems can be very efficient with as much as 90 percent of the energy being converted to electrical power (MDNR Jul 2007). In some cases, impoundment systems are used specifically to store energy. This is done at pumped storage facilities with two separate reservoirs, one positioned at a much higher elevation than the other. Water is released from the upper reservoir to flow through a turbine to produce electricity during peak demand. During off-peak periods, the water is pumped back to the upper reservoir using a different source of power. Pumped storage serves as a load management tool by lowering the amount of power that other generation units must provide during the periods of highest demand (and highest cost) for electricity (NRRI Feb 2007).

Diversion facilities use the flow of a fast-moving river, often near waterfalls, and do not require a dam. A portion of the water is diverted through a canal or set of pipes to a turbine positioned in or to the side of the river. Electricity generation, therefore, varies depending on the flow of the river. These systems cannot store power in the way a dam does and are best applied for smaller-scale local power applications or in remote locations away from main utility power grids (MDNR Jul 2007).

9.2.2.4.3 Ability to Serve Regional Needs

Though Florida is bordered on three sides by water, it is classified as a low-hydropower resource (EIA Aug 2006). A study conducted by the DOE estimates that there are 13 undeveloped potential hydropower sites in Florida. The results for individual site capacities range from 200 kW to 18 MW. The majority (69 percent) of the hydropower sites in Florida are greater than 1 MW, and less than 10 MW. The 13 identified sites are located within one major river basin (Appalachicola River Basin) and several minor river basins (U.S. DOE Dec 1998b). Thus, the available hydropower in the entire state of Florida is well below the approximate 2200 MWe net capacity of the proposed nuclear project.

9.2.2.4.4 Potential Environmental Impacts

Land use impacts for a large-scale hydropower facility using impoundments is likely to be substantial. NUREG-1437 estimates land use of 1 million acres per 1000 MWe generated by hydropower. Based on this estimate, an approximate 2200 MW hydroelectric plant would require approximately 2.2 million acres, 3459 square miles, to be flooded. Associated with this large land loss would be some erosion, sedimentation, dust, potential loss of cultural artifacts, aesthetic impacts, and equipment exhaust from land clearing and excavation. Alterations to terrestrial habitats could increase the risks to threatened and endangered species. The original land uses would be replaced by electricity generation and recreation, and perhaps, residential and business developments that take advantage of the lake environment.

Hydropower facilities can have a substantial effect on the surrounding environment's ecology. Diverting water out of the stream channel (or storing water for future electrical generation) can dry out streamside vegetation. Insufficient stream flow degrades habitat for fish and other aquatic organisms in the affected river reach below the dam. Water in the reservoir is stagnant compared to a free-flowing river, so waterborne sediments and nutrients can be trapped, resulting in the undesirable growth and spread of algae and aquatic weeds. In some cases, water spilled from high dams may become supersaturated with nitrogen gas and cause gas-bubble disease in aquatic organisms inhabiting the tailwaters below the hydropower plant (U.S. DOE Aug 2005a).

Additionally, changes in water temperature, currents, and amount of sedimentation produce a different aquatic environment above and below the dam. Alterations to aquatic habitats could change the risks to threatened and endangered species (NUREG-1437). The dam can block upstream movements of migratory fish. Downstream-moving fish may be drawn into the power plant intake flow and pass through the turbine. These fish are exposed to physical stresses (pressure changes, shear, turbulence, strike) that may cause disorientation, physiological stress, injury, or death (U.S. DOE Aug 2005a).

9.2.2.4.5 Conclusions

Based on this analysis, although hydropower is a developed and proven technology for baseload power, the potential for future hydropower development in Florida is inadequate to supply the amount of power to be provided by the proposed nuclear project. Because hydropower in Florida is not available in sufficient quantities to supply the power to be provided by the proposed project, it cannot serve the purpose of the proposed project and, therefore, is not a potentially competitive alternative.

9.2.2.5 Geothermal

9.2.2.5.1 Overview

Geothermal power plants use naturally heated fluids in underground reservoirs as an energy source for electricity production. Electricity production using geothermal energy is based on conventional steam turbine and generator equipment, in which expanding steam powers the turbine generator to produce electricity. Geothermal energy is tapped by drilling wells into the reservoirs and piping the hot water or steam into a power plant for electricity production.

9.2.2.5.2 Current Technology Status

Geothermal energy has provided commercial baseload power around the world for more than a century (MIT 2006). Geothermal plants have high availabilities and can achieve capacity factors of 97 percent (GEA 2008). The United States is the world leader in online capacity of geothermal energy and the generation of electric power from geothermal energy, with 30 percent of the world total. As of August 2008, the United States had approximately 2958 MW of geothermal generating capacity with seven states generating power from geothermal plants (GEA Aug 2008).

There are four types of geothermal resources: hydrothermal (hot water or steam at moderate depths of 330 feet to 14,800 feet), geopressured (hot water aquifers containing dissolved methane under high pressure in sedimentary formations at depths of 9800 feet to 19,700 feet), hot dry rock (abnormally hot geologic formations with little or no water), and magma (molten rock at temperatures of 1200ºF to 2370ºF) (USGS Mar 2003 and RISE 2008).

At present, only high-grade (shallow, hot, and permeable) hydrothermal reservoirs are used for the generation of electricity. However, recent research indicates that it may be feasible to extract geothermal electric power from hot dry rock systems and geopressured reservoirs using enhanced geothermal systems. Enhanced geothermal systems is a process where geothermal aquifers with low permeability can be stimulated to create a conductive fracture network where the reservoir operates similar to a conventional hydrothermal reservoir (MIT 2006). Enhanced geothermal systems are currently in the early stages of development. The DOE Geothermal Technologies Program is conducting research on enhanced geothermal systems with the goals of demonstrating the feasibility of creating enhanced geothermal system reservoirs capable of producing hot fluids at the high rates needed for commercial development by 2011 and demonstrating the economic feasibility of enhanced geothermal systems by 2018 (U.S. DOE Aug 2005b).

Another emerging technology is hydrocarbon/geothermal coproduction. There is growing interest in producing electricity from the thermal fluid that flows from oil and gas wells. Geothermal coproduction has been predicted to be capable of providing 1000 to 5000 MW to the seven states in the Texas Gulf Coast Plain alone (GEA Aug 2008).

Commercially available geothermal generating technologies include dry steam, flash steam, and binary-cycle power plants. The type of power plant depends on the temperature and pressure of the geothermal reservoir (U.S. DOE Nov 2004).

Dry steam power plants draw from underground reservoirs of steam. The steam is piped directly from wells to the power plant, where it enters a turbine. The steam turns the turbine, which turns a generator. The steam is then condensed and injected back into the reservoir via another well. The geysers in northern California, the world’s largest source of geothermal power, use dry steam (U.S. DOE Nov 2004).

Flash steam power plants tap into reservoirs with temperatures of 360°F or higher. This very hot water flows up through the wells under its own pressure. As it flows to the surface, the fluid pressure decreases and some of the hot water boils or “flashes” into steam. The steam is then separated from the water and used to power a turbine generator unit. The remaining water and condensed steam are injected through a well back into the reservoir (U.S. DOE Nov 2004).

Binary-cycle power plants operate with water at lower temperatures of approximately 225°F to 360°F. These plants use heat from the geothermal water to boil a working fluid, usually an organic compound with a lower boiling point. The working fluid is vaporized in a heat exchanger and the vapor turns a turbine. The water is then injected back into the ground to be reheated. The water and the working fluid are confined in separate closed loops during the process, so there are little or no air emissions (U.S. DOE Nov 2004).

9.2.2.5.3 Ability to Serve Regional Needs

Use of geothermal resources for the generation of electricity is currently limited to shallow, high-temperature convective hydrothermal reservoirs. A lower temperature type of geothermal energy is found in parts of the eastern United States. The University of Florida Geophysical Laboratory has investigated heat flow values for the Gulf coastal plain and north-central Florida. Thermal gradients found in the majority of the wells drilled in Florida were below average to average, indicating little promise of a significant geothermal resource (OSTI Nov 1984). A heat flow map of the United States shows Florida with heat flows generally in the 25 to 39 MW-per-square-meter range with a small portion in the 40 to 44 MW-per-square-meter range and an even smaller portion located in the panhandle in the 55 to 59 MW per square meter range (MIT 2006). However, a new geothermal demonstration project is under development in Florida. The Jay Oilfield demonstration project is set to begin in 2008 and will use thermal fluids commonly coproduced from oil and gas wells. The expected capacity of the project is 200 kW but has potential for 1 MW, much less than the proposed project (GEA Aug 2008).

9.2.2.5.4 Potential Environmental Impacts

Land use impacts from geothermal power are potentially substantial. Estimates found in NUREG-1437 estimate that geothermal power generation facilities require between 1 and 8 acres per MW (U.S. DOE Nov 2004). Based on a 95-percent capacity factor, a geothermal power plant with a net output of approximately 2200 MW would require at least 2300 acres (3.64 square miles). Other major environmental concerns associated with geothermal development are the release of small quantities of carbon dioxide and hydrogen sulfide, and disposal of sludge and spent geothermal fluids. Subsidence and reservoir depletion is also a concern when withdrawal of geothermal fluids exceeds natural recharge or injection. Induced seismicity can be a concern when large amounts of geothermal fluids are injected back into the hydrothermal reservoir (U.S. DOE Nov 2004).

9.2.2.5.5 Conclusions

Based on this analysis, geothermal power using high-grade (shallow, hot, and permeable) hydrothermal reservoirs is developed and proven. However, because there are no known shallow, high-temperature hydrothermal resources in Florida, the potential for future geothermal power using currently available technology is inadequate to supply the equivalent power of the proposed nuclear facility. Therefore, geothermal power is not a potentially competitive alternative for baseload power in Florida.

9.2.2.6 Fuel Cells

9.2.2.6.1 Overview

Fuel cells are similar to common batteries. Both have a positive and a negative terminal, rely on chemical reaction, and produce electricity when the circuit is closed. In hydrogen fuel cells, hydrogen passes through an anode catalyst where it is ionized into a positively charged hydrogen ion and a negatively charged electron. The hydrogen ions then pass through a conductive medium and combine with oxygen to form water. The electrons formed by the ionization process create an electrical current (NRRI Feb 2007). Hydrogen fuel can come from a variety of hydrocarbon resources that are gasified by subjecting them to steam under pressure. Natural gas is typically used as the source of hydrogen.

9.2.2.6.2 Current Technology Status

Fuel cell power plants are in the initial stages of commercialization and are still an immature technology. Fuel cells are classified by the type of electrolyte used. There are currently five types: (1) alkaline fuel cells, (2) phosphoric acid fuel cells, (3) proton exchange membrane fuel cells, (4) molten carbonate fuel cells, and (5) solid oxide fuel cells. Electric output for proton exchange membrane fuel cells and solid oxide fuel cells range from 5 kW to 250 kW. Phosphoric acid fuel cells are capable of producing 200 kW, and molten carbonate fuel cells can produce anywhere from 250 kW to 2 MW of power (NRRI Feb 2007).

9.2.2.6.3 Ability to Serve Regional Needs

According to the Fuel Cells 2000 Worldwide Stationary Fuel Cell Installation database, nine fuel cell power plants have been installed in Florida and one system is planned by the state of Florida for an undisclosed university (FC2000 2008). These are all stationary fuel cell installations. That is, they generally provide supplemental power and/or backup assurance for critical areas, or they may be installed as a grid-independent generator for onsite service in areas that are inaccessible by powerlines. FPL has also been investigating fuel cell technologies through monitoring of industry trends, discussions with manufacturers, and direct field trials. From 2002 through the end of 2005, FPL conducted field trials and demonstration projects of proton exchange membrane fuel cells with the objectives of serving customer end-uses while evaluating the technical performance, reliability, economics, and relative readiness of the proton exchange membrane technology (FPL Apr 2010). Currently, the technology is still too immature to provide baseload capacity on a utility scale.

9.2.2.6.4 Potential Environmental Impacts

Fuel cells work without combustion and, therefore, do not produce the environmental side effects associated with combustion. The only by-products of the fuel cell generation process are heat, water, and carbon dioxide (MTC 2008b). The impacts of the end-of-life phase of fuel cells are small, in part, because of the large motivation to recover precious metals components. However, one must also consider the life cycle impacts of fuel cells. A life cycle assessment which considered the manufacturing of fuel cells was conducted by EPA’s National Risk Management Research Laboratory and NASA’s Jet Propulsion Laboratory. As detailed in this report, the fabrication of fuel cells is an energy-intensive, high-temperature process and the fuel cell also uses heavy metals such as nickel, chromium, and manganese in the catalysts, electrodes, and interconnects (U.S. EPA 2009). Further, the fuel, hydrogen, in hydrogen fuel cells requires the manufacturing of hydrogen. Significant challenge must be overcome. Hydrogen production is capital intensive and developers have not established standard designs (U.S. DOE Dec 2005).

9.2.2.6.5 Conclusions

This technology has not matured sufficiently for a baseload facility on a utility scale. Therefore, fuel cell technology is not a potentially competitive alternative for the proposed project.

9.2.2.7 Biomass

9.2.2.7.1 Overview

Biopower refers to electric power generated from converted vegetation (i.e., biomass). The most common biomass resources today are waste wood and agricultural crop residues from growing such crops as corn and sugar cane. Research is underway to explore the production of switch grass and other crops for the specific purpose of biomass conversion for electricity production (NRRI Feb 2007).

Biopower generation is a two-step process. The first step is to convert biomass feedstock into biofuel. The second step is to convert biofuel into electricity via combustion. Most biopower today is produced in direct combustion gas turbines, but it can also be used in combined-cycle turbines, diesel engines, or serve as a substitute in existing coal-fired burners (NRRI Feb 2007). Power from biomass is a proven commercial electricity generation option in the United States (EERE Jun 2000).

9.2.2.7.2 Current Technology Status

Biomass-fired facilities generate electricity using commercially available equipment and well-established technology (EERE Jun 2000). Biomass is the largest source of renewable electricity generation among the non-hydropower renewable fuels (EIA Mar 2009). There are four primary classes of utility-scale biomass power systems: direct-fired, co-fired, gasification, and modular systems. A brief description of each class is provided as follows:

- Nearly all of the biomass-energy-using electricity generation facilities in the United States use direct-fired steam turbine conversion technology. This technology is relatively simple to operate and it can accept a wide variety of biomass fuels. Biomass power boilers are typically in the 20 MW to 50 MW range and the technology is inefficient (U.S. DOE Sep 2006).

- Co-firing involves substituting biomass for a portion of coal in an existing power plant furnace. It is the most economic near-term option for introducing new biomass power generation. Because much of the existing power plant equipment can be used without major modifications, co-firing is far less expensive than building a new biopower plant. Compared to the coal it replaces, biomass reduces sulfur dioxide, nitrogen oxides, and other air emissions. After tuning the boiler for peak performance, there is little or no loss in efficiency from adding biomass (U.S. DOE Sep 2006). While biomass can be successfully co-fired with coal, it is not without technical challenges. Biomass is much less dense than coal, requiring a large volume of fuel to be handled. Larger areas of biomass storage and additional handling are required to accommodate the lower-density materials. Moreover, the ash residue left from combusting biomass contains alkali and alkaline earth elements, such as sodium, potassium, and calcium. These compounds bind irreversibly with the catalysts used in selective catalytic reduction reactors that have been installed on coal-fired generating plants. These compounds can lead to increased catalyst plugging and cause deactivation of selective catalytic reduction catalysts, thus reducing or eliminating the ability of this technology to reduce nitrogen oxide emissions (Bowers Mar 2005).

- Biomass can be used in integrated gasification combined-cycle (IGCC) systems in which gasifiers heat the biomass in an environment where the solid biomass breaks down to form a flammable gas. The biogas is then cleaned and filtered to remove problem chemical compounds before being burned in a combined-cycle unit (U.S. DOE Sep 2006). IGCC systems are described in Subsection 9.2.2.12.

- Modular systems employ some of the same technologies mentioned above, but on a smaller scale that is more applicable to villages, farms, and small industries (U.S. DOE Sep 2006).

9.2.2.7.3 Ability to Serve Regional Needs

Florida ranks 16th in the nation in agriculture. According to the U.S. Department of Agriculture 2002 Census, there are 10.41 million acres of farmland equaling 30.2 percent of the state’s total land area (USDA Jul 2008). The Department of Agriculture and Consumer Services believes that Florida can be a leader in the effort of producing energy from crops and timber because of the vast amount of farm acreage in the state and its mild climate, which permits crops to be grown virtually year round (FDACS 2008).

In 2006, the Farm-to-Fuel Initiative was statutorily created to enhance the market for and promote the production and distribution of renewable energy from Florida-grown crops, agricultural waste and residues, and other biomass (FDACS 2008). In 2006, wood/wood waste and other biomass accounted for 1.1 percent of Florida’s 2 percent total renewable net generation or 202 MW of summer electricity capacity (EIA May 2008).

A study on biomass feedstock availability (Walsh et al. 2000) reports that there are 9,757,000 tons of forest residues available annually in Florida. Because mill residues are clean, concentrated at one source, and relatively homogeneous, nearly 98 percent of all residues generated in the United States are currently used as fuel or to produce other fiber products. There are 2,678,000 tons of mill residues available annually in the state (Walsh et al. Jan 2000).

9.2.2.7.4 Potential Environmental Impacts

As addressed in NUREG-1437, the overall level of construction of a biomass-fired power facility would be approximately the same as that for a similar sized coal-fired plant. Like coal-fired facilities, biomass plants require large areas for fuel storage and processing and involve the same type of combustion equipment. Fuel processing, in most cases involving some type of grinding operation, produces emissions of dust and particulates (NREL Nov 1999).

Conversion of large tracts of land for production of energy crops would pose potentially adverse environmental impacts on wildlife habitat and biodiversity, reduce soil fertility, increase erosion, and reduce water quality. The net environmental impacts would depend on previous land use, the particular energy crop, and how the crop is managed. If the land has not previously been developed for farming or other purposes, displacement of natural land cover such as forests and wetlands with energy crops would likely have negative environmental impacts. In addition, conversion of food crops into energy crops results in a reduction in food production that may need to be replaced elsewhere.

Air emissions and water consumption are usually the principal sources of environmental concern related to biomass facilities. Combustion of biomass fuels in modern power plants leads to many of the same kinds of emissions as the combustion of fossil fuels, including criteria air pollutants, greenhouse gases, and production of ash. While the air emissions would likely be less than a coal-fired facility, they would be substantially greater than the proposed nuclear project. The controls for limiting these emissions are similar to those used in coal-fired plants (NREL Nov 1999). Water consumption impacts would be similar to other boiler power technology.

9.2.2.7.5 Conclusions

Based on this analysis, biomass-fired technology is developed, proven, and available in Florida at the start of commercial operation of the proposed nuclear project. However, as a result of adverse environmental impacts, the small scale of existing plants, and the large amount of fuel preparation, burning biomass to generate electricity is not considered to be a potentially competitive alternative.

9.2.2.8 Municipal Solid Waste/Landfill Gas

9.2.2.8.1 Overview

Municipal solid waste refers to the stream of garbage collected through community sanitation services. Municipal solid waste includes everyday items such as grass clippings, household garbage, newspapers, food scraps, clothing, bottles, paint, batteries, etc. Municipal solid waste can be directly combusted in waste-to-energy facilities to generate electricity (U.S. EPA Dec 2007c).

Landfill gas is created when organic waste in a landfill naturally decomposes. This gas consists of approximately 50 percent methane, approximately 50 percent carbon dioxide, and a small amount of non-methane organic compounds. Instead of allowing landfill gas to escape into the air, it can be captured, converted, and used as an energy source (U.S. EPA Jun 2008).

9.2.2.8.2 Current Technology Status

Municipal solid waste-fired and landfill gas facilities generate electricity using commercially available equipment and well-established technology. Conventional direct combustion is presently the most common technology used in the United States for municipal solid waste-to-energy power generation. At the power plant, municipal solid waste is unloaded from collection trucks and shredded or processed to ease handling. Very large items such as refrigerators or stoves, recyclable materials, and hazardous waste materials such as batteries are removed before combustion. Noncombustible materials such as metals can be removed before or after combustion, but are usually separated from the ash with magnetic separators. After separation, the remaining waste is fed into a combustion chamber to be burned. The heat released from burning the municipal solid waste is used to produce steam, which turns a steam turbine to generate electricity (U.S. EPA Dec 2007c).

At the end of 2007, the DOE reported 107 municipal solid waste generation facilities in operation in the United States. Nameplate capacities of these plants range from 0.1 MW to 90 MW, and more than half are less than 20 MW. The combined power capacity of the nation’s municipal solid waste facilities is approximately 2829 MW (EIA 2007). These power facilities are much smaller than the proposed nuclear project.

Another option of converting landfill waste into electricity is using landfill gas in internal-combustion turbines that are connected to generators. The amount of gas that a particular landfill will produce depends on its age and size. Although gas is produced as soon as anaerobic conditions are established in the landfill, it may be several years before there is enough gas to fuel an electric generator. Later, as the site ages, gas production (as well as the quality of the gas) declines to the point at which power generation is no longer economical. In the case of a typical well-engineered and well-operated landfill, gas may be produced for as long as 50 to 100 years, but using this to fuel generators may be economically feasible for only 10 to 15 years (Santee Cooper 2008).

The EPA reports that the United States has at least 450 operational projects in 43 states supplying 11 billion kilowatt hours of electricity and 77 billion cubic feet of landfill gas to direct-use applications annually. The power capacity of these power plants ranges between 30 kW and 10.5 MW. There are an additional 540 candidate landfills with a total gas generation potential of 240 billion cubic feet per year or electric potential of 1280 MW—much less than the proposed project (U.S. EPA Jun 2008).

9.2.2.8.3 Ability to Serve Regional Needs

In Florida, there are 12 municipal solid waste-to-energy facilities (FLDEP 2007). Currently, there are 82 landfills in Florida, and the EPA regards only 21 of them as candidates for landfill gas-to-energy development and an additional 30 others as potential candidate sites (U.S. EPA Aug 2008). Assuming the landfills identified by the EPA as candidates or potential candidates produce enough gas to generate 20 MW each annually, the energy production is still less than half of the proposed nuclear project's power capacity. In 2006, municipal solid waste-landfill gas accounted for 0.8 percent of Florida's 2 percent total renewable net generation or 447 MW of summer electricity capacity (EIA May 2008). Additionally, as landfill gas generators can only be economically used for 10 to 15 years, even if future landfills are constructed that provide additional candidate sites, the fuel source will likely be depleted before the end of the proposed nuclear project's operating life.

9.2.2.8.4 Environmental Impacts

The decision to burn municipal solid waste to generate energy is usually driven by the need for an alternative to landfills rather than by energy considerations (NUREG-1437). Combusting waste usually reduces its volume by approximately 90 percent and the remaining ash is buried in landfills (FPSC & FDEP Jan 2003). However, it is unlikely that many landfills will begin converting waste to energy due to the factors that may limit the growth in municipal solid waste power generation. Chief among these reasons are environmental regulations and public opposition to siting municipal solid waste facilities near feedstock supplies.

The overall level of land use impacts from construction of a municipal solid waste-fired plant would be approximately the same as that for a conventional coal-fired plant (NUREG-1437). The air emission profile and other operational impacts (including impacts on the aquatic environment, air, and waste disposal) for a municipal solid waste plant would also be similar to a conventional fossil fuel unit.

Burning landfill gas is beneficial to the environment by preventing methane, a greenhouse gas, from entering the atmosphere directly (Santee Cooper 2008). The air emission profile and other operational impacts (including impacts on the aquatic environment, air, and waste disposal) for a landfill gas plant would also be similar to a conventional fossil fuel unit. The overall level of land use impacts from construction of a landfill gas-fired plant should be approximately the same as for similar sized conventional gas-fired plant.

9.2.2.8.5 Conclusions

Based on this analysis, municipal solid waste- and landfill gas-fired technology is developed, proven, and would be available in Florida at the start of commercial operation of the proposed nuclear project. However, the small scale of existing plants, the large amount of fuel preparation required in the case of municipal solid waste-fired plants, the relatively short operating life in the case of landfill gas-fired plants, and because the full potential of municipal solid waste and landfill gas in Florida is less than the proposed project, burning municipal solid waste and landfill gas to generate electricity is not a potentially competitive alternative.

9.2.2.9 Coal

9.2.2.9.1 Overview

Coal-fired electric plants provide the greatest percentage of the electricity generated in the United States, accounting for approximately 48.5 percent of the electricity generated and approximately 31.4 percent of the available net summer electric power capacity in 2007 (EIA Apr 2009). To generate electricity from coal, coal is initially extracted from surface or underground mines. The coal is often cleaned or washed at the coal mine to remove impurities before it is transported to the power plant—usually by train, barge, or truck. At the power plant, coal is burned in a boiler to produce steam. The steam is run through a turbine to generate electricity (U.S. EPA Dec 2007).

The United States has abundant coal reserves, and the price of coal per million Btu is projected to be roughly the same price in 2030 as in 2007 (EIA Mar 2009). Coal-fired plants are likely to continue to be a reliable energy source well into the future, assuming environmental constraints do not cause the gradual substitution of other fuels.

9.2.2.9.2 Current Technology Status

There are two primary technologies identified for generating electrical energy from coal: pulverized coal boiler and circulating fluidized bed boiler.

9.2.2.9.3 Pulverized Coal Boiler

In pulverized coal boilers, coal is ground up finely and blown into the combustion chamber of a boiler where it is combusted. The hot gases and heat energy from the incineration process convert water into high-pressure steam. The steam is then passed through a turbine to produce electricity. Flue gases are usually routed through a selective catalytic reduction scrubber for nitrogen oxide reduction, and into a heat exchanger to salvage any residual heat. After this, the flue gas flows to a particulate removal system and a sulfur dioxide scrubber system.

The steam systems used in the current generation of pulverized coal boilers are generally designated as subcritical (or conventional), supercritical, or ultra-supercritical. This designation is based on the pressure and temperature of the steam. Subcritical units operate at a nominal pressure of 2400 psi and a peak temperature of 1050°F. Supercritical units would operate at a similar peak temperature but at a nominal pressure of 3500 psi. Ultra-supercritical units operate at a nominal pressure of 4500 psi and a minimum temperature of 1100°F. As the temperature and pressure of the steam at the turbine inlet increases, so does the efficiency of the power steam cycle. As the efficiency of the steam cycle is increased, the amount of fuel necessary to produce the same amount of energy is reduced, in turn reducing plant emissions (NRRI Feb 2007). Therefore, ultra-supercritical units are the most effective steam systems available and have efficiencies as high as 46 to 48 percent. This is compared to subcritical and supercritical net efficiencies of 36 to 37.5 percent and 40 to 42 percent, respectively (EPRI May 2007).

The subcritical pulverized coal technologies are commercially mature and widely used throughout the world. In 2005, 346 of the operating coal plants in the United States had been in operation for more than 50 years. Supercritical pulverized coal plants are a highly proven and reliable technology with installations dating back to 1957. Ultra-supercritical units are still undergoing development in the United States (NRRI Feb 2007).

9.2.2.9.4 Fluidized Bed Boiler Technologies

The fluidized bed boiler is an advanced electric power generation process that minimizes the formation of gaseous pollutants by controlling coal combustion parameters and by injecting a sorbent (such as crushed limestone) into the combustion chamber along with the fuel. Crushed fuel mixed with the sorbent is fluidized on jets of air in the combustion chamber to enhance combustion and heat transfer. Sulfur released from the fuel as sulfur dioxides is captured by the sorbent in the bed to form a solid compound that is removed with the ash. The resultant by-product is a dry, benign solid that is potentially a marketable by-product for agricultural and construction applications. More than 90 percent of the sulfur in the fuel is captured in this process. Nitrogen oxide formation in fluidized bed power plants is approximately 70 to 80 percent lower than that for conventional pulverized coal boilers because the operating temperature range of 1500ºF to 1700ºF is below the temperature at which thermal nitrogen oxide is formed. However, due to this lower operating temperature, fluidized bed systems do not achieve the higher efficiency levels achieved by conventional pulverized coal boilers (U.S. DOE Mar 2003).

Circulating fluidized bed combustion boilers use a relatively high fluidization velocity that entrains the bed material, in conjunction with hot cyclones, to separate and recirculate the bed material from the flue gas before it passes to a heat exchanger (U.S. DOE Mar 2003). This improves operating characteristics and performance and simplifies design, making it easier to scale up (Ghosh Sep 2005). In terms of environmental performance, circulating beds have better sulfur capture, carbon burnout, and nitrogen oxide control characteristics than noncirculating beds (Ghosh Sep 2005).

To improve the thermal efficiency of the fluidized bed technology, a new type of fluidized bed boiler has been proposed that encases the entire boiler inside a large pressure vessel pressurized 6 to 16 times greater than atmospheric pressure. Combustion of coal in a pressurized fluidized bed boiler results in a high-pressure stream of combustion gases that can spin a gas turbine to make electricity and boil water for a steam turbine. It is estimated that pressurized fluidized bed plants could generate 50 percent more electricity from coal than a regular power plant from the same amount of coal. The pressurized fluidized bed technology is currently in the demonstration phase and is not a feasible alternative for the proposed nuclear project (U.S. DOE Mar 2003).

The atmospheric fluidized bed combustion technology is a commercially mature technology that has been used for more than 50 years and has more than 600 units operating worldwide in the size range of 20 MW to 300 MW (Ghosh Sep 2005). Designs are being developed for units as large as 600 MW. The technology's total capacity represents approximately 2 percent of the overall coal-fired generation capacity in the world. In the United States, there are 185 atmospheric fluidized bed combustion boilers with a total capacity of 6000 MW (Ghosh Sep 2005).

9.2.2.9.5 Ability to Serve Regional Needs

The United States has abundant low-cost coal reserves, and the price of coal for electric generation is projected to remain steady for the next 20 years (EIA Mar 2009). Coal is one of the leading fuels for electricity production in Florida, accounting for over one-third of the net generation. There are no coal mines in Florida and coal-fired plants rely on supplies delivered by railroad and barge, mainly from Kentucky, Illinois, and West Virginia (EIA Aug 2008). However, Executive Orders issued by Florida's Governor in July 2007 requiring a significant reduction in greenhouse gas emissions in Florida, may hinder the approval to build a new advanced coal technology plant in Florida (FPL Apr 2010).

9.2.2.9.6 Potential Environmental Impacts

The environmental impacts of construction of a typical pulverized coal-fired steam plant are well known because coal-fired steam plants represent approximately half of the electrical generation in the United States (EIA Apr 2009). The combustion of coal creates several by-products that are damaging to the air quality of the environment, including sulfur dioxides, nitrogen oxides, carbon dioxide, mercury and other trace metals, ash, and volatile organic compounds (NRRI Feb 2007).

Coal-fired power plants use large quantities of water for producing steam and for cooling (U.S. EPA Dec 2007). A coal-fired plant uses approximately 600 gallons of water per megawatt-hour of generation (EPRI Mar 2002). When the water used in the power plant is discharged to a lake or river, the pollutants in the water can harm fish and plants (U.S. EPA Dec 2007). This water may contain trace levels of metals or chemicals and may be at a higher temperature than the source water into which it is discharged (NRRI Feb 2007). Life cycle impacts are also associated with the mining and transportation of coal. Coal mining impacts include air quality impacts from fugitive dust, water quality impacts from acidic runoff, and aesthetic and cultural resource impacts (NUREG-1437). While impacts from the transportation of coal include air quality impacts from the emissions produced during transport, environmental impacts from the transportation of coal by barge would also include aquatic ecology and water impacts.

9.2.2.9.7 Conclusions

Based on the analysis, pulverized coal boiler technology is a potentially competitive alternative to the proposed nuclear project. Based on ample fuel availability, generally understood environmental impacts associated with constructing and operating a coal-fired power generation plant, and good plant efficiencies, a pulverized coal-fired power plant is considered a potentially competitive alternative and is, therefore, examined further in Subsection 9.2.3.

However, because of the lower operating temperature of the fluidized bed system—thus its lower efficiency levels in relation to the conventional pulverized coal boilers—and the limited size of available units, fluidized bed is not a potentially competitive alternative for the proposed nuclear project.

9.2.2.10 Natural Gas

9.2.2.10.1 Overview

There are several commercially mature generation technologies that use natural gas as fuel, as described below:

- Gas-fired steam generator technology uses combustion to heat water to produce pressurized steam, which rotates a generator to produce electricity. Because of the much lower energy efficiencies of steam gas facilities, this technology is being replaced, in particular with combined cycle technology.

- In simple-cycle combustion turbine technology, fuel is burned in a combustion turbine and the resulting hot gases rotate the turbine to generate electricity before being emitted to the air. Simple combustion gas turbine systems are not efficient enough to be economically viable for baseload applications.

- Combined-cycle technology uses a combination of combustion turbine technology and steam generator technology. In the combined-cycle unit, hot combustion gases in the turbine rotate the turbine to generate electricity, and waste combustion heat from the turbine is routed through a heat recovery steam generator. There, water is turned to steam that rotates a steam turbine to generate additional electricity. Combining two cycles in the generation of electricity improves the overall thermal efficiency by as much as 50 percent over simpler, straight combustion gas turbines (NRRI Feb 2007).

9.2.2.10.2 Current Technology Status

Since the early 1990s, gas-fired power plants have comprised more than 90 percent of new generation capacity in the United States (NRRI Feb 2007). Natural gas-fired electric plants now account for the largest percentage of the U.S. electric power net summer capacity at 39.5 percent, but generated only 21.6 percent of the nation's electricity in 2006 (EIA Apr 2009). This low use is caused by the high prices for natural gas in recent years, making it more economical to produce electricity using other fuels and using gas-fired plants during periods of high demand. Recent studies indicate that when natural gas prices exceed $6 per thousand cubic feet, gas-fired combined cycle units lose their competitiveness with other technologies, particularly pulverized coal units (NRRI Feb 2007). In 2007, the average annual price of natural gas used for electric power generation was $7.30 per thousand cubic feet (EIA Jul 2008a).

9.2.2.10.3 Ability to Serve Regional Needs

Natural gas accounts for approximately 27 percent of Florida's net power generation (EIA Aug 2008). Florida receives most of its natural gas supply from other Gulf Coast States via two major interstate pipelines: the Florida Gas Transmission line, which runs from Texas through the Florida panhandle to Miami, and the Gulfstream pipeline, an underwater link from Mississippi and Alabama to central Florida. With the completion of the Cypress pipeline in May 2007, the Jacksonville area has also begun receiving supplies from the liquefied natural gas import terminal at Elba Island, Georgia. Because Florida's natural gas supply is vulnerable to disruption from hurricanes and tropical storms, to safeguard against these threats and meet energy demand, FPL is considering the option of constructing a third natural gas pipeline along the eastern portion of the state.

Florida's natural gas consumption is high and has grown rapidly in recent years, due primarily to increasing demand from the electric power sector. To help meet Florida's growing demand for natural gas, companies have proposed building new liquefied natural gas import terminals in the federal waters off of Florida's Atlantic and Gulf Coasts, and on the nearby islands of the Bahamas (EIA Aug 2008). There is an extensive infrastructure for distribution and abundant resources available for a large baseload combined cycle gas-fired power plant. However, Executive Orders issued by Florida's Governor in July 2007 requiring a significant reduction in greenhouse gas emissions in Florida, may hinder the approval to build a gas-fired power plant in Florida (FPL Apr 2010).

9.2.2.10.4 Potential Environmental Impacts

Combustion of natural gas produces nitrogen oxides and carbon dioxide, but in lower quantities than burning coal or oil (U.S. EPA Dec 2007b). The burning of natural gas in combustion turbines requires very little water and does not produce any water discharges. However, pollutants and heat build up in natural gas boilers and combined cycle systems. When these pollutants and heat reach certain levels, the water is often discharged into lakes or rivers (U.S. EPA Dec 2007b).

Gas-fired plants occupy approximately one-tenth the space of nuclear and pulverized coal plants. This partially explains the relatively low level of public opposition to combined cycle gas turbine plants relative to other baseload technologies (NRRI Feb 2007).

9.2.2.10.5 Conclusions

Because gas-fired generation, using combined-cycle turbines, is based on the use of well-known technology and generally has well-understood environmental impacts associated with construction and operation, it is a potentially competitive alternative to the proposed nuclear project. Gas-fired generation is examined further in Subsection 9.2.3.

9.2.2.11 Petroleum

9.2.2.11.1 Overview

Petroleum (oil) consumption in the electric power sector uses three main types of oil derivatives: distillate fuel oil, residual fuel oil, and petroleum coke. To produce electricity from oil, crude oil is initially removed from the ground by drilling deep wells and pumping it to the surface. The crude oil is then transported to a refinery where it is refined into a number of fuel products and where a number of the impurities such as sulfur, nitrogen, and metals are removed. From the refinery, oil is transported to power plants by barge, pipelines, trucks, or trains. At the power plants, several methods can be used to generate electricity from oil. One method is to burn the oil in boilers to produce steam that is used by a steam turbine to generate electricity. Alternatively, a more common method is to burn the petroleum in combustion turbines, similar to simple combustion gas turbine systems. Another technology is to burn the oil in a combustion turbine and use the hot exhaust to make steam to drive a steam turbine—called combined-cycle technology (U.S. EPA Sep 2008).

9.2.2.11.2 Current Technology Status

Petroleum-fired power plants are a commercially mature generation technology. Petroleum-fired power plants provided 1.6 percent of electricity generated in the United States in 2006 and accounted for approximately 5.6 percent of the electric power capacity (EIA Apr 2009). The high cost of petroleum has prompted a steady decline in its use for electricity generation in recent decades. Reliance on foreign sources of petroleum, future increases in petroleum prices, and competition for petroleum resources by the transportation and petrochemical industry are expected to make petroleum-fired generation less attractive than other power alternatives.

9.2.2.11.3 Ability to Serve Regional Needs

Most of Florida's crude oil production comes from fields in the northwestern panhandle, but the state also produces some crude oil from smaller fields in the south. Although companies have explored for oil and gas in the federal outer continental shelf south of Panama City, exploration activity has been dormant since 1995, when a litigation settlement returned 73 oil and gas leases in this area to the federal government. Florida has no oil refineries and relies on petroleum products delivered by tanker and barge to marine terminals near the state's major coastal cities. Due in part to Florida's tourist industry, demand for petroleum-based transportation fuels (i.e., motor gasoline and jet fuel) is among the highest in the United States (EIA Aug 2008). Though Florida petroleum reserves are approximately 0.3 percent of U.S. reserves, Florida ranks third among states in petroleum use, and approximately 73 percent of Florida petroleum consumption is for transportation. Florida production of electrical power from oil fluctuates between 12 and 17 percent (Mulkey Sep 2007).

9.2.2.11.4 Environmental Impacts

Construction and operation of a petroleum-fired plant would have environmental impacts. For example, NUREG-1437 estimates that construction of a 1000 MWe petroleum-fired plant would require approximately 120 acres. Construction and operation of a petroleum-fired plant would have comparable impacts on regional air quality and the aquatic environment as would a similar sized coal-fired plant.

9.2.2.11.5 Conclusions

Based on this analysis, petroleum energy technology is developed, proven, and would be available in Florida at the start of commercial operation of the proposed nuclear project. Although the land use requirements are relatively small, concerns related to fuel availability, along with the national policy to reduce foreign oil dependence, and the adverse environmental impacts to air and water quality led to the conclusion that petroleum energy technology is not a potentially competitive alternative.

9.2.2.12 Integrated Gasification Combined Cycle

9.2.2.12.1 Overview

Integrated Gasification Combined Cycle (IGCC) is an electric power generation process that combines modern gasification technology with both gas turbine and steam turbine power generation (combined-cycle). IGCC plants can be powered by many carbon-based fuels such as coal, petroleum coke, and biomass. Gasification uses steam and oxygen to convert the fuel into synthesis gas (syngas) in a high-temperature, high-pressure chamber. Syngas is a mixture of carbon dioxide, carbon monoxide, and hydrogen, of which the last two are the primary combustible components. The syngas is burned in a combustion turbine and the hot exhaust gas from the turbine is routed to a heat recovery steam generator, where it produces steam to power a steam turbine. Electricity is produced in both cycles via generators, powered by the gas turbine and the steam turbine, thus the term combined cycle. IGCC plants are suitable for baseload operation because they combine low cost fuels and high output (NRRI Feb 2007).

9.2.2.12.2 Current Technology Status

IGCC power plants are in the early stages of commercialization. There are currently two commercial-size, coal-based IGCC plants in the United States. Both were supported initially under the DOE Clean Coal Technology demonstration program, but now operate commercially without DOE support (CEUS Jul 2006). The nameplate capacity of existing and planned units typically ranges from 250 MW to 630 MW (NRRI Feb 2007).

Experience has been gained with the chemical processes of gasification, fuel properties, and their impact on the IGCC design, efficiency, and economics. However, system reliability is still relatively lower than conventional coal-fired power plants, and the major reliability problem is related to the gasification section. There are also problems with the combination of gasification and power production systems. For example, if the gases are not adequately cleaned, they can cause damage to the gas turbine (PERMG Jun 2005).

9.2.2.12.3 Ability to Serve Regional Needs

As mentioned in Subsection 9.2.2.9, the United States has abundant low-cost coal reserves, and the price of coal for electric generation is projected to remain steady for the next 20 years (EIA Mar 2009). As described in Subsection 9.2.2.7, there is insufficient biomass feedstock available in the Florida to power a large baseload facility. Subsection 9.2.2.11 describes that petroleum coke sources are likely to be available economically in Florida. Further, IGCC technology has the ability to economically capture the sulfur in the carbon-based fuels; therefore, the process can be used to burn cheaper high-sulfur coal and petroleum-coke with less environmental impacts.

9.2.2.12.4 Environmental Impacts

IGCC technology is cleaner than any other coal-based fuel combustion technology because major pollutants can be removed from the gas stream before combustion (NRRI Feb 2007 and Ghosh Sep 2005). For example, the sulfur in the fuel is captured and removed as hydrogen sulfide in the gasifier via a conventional acid-gas removal system. The concentrated hydrogen sulfide can be recovered as elemental sulfur or sulfuric acid and sold as commercial by-product. The largest solid waste stream produced by IGCC installations is slag, a black, glassy, sand-like material that is potentially a marketable byproduct. Slag production is a function of the fuel's ash content. In this way, IGCC units do not produce ash or scrubber wastes. As much as 50 percent of the mercury in a feedstock is removed in IGCC systems, much of it bound in the slag and sulfur byproducts (NCC May 2001 and Ghosh Sep 2005). Land use concerns would be similar to conventional pulverized coal-fired power plants of the same capacity.

9.2.2.12.5 Conclusions

Based upon the analysis, IGCC technology has not matured sufficiently to support production for a large baseload facility. Both of the IGCC facilities that presently operate in the United States were supported with federal funds that would be unavailable for this IGCC alternative. Additionally, the system reliability associated with IGCC technology is considerably less than other carbon-based fuel-fired technologies. Thus, IGCC is not considered to be a potentially competitive alternative.

9.2.2.13 Conclusion

Based on the analysis of alternatives that require new generation, there are two potentially competitive alternatives identified—the pulverized coal-fired alternative and the combined cycle natural gas fired alternative—each is, therefore, retained for further analysis in Subsection 9.2.3. The remaining alternatives were eliminated either because they could not reasonably meet the demand as a baseload source, the technology was immature, or the technology was not viable in the region of interest.

9.2.3 ASSESSMENT OF COMPETITIVE ALTERNATIVE ENERGY SOURCES AND SYSTEMS

This subsection provides an analysis of the potentially competitive alternatives identified in Subsections 9.2.1 and 9.2.2 for comparison with the associated proposed nuclear project. The analysis of the potentially competitive alternatives is a two-step process:

1. The first step provides a comparison of the environmental and health impacts of the potentially competitive alternatives to the proposed action to determine if one or more of the identified potentially competitive alternatives can be expected to provide an appreciable reduction in overall environmental and health impacts, and/or offer solutions to potential adverse impacts predicted for the proposed project for which no mitigation procedure could be identified.

2. The second step includes a comparison of the economic costs of any potentially competitive alternatives found to be environmentally preferable to the proposed action to determine if an alternative is preferred/superior to the proposed project.

The alternatives assessed in Subsections 9.2.1 and 9.2.2 that were considered to be competitive and were identified for further analysis are: (1) pulverized coal-fired generation, (2) combined cycle gas-fired generation, and (3) a combination of alternatives. Completion of the first step of the analysis involves a determining or categorizing the environmental impacts associated with the potentially competitive alternative. This categorization of the environmental impacts associated with the identified alternatives and the proposed action was completed in accordance with the NRC established regulations for quantifying environmental impacts based on the Council on Environmental Quality Guidance, 40 CFR 1508.27, and those identified in 10 CFR Part 51, and in NUREG-1555. These regulations and guidance establish three significance levels for characterizing environmental impacts: SMALL, MODERATE, or LARGE. The definitions of the significance levels are as follows:

- SMALL — Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
- MODERATE — Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
- LARGE — Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

Consideration is given to ongoing and potential additional mitigation in proportion to the significance of the impact to be addressed (i.e., impacts that are SMALL receive less mitigative consideration than impacts that are LARGE).

9.2.3.1 Pulverized Coal-Fired Generation

Subsection 9.2.2.9 identified pulverized coal boiler technology as a potentially competitive alternative to the proposed nuclear project. The comparative pulverized coal-fired alternative consists of three boiler units, each with a net capacity of 728.4 MW. This configuration was chosen to equate to the proposed nuclear project net capacity and the natural gas-fired alternative described in Subsection 9.2.3.2, allowing for a valid comparison amongst the alternatives chosen and the proposed project. Table 9.2-1 details basic attributes chosen to complete a reasonable analysis of the pulverized coal-fired units. The boiler and emission control technology were chosen to yield the lowest emission factor for the pollutants of concern provided by the EPA AP-42 document, yielding a more favorable comparison for the alternative (U.S. EPA Jan 1995). For the purposes of this analysis, coal and limestone were assumed to be delivered by barge to the Turkey Point plant property.

9.2.3.1.1 Environmental Impacts

In accordance with NUREG-1555, the first step in the analysis is to make a determination as to whether the potentially competitive alternative is environmentally preferable. The results of this analysis are presented in this subsection. In conformance with NUREG-1555, an analysis of the following environmental impact categories is included for comparison with the proposed project:

air quality, waste management, land use, ecology, water use and quality, aesthetics, socioeconomics, historic and cultural resources, and environmental justice.

The NRC provides an overview of these environmental impact categories associated with the construction and operation of a coal-fired alternative in NUREG-1437. In summary, the NRC concludes that construction impacts could be substantial, due in part to the large land area required (which can result in natural habitat loss) and the large workforce needed; however, the installation of a new coal-fired plant where an existing nuclear plant is located would reduce many of these construction impacts. The analysis presented in NUREG-1437 also concludes that there are major adverse impacts from operations of a coal-fired plant such as human health concerns associated with air emissions, waste generation, and losses of aquatic biota as a result of cooling water withdrawals and discharges. NUREG-1437 also identifies socioeconomic benefits for the surrounding communities in the form of several hundred jobs, substantial tax revenues, and plant spending. In order to characterize the environmental impacts of the comparison pulverized coal-fired plant, a more detailed evaluation of the particular comparison plant, taking into account the conclusions presented in NUREG-1437, is provided below.

Air Quality

Air quality impacts of coal-fired generation are considerably different from those of nuclear power and can potentially be significant, as depicted in NUREG-1437. A coal-fired plant would emit:

- Acid rain precursors—(sulfur dioxides, as sulfur oxide surrogate) and nitrogen oxides
- Criteria (health based) air pollutants—particulate matter, carbon monoxide, sulfur dioxides, and an ozone precursor, nitrogen oxide
- Hazardous air pollutants—mercury (Hg), and the naturally occurring radionuclides—uranium-238 and thorium-232
- Greenhouse gases —mainly CO_2 which has been linked to global climate change

As Table 9.2-1 indicates, and for the purpose of this analysis, it is assumed a plant design would minimize air emissions through a combination of boiler technology and post-combustion pollutant removal. The analysis indicates that the comparison pulverized coal-fired alternative would burn an estimated 5.72 million tons of coal per year and produce the following emissions:

Pollutant	Emissions
Nitrogen Oxide	1387 tons per year
Sulfur Dioxides	7499 tons per year
Carbon Monoxide	1430 tons per year
PM_{10}[(a)]	58 tons per year
$PM_{2.5}$[(b)]	15 tons per year
Carbon Dioxide	14 million tons per year
Mercury	0.24 tons per year

(a) Particulates with an aerodynamic diameter of less than 10 microns
(b) Particulates with an aerodynamic diameter of less than 2.5 microns

These emission totals for the potentially competitive alternative are calculated based on the parameters and assumptions identified in Table 9.2-1 and emission factors published in AP-42 (U.S. EPA Jan 1995).

Thus, the pulverized coal-fired comparison plant would emit several of the regulated criteria air pollutants. Criteria air pollutants are regulated in the Clean Air Act. The Clean Air Act required the EPA to set national ambient air quality standards (NAAQS) for six common air pollutants known as criteria pollutants: particle pollution, or particulate matter, ground-level ozone, carbon monoxide, sulfur oxides, nitrogen oxides, and lead. For each of these six criteria air pollutants, the EPA has set primary (health-based) standards and/or secondary (environmental and property damage) standards. Areas of the country in violation of NAAQS primary standards are designated as non-attainment areas, and new sources to be located in or near these areas may be subject to more stringent air permitting requirements. Florida does not have regions that are designated as non-attainment with respect to the NAAQS for one or more criteria pollutants. New sources of criteria air pollutants would need to be considered to prevent significant deterioration or increases above the air quality baseline before permitting a pulverized coal-fired plant (U.S. EPA Apr 2008).

The pulverized coal-fired comparison plant would also emit significant sulfur dioxides and nitrogen oxide emissions, both acid rain precursors, and would be subject to the requirements in Title IV of the Clean Air Act. Title IV of the Clean Air Act was enacted to reduce emissions of sulfur dioxides and nitrogen oxide, the two principal precursors of acid rain. The acid rain requirements of the Clean Air Act amendments established a cap on the allowable sulfur dioxides emissions from power plants. Each company with fossil fuel-fired units was allocated sulfur dioxide allowances. To be in compliance with the Act, companies must hold enough allowances to cover their annual sulfur dioxides emissions. The Clean Air Act amendments also implemented a technology-based emission reduction program for nitrogen oxide aimed at achieving emission reductions through compliance with emission limitations (U.S. EPA Apr 2008). In 2007, emissions from generators in Florida ranked third nationally (in thousand metric tons) and 28th nationally (in lbs/MWh—for nitrogen oxide emissions). While for sulfur dioxide emissions, Florida ranked 11th highest nationally (in thousand metric tons) and 31st nationally (in lbs/MWh) for sulfur dioxide emissions (EIA Apr 2009). Both sulfur dioxides and nitrogen oxide emissions would increase if a new coal-fired plant were operated at Turkey Point. To operate a fossil-fuel generation plant, FPL would have to purchase sulfur dioxide allowances from the open market or shut down existing fossil-fired capacity from one of its other plants and apply the credits from that plant to the new one. Additionally, technology based nitrogen oxide limitations would have to be met.

The emission of nitrogen oxide, sulfur dioxides, and mercury from the pulverized coal-fired comparison plant may potentially be impacted by additional pieces of legislation. In March 2005, the EPA promulgated two rules as part of the Clear Skies initiative—the Clean Air Interstate Rule (CAIR) and the Clean Air Mercury Rule (CAMR). Although both CAIR and CAMR have been vacated, consideration of the possible impacts of potentially similar regulations is warranted. The CAIR rule addressed power plant nitrogen oxide and sulfur dioxide emissions that contribute to non-attainment of the 8-hour ozone and fine particulate matter standards in downwind states. Twenty-eight states, including Florida, would have been subject to the requirements of the rule. On July 11, 2008, the D.C. Court issued an opinion vacating and remanding these rules; however, parties to the litigation requested rehearing of aspects of the Court's decision, including the vacatur of the rules. On December 23, 2008, the Court granted rehearing only to the extent that it remanded the rules to EPA without vacating them. It is anticipated that promulgation of a rule similar to the CAIR would yield the following analogous emission reduction requirements—emission reductions of nitrogen oxide by over 60 percent and sulfur dioxide emissions by over 70 percent would be required. These reductions would be accomplished by the installation of additional emission controls at existing coal-fired facilities or by the purchase of emission allowances from a cap-and-trade program (U.S. EPA Mar 2009).

The second rule of legislation the U.S. EPA issued, the CAMR, addressed mercury emissions, a regulated hazardous air pollutant—also potentially emitted by the pulverized coal-fired comparison plant. CAMR would have set emissions limits on mercury to be met in two phases beginning in 2010 and 2018, and encouraged a cap and trade approach to achieve the target emission limits. On February 8, 2008, the D.C. circuit court vacated the EPA’s CAMR. On February 6, 2009, the Department of Justice, on behalf of EPA, asked the Supreme Court to dismiss EPA's request that the Court review the D.C. Circuit Court's vacatur of the CAMR. Promulgation of a rule similar to CAMR would yield the following analogous emission reduction requirements to the March 2005 rule—during the first phase cap in 2010, mercury will be reduced by taking advantage of “co-benefit” reductions required in CAIR— nitrogen oxide and sulfur dioxide controls indirectly help to reduce mercury emissions. The second phase cap in 2018 would reflect a level of mercury emission reductions that exceed the level that would be achieved solely as a co-benefit of controlling nitrogen oxides and sulfur dioxides under CAIR. Each new coal-fired electrical generation unit in Florida would be required to acquire enough mercury allowances to cover its annual mercury emissions (U.S. EPA Mar 2009b).

The pulverized coal-fired comparison plant would also emit large quantities of greenhouse gases, particularly carbon dioxide. Recent concern over the emissions of greenhouse gases and their effect on climate change is leading to legislation requiring the reduction of greenhouse gas emissions. In fact, Executive Orders issued by Florida's Governor in July 2007 require a significant reduction in greenhouse gas emissions in Florida. These orders include a goal of providing 20 percent of the energy produced by electric utilities from renewable, non-emitting sources and requiring a significant reduction in greenhouse gas emissions by 2017. Therefore, new advanced coal technology power plants may no longer be seen as viable options in Florida (FPL Apr 2010).

NUREG-1437 identified that air quality from a coal-fired alternative would be impacted by releases of radionuclides. Radionuclides are among the hazardous air pollutants included in section 112 (b) of the Clean Air Act amendments. The three major fossil fuels—coal, oil, and natural gas—contain varying quantities of the naturally occurring radionuclides of the uranium-238 and thorium-232 series and potassium-40. When these fuels are burned to produce steam in the production of electricity, radionuclides are entrained in the combustion gases and may be emitted into the environment. The decay series of uranium and thorium constitute the major radionuclides contained in coal. A national database of nearly 7000 coal samples was analyzed with regard to the uranium and thorium content of the major ranks of coal used by utilities. Bituminous coal, the coal assumed to be used in the comparison plant, had an average content of 1.24 ppm uranium and 2.18 ppm thorium, with a corresponding activity of 0.41 picoCuries per gram (pCi/g) for each member of the U-238 series and 0.24 pCi/g for each member of the Th-232 series. The EPA assessed the exposure and risks as a result of radionuclide emissions from utilities and decided not to regulate radionuclide emissions from coal-fired boilers. The radionuclide content of coal is not unique when compared to other natural materials. In fact, it is generally assumed that the average radioactivity of the earth's crust (i.e., soil and rocks) is approximately twice that of coal (U.S. EPA Feb 1998).

NUREG-1437 also identified that temporary fugitive dust would be generated during construction of a coal-fired plant. Exhaust emissions would come from vehicles and equipment used during the construction process. In addition, during operations, coal-handling equipment would introduce fugitive particulate emissions.

Thus, air impacts from a coal-fired generation facility would be substantial. Adverse human health effects from coal combustion have led to important federal legislation in recent years because public health risks, such as cancer and emphysema, have been associated with coal combustion. Global warming and acid rain are also potential impacts. Recent changes in air quality regulations indicate that the EPA and the federal government recognize the importance of stability for air resources. However, a new pulverized coal-fired generating plant would need to obtain a New Source Review and Prevention of Significant Deterioration construction permit and the plant would need an operating permit issued under Title V of the Clean Air Act. These permits would establish limits to prevent substantial air quality impacts from the pulverized coal-fired alternative.

Thus, the coal-fired alternative would have MODERATE impacts on air quality. The impacts may be noticeable, but would not destabilize air quality in the area as a result of the use of mitigation technologies and compliance with issued permits.

Waste Management

The pulverized coal-fired alternative would generate substantial solid waste in the form of ash from coal combustion and scrubber sludge from air pollution controls. Based on the assumed plant parameters, the potentially competitive coal comparison plant would annually consume approximately 5.72 million tons of coal with an ash content of 8.94 percent. Particulate control equipment would collect most (99.9 percent) of this ash (approximately 510,906 tons per year). According to the EPA, approximately 30 percent of the ash produced by coal-fired power plants is recycled (U.S. EPA Jul 2008). Assuming this amount of waste mitigation, a new pulverized coal-fired plant at Turkey Point would recycle approximately 153,272 tons of coal ash per year and an annual total of approximately 357,634 tons of ash would require disposal.

For comparison purposes, it was assumed that the potentially competitive pulverized coal plant would be equipped with a wet flue gas desulfurization system with forced air oxidation using limestone as a reagent. (The wet flue gas desulfurization system would be located after the particulate matter control equipment [filter baghouse].) The wet flue gas desulfurization control removal technology with a forced-air oxidation system generates a large amount of gypsum waste that would need to be recycled or disposed of in a landfill (Buecker Aug 2006). Forced-oxidized systems produce gypsum (calcium sulfate dihydrate, whereas unoxidized systems will produce a wet material that is comprised of calcium sulfite with varying levels of calcium sulfate (EERC Dec 2007). The American Coal Ash Association reported that over 79 percent of the flue gas desulfurization gypsum was beneficially used in 2006. The major beneficial use of gypsum is wallboard. In addition to building materials, gypsum can be used for a variety of civil engineering applications from road construction to agricultural applications such as soil conditioners, nutritional sulfur, and fertilizer absorption enhancers (ACAA Aug 2006 and U.S. EPA Mar 2008). The comparison plant flue gas desulfurization control equipment would require approximately 234,107 tons of limestone a year to mitigate sulfur oxide emissions and would generate 402,708 tons per year of waste in the form of gypsum. Assuming 79 percent of the waste is recycled as a mitigation measure, Turkey Point would recycle approximately 318,140 tons of gypsum under the pulverized coal-fired alternative and an annual total of 84,569 tons of gypsum would require disposal. Ash and gypsum waste disposal over a 60-year plant life would require approximately 380 acres, primarily for ash disposal—assuming a landfill height of 30 feet (U.S. EPA Jul 2008).

With proper facility placement, along with current waste management and monitoring practices, waste disposal would not destabilize any resources. After closure of the waste site and revegetation, the land would be available for other uses. Waste disposal for the coal-fired alternative would have MODERATE impacts. The impacts of increased waste disposal would be clearly noticeable, but would not destabilize any important resource and further mitigation of the impact would be unwarranted.

Land Use

NUREG-1437 estimates that approximately 1700 acres and the associated terrestrial habitat would be impacted during the construction of a 1000 MW coal-fired power plant and an additional 22,000 acres for mining the coal and disposing of the waste could be committed to supporting a coal plant during its operational life. Because most of this construction would be in previously disturbed areas, impacts would be minimal. As with any large construction project, some erosion, sedimentation, and fugitive dust emissions could be anticipated, but would be minimized through application of best management practices that minimize soil loss and restore vegetation after construction (NUREG-1437).

Thus, land use impacts from construction and operation of the pulverized coal-fired alternative would be MODERATE.

Ecology

During construction of the pulverized coal-fired alternative, construction impacts would alter the ecology. Ecological impacts to a plant site could include impacts on threatened or endangered species, wildlife habitat loss, reduced wildlife reproduction, habitat fragmentation, and a local reduction in biodiversity. There could be impacts to terrestrial ecology from cooling tower drift. There would also be aquatic ecology impacts from the transport of coal by barge to the site. It is estimated that approximately 272 barge deliveries to the site per year would be required, assuming the capacity of each coal barge is 21,000 tons (NREL Jun 1999). Most of the construction impacts would be avoided if a previously disturbed site such as Turkey Point is used (NUREG-1437).

Thus, the ecological impacts and impacts to threatened and endangered species would be SMALL to MODERATE, similar to the proposed project.

Water Use and Quality

Construction activities would disturb the land surface, which may temporarily affect surface water quality. Potential water quality impacts would consist of suspended solids from disturbed soils, biochemical oxygen demand, nutrient loading from disturbed vegetation, and oil and grease from construction equipment. Construction activities that disturb one acre or more would require a

National Pollutant Discharge Elimination System (NPDES) permit for stormwater discharges from the site. Provisions of the NPDES permit would ensure that best management practices are implemented to minimize impacts to surface waters during construction. A spill prevention, control, and countermeasures plan would be implemented to minimize water quality impacts from minor spills of fuel, hydraulic fluid, lubricants, paint, and other liquids. Construction would cause no appreciable consumption of surface water resources.

During operation of the pulverized coal-fired alternative, based on EPRI estimates, cooling tower water makeup water withdrawal would be approximately 18,450 gpm to 22,140 gpm and consumptive use through evaporation would be approximately 17,712 gpm (EPRI Mar 2002). This amount of water consumption would be taken from a combination of sources, reclaimed water and radial collector wells. Reclaimed water would come from a Miami-Dade County wastewater treatment plant that could potentially supply the required makeup water for the comparison pulverized coal-fired plant along with radial collector wells. Radial collector wells would be designed and sited to induce recharge from Biscayne Bay. The quality of the supply water from these sources would meet the regulatory requirement for use in industry.

The Boulder Zone within the lower Floridian aquifer could be used for discharge of blowdown effluents originally sourced from either saline or fresh water. The Boulder Zone has been used since 1977 to store vast quantities of treated sewage injected into it by Miami, Fort Lauderdale, and West Palm Beach. Currently, over 90 Class I injection wells are used to dispose over 400 million gallons/day of secondary wastewater in southeast Florida. The extremely high permeability associated with its cavernous nature prevents pressure buildup in injection wells, and its high salinity, make it an ideal zone for receiving injected wastes.

An underground injection control permit would be required for disposal of effluent through an underground injection well. This permit would establish conditions for discharging wastewater to the Boulder Zone. Stormwater runoff streams from the coal storage area, fly ash and bottom ash piles, and the gypsum storage area would be collected in a lined recycle basin for reuse with no direct discharge to the surface water. A spill prevention, control, and countermeasures plan would be implemented to minimize water quality impacts from minor spills.

Thus, water use and quality impacts would be SMALL.

Aesthetics

The pulverized coal-fired power block would be as high as 200 feet tall and the exhaust stack could be as high as 650 feet. The stack and associated plume would likely be visible in daylight hours for distances greater than 10 miles. The Federal Aviation Administration generally requires that structures exceeding an overall height of 200 feet above ground level have markings and/or lighting so as not to impair aviation safety. Visual effects of a new coal-fired plant at Turkey Point would be consistent with the industrial nature of the current site—located onsite are two nuclear units along with three oil and gas units.

Coal-fired generation introduces mechanical sources of noise that could be audible offsite. Sources contributing to total noise produced by plant operation are classified as continuous or intermittent. Continuous sources include the mechanical equipment associated with normal plant operations. Intermittent sources include the equipment related to coal handling, solid waste disposal, transportation related to coal and limestone delivery, use of outside loudspeakers, and the commuting of plant employees. Noise associated with barge transportation of coal and limestone would be minimal for the pulverized coal-fired alternative comparison plant. Noise and light from the pulverized coal-fired comparison plant may be detectable offsite, but these effects would be mitigated by the location of the comparison pulverized coal-fired plant in a relatively unpopulated area.

Thus, the aesthetic impacts associated with the pulverized coal-fired alternative would be SMALL.

Socioeconomics

Short-term socioeconomic impacts would result from the estimated 2500 peak construction workers to build the facilities, and long-term impacts would result from the estimated 250 full-time workers to operate the coal-fired facility (NUREG-1437).

During construction, the communities immediately surrounding the plant site would experience demands on housing and public services that could have noticeable impacts. NUREG-1437 states that socioeconomic impacts at a rural site would be greater than at an urban site, because more of the peak construction workforce would need to move to the area to work. New construction could have a negative impact on availability and cost of housing and after construction, the communities would be affected by the loss of jobs (NUREG-1437). Transportation impacts would be temporary, noticeable, but not destabilizing during plant construction and small during plant operation.

Miami-Dade County would benefit from tax payments for the new pulverized coal-fired comparison plant and, depending on how these are distributed, this could help address socioeconomic impacts.

Thus, socioeconomic impacts associated with constructing and operating the pulverized coal-fired alternative would be MODERATE (adverse) to LARGE (beneficial).

Historic and Cultural Resources

The potential impacts of new plant construction on historic and archaeological resources have been described and evaluated for the proposed project, Units 6 & 7 in Subsection 2.5.3 and 4.4.3. Cultural resource impacts would be unlikely because of the previously disturbed nature of the site and could be, if needed, minimized by survey and recovery techniques.

Thus, cultural resource impacts associated with constructing and operating the pulverized coal-fired alternative at Turkey Point and associated transmission corridors would be SMALL.

Environmental Justice

Environmental justice impacts would depend on the nearby population distribution. Environmental justice impacts have been described and evaluated for the proposed project in Subsections 2.5.3 and 4.4.3.

Thus, environmental justice impacts associated with constructing and operating the pulverized coal-fired alternative at Turkey Point and associated transmission corridors would be SMALL.

9.2.3.1.2 Human Health Effects

As NUREG-1437 states, human health effects associated with coal combustion include public health risks such as cancer and emphysema. Concerns over adverse human health effects from coal combustion have led to federal legislation in recent years. The principal pollutants generated by coal combustion that can cause health problems are particulates, sulfur oxide, and nitrogen oxide, mercury, trace elements (including arsenic, fluorine, selenium, and the radionuclides uranium and thorium), and organic compounds generated by incomplete coal combustion.

Nitrogen oxide emissions contribute to ozone formation, which in turn contributes to health risks. Ozone can irritate respiratory systems, reduce lung function, aggravate asthma, inflame and damage cells that line the lungs, and may cause permanent lung damage (U.S. EPA Sep 2008b). Additionally, exposure to fine particulates, $PM_{2.5}$ —sulfur dioxides are a precursor to fine particulates—has been associated with reduced lung function and chronic bronchitis; and, in people with heart disease, short-term exposure has been linked to heart attacks and arrhythmias (U.S. EPA Sep 2008c).

Recently, the EPA conducted a detailed study of possible health impacts from exposure to emissions of approximately 20 potentially toxic substances from coal-burning electric utilities. The EPA used U.S. Geological Survey (USGS) information on U.S. coal quality to assess the potential health impacts of approximately 14 potentially toxic trace elements that may be mobilized by coal combustion. The EPA concluded that, with the possible exception of mercury, there is no compelling evidence to indicate that emissions from U.S. coal-burning electric utilities cause human health problems in relation to toxic pollutants of concern (USGS Jul 2000).

Regulatory agencies, including the EPA and state agencies, set air emission standards and requirements based on human health and environmental impacts for the criteria air pollutants. These agencies also impose site-specific emission limits as needed to meet the health standards.

Thus, with the limits imposed for the regulated constituents of air emissions, human health impacts from burning coal at a newly constructed coal-fired plant would be SMALL.

9.2.3.1.3 Design Alternatives

The location of Turkey Point lends itself to coal delivery by barge. Subsection 9.4.1 analyzes alternative designs for the Units 6 & 7 heat dissipation systems. Based on this analysis, a cooling tower was assumed to be used for the pulverized coal-fired alternative.

9.2.3.1.4 Conclusion

The impacts of the pulverized coal-fired alternative are compared to the proposed nuclear project in Table 9.2-3. As the comparison in these tables demonstrates, the pulverized coal-fired alternative is not environmentally preferable to the proposed nuclear project. Therefore, an economic cost comparison is not warranted.

9.2.3.2 Natural Gas Generation

As identified in Subsection 9.2.2.10, gas-fired generation using combined-cycle turbines has been identified as a potentially competitive alternative to the proposed project. The gas-fired alternative would be located at the site for the proposed nuclear project. It would be comprised of three 728.4 MW net capacity natural gas combined cycle units for comparison with the proposed project. Table 9.2-2 details basic attributes chosen to complete a reasonable analysis of the natural gas-fired units. The emission control technology selected was chosen to yield the lowest emission factor for the pollutants of concern provided by the EPA AP-42 document, yielding a more favorable comparison for the alternative. The gas-fired alternative defined in Subsection 9.2.2.10 would be located on land adjacent to an 1100 MW unit, Unit 5, natural gas combined-cycle unit exists along with the associated pipeline (U.S. EPA Jan 1995).

9.2.3.2.1 Environmental Impacts

The NRC provides an overview of the environmental impacts associated with natural gas-fired plants. Land use impacts from gas-fired units would be less than those of the coal-fired alternative. Reduced land requirements as a result of construction on the existing site and a smaller facility footprint would reduce impacts to ecological, aesthetic, and cultural resources. As described, an incremental increase in the workforce could have socioeconomic impacts. Human health effects associated with air emissions would be of concern, but the effect would be less than those of coal-fired generation (NUREG-1437). An evaluation of the environmental impacts related to the potentially competitive combined-cycle gas-fired plant is presented below.

Air Quality

As indicated in NUREG-1437, natural gas combustion is relatively clean compared to other fossil fuel combustion. Also, because the heat recovery steam generator does not receive supplemental fuel, the combined-cycle operation is highly efficient versus the coal-fired alternative. Therefore, the gas-fired alternative would release similar types of emissions, but generally in quantities less than the coal-fired alternative (NUREG-1437). Control technology for gas-fired turbines focuses on the reduction of nitrogen oxide emissions. The comparative gas-fired alternative would use approximately 104 billion standard cubic feet of natural gas per year and would generate these emissions:

Pollutant	Emissions
Nitrogen Oxide	584 tons per year
Sulfur Dioxides	35 tons per year
Carbon Monoxide	121 tons per year
$PM_{2.5}$[(a)]	101 tons per year
Carbon Dioxide	5.9 million tons per year

(a) Particulates with an aerodynamic diameter of less than 2.5 microns—all particulates are $PM_{2.5}$

These emission totals for the competitive alternative are calculated based on the parameters and assumptions identified in Table 9.2-2 and emission factors published in AP-42 (U.S. EPA Jan 1995).

As described in Subsection 9.2.3.2, the potentially competitive natural gas combined-cycle plant would also have to meet requirements of the Clean Air Act regarding both the criteria air pollutants and acid rain requirements. The emission reductions required in potentially new legislation would also apply to the competitive combined-cycle gas-fired generation plant—analogous to the CAIR. Additionally, similar to the pulverized coal-fired alternative, the combined-cycle gas-fired alternative would also need to obtain and meet New Source Review and Prevention of Significant Deterioration requirements and operational requirements in a Title V operating permit.

Similar to the pulverized coal-fired comparison plant, the combined cycle gas-fired alternative would also emit large quantities of greenhouse gases, although in much less quantities than the coal-fired alternative. As described in Subsection 9.2.3.1, Executive Orders issued by Florida's

Governor in July 2007 require a significant reduction in greenhouse gas emissions in Florida. These orders include a goal of providing 20 percent of the energy produced by electric utilities from renewable, non-emitting sources and requiring a significant reduction in greenhouse gas emissions by 2017. Therefore, approval for a new combined cycle gas-fired power plants may prove challenging in Florida (FPL Apr 2010).

Thus, the combined cycle gas-fired alternative would have MODERATE impacts on air quality. The impacts may be noticeable, but would not destabilize air quality in the area due the use of mitigation technologies and compliance with permits.

Waste Management

In NUREG-1437, an analysis of environmental impacts from waste generation from gas-fired plants concludes that the impact would be minimal. The only significant solid waste generated at a new gas-fired plant would be spent selective catalytic reduction catalyst used to control nitrogen oxide emissions, portions of which could be regenerated or recycled. Other then spent selective catalytic reduction catalyst, waste generation at an operating natural gas-fired plant would largely be limited to construction debris during construction and typical office wastes. These impacts would be so minor that they would not noticeably alter any important resource attribute.

Thus, the solid waste impacts associated with a combined cycle natural gas-fired alternative would be SMALL.

Land Use

Similar to the coal-fired alternative, the ability to construct the gas-fired alternative on land adjacent to Turkey Point would reduce construction-related impacts relative to construction on a greenfield site. NUREG-1437 estimates that the gas-fired alternative would impact approximately 110 acres of land and associated terrestrial habitat for plant requirements and approximately 3600 acres of additional land would be required for gas wells, collection stations, and pipelines. A new pipeline corridor would not need to be constructed. An existing 24-inch transmission pipeline located at Turkey Point, which serves Unit 5, is present and utilization of the existing corridor would minimize additional land use impacts. Construction impacts would be minimized through the application of best management practices that minimize soil loss and restores vegetation immediately after the excavation is backfilled.

Thus, land use impacts for construction and operation of the combined cycle gas-fired alternative would be SMALL.

Ecology

The gas-fired alternative would introduce construction impacts and new incremental operational impacts, which may alter the ecology of the surrounding environment. Ecological impacts to a plant site could include impacts on threatened or endangered species, wildlife habitat loss, reduced wildlife reproduction, habitat fragmentation, and a local reduction in biological diversity. Most of these impacts would be avoided, however, due to the disturbed nature of Turkey Point (NUREG-1437).

Thus, the ecological impacts and impacts to threatened and endangered species would be SMALL.

Water Use and Quality

Construction activities would disturb land surface, which may temporarily affect surface water quality. Potential water quality impacts would consist of suspended solids from disturbed soils, biochemical oxygen demand, nutrient loading from disturbed vegetation, and oil and grease from construction equipment. Construction would require an NPDES permit for stormwater discharges from the site. Provisions of the NPDES permit would ensure implementation of best management practices to minimize impacts to surface waters during construction. Runoff detention ponds would be designed to detain runoff within the containment areas to allow for settling and to reduce peak discharges. A spill prevention, control, and countermeasures plan would be implemented to minimize water quality impacts from minor spills of fuel, hydraulic fluid, lubricants, paint, and other liquids. Although the spill prevention control and countermeasures plan would be primarily intended to prevent spills from reaching navigable waters, it would also mitigate impacts on local groundwater because any spills would be quickly responded to and not permitted to penetrate to groundwater. Construction would cause no appreciable consumption of surface water resources.

During operation of the gas-fired alternative, based on the EPRI estimates, cooling tower makeup water withdrawal would be approximately 8487 gpm and consumptive use through evaporation would be approximately 6642 gpm (EPRI Mar 2002). This amount of water consumption would be taken from a combination of sources, reclaimed water and radial collector wells. Reclaimed water would come from a Miami-Dade County wastewater treatment plant that could potentially supply the required makeup water for the comparison gas-fired plant along with radial collector wells that would be designed and sited to induce recharge from Biscayne Bay. The quality of the supply water from these sources would meet the regulatory requirement for use in the industry.

The Boulder Zone within the lower Floridian aquifer could be used for discharge of blowdown effluents originally sourced from either saline or fresh water. The Boulder Zone has been used since 1977 to store vast quantities of treated sewage injected into it by Miami, Fort Lauderdale, and West Palm Beach. Currently, over 90 Class I injection wells are used to dispose over 400 million gallons/day of secondary wastewater in southeast Florida. The extremely high permeability associated with its cavernous nature prevents pressure buildup in injection wells, and its high salinity makes it an ideal zone for receiving injected wastes.

An underground injection control permit would be required for disposal of effluent through an underground injection well. This permit would establish conditions for discharging wastewater to the Boulder Zone. A spill prevention control and countermeasures plan would be implemented to minimize water quality impacts from minor spills.

Thus, water use and quality impacts would be SMALL.

Aesthetics

Aesthetic impacts would be similar to the pulverized coal-fired alternative, but smaller because of the reduced site size. The gas-fired units' steam turbine building would be approximately 100 feet high. The tallest structure would be the 150-foot-high auxiliary boilers and heat recovery steam generator stacks. These structures would not alter the visual effects of existing two nuclear units along with three oil and gas units located at Turkey Point.

Thus, the aesthetic impacts associated with the gas-fired alternative would be SMALL.

Socioeconomics

Short-term socioeconomic impacts would result from the estimated 1200 peak construction workers to build the facilities, and long-term impacts would result from the estimated 150 full-time workers to operate the gas-fired facility (NUREG-1437).

Similar to the pulverized coal-fired alternative, during construction, the communities immediately surrounding the plant site would experience demands on housing and public services that could have noticeable impacts. New construction could have a negative impact on availability and cost of housing and after construction, and the communities would be affected by the loss of jobs (NUREG-1437).

Miami-Dade County would benefit from tax payments for the new gas-fired comparison plant and, depending on how these tax payments are distributed, this could help address socioeconomic impacts.

Transportation impacts would be temporary, noticeable, and destabilizing for brief periods during plant construction and small during plant operation.

Thus, socioeconomic impacts associated with constructing and operating the gas-fired alternative would be MODERATE (adverse) to MODERATE (beneficial).

Historic and Cultural Resources

The potential impacts of new plant construction on historic and archaeological resources have been described and evaluated for the proposed project in Subsections 2.5.3 and 4.4.3. Cultural resource impacts would be unlikely due to the previously disturbed nature of the site and could be, if needed, minimized by survey and recovery techniques.

Thus, cultural resource impacts associated with constructing and operating the gas-fired alternative at Turkey Point and associated transmission corridors would be SMALL.

Environmental Justice

Environmental justice impacts would depend on the nearby population distribution. Environmental justice impacts have been described and evaluated for the proposed project in Subsections 2.5.3 and 4.4.3.

Thus, environmental justice impacts associated with constructing and operating the gas-fired alternative at Turkey Point and associated transmission corridors would be SMALL.

9.2.3.2.2 Human Health Effects

In NUREG-1437, the NRC identified cancer and emphysema as potential health risks from gas-fired plants. Nitrogen oxide emissions contribute to ozone formation, which in turn contributes to health risks. Ozone can irritate respiratory systems, reduce lung function, aggravate asthma, inflame and damage cells that line the lungs, and may cause permanent lung damage (U.S. EPA Sep 2008b). Nitrogen oxide emissions from any plant would be regulated by the state or EPA. Exposure to fine particulates, $PM_{2.5}$, has been associated with reduced lung function and chronic bronchitis; and, in people with heart disease, short-term exposure has been linked to heart attacks and arrhythmias (U.S. EPA Sep 2008c).

Regulatory agencies, including the EPA and state agencies, set air emission standards and requirements based on human health and environmental impacts for the criteria air pollutants. These agencies also impose site-specific emission limits as needed to meet the health standards.

Thus, with the limits imposed for the regulated constituents of air emissions, human health impacts from a newly constructed gas-fired plant would be SMALL.

9.2.3.2.3 Design Alternatives

Combined-cycle plants use a combination of combustion turbine and heat recovery steam generators to generate power. Therefore, their heat rejection rates are substantially lower than comparably sized nuclear- and coal-fired steam generators. Consequently, combined-cycle plants with recirculated cooling systems generally use cooling towers rather than ponds.

9.2.3.2.4 Conclusion

The impacts of the potentially competitive combined-cycle gas-fired generation are compared to the proposed nuclear project in Table 9.2-3. As the comparison in this table demonstrates, the gas-fired alternative is not environmentally preferable to proposed nuclear project. As such, an economic cost comparison is not warranted.

9.2.3.3 Combination of Alternatives

As identified in NUREG-1555, consideration of combinations of individual alternatives available to the applicant should be analyzed with respect to environmental and health impacts for comparison with the proposed project to determine if any of the available combinations are environmentally preferable. This subsection reviews possible combinations of alternatives that could generate replacement baseload power instead of the proposed nuclear project. As previously stated, the nuclear project has a net capacity of approximately 2200 MW of electrical generation and is expected to supply baseload power to the Florida Public Service Commission region.

9.2.3.3.1 Determination of Alternatives

The selected combinations of alternatives were developed as potentially competitive alternatives to the proposed project, based on technological maturity, ability to serve regional needs, and suitability of the technology in the region of interest. As detailed in Subsection 9.2.2, individually, many of the alternatives would not be able to provide the baseload capacity required; however, a combination of these alternatives may be sufficient to provide the required baseload capacity equivalent to the proposed project.

When determining a plausible combination of alternatives, consideration was given to either a technology’s capability of supplying baseload power, or its ability to provide smaller environmental impacts. Because the proposed nuclear project would provide baseload capacity in a predictable, consistent manner, the alternative combination would need to provide the consistent baseload supply, and if coupled with a renewable energy source, environmental impacts may be reduced. Therefore, when determining a combination of alternative sources that includes a variable renewable source of energy, the alternative must be combined with an alternative capable of supplying baseload capacity, a fossil fuel-fired source. This allows the fossil fuel-fired portion to provide the entire load during times when the output of the renewable source of energy is reduced or unavailable. When available, the output of the renewable source may displace a portion of the baseload supply, and the output of the fossil fuel-fired portion can be reduced to accommodate the increase in renewable generation.

Of the renewable energy alternatives evaluated, only wind and solar are viable technologies in the region of interest. The remaining technologies were eliminated from further consideration because they were either not viable in the region of interest, the technology was not mature, and/or the environmental impacts would not be preferable to the proposed project. The two remaining renewable energy technologies, evaluated in Subsection 9.2.2, wind energy (Subsection 9.2.2.2) and solar energy (Subsection 9.2.2.3), individually were not considered potentially competitive alternatives as stand-alone technologies primarily because of each alternative's lack of ability to provide the required baseload capacity because of their intermittent capacity. However, as noted in the evaluation provided in Subsection 9.2.2, each technology is viable in the region of interest. In fact, FPL plans to pursue both wind and solar projects in the FPL service area. Therefore, for this portion of this analysis, wind and solar are considered as renewable power sources that can supplement a baseload capable source.

Of the fossil fuel alternatives evaluated, only coal (Subsection 9.2.2.9) and natural gas (Subsection 9.2.2.10) were technologically viable and could provide the required baseload capacity and, thus, were deemed potentially competitive alternatives. However, as the evaluations presented in Subsections 9.2.3.1 and 9.2.3.2 indicate, the coal and natural gas alternatives did not produce smaller environmental impact levels in comparison with the proposed project. Of the two technologies, natural gas has a smaller environmental impact. For this reason, in the environmental comparison portion of this combination alternative study, natural gas is used as the fossil fuel for baseload capacity.

Thus, this analysis examines the reduction in environmental impacts from a combined-cycle natural gas-fired facility when generation from the facility is displaced by a renewable resource—either wind or solar. The impacts of natural gas considered are those shown in Subsection 9.2.3.2. Also, the renewable part of the alternative combination is any combination of renewable technologies that could produce power equal to or less than the proposed nuclear project, when that resource is available.

9.2.3.3.2 Environmental Impacts

The overall environmental impacts associated with the construction and operation of the combined-cycle gas-fired alternative is addressed in Subsection 9.2.3.2 and summarized in Table 9.2-3. Depending on the amount of renewable output included in the combination alternative, the level of environmental impacts of the combined-cycle gas-fired alternative portion would be comparatively lower. If 100 percent of the power level of the proposed project was not available from the renewable alternative, some level of environmental impact associated with the combined-cycle gas-fired alternative remains. Alternatively, when 100 percent of the load is carried by the renewable portion, the environmental impact of the operation of the combined-cycle gas-fired alternative is eliminated.

A determination of the environmental impacts that a combination of these alternatives would have can be made from the previous evaluations provided in Subsections 9.2.2 and 9.2.3.2. The environmental impacts associated with a combined-cycle gas-fired facility and equivalent renewable wind and solar facilities are summarized in Table 9.2-3. Individually, the combined-cycle gas-fired facility has impacts that are greater than the proposed project. Some of the environmental impacts of the renewable energy sources are equal to or greater than those of the proposed nuclear project. Therefore, the combination of a gas-fired plant and wind or solar facilities would have environmental impacts that are equal to or greater than those of a nuclear facility.

Impacts from wind and solar facilities are described in Subsections 9.2.2.2 and 9.2.2.3, respectively. Land use impacts from wind and/or solar facilities could be SMALL to LARGE, and the aesthetic impacts of wind could be SMALL to LARGE, depending on the size of the facilities. Similarly, impacts of wind/solar facilities on ecological resources and threatened and endangered species could be SMALL to MODERATE, depending on facility sizes and locations. The environmental impacts from the operation of wind and/or solar facilities in combination with a combined-cycle gas-fired facility would be SMALL, except for land use and aesthetic impacts from wind and solar facilities which would range from SMALL to LARGE, the ecological resource and threatened and endangered species impacts from wind and solar facilities which would range from SMALL to MODERATE, and the air quality impacts from the combined cycle gas-fired facility which would be MODERATE. In comparison, the environmental impacts of a new nuclear plant for the proposed nuclear project would be SMALL except for ecological resources (SMALL to MODERATE). Therefore, a combination of alternatives would not be environmentally preferable to the proposed nuclear project and are not evaluated further.

9.2.3.3.3 Summary

Although other combinations of the various alternatives are not presented, the lower capacity factors, greater potential environmental impacts, and immature technologies would not provide a viable, potentially competitive alternative that is either environmentally equivalent or preferable. Wind and solar generation in combination with a combined-cycle natural gas-fired facility could be used to generate baseload power and would serve the equivalent purpose of the proposed project. However, wind and solar generation in combination with a combined-cycle natural gas-fired alternative would have equivalent or greater environmental impacts when compared to a new nuclear units at Turkey Point. Therefore, wind and solar generation in combination with a natural gas-fired alternative is not competitive with the proposed project.

9.2.4 CONCLUSION

Based on the environmental impacts evaluated, neither a pulverized coal-fired nor a combined-cycle natural gas-fired alternative would result in fewer environmental impacts than the proposed nuclear project. In fact, both types of plants would result in substantially greater environmental impacts on air quality relative to the proposed nuclear project. This conclusion is shown in detail in Table 9.2-3. In addition, a combination of the combined-cycle natural gas-fired alternative with a renewable source of energy—wind or solar—could achieve a smaller impact on the air quality but only with an accompanying moderate to large impact on land use. Therefore, the pulverized coal-fired alternative, combined-cycle natural gas-fired alternative, and combination of alternatives would not be environmentally preferable to the proposed nuclear project.

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Table 9.2-1
Coal-Fired Alternative

Attribute	Basis
Unit size = 728.4 MWe net	Will provide equivalent comparison to the AP1000 units at Turkey Point
Number of units = 3	Provides equivalent comparison to two AP1000 units at Turkey Point
Boiler type = PC, dry bottom, tangentially fired, bituminous	Minimizes nitrogen oxide emissions (U.S. EPA Jan 1995)
Capacity factor = 0.85	Typical for large coal-fired units (U.S. DOE Dec 1998)
Heat rate = 8,568 Btu/kWh	Assumed based on DOE data (U.S. DOE Dec 1998)
Fuel type = Bituminous coal	Typical coal used by Florida electric utilities in 2005 and 2006 (EIA Oct 2007) and (USGS 1996)
Fuel heat value = 12,185 Btu/lb	Average heat value of coal used in Florida electric utilities in 2005 and 2006 (EIA Oct 2007)
Fuel ash content by weight = 8.94%	Average percent ash content of coal by weight used in Florida electric utilities in 2005 and 2006 (EIA Oct 2007)
Fuel sulfur content by weight = 1.38%	Average sulfur content of coal used in Florida electric utilities in 2005 and 2006 (EIA Oct 2007)
Uncontrolled nitrogen oxide emission factor = 9.7 lb/ton	AP-42 emission factor for PC, bituminous, tangentially fired, dry-bottom, with low nitrogen oxide burner (U.S. EPA Jan 1995)
Nitrogen oxide control = low nitrogen oxide burners, overfire air and selective catalytic reduction (95% reduction)	Best available and widely demonstrated to minimize nitrogen oxide emissions (U.S. EPA Jan 1995)
Uncontrolled sulfur oxide emission factor = 38S, where S= the weight percent sulfur content of coal; therefore, the emission factor for the comparison plant = 52.44 lbs/ton	AP-42 emission factor for PC, bituminous, tangentially fired, dry-bottom, with low nitrogen oxide burner (U.S. EPA Jan 1995)
Sulfur oxide control = post combustion flue gas desulfurization wet scrubber system - limestone (95% removal efficiency)	Best available for minimizing sulfur oxide emissions (U.S. EPA Jan 1995)
Uncontrolled PM filterable (PM_{10}) emission factor = 2.3A, where A is the percent ash content of the coal; therefore, the emission factor for the comparison plant = 20.56 lbs/ton	AP-42 uncontrolled emission factor for PM_{10} (U.S. EPA Jan 1995)
Uncontrolled $PM_{2.5}$ emission factor = 0.6A, where A is the percent ash content of the coal; therefore, the emission factor for the comparison plant = 5.36 lbs/ton	AP-42 uncontrolled emission factor for $PM_{2.5}$ (U.S. EPA Jan 1995)
PM control = fabric filters (baghouse-99.9% removal efficiency)	Best available for minimizing particulate emissions (U.S. EPA Jan 1995)
Uncontrolled carbon monoxide emission factor = 0.5 lb/ton	AP-42 emission factor for PC, bituminous, tangentially fired, dry-bottom, (U.S. EPA Jan 1995)
Mercury (Hg) emission factor = 8.3E-05 lbs/ton	AP-42 emission factor for controlled coal combustion—wet limestone scrubber with a fabric filter (U.S. EPA Jan 1995)
Uncontrolled carbon dioxide emission factor = 204.33 lbs/MMBtu	DOE emission factor based upon typical coal used by Florida electric utilities in 2005 and 2006 (EIA Aug 1994) and (EIA Oct 2007)

Btu = British thermal unit
kWh = kilowatt hour
MWe = megawatt electrical output
MM= million
PM= Particulate Matter
$PM_{2.5}$ = particulates with a diameter of 2.5 microns or less

Table 9.2-2
Gas-Fired Alternative

Attribute	Basis
Unit size = 728.4 MWe net	Will provide equivalent comparison to the AP1000 units at Turkey Point
Number of units = 3	Provides equivalent comparison to two AP1000 units at Turkey Point
Comparison Plant Type = combined cycle natural gas	Assumed
Capacity factor = 0.8	Assumed based on performance of modern plants (Baxter Sep 2004)
Heat rate = 7,000 Btu/kWh	Assumed based on comparison data for new gas-fired combined cycle developed for Interstate Natural Gas Association of America (INGAA 2000)
Fuel heat value = 1,028 Btu/cubic feet	Approximate heat value of natural gas for the years 2005–2008 as listed by the Energy Information Administration (EIA Jul 2008c)
Fuel Sulfur content = 0.0007%	Sulfur content of natural gas in pipelines (INGAA 2000)
Nitrogen oxide control = selective catalytic reduction with steam/ water injection	Best available to minimize nitrogen oxide emissions (U.S. EPA Jan 1995)
Nitrogen oxide emission factor = 0.0109 lb/MMBtu	AP-42 emission factor for selective catalytic reduction -controlled gas fired units with water injection (U.S. EPA Jan 1995)
Uncontrolled sulfur dioxide emission factor = 0.94S, where S= the weight percent sulfur content of coal; therefore, the emission factor for the comparison plant = 0.000658 lbs/MMBtu	AP-42 emission factor for natural gas fired turbines (U.S. EPA Jan 1995)
Carbon monoxide emission factor = 0.00226 lb/MMBtu	AP-42 emission factor for selective catalytic reduction -controlled gas fired units (U.S. EPA Jan 1995)
Uncontrolled $PM_{2.5}$ emission factor[(a)] = 0.0019 lb/MMBtu	AP-42 emission factor for stationary gas turbines using water-steam injection

(a) All particulate matter is $PM_{2.5}$

Btu = British thermal unit
kWh = kilowatt hour
MWe = megawatt electrical output
MM= million
PM= Particulate Matter
$PM_{2.5}$ = particulates with a diameter of 2.5 microns or less

Table 9.2-3
Impacts Comparison Summary

Impact Category	Proposed Project (Turkey Point COL)	Coal-Fired Generation	Gas-Fired Generation	Combinations of Alternatives
Land Use	SMALL	MODERATE	SMALL	SMALL to LARGE
Water Use and Quality	SMALL	SMALL	SMALL	SMALL
Air Quality	SMALL	MODERATE	MODERATE	SMALL to MODERATE
Ecological Resources	SMALL to MODERATE	SMALL to MODERATE	SMALL	SMALL to MODERATE
Human Health	SMALL	SMALL	SMALL	SMALL
Socioeconomics	SMALL[a]	SMALL[a]	SMALL[b]	SMALL
Waste Management	SMALL	MODERATE	SMALL	SMALL
Aesthetics	SMALL	SMALL	SMALL	SMALL to LARGE
Historic and Cultural Resources	SMALL	SMALL	SMALL	SMALL
Environmental Justice	SMALL	SMALL	SMALL	SMALL

(a) SMALL (adverse) to LARGE (beneficial).
(b) SMALL (adverse) to MODERATE (beneficial).
Note: To allow for a valid comparison, only adverse impacts are listed in the table.

9.3 SITE SELECTION PROCESS

As required by 10 CFR 51.45(b)(3), this section provides an analysis of alternative sites for the proposed Turkey Point site for the construction and operation of two nuclear power reactors (the proposed project). The National Environmental Policy Act (NEPA) mandates that reasonable alternatives to a proposed action be evaluated. Consistent with this requirement, the site selection process is focused on other sites that could be considered to be reasonable alternatives to the proposed project. The analysis described in this section addresses alternative sites to determine if there is an "environmentally preferable" site in terms of environmental impacts and other factors when compared to the proposed site (U.S. NRC April 2011).

This section provides a description of the process for evaluating alternative sites that includes identification of the Region of Interest (ROI); selection of candidate areas, potential sites, primary sites, and candidate sites; factors considered at each level of the selection process; criteria used to screen sites; and methodologies used in the alternative site comparison process. Subsection 9.3.1 provides an overview of the site selection process. Subsection 9.3.2 details how the alternative sites were selected. Subsection 9.3.3 compares these alternatives with the proposed site.

9.3.1 OVERVIEW OF THE SITE SELECTION PROCESS

FPL currently operates a two-unit nuclear power plant at its Turkey Point site near Homestead, Florida (Turkey Point Units 3 & 4). Including the two nuclear power units, FPL operates five power-generating units at the Turkey Point site. Nuclear Units 3 and 4 and associated structures and features occupy approximately 8000 acres, including the cooling canal system. The proposed site for Turkey Point 6 & 7 was previously found acceptable on the basis of a NEPA review and has been demonstrated to be environmentally satisfactory on the basis of nearly 40 years of operating experience (Units 3 and 4 began operation in 1972 and 1973). The area to be occupied by the proposed new units was included in the original license application and site analysis for Turkey Point Units 3 & 4. Under these circumstances, NUREG-1555 allows consideration of the proposed site as a "special case" enabling it to be compared to other alternative sites within the ROI, as follows:

> *"…there will be special cases in which the proposed site was not selected on the basis of a systematic site-selection process. Examples include plants proposed to be constructed on the site of an existing nuclear power plant previously found acceptable on the basis of a NEPA review and/or demonstrated to be environmentally satisfactory on the basis of operating experience, and sites assigned or allocated to an applicant by a State government from a list of State-approved power-plant sites. For such cases, the reviewer should analyze the applicant's site-selection process only as it applies to candidate sites*

other than the proposed site, and the site comparison process may be restricted to a site-by-site comparison of these candidates with the proposed site."

"As a corollary, all nuclear power plants sites within the identified region of interest having an operating nuclear power plant or a construction permit issued by the NRC should be compared with the applicant's proposed site."

The review process outlined in this section is consistent with the special case postulation recognized in NUREG-1555 and considers the advantages already present at existing nuclear facilities that have been previously reviewed by the NRC and found to be suitable for construction and operation of a nuclear power plant.

In 2006, FPL commissioned a team of industry and environmental experts to initiate a site selection study to identify and evaluate possible sites for construction and operation of two new nuclear power units. Site selection was conducted consistent with the process outlined in the *EPRI Siting Guide: Site Selection and Evaluation Criteria for an Early Site Permit Application*, dated March 2002 (EPRI 2002). The site selection study led to selection of Turkey Point as the site for its Combined License application (COLA) for new nuclear units. Decision processes and results of the site selection study were reported in Florida Power & Light Company, *Project Bluegrass New Nuclear Power Generation Final Site Selection Study Report*, October 2006. The overall objective of that process was to identify a nuclear power plant site that 1) meets FPL's business objectives for the COL project, 2) satisfies applicable NRC site suitability requirements, and 3) is compliant with NEPA requirements regarding the consideration of alternative sites.

The 2006 Siting Study was augmented in 2011 to:

- Address FPL's additional understanding of NRC guidance (NUREG-1555, Section 9.3) for the consideration of alternative sites subsequent to publication of the original 2006 Siting Report, and

- Provide additional technical basis and rationale in response to questions raised by the NRC during the environmental audit in June 2010 and formal Requests for Additional Information (RAI) issued by the NRC in its review of the Turkey Point Units 6 & 7 COLA.

Specifically, the augmentation adds:

- Explicit steps for regional screening and candidate area identification,

- Canvassing candidate areas to identify additional greenfield potential sites, and

- Evaluation of additional potential sites in accordance with criteria and processes used in the 2006 Siting Study.

Results of the augmentation analysis have been documented in Florida Power & Light Company, Turkey Point 6 & 7, *New Nuclear Power Generation (formerly Project Bluegrass) Augmented Site Selection Study Report,* August 2011 (FPL Aug 2011). The Augmentation Report does not supersede or replace analyses in the original Siting Report. The original site selection methodologies are preserved, and augmented with the regional screening, candidate area identification, and additional potential site evaluations noted above. The Augmentation Report was written to provide an integrated decision document describing how FPL made its decision to select Turkey Point as the proposed site while meeting the current NRC review requirements. It provides the basis on which FPL addresses requirements for the consideration of alternative sites for the Turkey Point 6 & 7 COLA.

FPL divided its analysis into two general steps:

- Identify the alternative sites (Subsection 9.3.2). This step includes identification of the ROI, and explains the process for identifying candidate areas, potential sites, primary sites, and candidate sites. From these candidate sites, Turkey Point 6 & 7 was selected as the proposed site and the remaining sites were designated as alternative sites.

- Compare the alternative sites with the proposed site (Subsection 9.3.3). This step is a site-by-site comparison of the alternative sites with the proposed site to see if any of the alternatives might be “environmentally preferable” to the proposed site. The objective of this step is to determine whether the impacts at the alternative sites are greater than or equal to the impacts at the proposed site. During this step, FPL considered various topics consistent with those identified in NUREG 1555. These topics provided the environmental and health impact information that enabled FPL to determine the environmental impacts of the proposed plant at the alternative sites. Once the comparison was completed, FPL determined if any of the alternative sites were environmentally preferable.

Because the findings in Subsection 9.3.3 identified no alternative site that was environmentally preferable to the proposed site, a subsequent analysis, consistent with NUREG-1555, to determine whether the proposed site was “obviously superior” to the alternative sites was not required.

9.3.2 SITE SELECTION PROCESS

The following subsections describe the process used to identify and evaluate potential locations, including the existing Turkey Point site, for construction and operation of the two proposed reactor units. The site selection process proceeded through the following steps that successively reduced the number of sites down to a final proposed site and four alternative sites (section numbers in parentheses).

- Identify the ROI (Subsection 9.3.2.1)
- Identify candidate areas of more favorable site suitability within the ROI, as part of the augmentation analysis in 2011 (Subsection 9.3.2.2)
- Identify potential sites within the ROI, via two parallel processes (Subsection 9.3.2.3), including:
    - — Identify a spectrum of existing and available sites for initial consideration, as identified by FPL team of experts in 2006; and
    - — Canvass candidate areas to identify additional potential greenfield sites, as part of the augmentation analysis in 2011
- Screen the potential sites to identify primary sites, using nine screening criteria (Subsection 9.3.2.4)
- Screen the primary sites to identify candidate sites, using 34 general siting criteria (Subsection 9.3.2.5)
- Select the proposed site (Turkey Point Units 6 & 7) from the candidate sites (Subsection 9.3.2.6)

9.3.2.1 Identification of Region of Interest

For the purpose of alternative site analysis, NUREG-1555 defines the ROI as the geographic area considered in the search for potential and candidate sites, and the relevant service area is defined as the region to be served by the proposed project (U.S. NRC April 2011). For this COL application, the ROI is the area within (or immediately adjacent to) the FPL service territory. The FPL service territory is shown in Figure 9.3-1.

The FPL service territory spans the state of Florida (north-south) and is concentrated mainly along the eastern coast. The general topography of the territory is relatively flat, and land classifications include residential, industrial, and agricultural. Florida has abundant surface water resources that include the Atlantic Ocean, the Gulf of Mexico, lakes, rivers, and canals, as well as abundant groundwater resources. Florida does not have significant seismic activity; however, karst formations and sinkholes are common in parts of Florida.

Power generated by the proposed project would be used within the FPL service territory, with particular emphasis on the load centers for the greater Miami area (Palm Beach, Broward, and Miami-Dade Counties). The need for power is described in Chapter 8. Figure 9.3-2 depicts the existing transmission system in the FPL service territory.

9.3.2.2 Identify Candidate Areas within the ROI

The ROI was screened to eliminate those areas that are either unsuitable or are significantly less suitable than other potential siting areas. Exclusionary and avoidance criteria identified in the EPRI Siting Guide (EPRI 2002) were reviewed to identify those regional screening criteria and related physical features that provide insights into site suitability on an areal basis within the FPL ROI. Regional screening criteria applied to the ROI are listed in Table 9.3-1.

Information defined for each of the ROI screening criteria listed in Table 9.3-1 was mapped and displayed on separate maps of the ROI. These maps were then combined using a simple overlaying technique to produce a composite screening map (FPL Aug 2011).

Figures 9.3-3 and 9.3-4 depict the results of the regional screening process, identifying areas of higher suitability for siting a new nuclear power plant. After applying all regional screening criteria, the following 16 candidate areas were identified:

- CA-1, Caloosahatchee River/West Lake Okeechobee
- CA-2, Various Canals/South Lake Okeechobee
- CA-3, St. Lucie Canal and River/East Lake Okeechobee
- CA-4, Kissimmee River/North Lake Okeechobee
- CA-5, Peace River
- CA-6, St. Johns River South
- CA-7, St. Johns River Central
- CA-8, St. Johns River North
- CA-9, St. Mary’s River
- CA-10, St. Johns River/Reclaimed
- CA-11, West Palm Beach Canal/Reclaimed (North)

- CA-12, West Palm Beach Canal/Reclaimed (South)
- CA-13, South Miami Reclaimed (South) (Turkey Point)
- CA-14, South Miami Reclaimed (North)
- CA-15, Coastal Existing Plant (St. Lucie)
- CA-16, South Gulf Coast

9.3.2.3 Identify and Screen Potential Sites

In order to obtain a set of potential sites that spans the nuclear power plant siting options within the region of interest, two independent processes for potential site identification were implemented. In the first, FPL convened a team of internal experts to identify the full spectrum of existing and available sites that could be initially considered. In the second, the candidate areas identified in Section 3.0 of the Augmentation Report (FPL Aug 2011) were canvassed to identify additional potential greenfield sites.

Cumulatively, a total of 21 potential sites (Figure 9.3-5) were identified:

Existing and Available Sites (15)	Additional Greenfield Sites (6)
Charlotte	Collier A
Desoto	DeSoto A
Ft. Myers	Glades A
Glades	Hendry A
Hardee	Martin A
Hendry (2 locations)	Palm Beach A
Highlands	
Manatee	
Martin	
Okeechobee (2 locations)	
St. Lucie	
Turkey Point	
West County	

9.3.2.3.1 Identify Existing and Available Sites

FPL established a site selection team to identify potential sites for consideration in the site selection study. Internal FPL members of the team were identified such that they represented the full span of FPL business units and their associated specialized knowledge of existing and available sites that could be initially considered. Business units represented included:

- Resource Assessment and Planning
- Nuclear Division
- Environmental Services
- Transmission Planning
- External and Governmental Affairs
- Corporate Real Estate
- Legal
- Development

Thus, in representing their business units, the team collectively provided access to the full knowledge and capability of the Company with respect to sites in the FPL service territory and nearby regions.

Functionally, the canvassing was conducted at an August 2006 meeting during which each FPL business unit representative was asked to bring to the meeting all site-related knowledge available within their units. The committee was polled to identify the full spectrum of known existing and available sites (e.g., undeveloped land already owned by FPL or an interested seller) within or near the FPL service territory. Once all site alternatives available within the region of interest had been identified, the committee – again representing the knowledge and insights inherent in their business units – determined the feasibility of developing a new nuclear power plant at the identified sites.

Within the ROI, 23 sites were identified by FPL as locations that could be evaluated for the COL project and, potentially, a new nuclear power plant. These sites, which included existing power plant sites and greenfield sites previously identified by FPL, represented the full suite of siting trade-offs available within the ROI and therefore provided an initial basis for evaluation of a reasonable set of alternative locations.

FPL team personnel reviewed this set of sites in a joint meeting on August 1, 2006, to identify the final set of potential sites for this study. The following groups of sites were reviewed.

FPL Existing Sites

Twelve existing FPL power-generating sites were considered. Two of the sites have existing nuclear power generating plants.

- Canaveral
- Cutler
- Ft. Myers
- Lauderdale
- Manatee
- Martin
- Port Everglades
- Putnam
- Riviera
- Sanford
- St. Lucie (existing nuclear)
- Turkey Point (existing nuclear)

Additionally, three FPL-owned greenfield sites were considered:

- Andytown
- DeSoto
- West County

Finally, eight non-FPL-owned greenfield sites were considered; these sites were identified by the FPL corporate real estate department as being potentially available and feasible sites for new power generation projects:

- Charlotte
- Glades

- Hardee
- Hendry (2 locations)
- Highlands
- Okeechobee (2 locations)

Each of the sites was evaluated qualitatively with respect to the following considerations:

- Sufficient land[1] currently exists for new nuclear power plant construction;
- Sufficient land can be obtained for new nuclear power plant construction;
- Adequate sources of water; and
- Transmission feasibility.

Using this process, the following 15 potential sites were identified for further consideration; these sites are depicted in Figure 9.3-5:

- Charlotte
- DeSoto
- Ft. Myers
- Glades
- Hardee
- Hendry (2 locations)
- Highlands

1. 3000 acres was used as a general guideline in determining land sufficiency for sites other than existing nuclear power plant sites, based on the lower bound of the Desired Owner Buffer Area for two nuclear power units, as identified by FPL - where the Desired Owner Buffer Area includes the plant components/protected area and the owner controlled/buffer area. Land sufficiency at existing nuclear power plant sites (St. Lucie and Turkey Point) is known, based on detailed licensing and operational knowledge of these sites.

- Manatee
- Martin
- Okeechobee (2 locations)
- St. Lucie
- Turkey Point
- West County

Sites in the northern part of the ROI (Putnam, Sanford, Canaveral), as well as the Cutler site, were eliminated due to transmission feasibility; these sites are located far from the FPL load centers identified in Subsection 9.3.2.1, and would not achieve the project objective of balancing loads in South Florida. Additionally, right-of-way acquisition would be difficult, and/or transmission connections at these sites would have to be coordinated with other utilities. In addition, the Cutler, Sanford and Canaveral sites do not have adequate land area, and additional land could not feasibly be acquired.

The Andytown, Lauderdale, Port Everglades, and Riviera sites were eliminated from further consideration because these sites do not include enough land for a new nuclear power plant and additional land cannot be feasibly acquired in the time-frame required to support the FPL COLA schedule.

9.3.2.3.2 Candidate Area Canvassing

Canvassing of the candidate areas identified in Subsection 9.3.2.2 was conducted to search for additional greenfield potential sites. The objective of this step was to identify a second set of potential sites – not necessarily associated with existing or known properties – that could be suitable for a nuclear power plant. These additional sites allowed for more comprehensive characterization of siting trade-offs within the ROI, as well as provided further assurance that the process identified the best environmental sites that could reasonably be identified in the ROI. The process for conducting this canvassing is described below.

The sixteen candidate areas identified in the ROI screening (Subsection 9.3.2.2) were canvassed to identify potential greenfield sites that would be feasible for a new nuclear power plant, using the following process:

1. Satellite imagery of the areas was viewed using Google Earth® (http://earth.google.com/). Potential sites of approximately 5000 acres were identified by applying the considerations described below.[2]

2. 1:100,000- and 1:24,000-scale topographic maps (USGS) were examined to identify areas for potential sites and to clarify and optimize locations identified from satellite photography. Information on identified sites was supplemented using state maps and atlases.

3. The latitude and longitude of the approximate center point of each potential site was noted.

Specific considerations applied in selecting these potential sites were:

- Avoidance of high-population areas.
- Avoidance of ecologically sensitive and special designation areas.
- Avoidance of special dedicated land uses (e.g., national parks).
- Proximity to target transmission/load centers.

Siting suitability characteristics of the candidate areas, as identified during the canvassing process, are provided in Table 9.3-2.

For each of the potential sites identified, aerial photographs and other available geographic information were compiled and nominal site locations were identified. Potential sites were defined to be approximately 5000 acres[2] in size. In addition to reflecting major siting trade-offs, the objective of this phase was to optimize potential sites within each area with respect to additional environmental considerations (e.g., wetlands) and engineering feasibility.

Additional factors taken into account in this process, as feasible, included:

- Flexibility to optimize site layout and design for cost minimization.
- Flexibility to optimize site layout and design for avoidance or mitigation of environmental impacts.
- Optimization of site engineering factors (e.g., topography, foundation conditions, grading requirements).

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2. The nominal 5000-acre area is consistent with the upper bound of the desired owner buffer area, as identified by FPL for the site selection study, and provided a consistent basis for comparison of potential sites while providing flexibility for ultimately locating plant components within the evaluated area. This flexibility allows for the refinement of detailed plant locations as more information (e.g., environmental and geotechnical considerations, land availability) is developed regarding the site in subsequent steps in the siting process, while avoiding the need to reevaluate the site as locational refinements are made.

Using this additional process, the following 6 potential greenfield sites were identified for further consideration; these sites are also depicted in Figure 9.3-5:

- Collier A
- DeSoto A
- Glades A
- Hendry A
- Martin A
- Palm Beach A

9.3.2.4 Identification of Primary Sites

The potential sites identified in Subsection 9.3.2.3 were evaluated to identify a smaller set of primary sites for more detailed evaluation (FPL Aug 2011).

The overall process for the evaluation of potential sites was composed of three elements; each element is described in the following paragraphs.

- Develop criterion ratings for each site;
- Develop weight factors reflecting the relative importance of each criterion; and
- Develop composite site-suitability ratings.

Criterion Ratings – Each potential site was assigned a rating of 1 to 5 (1 = least suitable, 5 = most suitable) for each of the nine screening criteria, using the rationale listed in Table 9.3-3. Information sources for these evaluations included publicly available data, data available from FPL files and personnel, and large-scale satellite photographs.

Weight Factors – Weight factors reflecting the relative importance of these criteria were developed by a multi-disciplinary committee in the areas of nuclear power plant site suitability that was convened at FPL offices on August 29, 2006; this committee was comprised of subject matter experts in water use and availability, engineering, real estate, ecology, transmission, land use, health & safety, socioeconomics and public relations. The weight factors were derived using methodology consistent with the modified Delphi process specified in the Siting Guide (EPRI 2002). Weight factors used (1 = least important, 10 = most important) are listed in the table below.

Criterion Number	Criterion	Weight Factor
P1	Cooling Water Supply	9.5
P2	Flooding	3.9
P3	Population	7.6
P4	Hazardous Land Uses	5.0
P5	Ecology	6.1
P6	Wetlands	6.4
P7	Railroad Access	5.6
P8	Transmission Access	8.5
P9	Land Acquisition	6.5

Composite Suitability Ratings – Ratings reflecting the overall suitability of each site were developed by multiplying criterion ratings by the criterion weight factors and summing over all criteria for each site.

Criteria used in this evaluation were derived from the larger set of more detailed criteria listed in Chapter 3 of the EPRI Siting Guide (EPRI 2002). These criteria provide insights into the overall site suitability trade-offs inherent in the available sites within the ROI and were designed to take advantage of data available at this stage of the site selection process.

Results of applying these screening criteria and weight factors are summarized in Table 9.3-4 and Figure 9.3-6 (FPL Aug 2011).

The top eight ranked sites were initially selected as primary sites. This set includes a variety of site characteristics and includes sites that were rated favorably (in the screening criteria evaluations) in comparison with lesser ranked sites from an environmental perspective.

In addition, the St. Lucie and Turkey Point sites were brought forward and included as primary sites based on the fact that they are existing, operating nuclear power plant sites within the ROI. Inclusion of these sites in the set of primary sites allows a detailed evaluation of their unique advantages, including confidence in site characteristics, existing infrastructure, and public acceptance. These sites are retained for further analysis as falling with the special case (described above) for licensed nuclear power plant sites.

The ten primary sites identified for further evaluation are:

- DeSoto
- Glades
- Glades A

- Hendry 1
- Martin
- Martin A
- Okeechobee 1
- Okeechobee 2
- St. Lucie
- Turkey Point

9.3.2.5 Identification of Candidate Sites

To narrow the ten primary sites even further, a more extensive set of 34 general siting criteria, also derived from the EPRI Siting Guide (EPRI 2002), were applied. The list of criteria is shown in Table 9.3-5. The overall process for applying the general site criteria was analogous to that described for the potential sites and involved the same three elements; a different set of weights were developed for the 34 general siting criteria by the same multi-disciplinary committee. Information sources for the primary site evaluations included publicly available data, information available from FPL files, personnel, and large scale satellite photographs.

Composite suitability ratings reflecting the overall suitability of each primary site were developed by multiplying criterion ratings by the criterion weight factors and summing over all criteria for each site (FPL Aug 2011). Results of applying these screening criteria and weight factors to the ten primary sites are summarized in Table 9.3-5 and Figure 9.3-7.

The Okeechobee 1, DeSoto, and Hendry 1 sites rated lowest in the general siting criteria evaluations, and were deferred from further analysis. The remaining seven top-ranked sites included:

- Glades
- Glades A
- Martin
- Martin A
- Okeechobee 2

- St. Lucie
- Turkey Point

Examination of evaluation results indicated that neither Glades A nor Martin A provided significant advantages over the other sites identified in their respective counties (i.e. Glades and Martin). Glades A is farther from the proposed water source, leading to the expectation that it would encounter more cost and regulatory difficulties in water supply compared to Glades. The Martin A site is expected to be questionable with regard to the regulatory feasibility of developing a water supply from the C-44 Canal due to its close geographic proximity to the C-44 Reservoir and Stormwater Treatment Area component of the Indian River Lagoon-South Everglades restoration project. Accordingly, Glades A and Martin A were not carried forward for further consideration as they were capably represented by the existing Glades and Martin sites, respectively. The following five candidate sites were identified:

- Glades
- Martin
- Okeechobee 2
- St. Lucie
- Turkey Point

9.3.2.6 Selection of Proposed Site

As discussed in Subsection 9.3.2.5, the Glades, Martin, Okeechobee 2, St. Lucie, and Turkey Point sites were selected as candidate sites for the FPL COLA. Based on the comprehensive evaluations conducted to this point, all of these sites appear to be feasible locations for a new nuclear power plant.

To select a proposed site for the COLA from this set of candidate sites, additional considerations were evaluated in 2006 to provide further insight on their relative suitability to support FPL's objectives for the COL project and a future nuclear plant.

The objective of these additional considerations for the five candidate site studies was to provide further insight into site conditions and/or to provide further confidence on specific issues that were viewed as important to the COLA site decision. Specific factors considered in this evaluation were as follows:

- Environmental impact – Existence of ecological or environmental permitting issues

- Transmission – Availability of existing right-of-way and cost of upgrades
- Land acquisition – Existing land ownership and expected difficulty of acquiring site (if applicable)
- Reliability (transmission) – Analysis of reliability from a power-transmission perspective
- Reliability (generation) – Qualitative analysis of risk factors for reliable power production and supply
- Public acceptance – Ability to obtain public acceptance to support siting activities
- Political (local) – Governmental/organizational support at the local level
- Political (state) – Governmental and regulatory support at the state and Federal level
- Transmission takeaway – Feasibility of constructing the necessary upgrades to deliver power to the system
- Schedule compatibility – Level of confidence that site will support commencement of COLA activities in January 2007
- Site layout feasibility – Ability of site to accommodate plant layout

Evaluation of these factors was conducted in 2006 by a multi-disciplinary team of FPL professionals with specific expertise, experience, and ongoing involvement in the areas being evaluated; for example, personnel involved in environmental permitting throughout the FPL service territory provided input on environmental matters, and public relations staff provided judgments on public acceptance and political factors.

Results of these evaluations were reported by assigning ratings for each candidate site that ranged from 1 to 3 (1 = more favorable, 3 = less favorable), based on experience and best professional judgment. Each of the ratings was discussed in 2006 by the FPL siting team. The resulting ratings are summarized in Table 9.3-6; information on the basis for these ratings, along with results of the General Siting Criteria evaluations (Subsection 9.3.2.5), are provided in the following paragraphs.

Environmental Impact

The St. Lucie site was rated least favorable because much of the land proposed for development contains red and black mangrove habitat and would incur significant environmental impact. Turkey Point was rated average with respect to environmental impact. Some of the land proposed for development at the Turkey Point site is designated as critical crocodile habitat. Some mitigation may be implemented because the entire cooling canal system is designated as critical habitat and the proposed area of development is small in relation to the whole canal system. The Glades, Martin, and Okeechobee 2 sites were rated as more favorable because environmental impacts can be mitigated more effectively than at the St. Lucie or Turkey Point sites.[3]

Transmission

Transmission access was originally evaluated in terms of distance to the load center in the greater Miami area and the amount of new right-of-way that would have to be acquired; these factors are described in the screening criteria rating description in Section 5.0 of the Augmentation Report. Based on those evaluations the following ratings were applied to the candidate sites:

- Glades – 2
- Martin – 1
- Okeechobee 2 – 2
- St. Lucie – 3
- Turkey Point – 1

Land Acquisition

The Turkey Point, St. Lucie, and Martin sites are all rated more favorable as these sites are FPL owned properties. The Glades site is rated average because while the property is not owned by FPL, options to purchase exist. The Okeechobee 2 site is rated less favorable because the property is not owned by FPL and purchasing options have not been developed.

3. The assumptions regarding the relative environmental impacts of the sites evaluated included the assumption that there is the potential for crocodile habitat to be impacted at Turkey Point, requiring species-specific mitigation, and that the other candidate sites had more common aquatic resources to be mitigated.

Reliability (Transmission)

The Turkey Point and Martin sites are rated more favorable with respect to transmission reliability. Power generation from a new power plant at Turkey Point could be routed on a geographically diverse corridor, thereby minimizing reliability risks. Transmission from all other sites would be co-located with existing transmission lines with varying degrees of congestion and crossings. Transmission from the St. Lucie site is less favorable as co-location within one heavily used right-of-way would be required.

Reliability (Generation)

The Glades site is rated more favorable due to a lower hurricane frequency and resulting site evacuation and shutdown requirements. The Turkey Point site is rated less favorable due to the slightly higher frequency of hurricanes.

Public Acceptance

The Turkey Point site is rated more favorable because the existing nuclear plant's license renewal received strong local community support. The Glades site also is rated favorable due to demonstrated local government support. The Okeechobee 2 site is rated average because local political leaders have indicated they would support a nuclear power generation project. The Martin and St. Lucie sites do not appear to have a similarly strong supportive base and are rated less favorable.

Political Acceptance (Local)

The Glades and Okeechobee 2 sites are rated more favorable because no rezoning or comprehensive plan amendments would be required for a new nuclear power plant. The Turkey Point site was rated average because no comprehensive plan amendments would be necessary, but some level of rezoning or land use definition appears to be required. The Martin and St. Lucie sites are rated less favorable because both sites would require significant effort with local planning issues.

Political Acceptance (State/Federal)

With respect to regulatory requirements, there is no significant distinction between the candidate sites. The Florida State government has shown strong support for new nuclear power generation. The Martin site could present some resistance due to previously observed political perception surrounding water use issues and Lake Okeechobee water levels. As such, all sites have been rated more favorable, with the exception of the Martin site, which has been rated less favorable.

Transmission Takeaway Feasibility

The Turkey Point and St. Lucie sites are rated more favorable because neither site would require significant acquisition of new transmission right-of-way. The Glades site would require a significant acquisition of new right-of-way, but was rated average because a coal-fired power plant was proposed in the vicinity of the Glades location (at the time the Siting Study was conducted), and a nuclear plant at the site would benefit from earlier work to obtain some portion of the necessary right-of-way. The Martin site also was rated average because existing right-of-way could be utilized, although they are congested in areas. The Okeechobee 2 site is rated less favorable because significant amounts of right-of-way acquisition and new line construction would be required.

Schedule Compatibility

The ability to meet schedule requirements at a site closely parallels the land-acquisition evaluation above. The Turkey Point, St. Lucie, and Martin sites were rated more favorable because they are located on FPL-owned property. The Glades site was rated average as the property is not owned by FPL, but options to purchase exist. The Okeechobee 2 site was rated less favorable because the property is not owned by FPL and purchasing options have not been developed.

Site Layout

The Glades and Okeechobee 2 sites were rated more favorable. Both sites are greenfield sites and would allow the greatest flexibility in developing layouts for a new nuclear power plant. The Martin site was also rated more favorable because a considerable amount of FPL-owned property exists that would provide a similar amount of flexibility. Both existing nuclear power plant sites were rated lower than the greenfield sites because layout flexibility is reduced at each site due to the existing facilities. The Turkey Point site was rated average because there are several potential locations that can be developed. St. Lucie was rated less favorable because the restrictions to available land and surrounding natural features would significantly limit the ability to site new nuclear facilities.

Results of the 11 additional site selection considerations above, combined with the results of the general criteria evaluations (Subsection 9.3.2.5), were used to identify a proposed site as described below.

Results of the evaluations as described above confirm that all of the five candidate sites are viable locations for a nuclear power plant. However, these evaluations do serve to further distinguish among the five candidate sites and identify the most favorable site. The Turkey Point site rates more favorable in 8 of the 12 considerations. With respect to the criteria described above, Turkey Point ranked least favorable in only one (Transmission Reliability), whereas

Martin, Okeechobee and St. Lucie each ranked least favorable in at least three. Glades ranked least favorable in none of these considerations, but its composite score (from the technical analysis reported in Subsection 9.3.2.5) was lowest of all the candidate sites.

Based on these results, the overall ranking of the five candidate sites is as follows:

1. Turkey Point
2. Glades
3. Martin
4. Okeechobee 2
5. St. Lucie

Thus, taking into consideration the results of each evaluation conducted (including satisfying the overall business objectives for the FPL COL project), the Turkey Point site was selected as the proposed site for FPL's new nuclear power generation project.

9.3.3 ALTERNATIVE SITE REVIEW

This subsection reviews the four alternative sites based on the selection criteria suggested in NUREG-1555 to determine whether any of the alternative sites are environmentally preferable or obviously superior to the proposed Turkey Point site.

RG 4.2, *Preparation of Environmental Reports for Nuclear Power Stations* notes: "The applicant is not expected to conduct detailed environmental studies at alternative sites; only preliminary reconnaissance-type investigations need be conducted" (U.S. NRC Jul 1976). The site alternatives described here are compared based on recent information about existing facilities in the surrounding area and existing environmental studies.

Potential impacts from construction and operation of the proposed project at candidate sites other than the proposed site are analyzed, and a single significance level of potential impact (i.e., SMALL, MODERATE, or LARGE) is assigned to each analysis consistent with the criteria that NRC established in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, Footnote 3 as follows:

- SMALL – Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
- MODERATE – Environmental effects are sufficient to alter noticeably, but not to destabilize, any important attribute of the resource.

- LARGE – Environmental effects are clearly noticeable and are sufficient to destabilize any important attributes of the resource.

For some analyses, FPL determined the criteria used by the NRC in NUREG-1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*, to be appropriate for the analyses presented here, and those criteria were reviewed to assign a significance level in impacts. Impact categories (e.g., land use, socioeconomics) for the alternative sites are the same as those described in Chapter 4 for construction and Chapter 5 for operation of Units 6 & 7 at the Turkey Point site.

For the purpose of alternative site analysis, FPL assumed the same type of power units would be placed at each of the four sites (two Westinghouse AP1000 nuclear power units). However, other design parameters would not necessarily be the same at each of the sites. For example, cooling water storage reservoirs are assumed to be necessary at some but not all alternative sites.

Based on conceptual site layouts developed for each alterative site, FPL estimated that approximately 3360 acres of land acquisition would be required at both the Glades and Okeechobee greenfield sites for the onsite plant components (facility and cooling water storage reservoir). With respect to the 11,300-acre Martin site, which is owned by FPL, the existing 6500-acre reservoir would not be available for two new nuclear units, and a new 3000-acre reservoir would need to be constructed, such that total onsite land requirements at the Martin site would be similar to that required at the two greenfield sites (approximately 3360 acres). Taking into account existing uses on the Martin site – including the existing power plant, cooling pond, the recently constructed solar thermal plant, and other protected areas that are unavailable for development, the amount of remaining land available for development is approximately 568 acres. As a result, FPL would need to acquire approximately 2800 acres of land to develop two nuclear units at this site. Land acquisition would not be required to site the facility at the St. Lucie site because sufficient land (over 900 acres available for development) is already owned by FPL and is designated for power plant activities.

FPL assumed that freshwater sources (primarily surface water) would supply the cooling water needs for the Glades, Martin, and Okeechobee 2 sites. Surface water sources include Lake Okeechobee, a river, or a water canal, and the water would be transferred to the site via underground pipelines. FPL assumed the St. Lucie site would employ the same type of water intake and canal transfer system used for St. Lucie Units 1 & 2 (ocean water). For heat rejection, FPL assumed a closed-loop system with mechanical draft cooling towers for each alternative site.

9.3.3.1 Evaluation of the Glades Site

During the site selection process, the Glades site was originally identified as a nominal 3000-acre undeveloped area in the southeastern region of Glades County approximately 1 mile south of U.S. Highway 27. Nearby towns include Moore Haven (2 miles east), Clewiston (15 miles southeast), La Belle (18 miles west), and Okeechobee (35 miles northeast). The Miami load center is approximately 75 miles southeast of the Glades site. Lake Okeechobee is approximately 5 miles to the northeast. The site is not owned by FPL but is considered potentially available and feasible for a power generation project. Portions of the site are within the 100-year floodplain. The location of the Glades site is shown in Figure 9.3-8.

9.3.3.1.1 Land Use Including Site and Transmission Line Rights-of-Way

Based on the conceptual site layout developed for the Glades greenfield site, the following land requirement assumptions were made which form the basis of the environmental comparison of alternative sites:

- The assumed facility footprint would require approximately 362 acres and the assumed cooling water storage reservoir would require approximately 3000 acres. New facilities at the plant site would include the nuclear power units, support buildings, a switchyard, storage areas, stormwater retention ponds, and deep injection wells for subsurface water disposal.

- The assumed extent of non-transmission linear features, including access road corridors, pipeline corridors and rail access, is as follows:

    — Access road: 23.1 acres – assuming a corridor length of approximately 1.9 miles and a corridor width of 100 feet. Based on conceptual site layouts developed for the Glades site, site access would be from SR 78. A portion of SR 78 would be widened from two lanes to four lanes to accommodate anticipated traffic levels attributable to construction.

    — Rail: 74.8 acres – based on an assumed length of approximately 6.2 miles and corridor width of 100 feet, to provide access to the nearest railway northeast of the site.

    — Intake/makeup pipeline corridors: 3.4 acres, including intake pipeline connecting the reservoir to the nearby C-43 Canal (assumed cooling water source).

- The assumed extent of conceptual transmission corridor routing is approximately 5824 acres based on an assumed length of 121 miles and a corridor width that varies from approximately 200 to 500 feet, connecting the new nuclear units to the existing FPL transmission system at the Andytown Substation in Broward County.

- Based on the sub-totals above for both onsite and offsite plant components, the total area potentially affected at the Glades alternative site is estimated at approximately 9287 acres. With respect to the transmission line corridor included within this total, the estimated acreage requirements assume corridor widths which may exceed the area that would actually be disturbed during project construction and operation. However, these estimates provide the basis for an updated and consistent environmental comparison of alternative sites.

- Additional acreage (up to several hundred acres) may be required to support construction activities (e.g., additional laydown areas, batch plant, fill/spoil areas). However, cleared land would be used to the greatest extent possible. The impact on this acreage would be temporary, and it would also be reclaimed to the extent possible following construction.

The majority of the Glades site area is currently in agricultural and farm use. A topographic survey of the nearby, formerly proposed FPL Glades Power Park site, was performed. In general, the topographic survey indicates that there is very little natural slope to the ground surface. The site is surrounded primarily by sugarcane fields.

Based on land use data for year 2002, approximately 82.4 percent of the land in Glades County is farmland (USDA Jun 2004). Glades County is currently the second largest producer of sugar in the state. Like most of the land area in the county, the Glades site is used for agriculture and farm activities. The topography of the site is generally flat with a mean elevation of approximately 15 feet. Portions of the site are included within the 100-year floodplain.

Land use impacts associated with plant construction include both impacts to the site and immediate vicinity, including the new reservoir; and impacts to offsite areas such as transmission, cooling water intake pipelines, and transportation rights-of-way (e.g., road and rail). Construction of a new nuclear power plant would include clearing, dredging, grading, excavation, spoil deposition, and dewatering activities. An area of approximately 362 acres for the main power plant site (major structures including switchyard), which would largely be focused in one central location; and approximately 3000 acres (surface area) for a new reservoir and intake structure would be permanently impacted.

Project construction activities at the Glades site would include filling those portions of the site area that are within the 100-year flood zone an additional 15 feet in elevation to bring them to approximately 29 feet MSL. FPL has determined that sufficient fill material would be available onsite, based on the amount of material that would be excavated for the reservoir and storm water retention ponds.

Project construction would have a long-term impact on the current uses which would change to industrial use. Much of the proposed power plant site area has been cleared and is now used for agricultural activities; over 4000 acres of the plant site area are currently in field crops, primarily sugarcane. Following construction activities, impacted areas without constructed buildings or transportation infrastructure would be reclaimed to the greatest extent feasible.

Construction at the proposed pipeline corridors would have temporary, minor effects on land use during actual construction due to trenching, equipment movement and material laydown. The ability to use current lands for their existing uses (e.g., farmland) along the proposed pipeline corridor would be temporarily lost during construction. Direct and indirect impacts of construction from the proposed transportation infrastructure would be similar to those for the proposed plant.

Development of the conceptual transmission corridor incorporated the most direct route where possible, while considering potential conflicts with natural or man-made areas where important environmental resources were located, and avoiding populated areas and residences to the extent possible. Whenever possible, the new line was routed along existing transmission rights-of-way. The use of lands that are currently used for forests would be altered. Trees would be replaced by low-growth types of ground cover such as grass. The new transmission corridor would not be expected to preclude agricultural activities near the eventual rights-of-way. The land use in the region, including along the conceptual transmission corridor, is generally rural, sparsely populated, and primarily used for agricultural activities. Glades County is not within the Florida Coastal Zone, and the route for the new transmission lines would not pass through any portion of the Florida Coastal Zone.

Table 9.3-7 includes estimates of the potentially affected area(s) of each land cover type (based on GIS FLUCCS Level III data analysis) for the Glades alternative site, including both onsite and offsite components (i.e., access road, rail, pipeline and transmission corridors). It also further breaks out the land cover types along the assumed conceptual transmission corridor only, given the significant acreage this corridor encompasses (63 percent of the total area). As noted previously, regarding the offsite linear features associated with the projects, the estimated acreage requirements assume corridor widths for transmission which may exceed the area that would actually be disturbed during project construction and operation. These estimates are intended to provide the basis for an updated and consistent environmental comparison of alternative sites.

The proposed project would be a change from current land use at the site. Operational impacts to site land use would include a permanent change in land use for approximately 3500 acres of land for the power plant site, reservoir, and rail/highway site access corridors – that would be generally unavailable for other purposes. This area would be excluded from future agricultural and recreational use for the estimated 60-year life of the AP1000 power units (WEC 2007).

Operational impacts to the site and immediate vicinity also would include maintenance operations on project structures that would be small and temporary in nature.

Operational impacts of transmission lines result primarily from line maintenance, and include right-of-way vegetation clearing and control, transmission line maintenance, and other normal access activities. Additional right-of-way acquisition and development would not normally be required as part of plant operational activities. Maintenance activities would be limited to the immediate right-of-way and would be minimal. New transmission corridors would not be expected to preclude agricultural activities near the eventual rights-of-way. Corridor vegetation management and line maintenance procedures would be established by the transmission service provider.

Other offsite land use impacts as a result of plant operational activities would be minimal, temporary, and limited in the area impacted. Such activities could include pipeline, road, and rail maintenance and auxiliary building maintenance. It is likely that most lands above the proposed water intake pipeline and related areas of construction could continue to be used for ranching, farming and any passive uses. The proposed transportation infrastructure could result in the loss of a small amount of ranch land, pasture land and forested land in areas where access road improvements/widening and a rail spur would be needed.

For the purpose of this analysis, land use impacts are considered small if less than 3000 acres are disturbed (including plant footprint, reservoir, rights-of-way, and corridors) and there are no major changes to land use. Impacts are considered moderate if land disturbance is greater than 3000 acres or there are major changes to land use; and large if land disturbance is greater than 6000 acres and there are major changes to land use. Based on a potentially affected area of approximately 9287 acres and the permanent change of land use from agricultural to industrial, land use impacts associated with site preparation, construction, and operation of the proposed nuclear plant at the Glades alternative site and the corresponding conceptual transmission corridor would be LARGE.

9.3.3.1.2 Air Quality

Glades County (the Glades site is within Glades County) is part of the Southwest Florida Intrastate Air Quality Control Region. Glades County, along with the entire state of Florida, is designated as attainment or unclassifiable with respect to the National Ambient Air Quality Standards (NAAQS) (40 CFR 81.310). The nearest non-attainment area is in Georgia, several hundred miles north northwest of the Glades site (40 CFR 81.311).

Criteria pollutant emissions from construction and operation of the proposed nuclear plant at the Glades site would be comparable to the emissions generated at the Turkey Point site, as described in Subsections 4.4.1.2 and 5.8.1.2, respectively. Construction impacts would be temporary and would be similar to any large-scale construction project. Particulate emissions in the form of dust from disturbed land, roads, and construction activities would be generated. Mitigation measures similar to those described in Subsection 4.4.1.2 would be applied as necessary. Criteria pollutants would also be generated from onsite fossil-fueled construction equipment and construction vehicles, and from commuter and delivery vehicles that travel to and from the site. The quantity of criteria pollutant emissions generated by construction activities would be small compared to total vehicular emissions in the region. It is assumed unlikely that construction-related emissions would cause any violation of the NAAQS.

The project would include standby diesel generators and diesel-driven fire pumps. Annual emissions from these sources are listed in Table 3.6-4. It is expected that standby diesel generators and auxiliary power systems would see limited use and, when used, would operate for a short time interval. The pollutant emissions generated by these systems (nonradiological) would be regulated by the Florida Department of Environmental Protection (FDEP) in accordance with the air rules published under Florida Administrative Code (F.A.C.) Chapter 62. These rules cover general air pollution control provisions, stationary source requirements, preconstruction review, emission standards, air monitoring requirements, and other rules for control of air pollutant emissions. Airborne release of criteria pollutant and hazardous air pollutant emissions would be small and would comply with FDEP rules (FDEP 2008a).

Nonradiological emissions can potentially affect regional visibility, and visibility is an important feature at Federal Class I areas. (The Federal Class I area nearest to the Glades site is the Everglades National Park approximately 63 miles to the south.) Because of the significant distance, and because the anticipated emission levels would be small, pollutant emissions attributable to operation of the new nuclear units would have a negligible impact on visibility at a Federal Class I area. Unfavorable psychometric conditions can result in visible vapor plumes from cooling tower operations. These plumes may be visible for several miles, but would not impact visibility or scenic vistas at any Federal Class I area.

Air quality impacts are considered small if the increase in regional pollutant concentrations attributable to the source (1) would not appreciably alter visibility, (2) would not exceed EPA significant impact levels, and (3) would not cause a violation of the most restrictive ambient air quality standards. Based on this evaluation metric, it is anticipated that the impacts to air quality from construction and operation would be SMALL.

9.3.3.1.3 Hydrology, Water Use, and Water Quality

Florida is divided into five watershed management areas. The Glades site is in the Kissimmee-Everglades watershed and falls under the jurisdiction of the South Florida Water Management District (SFWMD). This watershed region spans over 16 counties and is logically divided into several river basins: Kissimmee River, Upper East Coast, Lower East Coast (which includes the entire southeast coast and the Everglades), and Lower West Coast (which includes the Big Cypress and Caloosahatchee Rivers). This region is the largest watershed region in Florida and is home to 40 percent of Florida's population. The region also contains the Everglades (the largest subtropical wetland in the United States) and Lake Okeechobee, the second largest freshwater lake in the United States. This lake is of national importance because its water has diverse usage and a large number of people depend on it for agricultural and domestic purposes (University of Florida Jun 2007). Lake Okeechobee is at the center of the south Florida regional water management system. This relatively shallow lake has an average depth of 9 feet and covers approximately 730 square miles. The Lake Okeechobee drainage basin covers more than 4600 square miles (SFWMD 2008).

Water quality and ecological health of Lake Okeechobee are adversely affected by excessive nutrient loading, extreme high and low water levels, and the proliferation of exotic species. To address restoration goals for the lake, the SFWMD, in coordination with the FDEP and the Florida Department of Agricultural and Consumer Services, has developed the Lake Okeechobee Watershed Construction Project Technical Plan. The plan was developed in response to the *Northern Everglades and Estuaries Protection Program* that the Florida Legislature signed into law in 2007. Primary components of the plan include implementing agricultural management practices, constructing treatment wetlands to clean water flows into the lake, and creating 900,000 to 1.3 million acre-feet of water storage north of the lake (SFWMD 2008).

In 2000, the average daily surface freshwater withdrawals in Glades County totaled 53.6 million gallons, which represents 72 percent of the total daily withdrawal rate for the county (USGS Dec 2004). Major surface freshwater sources near the Glades site include Lake Okeechobee (5 miles away) and the C-43 Channel (adjacent to the proposed site reservoir).

The entire state of Florida, and portions of southern Alabama, southeastern Georgia, and southern South Carolina, are atop the Floridan aquifer. This aquifer covers some 100,000 square miles and is one of the most productive aquifers in the world. The Floridan aquifer system provides water for several large cities, such as Savannah and Brunswick in Georgia; and Jacksonville, Tallahassee, Orlando, Tampa Bay, and St. Petersburg in Florida. In addition, the aquifer system provides water for hundreds of thousands of people in smaller communities and rural areas. Locally, the Floridan aquifer is intensively pumped for industrial and irrigation supplies (USGS Jul 1980).

Principal groundwater sources in Glades County include the surficial aquifer and the middle Floridan aquifer. Within Glades County, in year 2000, average daily (fresh) groundwater withdrawals from these aquifers totaled approximately 21 million gallons per day (mgd), and surface freshwater withdrawals totaled approximately 53.6 million gallons per day. Approximately 92 percent of freshwater withdrawals (ground and surface) in Glades County (69 mgd) are used for agriculture. Fresh groundwater was the only source of public water supply in Glades County (USGS Dec 2004).

The depth to the water table near the site is less than 30 feet below ground level. Therefore, it is expected that dewatering may be necessary during the construction phase. This may require construction of temporary retention ponds to allow sediment-laden waters to settle before discharge to surface waters. Dewatering activities would be subject to National Pollutant Discharge Elimination System (NPDES) permit requirements to avoid adverse impacts on surface waters.

Land subsidence related to karst terrain is not anticipated at the site. The site is in karst Area II, where the surface cover is reported to be 30 to 200 feet thick. In such areas, sinkholes are reported to be few, shallow, of small diameter, and develop gradually (Sinclair, et. al, 1985). Furthermore, there were no indications of karst geology, such as voids or loss of circulation, encountered in borings drilled nearby as part of the site investigation for the proposed Glades Power Park, approximately 2 miles away.

Site groundwater wells are expected to be installed in the middle Floridan aquifer. Since the site is inland from the coast, lateral saltwater intrusion is not likely. However, there is a potential for saltwater to migrate vertically into the middle Floridan aquifer from the saline deeper Floridan aquifer. Since the middle Floridan aquifer already produces brackish water, resultant saltwater intrusion could require additional osmosis or dilution with clean water to satisfy potable water quality standards.

As shown in Subsection 4.2.2.1, the peak construction water demand is estimated at 565 gallons per minute (gpm), which is slightly greater than 1 cfs, and the peak estimated potable water demand for operations is 2553 gpm (Table 3.3-1). As described in Section 3.3, an estimated 100 cfs of freshwater would be required to replace consumptive water use associated with operation of the proposed nuclear power units. Lake Okeechobee offers a potential water supply of approximately 360 cfs, and the annual average flow of the Caloosahatchee River/Canal near the site is approximately 592 cfs. The estimated groundwater potential at the Glades site is approximately 155 cfs. These water sources are suitable to satisfy potable and process water demands associated with construction and operation at the Glades site. Water use impacts are considered small when water sources are readily available to meet demand. A permittability assessment of the probability of obtaining water permits at the Glades alternative site would be required to develop the documentation necessary to firmly establish conditions under which water from these sources could be made available. Such analysis is beyond the reconnaissance-level evaluations required for alternatives analysis. Instead, these evaluations must be based on statutory and regulatory criteria requiring site-specific analysis of reasonable beneficial use, existing legal users, and public interest factors. Accordingly, because adequate water sources are physically available nearby, the impact on regional water use for both construction and operation would be SMALL.

Water quality impacts are considered small when changes in water quality do not affect or minimally affect aquatic biota and water uses (NUREG-1437). It is assumed that a closed loop, mechanical draft, tower-cooled system would be used for power cycle waste heat rejection, whereby blowdown waters are injected into the Boulder Zone (The Boulder Zone is a deep underground, extremely permeable, cavernous region in southeastern Florida. It is called the Boulder Zone not because it contains boulders, but instead, because efforts to drill into this zone pose difficulties similar to the difficulties posed by subsurface boulders). Plant construction and operation activities at the Glades site would be performed under the authorization of an NPDES permit (construction) Industrial Wastewater (IWW) permit (surface water), or Underground Injection Control (UIC) (groundwater) permit issued by the FDEP (FDEP 2008b). Any releases from the power plant site into Lake Okeechobee, regional streams, or groundwater as result of construction or operation would be regulated by the FDEP through the NPDES, IWW, or UIC permit process to ensure that water quality is protected. To ensure that wetlands and streams are not harmed by petroleum products or other industrial chemicals, FPL would restrict certain activities (e.g., transfer and filling operations) that involve the use of petroleum products and solvents to designated areas such as laydown, fabrication, and shop areas. In addition, construction activities would be guided by a stormwater pollution prevention plan and construction-phase spill prevention, control, and countermeasures plan similar to those proposed for the Turkey Point site as described in Section 4.2. Therefore, any impacts to surface water during plant construction would be SMALL and would not warrant mitigation beyond best management practices required by the permits. The impacts to water quality during operations would also be SMALL because the IWW and UIC permit requirements would ensure that adequate measures are applied to protect water quality.

9.3.3.1.4 Terrestrial Resources and Protected Species

Table 9.3-7 includes estimates of the potentially affected area(s) of each land cover type within the project area for both onsite and offsite components, including any natural vegetation and wetland areas. As can be seen in Table 9.3-7, the Glades site is developed for agricultural and farm use. A topographic survey of the nearby formerly proposed FPL Glades Power Park site was performed. In general, the topographic survey indicates that there is very little natural slope to the ground surface. The average ground surface elevation is approximately 15 feet MSL, and the plant area is surrounded primarily by sugarcane fields. The site has been modified to allow for irrigation using an irrigation/drainage ditch network throughout the site. Water levels in the ditches are controlled manually with pumps to support the irrigation process. Most of the site is an active sugarcane field that is unsuitable habitat for most wildlife species because of the lack of native vegetation and the amount and frequency of human disturbance. The fields are regularly treated with herbicides and pesticides, and the agricultural ditches are routinely maintained. However, wading birds and alligators do use the irrigation canals and opportunistically forage in areas of heavy machinery usage such as ditch maintenance sites and field clearing/preparation areas for replanting. The wetlands within the surrounding sugarcane fields also provide habitat for avian species and common herpetofauna (FPL Dec 2006).

As shown in Table 9.3-7, there are approximately 306 acres of wetlands within the project area, excluding the conceptual transmission corridor, which could be directly impacted from project construction. Of these, approximately 238 acres are identified as forested wetlands and considered to be high quality. Any wetland functions that are impacted during construction would be replaced or restored. The footprint of the new facilities, excluding the assumed conceptual transmission corridor, would cover approximately 3463 acres.

Non-listed wildlife observed at the nearby formerly proposed FPL Glades Power Park site include a variety of common avian species, such as cattle egret (*Bubulcus ibis*), barn swallow (*Hirundo rustica*), loggerhead shrike (*Lanius ludovicianus*), black vulture (*Coragyps atratus*), turkey vulture (*Cathartes aura*), mourning dove (*Zenaida macroura*), redwinged blackbird (*Agelaius phoeniceus*), ground dove (*Columbina passerina*), swallow-tail kite (*Elanoides forficatus*), cardinal (*Cardinalis cardinalis*), moorhen (*Gallinula chloropus*), green heron (*Butorides virescens*), great egret (*Ardea albus*), glossy ibis (*Plegadis falcinellus*), red-shouldered hawk (*Buteo lineatus*), anhinga (*Anhinga anhinga*), least bittern (*Ixobrychus exilis*), great blue heron (*Ardea herodias*), osprey (*Pandion halieatus*), common nighthawk (*Chordeiles minor*), red-tailed hawk (*Buteo jamaicense*), marsh hawk (*Circus cyaneus*), coot (*Fulica americana*), white-eyed vireo (*Vireo griseus*), black-crowned night heron (*Nycticorax nycticorax*), yellow-crowned night heron (*Nycticorax violaceus*), bobwhite quail (*Colinus virginianus*), purple gallinule (*Porphyrio martinica*), red-bellied woodpecker (*Melanerpes carolinus*), and Eastern meadowlark (*Sturnella magna*) (FPL Dec 2006).

Mammalian species directly observed or identified through tracks or scat include Eastern cottontail (*Sylvilagus floridanus*), feral hog (*Sus scrofa*), raccoon (*Procyon lotor*), armadillo (*Dasypus novemcinctus*), bobcat (*Lynx rufus*), coyote (*Canis latrans*), otter (*Lutra canadensis*), and white-tailed deer (*Odocoileus virginianus*). Herpetofauna observed include Florida cooter (*Pseudemys floridana*), green tree frog (*Hyla cinerea*), soft-shelled turtle (*Trionyx ferox*), pig frog (*Rana grylio*), leopard frog (*Rana pipiens*), and broadhead skink (*Eumeces laticeps*) (FPL Dec 2006).

Threatened, endangered, and/or species of special concern that exist in Glades County are listed in Table 9.3-8. The site has been largely cleared of native vegetation, graded, and planted with sugarcane. The Florida Natural Areas Inventory (FNAI) element occurrence report for the formerly proposed FPL Glades Power Park did not include any documented occurrences of listed plants within that site and vicinity. For fauna, the formerly proposed FPL Glades Power Park site was surveyed in August and December 2006 through pedestrian and vehicular surveys, and observations of protected species were recorded. Three federally listed species – the wood stork, the crested caracara, and the Everglades snail kite – were observed at that site, while seven species listed by the state were identified. These species include the little blue heron, snowy egret, white ibis, tricolor heron, sandhill cranes and American alligator. No nesting areas were observed, nor do any critical wildlife habitats exist on the site (FPL Dec 2006).

The irrigation ditches within the site provide foraging habitat for a variety of wading birds, which although not classified as threatened or endangered by the U.S. Fish and Wildlife Service (USFWS) or the Florida Fish and Wildlife Conservation Commission (FFWCC), are considered species of special concern by the FFWCC. These include the little blue heron, snowy egret, white ibis, and tricolor heron. A few individual wood storks were also observed associated with irrigation ditches. The wood stork is classified as endangered by both the USFWS and the FFWCC. American alligators also use the irrigation ditches at the site. The alligator is not classified as threatened or endangered, but is listed as a species of special concern by the FFWCC and listed by the USFWS because of its similarity in appearance to the endangered American crocodile (*Crocodylus acutus*) (FPL Dec 2006).

According to the FFWCC Bald Eagle Nest Location Database, no active bald eagle (*Haliaeetus leucocephalus*) nests are at the Glades site. The closest nest is approximately 6 miles from the project area: Nest GL018 is west of the site at 26°47.98′ N 81°16.04′ W (Section 19, Township 42 South, Range 31 East) (FFWCC 2008a).

Further field surveys would be conducted for federally listed and state-protected species as part of the permitting process before any land preparation or construction activities began at the site or along associated transmission or pipeline corridors. Land preparation activities associated with construction of the plant and transmission lines would be conducted in accordance with federal and state regulations, permit conditions, existing FPL procedures, good construction practices, and established best management practices (e.g., directed drainage ditches, silt fencing) (FPL Dec 2006).

As described in Subsection 9.3.3.1.1, the conceptual transmission corridor connecting the Glades site to the existing FPL transmission system via the Andytown Substation in Broward County, is approximately 121 miles long and varies in width between 200 and 500 feet. The most direct route was generally used between terminations with consideration also given to avoiding possible conflicts with natural areas where important environmental resources are located.

As shown in Table 9.3-7, there are approximately 1567 acres of wetlands found within the conceptual transmission corridor; approximately 411 acres of which are forested wetlands and considered to be high quality. This compares to a 5824-acre area potentially affected by the conceptual transmission corridor, based on the dimensions above. However, the estimated acreage requirements for the conceptual transmission corridor assume corridor widths which may exceed the area that would actually be disturbed during project construction and operation.

These estimates are used to provide the basis for an updated and consistent environmental comparison of alternative sites.

Cooling tower operations can generate vapor plumes that drift downwind. Salt and mineral deposits in the vapor plumes have the potential to adversely impact sensitive plant and animal communities through changes in water and soil chemistry. However, the freshwater sources identified for the Glades site have modest levels of salts and dissolved minerals. Therefore, the impact of salt and mineral deposits from vapor drift would be minimal. The use of drift eliminators, along with proper tower design and operation, would further minimize the potential for impacts.

For the purpose of this analysis, impacts to terrestrial resources are considered small if no sensitive habitats, including wetlands, are disturbed and no important species are affected. Glades County has a low number of sensitive species and there are no known sensitive species onsite. However, the 121-mile conceptual transmission corridor includes a significant area (5824 acres). In addition, up to 1873 acres of wetlands (approximately 650 acres of high quality wetlands) within the entire project area (onsite and offsite features) could potentially be affected by project construction and operation. Construction of the plant and reservoir would result in a loss of primarily agricultural land that may serve as habitat to various common terrestrial species; however, the creation of a new reservoir to support plant operation would provide new habitat for birds and waterfowl that would not be adversely affected by plant operation. FPL concluded that impacts to terrestrial resources, including endangered and threatened species, from construction and operation of the proposed nuclear plant and conceptual transmission corridor at the Glades alternative site would be MODERATE.

9.3.3.1.5 Aquatic Resources and Protected Species

The Glades site is just north of the C-43 Channel and Lake Hicpochee and approximately 5 miles from Lake Okeechobee. Lake Hicpochee sometimes does not resemble a lake and often looks like a sandy desert plain (U.S. Power Squadrons 2008). The lake changes in size as Lake Okeechobee is drained to meet proper levels and acts as a stormwater discharge area. The C-43 Channel connects to Lake Okeechobee just east of the site, and includes similar aquatic resources to those found in Lake Okeechobee.

Lake Okeechobee is at the center of the south Florida regional water management system. The massive lake is a 730-square-mile, relatively shallow lake with an average depth of 9 feet and is the second-largest freshwater lake wholly within the continental United States, second only to Lake Michigan. The Lake Okeechobee drainage basin covers more than 4600 square miles (SFWMD 2008).

Lake Okeechobee supports a nationally recognized sport fishery for largemouth bass (*Micropterus salmoides*) and black crappie (*Pomoxis nigromacultus*), as well as a commercial fishery for various catfish and bream (*Lepomis spp.*). These fisheries generate nearly $30 million per year for the local economies, and they have an asset value in excess of $100 million. Another estimate places the value of the recreational fish species at more than $300 million. In addition to the sport and commercial species, Lake Okeechobee supports a diverse community of fish, including (in total) 41 species. These fish are a food resource for wading birds, alligators, and other animals that use the lake (SFWMD 2005a).

For the purpose of this analysis, impacts to aquatic resources are considered small if no sensitive habitats are disturbed and no important species are affected. Water from the C-43 Channel via pipeline is assumed to be the source to cool the new nuclear units constructed at the Glades alternative site. Although recreational sport fish and other aquatic species would be temporarily displaced during construction of a water intake structure, they would be expected to recolonize the area after construction is complete. No listed fish species are known to exist in Glades County (FNAI 2011), that includes the C-43 Channel and the portion of Lake Okeechobee near the Glades site. One state-listed amphibian, the gopher frog (*Rana capito*), has been documented or observed in Glades County. Field surveys would be conducted for federally listed and state-protected aquatic species as part of the permit process before any land preparation or construction activities began at the site or along associated transmission corridors. Because of this, and because land clearing associated with construction of the plant and transmission lines would be conducted in accordance with federal and state regulations, permit conditions, existing FPL procedures, good construction practices, and established best management practices, impacts to aquatic resources, including endangered and threatened species, from construction of nuclear power facilities at the Glades site would be SMALL.

There would be no direct discharges to the nearby surface waters from plant operation since plant design assumes discharge by underground injection. The most likely aquatic impact from nuclear operations at the Glades site would be entrainment and impingement of aquatic organisms in the C-43 Channel. Because the EPA requires facilities to meet criteria designed to protect organisms from entrainment and impingement, the potential for environmental impacts to aquatic resources, including endangered and threatened species, from nuclear power facility operations at the Glades site would be SMALL.

9.3.3.1.6 Socioeconomics

This subsection evaluates the social and economic impacts to the region from construction and operation of the proposed nuclear plant at the Glades site. Much of the socioeconomic analysis relies on census data gathered by the United States Census Bureau (USCB). The USCB performs an extensive census every 10 years. At the time this evaluation was performed, the most recent decennial U.S. census was conducted in 2000. The USCB assembles the decennial census data into a wide range of reports that can be used to characterize socioeconomic conditions of a region. In addition, the NRC sponsored development of a computer program called SECPOP2000 that enables an analyst to quickly assemble and quantify customized regional socioeconomic information. However, this program does not produce results for years later than 2000 (U.S. NRC Aug 2003). For years that fall between each decennial census, the USCB issues estimates based on surveys and statistical models. However, the types of data collected and assembled for intermediate years is less extensive than for years when a decennial census is performed; therefore, the decennial census provides the most comprehensive information.

Because the decennial census provides the most comprehensive information, and because the NRC software tool, SECPOP2000, is not available for intermediate years, information from the 2000 census is chosen as a common baseline for socioeconomic comparison for this analysis. Published census data for later years, if available, is presented as supplemental information.

9.3.3.1.6.1 Physical Impacts

Construction activities can cause temporary localized physical impacts such as noise, odor, fugitive dust, vehicle exhaust emissions, ground vibration, and shock from blast activities. The use of public roadways and railways would be necessary to transport construction materials and equipment to the site. Most of the construction activities would occur within the boundaries of the Glades site; however, an access road and a railway connection spur would be constructed on lands adjacent to the site. These new transportation rights-of-way would be routed to avoid residences and populated areas, however, a portion of SR 78 would be widened by two lanes to accommodate anticipated traffic levels attributable to project construction; some residences and commercial services could be temporarily affected during construction. In addition, the conceptual site layout developed for the site includes construction of a 121-mile conceptual transmission corridor that would include off-site impacts. Other offsite areas that would support construction activities (for example, borrow pits, quarries, and disposal sites) are expected to be already permitted and operational. Impacts on those facilities from construction of the new plant would be small incremental impacts from those due to their normal operations.

Potential impacts from power plant operations include noise, odors, exhausts, thermal emissions, and visual intrusions. Operational noise would be generated by pumps, fans, transformers, turbines, generators, onsite traffic, and switchyard equipment. Noise levels attenuate rapidly with distance so that ambient noise levels (attributable to power plant operations) would be minimal at the site boundary. Also, the Glades site is in a rural area surrounded by agricultural land, with few residents in the area. Commuter traffic would be controlled by speed limits. Good road conditions and appropriate speed limits would minimize the dust and noise level generated by the delivery trucks and site workers that travel to and from the site.

The project would have standby diesel generators and auxiliary power systems. Air quality permits would govern operation of this equipment to ensure that air emissions comply with regulations. In addition, the generators would be operated on a limited, short-term basis. Normal plant operations would not use a quantity of chemicals that could generate odors that exceed odor threshold values.

Physical impacts are considered small when offsite areas are not affected, or only minimally or temporarily affected by noise, odor, dust, emissions, vibration, or shock. In summary, construction activities would be temporary and would occur primarily within the boundaries of the Glades site. Offsite impacts would represent small incremental changes to offsite services that support construction activities. During station operations, ambient noise levels would be minimal at the site boundary. Air quality permits would be required for the diesel generators to ensure emissions comply with regulatory guidelines, and chemical use would be limited, which should limit odors. Therefore, the physical impacts of construction and operation of the new units at the Glades site would be SMALL.

9.3.3.1.6.2 Demography

The population distribution within and around the Glades site is low with typical rural characteristics, and satisfies the 10 CFR Part 100 definition of a low population zone. The nearest population center is Moore Haven, approximately 2 miles east, with a population of 1635 residents. The nearest population center larger than 25,000 residents is Fort Myers, approximately 45 miles west. Conterminous counties include Highlands to the north, Okeechobee to the northeast, Martin to the east, Palm Beach to the southeast, Hendry to the south, Lee to the southwest, Charlotte to the west, and DeSoto to the northwest. Other counties within 50 miles include Hardee to the northwest, St. Lucie to the northeast, Broward to the southeast, and Collier to the south.

To determine which counties best represent the ROI for socioeconomic analysis of the Glades site, counties that fall within 50 miles around the Glades site were initially identified. Several factors were then considered to determine which of these counties would best represent the ROI. These factors, listed below, are evaluated based on historical data from the USCB. Key assumptions of the ROI determination are that (1) workers will seek to live within 50 air miles of the site and within a 60-minute commute time and (2) most workers will seek to live in population centers that generally offer more amenities (stores, medical facilities, schools, churches, a larger selection of houses, etc.) than rural locations.

<u>Factors Considered to Determine Which Counties Would Best Represent the ROI</u>

- County population and population density
- Populations of the largest population centers
- Geographic locations of the population centers in relation to the Glades site

- The land fraction of nearby counties that falls within 50 miles of the site
- Relative distance from nearby counties to the site
- Estimated travel distance and estimated travel time from the population centers to the site
- Mean travel time to work
- County employment
- Worker commuter patterns to and from counties conterminous the site

Based on the results of this evaluation, the counties that best represent the ROI for socioeconomic analysis of the Glades site include Glades, Hendry, Lee, and Okeechobee. Because there is no reliable method to predict the distribution of the workforce among these four counties, the ROI is generally treated as a whole for much of the socioeconomic analysis.

Based on the 2000 census, the total population of the ROI was 523,584, that included 10,576 in Glades County, 36,210 in Hendry County; 440,888 in Lee County, and 35,910 in Okeechobee County (USCB 2000). Census estimates for 2007 showed an ROI population of 681,595, that included 11,109 in Glades County, 39,611 in Hendry County, 590,564 in Lee County, and 40,311 in Okeechobee County (USCB 2009).

NRC guidelines have been established to assess the demographic sparseness and proximity of a proposed site. Sparseness is a combined measure of (1) the population density within 20 miles of the site and (2) the relative population of the nearest metropolitan area within 20 miles of the site. Proximity is a combined measure of (1) the population density within 50 miles of the site and (2) the relative population of the nearest metropolitan area within 50 miles of the site. Based on the sparseness-proximity evaluation, a site is categorized as low, medium, or high (NUREG-1437).

The land area within 20 miles of the Glades site (i.e., excluding water bodies such as Lake Okeechobee) is 979.5 square miles, and based on 2000 census data, the population of this area was 39,196. This yields a population density of 40 people per square mile, based on land area. There are no cities within 20 miles of the Glades site that have a population greater than 25,000. Therefore, the sparseness level is 2 based on a population density of 40 to 60 people per square mile and no community greater than 25,000 people within 20 miles (NUREG-1437).

Similarly, the land area within 50 miles of the Glades site is 6540.3 square miles, and the population of this area was 512,911. This yields a population density of 78.4 people per square mile. There are no cities within 50 miles of the Glades site that have a population greater than 100,000. Therefore, based on NRC guidelines, the proximity level is 2 based on a population density of 50 to 190 people per square mile and no city greater than 100,000 people within 50 miles. Therefore, the Glades site has a sparseness-proximity measure of 2.2, which is categorized as medium (NUREG-1437).

Based on FPL estimates, the peak construction workforce for the project would be 3548 construction workers. Operations would overlap with peak construction activity for a period of time. Therefore, in addition to the construction workforce, there would be a small number (99) of operations workers on the site during the peak construction period, and some of these workers would also relocate to the area. Because of the location of the Glades site relative to population centers, FPL assumed that 70 percent of the construction workers and 85 percent of the operation workers would relocate from outside the ROI. FPL further assumed that 70 percent of construction workforce and 100 percent of the operation workforce that moved to the area would bring their families. Based on these assumptions, 2484 construction and 84 operation workers would relocate to the area during the project construction phase, and 1823 of these workers would bring their families. Based on an average household size of 3.25 people (BMI Apr 1981), the total increase in population attributable to the peak total workforce at the Glades site would be 6669 people. An influx of 6669 people represents a 1.3 percent increase in the ROI population of 523,584. Impacts are considered small if plant-related population growth is less than 5 percent of the area’s total population (NUREG-1437). Therefore, this would pose a SMALL impact on population for the ROI.

FPL estimated the total onsite operations workforce to be 1050 workers, and that 85 percent of these workers (893) would relocate from outside the ROI. For this analysis, FPL assumed that 100 percent of operations workers who relocate will bring their families. Based on an average household size of 3.25 people (BMI Apr 1981), the total population increase attributable to project operations is 2901 people. This represents a 0.6 percent increase in the four-county ROI population. This would pose a SMALL impact on population for the ROI.

9.3.3.1.6.3 Economy

Based on 2000 census data, Glades County had a civilian labor force of 4034 people and an unemployment rate of 8.8 percent; Hendry County had a civilian labor force of 15,814 people and an unemployment rate of 7.8 percent; Lee County had a civilian labor force of 193,651 people and an unemployment rate of 3.7 percent; and Okeechobee County had a civilian labor force of 14,863 people and an unemployment rate of 4.7 percent. For the entire ROI, 99.9 percent of the labor force was part of the civilian labor force and 0.1 percent was in the armed forces. Of the civilian labor force, 95.8 percent are employed and 4.2 percent are unemployed. The overall unemployment rate for the four-county ROI is slightly lower than that of the state, which is 5.6 percent (USCB 2000).

The economies of the four counties in the ROI are very similar, dominated primarily by educational, health, and social services; agriculture, forestry, fishing and hunting, and mining; and retail trade. Most of the labor force resides in Lee County (USCB 2000).

Based on the assumptions stated above, the number of workers who relocate from outside the area would include 70 percent of the 3548 peak construction workers and 85 percent of the 99 operations workers for a total of 2568 workers. An influx of 2568 construction and operation workers from outside the region would have positive economic impacts in the four-county region. Based on a multiplier of 1.7604 jobs (direct and indirect) for every construction job and 2.3016 for every operation job (BEA Aug 2009), an influx of 2568 construction and operation workers would create 2006 indirect jobs, for a total of 4574 new jobs in the ROI. This represents a 2 percent increase in the total labor force in the ROI. Economic effects are considered small if peak employment accounts for less than 5 percent of area employment (NUREG-1437). The creation of direct and indirect jobs could potentially reduce unemployment and would likely create business opportunities for goods and service-related industries and the housing industry. Overall, the economic impacts attributable to project construction would be beneficial and SMALL within the ROI.

An estimated 1050 workers would be required for the operation of two nuclear power facilities at the Glades site (U.S. DOE May 2004), and FPL assumes that 85 percent of these employees (893) would migrate into the region. Based on a multiplier of 2.3016 jobs (direct and indirect) for every operations job at the new units (BEA Aug 2009), an influx of 893 workers would create 1162 indirect jobs for a total of 2054 new jobs in the region. This represents a 0.9 percent increase in the total labor force in the ROI. The creation of direct and indirect jobs could potentially reduce unemployment and would likely create business opportunities for goods and service-related industries and the housing industry. Overall, the economic impacts attributable to project operation would be beneficial and SMALL within the ROI.

9.3.3.1.6.4 Taxes

Taxes collected as a result of construction and operation of the new nuclear units at the Glades site would benefit the state and local tax authorities. FPL would pay property taxes to each taxing authority whose boundaries would contain the plant. Tax payments would be based on the assessed valuation of the plant and local tax rates. If the plant site straddled a jurisdictional boundary, FPL would pay taxes to both entities based on the assessed valuation within each entity.

As described in Subsection 4.4.2.2.2, it is not clear whether FPL corporate income taxes would increase as a result of construction of the new units at the Glades site, because the units would not generate revenues until they became operational. However, once the units were placed in service, Glades County property taxes would begin and would continue for the 60-year operational life of the facility.

FPL assumed that annual property tax payments at Glades site would be similar to those paid by the nuclear units at Turkey Point plant. In 2007, the annual tax payment for the two units at the Turkey Point nuclear power plant was $6,902,670. For the 2007 fiscal year, Glades County had property tax revenues of $4,735,034 (State of Florida, Mar 2008a).

With respect to the school district, in Florida, local revenue for the school districts is derived almost entirely from property taxes levied by Florida's 67 counties, each of which constitutes a school district (Florida Department of Education 2008). As described in Subsection 2.5.2.3.5, the state of Florida has an established equalized funding program that reallocates tax base funds from counties that have a high economic tax base to counties that have a low economic tax base. The Florida Education Finance Program is the primary mechanism to fund the operational costs of Florida school districts. Funding is based on the number of full-time equivalent students, and considers variations in several factors to determine funding for each district: local property tax bases, education program costs, costs of living, and costs for equivalent educational programs because of the density and distribution of the student population.

It should be noted that school property tax payments would be based on the location of the plant and not necessarily on the district(s) attended by most of the workers' children. Therefore, it is not possible to assess the direct impact of the plant on the school district. In addition, the impact of plant construction and operation on the special tax districts is not assessed here because most of the property tax payment from the plant would go to the county and the school district(s).

The benefits of taxes are considered small when new tax payments by the nuclear plant constitute less than 10 percent of total revenues for local jurisdictions and large when new tax payments represent more than 20 percent of total revenues (NUREG-1437). Therefore, based on the county portion of the FPL property tax payment for the new units, 59 percent of the 2007 property tax revenues for Glades County would be provided by FPL and would constitute a LARGE positive impact.

9.3.3.1.6.5 Transportation

Principal road access to the Glades site would be from U.S. Highway 27/SR 78, both of which run concurrently in an east-west orientation along the northern boundary of the site. This road is a four-lane divided highway. Approximately 2 miles west of the site, U.S. Highway 27/SR 78 diverge, such that U.S. Highway 27 spans northward toward Palmdale and Venus communities, and SR 78 generally spans westward toward La Belle. U.S. Highway 27 and SR 78 also diverge approximately 2 miles east of the site, so that U.S. Highway 27 continues eastward through Moore Haven, and SR 78 continues northward toward Lakeport, Buckhead Ridge, and

Okeechobee. Therefore, commuters from the west (La Belle) would travel eastward along U.S. Highway 27 and SR 78; those from the northwest (Venus, Palmdale) would travel eastward along U.S. Highway 27; those from the northeast (Lakeport, Buckhead Ridge, Okeechobee) would travel south along SR 78; and those from the east and southeast (Moore Haven, Clewiston, Harlem, Lake Harbor, Belle Glade) would travel westward along U.S. Highway 27. Based on the conceptual site layout developed for the Glades site, access to the site is assumed to be provided from SR 78 where it diverges south of U.S. Highway 27 just west of the site. SR 78 is a two-lane undivided rural highway.

The Florida Department of Transportation (FDOT) reports the average annual daily traffic (AADT), the K_{100} demand factor, and direction factors (D-factors) at several points along the travel routes to the site. The product of these parameters yields the directional peak hour volume that is the volume of traffic in the most congested direction for the most congested hour of the day. Monitored locations include U.S. Highway 27 just west of the site at the confluence of U.S. Highway 27 and SR 78, U.S. Highway 27 just east of the site within Moore Haven, and the stretch of SR 78 that spans just north of the site. The AADT count and directional peak hour volume of the western location along U.S. Highway 27 is 7800 vehicles per day and 424 vehicles per hour (FDOT 2008). This directional peak hour volume classifies this western portion of the roadway as a level of service (LOS) of A (FDOT 2007), and the remaining peak hour capacity is 1776 vehicles. In general terms, LOS is an indicator of how effectively the road accommodates the volume of traffic. LOS is represented by one of the letters A through F, A for the freest flow and F for the least free flow. The remaining directional peak hour capacity is the total number of vehicles that can be added to the most congested direction traffic at the peak hour and still remain within the capacity of the road. The directional peak hour volume of the eastern location along U.S. Highway 27 is 10,200 vehicles per day and 554 vehicles per hour (FDOT 2008). This peak hour volume classifies this eastern portion of the roadway as a LOS of A (FDOT 2007), and the remaining directional peak hour capacity is 1676 vehicles. The AADT count and directional peak hour volume of the northern location along SR 78 is 3282 vehicles per day and 173 vehicles per hour (FDOT 2008). This peak hour volume classifies this northern location as a LOS of B, and the remaining directional peak hour capacity is 247 vehicles (FDOT 2007).

Based on the existing population distribution around the site, FPL assumed that most of the workforce would likely travel along the westward portion U.S. Highway 27 and that smaller portions of the workforce would travel along the eastern portion of U.S. Highway 27 and the northern portion of SR 78. Also, the traffic attributable to delivery of construction materials could cause additional congestion on U.S. Highway 27 during certain times of the day. Based on the methodology presented in Subsection 4.4.2.2.4, FPL determined that construction at the Glades site would add 1485 vehicles per day and 488 vehicles during the peak hour to the western and eastern portion of U.S. Highway 27. The additional construction traffic would not cause U.S. Highway 27 to exceed capacity but would drop the roadway to a LOS classification of C in the western direction, and to a LOS classification of B in the eastern direction. FPL determined that construction at Glades site would add 382 vehicles during the peak hour to the northern portion of SR 78. The additional construction traffic would cause the road to exceed capacity, further add to current traffic congestion, and drop the roadway to a LOS classification of D.

Based on the above analysis, it is likely that the additional traffic would pose delays along U.S. Highway 27 and SR 78. It is anticipated that the drops in LOS classification along U.S. Highway 27 would only pose negligible additional delays or other operational problems. To facilitate the additional traffic, a portion of SR 78 could be widened to a four-lane highway from U.S. 27 to the project site, and acceleration/deceleration lanes could be added to facilitate commuter traffic. The NRC applied significance levels to the LOS classifications that were projected to result from the additional traffic associated with refurbishment activities at nuclear plants (NUREG-1437). FPL considers this approach to be appropriate for construction of a nuclear plant because both plant construction and refurbishment would be large construction projects. The NRC associates small impacts with LOS A and B, moderate impacts with LOS C and D, and large impacts with LOS E and F. Therefore, it is anticipated that the impact of the construction workforce on transportation would be MODERATE and may warrant mitigation.

Operations at the Glades site would add approximately 427 and 140 more vehicles to the western and eastern respective portions of U.S. Highway 27 during the hour of peak traffic. An estimated 110 vehicles would be added the northern portion of SR 78 during the hour of peak traffic as well. The current peak hour capacities of these roadways are sufficient to accommodate the additional traffic expected from operations. Additional traffic as a result of operations would not result in any changes to LOS classifications along U.S. Highway 27, but would drop the LOS classification on SR 78 from B to C. Shift changes could be staggered so that the traffic increase would be less likely to cause congestion. Therefore, it is anticipated that the impact of the operations workforce on transportation would be MODERATE and would not warrant mitigation.

9.3.3.1.6.6 Aesthetics and Recreation

The Glades site is an undeveloped site in an unincorporated area of Glades County, approximately 5 miles southwest of Lake Okeechobee. The site is on flat, swampy land at an approximate elevation of 15 feet above MSL (USGS 1971) and lies within the Everglades physiographic province (USGS 2008).

Because the entire area is relatively flat, the power plant and water intake facilities may be visible from some angles. There would be occasional visible plumes associated with cooling tower operations. Visibility of the plumes would depend on weather conditions and the location of the viewer in the area. Impacts on aesthetic resources are considered to be moderate if there is the potential for diminution in the enjoyment of the physical environment and measurable impacts that do not alter the continued function of socioeconomic institutions and processes. Construction and operation of an industrial facility on a previously undeveloped site would likely result in some complaints from the affected public with respect to diminution in the enjoyment of the physical environment. Therefore, impacts of construction and operation of the new units on aesthetics would be MODERATE and could warrant mitigation.

The western shoreline of Lake Okeechobee lies within 6 miles of the site, as well as portions of the Lake Okeechobee Scenic Trail and Big Water Heritage Trail, which parallel the shoreline of the lake. Lake Hicpochee is approximately 2 miles southeast of the site. There are no state parks or federal parks within 6 miles of the Glades site.

Lake Okeechobee occupies 730 square miles and is the second largest freshwater lake wholly within the United States. The lake is the epicenter of Florida and is renowned for its unique natural habitat, rich heritage, recreational fishing, and birding (SFRPC 2008).

The Lake Okeechobee Scenic Trail spans 110 miles along the perimeter of Lake Okeechobee. The trail is designated as a segment of the Florida National Scenic Trail. The trail is atop the Herbert Hoover Dike, which surrounds the lake for flood protection, and provides views ranging from scenic lakeside to working agricultural landscapes. The trail affords opportunities to view wildlife and to fish, bike, and hike. The nearest access point to the trail from the Glades site is the Moore Haven Recreation Area, which is east of the site at the confluence of Lake Okeechobee and the Caloosahatchee River (USACE 2008a).

The Big Water Heritage Trail is a designated vehicle roadway that provides vehicular access to the landscapes created by south central Florida's watersheds. The trail begins at the Kissimmee River and continues through the communities around Lake Okeechobee and south through the Everglades. It includes portions of SR 78, U.S. Highway 27, SR 76, U.S. Highway 98, and U.S. Highway 441, and spans within a few miles of the Glades site. The Big Water Heritage Trail is a partnership project that promotes public awareness of natural and cultural features (SFRPC 2008).

Within 50 miles of the Glades site there are several lakes, rivers, swamps, wetlands, and other areas of interest. The Nicodemus Slough is approximately 5.8 miles northeast of the Glades site. The slough contains wet prairies, freshwater marsh wetlands, and pasturelands bordered on the north by a portion of the Herbert Hoover Dike. The property was historically used to graze cattle. In the 1990s, the SFWMD purchased 2219 acres of Nicodemus Slough for hydrologic restoration and public recreational use and designated the area as the Nicodemus Slough Management Area. The area was sparsely used by recreational enthusiasts; therefore, as part of a large land acquisition, the land, encumbered with the continued right to flow water over it, reverted to private ownership in the summer of 2006 and public access was closed (FPL Dec 2006).

Fisheating Creek Wildlife Management Area (FECWMA) is approximately 9.7 miles north-northeast of the Glades site. The FECWMA is bounded on the north and south by the Herbert Hoover Dike, and north and west of the Nicodemus Slough. Fisheating Creek travels approximately 50 miles from its origin in Highlands County through Glades County into Lake Okeechobee. The FECWMA spans 40 miles along this course and includes cypress swamps, hardwood hammocks, freshwater marsh, and mesic hammock habitats. Fisheating Creek has become incorporated into the Fisheating Creek ecosystem project in Glades and Highlands Counties, which is a part of the Florida Forever land acquisition and restoration program. The ecosystem project entails purchase of lands for conservation along the shores of Fisheating Creek for hikers, hunters, and wildlife observers, and to help maintain populations of rare plant and animal communities. The Fisheating Creek ecosystem project is designed to conserve lands that link Fisheating Creek to the Okaloacoochee Slough, Big Cypress swamp, and Babcock-Webb Wildlife Management Area, and Lake Okeechobee. The Fisheating Creek ecosystem project plans include 176,876 acres, 59,910 of which have been acquired by the state of Florida (FPL Dec 2006).

The Lake Wales Ridge National Wildlife Refuge is approximately 23 miles northwest of the site. The refuge occupies approximately 1858 acres and was established in 1993 as the first refuge designated for the recovery of endangered and threatened plants (USFWS 2008a). The northern portion of the Big Cypress National Preserve is approximately 39 miles south of the Glades site, and the Florida Panther National Wildlife Refuge is due west and adjacent to the Big Cypress National Preserve. The Big Cypress Preserve protects more than 720,000 acres of vast swamp containing a dynamic mixture of tropical and temperate plant communities that are home to diverse wildlife. The preserve provides a variety of recreational opportunities including hiking, backpacking, paddling, biking, camping, fishing, hunting, and off-road vehicle access (NPS 2008a). The Florida Panther National Wildlife Refuge consists of 26,400 acres and was established in 1989 under the authority of the Endangered Species Act to protect the Florida panther and its habitat (USFWS 2008b).

Two of the 154 state parks in Florida are within 50 miles of the Glades site and include the Highlands Hammock State Park and the Lake June in Winter Scrub State Park, both of which are more than 35 miles northwest of the Glades site.

Construction activities at the Glades site would pose temporary aesthetic impacts in the region. Construction activities would generate noise and fugitive dust, and the use of cranes (which could exceed 400 feet in height) would alter a portion of the regional viewscape. Construction of the transmission lines would pose similar impacts. Because the parks, trails, and other scenic areas in the region are several miles away, the aesthetic impacts from construction would be SMALL.

When completed, the presence of the power plant and transmission lines would pose a visual disturbance in the viewscape for the life of the structures. Vapor plumes generated by operations could also be visible. Plume visibility would depend on weather conditions and the location of the viewer; however, the visible portion of a vapor plume generally dissipates within 200 meters of the source. Because the region is sparsely populated and is used mainly as farmland, and because the parks, trails, and other scenic areas in the region are several miles away, the aesthetic impacts from operations would be SMALL.

Construction and operation of the new units at the Glades site could impact the attractiveness of recreational areas in the region. Recreational facilities could also be affected by increased traffic on area roads at peak travel periods; however, impacts would be minimal. During plant operations, some employees and their families would use the regional recreational facilities. However, the increase attributable to plant operations would be small compared to overall use of these facilities. Impacts on tourism and recreation are considered small if current facilities are adequate to handle local levels of demand. Therefore, impacts of facility construction and operation on tourism and recreation would be SMALL.

9.3.3.1.6.7 Housing

FPL estimates that 2568 construction and operation workers would move from outside the 50-mile radius of the Glades site to one of the counties within 50 miles, and each of these workers would need a place to live. Some of the workers would seek permanent residence, generally owner-occupied; some would choose to rent; and others would choose a transitional residence such as a hotel, a room in a private home, or a camper or mobile home.

Based on 2000 census data, within the four-county ROI, there are 278,993 housing units of which 63,099 are vacant (22.6 percent). The number of vacant housing units within each of these counties was 1938 (33.5 percent) in Glades County, 1444 (11.7 percent) in Hendry County, 56,806 (23.1 percent) in Lee County, and 2911 (18.8 percent) in Okeechobee County. This includes housing that is designated as seasonal, recreational, or occasional use (USCB 2000).

FPL estimates that, in absolute numbers, the available housing would be sufficient to house the construction workforce. Workers who relocate could secure housing from the existing stock in any of the four counties within the region, have new homes constructed, or bring their own residence (mobile home or trailer) to the region.

Because Glades, Hendry, and Okeechobee Counties have relatively small populations, their housing markets would likely be the most impacted. Impacts on housing are considered to be small when a small and not easily discernable change in housing availability occurs (NUREG-1437). The entire construction and operation workforce would occupy no more than 4.1

percent of vacant housing units in the ROI. Therefore, the impacts during plant construction would be SMALL, and mitigation would not be warranted.

FPL estimated that approximately 1050 workers would be needed for operation of two nuclear power facilities at the Glades site (U.S. DOE May 2004). FPL assumed that 85 percent of these workers (893) would relocate from outside the region and would settle in the four-county ROI. Based on these assumptions, the entire operations workforce would occupy no more than 1.4 percent of vacant housing units in the ROI. Therefore, the impacts from plant operations would be SMALL, and mitigation would not be warranted.

9.3.3.1.6.8 Public Services

Public services in the ROI include water supply and wastewater treatment facilities; law enforcement, fire, and medical facilities; libraries, parks and recreation, roadway maintenance, and other social services. Construction or operations employees who relocate from outside the region would most likely live in residentially developed areas where adequate water supply and wastewater treatment facilities already exist. The medical facilities in the four-county ROI provide medical care to much of the population within the 50-mile region, and, therefore, the small increases in the regional population would not materially impact the availability of medical services. Although the workers and their families would pose an additional overall demand on other public services, it is anticipated that the current capacity of the public services within the four-county ROI would be adequate to accommodate the increased demand. Therefore, the impact would be SMALL.

The new nuclear plant and the associated population influx would likely economically benefit the disadvantaged population served by the Florida Department of Children and Families. Direct jobs created by the project would bring indirect jobs that could be filled by currently unemployed workers and, therefore, remove them from the care of social services.

The ratio of residents to law enforcement officers in Glades, Hendry, Lee, and Okeechobee Counties was 353:1, 624:1, 796:1, and 399:1, respectively (FBI 2008). Within the ROI, the resident-to-law-enforcement-officer ratio was 715:1, and for the state of Florida, the resident-to-law-enforcement-officer ratio was 851:1. Ratios partly depend on population density. In general, fewer law enforcement safety officers are necessary for the same population if the population resides in a smaller area. Within the ROI, if no additional law enforcement officers were hired, the population increase attributable to project construction at the Glades site would increase the resident-to-law-enforcement-officer ratio by 1.3 percent to 724:1. This is a small increase and would still yield a lower resident-to-law-enforcement-officer ratio than the average for the state of Florida. Similarly, the increase in the resident-to-law-enforcement-officer ratio attributable to operations would yield less than a 0.6 percent increase.

The ratio of residents to firefighters in Glades, Hendry, Lee, and Okeechobee Counties was 82:1, 394:1, 431:1 and 492:1, respectively. Within the ROI, the resident-to-firefighter ratio was 397:1, and for the state of Florida, the resident-to-firefighter ratio was 1230:1 (USFA 2009). As described above concerning law enforcement officers, ratios partly depend on population density. In general, fewer firefighters are necessary for the same population if the population resides in a smaller area. Within the ROI, if no additional firefighters were hired, the population increase attributable to project construction at the Glades site would increase the resident-to-firefighter ratio by 1.3 percent to 402:1. This is a small increase and would still yield a lower resident-to-firefighter ratio than the average for the state of Florida. Similarly, the increase in the resident-to-firefighter ratio attributable to operations would yield less than a 0.6 percent increase.

Impacts on public services are considered small if there is little or no need for additional personnel. Impacts are considered moderate if some permanent additions or some new capital equipment purchases are needed (NUREG-1437). The population increase in the four-county region attributable to construction or operation of the new power units could pose a need to hire additional emergency personnel. However, any additional need would be small, and increased tax revenues generated by the project would be adequate to pay the salaries of any additional emergency personnel hired. Therefore, it is not expected that public services would be materially impacted by new construction or operations employees that relocate from outside the region. Therefore, impacts are considered SMALL, and mitigation would not be warranted.

9.3.3.1.6.9 Education

Based on data for the 2006–2007 school year, Glades County had 8 schools that covered prekindergarten through 12th grade (PK-12) schools with a total enrollment of 1256 students; Hendry County had 17 PK-12 schools with a total enrollment of 7463 students; Lee County has 112 PK-12 schools with a total enrollment of 78,981 students; and Okeechobee County had 17 PK-12 schools with a total enrollment of 7289 students (NCES 2009). In the four-county ROI, there are 154 schools with a total enrollment of 94,989 students.

FPL estimated that 2568 construction and operation workers would migrate to the area, and that 1823 workers would bring a family. This would yield a total population increase of 6669 people. Based on an estimate of 0.8 school-aged children per family (BMI Apr 1981), an estimated 1458 of the 6669 people who relocate to the four-county area would be school-aged children. This would yield a 1.5 percent increase in the student population within the four-county ROI. Small impacts are generally associated with project-related enrollment increases of up to 3 percent, and moderate impacts on local school systems are generally associated with project-related enrollment increases of 3 to 8 percent (NUREG-1437). Therefore, this would pose a SMALL impact on the ROI, and mitigation would not be warranted.

FPL assumed that 893 operations workers and their families would relocate from outside the region and that the total population increase attributable to operations would be 2901 people. This would include an estimated 714 children in the PK-12 school range. This influx of students would increase the student population in the ROI by 0.8 percent within the four-county ROI. The impacts on public education are considered SMALL, and mitigation would not be warranted.

9.3.3.1.7 Historic and Cultural Resources

FPL conducted historical and archaeological records searches on the National Park Service National Register Information System (NRIS) and reviewed information on historic and archeological sites provided in documents associated with the formerly proposed FPL Glades Power Park project, which was located near the Glades site. Where applicable, historic and archeological sites are identified by their historic site structure identifier.

In 2006, FPL conducted an archeological reconnaissance survey for a 4900-acre undeveloped area for the formerly-proposed FPL Glades Power Park project (FPL Dec 2006). The FPL Glades Power Park site is approximately 3 miles north of the Glades site.

No archaeological sites were identified during the FPL archeological reconnaissance survey. Background research conducted as part of the 2006 FPL Glades Power Park archeological survey indicates that one archaeological site (8GL60) is within the FPL Glades Power Park project boundary. The site was recorded as a Belle Glade mound based on its designation as an "Indian Mound" on a topographic map. Because of lack of previous field investigation of the site, it has not been evaluated for its National Register of Historic Places (NRHP) eligibility. Other notable archaeological sites in the vicinity of the Glades site are described below.

Gator Mound (8GL53) is just outside the northeastern corner of FPL Glades Power Park project boundary and just south of the Nicodemus Slough. This site is recorded as a prehistoric mound and earthworks of unknown cultural affiliation, and has not been evaluated for NRHP eligibility.

The Nicodemus Earthworks site (8GL9) is approximately 2500 feet north of the FPL Glades Power Park site and Nicodemus Slough. It is recorded as a destroyed white sand burial mound and linear crescent earthworks with linear ridge and mound components that are associated with the Belle Glade culture. The burial mound has been recorded as containing human remains. This site has not been evaluated for its NRHP eligibility.

An unnamed site (8GL61) is approximately 6500 feet north of the FPL Glades Power Park site. It is recorded as a prehistoric mound associated with Belle Glade culture. This site has not been evaluated for its NRHP eligibility.

The Glades Circle Ditch (8GL38) is 7000 feet north of the FPL Glades Power Park site and Nicodemus Slough. The site is recorded as a prehistoric earthwork associated with the Glades culture. It has not been evaluated for its NRHP eligibility.

The Fort Center Archeological District (8GL13) is composed of numerous middens and earthworks associated with the Belle Glade I and II culture. The earthworks include mounds, linear embankments, a burial mound, borrow areas, and circular ditches. This complex includes archeological sites 8GL11–8GL13, 8GL15–8GL25, 8GL375 and 8GL376. The site is named for a 19th century Seminole war fort (8GL23) built on the site. The complex is situated in both hammock and savannah adjacent to the south bank of Fisheating Creek. The Fort Center Archaeological District is an important prehistoric site group with the potential to be a state park, but it has not been evaluated for NRHP eligibility.

The Herbert Hoover Dike (8GL421) that surrounds Lake Okeechobee is listed in the Florida Master Site File as a district or resource group. The site consists of five historic structures in five different counties; 8GL421A is the historic site structure number for the segment in Glades County. Construction of the dike began in the early 1930s by the U.S. Army Corps of Engineers (USACE) and was completed in 1938. The 34-foot high dike is composed of shell, rock, and gravel covered with grass, trees, and a service drive on top of the levee. It is considered to be the largest civil engineering work in south Florida and continues to control the waters around Lake Okeechobee. This historic resource has been previously determined by the State Historic Preservation Officer (SHPO) to be NRHP-eligible.

The archeological background research did not reveal any military forts, encampments or roads, battle sites, homesteads, farmsteads, trails, or Native American villages within 3 miles of the FPL Glades Power Park site.

There are two Seminole Indian Reservations within the four-county ROI (Seminole Tribe of Florida 2008). The Brighton Seminole Reservation is in Glades County approximately 12 miles northeast of the Glades site. The northern portion of the Big Cypress Seminole Reservation is in the southwest corner of Hendry County approximately 33 miles southeast of the Glades site.

The NRHP identifies 61 properties in the four-county ROI, including two properties in Glades County, 46 properties in Lee County, two properties in Okeechobee County, and 11 properties in Hendry County. Two of these properties, the Glades Moore Haven Downtown Historic District and the Glades Moore Haven Residential Historic District, are within 10 miles of the Glades site (NPS 2008b).

Siting the proposed nuclear plant at the Glades site would require a formal cultural resources survey, and consultation with the SHPO would be conducted so that any adverse effects to onsite archeological or historic resources would be avoided, minimized, or mitigated. Sites are considered to have small impacts to historic and cultural resources if the SHPO identifies no significant resources on or near the site or determines they would not be affected by plant construction or operation. Mitigation measures would be applied to resolve any adverse effects and reduce impacts to onsite cultural resources from construction or operation of the new units at the Glades site to SMALL.

Sites are considered to have large impacts to historic resources if they would be disturbed or otherwise have their historic character altered by construction. Two historic properties and several archeological areas were identified within 10 miles of the Glades site. Construction of the new units at the Glades site would result in adverse effects to the historic and cultural landscape through introduction of visual elements that would be out of character with the property and its setting. The visual impacts would be LARGE and would warrant mitigation.

Siting the proposed nuclear plant at the Glades site would require a formal determination of areas of potential effect from physical disturbance or visual impacts, identification of historic properties within the areas of potential effect, and a determination of adverse effects. FPL would consult with the SHPO to identify measures for avoidance, minimization, or mitigation of any adverse effects.

9.3.3.1.8 Environmental Justice

Environmental justice refers to a federal policy under which each federal agency identifies and addresses, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority or low-income populations. The NRC has a policy on the treatment of environmental justice matters in licensing actions (69 FR 52040) and guidance (U.S. NRC May 2004). Subsection 2.5.4.1 describes the methodology FPL used to establish locations of minority and low-income populations.

The 2000 census block groups were used to ascertain minority and low-income population distributions in the area. There are 499 block groups within 50 miles of the Glades site. The census data for Florida characterizes 14.6 percent of the population as black; 0.3 percent American Indian or Alaskan Native; 1.7 percent Asian; 0.1 percent Native Hawaiian or other Pacific Islander; 3.0 percent as other single minorities; 2.4 percent multiracial; 22.0 percent aggregate of minority races; and 16.8 percent Hispanic ethnicity. If any block group percentage exceeded the state percentage by more than 20 percent or was greater than 50 percent, then the block group was considered to have a significant minority population.

Significant black minority populations exist in 54 block groups; significant American Indian or Alaskan Native populations exist in 3 block groups; significant other minority populations exist in 21 block groups; significant multiracial minority populations exist in 3 block groups; significant “aggregate of minority races” populations exist in 80 block groups; and significant Hispanic ethnicity populations exist in 53 block groups. There are no block groups containing significant Asian or Native Hawaiian or other Pacific Islander minority populations within 50 miles of the Glades site.

Three Indian Reservations lie within 50 miles of the Glades site: the Brighton Indian Reservation, the Big Cypress Indian Reservation, and a portion of the Miccosukee Indian Reservation. The Brighton and Big Cypress Indian Reservations are both part of the Seminole Tribe of Florida. The Brighton Indian Reservation, 10 miles north of the Glades site, offers several tourist attractions including Indian arts and crafts shops, the Seminole Casino Brighton, a rodeo arena, the Brighton Citrus Grove, and the Brighton Seminole Campground. The Big Cypress Reservation, an 85-acre complex 40 miles south of the Glades site, offers the Ah-Tah-Thi-Ki Museum, the Billie Swamp Safari, the Big Cypress RV Resort, the Big Cypress Citrus Grove, the Swamp Water Café, and Big Cypress Hunting Adventures. Today, most Seminole Tribal members are afforded modern housing and health care. In fact, today the Seminole Indians live much the same way as those who live outside Seminole County (Seminole Tribe of Florida 2008).

A portion of the Alligator Alley Miccosukee Indian Reservation also lies within the 50-mile radius. The Miccosukee Tribe of Indians was originally part of the Creek Nation, an association of clan villages that inhabited the areas now known as Alabama and Georgia. There are approximately 650 people enrolled in the Miccosukee Tribe. However, The Tamiami Trail Reservation, 40 miles west of Miami in Miami-Dade County, is the site of most Tribal operations and the center of the Miccosukee Indian population. Alligator Alley is the largest of the Miccosukee Tribe reservations and covers approximately 75,000 acres. This land consists of 20,000 acres with potential for development and 55,000 acres of wetlands. The reservation contains a modern service station plaza, a police substation, and 13,000 acres of land that is leased for cattle grazing. Plans are currently underway for additional commercial and agricultural development as well as community facilities and homes sites (Miccosukee Resort and Gaming 2007).

The locations of the minority populations and Indian Reservations within 50 miles of the Glades site are shown in Figure 9.3-9.

The census data characterizes 11.7 percent of Florida households as low income. Based on the “more than 20 percent” criterion, 45 block groups out of a possible 499 contain a significant number of low-income households. The locations of the low-income populations within 50 miles of the Glades site are shown in Figure 9.3-10.

Although the Glades site is within a minority block group, construction activities (noise, fugitive dust, and air emissions) would be contained with site boundaries and would not disproportionately impact minority populations. In fact, minority and low-income populations would most likely benefit from construction activities through an increase in construction-related jobs. Operating the new units at the Glades site is also unlikely to have disproportionate impacts on minority or low-income populations.

FPL concludes that construction and operation of the proposed nuclear plant at the Glades site would not disproportionately impact minority or low-income populations and that mitigation would not be warranted, and the impacts to these populations would be SMALL.

9.3.3.1.9 Other Projects in the Vicinity of the Glades Site

The cumulative impacts of past, present, and reasonably foreseeable federal (e.g. USCOE, USGS), non-federal (e.g., FDEP, FDOT, county), and private projects within a 50-mile radius of the Glades site, excluding Brownfield and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites, that could have cumulative impacts with the proposed action are described in Table 9.3-9. These projects have either requested an air or water permit/license or had an environmental impact statement complete. Projects included in the Table 9.3-9 are within the 50-mile radius of the Glades site and the appropriate timeframe for construction and operation of the new units (Figure 9.3-8) from 2013 to 2063 (based on a construction start date of 2013, a Unit 7 in-service date of 2023, and a 40-year operating license). Nuclear power projects within 100 miles of the Glades site (i.e., St. Lucie) are also described in Table 9.3-9. The Turkey Point site is more than 100 miles from the Glades site and is therefore not included in the table. The only other nuclear power plant currently operating in Florida, Crystal River, is more than 170 miles from the Glades site and therefore is also not included in the table. The proposed nuclear power plant in Levy County is approximately the same distance as the Crystal River site and is not in the table. It should be noted that this list is not intended to be exhaustive and should not be used to imply that no other past, present, or reasonably foreseeable projects exist that could contribute to cumulative impacts within each alternative site project area.

The impacts to land use that would have a cumulative impact on alternative sites would generally be characterized as a change to the land use designation from “agriculture” to “industrial.” A positive land-use impact, for example, would be the Comprehensive Everglades Restoration Plan (CERP) projects. These projects within the 50-mile radius would redevelop, reuse, or develop additional land for conservation. The cumulative impacts to hydrology and water use would be minimally negative due to the restrictions placed on all surface water and groundwater use. There also would be beneficial impacts due to the large scale CERP projects for reservoir and storage areas which would provide additional water to the southern Everglades Agricultural Area and reestablish wetland hydropatterns. The cumulative impacts for terrestrial/aquatic resources would be associated with the minimal loss of wetlands, which is offset by the restoration of developed lands for conservation and restoration of native species through CERP projects. The cumulative impacts for socioeconomics for the Glades Site would appear as beneficial impacts to taxes and adverse impacts on transportation. Also, because there would not be any disproportionate impact to low-income or minority populations by the activities at the Glades site.

9.3.3.2 Evaluation of the Martin Site

The Martin site is an 11,300-acre area that includes five fossil-fired power units and a solar unit. The site is owned by FPL (FPL Apr 2009) although additional land would need to be acquired to the south of the site to develop it for two new nuclear power plant units given that a new 3000-acre cooling water storage reservoir would be required and the amount of FPL-owned land currently available for development is less than 600 acres. The site is located in western Martin County, approximately 40 miles northwest of West Palm Beach, 5 miles east of Lake Okeechobee, and 7 miles northwest of Indiantown. The Miami load center is approximately 65 miles south southeast. The site is bounded on the west by the Florida East Coast Railway (FEC) and the adjacent SFWMD L-65 Canal; on the south by the St. Lucie Canal (C-44 or Okeechobee Waterway); and on the northeast by State Route 710 and the adjacent CSX Railroad (FPL Apr 2009). Site elevation is 28 feet above sea level and outside the 100-year floodplain. The location of the Martin site is shown in Figure 9.3-11.

9.3.3.2.1 Land Use Including Site and Transmission Line Rights-of-Way

Power plant units and related facilities occupy approximately 300 acres of the Martin site. The site also includes a 6800-acre water reservoir (6500 acres of water surface and 300 acres of dike area) used to cool the existing fossil-fired power units. To the east of the power plant there is an area of mixed pine flat wood and scattered small wetlands. To the north of the onsite water reservoir is a 1200-acre area that has been set aside as a mitigation area. There is a peninsula of wetland forest on the west side of the reservoir that is named the Barley Barber Swamp. The Barley Barber Swamp encompasses 400 acres and is preserved as a natural area (FPL Apr 2009). These on-site protected areas would be avoided in development of the site for two nuclear units.

Based on the conceptual site layout developed for the Martin site, the following land requirement assumptions were made which form the basis of the environmental comparison of alternative sites:

- The assumed facility footprint would require approximately 362 acres and the assumed cooling water storage reservoir would require approximately 3000 acres for an on-site cooling water makeup reservoir (including intake structure); the existing 6500 acre on-site reservoir at Martin would not be available to the new nuclear units. New facilities at the plant site would include the nuclear power units, support buildings, a switchyard, storage areas, storm water retention ponds, and deep injection wells for subsurface water disposal.

- The assumed extent of non-transmission linear features, including access road corridors, pipeline corridors and rail access, is as follows:
  - Access road: 473.3 acres – assuming a corridor length of approximately 39.3 miles and a corridor width of 100 feet. Based on conceptual site layouts developed for the Martin site, site access would be from SR 710, and a significant span of SR 710 would need to be widened to accommodate anticipated traffic levels attributable to construction.
  - Rail: 51.5 acres – based on an assumed length of 4.3 miles and a corridor width of 100 feet, to provide access to the nearest railway northeast of the site.
  - Intake/makeup pipeline corridors: 21.7 acres, including pipeline connecting the reservoir to the C-44 Canal/St. Lucie canal (assumed cooling water source) directly to the south of the site. The Channel/canal connects Lake Okeechobee to the South Fork of the St. Lucie River and the Atlantic Coast.
- The assumed extent of conceptual transmission corridor routing is 763.6 acres based on an assumed length of 31 miles and a corridor width that varies between 200 and 300 feet. The corridor would connect the new nuclear units to the existing FPL transmission system at the Corbett substation inside Palm Beach County.
- Based on subtotals above for both onsite and offsite plant components, the total area potentially affected at the Martin site is estimated at approximately 4672 acres. With respect to the transmission line corridor included within this total, the estimated acreage requirements assume corridor widths which may exceed the area that would actually be disturbed during project construction and operation. However, these estimates provide the basis for an updated and consistent environmental comparison of alternative sites.
- Additional acreage (up to several hundred acres) may be required to support construction activities (e.g., additional laydown areas, batch plant, fill/spoil areas, especially from reservoir excavation until fill material can be transported offsite). However, cleared land would be used to the greatest extent possible. The impact on this acreage would be temporary, and it would also be reclaimed to the extent possible following construction.

Agricultural uses such as croplands, pastures, and groves account for much of the land use and cover within 5 miles of the Martin site. Three types of wetlands (forested freshwater, non-forested freshwater, and mixed forested and forested freshwater) also account for a large portion of nearby land use. Forested cover found nearby includes coniferous and other mixed species (FPL May 2008).

Land use impacts associated with plant construction include both impacts to the site and immediate vicinity, including the new reservoir; and impacts to offsite areas such as transmission, cooling water intake pipelines, and transportation rights-of-way (e.g., road and rail). Construction of a new nuclear power plant would include clearing, dredging, grading, excavation, spoil deposition, and dewatering activities. An area of approximately 362 acres for the main power plant site (major structures including switchyard), which would largely be focused in one central location; and approximately 3000 acres (surface area) for a new reservoir and intake structure would be permanently impacted.

While the site already hosts multiple power generation units, construction of additional power units at the site would be located in an area, based on conceptual site layouts, that includes primarily pine flatwoods, palmetto prairies and pastureland, along with several acres of freshwater marshes and hardwood-coniferous mixed forest. This land would be altered, as would existing agricultural lands to the south of the FPL-owned site, from construction of the new reservoir.

Project construction would have a long-term impact on the current uses which would change to industrial use. Much of the proposed power plant site area within existing FPL-owned land has already been cleared and is in an industrial area, but the agricultural area to be acquired for reservoir construction, consisting primarily of citrus groves, would be permanently altered. Following construction activities, impacted areas without constructed buildings or transportation infrastructure would be reclaimed to the greatest extent feasible.

Construction at the proposed pipeline corridors would have temporary, minor effects on land use during actual construction due to trenching, equipment movement and material laydown. The ability to use current lands for their existing uses (e.g., farmland) along the proposed pipeline corridor would be temporarily lost during construction. Direct and indirect impacts of construction from the proposed transportation infrastructure would be similar to those for the proposed plant. The widening of State Route 710 would affect pasture land, citrus groves, wetland areas, as well as residential, commercial and other light industrial areas.

Development of the conceptual transmission corridor incorporated the most direct route where possible, while considering potential conflicts with natural or man-made areas where important environmental resources were located, and avoiding populated areas and residences to the extent possible. Whenever possible, the new line was routed along existing transmission rights-of-way. The use of lands that are currently used for forests would be altered. Trees would be replaced by low-growth types of ground cover such as grass. The new transmission corridor would not be expected to preclude agricultural activities near the eventual rights-of-way. The land use in the region along the new transmission corridors is generally rural, sparsely populated, and primarily used for agricultural activities. Because Martin County is within the Florida Coastal

Zone, the route for the new transmission lines may be subject to Florida Coastal Zone Management requirements.

Table 9.3-10 includes estimates of the potentially affected area(s) of each land cover type (based on GIS FLUCCS Level III data analysis) for the Martin site, including both onsite and offsite components (i.e., access road, rail, pipeline and transmission corridors). It also further breaks out the land cover types along the assumed conceptual transmission corridor only, as a basis for comparison of land use impacts from the conceptual transmission corridor versus other project components. Note that assumed conceptual transmission corridors account for 16% of the total potentially affected area listed for the Martin site.

As noted previously, regarding the offsite linear features associated with the projects, the estimated acreage requirements assume corridor widths for transmission which may exceed the area that would actually be disturbed during project construction and operation. These estimates are intended to provide the basis for an updated and consistent environmental comparison of alternative sites.

Operational impacts to site land use would include a permanent change in land use for approximately 3908 acres of land for the power plant site, reservoir and rail/highway access corridors that extend outside the existing Martin plant boundaries and would be generally unavailable for other purposes. This area would be excluded from future agricultural and recreational use for the estimated 60-year life of the AP1000 power units (WEC 2007). While the proposed changes occurring outside the existing plant boundaries would be a change from current land use in the area, they would be somewhat compatible given their occurrence immediately adjacent to the Martin power plant industrial area.

Operational impacts to the site and immediate vicinity also would include maintenance operations on project structures that would be small and temporary in nature.

Operational impacts of transmission lines result primarily from line maintenance, and include right-of-way vegetation clearing and control, transmission line maintenance, and other normal access activities. Additional right-of-way acquisition and development would not normally be required as part of plant operational activities. Maintenance activities would be limited to the immediate right-of-way and would be minimal. New transmission corridors would not be expected to preclude agricultural activities near the eventual rights-of-way. Corridor vegetation management and line maintenance procedures would be established by the transmission service provider.

Other offsite land use impacts as a result of plant operational activities would be minimal, temporary, and limited in the area impacted. Such activities could include pipeline, road, and rail maintenance and auxiliary building maintenance. It is likely that most lands above the proposed water intake pipeline and related areas of construction could continue to be used for ranching, farming and any passive uses. The proposed transportation infrastructure could result in the loss of a small amount of ranch land, pasture land and forested land in areas where access road improvements/widening and a rail spur would be needed.

For the purpose of this analysis, land use impacts are considered small if less than 3000 acres are disturbed (including plant footprint, rights-of-way, and corridors) and there are no major changes to land use. Impacts are considered moderate if land disturbance is greater than 3000 acres or there are major changes to land use; and large if land disturbance is greater than 6000 acres and there are major changes to land use. Based on a potentially affected area of approximately 4674 acres, including over 4000 acres that would occur outside the existing Martin plant boundaries, and the existing industrial use, land use impacts associated with site preparation, construction, and operation of the proposed nuclear plant at the Martin site and the conceptual transmission corridor would be MODERATE.

9.3.3.2.2 Air Quality

Martin County (the Martin site is within Martin County) is part of the Southeast Florida Intrastate Air Quality Control Region. Martin County, along with the entire State of Florida, is designated as attainment or unclassifiable with respect to the NAAQS (40 CFR 81.310). The nearest non-attainment area is in Georgia, several hundred miles north northwest of the Martin site (40 CFR 81.311).

Criteria pollutant emissions from construction and operation of the proposed nuclear plant at the Martin site would be comparable to the emissions generated at the Turkey Point site, as described in Subsections 4.4.1.2 and 5.8.1.2, respectively. Construction impacts would be temporary and would be similar to those from large-scale construction projects. Particulate emissions in the form of dust from disturbed land, roads, and construction activities would be generated. Mitigation measures similar to those described in Subsection 4.4.1.2 would be applied as necessary. Criteria pollutants would also be generated from onsite fossil-fueled construction equipment and construction vehicles, and from commuter and delivery vehicles that travel to and from the site. The quantity of criteria pollutant emissions generated by construction activities would be small compared to total emissions from the fossil units at the Martin plant and other emission sources in the region; therefore, it is assumed unlikely that construction-related emissions would cause any violation of the NAAQS.

The project would include standby diesel generators and diesel-driven fire pumps. Annual emissions from these sources are listed in Table 3.6-4. It is expected that standby diesel generators and auxiliary power systems would see limited use and, when used, would operate for a short time interval. The pollutant emissions generated by these systems (nonradiological) would be regulated by the FDEP in accordance with the air rules published under FAC Chapter

62. These rules cover general air pollution control provisions, stationary source requirements, preconstruction review, emission standards, air monitoring requirements, and other rules for control of air pollutant emissions. Airborne release of criteria pollutant and hazardous air pollutant emissions would be small and would comply with FDEP rules (FDEP 2008a).

Nonradiological emissions can potentially affect regional visibility, and visibility is an important feature at Federal Class I Areas. The Federal Class I Area nearest to the Martin site is the Everglades National Park more than 100 miles to the south. Because the distance is large, and because the anticipated emission levels would be small, pollutant emissions attributable to operation of the new nuclear units would have a negligible impact on visibility at a Federal Class I Area. Unfavorable psychometric conditions can result in visible vapor plumes from the cooling tower operations. These plumes may be visible for several miles, but would not impact visibility or scenic vistas at any Federal Class I Area.

Air quality impacts are considered small if the increase in regional pollutant concentrations attributable to the source (1) would not appreciably alter visibility, (2) would not exceed EPA significant impact levels, and (3) would not cause a violation of the most restrictive ambient air quality standards. Based on this evaluation metric, it is anticipated that the impacts to air quality from construction and operation would be SMALL.

9.3.3.2.3 Hydrology, Water Use, and Water Quality

The state of Florida is divided into five watershed management areas. The Martin site is in the Kissimmee-Everglades watershed and falls under the jurisdiction of the SFWMD. This watershed region spans more than 16 counties and is logically divided into several river basins: Kissimmee River, Upper East Coast, Lower East Coast (which includes the entire southeast coast and the Everglades), and Lower West Coast (which includes the Big Cypress and Caloosahatchee Rivers). This region is the largest watershed region in the state of Florida and is home to 40 percent of Florida's population. The region also contains the Everglades (the largest subtropical wetland in the United States) and Lake Okeechobee, the second largest freshwater lake in the United States. This lake is of national importance, because its water has diverse usage and a large number of people depend on it for agricultural and domestic purposes (University of Florida Jun 2007).

Currently, Lake Okeechobee’s water quality and ecological health are adversely affected by excessive nutrient loading, extreme high and low water levels, and the proliferation of exotic species. To address restoration goals for the lake, the SFWMD in coordination with the FDEP and the Florida Department of Agricultural and Consumer Services has developed the Lake Okeechobee Watershed Construction Project Technical Plan. The plan was developed in response to the Northern Everglades and Estuaries Protection Program that the Florida Legislature signed into law in 2007. Primary components of the plan include implementing agricultural management practices, building treatment wetlands to clean water flowing into the lake, and creating between 900,000 and 1.3 million acre-feet of water storage north of the lake (SFWMD 2008).

The entire state of Florida, and portions of southern Alabama, southeastern Georgia, and southern South Carolina, are atop the Floridan aquifer. This aquifer covers some 100,000 square miles and is one of the most productive aquifers in the world. The Floridan aquifer system provides water for several large cities, such as Savannah and Brunswick in Georgia; and Jacksonville, Tallahassee, Orlando, Tampa Bay, and St. Petersburg in Florida. In addition, the aquifer system provides water for hundreds of thousands of people in smaller communities and rural areas. The Floridan aquifer is intensively pumped for industrial and irrigation supplies (USGS Jul 1980). For the year 2000, the average groundwater withdrawals in Martin County were 43.6 million gallons per day – approximately 87 percent of this was from surficial aquifers (37.8 million gallons per day) and the other 13 percent (5.8 million gallons per day) was from the Floridan aquifer (USGS Dec 2004).

The average daily water withdrawal rate in Martin County (from both groundwater and surface water sources) in year 2000 was 198.87 million gallons. Approximately 78.1 percent (155.3 million gallons) was from fresh surface water, and 21.9 percent (43.6 million gallons) was from fresh groundwater. No saline water withdrawals were reported (USGS Dec 2004). Average withdrawal for agricultural use in the year 2000 was 140 million gallons per day that represented 70 percent of daily withdrawals from available sources. The second largest user was the power generation industry with an average withdrawal rate of 24.63 million gallons per day (12.4 percent) (USGS Dec 2004). Major surface freshwater sources near the Martin site include Lake Okeechobee (5 miles away), the C-44 Channel (adjacent to the proposed cooling water storage reservoir), and the SFWMD L-65 Canal (5.8 miles away) (FPL Apr 2009).

The depth to the water table near the site is less than 30 feet below ground level (USGS 2008). Therefore, it is expected that dewatering may be necessary during the construction phase. This may require construction of temporary retention ponds to allow sediment-laden waters to settle before discharge to surface waters. Dewatering activities would be subject to NPDES permit requirements to avoid adverse impacts on surface waters.

Land subsidence related to karst terrain is not anticipated at the site. The site is in karst Area II where the surface cover is reported to be 30 to 200 feet thick. In such areas, sinkholes are reported to be few, shallow, of small diameter, and develop gradually (Sinclair, et al.,1985).

As shown in Subsection 4.2.2.1, the peak construction water demand is estimated at 565 gpm which is slightly greater than 1 cubic foot per second, and the peak estimated potable water demand for operations is 2553 gpm (Table 3.3-1). As described in Section 3.3, an estimated 100 cfs of freshwater would be required to replace consumptive water use associated with operation of the proposed nuclear power units. Lake Okeechobee offers a potential water supply of more than 360 cfs, and the annual average flow of the St. Lucie Canal near the site is approximately 842 cfs. The estimated groundwater potential at the Martin site is approximately 155 cfs. These water sources are suitable to satisfy potable and process water demands associated with construction and operation at the Martin site. Water use impacts are considered small when water sources are readily available to meet demand. A permittability assessment of the probability of obtaining water permits at the Martin alternative site would be required to develop the documentation necessary to firmly establish conditions under which water from these sources could be made available. Such analysis is beyond the reconnaissance-level evaluations required for alternatives analysis. Instead, these evaluations must be based on statutory and regulatory criteria requiring site-specific analysis of reasonable beneficial use, existing legal users, and public interest factors. Accordingly, because adequate water sources are physically available nearby, the impact on regional water use for both construction and operation would be SMALL.

Water quality impacts are considered small when changes in water quality do not affect or minimally affect aquatic biota and water uses (NUREG-1437). For the Martin site, FPL assumed that a closed loop, mechanical draft, tower-cooled system would be used for power cycle waste heat rejection, whereby blowdown water is injected into the Boulder Zone. The Boulder Zone is a deep underground, extremely permeable, cavernous region in southeastern Florida. It is called the Boulder Zone not because it contains boulders, but instead, because efforts to drill into this zone pose difficulties similar to the difficulties posed by subsurface boulders. Construction and operation activities at the Martin site would be performed under the authorization of an NPDES permit (construction), IWW permit (surface water), or UIC permit (groundwater) issued by the FDEP (FDEP 2008b). Any releases from the power plant site into Lake Okeechobee or regional streams as result of construction or operation would be regulated by the FDEP through the NPDES, IWW, or UIC permit process to ensure that water quality is protected. To ensure that wetlands and streams are not harmed by petroleum products or other industrial chemicals, FPL would restrict certain activities (e.g., transfer and filling operations) that involve the use of petroleum products and solvents to designated areas, such as laydown, fabrication, and shop areas. In addition, construction activities would be guided by a stormwater pollution prevention plan and a construction-phase spill prevention, control, and countermeasures plan similar to those proposed for the Turkey Point site as described in Section 4.2. Therefore, any impacts to surface water during plant construction would be SMALL and would not warrant mitigation beyond best management practices required by the permits. The impacts to water quality during operations would also be SMALL because the IWW and UIC permit requirements would ensure that adequate measures are applied to protect water quality.

9.3.3.2.4 Terrestrial Resources and Protected Species

The terrestrial systems within the Martin site area include palmetto prairie and pine flatwoods. Surrounding areas also include unimproved pasture, herbaceous rangeland, mixed hardwood/

conifer forest, mixed wetland hardwoods, cypress, mixed wetland forest, freshwater marsh, and wet prairie (FPL May 2008). Table 9.3-10 includes estimates of the potentially affected area(s) of each land cover type within the project area for both onsite and offsite components, including natural vegetation and wetland areas.

Although the palmetto prairie and pine flatwoods areas at the site provide habitat for common wildlife species such as feral pig, turkey, armadillo, and white-tailed deer, no unique wildlife species or critical habitat for listed species would be impacted. These habitats are also common in the surrounding area (FPL May 2008). A portion of the site has been severely altered by the past construction of the existing Martin plant and provides poor wildlife habitat. The ditches and stormwater basin provide foraging opportunities for wading birds. Habitat for fish and wildlife is provided by the makeup water reservoir (FPL May 2008).

As shown in Table 9.3-10, there are approximately 163 acres of wetlands within the project area, excluding the conceptual transmission corridor, which could be directly impacted from project construction. Of these, approximately 82 acres are identified as forested wetlands and considered to be high quality. Any wetland functions that are impacted during construction would be replaced or restored. The footprint of the new facilities, excluding the assumed conceptual transmission corridor, would cover approximately 3910 acres.

A vegetation/land use survey of the project area and surrounding areas was conducted in March 2008 as part of the Site Certification Modification for the Martin Solar Energy Center. Before the 2008 field surveys, literature reviews were undertaken to determine the species that could potentially be present in the habitats found on the project area (FPL May 2008). Threatened, endangered, and/or species of special concern that occur within Martin County are listed in Table 9.3-11. The field surveys and FNAI database review did not result in any occurrences of listed plant species in the vicinity of the project area. Listed fauna species observed or likely to occur within the project area include the American alligator as well as several species of wading birds: white ibis, little blue heron, tricolored heron, snowy egret, wood stork, and sandhill crane. According to the FFWCC Bald Eagle Nest Location Database, two active bald eagle (*Haliaeetus leucocephalus*) nests are within approximately 2 miles of the project area. Nest MT012 is within the Northwest Mitigation Area just north of the cooling pond at 27°04.64′ N 80°36.42′ W (Section 14, Township 39 South, Range 37 East). Nest MT002 is in the Barley Barber Swamp at 27°02.77′ N 80°35.66′ W (Section 25, Township 39 South, Range 37 East). The FNAI database review found one occurrence of an active bald eagle nest in the Barley Barber Swamp (Nest MT002) and another nest approximately 0.25 miles west of the Northwest Mitigation Area. In addition, the Florida Game and Freshwater Fish Breeding Bird Atlas Project identified both the bald eagle and the Florida sandhill crane (*Grus canadensis pratensis*) as breeding in the cooling pond to the west of the project area. A bald eagle was observed between the cooling pond and the Northwest Mitigation Area during field reconnaissance conducted in March 2008 (FPL May 2008).

Further field surveys would be conducted for federally listed and state protected species as part of the permitting process before any clearing or construction activities at the site or along associated transmission or pipeline corridors. Land preparation activities associated with construction of the plant and transmission lines would be conducted in accordance with federal and state regulations, permit conditions, existing FPL procedures, good construction practices, and established best management practices (e.g., directed drainage ditches, silt fencing) (FPL Dec 2006).

FPL assumed that a new transmission corridor would be routed to the existing FPL transmission system via the Corbett Substation in northern Palm Beach County. Based on the conceptual site layout, the conceptual transmission corridor is approximately 31 miles long and varies in width between 200 and 300 feet. Although the most direct route was generally used between terminations, consideration was also given to avoiding possible conflicts with natural areas where important environmental resources are, such as the bald eagle and the Florida sandhill crane.

As shown in Table 9.3-10, there are approximately 315 acres of wetlands found within the conceptual transmission corridor; approximately 63 acres are forested wetlands and considered to be high quality. This compares to a 764-acre area potentially affected by the conceptual transmission corridor, based on the dimensions above. Any wetland functions that are impacted during construction would be replaced or restored. The estimated acreage requirements for the conceptual transmission corridor assume corridor widths which may exceed the area that would actually be disturbed during project construction and operation. These estimates are used to provide the basis for an updated and consistent environmental comparison of alternative sites.

Cooling tower operations can generate vapor plumes that drift downwind. Salt and mineral deposits in the vapor plume have the potential to adversely impact sensitive plant and animal communities through changes in water and soil chemistry; however, the freshwater sources identified for the Martin site have modest levels of salts and dissolved minerals; therefore, the impact of salt and mineral deposits from vapor drift would be minimal. The use of drift eliminators, along with proper tower design and operation, would further minimize the potential for impacts.

For the purpose of this analysis, impacts to terrestrial resources are considered small if no sensitive habitats, including wetlands, are disturbed and no important species are affected. There are no known sensitive species onsite, and the transmission corridors would be relatively short. Portions of the proposed site area would be located within the existing Martin plant boundary, and the new reservoir would be constructed in an area planted in crop (primarily citrus groves). Much of the proposed project area located within the existing Martin plant boundary (approximately 360 acres), would include wood palmetto prairies, pine flatwoods, unimproved pasture and some freshwater marshes. Construction of the plant and reservoir would result in a loss of primarily pasture land and wet prairies that may serve as habitat to numerous common terrestrial species;

however, the creation of a new reservoir to support plant operation would provide new habitat for birds and waterfowl that would not be adversely affected by plant operation. FPL concluded that impacts to terrestrial resources, including endangered and threatened species, from construction and operation of the proposed nuclear plant and conceptual transmission corridor at the Martin site would be SMALL.

9.3.3.2.5 Aquatic Resources and Protected Species

The Martin site is on the St. Lucie Canal approximately 5 miles from Lake Okeechobee. The surface waters near the project area, which potentially could be affected by site preparation and construction activities, include the L-65 Canal and the St. Lucie Canal. The St. Lucie Canal connects to Lake Okeechobee just west of the site and includes similar aquatic resources to those found in Lake Okeechobee. There are also four onsite surface water bodies on the Martin plant site: the cooling pond, the Barley Barber Swamp, the Northwest Parcel wetland mitigation area, and the make-up (intake/discharge) canal (FPL May 2008).

Lake Okeechobee is at the center of south Florida's regional water management system, and is in south-central Florida. The massive lake is a 730 square mile, relatively shallow lake with an average depth of 9 feet and is the second-largest freshwater lake wholly within the continental United States, second only to Lake Michigan. Lake Okeechobee's drainage basin covers more than 4600 square miles (SFWMD 2008).

Lake Okeechobee supports a nationally recognized sport fishery for largemouth bass (*Micropterus salmoides*) and black crappie (*Pomoxis nigromacultus*), as well as a commercial fishery for various catfish and bream (*Lepomis spp.*). These fisheries generate nearly $30 million per year for the local economies, and they have an asset value that is in excess of $100 million. Another estimate places the value of the recreational fish species at more than $300 million. In addition to the sport and commercial species, Lake Okeechobee supports a diverse community of fish, including (in total) 41 species. These fish are a food resource for wading birds, alligators, and other animals that use the lake (SFWMD 2005a).

For the purpose of this analysis, impacts to aquatic resources are considered small if no sensitive habitats are disturbed and no important species are affected. Water from the St. Lucie Canal (the C-44 Canal) via pipeline is assumed to be the source to cool the new nuclear units constructed at the Martin site. Although recreational sport fish and other aquatic species would be temporarily displaced during construction of a water intake structure, they would be expected to recolonize the area after construction is complete. No federally or state-listed aquatic species are known to exist in the St. Lucie Canal in the vicinity of the Martin site (FNAI 2008b). Field surveys would be conducted for federally listed and state-protected aquatic species as part of the permitting process before any clearing or construction activities at the site or along associated transmission corridors. Because of this, and because land clearing associated with construction of the plant and transmission lines would be conducted according to federal and state regulations, permit conditions, existing FPL procedures, good construction practices, and established best management practices, impacts to aquatic resources, including endangered and threatened species, from construction of nuclear power facilities at the Martin site would be SMALL.

There would be no direct discharges to the nearby surface waters from plant operation since plant design assumes discharge by underground injection. The most likely aquatic impact from nuclear operations at the Martin site would be entrainment and impingement of aquatic organisms in the St. Lucie Canal. Because the EPA requires facilities to meet criteria designed to protect organisms from entrainment and impingement, the potential for environmental impacts to aquatic resources, including endangered and threatened species, from nuclear power facility operations at the Martin site would be SMALL.

9.3.3.2.6 Socioeconomics

This subsection evaluates the social and economic impacts to the region from construction and operation of the proposed nuclear plant at the Martin site. Much of the socioeconomic analysis relies on census data gathered by the USCB. The USCB performs an extensive census every ten years. At the time this evaluation was performed, the most recent decennial census was conducted in 2000. The USCB assembles the decennial census data into a wide range of reports that can be used to characterize socioeconomic conditions of a region. In addition, the NRC sponsored the development of a computer program called SECPOP2000 that enables an analyst to quickly assemble and quantify customized regional socioeconomic information; however, this program does not produce results for years later than 2000 (U.S. NRC Aug 2003). For years that fall between each decennial census, the USCB issues estimates based on surveys and statistical models; however, the types of data collected and assembled for intermediate years is less extensive than for years when a decennial census is performed; therefore, the decennial census provides the most comprehensive information.

Because the decennial census provides the most comprehensive information, and because the NRC software tool, SECPOP2000, is not available for intermediate years, information from the 2000 census was chosen as a common baseline for socioeconomic comparison for this analysis. Published census data for later years, if available, is presented as supplemental information.

9.3.3.2.6.1 Physical Impacts

Construction activities can cause temporary localized physical impacts such as noise, odor, fugitive dust, vehicle exhaust emissions, ground vibration, and shock from blast activities. The use of public roadways and railways would be necessary to transport construction materials and equipment to the site. Most construction activities would occur within the boundaries of the Martin site. However, an access road and a railway connection spur would be constructed on lands adjacent to the site. These new transportation rights-of-way would be routed to avoid residences and populated areas where possible, however, a significant portion of State Route 710 would be widened to four lanes to accommodate anticipated traffic levels attributable to project construction, including workforce commuters, truck deliveries and the transfer of fill (primarily from reservoir construction) to an offsite location. Some residences and commercial services could be temporarily affected during construction. In addition, the conceptual site layout developed for the site also includes construction of a 31-mile conceptual transmission corridor that would include off-site impacts. Other offsite areas that would support construction activities (for example, borrow pits, quarries, and disposal sites) are expected to be already permitted and operational. Impacts on those facilities from construction of the new plant would be small incremental impacts associated with their normal operations.

Potential impacts from power plant operations include noise, odors, exhausts, thermal emissions, and visual intrusions. Operational noise would be generated by pumps, fans, transformers, turbines, generators, onsite traffic, and switchyard equipment. Noise levels attenuate rapidly with distance so that ambient noise levels (attributable to power plant operations) would be minimal at the site boundary. Also, the Martin site is in a rural area generally surrounded by agricultural land and with few residents in the area. Commuter traffic would be controlled by speed limits. Good road conditions and appropriate speed limits would minimize the dust and noise level generated by the delivery trucks and site workers that travel to and from the site.

The project would have standby diesel generators and auxiliary power systems. Air quality permits would govern operation of this equipment to ensure that air emissions comply with regulations. In addition, the generators would be operated on a limited, short-term basis. Normal plant operations would not use a quantity of chemicals that could generate odors that exceed odor threshold values.

Physical impacts are considered small when offsite areas are not affected or only minimally or temporarily affected by noise, odor, dust, emissions, vibration, or shock. In summary, construction activities would be temporary and would occur mainly within the boundaries of the Martin site. Offsite impacts would represent small incremental changes to offsite services that support construction activities. During station operations, ambient noise levels would be minimal at the site boundary. Air quality permits would be required for the diesel generators to ensure emissions comply with regulatory guidelines, and chemical use would be limited, which should limit odors. Therefore, the physical impacts of construction and operation of the new units at the Martin site would be SMALL.

9.3.3.2.6.2 Demography

The population distribution near the Martin site is low with typical rural characteristics and satisfies the 10 CFR Part 100 definition of a low population zone. The nearest population center larger than 25,000 residents is Port St. Lucie 20 miles east. Coterminous counties include St. Lucie to the north, Okeechobee to the northeast, and Palm Beach to the south.

The entire Martin plant workforce lives in a four-county region that includes Martin County (32.7 percent), Okeechobee County (24.0 percent), St. Lucie County (23.1 percent), and Palm Beach County (20.2 percent) (FPL Dec 1989). Based on this workforce demographic, these same counties are selected to represent the ROI for socioeconomic analysis of the Martin site.

Based on the 2000 census, the total population within the ROI was 1,486,520 which included 126,731 in Martin County; 35,910 in Okeechobee County; 1,131,184 in Palm Beach County; and 192,695 in St. Lucie County (USCB 2000). Census estimates for year 2007 show an ROI population of 1,706,883 people, which included 139,182 in Martin County; 40,311 in Okeechobee County; 1,266,451 in Palm Beach County; and 260,939 in St. Lucie County (USCB 2009).

NRC guidelines have been established to assess the demographic sparseness and proximity of a proposed site. Sparseness is a combined measure of (1) the population density within 20 miles of the site, and (2) the relative population of the nearest metropolitan area within 20 miles of the site. Proximity is a combined measure of (1) the population density within 50 miles of the site, and (2) the relative population of the nearest metropolitan area within 50 miles of the site. Based on the sparseness-proximity evaluation, a site is categorized as low, medium, or high (NUREG-1437).

The land area within 20 miles of the Martin site (i.e., excluding water bodies such as Lake Okeechobee) is 870.0 square miles, and based on 2000 census data, the population of this area was 95,093 (U.S. NRC Aug 2003). This yields a population density of 109.3 people per square mile, based on land area. There is at least one city within 20 miles of the Martin site that has a population greater than 25,000. Therefore, the sparseness level is 3 (population density of 60 to 120 people per square mile and at least one community greater than 25,000 people within 20 miles) (NUREG-1437).

Similarly, the land area within 50 miles of the Martin site is 5486.6 square miles, and the population of this area was 1,380,905 (U.S. NRC Aug 2003). This yields a population density of 251.7 people per square mile. Therefore, based on NRC guidelines, the proximity level is 4 (population density greater than or equal to 190 people per square mile within 50 miles). Therefore, the Martin site has a sparseness-proximity measure of 3.4, which is categorized as high (NUREG-1437).

Based on FPL estimates, the peak construction workforce for the project would be 3548 construction workers. Operations would overlap with peak construction activity for a period of time; therefore, in addition to the construction workforce, there would be a small number (99) of operations workers on the site during the peak construction period, and these workers would also relocate to the area. Because of the location of the Martin site relative to population centers, FPL assumed that 50 percent of the construction and operation workers would relocate from outside the ROI. FPL further assumed that 70 percent of construction and 100 percent of operation workforce that moved to the area would bring their families. Based on these assumptions, a total of 1824 construction and operation workers would relocate to the area in the project construction phase, and 1291 would bring their families. Based on an average household size of 3.25 people (BMI Apr 1981), the total increase in population attributable to construction at the Martin site would be 4729 people. An influx of 4729 people represents a 0.3 percent increase in the ROI population of 1,486,520 people. Impacts are considered small if plant-related population growth is less than 5 percent of the area's total population (NUREG-1437). Therefore, construction worker influx would pose a SMALL impact on population for the ROI.

At the county level, if the demographic distribution of the construction workforce follows that of the Martin plant workforce, the addition of the construction and operation workforce employees and their families would increase the population in Martin, Okeechobee, Palm Beach, and St. Lucie Counties by 1.2 percent, 3.2 percent, 0.1 percent, and 0.6 percent, respectively. These represent SMALL increases in the county population levels.

FPL estimated the total onsite operations workforce to be 1050 workers and assumed that 50 percent of these workers (525) would relocate from outside the ROI. For this analysis, FPL assumed that 100 percent of operations workers who relocated would bring their families. Based on an average household size of 3.25 people (BMI Apr 1981), the total population increase attributable to project would be 1706 people. This represents a 0.1 percent increase in the ROI population. At the county level, if the demographic distribution of the operations workforce follows that of the Martin plant workforce, the addition of the operations workforce employees and their families would increase the population in Martin, Okeechobee, Palm Beach, and St. Lucie Counties by 0.4 percent, 1.1 percent, 0.03 percent, and 0.2 percent, respectively. These represent SMALL increases in the county population levels.

In summary, the population increase in the ROI would pose a SMALL demographic impact. Likewise, it is anticipated that the population increase in each of the four counties would pose a SMALL impact during operations.

9.3.3.2.6.3 Economy

Based on 2000 census data, Martin County had a civilian labor force of 53,301 people and an unemployment rate of 4.2 percent; Okeechobee County had a civilian labor force of 14,863 people and an unemployment rate of 4.7 percent; Palm Beach County had a civilian labor force of 510,046 people and an unemployment rate of 5.0 percent; and St. Lucie County had a civilian labor force of 82,070 people and an unemployment rate of 5.2 percent. For the entire ROI, 99.92 percent of the labor force was part of the civilian labor force and 0.08 percent was in the armed forces. Of the civilian labor force, 95.1 percent were employed and 4.9 percent were unemployed. The overall unemployment rate for the four-county ROI is slightly lower than that of the State, which is 5.6 percent (USCB 2000).

The principal economies of the counties in the ROI are the same, dominated mainly by educational, health, and social services; agriculture, forestry, fishing and hunting, and mining; and retail trade. Most of the labor force within the four-county ROI resides in Palm Beach County (USCB 2000).

As described above, the peak number of workers at the Martin site would include 3548 construction workers and 99 operations workers, and half of these workers (1824) are assumed to relocate from outside the area. An influx of 1824 construction and operation workers from outside the region would have positive economic impacts in the four-county region. Based on a multiplier of 1.7289 jobs (direct and indirect) for every construction job and 2.2799 for every operation job (BEA Aug 2009), an influx of 1824 construction and operation workers would create 1384 indirect jobs, for a total of 3207 new jobs in the ROI. The creation of such a large number of direct and indirect jobs could reduce unemployment and would create business opportunities for goods and service-related industries and the housing industry. Based on the workforce demographics of the Martin plant, the additional jobs created would represent 2 percent, 5.2 percent, 0.1 percent, and 0.9 percent of the workforce in Martin, Okeechobee, Palm Beach, and St. Lucie Counties, respectively. Economic effects are considered small if peak employment accounts for less than 5 percent of area employment (NUREG-1437). Economic impacts attributable to project construction are considered beneficial and therefore require no mitigation. The number of new jobs created would represent only a 0.5 percent increase in jobs within the ROI, therefore, the economic impacts for the ROI would be SMALL. The projected increase in Okeechobee County would be MODERATE, and the projected increases in the other counties would be SMALL.

An estimated 1050 workers would be required for the operation of two nuclear power facilities at the Martin site (U.S. DOE May 2004), and FPL assumed that 50 percent of these employees would migrate into the region. Based on a multiplier of 2.2799 jobs (direct and indirect) for every operations job at the new units (BEA Aug 2009), an influx of 525 operations workers would create 672 indirect jobs for a total of approximately 1197 new jobs in the region. Based on the workforce demographics of the Martin plant, the additional jobs created would represent 0.7 percent, 1.9 percent, 0.05 percent, and 0.3 percent of the workforce in Martin, Okeechobee, Palm Beach, and St. Lucie Counties, respectively. FPL concluded that the impacts of operation of two nuclear power facilities on the economy would be beneficial and SMALL in the ROI and mitigation would not be warranted.

9.3.3.2.6.4 Taxes

Taxes collected as a result of construction and operation of the new nuclear units at the Martin site would benefit the state and local tax authorities. FPL would pay property taxes to each of the taxing authorities whose boundaries would contain the plant. Tax payments would be based on the assessed valuation of the plant and local tax rates. If the plant site straddled a jurisdictional boundary, FPL would pay taxes to both entities based on the assessed valuation within each entity.

As described in Subsection 4.4.2.2.2, it is not clear whether FPL corporate income taxes would increase as a result of construction of the new units at the Martin site, because the units would not generate revenues until they become operational. However, once the units were placed in service, Martin County property taxes would begin and would continue for the 60-year operational life of the facility.

FPL assumed that annual property tax payments at Martin site would be similar those paid by the nuclear units at Turkey Point plant. In 2007, the annual tax payment for the two units at the Turkey Point nuclear power plant was $6,902,670. For the 2006 fiscal year, Martin County had property tax revenues of $139,155,807 (State of Florida Dec 2007).

With respect to the school districts in Florida, local revenue for the school districts is derived almost entirely from property taxes levied by Florida’s 67 counties, each of which constitutes a school district (Florida Department of Education 2008). As described in Subsection 2.5.2.3.5, the state of Florida has an established equalized funding program that re-allocates tax base funds from counties that have a high economic tax base to counties that have a low economic tax base. The Florida Education Finance Program is the primary mechanism to fund the operational costs of Florida school districts. Funding is based on the number of full-time equivalent students, and considers variations in several factors to determine funding for each district: local property tax bases, education program costs, costs of living, and costs for equivalent educational programs because of the density and distribution of the student population.

It should be noted that school property tax payments would be based on the location of the plant and not necessarily on the district(s) attended by the workers’ children. Therefore, it is not possible to assess the direct impact of the plant on the school districts. In addition, the impact of plant construction and operation on the special tax districts is not assessed here because most of the property tax payment from the plant would go to the county and the school district(s).

The benefits of taxes are considered small when new tax payments by the nuclear plant constitute less than 10 percent of total revenues for local jurisdictions and large when new tax payments represent more than 20 percent of total revenues (NUREG-1437). Therefore, based on the county portion of the FPL property tax payment for the new units, 4.7 percent of 2007 property tax payments for Martin County would be provided by FPL and would constitute a SMALL positive impact.

9.3.3.2.6.5 Transportation

Roadways close to the proposed site include U.S. Highway 98 (a two-lane highway) that spans north-south between the Martin site and Lake Okeechobee, State Route 76 (a two-lane highway) that spans generally east-west near the southern boundary of the site, and SR 710 (a two-lane highway) that spans in a northwesterly direction from Indiantown. Based on the conceptual site layout for the Martin site, principal road access to the Martin site would be from SR 710 that spans in northwest-southeast orientation along the northeast site boundary. SR 710 intersects with SR 70 near Okeechobee approximately 20 miles northwest, and intersects with SR 76 approximately 7 miles southeast at Indiantown. The region east and northeast of SR 710 is rural and sparsely populated with few roads; therefore, most workforce commuters access SR 710 from SR 76 or SR 70.

FDOT reports the AADT count at two locations along SR 710, one in Okeechobee County approximately 18 miles northwest of the site, and one in Martin County approximately 4 miles southeast of the site. The AADT count and directional peak hour volume of the northwestern location is 8300 vehicles per day and 482 vehicles per hour (FDOT 2008). This peak hour volume classifies this location as a LOS of D (FDOT 2007) and already exceeds the Martin County peak hour capacity by 62 vehicles. The AADT count and directional peak hour volume of the southeastern location is 9600 vehicles per day and 543 vehicles per hour (FDOT 2008). This directional peak hour volume also classifies this location as a LOS of D (FDOT 2007) and already exceeds the Martin County peak hour capacity by 12 vehicles.

Based on the existing workforce at the Martin site, nearly equal amounts of the construction workforce would use the northwestern and southeastern portions of SR 710. Also, the traffic attributable to construction material deliveries could cause additional congestion on SR 710 during certain times of the day. Based on the methodology presented in Subsection 4.4.2.2.4, FPL determined that construction at the Martin site would add 1125 and 944 vehicles during the peak hour to the respective northwestern and southeastern portions of SR 710. This would cause the road to further exceed capacity, add to existing traffic congestion, and drop both roadway locations to a LOS classification of F.

Based on the above analysis, it is likely that the additional traffic would pose delays along SR 710. To facilitate the additional traffic, a large span (almost 40 miles) of SR 710 could be widened to a four-lane highway, and acceleration/deceleration lanes could be added to facilitate commuter traffic. These roadway modifications would be needed along SR 710 between Okeechobee and Indiantown in the vicinity of the Martin site. The NRC applied significance levels to the LOS classifications that were projected to result from the additional traffic associated with refurbishment activities at nuclear plants (NUREG-1437). FPL considers this approach to be appropriate for construction of a nuclear plant since both refurbishment and new plant construction would be large construction projects. The NRC associates small impacts with LOS A and B, moderate impacts with LOS C and D, and large impacts with LOS E and F. It is therefore anticipated that the impact of the construction workforce on transportation would be LARGE.

Operations at the Martin site would add approximately 323 and 271 more vehicles to the northwestern and southeastern portions of SR 710 during the hour of peak traffic, respectively. If the roadway modifications to SR 710 (mentioned above) were undertaken, the directional peak hour capacity of this roadway would accommodate the additional traffic from operations. Without these modifications, shift changes could also be staggered so that the traffic increase would be less likely to cause congestion. However, based on the NRC LOS significance levels, in the absence of road modifications that increase road capacity, the impact of the operations workforce on transportation would be LARGE.

9.3.3.2.6.6 Aesthetics and Recreation

The Martin site is an 11,300-acre area that includes five fossil-fired power units and a solar unit. The site is owned by FPL and is in western Martin County approximately 5 miles east of Lake Okeechobee. The site is on flat land with minor relief at an approximate elevation of 28 feet above MSL (USGS 1953) and lies within the Everglades physiographic province (USGS 2008).

The construction of the new units at the Martin site could be viewed from offsite at certain locations, but the addition of two nuclear facilities would not substantially change the viewscape that results from the current fossil-fired units. There would be a need to construct cooling water intake structures at the C-44 Canal. Additional cooling towers would be required. Operation of the new nuclear units probably would have visual impacts similar to those of the fossil-fired units at the Martin plant, but with occasional visible vapor plumes associated with cooling tower operations. Visibility of the plumes would depend on weather conditions and the location of the viewer in the area. Impacts on aesthetic resources are considered small if there is no potential for diminution in the enjoyment of the physical environment and no measurable impact on socioeconomic institutions and processes. Therefore, impacts of construction and operation of the new units on aesthetics would be SMALL and would not warrant mitigation.

The western shoreline of Lake Okeechobee lies within 5 miles of the Martin site, as well as portions of the Lake Okeechobee Scenic Trail and Big Water Heritage Trail, which parallel the Lake Okeechobee shoreline. Lake Okeechobee occupies 730 square miles and is the second largest freshwater lake wholly within the United States. The lake is the epicenter of Florida and is renowned for its unique natural habitat, rich heritage, and recreational opportunities to fish and view birds (SFRPC 2008).

The Lake Okeechobee Scenic Trail spans 110 miles along the perimeter of Lake Okeechobee. The Trail is designated as a segment of the Florida National Scenic Trail. The trail is atop the Herbert Hoover Dike, which surrounds the lake for flood protection, and provides views ranging from scenic lakeside to working agricultural landscapes. The trail affords opportunities to view wildlife, fish, bike, and hike. The nearest access point to the trail from the Martin site is the Port Mayaca Recreation Area, which is west of the site (USACE 2008a).

The Big Water Heritage Trail is a designated vehicle roadway that provides vehicular access to the landscapes created by south central Florida's watersheds. The trail begins at the Kissimmee River and continues through the communities around Lake Okeechobee and south through the Everglades. It includes portions of SR 78, U.S. Highway 27, SR 76, U.S. Highway 98, U.S. Highway 441, and spans within a few miles of the Martin site. The Big Water Heritage Trail is a partnership project that promotes public awareness of natural and cultural features (SFRPC 2008).

The Barley Barber Swamp is approximately 2 miles west of the Martin site and comprises a 400-acre freshwater cypress swamp preserve. The swamp is managed by FPL as a nature preserve that provides visitors with an example of how Florida may have appeared more than 100 years ago. The swamp is open to the public by appointment only (FPL Dec 1989).

The DuPuis Wildlife and Environmental Area and J. W. Corbett Wildlife Management Area are less than 5 miles south of the Martin site (SFWMD 2005b). The Dupuis Management Area consists of nearly 22,000 acres that were part of the Everglades ecosystem before conversion to a ranch, which altered the hydrology of the area. The South Florida Water Management District is currently restoring portions of the land by rehydrating interior wetlands. The DuPuis Wildlife and Environmental Area offers hunting, hiking, camping, horseback riding, and scenic driving (FFWCC 2008b). The J.W. Corbett Wildlife Management Area consists of approximately 60,230 acres and also offers hunting, hiking, camping, horseback riding, and scenic driving (FFWCC 2008c).

Within 50 miles of the Martin site there are a number of lakes, rivers, swamps, wetlands, and other areas of interest that include three National Wildlife Refuges: Arthur R. Marshall Loxahatchee, Hobe Sound, and Pelican Island National Wildlife Refuges.

Of the 154 state parks in Florida, 10 are within 50 miles of the Martin site. The closest state park to the site is the Atlantic Ridge State Preserve, approximately 19 miles east of the site (SFWMD 2005b).

Because the Martin site already hosts a power plant with tall structures and transmission towers, the construction and operation of the two new nuclear power units and associated transmission lines would not pose an appreciable change in viewscape. Therefore, visual impacts on the region would be SMALL.

The attractiveness of the Okeechobee Lake for fishing and other recreational uses could be impacted during construction of intake and discharge structures. During operation, some employees and their families would use the regional recreational facilities; however, the increase attributable to plant operation would be small compared to overall use of these facilities. Impacts on tourism and recreation are considered small if current facilities are adequate to handle local levels of demand. Therefore, impacts of facility construction and operation on tourism and recreation would be SMALL.

9.3.3.2.6.7 Housing

FPL estimated that 1824 construction and operation workers would move from outside the ROI to the counties within the ROI. These 1824 workers would need housing. Some of the workers would seek permanent residence, generally owner-occupied; some would choose to rent; and others would choose a transitional residence such as a hotel, a room in a private home, or a camper or mobile home.

Based on 2000 census data, within the four-county ROI, there were 728,665 housing units of which 109,676 were vacant (15.1 percent). At the county level, the number of vacant housing units was 10,183 (15.6 percent) in Martin County; 2911 (18.8 percent) in Okeechobee County; 82,253 (14.8 percent) in Palm Beach County; and 14,329 (15.7 percent) in St. Lucie County. This includes housing that is designated as seasonal, recreational, or occasional use (USCB 2000).

Based on absolute numbers, FPL estimated that the available housing would be sufficient to house the construction workforce. Workers who relocated could secure housing from the existing stock in any of the four counties within the region, have new homes constructed, or bring their own residence (mobile home or trailer) to the region. At the county level, if the construction workforce that moved to the ROI followed that of the workforce at the Martin plant, the percentage of vacant housing required in each county would be 5.9 percent, 15 percent, 0.4 percent, and 2.9 percent for Martin, Okeechobee, Palm Beach, and St. Lucie Counties, respectively. Impacts on housing are considered to be small when a small and not easily discernable change in housing availability occurs (NUREG-1437). In summary, FPL concluded that the impacts on housing could be Moderate in Okeechobee County but would be SMALL in the other individual counties of the ROI. For the ROI, the impacts on housing during plant construction would be SMALL and mitigation would not be warranted.

FPL estimated that 1050 workers would be needed for operation of two nuclear power facilities at the Martin site (U.S. DOE May 2004). An estimated 50 percent of these workers (525) would come from within the ROI, and 50 percent (525) would relocate to the area. This would represent less than 1 percent of the vacant housing in the ROI. At the county level, if the construction workforce that moved to the ROI followed that of the workforce at the Martin plant, the percentage of vacant housing required in each county during plant operations would be 1.7 percent, 4.3 percent, 0.1 percent, and 0.8 percent for Martin, Okeechobee, Palm Beach, and St. Lucie Counties, respectively. In summary, FPL concluded that the impacts on housing in the ROI and for any individual county would be SMALL and mitigation would not be warranted.

9.3.3.2.6.8 Public Services

Public services in the ROI include water supply and wastewater treatment facilities, law enforcement, fire and medical facilities, libraries, parks and recreation, roadway maintenance, and other social services. Construction or operations employees who relocate from outside the region would most likely live in residentially developed areas where adequate water supply and wastewater treatment facilities already exist. The medical facilities in the four-county ROI provide medical care to much of the population within the 50-mile region, and therefore the small increases in the regional population would not materially impact the availability of medical services. Although the workers and their families would pose an additional overall demand on other public services, it is anticipated that the current capacity of public services within the four-county ROI would be adequate to accommodate the increased demand. Therefore, the impact would be SMALL.

The new nuclear plant and the associated population influx would likely pose an economic benefit for the disadvantaged population served by the Florida Department of Children and Families. Direct jobs created by the project would bring indirect jobs that could be filled by currently unemployed workers and therefore remove them from the care of social services.

The ratio of residents-to-law enforcement officers in Martin, Okeechobee, Palm Beach, and St. Lucie Counties was 466:1, 399:1, 928:1, and 722:1, respectively (FBI 2008). Within the ROI, the resident-to-law enforcement officer ratio was 804:1, and for the state of Florida, the resident-to-law enforcement officer ratio was 851:1. Ratios are partly dependent on population density. In general, fewer law enforcement safety officers are necessary for the same population if the population resides in a smaller area. Within the ROI, if no additional law enforcement officers were hired, the population increase attributable to project construction at the Martin site would increase the resident to law enforcement officer ratio by 0.32 percent to 807:1. This is a small increase and would still yield a lower resident-to-law enforcement officer ratio than the average for the state of Florida. Similarly, the increase in the resident-to-law enforcement officer ratio attributable to operations would yield only a 0.11 percent increase.

The ratio of residents to firefighters in Martin, Okeechobee, Palm Beach, and St. Lucie Counties was 363:1, 492:1, 519:1 and 563:1, respectively. Within the ROI, the resident-to-firefighter ratio was 505:1, and for the state of Florida, the resident-to-firefighter ratio was 1230:1 (USFA 2009).

As was described above in the description of law enforcement officers, ratios are partly dependent on population density. In general, fewer firefighters are necessary for the same population if the population resides in a smaller area. Within the ROI, if no additional firefighters were hired, the population increase attributable to project construction at the Martin site would increase the resident-to-firefighter ratio by 0.32 percent to 506:1. This is a small increase and would still yield a lower resident-to-firefighter ratio than the average for the state of Florida. Similarly, the increase in the resident-to-firefighter ratio attributable to operations would yield less than a 0.12 percent increase.

Impacts on public services are considered small if there is little or no need for additional personnel. Impacts are considered moderate if some permanent additions or some new capital equipment purchases are needed (NUREG-1437). The population increase in the four-county region attributable to construction or operation of the new power units could pose a need to hire additional emergency personnel; however, any additional need would be small, and increased tax revenues generated by the project would be adequate to pay the salaries of any additional emergency personnel hired. Therefore, it is not expected that public services would be materially impacted by new construction or operations employees that relocate from outside the region. Impacts are therefore considered SMALL, and mitigation would not be warranted.

9.3.3.2.6.9 Education

Based on data for the 2006–2007 school year, Martin County had 36 prekindergarten through 12 (PK-12) schools with a total enrollment of 18,239 students; Okeechobee County had 17 PK-12 schools with a total enrollment of 7289 students; Palm Beach County had 264 PK-12 schools with a total enrollment of 171,431 students; and St. Lucie County had 46 PK-12 schools with a total enrollment of 38,793 students (NCES 2009). In the four-county ROI, there were 363 PK-12 schools with a total enrollment of 235,752 students (NCES 2009).

FPL estimated that 1824 construction and operation workers would migrate to the area, and that 1291 of these workers would bring a family. This would yield a total population increase of 4729 people. Based on an estimate of 0.8 school-aged children per family, 1033 of the 4740 people who relocated to the four-county area would be school-aged children. This would yield a 0.4 percent increase in the student population within the ROI.

Based on the demographic distribution of the Martin plant workforce, an increase of 1033 students would increase the student populations in Martin, Okeechobee, Palm Beach, and St. Lucie Counties by 1.9 percent, 3.4 percent, 0.1 percent, and 0.6 percent, respectively. Small impacts are generally associated with project-related enrollment increases less than 3 percent and moderate impacts on local school systems are generally associated with project-related enrollment increases of 3 to 8 percent (NUREG-1437). Therefore, projected increases in the student populations for the ROI would be SMALL. The projected increase in Okeechobee County would be MODERATE, and the projected increases in the other counties would be SMALL. The quickest mitigation would be to hire additional teachers and move modular classrooms to existing schools. Increased property and special option sales tax revenues as a result of the increased population would fund additional teachers and facilities. No additional mitigation would be warranted.

FPL assumed that 525 operations workers and their families would relocate from outside the region, and that the total population increase would be 1706 people. This would include an estimated 420 children in the PK-12 school range. This influx of students would increase the student population in the ROI by 0.2 percent. Based on the demographic distribution of the Martin plant workforce, an increase of 420 students would increase the student populations in Martin, Okeechobee, Palm Beach, and St. Lucie Counties by 0.8 percent, 1.4 percent, 0.05 percent, and 0.25 percent, respectively. Therefore, projected increases in the student populations for the ROI and for each individual county are expected to be SMALL and mitigation would not be warranted.

9.3.3.2.7 Historic and Cultural Resources

FPL conducted historical and archaeological records searches on the National Park Service National Register Information System, and reviewed information on historic and archeological sites provided in documents associated with the FPL Martin Expansion project. Where applicable, historic and archeological sites are identified by their historic site structure identifier.

A detailed cultural resource assessment was conducted at the Martin site in 1989 in support of the Martin Coal Gasification/Combined Cycle (CG/CC) project (FPL May 2008). Approximately 3300 acres of the Martin Power plant site were proposed for use for that project that encompassed the area for the proposed nuclear plant at the Martin site. As a result, an evaluation of sites with archaeological or historical importance was performed for the Martin site.

The evaluation consisted of a review of the Florida Master site File and the examination of the historical and archeological literature and historic records. The search revealed that no archeological sites have been recorded on the FPL Martin plant site.

Areas of potential high archaeological importance were identified based on U.S. Geological Survey (USGS) Quadrangle Maps and aerial photographs before the 1989 field survey. The archeological field survey included each of these areas plus other areas identified in the field with potential significance. The survey strategy required an intensive, systematic, cultural resource survey of these areas and limited systematic and judgmental survey of the remaining areas. The surveys found no archaeological sites within those areas currently designated for the Martin site (FPL May 2008).

The NRHP identifies 100 sites in the four-county ROI; including 70 sites in Palm Beach County, 12 sites in Martin County, 16 sites in St. Lucie County, and two sites in Okeechobee County. One of these properties, the Seminole Inn, is within 10 miles of the Martin site (NPS 2008c). The Seminole Inn is an historic hotel in Indiantown, Florida (Martin County). It was built by S. Davies Warfield, who was president of the Seaboard Air Line Railroad, which developed Indiantown.

Sites are considered to have small impacts to historic and cultural resources if the SHPO identifies no significant resources on or near the site or determines they would not be affected by plant construction or operation. A detailed cultural resource assessment conducted at the Martin site in 1989 found no archaeological sites within those areas currently designated for the Martin site; therefore, FPL concludes that impacts to cultural sites during construction or operation of the proposed nuclear plant at the Martin site would be SMALL.

Construction of the new units at the Martin site could be viewed from the historic and cultural sites within 10 miles of the site, but the addition of two nuclear power facilities would not substantially change the view. The operation of the new units probably would have visual impacts similar to those of the existing FPL Martin power plant, with the addition of cooling tower plumes. Therefore, visual impacts of construction and operation of the Martin site relative to historic and culture sites would be SMALL and would not warrant mitigation.

9.3.3.2.8 Environmental Justice

Environmental justice refers to a federal policy under which each federal agency identifies and addresses, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority or low-income populations. The NRC has a policy on the treatment of environmental justice matters in licensing actions (69 FR 52040) and guidance (U.S. NRC May 2004). Subsection 2.5.4.1 describes the methodology FPL used to establish locations of minority and low-income populations.

The 2000 census block groups were used to ascertain minority and low-income population distributions in the area. There are 794 block groups within 50 miles of the Martin site. The census data for Florida characterizes 14.6 percent of the population as black; 0.3 percent American Indian or Alaskan Native; 1.7 percent Asian; 0.1 percent Native Hawaiian or other Pacific Islander; 3.0 percent as other single minorities; 2.4 percent multiracial; 22.0 percent aggregate of minority races; and 16.8 percent Hispanic ethnicity. If any block group percentage exceeded the state percentage by more than 20 percent or was greater than 50 percent, then the block group was considered to have a significant minority population. Significant black minority populations exist in 118 block groups; significant American Indian or Alaskan Native populations exist in 1 block group; significant other race minority populations exist in 7 block groups; significant multiracial minority populations exist in 3 block groups; significant aggregate of minority races populations exist in 139 block groups; and significant Hispanic ethnicity populations exist in 55 block groups. There are no block groups containing significant Asian or Native Hawaiian or other Pacific Islander minority populations within 50 miles of the Martin site.

The Brighton Seminole Indian Reservation is 30 miles west of the Martin site. As described in Subsection 9.3.3.1.7, the reservation offers several tourist attractions including Indian arts and crafts shops, the Seminole Casino Brighton, a rodeo arena, the Brighton Citrus Grove, and the Brighton Seminole Campground. Today, most Seminole Tribal members are afforded modern housing and health care. In fact, today the Seminole Indians live much the same way as those who live outside Seminole County (Seminole Tribe of Florida 2008).

The locations of the minority populations within 50 miles of the Martin site and the Brighton Indian Reservation are shown in Figure 9.3-12.

The USCB data characterizes 11.7 percent of Florida households as low income. Based on the more than 20 percent criterion, 53 block groups out of a possible 794 contain a significant number of low-income households. The locations of the low-income populations within 50 miles of the Martin site are shown in Figure 9.3-13.

Although the Martin site is within a minority block group, construction activities (noise, fugitive dust, and air emissions) would be contained with site boundaries and would not disproportionately impact minority populations. In fact, minority and low-income populations would most likely benefit from construction activities through an increase in construction-related jobs. Operation of the new units at the Martin site is also unlikely to have disproportionate impacts on minority or low-income populations.

FPL concluded that construction and operation of the proposed nuclear plant at the Martin site would not disproportionately impact minority or low-income populations and that mitigation would not be warranted, and the impacts to these populations would be SMALL.

9.3.3.2.9 Other Projects in the Vicinity of the Martin Site

The cumulative impacts of past, present, and reasonably foreseeable federal (e.g. USCOE, USGS), non-federal (e.g. FDEP, FDOT, county), and private projects within a 50-mile radius of the Martin site, excluding Brownfield and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites, that could have cumulative impacts with the proposed action are described in Table 9.3-12. These projects have either requested an air or water permit/license or had an environmental impact statement complete. Projects included in Table 9.3-12 are within the 50-mile radius of the Martin site and the appropriate timeframe for construction and operation of the new units (Figure 9.3-11) from 2013 to 2063 (based on a construction start date of 2013, a Unit 7 in-service date of 2023, and a 40-year operating license). Nuclear power projects within 100 miles of the Martin site (i.e., St. Lucie) are also described in Table 9.3-12. The Turkey Point site is more than 110 miles from the Martin site and is therefore not included in the table. The only other nuclear power plant currently operating in Florida, Crystal River, is more than 180 miles from the Martin site and therefore is also not included in the table. The proposed nuclear power plant in Levy County is approximately the same distance as the Crystal River site and is not included in the table. It should be noted that this list is not intended to be exhaustive and should not be used to imply that no other past, present, or reasonably foreseeable projects exist that could contribute to cumulative impacts within each alternative site project ares.

The impacts to land use that would have a cumulative impact on alternative sites would generally be characterized as a change to the land use designation from “agriculture” to “industrial.” A positive land-use impact, for example, would be the CERP projects. These projects within the 50-mile radius would redevelop, reuse, or develop additional land for conservation. The cumulative impacts to hydrology and water use would be minimally negative due to the restrictions placed on all surface water and groundwater use, also beneficial impact due to the large scale CERP projects for reservoir and storage areas which would provide additional water to the southern Everglades Agricultural Area, reestablish wetland hydropatterns and improve Everglades water quality by treating urban stormwater runoff. The cumulative impacts for terrestrial/aquatic resources would be associated with the minimal loss of wetlands, which is offset by the restoration of developed lands for conservation and restoration of native species through CERP projects. The cumulative impacts for socioeconomics for the Martin site would appear as beneficial impacts to taxes and adverse impacts on transportation. Also, there would not be any disproportionate impact to low-income or minority populations by the activities at the Martin site.

9.3.3.3 Evaluation of the Okeechobee 2 Site

During the site selection process, the Okeechobee 2 site was identified as a 3000-acre undeveloped site in Okeechobee County located approximately 8 miles west of the town of Okeechobee, just north of SR 70 along County Road 128th Avenue Northwest. The site is not owned by FPL but is considered potentially available and feasible for a power generation project. Nearby towns include Okeechobee (8 miles east), Buckhead Ridge (10 miles south), Lakeport (22 miles southwest), Cypress Quarters (10 miles east southeast), Taylor Creek (11 miles east southeast), Indiantown (34 miles southeast), Fort Pierce (40 miles northeast), Lorida (14 miles northwest), Lake Placid (19 miles west), Moore Haven (29 miles south), and Port St. Lucie (30 miles east). (Rand McNally 1999) The Miami Load Center is approximately 90 miles to the south. Nearby water bodies include the Kissimmee River (2 miles west) and Lake Okeechobee (7.6 miles southeast). Portions of the site are located within the 100-year floodplain. The location of the Okeechobee 2 site is shown in Figure 9.3-14.

9.3.3.3.1 Land Use Including Site and Transmission Line Rights-of-Way

Based on the conceptual site layout developed for the Okeechobee 2 greenfield site, the following land requirement assumptions were made which form the basis of the environmental comparison of alternative sites:

- The assumed facility footprint would require approximately 362 acres and the assumed cooling water storage reservoir would require approximately 3002 acres. New facilities at the plant site would include the nuclear power units, support buildings, a switchyard, storage areas, stormwater retention ponds, and deep injection wells for subsurface water disposal.
- The assumed extent of non-transmission linear features, including access road corridors, pipeline corridors and rail access, is as follows:
  - Access road: 112.3 acres – assuming a corridor length of approximately 9.3 miles and corridor width of 100 feet. Based on conceptual site layouts developed for the Okeechobee 2 site, site access would be from SR 70. Improvements to SR 70 would include widening a portion of SR 70 from two lanes to four lanes to accommodate anticipated traffic levels attributable to construction.
  - Rail: 46.6 acres – based on assumed length of approximately 3.9 miles and corridor width of 100 feet, to provide access to the nearest railway northeast of the site.
  - Intake/makeup pipeline corridors: 22.5 acres, including pipeline connecting the reservoir to the Kissimmee River (assumed cooling water source) to the south.
- The assumed extent of conceptual transmission corridor routing is 3022 acres based on an assumed length of approximately 38 miles and a corridor width of 660 feet, to connect to the existing FPL transmission system at the Corbett substation inside Palm Beach County.
- Based on sub-totals above for both onsite and offsite plant components, the total area potentially affected at the Okeechobee 2 site is estimated at approximately 6567 acres. With respect to the transmission line corridor included within this total, the estimated acreage requirements assume a corridor width which may exceed the area that would actually be disturbed during project construction and operation. However, these estimates provide the basis for an updated and consistent environmental comparison of alternative sites.
- Additional acreage (up to several hundred acres) may be required to support construction activities (e.g., additional laydown areas, batch plant, fill/spoil areas). However, cleared land would be used to the greatest extent possible. The impact on this acreage would be temporary, and it would also be reclaimed to the extent possible following construction.

The Okeechobee 2 site is used mainly for farmland and agriculture. The county has substantial cattle, dairy, and citrus operations. The site is generally flat with a mean elevation of 28 feet. Portions of the site are located within the 100-year floodplain and may require filling to increase the elevation. Should FPL determine that some areas would require filling, sufficient quantities of fill material would be available from excavation of the reservoir and/or storm water retention ponds. An area of approximately 362 acres for the main power plant site (major structures including switchyard), which would largely be focused in one central location; and approximately 3000 acres (surface area) for a new reservoir and intake structure would be permanently impacted.

Land use impacts associated with plant construction include both impacts to the site and immediate vicinity, including the new reservoir; and impacts to offsite areas such as transmission, cooling water intake pipelines, and transportation rights-of-way (e.g., road and rail).

Project construction activities at the Okeechobee 2 site may require filling those portions of the site area that are within the 100-year flood zone. FPL has determined that sufficient fill material could be available onsite, based on the amount of material that would be excavated for the reservoir and storm water retention ponds.

Construction of the power plant and transmission lines would alter land use at the site from agricultural to industrial. Much of the proposed power plant site area has already been cleared and is now used for agricultural activities; nearly 2000 acres of the plant site area are currently in pasture; another 1200 acres consist of wet prairies. Following construction activities, impacted areas without constructed buildings or transportation infrastructure would be reclaimed to the greatest extent feasible.

Construction at the proposed pipeline corridors would have temporary, minor effects on land use during actual construction due to trenching, equipment movement and material laydown. The ability to use current lands for their existing uses (e.g., farmland) along the proposed pipeline corridor would be temporarily lost during construction. Direct and indirect impacts of construction from the proposed transportation infrastructure would be similar to those for the proposed plant.

Development of the conceptual transmission corridor incorporated the most direct route where possible, while considering potential conflicts with natural or man-made areas where important environmental resources were located, and avoiding populated areas and residences to the extent possible. Whenever possible, the new line was routed along existing transmission rights-of-way. The use of lands that are currently forested would be altered. Trees would be replaced by low-growth types of ground cover such as grass. The new transmission corridor would not be expected to preclude agricultural activities near the eventual rights-of-way. The land use in the region (along the new transmission corridors) is generally rural, sparsely populated, and primarily used for agricultural activities. The Okeechobee 2 site is 45 miles inland from the Atlantic Ocean and is therefore not part of the Florida Coastal Zone. The route for the new transmission line includes 38 inland miles and would not pass through any portion of the Florida Coastal Zone.

Table 9.3-13 includes estimates of the potentially affected area(s) of each land cover type (based on GIS FLUCCS Level III data analysis) for the Okeechobee 2 site, including both onsite and offsite components (i.e., access road, rail, pipeline and transmission corridors). It also further breaks out the land cover types along the assumed conceptual transmission corridor only, given the significant acreage this corridor encompasses (46 percent of the total area). As noted previously, regarding the offsite linear features associated with the projects, the estimated acreage requirements assume corridor widths for transmission which may exceed the area that would actually be disturbed during project construction and operation. These estimates are intended to provide the basis for an updated and consistent environmental comparison of alternative sites.

The proposed project would be a change from current land use at the site. Operational impacts to site land use would include a permanent change in land use approximately 3500 acres of land for the power plant site, reservoir, and rail/highway site access corridors – that would be generally unavailable for other purposes. The entire plant footprint, reservoir and offsite access road and rail spur would be excluded from future agricultural and recreational use for the estimated 60-year life of the AP1000 power units (WEC 2007).

Operational impacts to the site and immediate vicinity also would include maintenance operations on project structures that would be small and temporary in nature.

Operational impacts of transmission lines result primarily from line maintenance, and include right-of-way vegetation clearing and control, transmission line maintenance, and other normal access activities. Additional right-of-way acquisition and development would not normally be required as part of plant operational activities. Maintenance activities would be limited to the immediate right-of-way and would be minimal. New transmission corridor would not be expected to preclude agricultural activities near the eventual rights-of-way. Corridor vegetation management and line maintenance procedures would be established by the transmission service provider.

Other offsite land use impacts as a result of plant operational activities would be minimal, temporary, and limited in the area impacted. Such activities could include pipeline, road, and rail maintenance and auxiliary building maintenance. It is likely that most lands above the proposed water intake pipeline and related areas of construction could continue to be used for ranching, farming and any passive uses. The proposed transportation infrastructure could result in the loss of a small amount of ranch land, pasture land and forested land in areas where access road improvements/widening and a rail spur would be needed.

For the purpose of this analysis, land use impacts are considered small if less than 3000 acres are disturbed (including plant footprint, reservoir, rights-of-way, and corridors) and there are no major changes to land use. Impacts are considered moderate if land disturbance is greater than 3000 acres or there are major changes to land use; and large if land disturbance is greater than 6000 acres and there are major changes to land use. Based on a potentially affected area of approximately 6568 acres, and the permanent change of land use from agricultural to industrial, land use impacts associated with site preparation, construction, and operation of the proposed nuclear plant at the Okeechobee 2 site and the conceptual transmission corridor would be LARGE.

9.3.3.3.2 Air Quality

Okeechobee County (which includes the Okeechobee 2 site) is part of the Southeast Florida Intrastate Air Quality Control Region. Okeechobee County, along with the entire state of Florida, is designated as attainment or unclassifiable with respect to the NAAQS (40 CFR 81.310). The nearest non-attainment area is in Georgia, several hundred miles north northwest of the Okeechobee 2 site (40 CFR 81.311).

Criteria pollutant emissions from construction and operation of the proposed nuclear plant at the Okeechobee 2 site would be comparable to the emissions generated at the Turkey Point site as described in Subsections 4.4.1.2 and 5.8.1.2, respectively. Construction impacts would be temporary and would be similar to those associated with any large-scale construction project. Particulate emissions in the form of dust from disturbed land, roads, and construction activities would be generated. Mitigation measures similar to those described in Subsection 4.4.1.2 would be applied as necessary. Criteria pollutants would also be generated from onsite fossil-fueled construction equipment and construction vehicles, and from commuter and delivery vehicles that travel to and from the site. The quantity of criteria pollutant emissions generated by construction activities would be small compared to total vehicular emissions in the region. It is assumed unlikely that construction-related emissions would cause any violation of the NAAQS.

The project would include standby diesel generators and diesel-driven fire pumps. Annual emissions from these sources are listed in Table 3.6-4. It is expected that standby diesel generators and auxiliary power systems would see limited use and, when used, would operate for a short time interval. The pollutant emissions generated by these systems (nonradiological) would be regulated by the FDEP in accordance with the air rules published under FAC Chapter 62. These rules cover general air pollution control provisions, stationary source requirements, preconstruction review, emission standards, air monitoring requirements, and other rules for control of air pollutant emissions. Airborne release of criteria pollutant and hazardous air pollutant emissions would be small and would comply with FDEP rules (FDEP 2008a).

Nonradiological emissions can potentially affect regional visibility, and visibility is an important feature at Federal Class I areas. The Federal Class I area nearest to the Okeechobee 2 site is the Everglades National Park nearly 100 miles to the south. Because the distance is large, and because the anticipated emission levels would be small, pollutant emissions attributable to operation of the new nuclear units would have a negligible impact on visibility at a Federal Class I area. Unfavorable psychometric conditions can result in visible vapor plumes from the cooling tower operations. These plumes may be visible for several miles, but would not impact visibility or scenic vistas at any Federal Class I area.

Air quality impacts are considered small if the increase in regional pollutant concentrations attributable to the source (1) would not appreciably alter visibility, (2) would not exceed EPA significant impact levels, and (3) would not cause a violation of the most restrictive ambient air quality standards. Based on this evaluation metric, it is anticipated that the impacts to air quality from construction and operation would be SMALL.

9.3.3.3.3 Hydrology, Water Use, and Water Quality

The state of Florida is divided into five watershed management areas. The Okeechobee 2 site is in the Kissimmee-Everglades watershed and falls under the jurisdiction of the SFWMD. This watershed region spans over 16 counties and is logically divided into several river basins: Kissimmee River, Upper East Coast, Lower East Coast (which includes the entire southeast coast and the Everglades), and Lower West Coast (which includes the Big Cypress and Caloosahatchee Rivers). This region is the largest watershed region in the state of Florida and is home to 40 percent of Florida's population. The region also contains the Everglades (the largest subtropical wetland in the United States) and Lake Okeechobee, the second largest freshwater lake in the United States. This lake is of national importance because its water has diverse usage and a large number of people depend on it for agricultural and domestic purposes (University of Florida Jun 2007).

Currently, Lake Okeechobee's water quality and ecological health are adversely affected by excessive nutrient loading, extreme high and low water levels, and the proliferation of exotic species. To address restoration goals for the lake, the SFWMD in coordination with the FDEP and the Florida Department of Agricultural and Consumer Services has developed the Lake Okeechobee Watershed Construction Project Technical Plan. The plan was developed in response to the Northern Everglades and Estuaries Protection Program that the Florida Legislature signed into law in 2007. Primary components of the plan include implementing agricultural management practices, building treatment wetlands to clean water flowing into the lake, and creating between 900,000 and 1.3 million acre-feet of water storage north of the lake (SFWMD 2008).

In the year 2000, the average daily surface freshwater withdrawals in Okeechobee County totaled 12.0 million gallons, which represents 16.7 percent of the total daily withdrawal rate for the county (71.83 million gallons) (USGS Dec 2004). Major surface freshwater sources near the Okeechobee 2 site include Lake Okeechobee (7.6 miles away) and the Kissimmee River (2 miles away).

The entire state of Florida, and portions of southern Alabama, southeastern Georgia, and southern South Carolina, are atop the Floridan aquifer. This aquifer covers some 100,000 square miles and is one of the most productive aquifers in the world. The Floridan aquifer system provides water for several large cities, such as Savannah and Brunswick in Georgia; and Jacksonville, Tallahassee, Orlando, Tampa Bay, and St. Petersburg in Florida. In addition, the aquifer system provides water for hundreds of thousands of people in smaller communities and rural areas. The Floridan aquifer is intensively pumped for industrial and irrigation supplies (USGS July 1980).

In the year 2000, average daily water withdrawals in Okeechobee County included groundwater (59.8 million gallons) and surface water (12 million gallons) for a total of 71.8 million gallons. Principal groundwater sources in the county included the Floridan and surficial aquifers. Nearly 96 percent of groundwater withdrawals (57.29 million gallons per day) and 93 percent of surface water withdrawals (9.75 million gallons per day) were used for agriculture. Average daily public water supply in Okeechobee County for the year 2000 was 2.23 million gallons per day, which included 24 percent fresh groundwater and 76 percent fresh surface water (USGS Dec 2004).

The depth to the water table near the site is less than 20 feet below ground level. Therefore, it is expected that dewatering may be necessary during the construction phase. This may require construction of temporary retention ponds to allow sediment-laden waters to settle before discharge to surface waters. Dewatering activities would be subject to NPDES permit requirements to avoid adverse impacts on surface waters.

Land subsidence related to karst terrain is not anticipated at the site. The site is in karst Area II where the surface cover is reported to be 30 to 200 feet thick. In such areas, sinkholes are reported to be few, shallow, of small diameter, and develop gradually (Sinclair, et al.,1985).

Site groundwater wells are expected to be installed in the middle Floridan aquifer. Since the site is inland from the coast, lateral saltwater intrusion is not likely. However, there is a potential for saltwater to migrate vertically into the middle Floridan aquifer from the saline deeper Floridan aquifer. Since the middle Floridan aquifer already produces brackish water, resultant saltwater intrusion could require additional osmosis or freshwater mixing to satisfy potable water quality standards.

As shown in Subsection 4.2.2.1, the peak construction water demand is estimated at 565 gpm which is slightly greater than one cubic foot per second, and the peak estimated potable water demand for operations is 2553 gpm (Table 3.3-1). As described in Section 3.3, an estimated 100 cfs of freshwater would be required to replace consumptive water use associated with operation of the proposed nuclear power units. Lake Okeechobee offers a potential water supply of more than 360 cfs, and the annual average flow of the Kissimmee River near the site is approximately 919 cfs. The estimated groundwater potential at the Okeechobee 2 site is approximately 155 cfs. These water sources are suitable to satisfy potable and process water demands associated with construction and operation at the Okeechobee 2 site. Water use impacts are considered small when water sources are readily available to meet demand. A permittability assessment of the probability of obtaining water permits at the Okeechobee 2 alternative site would be required to develop the documentation necessary to firmly establish conditions under which water from these sources could be made available. Such analysis is beyond the reconnaissance-level evaluations required for alternatives analysis. Instead, these evaluations must be based on statutory and regulatory criteria requiring site-specific analysis of reasonable beneficial use, existing legal users, and public interest factors. Accordingly, because adequate water sources are physically available nearby, the impact on regional water use for both construction and operation would be SMALL.

Water quality impacts are considered small when changes in water quality do not affect or minimally affect aquatic biota and water uses (NUREG-1437). For the Okeechobee 2 site, FPL assumed that a closed-loop, mechanical draft, tower-cooled system would be used for power cycle waste heat rejection, whereby blowdown water is injected into the Boulder Zone. The Boulder Zone is a deep underground, extremely permeable, cavernous region in southeastern Florida. It is called the Boulder Zone not because it contains boulders, but instead, because efforts to drill into this zone pose difficulties similar to the difficulties posed by subsurface boulders. Construction and operation activities at the Okeechobee 2 site would be performed under the authorization of an NPDES permit (construction), IWW permit (surface water), or UIC permit (groundwater) issued by the FDEP (FDEP 2008b). Any releases from the water storage reservoir into Lake Okeechobee or regional streams as result of construction or operation would be regulated by the FDEP through the NPDES, IWW, or UIC permit process to ensure that water quality was protected. To ensure that wetlands and streams are not harmed by petroleum products or other industrial chemicals, FPL would restrict certain activities (e.g., transfer and filling operations) that involve the use of petroleum products and solvents to designated areas, such as laydown, fabrication, and shop areas. In addition, construction activities would be guided by a stormwater pollution prevention plan and a construction-phase spill prevention, control, and countermeasures plan similar to those proposed for the Turkey Point site as described in Section 4.2. Therefore, any impacts to surface water during plant construction would be SMALL and would not warrant mitigation beyond best management practices required by the permits.

The impacts to water quality during operations would also be SMALL because the IWW and UIC permit requirements would ensure that adequate measures are applied to protect water quality.

9.3.3.3.4 Terrestrial Resources and Protected Species

Table 9.3-13 includes estimates of the potentially affected area(s) of each land cover type within the project area for both onsite and offsite components, including natural vegetation and wetland areas. As can be seen in Table 9.3-13, the Okeechobee 2 site consists mainly of improved pasture and wet prairies. The site is generally flat with a mean elevation of 28 feet.

As shown in Table 9.3-13, there are approximately 1500 acres of wetlands within the project area, excluding the conceptual transmission corridor, which could be directly impacted from project construction. Of these, approximately 89 acres are identified as forested wetlands and considered to be high quality. Any wetland functions that are impacted during construction would be replaced or restored. The footprint of the new facilities, excluding the assumed conceptual transmission corridor, would cover approximately 3545 acres.

Wildlife viewing along the nearby Lake Okeechobee Scenic Trail, which encircles Lake Okeechobee, includes herons, egrets, and wintering waterfowl, which are prevalent along the rim of the lake and in open water. Dry prairies interspersed with oak and cabbage palm hammocks provide habitat for crested caracaras (*Caracara cheriway*), burrowing owls (*Athene cunicularia floridana*), and sandhill cranes (*Grus canadensis pratensis*). Alligators, snakes, and turtles are common in the marshes (FFWCC 2008d). In neighboring Highlands County, the Lake Wales Ridge Wildlife and Environmental Area, which contains habitat similar to the Okeechobee 2 site, has a number of species present: amphibians and reptiles include the American alligator (*Alligator mississippiensis*), dusky pygmy rattlesnake (*Sistrurus miliarius barbouri*), eastern indigo snake (*Drymarchon corais couperi*), gopher frog (*Rana capito*), gopher tortoise (*Gopherus polyphemus*), green anole (*Anolis carolinensis*), short-tailed snake (*Stilosoma extenuatum*), and southern black racer (*Coluber constrictor priapus*). Birds include the bald eagle (*Haliaeetus leucocephalus*), common loon (*Gavia immer*), Florida scrub-jay (*Aphelocoma coerulescens*), great egret (*Ardea alba*), little blue heron (*Egretta caerulea*), osprey (*Pandion haliaetus*), roseate spoonbill (*Platalea ajaja*), sandhill crane (*Grus canadensis pratensis*), snowy egret (*Egretta thula*), and swallow-tailed kite (*Elanoides forficatus*). Mammals include the bobcat (*Lynx rufus*), coyote (*Canis latrans*), Florida black bear (*Ursus americanus floridanus*), Florida mouse (*Podomys floridanus*), Florida weasel (*Mustela frenata peninsulae*), gray fox (*Urocyon cinereoargenteus*), and river otter (*Lutra canadensis*) (FFWCC 2008e).

Threatened, endangered, and/or species of special concern that exist in Okeechobee County are listed in Table 9.3-14. The FNAI biodiversity matrix query results for the matrix units encompassing the Okeechobee 2 site did not include any documented occurrences of rare species tracked by FNAI (FNAI 2011).

According to the FFWCC Bald Eagle Nest Location Database, no active bald eagle (*Haliaeetus leucocephalus*) nests are at the Okeechobee 2 site. The closest nest is approximately 1.4 miles from the project area, and there are five nests within 2 miles: Nests OK005, OK006, OK017, OK026, and OK027 (FFWCC 2008a).

Further field surveys would be conducted for federally listed and state-protected species as part of the permitting process before any clearing or construction activities were conducted at the site or along associated transmission or pipeline corridors. Land preparation associated with construction of the plant and transmission lines would be conducted in accordance with federal and state regulations, permit conditions, existing FPL procedures, good construction practices, and established best management practices (e.g., directed drainage ditches, silt fencing) (FPL Dec 2006).

As described in Subsection 9.3.3.3.1, FPL assumed that two 230 kV transmission lines and two 500 kV transmission lines would be required to connect the new nuclear units to the existing FPL transmission system via the Corbett Substation in northern Palm Beach County. The transmission lines would be routed in two parallel corridors. Based on the site layout for Okeechobee 2, the conceptual corridor encompassing the four lines would be approximately 38 miles long and nominally 660 feet wide. The conceptual transmission corridor generally follows the most direct route between terminations while consideration was also given to avoiding possible conflicts with natural areas where important environmental resources are located.

As shown in Table 9.3-13, there are approximately 542 acres of wetlands found within the conceptual transmission corridor; approximately 211 acres are forested wetlands and considered to be high quality. This compares to a 3022-acre area potentially affected by the conceptual transmission corridor, based on the dimensions above. Any wetland functions that are impacted during construction would be replaced or restored. Construction of the new transmission lines would potentially impact approximately 3022 acres within the conceptual transmission corridor. However, the estimated acreage requirements for the transmission corridor assume corridor widths which may exceed the area that would actually be disturbed during project construction and operation. These estimates are used to provide the basis for an updated and consistent environmental comparison of alternative sites.

Cooling tower operations can generate vapor plumes that drift downwind. Salt and mineral deposits in the vapor plume have the potential to adversely impact sensitive plant and animal communities through changes in water and soil chemistry; however, the freshwater sources identified for the Okeechobee 2 site have modest levels of salts and dissolved minerals; therefore, the impact of salt and mineral deposits from vapor drift would be minimal. The use of drift eliminators, along with proper tower design and operation, would further minimize the potential for impacts.

For the purpose of this analysis, impacts to terrestrial resources are considered small if no sensitive habitats, including wetlands, are disturbed and no important species are affected. Okeechobee County has a low number of sensitive species, and there are no known sensitive species onsite. The site area includes a relatively small area of undisturbed woodlands that could be potentially affected by project construction and operation. However, it also includes over 2000 acres of wetlands, including approximately 1300 acres of wet prairies and 300 acres of high quality wetlands that could be potentially affected. Construction of the plant and reservoir would result in a loss of primarily pasture land and wet prairies that may serve as habitat to various common terrestrial species; however, the creation of a new reservoir to support plant operation would provide new habitat for birds and waterfowl that would not be adversely affected by plant operation. FPL concluded that impacts to terrestrial resources, including endangered and threatened species, from construction and operation of the proposed nuclear plant and conceptual transmission corridor at the Okeechobee 2 site would be MODERATE.

9.3.3.3.5 Aquatic Resources and Protected Species

The Okeechobee 2 site is approximately 2 miles from the Kissimmee River and 7.6 miles from Lake Okeechobee. Historically the Kissimmee River meandered approximately 103 miles from Lake Kissimmee to Lake Okeechobee through a one to 2-mile wide floodplain. The river and its flanking floodplain consisted of a mosaic of wetland plant communities and supported a diverse group of waterfowl, wading birds, fish, and other wildlife. The historic Kissimmee River was hydrologically unique among North American river systems in that it had prolonged periods of extended floodplain inundation. Between 1962 and 1971, the river was channelized and two-thirds of the historical floodplain was drained. Excavation of the canal and placement of the spoil material destroyed one-third of the river channel. Implementation of the Kissimmee Flood Control project led to drastic declines in wintering waterfowl, wading bird and game fish populations, and the loss of ecosystem functions. A restoration project, to be undertaken by the U.S. Army Corps of Engineers, is expected to include filling 22 miles of the C-38 Canal, excavation of nearly 9 miles of river channel in the river’s lower basin, and the removal of the S-65B and S-65C water control structures. These actions will provide a more natural fluctuation of water levels in both the upper and lower basins that will enhance marshes around the lakes and reestablish the river’s hydrology. Fish and wildlife habitat in the river’s one to 2-mile-wide floodplain would benefit substantially from this restoration project (USACE 2008b).

Lake Okeechobee is at the center of south Florida's regional water management system, and is in south-central Florida. The massive lake is a 730 square mile, relatively shallow lake with an average depth of 9 feet and is the second-largest freshwater lake wholly within the continental United States, second only to Lake Michigan. Lake Okeechobee's drainage basin covers more than 4600 square miles (SFWMD 2008).

Lake Okeechobee supports a nationally recognized sport fishery for largemouth bass (*Micropterus salmoides*) and black crappie (*Pomoxis nigromacultus*), as well as a commercial fishery for various catfish and bream (*Lepomis spp.*). These fisheries generate nearly $30 million per year for the local economies, and they have an asset value that is in excess of $100 million. Another estimate places the value of the recreational fish species at more than $300 million. In addition to the sport and commercial species, Lake Okeechobee supports a diverse community of fish, including (in total) 41 species. These fish are a food resource for wading birds, alligators, and other animals that use the lake (SFWMD 2005a).

For the purpose of this analysis, impacts to aquatic resources are considered small if no sensitive habitats are disturbed and no important species are affected. Water from the Kissimmee River via pipeline would be the source to cool the new nuclear units constructed at the Okeechobee 2 site. Although recreational sport fish and other aquatic species would be temporarily displaced during construction of a water intake structure, they would be expected to recolonize the area after construction is complete. No listed fish species are known to exist in Okeechobee County (FNAI 2011), which includes the Kissimmee River and portion of Lake Okeechobee near the Okeechobee 2 site. One state-listed amphibian, the gopher frog (*Rana capito*), has been documented or observed in Okeechobee County. Field surveys would be conducted for federally listed and state protected aquatic species as part of the permitting process before any clearing or construction activities at the site or along associated transmission corridors. Because of this, and because land clearing associated with construction of the plant and transmission lines would be conducted according to federal and state regulations, permit conditions, existing FPL procedures, good construction practices, and established Best Management Practices, impacts to aquatic resources, including endangered and threatened species, from construction of nuclear power facilities at the Okeechobee 2 site would be SMALL.

There would be no direct discharges to the nearby surface waters from plant operation since plant design assumes discharge by underground injection. The most likely aquatic impact from nuclear operations at the Okeechobee 2 site would be entrainment and impingement of aquatic organisms in the Kissimmee River. Because the EPA requires facilities to meet criteria designed to protect organisms from entrainment and impingement, the potential for environmental impacts to aquatic resources, including endangered and threatened species, from nuclear power facility operations at the Okeechobee 2 site would be SMALL.

9.3.3.3.6 Socioeconomics

This subsection evaluates the social and economic impacts to the region from construction and operation of the proposed nuclear plant at the Okeechobee 2 site. Much of the socioeconomic analysis relies on census data gathered by the USCB. The USCB performs an extensive census every 10 years. The most recent decennial U.S. census was performed in year 2000. The USCB assembles the decennial census data into a wide range of reports that can be used to characterize socioeconomic conditions of a region. In addition, the NRC sponsored development of a computer program called SECPOP2000 that enables an analyst to quickly assemble and quantify customized regional socioeconomic information; however, this program does not produce results for years later than 2000 (U.S. NRC Aug 2003). For years that fall between each decennial census, the USCB issues estimates based on surveys and statistical models; however, the types of data collected and assembled for intermediate years is less extensive than for years when a decennial census is performed; therefore, the decennial census provides the most comprehensive information.

Because the decennial census provides the most comprehensive information, and because the NRC software tool, SECPOP2000, is not available for intermediate years, information from the 2000 census is chosen as a common baseline for socioeconomic comparison for this analysis. Published census data for later years, if available, is presented as supplemental information.

9.3.3.3.6.1 Physical Impacts

Construction activities can cause temporary localized physical impacts such as noise, odor, fugitive dust, vehicle exhaust emissions, ground vibration, and shock from blast activities. The use of public roadways and railways would be necessary to transport construction materials and equipment to the site. Most activities would occur within the boundaries of the Okeechobee 2 site; however, an access road and a railway connection spur would be constructed on lands adjacent to the site. These new transportation rights-of-way would be routed to avoid residences and populated areas, although a portion of SR 70 would be widened by two lanes to accommodate anticipated traffic levels attributable to project construction; some residences and commercial services could be temporarily affected during construction. In addition, the conceptual site layout developed for the site also includes construction of a 38-mile conceptual transmission corridor that would include off-site impacts. Other offsite areas that would support construction activities (for example, borrow pits, quarries, and disposal sites) would be expected to be already permitted and operational. Impacts on those facilities from construction of the new plant would be small incremental impacts from those associated with their normal operations.

Potential impacts from power plant operations include noise, odors, exhausts, thermal emissions, and visual intrusions. Operational noise would be generated by pumps, fans, transformers, turbines, generators, onsite traffic, and switchyard equipment. Noise levels attenuate rapidly with distance so that ambient noise levels (attributable to power plant operations) would be minimal at the site boundary. Also, the Okeechobee 2 site is in a rural area surrounded by agricultural land, with few residents in the area. Commuter traffic would be controlled by speed limits. Good road conditions and appropriate speed limits would minimize the dust and noise level generated by the delivery trucks and site workers that travel to and from the site.

The project would have standby diesel generators and auxiliary power systems. Air quality permits obtained for this equipment would ensure that air emissions comply with regulations. In addition, the generators would be operated on a limited, short-term basis. Normal plant operations would not use a quantity of chemicals that could generate odors that exceed odor threshold values.

Physical impacts are considered small when offsite areas are not affected or only minimally or temporarily affected by noise, odor, dust, emissions, vibration, or shock. In summary, construction activities would be temporary and would occur mainly within the boundaries of the Okeechobee 2 site. Offsite impacts would represent small incremental changes to offsite services that support construction activities. During station operations, ambient noise levels would be minimal at the site boundary. Air quality permits would be required for the diesel generators to ensure emissions comply with regulatory guidelines, and chemical use would be limited, which should limit odors. Therefore, the physical impacts of construction and operation of the new units at the Okeechobee 2 site would be SMALL.

9.3.3.3.6.2 Demography

The population distribution at and around the Okeechobee 2 site is low with typical rural characteristics. The nearest population center larger than 25,000 residents is Port St. Lucie approximately 30 miles east. The site satisfies the 10 CFR Part 100 definition of a low population zone. Coterminous counties include Osceola to the north, Indian River to the northeast, St. Lucie to the east, Martin to the southeast, Glades to the southwest, Polk to the northwest, and Highlands to the west.

To determine which counties best represent the ROI for socioeconomic analysis of the Okeechobee 2 site, each county that falls within 50 miles of the site were initially identified. Several factors were then considered to determine which of these counties would best represent the ROI. These factors, listed below, are evaluated based on historical data from the U.S. census. Key assumptions of the ROI determination are that (1) workers will seek to live within 50 air miles of the site and within a 60-minute commute time and (2) most workers will seek to live in population centers that generally offer more amenities (stores, medical facilities, schools, churches, a larger selection of houses, etc.) than rural locations.

Factors Considered to Determine Which Counties Would Best Represent the ROI

- County population and population density
- Populations of the largest population centers
- Geographic locations of the population centers in relation to the Glades site

- The land fraction of nearby counties that falls within 50 miles of the site
- Relative distance from nearby counties to the site
- Estimated travel distance and estimated travel time from the population centers to the site
- Mean travel time to work
- County employment
- Worker commuter patterns to and from counties conterminous the site

Based on the results of this evaluation, the counties that best represented the ROI for socioeconomic analysis of the Okeechobee 2 site include Glades, Highlands, Okeechobee, and St. Lucie. Because there is no reliable method to predict the distribution of the workforce among these four counties, the ROI is generally treated as a whole for much of the socioeconomic analysis.

Based on the 2000 census, the total population of the ROI was 326,547 people, which included 10,576 in Glades County; 87,366 in Highlands County; 35,910 in Okeechobee County; and 192,695 in St. Lucie County (USCB 2000). Census estimates for year 2007 show an ROI population of 411,708 people, which included 11,109 in Glades County; 99,349 in Highlands County; 40,311 in Okeechobee County; and 260,939 in St. Lucie County (USCB 2009).

NRC guidelines have been established to assess the demographic sparseness and proximity of a proposed site. Sparseness is a combined measure of (1) the population density within 20 miles of the site and (2) the relative population of the nearest metropolitan area within 20 miles of the site. Proximity is a combined measure of (1) the population density within 50 miles of the site and (2) the relative population of the nearest metropolitan area within 50 miles of the site. Based on the sparseness-proximity evaluation, a site is categorized as low, medium, or high (NUREG-1437).

The land area within 20 miles of the Okeechobee 2 site (i.e., excluding water bodies such as Lake Okeechobee) is 967.59 square miles, and based on 2000 census data, the population of this area was 38,539. This yields a population density of 39.8 people per square mile, based on land area. There are no cities within 20 miles of the Okeechobee 2 site that have a population greater than 25,000. Therefore, the sparseness level is 1 based on a population density of less than 40 people per square mile and no community greater than 25,000 people within 20 miles (NUREG-1437).

Similarly, the land area within 50 miles of the Okeechobee 2 site is 6513.3 square miles, and the population of this area was 647,980. This yields a population density of 99.5 people per square mile. Based on the 2000 census, there were no cities within 50 miles of the Okeechobee 2 site that have a population greater than 100,000 (USCB 2000). Therefore, based on NRC guidelines, the proximity level is 2 based on a population density of 50 to 190 people per square mile and no city greater than 100,000 people within 50 miles. Therefore, the Okeechobee 2 site has a sparseness-proximity measure of 1.2, which is categorized as "low" (NUREG-1437).

Based on FPL estimates, the peak construction workforce for the project would be 3548 construction workers. Operations would overlap with peak construction activity for a period of time; therefore, in addition to the construction workforce, there would be a small number (99) of operations workers on the site during the peak construction period, and these workers would also relocate to the area. Because of the location of the Okeechobee 2 site relative to population centers, FPL assumed that 70 percent of the construction and 85 percent of the operation workers would relocate from outside the ROI. FPL further assumed that 70 percent of the construction and 100 percent of the operation workforce that moved to the area would bring their families. Based on these assumptions, a total of 2568 construction and operation workers would relocate to the area in the project construction phase, and 1823 would bring their families. Based on an average household size of 3.25 people (BMI Apr 1981), the total increase in population attributable to construction at the Okeechobee 2 site would be 6669 people. An influx of 6669 people represents a 2.0 percent increase in the ROI population of 326,547 people. Impacts are considered small if plant-related population growth is less than 5 percent of the area's total population (NUREG-1437). Therefore, this would pose a SMALL impact on population for the ROI.

FPL estimated the total onsite operations workforce to be 1050 workers, and that 85 percent of these workers (893) would relocate from outside the ROI. For the purpose of this analysis, FPL assumed that 100 percent of operations workers who relocated would bring their families. Based on an average household size of 3.25 people (BMI Apr 1981), the total population increase attributable to project operations is 2901 people. This represents a 0.9 percent increase in the four-county ROI population. This would pose a SMALL impact on population for the ROI.

9.3.3.3.6.3 Economy

Based on 2000 census data, Glades County had a civilian labor force of 4034 people and an unemployment rate of 8.8 percent; Highlands County had a civilian labor force of 31,437 people and an unemployment rate of 4.4 percent; Okeechobee County had a civilian labor force of 14,863 people and an unemployment rate of 4.7 percent; and St. Lucie County had a civilian labor force of 82,070 people and an unemployment rate of 5.2 percent. For the entire ROI, 99.9 percent of the labor force was part of the civilian labor force and 0.1 percent was in the armed forces. Of the civilian labor force, 95.0 percent are employed and 5.0 percent are unemployed. The overall unemployment rate for the four-county ROI is slightly lower than that of the State, which is 5.6 percent (USCB 2000).

The economies of the four-county ROI are very similar, dominated mainly by educational, health, and social services; retail trade; and agriculture, forestry, fishing and hunting, and mining. Most of the labor force resides in St. Lucie County (USCB 2000).

Based on the assumptions stated above, the number of workers who relocated from outside the area would include 70 percent of the 3548 peak construction workers and 85 percent of the 99 operations workers for a total of 2568 workers. An influx of 2568 construction and operation workers from outside the region would have positive economic impacts in the four-county region. Based on a multiplier of 1.6260 jobs (direct and indirect) for every construction job and 2.4679 for every operation job (BEA Aug 2009), an influx of 2568 construction and operation workers would create 1691 indirect jobs, for a total of 4259 new jobs in the ROI. This represents a 3.2 percent increase in the total labor force in the ROI. Economic effects are considered small if peak employment accounts for less than 5 percent of area employment (NUREG-1437). The creation of direct and indirect jobs could potentially reduce unemployment and would likely create business opportunities for goods and service-related industries and the housing industry. Overall, the economic impacts attributable to project construction would be beneficial and SMALL within the ROI.

An estimated 1050 workers would be required for the operation of two nuclear power facilities at the Okeechobee 2 site (U.S. DOE May 2004), and FPL assumed that 85 percent of these employees would migrate into the region. Based on a multiplier of 2.4679 jobs (direct and indirect) for every operations job at the new units (BEA Aug 2009), an influx of 893 workers would create 1310 indirect jobs for a total of 2203 new jobs in the region. This represents a 1.7 percent increase in the total labor force in the ROI. The creation of direct and indirect jobs could potentially reduce unemployment and would likely create business opportunities for goods and service-related industries and the housing industry. Overall, the economic impacts attributable to project operation would be beneficial and SMALL within the ROI.

9.3.3.3.6.4 Taxes

Taxes collected as a result of construction and operation of the new nuclear units at the Okeechobee 2 site would benefit the State and local tax authorities. FPL would pay property taxes to each taxing authorities whose boundaries contained the plant. Tax payments would be based on the assessed valuation of the plant and local tax rates. If the plant site straddled a jurisdictional boundary, FPL would pay taxes to both entities based on the assessed valuation within each entity.

As described in Subsection 4.4.2.2.2, it is not clear whether FPL corporate income taxes would increase because of construction of the new units at the Okeechobee 2 site, because the units would not generate revenues until they became operational. However, once the units were placed in service, Okeechobee County property taxes would begin and would continue for the 60-year operational life of the facility.

FPL assumed that annual property tax payments at Okeechobee 2 site would be similar those paid by the nuclear units at Turkey Point plant. In 2007, the annual tax payment for the two units at the Turkey Point nuclear power plant was $6,902,670. For the 2007 fiscal year, Okeechobee County had property tax revenues of approximately $17,558,005 (State of Florida Mar 2008b).

With respect to the school districts, in Florida, local revenue for the school districts is derived almost entirely from property taxes levied by Florida's 67 counties, each of which constitutes a school district (Florida Department of Education 2008). As described in Subsection 2.5.2.3.5, the state of Florida has an established equalized funding program that re-allocates tax base funds from counties that have a high economic tax base to counties that have a low economic tax base. The Florida Education Finance Program is the primary mechanism to fund the operational costs of Florida school districts. Funding is based on the number of full-time equivalent students, and considers variations in several factors to determine funding for each district: local property tax bases, education program costs, costs of living, and costs for equivalent educational programs because of the density and distribution of the student population.

It should be noted that school property tax payments would be based on the location of the plant and not necessarily on the district(s) attended by the workers' children. Therefore, it is not possible to assess the direct impact of the plant on the school districts. In addition, the impact of plant construction and operation on the special tax districts is not assessed here because most of the property tax payment from the plant would go to the county and the school district(s).

The benefits of taxes are considered small when new tax payments by the nuclear plant constitute less than 10 percent of total revenues for local jurisdictions and large when new tax payments represent more than 20 percent of total revenues (NUREG-1437). Therefore, based on the county portion of the FPL property tax payment for the new units, 28 percent of the 2007 property tax revenues for Okeechobee County would be provided by FPL and would constitute a LARGE positive impact.

9.3.3.3.6.5 Transportation

Principal roadways close to the Okeechobee 2 site include SR 70 (a two-lane highway) which spans westward from the town of Okeechobee approximately 1 mile south of the site, and U.S. Highway 98 (a two-lane highway) that spans in a northwest direction approximately 2 miles from the site. Directly east of the site is a county road (128th Avenue Northwest) which spans northward between SR 70 and Highway 98.

Principal road access to the Okeechobee 2 site would be SR 70. Commuters from most cities in the region (Buckhead Ridge, Cypress Quarters, Fort Pierce, Indiantown, Lakeport, Okeechobee, Port St Lucie, Taylor Creek) would travel westbound on SR 70 to reach the site. Commuters from Lake Placid and Lorida would travel eastbound along SR 70 to reach the site.

FDOT reports the AADT count at two locations along SR 70, one at 3.7 miles east of the site, and one at 2.0 miles west of the site. The AADT count and directional peak hour volume of the eastern location is 7700 vehicles per day and 447 vehicles per hour (FDOT 2008). This peak hour volume classifies this portion of the roadway as a LOS of D and already exceeds the Okeechobee County directional peak hour capacity by 27 vehicles (FDOT 2007). The western location has an AADT count and directional peak hour volume of 4800 vehicles per day and 279 vehicles per hour (FDOT 2008). This directional peak hour volume classifies this western portion of the roadway as a LOS of C (FDOT 2007), and the remaining peak hour capacity is 140 vehicles.

Based on the existing population distribution around the site, FPL assumed that most of the workforce would likely travel along the eastward portion SR 70 and that a smaller amount of the workforce would travel along the western portion. Also, the traffic attributable to construction material deliveries could cause additional congestion on SR 70 during certain times of the day. Based on the methodology presented in Subsection 4.4.2.2.4, FPL determined that construction at the Okeechobee 2 site would add approximately 1611 vehicles during the peak hour to the eastern portion of SR 70. This would cause the road to further exceed capacity, add to existing traffic congestion, and drop the roadway in the eastern direction to a LOS classification of F. As described above, SR 70 west of the site currently operates very close to capacity. The additional construction traffic would cause the road to exceed capacity, further add to current traffic congestion, and drop the roadway to a LOS classification of E. Construction would also add approximately 448 vehicles to the western portion of SR 70 during the hour of peak traffic. Based on this analysis, it is likely that the additional traffic would pose delays along SR70. To facilitate the additional traffic, a portion of SR 70 could be widened to a four-lane highway, and acceleration/deceleration lanes could be added to facilitate commuter traffic. These roadway modifications would likely be needed between Highway 98 east of the site to the Kissimmee River west of the site. NRC applied significance levels to the LOS classifications that were projected to result from the additional traffic associated with refurbishment activities at nuclear plants (NUREG-1437). FPL considers this approach to be appropriate for construction of a nuclear plant since both would be large construction projects. The NRC associates small impacts with LOS A and B, moderate impacts with LOS C and D, and large impacts with LOS E and F. It is therefore anticipated that the impact of the construction workforce on transportation would be LARGE.

Operations at Okeechobee 2 site would add approximately 463 and 129 more vehicles to the eastern and western portions of SR 70 during the hour of peak traffic, respectively. The roadway modifications (mentioned above) to the eastern part of SR 70 would raise the peak hour capacity of this roadway sufficiently to accommodate the additional traffic from operations. Shift changes could be also be staggered so that the traffic increase would be less likely to cause congestion. However, based on the NRC LOS significance levels, in the absence of road modifications that increase road capacity, the impact of the operations workforce on transportation would be LARGE.

9.3.3.3.6.6 Aesthetics and Recreation

The Okeechobee 2 site is an undeveloped site in Okeechobee County approximately 8 miles west of Lake Okeechobee. The site is on flat, swampy land at an approximate elevation of 28 feet MSL and lies within the Flatwoods physiographic province (USGS 2008).

Because the entire area is relatively flat, the power plant and water intake facilities may be visible from some angles. There would be occasional visible plumes associated with the cooling towers. Visibility of the plumes would depend on weather conditions and the location of the viewer in the area. Impacts on aesthetic resources are considered to be moderate if there is the potential for diminution in the enjoyment of the physical environment and measurable impacts that do not alter the continued function of socioeconomic institutions and processes. Construction and operation of an industrial facility on a previously undeveloped site would likely result in some complaints from the affected public with respect to diminution in the enjoyment of the physical environment. Therefore, impacts of construction and operation of the new units on aesthetics would be MODERATE and could warrant mitigation.

The Kissimmee River is approximately 2 miles west of the Okeechobee 2 site. Two SFWMD recreational areas, both remnants of the old Kissimmee River, are within 6 miles of the site. Yates Marsh is a few miles north of the site and offers paddling, camping, wildlife viewing, and hiking along a section of the Florida National Scenic Trail (SFWMD 2008). Several miles southeast of the Okeechobee 2 site is a section of the Kissimmee River that has been designed as the S-65E Impoundment and Paradise Run Management Units. These units are remnants of the end of the old Kissimmee River and consist of thick marshes that are virtually inaccessible; therefore, the area is not heavily visited. The units also offer paddling, hunting, and bird watching (SFWMD 2008).

The northern shoreline of Lake Okeechobee lies within 8 miles of the site. As described in Subsection 9.3.3.1.6.6, both the Lake Okeechobee Scenic Trail and the Big Water Heritage Trail parallel the shoreline of the lake.

The Lake Wales National Wildlife Refuge, the Hobe Sound National Wildlife Refuge, and the Pelican Island National Wildlife Refuge are within 50 miles of the Okeechobee 2 site, none of which are within 6 miles of the site.

Of the 154 state parks in Florida, 12 are within 50 miles of the Okeechobee 2 site and include the Highlands Hammock State Park and Lake June in Winter Scrub State Park, both of which are more than 29 miles northwest and north, respectively, of the Okeechobee 2 site.

Construction and operation of the new units at the Okeechobee 2 site could impact the attractiveness of recreational areas within the region. Construction of new transmission lines in the region would also alter the viewscape. However, the route for the new transmission lines would be selected to minimize these impacts, and the overall aesthetic impacts to the region would be SMALL. Recreational facilities could also be affected by increased traffic on area roads at peak travel periods; however, impacts would be minimal. During plant operations, some employees and their families would use the regional recreational facilities; however, the increase attributable to plant operations would be small compared to overall use of these facilities. Impacts on tourism and recreation are considered small if current facilities are adequate to handle local levels of demand. Therefore, impacts of facility construction and operation on tourism and recreation would be SMALL.

9.3.3.3.6.7 Housing

FPL estimated that 2568 construction and operation workers would move from outside the 50-mile radius of the Okeechobee 2 site to one of the counties within the 50-mile radius, and each of these workers would need a place to live. Some of the workers would seek permanent residence, generally owner-occupied; some would choose to rent; and others would choose a transitional residence such as a hotel, a room in private home, or a camper or mobile home.

Based on 2000 census data, within the four-county ROI, there are 161,402 housing units of which 30,553 are vacant (18.9 percent). The number of vacant housing units within each of these counties was 1938 (33.5 percent) in Glades County; 11,375 (23.3 percent) in Highlands County; 2911 (18.8 percent) in Okeechobee County; and 14,329 (15.7 percent) in St. Lucie County. This includes housing that is designated as seasonal, recreational, or occasional use (USCB 2000).

FPL estimated that, in absolute numbers, the available housing would be sufficient to house the construction workforce. Workers who relocated could secure housing from the existing stock in any of the four counties within the region, have new homes constructed, or bring their own residence (mobile home or trailer) to the region.

Because Glades, Highlands, and Okeechobee Counties have relatively small populations, their housing markets would likely be the most impacted. Impacts on housing are considered to be small when a small and not easily discernable change in housing availability occurs (NUREG-1437). The entire construction and operation workforce would occupy no more than 8.4 percent of vacant housing units in the ROI; therefore, the impacts during plant construction would be SMALL TO MODERATE, and mitigation would not be warranted.

FPL estimated that approximately 1050 workers would be needed for operation of two nuclear power facilities at the Okeechobee 2 site (U.S. DOE May 2004). FPL assumed that 85 percent of these workers (893) would relocate from outside the region and would settle in the four-county ROI. Based on these assumptions, the entire operations workforce would occupy no more than 2.9 percent of vacant housing units in the ROI; therefore, the impacts during plant operations would be SMALL, and mitigation would not be warranted.

9.3.3.3.6.8 Public Services

Public services in the ROI include water supply and wastewater treatment facilities; law enforcement, fire, and medical facilities; libraries, parks and recreation, roadway maintenance; and other social services. Construction or operations employees who relocated from outside the region would most likely live in residentially developed areas where adequate water supply and wastewater treatment facilities already exist. The medical facilities in the four-county ROI provide medical care to much of the population within the 50-mile region, and therefore the small increases in the regional population would not materially impact the availability of medical services.

Although the workers and their families would pose an additional overall demand on other public services, it is anticipated that the current capacity of public services within the four-county ROI would be adequate to accommodate the increased demand. Therefore, the impact would be SMALL.

The new nuclear plant and the associated population influx would likely economically benefit the disadvantaged population served by the Florida Department of Children and Families. Direct jobs created by the project would bring indirect jobs that could be filled by currently unemployed workers and therefore remove them from the care of social services.

The ratio of residents-to-law enforcement officers in Glades, Highlands, Okeechobee, and St. Lucie Counties was 353:1, 722:1, 399:1, and 722:1, respectively (FBI 2008). Within the ROI, the resident-to-law enforcement officer ratio was 643:1, and for the state of Florida, the resident-to-law enforcement officer ratio was 851:1. Ratios are partly dependent on population density. In general, fewer law enforcement safety officers are necessary for the same population if the population resides in a smaller area. Within the ROI, if no additional law enforcement officers were hired, the population increase attributable to project construction at the Okeechobee 2 site would increase the resident-to-law enforcement officer ratio by 2 percent to 656:1. This is a small increase and would still yield a lower resident-to-law enforcement officer ratio than the average for the state of Florida. Similarly, the increase in the resident-to-law enforcement officer ratio attributable to operations would yield less than a 0.9 percent increase.

The ratio of residents to firefighters in Glades, Highlands, Okeechobee, and St. Lucie Counties was 82:1, 491:1, 492:1 and 563:1, respectively. Within the ROI, the resident-to-firefighter ratio was 452:1, and for the state of Florida, the resident-to-firefighter ratio was 1,230:1 (USFA 2009). As was described above in the description of law enforcement officers, ratios are partly dependent on population density. In general, fewer firefighters are necessary for the same population if the population resides in a smaller area. Within the ROI, if no additional firefighters were hired, the population increase attributable to project construction at the Okeechobee 2 site would increase the resident-to-firefighter ratio by 2 percent to 462:1. This is a small increase and would still yield a lower resident-to-firefighter ratio than the average for the state of Florida. Similarly, the increase in the resident-to-firefighter ratio attributable to operations would yield less than a 0.9 percent increase.

Impacts on public services are considered small if there is little or no need for additional personnel. Impacts are considered moderate if some permanent additions or some new capital equipment purchases are needed (NUREG-1437). The population increase in the four-county region attributable to construction or operation of the new power units could pose a need to hire additional emergency personnel; however, any additional need would be small, and increased tax revenues generated by the project would be adequate to pay the salaries of any additional emergency personnel hired. Therefore, it is not expected that public services would be materially impacted by new construction or operations employees that relocate from outside the region. Impacts are therefore considered SMALL, and mitigation would not be warranted.

9.3.3.3.6.9 Education

Based on data for the 2006–2007 school year, Glades County had 8 schools that covered prekindergarten through 12 (PK-12) schools with a total enrollment of 1256 students; Highlands County had 18 PK-12 schools with a total enrollment of 12,456 students; Okeechobee County has 17 PK-12 schools with a total enrollment of 7289 students; and St. Lucie County has 46 PK-12 schools with a total enrollment of 38,793 students (NCES 2009). In the four-county ROI, there are 89 schools with a total enrollment of 59,794 students.

FPL estimated that 2568 construction and operation workers would migrate to the area, and that 1823 of these would bring a family. This would yield a total population increase of 6669 people. Based on an estimate of 0.8 school-aged children per family (BMI Apr 1981), an estimated 1458 of the 6669 people who relocated to the four-county area would be school-aged children. This would yield a 2.4 percent increase in the student population within the four-county ROI. Small impacts are generally associated with project-related enrollment increases of up to 3 percent, and moderate impacts on local school systems are generally associated with project-related enrollment increases of 3 to 8 percent (NUREG-1437). Therefore, this would pose a SMALL impact on the ROI, and mitigation would not be warranted.

FPL has assumed that 893 operations workers and their families would relocate from outside the region, and that the total population increase attributable to operations would be 2901 people. This would include an estimated 714 children in the PK-12 school range. This influx of students would increase the student population in the ROI by 1.2 percent within the four-county ROI. The impacts on public education are considered SMALL, and mitigation would not be warranted.

9.3.3.3.7 Historic and Cultural Resources

FPL conducted historical and archaeological records searches on the National Park Service NRIS. The NRHP identifies 34 sites in the four-county ROI, including two sites in Glades County, 14 sites in Highlands County, 16 sites in St. Lucie County, and two sites in Okeechobee County. Two of these properties, the Freedman-Raulerson House and Okeechobee Battlefield, are within 10 miles of the Okeechobee 2 site (NPS 2008d).

Siting the proposed nuclear plant at the Okeechobee 2 site would require a formal cultural resources survey be conducted so that no archeological or historic resources would be damaged during construction. Sites are considered to have small impacts to historic and cultural resources if the SHPO identifies no significant resources on or near the site or determines they would not be affected by plant construction or operation. Mitigation measures would be applied to prevent permanent damage and ensure that any impacts to cultural resources from construction or operation of the new units at the Okeechobee 2 site would be SMALL.

Sites are considered to have large impacts to historic resources if they would be disturbed or otherwise have their historic character altered by construction. Two historic properties and several archeological areas were identified within 10 miles of the Okeechobee site. Construction of the new units at the Okeechobee 2 site would result in adverse effects to the historic and cultural landscape through physical disturbance to these elements and through introduction of visual elements that would be out of character with the property and its setting. The visual impacts would be LARGE and would warrant mitigation.

Siting the proposed nuclear plant at the Okeechobee site would require a formal determination of areas of potential effect from physical disturbance or visual impacts from the site. FPL would consult with the SHPO to identify measures for avoidance, minimization, or mitigation of any adverse effects.

9.3.3.3.8 Environmental Justice

Environmental justice refers to a federal policy under which each federal agency identifies and addresses, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority or low-income populations. The NRC has a policy on the treatment of environmental justice matters in licensing actions (69 FR 52040) and guidance (U.S. NRC May 2004). Subsection 2.5.4.1 describes the methodology FPL used to establish locations of minority and low-income populations.

The 2000 census block groups were used to ascertain minority and low-income population distributions in the area. There are 452 block groups within 50 miles of the Okeechobee 2 site. The census data for Florida characterizes 14.6 percent of the population as black; 0.3 percent American Indian or Alaskan Native; 1.7 percent Asian; 0.1 percent Native Hawaiian or other Pacific Islander; 3.0 percent as other single minorities; 2.4 percent multiracial; 22.0 percent aggregate of minority races; and 16.8 percent Hispanic ethnicity. If any block group percentage exceeded the state percentage by more than 20 percent or was greater than 50 percent, then the block group was considered to have a significant minority population. Significant black minority populations exist in 62 block groups; significant American Indian or Alaskan Native populations exist in 1 block group; significant other race minority populations exist in 10 block groups; significant multiracial minority populations exist in 3 block groups; significant aggregate of minority races populations exist in 74 block groups; and significant Hispanic ethnicity populations exist in 26 block groups. There are no block groups containing significant Asian, Native Hawaiian, or other Pacific Islander minority populations within 50 miles of the Okeechobee 2 site.

The Brighton Seminole Indian Reservation is approximately 10 miles southwest of the Okeechobee 2 site. As described in Subsection 9.3.3.1.8, the reservation offers several tourist attractions including Indian arts and crafts shops, the Seminole Casino Brighton, a rodeo arena, the Brighton Citrus Grove, and the Brighton Seminole Campground. Today, most Seminole Tribal members are afforded modern housing and health care. In fact, today the Seminole Indians live much the same way as those who live outside Seminole County (Seminole Tribe of Florida 2008).

The locations of the minority populations within 50 miles of the Okeechobee 2 site and the Brighton Indian Reservation are shown in Figure 9.3-15.

The census data characterizes 11.7 percent of Florida households as low income. Based on the more than 20 percent criterion, 49 block groups out of a possible 452 contain a significant number of low-income households. The locations of the low-income populations within 50 miles of the Okeechobee 2 site are shown in Figure 9.3-16.

The Okeechobee 2 site is approximately 1 mile from a minority and low-income block group. However, construction activities (noise, fugitive dust, and air emissions) would be contained with site boundaries and would not impact minority populations. In fact, minority and low-income populations would most likely benefit from construction activities through an increase in construction-related jobs. Operation of the new units at the Okeechobee 2 site is also unlikely to have disproportionate impacts on minority or low-income populations.

FPL concludes that construction and operation of the proposed nuclear plant at the Okeechobee 2 site would not disproportionately impact minority or low-income populations and that mitigation would not be warranted, and the impacts to these populations would be SMALL.

9.3.3.3.9 Other Projects in the Vicinity of the Okeechobee 2 Site

The cumulative impacts of past, present, and reasonably foreseeable federal (e.g. USCOE, USGS), non-federal (e.g. FDEP, FDOT, county), and private projects within a 50-mile radius of the Okeechobee 2 site, excluding Brownfield and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites, that could have cumulative impacts with the proposed action are described in Table 9.3-15. These projects have either requested an air or water permit/license or had an environmental impact statement complete. Projects included in Table 9.3-15 are within the 50-mile radius of the Okeechobee 2 site and the appropriate timeframe for construction and operation of the new units (Figure 9.3-14) from 2013 to 2063 (based on a construction start date of 2013, a Unit 7 in-service date of 2023, and a 40-year operating license). Nuclear power projects within 100 miles of the Okeechobee 2 site (i.e., St. Lucie) are also described in Table 9.3-15. The Turkey Point site is more than 110 miles from the Okeechobee 2 site and is therefore not included in the table. The only other nuclear power plant currently operating in Florida, Crystal River, is more than 180 miles from the Okeechobee 2 site and therefore is also not included in the table. The proposed nuclear power plant in Levy County is approximately the same distance as the Crystal River site and is not included in the table. It should be noted that this list is not intended to be exhaustive and should not be used to imply that no other past, present or reasonably foreseeable projects exist that could contribute to cumulative impacts within each alternative site project area.

The impacts to land use that would have a cumulative impact on alternative sites would generally be characterized as a change to the land use designation from “agriculture” to “industrial.” A positive land-use impact, for example, would be the CERP projects. These projects are within the 50-mile radius would redevelop, reuse, or develop additional land for conservation. The cumulative impacts to hydrology and water use would be minimally negative due to the restrictions placed on all surface water and groundwater use, also beneficial impact due to the large scale CERP projects for reservoir and storage areas which would provide additional water to the southern Everglades Agricultural Area, reestablish wetland hydropatterns and improve water quality in several different watersheds by treating excessive discharge. The cumulative impacts for terrestrial/aquatic resources would be associated with the minimal loss of wetlands, which is offset by the restoration of developed lands for conservation and restoration of native species through CERP projects. The cumulative impacts for socioeconomics for the Okeechobee 2 site would appear as beneficial impacts to taxes and adverse impacts on transportation. Also, there would not be any disproportionate impact to low-income or minority populations by the activities at the Okeechobee site.

9.3.3.4 Evaluation of the St. Lucie Site

The 1130-acre St. Lucie site is an FPL-owned nuclear power generation station on Hutchinson Island in St. Lucie County. St. Lucie Units 1 & 2 and associated support facilities occupy less than half of the 1130-acre site. The St. Lucie nuclear units (Units 1 & 2) provide 1553 MW of summer capacity to the regional power grid. The site is bordered by the Atlantic Ocean to the east and the Indian River Lagoon to the west (FPL Apr 2009). The nearest municipalities are Fort Pierce, approximately 7 miles northwest; Port St. Lucie, approximately 4.5 miles to the west; and Stuart, approximately 8 miles to the south. The nominal site elevation is 0 to 5 feet above sea level which falls within the 100-year floodplain. The location of the St. Lucie site is shown in Figure 9.3-17.

9.3.3.4.1 Land Use Including Site and Transmission Line Rights-of-Way

St. Lucie Units 1 & 2 are on the west side of SR A1A in a relatively flat, sheltered area of Hutchinson Island. The site lies within the 100-year floodplain. West of the facility, the land gradually slopes downward to a mangrove fringe that borders the intertidal shoreline of the Indian River Lagoon. East of the facility, land rises from the ocean shore to form dunes and ridges approximately 15 feet above mean low water. Two county parks with beach access, Blind Creek Pass Park and Walton Rocks Park, lie within the St. Lucie Units 1 & 2 property boundary. Recreational facilities for FPL employees and their families are also available within the site property boundary.

The Indian River Lagoon is a long, shallow, tidally-influenced estuary that stretches along the central east coast of Florida between the mainland and a series of offshore islands. At St. Lucie Units 1 & 2, the Indian River Lagoon is approximately 7200 feet wide. Blind Creek and Big Mud Creek, inlets off the Indian River Lagoon, are adjacent to the site. The stretch of lagoon adjacent to the site is designated as the Jensen Beach to Jupiter Inlet Aquatic Preserve. The North Fork St. Lucie River Aquatic Preserve is located on the north fork of the St. Lucie River at Port St. Lucie. The St. Lucie Canal connects the St. Lucie River with Lake Okeechobee and parallels SR 76, south of the town of Stuart (NUREG-1437, Supplement 11).

Based on the conceptual site layout developed for the St. Lucie site, the following land requirement assumptions were made which form the basis of the environmental comparison of alternative sites:

- The assumed facility footprint would require approximately 357 acres, split between 320.5 acres on the west side of Ocean Drive (SR A1A), and 37 acres for nuclear administration/ parking on the east side of Ocean Drive. New facilities at the plant site would include the nuclear power units, support buildings, a switchyard, storage areas and the water intake and discharge canals.

- The assumed extent of non-transmission linear features, including access road corridors, pipeline corridors and rail access, is as follows:

  — Access road: 266.8 acres – assuming a corridor length of approximately 22 miles and a corridor width of 100 feet to include widening of SR A1A which spans north-south along Hutchinson Island. Because the access road (A1A) extends through the site, there would be no need to develop road access directly to the site. However, FPL has determined that there would be a need widen A1A from two lanes to four lanes to accommodate anticipated traffic levels attributable to construction (including truck transfer of significant quantities of fill material to the site) and to mitigate traffic delays for island residents and delivery trucks.

  — Rail: Rail access does not extend to the St. Lucie site and is not necessary to support operation of Units 1 & 2 as barge access is available at the site (NUREG-1437, Supplement 11); therefore, rail access would not be needed to support operation of the proposed new units.

  — Heavy Haul: 6.3 acres – the conceptual site layout developed for the St. Lucie site has identified the need for a heavy haul road, connecting the barge access location and the project site, to include a two-lane, approximately 0.5-mile road with a corridor width of 100 feet.

  — Intake/blowdown pipeline corridors: 10.5 acres – Units 1 & 2 are cooled by a once-through system that withdraws water from the Atlantic Ocean and then discharges the heated water back into the Atlantic Ocean. Water canals channel the intake water to the west side of the plant. The intake canal spans approximately 4920 feet and has a trapezoidal cross section that is 180 feet wide and 30 feet deep. The discharge canal is approximately 2200 feet long with cross-sectional dimensions similar to those of the intake canal (NUREG-1437, Supplement 11).

  FPL assumed that the proposed new units at the St. Lucie site would use a closed loop, tower-cooled system for power cycle waste heat rejection, whereby consumptive losses are replaced from the Atlantic Ocean and blowdown water is routed to the Atlantic Ocean. This system would require little land use because the water source, the Atlantic Ocean, borders the St. Lucie site (i.e., it would only be necessary to construct a pipeline to transfer the water). Based on the conceptual site layout developed for the site, FPL has determined that approximately 10.5 acres would be affected by construction.

- The assumed extent of conceptual transmission corridor routing is 2187 acres based on an assumed length of 63 miles, to connect to the existing FPL transmission system at the

Corbett substation inside Palm Beach County, and a corridor width that varies from approximately 200 to 660 feet.

- Based on subtotals above for both onsite and offsite plant components, the total area potentially affected at the St. Lucie site is estimated at approximately 2828 acres. With respect to the transmission line corridor included within this total, the estimated acreage requirements assume corridor widths which may exceed the area that would actually be disturbed during project construction and operation. However, these estimates provide the basis for an updated and consistent environmental comparison of alternative sites.

- Additional acreage may be required to support construction activities (e.g., additional laydown areas, batch plant, fill/spoil areas). Although the undeveloped acreage of St. Lucie site is adequate to support construction of the new units, the physical layout of the site and the proximity of the site (midspan along a long island) would likely pose special logistical challenges for construction that would not be incurred on non-island sites.

Land use impacts associated with plant construction include both impacts to the site and immediate vicinity, and impacts to offsite areas such as transmission, and transportation rights-of-way (e.g., access road). As mentioned previously, the physical layout of the site and the proximity of the site (midspan along a long island) would likely pose special logistical challenges for construction that would not be incurred on non-island sites.

Construction of a new nuclear power plant would include clearing, dredging, grading, excavation, spoil deposition, and dewatering activities. An area of approximately 357 acres would be required for the main power plant site (major structures including switchyard), which would largely be focused essentially in one central location and would be permanently impacted.

While the site location is owned by FPL and adjacent to the existing St. Lucie Nuclear Power Plant, the proposed facility footprint area would be located primarily in an area of mangrove swamps, based on the conceptual site layout.

The nominal site elevation of the St. Lucie site is 0 to 5 feet above sea level, which falls within the 100-year floodplain. Because the St. Lucie site is within the 100-year floodplain, FPL assumed that site development would require filling to bring the elevation to approximately 20 feet MSL. It is assumed that currently operating public sources of fill material (sources already permitted and land types already potentially disturbed) would be utilized, as well as fill from construction of the onsite storm water retention ponds.

Following construction activities, impacted areas without constructed buildings or transportation infrastructure would be reclaimed to the greatest extent feasible. Direct and indirect impacts of construction from the proposed transportation infrastructure (widening of A1A) would be similar to those for the proposed plant; the proposed span to be widened includes mostly mangrove and smaller areas of upper hardwood forest, as some residential and commercial service areas among other uses.

Development of the conceptual transmission corridor incorporated the most direct route where possible, while considering potential conflicts with natural or man-made areas where important environmental resources were located, and avoiding populated areas and residences to the extent possible. Whenever possible, the new line was routed along existing transmission rights-of-way. The use of lands that are forested would be altered. Trees removed for construction would be replaced by low-growth types of ground cover such as grass. The new transmission corridor would not be expected to preclude agricultural activities near the eventual rights-of-way, but has the potential to affect a number of residents along the right-of-way. The land use in the region (i.e., outside the coastal developments along the new transmission corridors) is generally rural, sparsely populated, and primarily used for agricultural activities. The St. Lucie site is within the Florida Coastal Zone; therefore, FPL would need to seek coastal zone certification to demonstrate that plant and transmission line construction activities are consistent with the requirements of the Coastal Zone Management Act [16 USC 1456(c)(3)(A)] (NUREG-1437, Supplement 11).

Table 9.3-16 includes estimates of the potentially affected area(s) of each land cover type (based on GIS FLUCCS Level III data analysis) for the St. Lucie site, including both onsite and offsite components (i.e., access road, and transmission corridors). It also further breaks out the land cover types along the assumed conceptual transmission corridor only, given the significant acreage this corridor encompasses (77 percent of the total area). As noted previously, regarding the offsite linear features associated with the projects, the estimated acreage requirements assume corridor widths for transmission which may exceed the area that would actually be disturbed during project construction and operation. These estimates are intended to provide the basis for an updated and consistent environmental comparison of alternative sites.

The proposed project would be a change from current land use. Operational impacts to site land use would include a permanent change in land use for approximately 623 acres of land for the power plant site and highway access corridor, including over 400 acres of mangrove swamps – that would be generally unavailable for other purposes. This area would be permanently altered for the estimated 60-year life of the AP power units (WEC 2007).

Operational impacts to the site and immediate vicinity also would include maintenance operations on project structures that would be small and temporary in nature.

Operational impacts of transmission lines result primarily from line maintenance, and include right-of-way vegetation clearing and control, transmission line maintenance, and other normal access activities. Additional right-of-way acquisition and development would not normally be required as part of plant operational activities. Maintenance activities would be limited to the immediate right-of-way and would be minimal. New transmission corridors would not be expected to preclude agricultural activities near the eventual rights-of-way. Corridor vegetation management and line maintenance procedures would be established by the transmission service provider.

Other offsite land use impacts as a result of plant operational activities would be minimal, temporary, and limited in the area impacted. Such activities could include primarily road maintenance and auxiliary building maintenance.

For the purpose of this analysis, land use impacts are considered small if less than 3000 acres are disturbed (including plant footprint, rights-of-way, and corridors) and there are no major changes to land use. Based on the land disturbance totals (potentially affected area of 2828 acres of which 2187 acres is within the conceptual transmission corridor), the existing industrial use, land use impacts associated with site preparation, construction, and operation of the proposed nuclear plant at the St. Lucie site and the conceptual transmission corridor would be SMALL.

9.3.3.4.2 Air Quality

St. Lucie County (the St. Lucie nuclear plant site is in St. Lucie County) is part of the Southeast Florida Intrastate Air Quality Control Region. St. Lucie County, along with the entire state of Florida, is designated as attainment or unclassifiable with respect to the NAAQS (40 CFR 81.310). The nearest non-attainment area is in Georgia, several hundred miles north northwest of the St. Lucie site (40 CFR 81.311).

Criteria pollutant emissions from construction and operation of the proposed nuclear plant at the St. Lucie site would be comparable to the emissions generated at the Turkey Point site as described in Subsections 4.4.1.2 and 5.8.1.2, respectively. Construction impacts would be temporary and would be similar to those for any large-scale construction project. Particulate emissions in the form of dust from disturbed land, roads, and construction activities would be generated. Mitigation measures similar to those described in Subsection 4.4.1.2 would be applied as necessary. Criteria pollutants would also be generated from onsite fossil-fueled construction equipment and construction vehicles, and from commuter and delivery vehicles that travel to activities would be small compared to other emissions in the region. It is assumed unlikely that construction-related emissions would cause any violation of the NAAQS.

The project would include standby diesel generators and diesel-driven fire pumps. Annual emissions from these sources are listed in Table 3.6-4. It is expected that standby diesel generators and auxiliary power systems would see limited use and, when used, would operate for a short-time interval. The pollutant emissions generated by these systems (nonradiological) would be regulated by the FDEP in accordance with the air rules published under FAC Chapter 62. These rules cover general air pollution control provisions, stationary source requirements, preconstruction review, emission standards, air monitoring requirements, and other rules for control of air pollutant emissions. Airborne release of criteria pollutant and hazardous air pollutant emissions would be small and would comply with FDEP rules (FDEP 2008a).

Nonradiological emissions can potentially affect regional visibility, and visibility is an important feature at Federal Class I areas. The Federal Class I area nearest to the St. Lucie site is the Everglades National Park more than 100 miles to the south. Because the distance is large, and because the anticipated emission levels would be small, pollutant emissions attributable to operation of the new nuclear units would have a negligible impact on visibility at a Federal Class I area. Unfavorable psychometric conditions can result in visible vapor plumes from the cooling tower operations. These plumes may be visible for several miles, but would not impact visibility or scenic vistas at any Federal Class I area.

Air quality impacts are considered small if the increase in regional pollutant concentrations attributable to the source (1) would not appreciably alter visibility, (2) would not exceed EPA significant impact levels, and (3) would not cause a violation of the most restrictive ambient air quality standards. Based on this evaluation metric, it is anticipated that the impacts to air quality from construction and operation would be SMALL.

9.3.3.4.3 Hydrology, Water Use, and Water Quality

The state of Florida is divided into five watershed management areas. The St. Lucie site is in the Kissimmee-Everglades watershed and falls under the jurisdiction of the SFWMD. This watershed region spans more than 16 counties and is logically divided into several river basins: Kissimmee River, Upper East Coast, Lower East Coast (which includes the entire southeast coast and the Everglades), and Lower West Coast (which includes the Big Cypress and Caloosahatchee Rivers). This region is the largest watershed region in the state of Florida and is home to 40 percent of Florida's population. The region also contains the Everglades (the largest subtropical wetland in the United States) and Lake Okeechobee, the second largest freshwater lake in the United States. This lake is of national importance, as its water has diverse usage and a large number of people depend on it for agricultural and domestic purposes (University of Florida Jun 2007).

Water quality and ecological health of Lake Okeechobee are adversely affected by excessive nutrient loading, extreme high and low water levels, and the proliferation of exotic species. To address restoration goals for the lake, the SFWMD, in coordination with the FDEP and the Florida Department of Agricultural and Consumer Services, has developed the Lake Okeechobee Watershed Construction Project Technical Plan. The plan was developed in response to the *Northern Everglades and Estuaries Protection Program* that the Florida

Legislature signed into law in 2007. Primary components of the plan include the implementation of agricultural management practices, construction of treatment wetlands to clean water flows into the lake, and the creation of 900,000 to 1.3 million acre-feet of water storage north of the lake (SFWMD 2008)

The entire state of Florida, and portions of southern Alabama, southeastern Georgia, and southern South Carolina, are atop the Floridan aquifer. This aquifer covers some 100,000 square miles and is one of the most productive aquifers in the world. The Floridan aquifer system provides water for several large cities, such as Savannah and Brunswick in Georgia; and Jacksonville, Tallahassee, Orlando, Tampa Bay, and St. Petersburg in Florida. In addition, the aquifer system provides water for hundreds of thousands of people in smaller communities and rural areas. The Floridan aquifer is intensively pumped for industrial and irrigation supplies (USGS Jul 1980).

Land subsidence related to karst terrain is not anticipated at the site. The site is in karst Area II where the surface cover is reported to be 30 to 200 feet thick. In such areas, sinkholes are reported to be few, shallow, of small diameter, and develop gradually (Sinclair, et al., 1985).

For the year 2000, water withdrawals in the region included both groundwater and surface water. Average daily surface water withdrawals were 1677 million gallons. Approximately 11.1 percent (198.9 million gallons) of this was freshwater and 88.9 percent (1478 million gallons) was saltwater. Average daily groundwater withdrawals were approximately 80.8 million gallons, and 100 percent of this was freshwater. The average total daily withdrawal in the county was 1758 million gallons per day, and approximately 84.1 percent was from saltwater sources (USGS Dec 2004).

St. Lucie Units 1 & 2 receive water from the city of Fort Pierce and the Fort Pierce Utilities Authority for potable and service uses at the plant. This freshwater is derived from groundwater sources on the mainland, and plant operations do not involve any additional groundwater withdrawal. Average potable water usage at the plant is approximately 131,500 gallons per day with no restrictions on supply (NUREG-1437, Supplement 11). It is anticipated that the addition of two more power units would nominally double this daily potable water requirement.

Water is withdrawn from the Atlantic Ocean in a once-through arrangement to cool St. Lucie Units 1 & 2 (NUREG-1437, Supplement 11). It is anticipated that a closed loop, tower-cooled system would be developed for the new nuclear power units, whereby consumptive losses are replaced from the Atlantic Ocean and blowdown water is routed to the Atlantic Ocean. As shown in Subsection 4.2.2.1, the peak construction water demand is estimated at 565 gpm which is slightly greater than 1 cubic foot per second, and the peak estimated potable water demand for operations is 2553 gpm (Table 3.3-1). Municipal potable water from St. Lucie County could easily satisfy these demands. As described in Subsection 5.2.1, an estimated 200 cfs of saltwater would be needed to support plant operations. The Atlantic Ocean is a virtually unlimited water source and could easily provide the estimated 200 cfs of saltwater needed to replace consumptive water use associated with operation of the proposed nuclear power units.

Water use impacts are considered small when water sources are readily available to meet demand. Therefore, because adequate water sources are available nearby, the impact on regional water use for both construction and operation would be SMALL.

Water quality impacts are considered small when changes in water quality do not affect or minimally affect aquatic biota and water uses (NUREG-1437, Supplement 11). The depth to the water table near the site is less than 5 feet below ground level. Therefore, it is expected that dewatering would be required during the construction phase. This may require construction of temporary retention ponds to allow sediment-laden waters to settle before discharge to surface waters. Dewatering activities would be subject to NPDES permit requirements to avoid adverse impacts on surface waters.

Construction and operation activities at the St. Lucie site would be performed under the authorization of an NPDES permit issued by the FDEP (FDEP 2008b). As authorized by the Clean Water Act, the NPDES permit program regulates discharges into waters of the United States to control water pollution. Industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters. NPDES permits describe (1) the limits on what can be discharged, (2) requirements to monitor and report discharges, and (3) other provisions to ensure that the discharge does not harm water quality. Any releases from the plant as result of construction or operation would be regulated by the FDEP through the NPDES permit process to ensure that water quality is protected. To ensure that wetlands and streams are not harmed by petroleum products or other industrial chemicals, FPL would restrict certain activities (e.g., transfer and filling operations) that involve the use of petroleum products and solvents to designated areas, such as laydown, fabrication, and shop areas. In addition, construction activities would be guided by a stormwater pollution prevention plan and a construction-phase spill prevention, control, and countermeasures plan similar to those proposed for the Turkey Point site, as described in Section 4.2. Therefore, any impacts to surface water during plant construction would be SMALL and would not warrant mitigation beyond best management practices required by the permits. The impacts to water quality during operations would also be SMALL because the NPDES permit requirements would ensure that adequate measures are applied to protect water quality.

9.3.3.4.4 Terrestrial Resources and Protected Species

Table 9.3-16 includes estimates of the potentially affected area(s) of each land cover type within the project area for both onsite and offsite components, including any natural vegetation and wetland areas. The nominal site elevation of the St. Lucie site is 0 to 5 feet above sea level, which falls within the 100-year floodplain. The most prominent topographic feature of the site is the grade for SR A1A, which passes through the eastern portion of the FPL property. Between the dunes and SR A1A, the principal feature is a series of mangrove-dominated mosquito impoundments interspersed with islands of natural coastal strand vegetation. St. Lucie Units 1 & 2 are on the west side of SR A1A in a relatively flat, sheltered area of the island. West of the facility, the land gradually slopes downward to a mangrove fringe bordering the intertidal shoreline of the Indian River Lagoon. East of the facility, land rises from the ocean shore to form dunes and ridges approximately 15 feet above mean low water (FPL Nov 2001).

As shown in Table 9.3-16, there are approximately 405 acres of wetlands within the project area, excluding the conceptual transmission corridor which could be directly impacted from project construction. All of the wetland areas include mangrove habitat which serves as important habitat for wildlife. Any wetland functions that are impacted during construction would be replaced or restored. The footprint of the new facilities, excluding the assumed conceptual transmission corridor but including other offsite components such as the widening of A1A, would cover approximately 641 acres.

There are no designated critical terrestrial habitats for endangered species in the vicinity of St. Lucie Units 1 & 2 and the transmission corridor associated with the plant. The beach and dunes, mangrove, and tropical hammock habitats are important, however, in that they represent important coastal ecosystems that have been reduced by development. Also, these habitats support a variety of animal species (FPL Nov 2001).

At the St. Lucie Units 1 & 2 site, the beach and dune habitat consists of a narrow band along the Atlantic Ocean shoreline and is subject to considerable wave erosion. The seaward side of the dunes currently has no vegetation. Vegetation on the inland side of the dunes includes sea oats (*Uniola paniculata*), sea grape (*Coccoloba uvifera*), salt marsh hay (*Spartina patens*), Australian pine (*Casuarina equisetifolia*), marsh ox-eye (*Borrichia frutescens*), beach sunflower (*Helianthus debilis*), marsh elder (*Iva frutescens*), bay bean (*Canavalia rosea*), and railroad vine (*Ipomoea pes-caprae*) (FPL Nov 2001).

The mangrove habitat has been considerably altered from its former natural state. In the 1930s and 1940s, the mangrove forest was destroyed by trenching, diking, and flooding with seawater as part of a Work Progress Administration mosquito control program. Many trees were killed by hydrologic alterations, particularly the black mangrove (*Avicennia germinans*). Since that time there has been partial restoration, particularly of red mangrove (*Rhizophora mangle*), which tends to grow in lower, wetter portions of mangrove forests. Some black and white mangrove (*Laguncularia racemosa*), coin vine (*Dalbergia ecastaphyllum*), and giant leather fern (*Acrostichum danaeifolium*) have since been established at higher elevations. The mangrove stands suffered freeze damage in 1989, and revegetation has not occurred in some areas.

Currently the mangrove areas are either inundated or intertidal, and function as mud flat habitats for wildlife (FPL Nov 2001).

The tropical hammock habitat exists east of SR A1A. The largest area of occurrence is amid the mangrove stands north of the St. Lucie Units 1 & 2 Discharge Canal. Prominent species include gumbo-limbo (*Bursera simaruba*), paradise tree (*Simarouba glauca*), white and Spanish stoppers (*Eugenia axillaris and E. foetida*), wild lime (*Zanthoxylum fagara*), white indigo berry (*Randia aculeata*), mastic (*Mastichodendron foetidissimum*), and snow berry (*Chiococca alba*). The existence of tropical hammocks with a distinct assemblage of tropical species this far north on the Atlantic coast is unusual (FPL Nov 2001). Based on the conceptual site layout for St. Lucie, part of this area would be impacted by plant construction and road widening activities for SR A1A.

Hutchinson Island habitats support a variety of animal species. FPL reported 24 species of mammals in Hutchinson Island, of which the Virginia opossum (*Didelphis virginiana*), raccoon (*Procyon lotor*), and beach mouse (*Peromyscus polionotus*) were most common. Nearly 160 bird species were reported to use Hutchinson Island, at least during part of their life cycles. Abundant resident species were typified by water-associated birds such as great egret (*Casmerodius albus*), American coot (*Fulica americana*), ring-billed gull (*Larus delawarensis*), and fish crow (*Corvus ossifragus*). Many migratory species pass through the area such as warblers [e.g., black and white warbler (*Mniotilta varia*)], spotted sandpiper (*Actitis macularia*), and Forster's tern (*Sterna forsteri*). Gopher tortoises (*Gopherus polyphemus*) are present on the site and have active burrows in areas of soft soils that are not subject to flooding (FPL Nov 2001).

Threatened, endangered, and/or species of special concern that exist in St. Lucie County are listed in Table 9.3-17. Certain species, such as the least tern (*Sterna antillarum*), black skimmer (*Rynchops niger*), American oystercatcher (*Haematopus palliateus*), several species of sea turtle, gopher tortoise (*Gopherus polyphemus*), and the Florida manatee (*Trichechus manatus latirostris*) have been documented at the St. Lucie Units 1 & 2 site. A number of the protected bird species listed in Table 9.3-17 have been seen on Hutchinson Island, including least tern, brown pelican (*Pelacanus occidentalis*), bald eagle (*Haliaeetus leucocephalus*), peregrine falcon (*Falco peregrinus*), wood stork (*Mycteria americana*), little blue heron (*Egretta caerulea*), snowy egret (*Egretta thula*), reddish egret (*Egretta rufescens*), and Louisiana heron (*Egretta tricolor*). The latter five species nest in mangroves. The least tern, a state threatened species, and the black skimmer, a state species of special concern, nest on the canal berms and building rooftops within the St. Lucie Units 1 & 2 property boundary. The American oystercatcher, a state species of special concern, also nests on the canal berms. The brown pelican, white ibis (*Eudocimus albus*), little blue heron, and the southeastern American kestrel (*Falco sparverius paulus*) were observed on site in recent surveys. Two protected plant species were also observed in recent surveys, inkberry (*Scaevola plumieri*) and common prickly pear (*Opuntia stricta*) (FPL Nov 2001).

Further field surveys would be conducted for federally listed and state protected species as part of the permitting process before any clearing or construction activities at the site or along associated transmission corridors. Land clearing associated with construction of the plant and transmission lines would be conducted according to federal and state regulations, permit conditions, existing FPL procedures, good construction practices, and established best management practices (e.g., directed drainage ditches, silt fencing) (FPL Dec 2006).

As described in Subsection 9.3.3.4.1, FPL assumed that a 63-mile conceptual transmission corridor, varying in width between 200 and 660 feet would extend from the site to the existing FPL transmission system via the Corbett Substation in Palm Beach County. The conceptual transmission corridor generally followed the most direct route between terminations, while consideration was also given to avoiding possible conflicts with natural areas where important environmental resources are located.

As shown in Table 9.3-16, there are approximately 512 acres of wetlands found within the conceptual transmission corridor; approximately 119 acres are forested wetlands and considered to be high quality. Any wetland functions that are impacted during construction would be replaced or restored. Construction of the new transmission lines would potentially impact approximately 2187 acres within the conceptual transmission corridor. However, the estimated acreage requirements for the transmission corridor assume corridor widths which may exceed the area that would actually be disturbed during project construction and operation. These estimates are used to provide the basis for an updated and consistent environmental comparison of alternative sites.

For the purpose of this analysis, impacts to terrestrial resources are considered small if no sensitive habitats, including wetlands, are disturbed and no important species are affected. St. Lucie County has a low number of sensitive species, although several have been observed in the site vicinity. Over 400 acres of mangrove habitat would be permanently lost from plant construction and the widening of SR A1A, which may serve as important habitat for wildlife. In addition, the proposed conceptual transmission corridor would potentially affect an additional 2187 acres of land, although existing transmission corridor has been used to the extent possible. The presence of additional structures could increase bird collisions but this affect would be minimal.

Because land clearing associated with construction of the plant and transmission lines would be conducted according to federal and state regulations, permit conditions, existing FPL procedures, good construction practices, and established best management practices, impacts to terrestrial resources, including endangered and threatened species, from construction of nuclear power facilities at the St. Lucie site would be minimized. However, because of the known presence of endangered species at the site, the permanent filling of over 400 acres of mangrove habitat, and potential impacts to an additional 2187 acres within the conceptual transmission corridor, the impact from construction would be considered MODERATE.

The most likely aquatic impact from nuclear operations at the St. Lucie site would be from drift from cooling tower operations. Cooling tower operations can generate vapor plumes that drift downwind. Salt and mineral deposits in the vapor plume have the potential to adversely impact sensitive plant and animal communities through changes in water and soil chemistry. Because the St. Lucie site would likely use ocean water for power plant heat rejection, the salt and mineral levels in the water would be high. The use of drift eliminators, along with proper tower design and operation, would help reduce these potential impacts. In addition, the surrounding ecosystem has already adapted to higher salinity levels given its coastal location. Therefore, the anticipated terrestrial impacts from operation of two nuclear units would be SMALL.

9.3.3.4.5 Aquatic Resources and Protected Species

The St. Lucie site is on Hutchinson Island in St. Lucie County and is bordered by the Atlantic Ocean to the east and the Indian River Lagoon to the west. Existing Units 1 & 2 are cooled by a once-through system that withdraws water from the Atlantic Ocean and then discharges the heated water back into the Atlantic Ocean. Water canals channel the intake water to the west side of the plant. The intake canal spans approximately 4920 feet and has a trapezoidal cross section that is 180 feet wide and 30 feet deep. The discharge canal is approximately 2200 feet long with cross-sectional dimensions similar to those of the intake canal (NUREG-1437, Supplement 11). FPL assumed that the proposed new units at the St. Lucie site would use a closed loop, tower-cooled system for power cycle waste heat rejection, whereby consumptive losses are replaced from the Atlantic Ocean and blowdown water is routed to the Atlantic Ocean.

The near shore area of the Atlantic Ocean has no reef structures, grass beds, or rock outcroppings. Seaward, the ocean floor consists of unconsolidated sediments composed of quartz and calcareous sands, broken shell fragments, and negligible amounts of silts and clays. The sea floor gently slopes into a trough with a maximum depth of approximately 39 feet at approximately 1 nautical mile offshore. Continuing offshore, the sea floor rises to form the Pierce Shoal at approximately 2 miles (FPL Nov 2001).

Baseline monitoring before the construction of St. Lucie Units 1 & 2 established that there were three subtidal microhabitats offshore of the plant: shallow beach terrace, offshore shoal, and a deeper trough in between the two. Sediment composition differed among these zones. The biological composition of macroinvertebrate communities is largely influenced by sediment composition. Because of the sediment heterogeneity, the trough supports the most abundant fauna. It was characterized by high diversity and relatively rapid turnover of less abundant and more transient species. In the intertidal zone, the worm reef community provided yet another distinct habitat for macroinvertebrates. Patterns of fish abundance and diversity were also largely aligned along microhabitat boundaries. In addition to the habitats identified above, the surf zone harbored yet another distinct assemblage of fish (FPL Nov 2001).

Baseline studies identified 127 species of arthropods and nearly 300 species of mollusks. The diverse makeup of these groups, and to some extent their seasonal variability, was attributed to the transitional temperate, subtropical, and tropical mix of climate and water masses in the general vicinity of Hutchinson Island. Some estuarine affinities were also noted and attributed to water mass intrusions from the Indian River Lagoon by way of St. Lucie Inlet and prevailing northerly coastal currents. Among species of direct commercial value, the calico scallop was the only mollusk recorded. Arthropods of potential commercial value included penaeid shrimp and the blue crab. However, these species were generally collected in small numbers and infrequently (FPL Nov 2001).

The fish communities offshore are transitional assemblages of temperate and tropical forms. Since oceanic icthyofauna are most diverse and abundant near reefs and other hard-bottom areas, FPL sited intake and discharge structures for St. Lucie Units 1 & 2 in areas devoid of these habitats (FPL Nov 2001). FPL would anticipate the same strategy for the new units at St. Lucie.

Commercial and recreational fishing are important activities in the vicinity of St. Lucie Units 1 & 2. Three of the most abundant species in commercial catches are the bluefish, Spanish mackerel, and king mackerel (*Scomberomorus cavalla*). All three species are highly migratory, spawn in coastal waters from late summer into winter (depending on species), and migrate northward along the East Coast during the warmer seasons. Several other species are quite abundant, including tilefish (e.g., *Caulolatilus* spp.) and swordfish (*Xiphias gladius*) (FPL Nov 2001).

The Indian River Lagoon is a productive estuary that adjoins the western edge of the St. Lucie Units 1 & 2 property. The Lagoon is characterized by extensive growths of manatee grass (*Syringodium filiforme*) and red algae such as the dominant form *Gracilaria*. In turn, the grass and algae are inhabited by a variety of gammarids, shrimp, isopods, crabs, and juvenile fish. A variety of microscopic organisms are supported by this vegetative community, including diatoms attached to the plant leaves. Benthic organisms are also abundant and include tube-dwelling worms and crustaceans, the latter including larger shellfish such as shrimp and blue crabs. A diverse and abundant fish community of more than 300 species has been identified in the southern portion of the Indian River Lagoon. Red drum (*Sciaenops ocellatus*), spotted seatrout (*Cynoscion nebulosus*), common snook (*Centropomus undecimalus*), sheepshead (*Archosargus probatocephalus*), and gray snapper (*Lutjanus griseus*) were commonly reported (FPL Nov 2001). Several species of sea turtle, gopher tortoise (*Gopherus polyphemus*), and the Florida manatee (*Trichechus manatus latirostris*) have been documented at the St. Lucie Units 1 & 2 site. Five species of sea turtle have been reported from Hutchinson Island. The federally threatened loggerhead sea turtle (*Caretta caretta*) has historically been most common. Between 5000 and 8000 loggerhead nests have been reported on Hutchinson Island over the last 10 years. The endangered green sea turtle (*Chelonia mydas*) also nests on Hutchinson Island, but these nests are less abundant than those of the loggerhead. Juveniles of both species use the area near the St. Lucie Units 1 & 2 site as a developmental area. The endangered leatherback sea turtle (*Dermochelys coriacea*) infrequently nests on Hutchinson Island. The endangered Kemp's Ridley sea turtle (*Lepidochelys kempii*) and hawksbill sea turtle (*Eretmochelys imbricata*) do not nest on Hutchinson Island and have only infrequently been reported from the area (FPL Nov 2001).

For the purpose of this analysis, impacts to aquatic resources are considered small if no sensitive habitats are disturbed and no important species are affected. Water from the Atlantic Ocean would cool the new nuclear units constructed at the St. Lucie site. Field surveys would be conducted for federally listed and state protected aquatic species as part of the permitting process before any clearing or construction activities at the site or along associated transmission corridors. Because of this, and because land clearing associated with construction of the plant and transmission lines would be conducted according to federal and state regulations, permit conditions, existing FPL procedures, good construction practices, and established best management practices, impacts to aquatic resources, including endangered and threatened species, from construction of nuclear power facilities at the St. Lucie site would be minimized. However, because of the known presence of endangered species at the site and the permanent filling of mangrove habitat, the impact from construction would be considered MODERATE.

The most likely aquatic impact from nuclear operations at the St. Lucie site would be entrainment and impingement of aquatic organisms from the Atlantic Ocean. Because the EPA requires facilities to meet criteria designed to protect organisms from entrainment and impingement, the potential for environmental impacts to aquatic resources, including endangered and threatened species, from nuclear power facility operations at the St. Lucie site would be minimized. The addition of two nuclear units would not be expected to entrain more turtles, fish, or cause more takes. Therefore, impacts would be SMALL.

9.3.3.4.6 Socioeconomics

This subsection evaluates the social and economic impacts to the region from construction and operation of a nuclear plant at the St. Lucie site. Much of the socioeconomic analysis relies on census data gathered by the USCB. The USCB performs an extensive census every 10 years. The most recent decennial U.S. census was performed in year 2000. The USCB assembles the decennial census data into a wide range of reports that can be used to characterize socioeconomic conditions of a region. In addition, the NRC sponsored development of a computer program called SECPOP2000 that enables an analyst to quickly assemble and quantify customized regional socioeconomic information; however, this program does not produce results for years later than 2000 (U.S. NRC Aug 2003). For years that fall between each decennial census, the USCB issues estimates based on surveys and statistical models; however, the types of data collected and assembled for intermediate years is less extensive than for years when a decennial census is performed; therefore, the decennial census provides the most comprehensive information.

Because the decennial census provides the most comprehensive information, and because the NRC software tool, SECPOP2000, is not available for intermediate years, information from the 2000 census was chosen as a common baseline for socioeconomic comparison for this analysis. Published census data for later years, if available, is presented as supplemental information.

9.3.3.4.6.1 Physical Impacts

Construction activities can cause temporary localized physical impacts such as noise, odor, fugitive dust, vehicle exhaust emissions, ground vibration, and shock from blast activities. The use of public roadways would be necessary to transport construction materials and equipment to the site. It is expected that most major plant footprint associated construction activities would occur within the boundaries of the St. Lucie site. However, a significant stretch of SR A1A would be widened to four lanes to the north, south and immediately adjacent to the site that would result in temporary impacts to local residents and commercial business located along the route. In addition, the conceptual site layout developed for the site includes construction of a 63-mile conceptual transmission corridor that would include offsite impacts. Other offsite areas that would support construction activities (for example, borrow pits, quarries, and disposal sites) would be expected to be already permitted and operational. Impacts on those facilities from construction of the new plant would be small incremental impacts associated with their normal operations.

Potential impacts from power plant operations include noise, odors, exhausts, thermal emissions, and visual intrusions. Operational noise would be generated by pumps, fans, transformers, turbines, generators, onsite traffic, and switchyard equipment. Noise levels attenuate rapidly with distance so that ambient noise levels (attributable to power plant operations) would be minimal at the site boundary. The St. Lucie site is on an industrial segment of Hutchinson Island. Commuter traffic on SR A1A would be controlled by speed limits. Good road conditions and appropriate speed limits would minimize the dust and noise level generated by the delivery trucks and site workers that travel to and from the site.

The project would have standby diesel generators and auxiliary power systems. Air quality permits obtained for this equipment would ensure that air emissions comply with regulations. In addition, the generators would be operated on a limited, short-term basis. Normal plant operations would not use a quantity of chemicals that could generate odors that exceed odor threshold values.

Physical impacts are considered small when offsite areas are not affected or only minimally or temporarily affected by noise, odor, dust, emissions, vibration, or shock. In summary, construction activities would be temporary and would occur mainly within the boundaries of the

St. Lucie site. Offsite impacts would represent small incremental changes to offsite services that support construction activities. During station operations, ambient noise levels would be minimal at nearby receptors. Air quality permits would be required for the diesel generators to ensure emissions comply with regulatory guidelines, and chemical use would be limited, which should limit odors. Therefore, the physical impacts of construction and operation of the new units at the St. Lucie site would be SMALL.

9.3.3.4.6.2 Demography

The St. Lucie site is in St. Lucie County on Hutchinson Island off the eastern coast of Florida. Coterminous counties include Indian River to the north, Okeechobee to the west, and Martin to the south. The nearest population centers larger than 25,000 residents are Port St. Lucie approximately 4.5 miles west and Fort Pierce approximately 7 miles northwest.

Based on the NRC (NUREG-1437, Supplement 11) approximately 97 percent of the St. Lucie site workforce lives in a four-county region that includes St. Lucie, Martin, Indian River, and Palm Beach Counties. Of the workforce in that lives in these counties, the percentage distribution is 47.4, 38.2, 8.2, and 6.2 percent, respectively. Based on this known workforce demographic, these same counties are selected to represent the ROI for the St. Lucie site.

Based on the 2000 census, the total population in the ROI was 1,563,557 which included 112,947 in Indian River County; 126,731 in Martin County; 1,131,184 in Palm Beach County; and 192,695 in St. Lucie County (USCB 2000). Census estimates for year 2007 show an ROI population of 1,798,409 people, which included 131,837 in Indian River County, 139,182 in Martin County, 1,266,451 in Palm Beach County, and 260,939 in St. Lucie County (USCB 2009).

NRC guidelines have been established to assess the demographic sparseness and proximity of a proposed site. Sparseness is a combined measure of (1) the population density within 20 miles of the site, and (2) the relative population of the nearest metropolitan area within 20 miles of the site. Proximity is a combined measure of (1) the population density within 50 miles of the site, and (2) the relative population of the nearest metropolitan area within 50 miles of the site. Based on the sparseness-proximity evaluation, a site is categorized as low, medium, or high (NUREG-1437, Supplement 11).

The land area within 20 miles of the St. Lucie site (i.e., excluding water bodies such as the Atlantic Ocean) is 553.1 square miles, and based on 2000 census data, the population of this area was 326,647 (NUREG-1437, Supplement 11). This yields a population density of 590.57 people per square mile, based on land area. Based on this metric, the sparseness level is 4 (population density greater than 120 people per square mile over a 20-mile radius) (NUREG-1437, Supplement 11).

Similarly, the land area within 50 miles of the St. Lucie site is 3551.9 square miles, and the population of this area was 1,003,699 (U.S. NRC Aug 2003). This yields a population density of 282.58 people per square mile. Based on this metric, the proximity level is 4 (population density greater than 190 people per square mile over a 50-mile radius). Therefore, the St. Lucie site has a sparseness-proximity measure of 4.4, which is categorized as high (NUREG-1437, Supplement 11).

Based on FPL estimates, the peak construction workforce for the project would be 3548 construction workers. Operations would overlap with peak construction activity for a period of time; therefore, in addition to the construction workforce, there would be a small number (99) of operations workers on the site during the peak construction period, and these workers would also relocate to the area. Because of the location of the St. Lucie site relative to population centers, FPL assumed that 50 percent of the construction and operation workers would relocate from outside the ROI. FPL further assumed that 70 percent of construction workforce and 100 percent of operation workforce that moved to the area would bring their families. Based on these assumptions, a total of 1824 construction and operation workers would relocate to the area in the project construction phase, and 1291 would bring their families. Based on an average household size of 3.25 people (BMI Apr 1981), the total increase in population attributable to construction at the St. Lucie site would be 4729 people. An influx of 4729 people represents a 0.3 percent increase in the ROI population of 1,563,557 people. Impacts are considered small if plant-related population growth is less than 5 percent of the area's total population (NUREG-1437, Supplement 11). This would pose a SMALL impact on population for the ROI.

At the county level, if the demographic distribution of the construction workforce follows that of the St. Lucie plant workforce, the addition of the construction workforce employees and their families would increase the population in Indian River, Martin, Palm Beach, and St. Lucie Counties by 0.3 percent, 1.4 percent, 0.03 percent, and 1.2 percent, respectively. Therefore, these represent SMALL increases in the county population levels.

FPL estimated the total onsite operations workforce to be 806 workers, and that 50 percent of these workers (403) would relocate from outside the ROI. For the purpose of this analysis, FPL assumed that each operations worker who relocated would bring their family. Based on an average household size of 3.25 people, the total population increase attributable to project operations is 1310 people. This represents a 0.1 percent increase in the four-county ROI population. At the county level, if the demographic distribution of the operations workforce follows that of the workforce at the St. Lucie plant workforce, the addition of the operations workforce employees and their families would increase the population in Indian River, Martin, Palm Beach, and St. Lucie Counties by 0.1 percent, 0.4 percent, 0.01 percent, and 0.3 percent, respectively. These represent SMALL increases in the county population levels.

In summary, the population increase in the ROI would pose a SMALL impact. Likewise, it is anticipated that the population increase in each of the four counties would pose a SMALL impact.

9.3.3.4.6.3 Economy

Based on 2000 census data, Indian River County had a civilian labor force of 47,627 people and an unemployment rate of 4.5 percent; Martin County had a civilian labor force of 53,301 people and an unemployment rate of 4.2 percent; Palm Beach County had a civilian labor force of 510,046 people and an unemployment rate of 5.0 percent; and St. Lucie County had a civilian labor force of 82,070 people and an unemployment rate of 5.2 percent (USCB 2000). For the entire ROI, 99.9 percent of the labor force was part of the civilian labor force and 0.1 percent was in the armed forces. Of the civilian labor force, 95.1 percent were employed and 4.9 percent were unemployed. The overall unemployment rate for the four-county ROI is slightly lower than that of the state, which is 5.6 percent (USCB 2000).

The principal economies of the counties in the ROI are the same, dominated mainly by educational, health, and social services; agriculture, forestry, fishing and hunting, and mining; and retail trade. Most of the labor force in the four-county ROI resides in Palm Beach County (USCB 2000).

An influx of 1824 construction and operation workers from outside the region would have positive economic impacts in the four-county region. Based on a multiplier of 1.7136 jobs (direct and indirect) for every construction job and 2.2500 for every operation job (BEA Aug 2009), an influx of 1824 workers would create 1354 indirect jobs, for a total of 3178 new jobs in the ROI. The creation of such a large number of direct and indirect jobs could reduce unemployment and would create business opportunities for goods and service-related industries and the housing industry. Workers generally spend most of their employment income in the county of permanent residence. The maximum impact on any single county would occur if 100 percent of the construction workforce settled there, and the minimum impact would occur if no construction workers settle there. Economic impacts attributable to project construction are considered beneficial and therefore require no mitigation. Economic effects are considered small if peak employment accounts for less than 5 percent of area employment (NUREG-1437, Supplement 11). The number of new jobs created would represent only a 0.5 percent increase in jobs within the ROI; therefore, the economic impacts would be SMALL.

An estimated 806 workers would be required for the operation of two nuclear power facilities at the St. Lucie site (U.S. DOE May 2004), and FPL assumed that 50 percent of these employees would migrate into the region. Based on a multiplier of 2.2500 jobs (direct and indirect) for every operations job at the new units (BEA Aug 2009), an influx of 403 operations workers would create 504 indirect jobs for a total of 907 new jobs in the region. FPL concluded that the impacts of operation of two nuclear power facilities on the economy would be beneficial and SMALL in the ROI and mitigation would not be warranted.

9.3.3.4.6.4 Taxes

Taxes collected as a result of construction and operation of the new nuclear units at the St. Lucie site would benefit the state and local tax authorities. FPL would pay property taxes to each taxing authorities whose boundaries contained the plant. Tax payments would be based on the assessed valuation of the plant and local tax rates. If the plant site straddled a jurisdictional boundary, FPL would pay taxes to both entities based on the assessed valuation within each entity.

As described in Subsection 4.4.2.2.2, it is not clear whether FPL corporate income taxes would increase as a result of construction of the new units at the St. Lucie site, because the units would not generate revenues until they became operational. However, once the units were placed in service, St. Lucie County property taxes would begin and would continue for the 60-year operational life of the facility.

FPL assumed that annual property tax payments at St. Lucie site would be similar those paid by the nuclear units at Turkey Point plant. In 2006, the annual tax payment for the two units at the Turkey Point nuclear power plant was $6,902,670. For fiscal year 2006, St. Lucie County had property tax revenues of $134,254,911 (State of Florida, Mar 2007).

With respect to the school districts in Florida, local revenue for the school districts is derived almost entirely from property taxes levied by Florida's 67 counties, each of which constitutes a school district (Florida Department of Education 2008). As described in Subsection 2.5.2.3.5, the state of Florida has an established equalized funding program that reallocates tax base funds from counties that have a high economic tax base to counties that have a low economic tax base. The Florida Education Finance Program is the primary mechanism to fund the operational costs of Florida school districts. Funding is based on the number of full-time equivalent students, and considers variations in several factors to determine funding for each district: local property tax bases, education program costs, costs of living, and costs for equivalent educational programs because of the density and distribution of the student population.

It should be noted that school property tax payments would be based on the location of the plant and not necessarily on the district(s) attended by the workers' children. Therefore, it is not possible to assess the direct impact of the plant on the school district. In addition, the impact of plant construction and operation on the special tax districts is not assessed here because most of the property tax payment from the plant would go to the county and the school district(s).

The benefits of taxes are considered small when new tax payments by the nuclear plant constitute less than 10 percent of total revenues for local jurisdictions and large when new tax payments represent more than 20 percent of total revenues (NUREG-1437, Supplement 11). Therefore, based on the county portion of the FPL property tax payment for the new units, 8 percent of the 2006 property tax revenues for St. Lucie County would be provided by FPL and constitute a SMALL positive impact.

9.3.3.4.6.5 Transportation

The only road access to the St. Lucie site would be SR A1A (a two-lane road) which spans in the north-south orientation along the eastern site boundary. SR A1A intersects with U.S. Highway 1 in both directions. U.S. Interstate 95 spans parallel to U.S. Highway 1 and can be reached by numerous routes. Commuters from most cities in the region (Boynton Beach, Indiantown, Palm City, Port St Lucie, West Palm Beach) would travel northbound on SR A1A to reach the site. Commuters from Fort Pierce, Palm Bay and Vero Beach would travel southbound along SR A1A to reach the site.

FDOT reports the AADT count at two locations along SR A1A, one at one-half mile south of the site, and one 6 miles north of the site. The AADT count and directional peak hour volume of the southern location is 4700 vehicles per day and 273 vehicles per hour (FDOT 2008). This directional peak hour volume classifies this southern portion of the roadway as a LOS of C (FDOT 2007), and the remaining peak hour capacity is 147 vehicles. The northern location has an AADT count and directional peak hour volume of 3700 vehicles per day and 215 vehicles per hour (FDOT 2008). This peak hour volume classifies this northern portion of the roadway as a LOS of B (FDOT 2007), and the remaining peak hour capacity is 205 vehicles.

Based on the existing workforce at the St. Lucie site, FPL assumed that most of the workforce would likely travel along the southern portion of SR A1A and that a smaller amount of the workforce would travel along the northern portion. Also, the traffic attributable to construction material deliveries could cause additional congestion on SR A1A during certain times of the day. Based on the methodology presented in Subsection 4.4.2.2.4, FPL determined that construction at the St. Lucie site would add 1507 and 623 vehicles during the peak hour to the respective southern and northern portions of SR A1A. This would cause the road to exceed capacity and drop the southern and northern roadway to LOS classifications of E and F, respectively.

Based on this analysis, it is likely that the additional traffic would pose delays along SR A1A. To facilitate the additional traffic, SR A1A could be widened to a four-lane highway, and acceleration/deceleration lanes could be added to facilitate commuter traffic. These roadway modifications would be needed along SR A1A between Seaway Drive to the north and NE Causeway Boulevard to the south, particularly in the vicinity of the St. Lucie site. NRC applied significance levels to the LOS classifications that were projected to result from the additional traffic associated with refurbishment activities at nuclear plants (NUREG-1437, Supplement 11). FPL considers this approach to be appropriate for construction of a nuclear plant since both plant refurbishment and new plant construction would be large construction projects. NRC associates small impacts with LOS A and B, moderate impacts with LOS C and D, and large impacts with LOS E and F. It is therefore anticipated that the impact of the construction workforce on transportation would be LARGE.

Operations at the St. Lucie site would add approximately 332 and 137 more vehicles to the southern and northern portions of SR A1A during the hour of peak traffic, respectively. The roadway modifications to the southern part of SR A1A (mentioned above) would raise the roadway peak hour capacity sufficiently to accommodate the additional traffic from operations. Shift changes could be also be staggered so that the traffic increase would be less likely to cause congestion. However, based on the NRC LOS significance levels in the absence of road modifications that increase road capacity, the impact of the operations workforce on transportation would be MODERATE.

9.3.3.4.6.6 Aesthetics and Recreation

The St. Lucie site consists of 1130 acres of developed land on the widest section of Hutchinson Island in St. Lucie County. A portion of the site is occupied by St. Lucie Units 1 & 2 nuclear power generation facilities. The site is on a flat barrier island at elevations that range from 0 to 5 feet above MSL (USGS 1948) and within the Flatwoods physiographic province (USGS 2008).

Construction of the new units at the St. Lucie site could be viewed from offsite at certain locations, but the addition of two nuclear facilities would not substantially change the viewscape which results from the current nuclear generation facilities. Operation of the new nuclear units would have visual impacts similar to those of the St. Lucie Units 1 & 2, with occasional visible vapor plumes associated with cooling tower operations. Visibility of the plumes would depend on weather conditions and the location of the viewer in the area. Impacts on aesthetic resources are considered small if there is no potential for diminution in the enjoyment of the physical environment and no measurable impact on socioeconomic institutions and processes. Therefore, impacts of construction and operation of the new units on aesthetics would be SMALL and would not warrant mitigation.

The Indian River Lagoon is a long, shallow, tidally-influenced estuary that stretches along the central-east coast of Florida between the mainland and a series of offshore islands. At the St. Lucie site, the Indian River Lagoon is approximately 7200 feet wide and bounds the site to the west. Blind Creek Park and Big Mud Creek Park, inlets off Indian River Lagoon, are adjacent to the site. The stretch of lagoon adjacent to the site is designated as the Jensen Beach to Jupiter Inlet Aquatic Preserve. The North Fork St. Lucie River Aquatic Preserve is on the north fork of the St. Lucie River at Port St. Lucie. The St. Lucie Canal connects the St. Lucie site with Lake Okeechobee.

Fort Pierce Inlet State Recreation Area is approximately 9 miles north of the St. Lucie site and immediately north of the Fort Pierce Inlet. Recreational area activities include beach activities, swimming, picnicking, camping, and hiking. Other state recreational areas include Avalon, Savannas, and Pepper Beach. The Savannas State Preserve, a freshwater lagoon, is on the mainland approximately 2 miles west of the St. Lucie site and offers fishing, hiking, picnicking, and other outdoor-related activities (NUREG-1437, Supplement 11).

Three National Wildlife Refuges are within 50 miles of the St. Lucie site and include Hobe Sound, Pelican Island, and Arthur R. Marshall Loxahatchee National Wildlife Refuges. Hobe Sound is approximately 22 miles south of the site and occupies approximately 1035 acres of the most productive sea turtle nesting areas on the Florida east coast (USFWS 2008c). Pelican Island is approximately 32 miles north of the site and consists of a 5413-acre bird rookery island (USFWS 2008d). Loxahatchee is approximately 48 miles south of the site and consists of more than 221 square miles of Everglades habitat (USFWS 2008e).

Other prominent features within 50 miles of the St. Lucie site include Lake Okeechobee, Blue Cypress Lake, Jonathan Dickinson State Park, the DuPuis and J.W. Corbett Wildlife Management Areas, and a portion of the Seminole Brighton Indian Reservation (NUREG-1437).

Because the St. Lucie site already hosts a power plant with tall structures and transmission towers, the construction and operation of two nuclear power units and associated transmission lines would not pose an appreciable change to the viewscape. Therefore, visual impacts on the region would be SMALL.

During plant operations, some employees and their families would use the regional recreational facilities; however, the increase attributable to plant operations would be small compared to overall use of these facilities. Impacts on tourism and recreation are considered small if current facilities are adequate to handle local levels of demand. Therefore, impacts of facility construction and operation on tourism and recreation would be SMALL.

9.3.3.4.6.7 Housing

FPL estimated that 1824 construction and operation workers would move from outside the ROI to the counties in the ROI. These 1824 workers would need housing. Some of the workers would seek permanent residence, generally owner-occupied; some would choose to rent; and others would choose a transitional residence such as a hotel, a room in private home, or a camper or mobile home.

Based on 2000 census data, within the four-county ROI, there were 771,063 housing units of which 115,530 were vacant (15.0 percent). At the county level, the number of vacant housing units was 8765 in Indian River County (15.1 percent), 10,183 (15.6 percent) in Martin County, 82,253 (14.8 percent) in Palm Beach County, and 14,329 (15.7 percent) in St. Lucie County. This includes housing that is designated as seasonal, recreational, or occasional use (USCB 2000).

Based on absolute numbers, FPL estimated that the available housing would be sufficient to house the construction workforce. Workers who relocated could secure housing from the existing stock in any of the four counties within the region, have new homes constructed, or bring their own residence (mobile home or trailer) to the region. The influx of 1824 construction workers represents 1.6 percent of the 115,530 vacant housing units in the ROI. At the county level, if the construction workforce follows workforce housing patterns at the St. Lucie plant, then the percentage of vacant housing required in each county would be 1.7 percent, 6.8 percent, 0.1 percent, and 6 percent for Indian River, Martin, Palm Beach, and St. Lucie Counties, respectively. Impacts on housing are considered to be small when a small and not easily discernable change in housing availability occurs (NUREG-1437, Supplement 11). In summary, FPL concluded that the impacts on housing in the ROI and for any individual county would be SMALL and mitigation would not be warranted.

FPL estimated that 806 workers would be needed for operation of two nuclear power facilities at the St. Lucie site (U.S. DOE May 2004). An estimated 50 percent of these workers (403) would come from within the ROI, and 50 percent (403) would relocate to the area. An influx of 403 workers would represent less than 1 percent of the vacant housing in the ROI. At the county level, if the construction workforce followed workforce housing patterns at the St. Lucie plant, then the percentage of vacant housing required in each county would be 0.4 percent, 1.5 percent, 0.03 percent, and 1.3 percent for Indian River, Martin, Palm Beach, and St. Lucie Counties, respectively. In summary, FPL concluded that the impacts on housing in the ROI and for any individual county would be SMALL and that mitigation would not be warranted.

9.3.3.4.6.8 Public Services

Public services in the ROI include water supply and wastewater treatment facilities, law enforcement, fire, and medical facilities, and social services. Construction or operations employees who relocated from outside the region would most likely live in residentially developed areas where adequate water supply and wastewater treatment facilities already exist. The medical facilities in the four-county ROI provide medical care to much of the population in the 50-mile region, and therefore the small increases in the regional population would not materially impact the availability of medical services. Although the workers and their families would pose an additional overall demand on other public services, it is anticipated that the current capacity of public services within the four-county ROI would be adequate to accommodate the increased demand. Therefore, the impact would be SMALL.

The new nuclear plant and the associated population influx would likely pose an economic benefit for the disadvantaged population served by the Florida Department of Children and

Families. Direct jobs created by the project would bring indirect jobs that could be filled by currently unemployed workers and therefore remove them from the care of social services.

The ratio of residents-to-law enforcement officers in Indian River, Martin, Palm Beach, and St. Lucie Counties was 562:1, 466:1, 928:1, and 722:1, respectively (FBI 2008). In the four-county ROI, the ratio was 798:1. For the state of Florida, the resident-to-law enforcement officer ratio was 851:1. Ratios are partly dependent on population density. In general, fewer law enforcement safety officers are necessary for the same population if the population resides in a smaller area. In the ROI, if no additional law enforcement officers were hired, the population increase attributable to project construction at the St. Lucie site would increase the resident-to-law enforcement officer ratio by 0.3 percent to 801:1. This is a small increase and would still yield a lower resident-to-law enforcement officer ratio than the average for the state of Florida. Similarly, the increase in the resident-to-law enforcement officer ratio attributable to operations would yield less than a 0.1 percent increase.

The ratio of residents to firefighters for these counties was 411:1, 363:1, 519:1 and 563:1, respectively (USFA 2009). In the ROI, the ratio was 497:1, and for the state of Florida, the resident-to-firefighter ratio was 1,230:1 (USFA 2009). As described above in the description of law enforcement officers, ratios are partly dependent on population density. In general, fewer firefighters are necessary for the same population if the population resides in a smaller area. In the ROI, if no additional firefighters were hired, the population increase attributable to project construction at the St. Lucie site would increase the resident-to-firefighter ratio by 0.3 percent to 498:1. This is a small increase and would still yield a lower resident-to-firefighter ratio than the average for the state of Florida. Similarly, the increase in the resident-to-firefighter ratio attributable to operations would yield less than a 0.1 percent increase.

Impacts on public services are considered small if there is little or no need for additional personnel. Impacts are considered moderate if some permanent additions or some new capital equipment purchases are needed (NUREG-1437, Supplement 11). The population increase in the four-county region attributable to construction or operation of the new power units could pose a need to hire additional emergency personnel; however, any additional need would be small, and increased tax revenues would be adequate to pay the salaries of any additional emergency personnel hired. Therefore, it is not expected that public services would be materially impacted by new construction or operations employees that relocate from outside the region. Impacts are therefore considered SMALL, and mitigation would not be warranted.

9.3.3.4.6.9 Education

Based on data for the 2006-2007 school year, Indian River County had 28 prekindergarten through 12 (PK–12) schools with a total enrollment of 17,611 students; Martin County had 36 PK–12 schools with a total enrollment of 18,239 students; Palm Beach County had 264 PK–12 schools with a total enrollment of 171,431 students; and St. Lucie County had 46 PK–12 schools with a total enrollment of 38,793 students (NCES 2009). In the four-county ROI, there were 374 PK–12 schools with a total enrollment of 246,074 students.

FPL estimated that 1824 construction and operation workers would migrate to the area, and that 1291 of these would bring a family. This would yield a total population increase of 4729 people. Based on an estimate of 0.8 school-aged children per family, an estimated 1033 of the 4729 people who relocated to the four-county area would be school-aged children. This would yield a 0.4 percent increased in the student population in the ROI.

Based on the demographic distribution of the St. Lucie plant workforce, an increase of 1033 students would increase the student populations in Indian River, Martin, Palm Beach, and St. Lucie Counties by 0.5 percent, 2.2 percent, 0.04 percent, and 1.3 percent, respectively. Small impacts are generally associated with project-related enrollment increases are less than 3 percent and moderate impacts on local school systems are generally associated with project-related enrollment increases of 3 to 8 percent (NUREG-1437). Therefore, projected increases in the student populations for the ROI and for each individual county are expected to be SMALL. The quickest mitigation would be to hire additional teachers and move modular classrooms to existing schools. Increased property and special option sales tax revenues as a result of the increased population would fund additional teachers and facilities. No additional mitigation would be warranted.

FPL assumed that 403 operations workers and their families would relocate from outside the region, and that the total population increase would be 1310 people. This would include an estimated 322 children in the PK–12 school range. This influx of students would increase the student population in the ROI by 0.1 percent. Based on the demographic distribution of the St. Lucie plant workforce, an increase of 322 students would increase the student populations in Indian River, Martin, Palm Beach, and St. Lucie Counties by 0.2 percent, 0.7 percent, 0.01 percent, and 0.4 percent, respectively. Therefore, projected increases in the student populations for the ROI and for each individual county are expected to be SMALL, and mitigation would not be warranted.

9.3.3.4.7 Historic and Cultural Resources

FPL conducted historical and archaeological records searches on the National Park Service NRIS and reviewed information on historic and archeological sites provided in the NRC *Final Report: Generic Environmental Impact Statement (GEIS) for License Renewal of Nuclear Plants, Supplement 11, St. Lucie Units 1 and 2* (NUREG-1437, Supplement 11).

The GEIS Supplement 11 for the St. Lucie Units 1 & 2 indicates that in 2001 FPL submitted a letter to the Florida SHPO to request comments on the St. Lucie Units 1 & 2 license renewal process. In the letter, FPL determined that the continued operation of St. Lucie would have no impact on historic properties. In response, the Florida SHPO cautioned that there was a moderate to high likelihood for the presence of significant prehistoric archaeological sites in the currently undeveloped portions of the St. Lucie site, as evidenced by the presence of the archeological remains along Blind Creek at the northern end of the site boundary (NUREG-1437, Supplement 11).

The NRHP identifies 124 sites in the four-county ROI; including 70 sites in Palm Beach County, 12 sites in Martin County, 16 sites in St. Lucie County, and 26 sites in Indian River County. Fifteen of these properties are within 10 miles of the St. Lucie site (NPS 2008e).

Siting the proposed nuclear plant at the St. Lucie site would require a formal cultural resources survey be conducted so that no archeological or historic resources would be damaged during construction. Sites are considered to have small impacts to historic and cultural resources if the SHPO identifies no significant resources on or near the site or determines they would not be affected by plant construction or operation. Sites are considered to have large impacts if historic or cultural resources would be disturbed or otherwise have their historic character altered by construction. Because of the moderate to high likelihood of significant prehistoric archaeological sites, the impacts to cultural resources from construction or operation of the new units at the St. Lucie site would be considered MODERATE. Mitigation measures would be applied to prevent any permanent damage.

Construction activities at the St. Lucie site could be viewed from the historic and cultural sites 10 miles from the site, but the addition of two nuclear power facilities would not substantially change the view. Operation of the new units probably would have visual impacts similar to those of the existing FPL St. Lucie power plant, with the addition of cooling tower plumes. Therefore, visual impacts of construction and operation of the St. Lucie site relative to historic and culture sites would be SMALL and would not warrant mitigation.

9.3.3.4.8 Environmental Justice

Environmental justice refers to a federal policy under which each federal agency identifies and addresses, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority or low-income populations. The NRC has a policy on the treatment of environmental justice matters in licensing actions (69 FR 52040) and guidance (U.S. NRC May 2004). Subsection 2.5.4.1 describes the methodology FPL used to establish locations of minority and low-income populations.

The 2000 census block groups were used to ascertain minority and low-income population distributions in the area. There are 590 block groups within 50 miles of the St. Lucie site. The census data for Florida characterizes 14.6 percent of the population as black, 0.3 percent

American Indian or Alaskan Native, 1.7 percent Asian, 0.1 percent Native Hawaiian or other Pacific Islander, 3.0 percent as other single minorities, 2.4 percent multiracial, 22.0 percent aggregate of minority races, and 16.8 percent Hispanic ethnicity. If any block group percentage exceeded the state percentage by more than 20 percent or was greater than 50 percent, then the block group was considered to have a significant minority population.

Significant black minority populations exist in 86 block groups, significant American Indian or Alaskan Native populations exist in 1 block group, significant other race minority populations exist in 5 block groups, significant aggregate of minority races populations exist in 96 block groups, and significant Hispanic ethnicity populations exist in 30 block groups. There are no block groups containing significant Asian, Native Hawaiian or other Pacific Islander, multiracial minority populations within 50 miles of the St. Lucie site.

A portion of the Brighton Seminole Indian Reservation is 50 miles west-southwest of the St. Lucie site. As described in Subsection 9.3.3.1.8, the reservation offers several tourist attractions including Indian arts and crafts shops, the Seminole Casino Brighton, a rodeo arena, the Brighton Citrus Grove, and the Brighton Seminole Campground. Today, most Seminole Tribal members are afforded modern housing and health care. In fact, today the Seminole Indians live much the same way as those who live outside Seminole County (Seminole Tribe of Florida 2008).

The locations of the minority populations within 50 miles of the St. Lucie site and the Brighton Indian Reservation are shown in Figure 9.3-18.

The census data characterizes 11.7 percent of Florida households as low income. Based on the more than 20 percent criterion, 37 block groups out of a possible 590 contain a significant number of low-income household. The locations of the low-income populations within 50 miles of the St. Lucie site are shown in Figure 9.3-19.

The closest minority and low-income block groups are in Fort Pierce approximately 10 miles north-northwest of the St. Lucie site. Construction activities (noise, fugitive dust, and air emissions) would be contained within site boundaries and would not impact minority populations. In fact, minority and low-income populations would most likely benefit from construction activities through an increase in construction-related jobs. Operation of the new units at the St. Lucie site is also unlikely to have disproportionate impacts on minority or low-income populations.

FPL concludes that construction and operation of the proposed nuclear plant at the St. Lucie site would not disproportionately impact minority or low-income populations and that mitigation would not be warranted, and the impacts to these populations would be SMALL.

9.3.3.4.9 Other Projects in the Vicinity of the St. Lucie Site

The cumulative impacts of past, present, and reasonably foreseeable federal (e.g. USCOE, USGS), non-federal (e.g. FDEP, FDOT, county), and private projects within a 50-mile radius of the St. Lucie site, excluding Brownfield and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites, that could have cumulative impacts with the proposed action are described in Table 9.3-18. These projects have either requested an air or water permit/license or had an environmental impact statement complete. Projects included in Table 9.3-18 are within the 50-mile radius of the St. Lucie site and the appropriate timeframe for construction and operation of the new units (Figure 9.3-17) from 2013 to 2063 (based on a construction start date of 2013, a Unit 7 in-service date of 2023, and a 40-year operating license). Nuclear power projects within 100 miles of the St. Lucie site (i.e., St. Lucie Units 1 & 2) are also described in Table 9.3-18. The Turkey Point site is more than 130 miles from the St. Lucie site and is therefore not included in the table. The only other nuclear power plant currently operating in Florida, Crystal River, is more than 180 miles from the St. Lucie site and therefore is also not included the table. The proposed nuclear power plant in Levy County is approximately the same distance as the Crystal River site and is not included in the table. It should be noted that this list is not intended to be exhaustive and should not be used to imply that no other past, present or reasonably foreseeable projects exist that could contribute to cumulative impacts within each alternative site project area.

The impacts to land use that would have a cumulative impact on alternative sites would generally be characterized as a change to the land use designation from “agriculture” to “industrial.” A positive land-use impact, for example, would be the CERP projects. These projects are within the 50-mile radius would redevelop, reuse, or develop additional land for conservation. The cumulative impacts to hydrology and water use would be minimally negative due to the restrictions placed on all surface water and groundwater use, also beneficial impact due to the large scale CERP projects for reservoir and storage areas which would provide additional water to the southern Everglades Agricultural Area, reestablish wetland hydropatterns and improve water quality in several different watersheds by treating excessive discharge. The cumulative impacts for terrestrial/aquatic resources would be associated with the minimal loss of wetlands, which is offset by the restoration of developed lands for conservation and restoration of native species through CERP projects. The cumulative impacts for socioeconomics for the St. Lucie site would appear as beneficial impacts to taxes and adverse impacts on transportation. Also, there would not be any disproportionate impact to low-income or minority populations by the activities at the St. Lucie site.

9.3.4 SUMMARY AND CONCLUSIONS

The decision to locate two additional nuclear power units at the Turkey Point site was based on a comparison of four alternative sites: a greenfield site in south-central Glades County, a greenfield site in southern Okeechobee County, an FPL-owned fossil power plant site in western Martin County, and an FPL-owned nuclear power plant site in eastern St. Lucie County. The FPL evaluation sought to determine whether any of the alternative sites are environmentally preferable to the Turkey Point site to site a pair of new nuclear power units to increase grid capacity in south Florida.

The evaluation process was consistent with the special case noted in NUREG-1555, Section 9.3(III)(8), and considered the advantages already present at existing nuclear facilities within the ROI. As described in Section 9.2, based on FPL knowledge and experience, 23 potential sites were initially identified for consideration (12 greenfield sites, 2 existing nuclear power plant sites, and 9 existing non-nuclear power plant sites). A parallel site identification process involving a GIS regional screening analysis was also conducted, and 6 additional potential greenfield sites were identified. These sites were then evaluated based on a range of performance criteria and weighted scores. After three successive stages of qualitative and quantitative evaluation, 24 sites were determined to be less favorable, and the top five sites were identified. Taking into consideration the results of each evaluation conducted (including satisfying the overall business objectives for the FPL COL project), the Turkey Point site was selected as the proposed site for FPL's new nuclear power generation project, and the Glades, Martin, Okeechobee 2, and St. Lucie sites were identified as the top alternative sites. Turkey Point is reviewed at length in other sections of the ER. This section, Subsection 9.3.3, describes the evaluation of the alternative sites based on reconnaissance level information.

A comparison of the environmental impacts from construction and operation for the proposed site and each of the top alternative sites is presented in Tables 9.3-19 and 9.3-20. The impact summaries presented in these tables indicate that environmental impacts at the Glades, Okeechobee 2, and St. Lucie sites would, in general, be higher than those at the Turkey Point and Martin sites. The magnitude of estimated impacts at Martin and Turkey Point are similar, with each site having MODERATE versus SMALL impacts in one or two of the resource areas evaluated, with Turkey Point having an advantage (SMALL to MODERATE versus LARGE) in the Transportation resource area. Overall, especially given the reconnaissance level information used in developing these estimates, neither Turkey Point nor Martin would be expected to have significantly less environmental impact. Therefore, based on these analyses, FPL concludes that no alternative site is environmentally preferable to the proposed Turkey Point site; accordingly, no alternative site is obviously superior to Turkey Point as the proposed site for its new two-unit nuclear power plant.

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Table 9.3-1 (Sheet 1 of 2)
Regional Screening Criteria

Criterion	Mapped Data	Mapping Criteria	Effect on Candidate Area Identification	Data Source(s)	Comments/Rationale
Cooling Water Availability (Surface Water)	Water sources (major rivers/ canals, existing lakes/reservoirs, coastal areas)	Rivers/canals within the FPL ROI for which the annual mean flow > 500 cfs (approximately 5 times the new plant cooling water requirement[(a)]) and the Atlantic Ocean and Gulf of Mexico	Excluded areas greater than 10 miles from qualifying rivers and 10 miles from the Atlantic Ocean and the Gulf of Mexico	USGS Water-Data Reports	Rivers for which more than 20% of the average flow will be required for makeup water may present permitting or operational water supply problems. The Atlantic Ocean and the Gulf of Mexico were assumed to be a viable source for cooling water makeup. Pumping makeup water more than 10 miles from rivers and the Atlantic Ocean/Gulf of Mexico may impose significant construction and operational costs and can result in operational risks.
Cooling Water Availability (Reclaimed Water)	Wastewater treatment plants	Wastewater treatment plants with an effluent flow rate of at least 20 Mgal/day (one-third the assumed makeup water requirement[(a)])	Excluded areas greater than 10 miles from qualifying wastewater treatment plants	FDEP Reuse Inventory Database and Annual Report	Wastewater treatment plants with a flow of at least one-third of the total makeup requirement (~20 Mgal/day) were identified as potential cooling water sources. Wastewater treatment plants unable to supply the total cooling water requirement would be supplemental sources of cooling water only. Wastewater treatment plants unable to supply at least one-third of the total cooling water requirement were assumed to be uneconomical as makeup water sources.
Population	Population Density	Census block groups where population density > 300 persons/ mi^2	Excluded	2000 Census, updated as available	Areas with > 300 persons/mi^2 likely have multiple imbedded areas > 500 persons/mi^2. Siting outside of these areas would more likely result in a population density less than the NRC guideline of 500 persons/mi^2 within a 20-mile radius of a site.
Dedicated Lands	Lands designated as National Parks, National Wildlife Refuges, National Marine Sanctuary Areas, military installations, Indian lands, and Florida state parks	Boundaries of dedicated lands identified	Excluded	Federal and state agency web sites (see Appendix A).	None.

Table 9.3-1 (Sheet 2 of 2)
Regional Screening Criteria

Criterion	Mapped Data	Mapping Criteria	Effect on Candidate Area Identification	Data Source(s)	Comments/Rationale
Ecological Features mapped on a regional basis	Mapped critical habitat for identified species (see comments column at right)	Areal extent of identified features	Not considered as favorable areas for identification of additional potential sites	U.S. Fish and Wildlife Service (USFWS) Digitized Critical Habitat Data	Regional screening included critical habitat for species for which the USFWS website provided GIS shape files (digital data).This included critical habitat for the following species: American Crocodile, Cape Sable Seaside Sparrow, Choctawhatchee Beach Mouse, Everglade Snail Kite, Frosted Flatwoods Salamander, Gulf Sturgeon, Johnson's Seagrass, Perdido Key Beach Mouse, Piping Plover, Purple Bankclimber, Rice Rat, Right Whale, St. Andrew Beach Mouse.

(a) Assumed makeup water requirements (two units, closed cycle) = 42.000 gpm,~ 100 cfs; ~ 60 Mgal/day).

Table 9.3-2 (Sheet 1 of 2)
Candidate Area Siting Suitability Characteristics

Candidate Area	Siting Suitability Characteristics
CA-1	A significant portion of the western half of the candidate area is covered in wetlands; these areas were avoided for potential site selection.
CA-2	A significant portion of the southern half of the candidate area is covered in wetlands; these areas were avoided for potential site selection. Potential sites in CA-2 were located in the central/southern portion of the candidate area to minimize the distance from the Miami load center and environmental impacts associated with construction of transmission and transportation infrastructure.
CA-3	The northeastern portion of the candidate area is located nearer areas of large population and does not offer any perceived advantages over other sites within the candidate area.
CA-4	The northern portion of the candidate area is located farther from the Miami load center than other sites in the candidate area and does not offer any perceived advantages over other sites within the candidate area.
CA-5	The southern and western portion of the candidate area is covered in wetlands; these areas were avoided for potential site selection.
CA-6 through CA-10	These candidate areas are located in the northern portion of FPL's service territory and are farther from the primary load center in the Miami area. Sites in these candidate areas will be disadvantaged due to the increased environmental impacts associated with construction of transmission infrastructure. These candidate areas do not offer any perceived advantages that would outweigh the increased environmental impacts associated with construction of transmission infrastructure. Additionally, significant portions of CA-6, CA-7, CA-9, and CA-10 are covered in wetlands.
CA-11	The majority of this candidate area is covered in wetlands; these areas were avoided for potential site selection. Additionally, the candidate area is surrounded by areas of large population.
CA-12	The candidate area contains pockets of larger population and is surrounded by areas of large population. Additionally, the wastewater treatment plant in the area can only supply a portion of the cooling water requirement, and access to other sources may be limited.
CA-13	The majority of this candidate area is covered in wetlands; these areas were avoided for potential site selection. The areas not covered in wetlands are developed and closer to areas of large population. During the process of canvassing the candidate areas to identify potential sites, FPL examined areas in southern Florida to attempt to identify potential sites that could potentially use the reuse water from the south Miami area. However, due to population and environmental constraints present in these candidate areas, FPL did not identify any potential sites other than Turkey Point that were located near viable sources of reclaimed water.
CA-14	The majority of the candidate area is populated and surrounded by areas of large population. The candidate area was examined closely to identify any potential sites that could take advantage of reclaimed water in the south Miami area, but no potential sites beyond Turkey Point were identified.

Table 9.3-2 (Sheet 2 of 2)
Candidate Area Siting Suitability Characteristics

Candidate Area	Siting Suitability Characteristics
CA-15	The majority of the candidate area is covered in wetlands. Aside from the area surrounding the St. Lucie nuclear power plant, no viable siting areas were identified in the candidate area.
CA-16	With the exception of the central portion, the majority of the candidate area is covered in wetlands; these areas were avoided for potential site selection. Additionally, pipeline access to the Gulf of Mexico could be complicated by area development, large population, and environmental concerns (e.g., estuarine/marine habitat).

Table 9.3-3 (Sheet 1 of 4)
Screening Evaluation Criteria

Criterion Number	Criterion	Measure of Suitability	
		Metric	**Rating Rationale**
P1	Cooling Water Supply	Composite ratings were based on an average of ratings for the following four aspects: **Flow** – Surface water: Annual mean flow for the period of record as reported by USGS. [http://waterdata.usgs.gov/fl/nwis/current/?type=flow]. Reclaimed water: WWTP flow reported by FDEP. [http://www.dep.state.fl.us/water/reuse/inventory.htm]. Groundwater: Flow estimated based on FPL familiarity with Floridan aquifer, where feasible. Lake Okeechobee: Conservatively estimated to be at least the lower of the low daily mean flow reported for the C44 and C43 canals (360 cfs).	Assumes only 20% of river/canal/lake flows are available for permit/withdrawal. 5 = No practical restriction 4 = Availability greater than 5 times the requirement 3 = Availability 3-5 times the requirement 2 = Availability less than 3 times the requirement 1 = Insufficient flow
		Flexibility – Number of source(s) of water present and capable of providing substantial portion of required flow.	Assumes groundwater only available as an augmentation source (data sources for groundwater availability on an areal basis throughout the ROI were not available). 5 = Multiple sources each capable of full flow required 4 = Additional sources capable of providing substantial portion of flow 3 = One source capable of providing full flow 2 = Multiple sources each capable of providing substantial portion of flow with no single source providing full flow requirements 1 = Insufficient flow regardless of number of sources

Table 9.3-3 (Sheet 2 of 4)
Screening Evaluation Criteria

Criterion Number	Criterion	Measure of Suitability	
		Metric	**Rating Rationale**
		Risk – Associated with flow variability, longer pumping distances and/or other reliability aspects of water supply.	5= All aspects favorable 4= Some favorable aspects 3= Neutral 2= Some risk 1= Substantial risk
		Regulatory Challenge – Known areas with elevated competition for water resources, a high number of water users, difficult supply conditions or challenging compliance situation are ranked lower than those without such challenges, based on knowledge and insights of the FPL siting team.	5= All aspects favorable 4= Some favorable aspects 3= Neutral 2= Some challenges 1= Substantial challenges
P2	Flooding	Flood potential considering difference between mean site elevation and surface water body elevation, proximity to swamp areas, and proximity to flood prone areas (100-year flood zone).	5 = Low flood potential, elevation difference greater than 20 feet, plant site can be located outside of swamp areas and outside of 100-year flood zone. 4 = Moderately low flood potential, elevation difference greater than 10 feet, plant site can be located outside of 100-year flood zone, swamp areas may be encountered. 3 = Moderate flood potential, elevation difference greater than 5 feet, plant site located on border of 100-year flood zone, swamp areas may be encountered. 2 = Moderately high flood potential, elevation difference less than 5 feet, plant site located within 500-year flood zone, swamp areas likely to be encountered. 1 = High flood potential, elevation difference less than 5 feet, plant site located within 100-year flood zone, base flood elevations above site elevation, swamp areas likely to be encountered.

Table 9.3-3 (Sheet 3 of 4)
Screening Evaluation Criteria

Criterion Number	Criterion	Measure of Suitability	
		Metric	**Rating Rationale**
P3	Population	Composite ratings were based on an average of ratings based on the following two conditions: (1) Distance to nearest population center (high density); and (2) Population density of host county (based on 2000 census). In addition, a rating point was deducted or added if the site is or is not in a particularly densely populated area. Population centers are defined as the nearest “place” or “concentration of population” as defined by the U.S. Census Bureau, where a place is either legally incorporated under the laws of its respective state, or a statistical equivalent that the Census Bureau treats as a Census Designated Place (CDP).	5 = No population centers within 20 miles 4 = Population centers between 20 and 15 miles 3 = Population centers between 15 and 10 miles 2 = Population centers between 10 and 5 miles 1= Population centers within 5 miles County Population Density Ratings: 5 = Less than 50 persons per square mile (psm) 4 = Between 250 psm and 50 psm 3 = Between 350 psm and 250 psm 2 = Between 500 psm and 350 psm 1 = Greater than 500 psm A point was added if no densely populated area is found within 40 miles of the site; a point deducted if a densely populated area is found within 15 miles of the site or if a large grouping of densely populated areas are located within 15-40 miles of the site.
P4	Hazardous Land Uses	Number of airports, pipelines, and other known hazardous industrial facilities (including Air Force Bases and Kennedy Space Center/ Cape Canaveral), as determined from publicly available data.	5 = No major airport, city or county airport, military base, or rail within 10 miles [small air fields/landing strips are allowed if no more than 2 within 5 miles] 4 = No major airport (or Air Force Base) within 10 miles, no rail, pipeline small city or county airport within 5 miles [1-2 small air fields/landings strips are ok] 3 = Rail and small airports (multiple) < 5 miles 2 = Major airport or Air Force Base < 10 miles 1 = Major airport or Air Force Base < 10 miles, rail and multiple small airports < 5 miles, and existing plant location
P5	Ecology	Number of Federal Threatened, Endangered and Rare Species in County [aquatic and terrestrial]	5 = 0 species 4 = 1-10 species 3 = 11-20 species 2 = 21-30 species 1 = over 30 species
P6	Wetlands	Number of mapped wetland acres within a 5000 acre nominal site area*, excluding riverine, existing reservoirs, and deepwater marine areas. Note: The use of the term “wetlands” is used solely as a descriptive term and is not used as a regulatory or jurisdictional term.	5 = 0 acres 4 = Between 0 acres and 250 acres, or ≤ 5% of land area 3 = Between 250 acres and 500 acres, or ≤ 10% of land area 2 = Between 500 acres and 1500 acres, or ≤ 30% of land area 1 = Greater than 1500 acres, or > 30% of land area

Table 9.3-3 (Sheet 4 of 4)
Screening Evaluation Criteria

Criterion Number	Criterion	Measure of Suitability	
		Metric	**Rating Rationale**
P7	Railroad Access	Estimated cost of constructing a rail spur to the site, based on distance in miles to the nearest in-service rail line.	Ratings computed by scaling costs from lowest (rating = 5) to highest (rating = 1). 1 = More than 15 miles 2 = Between 15 miles and 10 miles 3 = Between 10 miles and 5 miles 4 = Between 5 miles and 2 miles 5 = Fewer than 2 miles Note: Ratings may be adjusted if barge access is located in the immediate vicinity in lieu of railroad access.
P8	Transmission Access	Transmission access is evaluated in the preliminary screening in terms of distance to the load center in the greater Miami area (Palm Beach, Broward, and Miami-Dade Counties) and amount of new right-of-way that would have to be acquired.	Ratings computed by measuring distances to greater Miami Area Load Center and considering high-level evaluation of transmission issues. 1 = More than 200 miles 2 = Between 200 miles and 100 miles 3 = Between 100 miles and 70 miles 4 = Between 70 miles and 50 miles 5 = Fewer than 50 miles Ratings points adjusted based on amount of new right-of-way that must be acquired and the relative difficulty of acquisition. The plant switchyard is assumed to be the same for all sites.
P9	Land Acquisition	Estimated cost of acquiring land (nominally 3000 acres per site where FPL does not own**), based on the following cost/acre assumptions: – very remote areas - $8000 - $12,000 [used $10,000] – farm areas - $15,000 - $20,000 per acre [used $17,500] – land near population centers - $30,000 - $40,000 per acre [used $35,000]	Ratings computed by scaling costs from lowest to highest as follows: 2 = FPL does not own; site near large population/highest cost 3 = FPL does not own; site in farm area/moderate cost 4 = FPL does not own; site in very remote area/lowest cost 5 = FPL owns sufficient land In instances where FPL owns some land but would need to acquire additional land to accommodate nuclear development, rating based on total cost compared to other greenfield sites, (total acres to be acquired X estimated cost per acre based on metric).

* To provide a consistent basis for site evaluation and comparison across sites in the screening phase wetlands evaluation, each potential site was initially identified as a 5000-acre area, nominally a circle centered on a site centerpoint. The 5000-acre general area provided a general characterization of the presence of wetlands and flexibility in the eventual plant layout. It is also consistent with the upper bound of the Desired Owner Buffer Area as identified by FPL for the site selection study.

** The lower bound of the Desired Owner Buffer Area (i.e., 3000 acres), as identified by FPL for the site selection study, was used for the land acquisition criterion evaluation as the basis for comparing sites according to the need to acquire land and the associated land costs at sites FPL does not already own (or owns but has determined holdings are insufficient for development of two new nuclear units).

Table 9.3-4
Screening Criteria Site Ratings

	Cooling Water Supply	Flooding	Popula-tion	Hazardous Land Uses	Ecology	Wetlands	Railroad Access	Transmis-sion Access	Land Acquisi-tion	
	Weight Factor									
Potential Site Name	**9.5**	**3.9**	**7.6**	**5.0**	**6.1**	**6.4**	**5.6**	**8.5**	**6.5**	**Site Rating**
Charlotte	3	2	4	5	2	1	1	2	3	**152.4**
Collier A	3	1	2	4	2	2	2	2	2	**133.8**
DeSoto	2	4	3	4	3	2	3	3	5	**183.3**
DeSoto A	2	4	3	4	3	3	3	3	3	**176.7**
Ft. Myers	3	2	1	1	2	2	4	2	3	**132.8**
Glades	3	2	4	3	3	3	4	4	3	**195.1**
Glades A	3	3	3	4	3	2	3	4	3	**184.4**
Hardee	2	4	4	3	3	2	5	2	3	**175.6**
Hendry 1	3	2	4	4	3	2	3	4	3	**188.1**
Hendry 2	2	1	5	5	3	1	2	4	3	**175.3**
Hendry A	3	1	3	4	3	2	1	4	3	**165.4**
Highlands	2	5	4	2	1	2	3	2	3	**151.1**
Manatee	3	5	2	3	3	2	4	1	5	**172.7**
Martin	3	2	3	3	2	3	5	5	5	**208.5**
Martin A	3	2	2	3	2	4	4	5	2	**182.2**
Okeechobee 1	2	5	4	4	3	2	3	4	3	**190.3**
Okeechobee 2	3	3	3	3	3	4	4	4	3	**197.8**
Palm Beach A	2	2	1	5	1	1	2	4	3	**136.6**
St. Lucie	4	1	1	3	2	1	4	1	5	**146.5**
Turkey Point	4	1	1	2	1	1	4	5	5	**169.4**
West County	2	2	1	4	1	1	2	2	3	**114.6**

Table 9.3-5 (Sheet 1 of 4)
General Siting Criteria Site Ratings

Health and Safety Criteria

Criteria		Weight Factor	DeSoto		Glades		Glades A		Hendry 1		Martin	
			Rating	Score	Rating	Score	Rating	Score	Rating	Score	Rating	Score
D.1.1.1	Geology/Seismology	**7.9**	5	39.5	5	39.5	5	39.5	5	39.5	5	39.5
D.1.1.2	Cooling System Requirements	**9.6**	2.50	24.0	3.00	28.8	3.25	31.2	3.00	28.8	3.00	28.8
D.1.1.3	Flooding	**3.9**	5	19.5	1	3.9	3	11.7	2	7.8	3	11.7
D.1.1.4	Nearby Hazardous Land Uses	**4.2**	4	16.8	3	12.6	4	16.8	4	16.8	3	12.6
D.1.1.5	Extreme Weather Conditions	**4.6**	3	13.8	3	13.8	3	13.8	3	13.8	3	13.8
D.1.2	Accident Effect Related	**8.1**	4	32.4	4	32.4	4	32.4	4	32.4	3	24.3
D.1.3.1	Surface Water – Radionuclide Pathway	**7.4**	4	29.6	4	29.6	4	29.6	4	29.6	4	29.6
D.1.3.2	Groundwater Radionuclide Pathway	**7.2**	3	21.6	3	21.6	3	21.6	3	21.6	3	21.6
D.1.3.3	Air Radionuclide Pathway	**7.4**	4	29.6	4	29.6	4	29.6	4	29.6	4	29.6
D.1.3.4	Air-Food Ingestion Pathway	**7.5**	1	7.5	1	7.5	1	7.5	1	7.5	2	15.0
D.1.3.5	Surface Water-Food Radionuclide Pathway	**7.4**	1	7.4	2	14.8	2	14.8	1	7.4	1	7.4
D.1.3.6	Transportation Safety	**5.4**	3	16.2	3	16.2	3	16.2	3	16.2	3	16.2

Environmental Criteria

Criteria		Weight Factor	DeSoto		Glades		Glades A		Hendry 1		Martin	
			Rating	Score	Rating	Score	Rating	Score	Rating	Score	Rating	Score
D.2.1.1	Disruption of Important Species/Habitats	**6.4**	4	25.6	4	25.6	4	25.6	4	25.6	4	25.6
D.2.1.2	Bottom Sediment Disruption Effects	**5.1**	3	15.3	3	15.3	3	15.3	3	15.3	3	15.3
D.2.2.1	Disruption of Important Species/Habitats and Wetlands	**6.5**	4.0	26.0	4.5	29.3	4.0	26.0	3.5	22.8	3.5	22.8
D.2.2.2	Dewatering Effects on Adjacent Wetlands	**5.6**	4	22.4	3	16.8	4	22.4	2	11.2	4	22.4
D.2.3.1	Thermal Discharge Effects	**6.1**	3	18.3	3	18.3	4	24.4	3	18.3	3	18.3
D.2.3.2	Entrainment/Impingement Effects	**6.1**	4	24.4	4	24.4	4	24.4	4	24.4	4	24.4
D.2.3.3	Dredging/Disposal Effects	**4.9**	5	24.5	5	24.5	5	24.5	5	24.5	5	24.5
D.2.4.1	Drift Effects on Surrounding Areas	**5.9**	3	17.7	4	23.6	4	23.6	4	23.6	3	17.7

Table 9.3-5 (Sheet 2 of 4)
General Siting Criteria Site Ratings

Health and Safety Criteria

Criteria		Weight Factor	Martin A		Okeechobee 1		Okeechobee 2		St. Lucie		Turkey Point	
			Rating	Score	Rating	Score	Rating	Score	Rating	Score	Rating	Score
D.1.1.1	Geology/Seismology	**7.9**	5	39.5	5	39.5	5	39.5	5	39.5	5	39.5
D.1.1.2	Cooling System Requirements	**9.6**	3.25	31.2	2.75	26.4	3.00	28.8	3.25	31.2	3.25	31.2
D.1.1.3	Flooding	**3.9**	3	11.7	5	19.5	3	11.7	1	3.9	1	3.9
D.1.1.4	Nearby Hazardous Land Uses	**4.2**	3	12.6	4	16.8	3	12.6	3	12.6	2	8.4
D.1.1.5	Extreme Weather Conditions	**4.6**	3	13.8	3	13.8	3	13.8	2	9.2	2	9.2
D.1.2	Accident Effect Related	**8.1**	4	32.4	4	32.4	4	32.4	3	24.3	3	24.3
D.1.3.1	Surface Water – Radionuclide Pathway	**7.4**	4	29.6	4	29.6	4	29.6	5	37.0	5	37.0
D.1.3.2	Groundwater Radionuclide Pathway	**7.2**	3	21.6	2	14.4	2	14.4	2	14.4	2	14.4
D.1.3.3	Air Radionuclide Pathway	**7.4**	4	29.6	4	29.6	4	29.6	5	37.0	5	37.0
D.1.3.4	Air-Food Ingestion Pathway	**7.5**	2	15.0	1	7.5	1	7.5	5	37.5	5	37.5
D.1.3.5	Surface Water-Food Radionuclide Pathway	**7.4**	1	7.4	2	14.8	2	14.8	5	37.0	5	37.0
D.1.3.6	Transportation Safety	**5.4**	3	16.2	3	16.2	3	16.2	3	16.2	3	16.2

Environmental Criteria

Criteria		Weight Factor	Martin A		Okeechobee 1		Okeechobee 2		St. Lucie		Turkey Point	
			Rating	Score	Rating	Score	Rating	Score	Rating	Score	Rating	Score
D.2.1.1	Disruption of Important Species/Habitats	**6.4**	4	25.6	4	25.6	4	25.6	3	19.2	3	19.2
D.2.1.2	Bottom Sediment Disruption Effects	**5.1**	3	15.3	3	15.3	3	15.3	4	20.4	4	20.4
D.2.2.1	Disruption of Important Species/Habitats and Wetlands	**6.5**	4.0	26.0	4.0	26.0	4.5	29.3	3.0	19.5	2.5	16.3
D.2.2.2	Dewatering Effects on Adjacent Wetlands	**5.6**	4	22.4	3	16.8	4	22.4	3	16.8	3	16.8
D.2.3.1	Thermal Discharge Effects	**6.1**	4	24.4	3	18.3	3	18.3	4	24.4	4	24.4
D.2.3.2	Entrainment/Impingement Effects	**6.1**	4	24.4	4	24.4	4	24.4	3	18.3	3	18.3
D.2.3.3	Dredging/Disposal Effects	**4.9**	5	24.5	5	24.5	5	24.5	4	19.6	5	24.5
D.2.4.1	Drift Effects on Surrounding Areas	**5.9**	3	17.7	4	23.6	4	23.6	2	11.8	3	17.7

Table 9.3-5 (Sheet 3 of 4)
General Siting Criteria Site Ratings

Socioeconomic Criteria

Criteria		Weight	DeSoto		Glades		Glades A		Hendry 1		Martin	
		Factor	Rating	Score	Rating	Score	Rating	Score	Rating	Score	Rating	Score
D.3.1	Socioeconomics – Construction – Related Effects	**5.2**	3	15.6	2	10.4	2	10.4	3	15.6	5	26.0
D.3.3	Environmental Justice	**4.3**	5	21.5	5	21.5	5	21.5	5	21.5	5	21.5
D.3.4	Land Use	**5.4**	3	16.2	3	16.2	3	16.2	3	16.2	3	16.2

Engineering and Cost Related Criteria

Criteria		Weight	DeSoto		Glades		Glades A		Hendry 1		Martin	
		Factor	Rating	Score	Rating	Score	Rating	Score	Rating	Score	Rating	Score
D.4.1.1	Water Supply	**8.5**	1	8.5	3	25.5	3	25.5	3	25.5	3	25.5
D.4.1.2	Pumping Distance	**5.6**	3	16.8	4	22.4	3	16.8	3	16.8	4	22.4
D.4.1.3	Flooding	**4.1**	5	20.5	3	12.3	4	16.4	4	16.4	5	20.5
D.4.1.5	Civil Works	**4.8**	3.0	14.4	2.0	9.6	3.0	14.4	2.0	9.6	2.5	12.0
D.4.2.1	Railroad Access	**6.7**	3	20.1	4	26.8	3	20.1	3	20.1	5	33.5
D.4.2.2	Highway Access	**6.6**	5	33.0	5	33.0	4	26.4	4	26.4	5	33.0
D.4.2.3	Barge Access	**6.7**	1	6.7	3	20.1	3	20.1	3	20.1	4	26.8
D.4.2.4	Transmission Access	**8.6**	3	25.8	4	34.4	4	34.4	4	34.4	5	43.0
D.4.3.1	Topography	**3.4**	5	17.0	5	17.0	5	17.0	5	17.0	5	17.0
D.4.3.2	Land Rights	**5.6**	5	28.0	3	16.8	3	16.8	3	16.8	5	28.0
D.4.3.3	Labor Rates	**5.4**	5	27.0	5	27.0	5	27.0	5	27.0	3	16.2

Composite Site Rating	**DeSoto**	**Glades**	**Glades A**	**Hendry 1**	**Martin**
	703.2	**721.1**	**733.9**	**700.1**	**762.7**

Table 9.3-5 (Sheet 4 of 4)
General Siting Criteria Site Ratings

Socioeconomic Criteria

Criteria		Weight Factor	Martin A		Okeechobee 1		Okeechobee 2		St. Lucie		Turkey Point	
			Rating	Score	Rating	Score	Rating	Score	Rating	Score	Rating	Score
D.3.1	Socioeconomics – Construction – Related Effects	**5.2**	5	26.0	3	15.6	3	15.6	5	26.0	5	26.0
D.3.3	Environmental Justice	**4.3**	5	21.5	5	21.5	5	21.5	5	21.5	5	21.5
D.3.4	Land Use	**5.4**	2	10.8	3	16.2	3	16.2	3	16.2	4	21.6

Engineering and Cost Related Criteria

Criteria		Weight Factor	Martin A		Okeechobee 1		Okeechobee 2		St. Lucie		Turkey Point	
			Rating	Score	Rating	Score	Rating	Score	Rating	Score	Rating	Score
D.4.1.1	Water Supply	**8.5**	3	25.5	1	8.5	3	25.5	5	42.5	5	42.5
D.4.1.2	Pumping Distance	**5.6**	4	22.4	3	16.8	4	22.4	5	28.0	5	28.0
D.4.1.3	Flooding	**4.1**	4	16.4	5	20.5	4	16.4	2	8.2	2	8.2
D.4.1.5	Civil Works	**4.8**	3.0	14.4	3.0	14.4	2.0	9.6	3.0	14.4	3.0	14.4
D.4.2.1	Railroad Access	**6.7**	4	26.8	3	20.1	4	26.8	4	26.8	4	26.8
D.4.2.2	Highway Access	**6.6**	5	33.0	5	33.0	5	33.0	5	33.0	5	33.0
D.4.2.3	Barge Access	**6.7**	3	20.1	3	20.1	3	20.1	5	33.5	5	33.5
D.4.2.4	Transmission Access	**8.6**	5	43.0	4	34.4	4	34.4	1	8.6	5	43.0
D.4.3.1	Topography	**3.4**	5	17.0	5	17.0	5	17.0	5	17.0	5	17.0
D.4.3.2	Land Rights	**5.6**	2	11.2	3	16.8	3	16.8	5	28.0	5	28.0
D.4.3.3	Labor Rates	**5.4**	3	16.2	4	21.6	4	21.6	3	16.2	2	10.8

	Martin A	Okeechobee 1	Okeechobee 2	St. Lucie	Turkey Point
Composite Site Rating	**745.2**	**711.5**	**731.2**	**769.7**	**807.5**

Table 9.3-6
Candidate Site Ratings

	Technical Analysis Composite Rating/Score	Environ-mental Impact	Trans-mission	Land Acquisition	Reliability (Trans-mission)	Reliability (Generation)	Public Acceptance	Political (Local)	Political (State)	Transmission Takeaway Feasibility	Schedule Compati-bility	Site Layout
Glades	721.13	1	2	2	2	1	1	1	1	2	2	1
Martin	762.72	1	1	1	1	2	3	3	3	2	1	1
Okeechobee 2	731.23	1	2	3	2	2	2	1	1	3	3	1
St. Lucie	769.72	3	3	1	3	2	3	3	1	1	1	3
Turkey Point	807.51	2	1	1	1	3	1	2	1	1	1	2

* Note: A scale of 1 (more favorable) to 3 (less favorable) is used in this Table

Table 9.3-7
Estimate of Potentially Affected Areas by Land Cover Type
Glades Alternative Site

Land Use Description	FLUCCS Code	Potentially Affected Area [acres] Entire Project including transmission corridor	Potentially Affected Area [acres] Transmission Corridor only
Extractive	160	32.7	—
Holding Ponds	166	35.4	—
Improved Pastures	211	1,443.3	1,263.1
Unimproved Pastures	212	10.9	9.0
Woodland Pastures	213	173.7	173.7
Row Crops	214	311.4	311.4
Field Crops	215	4,087.7	1,352.6
Citrus Groves	221	851.5	851.5
Aquaculture	254	4.1	4.1
Herbaceous (Dry Prairie)	310	69.6	69.6
Shrub and Brushland	320	2.8	2.8
Mixed Rangeland	330	35.9	35.9
Upland Hardwood Forests	420	16.6	7.0
Brazilian Pepper	422	50.8	50.8
Live Oak	427	8.5	8.5
Cabbage Palm	428	6.3	6.3
Hardwood-Coniferous Mixed	434	18.5	18.5
Coniferous Plantations	441	16.3	—
Streams and Waterways	510	57.8	57.8
Ditches	511	145.3	0.1
Lakes	520	1.5	1.5
Reservoirs	530	0.2	0.2
Reservoirs less than 10 acres	534	1.4	—
Mixed Wetland Hardwoods	617	419.9	358.8
Exotic Wetland Hardwoods	619	185.9	9.4
Cypress	621	43.3	43.3
Wetland Forested Mixed	630	0.2	0.2
Freshwater Marshes	641	934.6	902.3
Wet Prairies	643	256.0	220.2
Emergent Aquatic Vegetation	644	33.2	33.2
Roads and Highways	814	1.5	1.5
Electric Power Facilities	831	1.1	1.1
Electrical Power Transmission Lines	832	29.5	29.5

Table 9.3-8 (Sheet 1 of 2)
Listed Species Documented or Reported in Glades County
August 2011

Scientific Name	Common Name	Federal Status	State Status
Amphibians			
Rana capito	Gopher Frog	N	LS
Birds			
Ammodramus savannarum floridanus	Florida Grasshopper Sparrow	LE	LE
Aphelocoma coerulescens	Florida Scrub-jay	LT	LT
Aramus guarauna	Limpkin	N	LS
Athene cunicularia floridana	Florida Burrowing Owl	N	LS
Campephilus principalis	Ivory-billed Woodpecker	LE	
Caracara cheriway	Crested Caracara	LT	LT
Egretta caerulea	Little Blue Heron	N	LS
Egretta thula	Snowy Egret	N	LS
Egretta tricolor	Tricolored Heron	N	LS
Eudocimus albus	White Ibis	N	LS
Falco sparverius paulus	Southeastern American Kestrel	N	LT
Grus americana	Whooping Crane	XN	—
Grus mbricate pratensis	Florida Sandhill Crane	N	LT
Mycteria Americana	Wood Stork	LE	LE
Pelecanus occidentalis	Brown Pelican	N	LS
Picoides borealis	Red-cockaded Woodpecker	LE	LS
Polyborus plancus audubonii	Audubon’s Crested Caracara	LT	—
Rostrhamus sociabilis plumbeus	Snail Kite	LE	LE
Gastropods (Snails)			
Orthalicus reses reses	Stock Island Tree Snail	LT	LE
Mammals			
Puma concolor coryi	Florida Panther	LE	LE
Puma concolor (all subsp. Except coryi)	Puma (Mountain Lion)	SAT	—
Sciurus niger shermani	Sherman’s Fox Squirrel	N	LS
Trichechus manatus	Manatee	LE	LE
Ursus americanus floridanus	Florida Black Bear	N	LT
Plants and Lichens			
Cucurbita okeechobeensis	Okeechobee Gourd	LE	LE
Hypericum edisonianum	Edison’s Ascyrum	N	LE
Warea carteri	Carter’s Mustard	LE	—

Table 9.3-8 (Sheet 2 of 2)
Listed Species Documented or Reported in Glades County
August 2011

Scientific Name	Common Name	Federal Status	State Status
Reptiles			
Alligator mississippiensis	American Alligator	SAT	LS
Crocodylus acutus	American Crocodile	LT	LE
Drymarchon couperi	Eastern Indigo Snake	LT	LT
Gopherus polyphemus	Gopher Tortoise	N	LT

FEDERAL STATUS
LE Endangered: species in danger of extinction throughout a significant portion of its range.
LT Threatened: species likely to become Endangered within the foreseeable future throughout a significant portion of its range.
SAT Treated as threatened because of similarity of appearance to a species that is federally listed so that enforcement personnel have difficulty in attempting to differentiate between the listed and unlisted species.
XN Nonessential experimental population.
N Not currently listed, nor currently being considered for listing as Endangered or Threatened.

STATE LEGAL STATUS
LE Endangered: species, subspecies, or isolated population so few or depleted in number or so restricted in range that it is in imminent danger of extinction.
LT Threatened: species, subspecies, or isolated population facing a very high risk of extinction in the future.
LS Species of Special Concern is a species, subspecies, or isolated population which is facing a moderate risk of extinction in the future.

Sources:FNAI, 2011
USFWS, Feb 2010

Table 9.3-9 (Sheet 1 of 12)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Glades Alternative Site

Project Name	Summary of Project	Location	Status	Reference
Energy Projects				
Charlotte County Solid Waste Management Facility - Landfill Gas to Energy Project	Two-unit, 3.2-MW landfill gas-fired plant	49 miles west of the Glades Site	Proposed. Air construction permit issued November 2009.	FDEP Nov 2009a
Desoto County Energy Park	Two-unit, 340-MW gas- and oil-fired plant	48 miles northwest of the Glades Site	Operational	FDEP Jan 2008a
Florida Gas Transmission - Phase VIII Expansion Project	Construction and operation of 483.2 miles of pipeline facilities, including an 89.8-mile long natural gas pipeline in a new right-of-way that runs from DeSoto County through Highlands and Okeechobee Counties to the FPL Martin Plant site.	DeSoto, Highlands, Okeechobee, and Martin Counties	Proposed. Final EIS issued September 2009.	FERC Sep 2009
Floridian Natural Gas Storage Company - Natural Gas Storage Facility	Liquefied natural gas storage, liquefaction, and vaporization facility with storage capacity of eight billion cubic feet of natural gas	43 miles northeast of the Glades Site	Proposed. Final EIS issued July 2008.	FERC Jul 2008
FPL - DeSoto Next Generation Solar Energy Center	25-MW solar photovoltaic plant	50 miles northwest of the Glades Site	Operational	FPL Feb 2010
FPL - Fort Myers Plant	Two-unit, 2503-MW gas- and oil-fired plant	39 miles southwest of the Glades Site	Operational	FDEP Jan 2008b
FPL - Martin Next Generation Solar Energy Center	75-MW solar thermal plant	40 miles northwest of the Glades Site	Proposed. Currently under construction, expected completion 3Q 2010.	FPL May 2008
FPL - Martin Plant	Five-unit, 3734-MW gas- and oil-fired plant	45 miles northwest of the Glades Site	Operational	FDEP Nov 2009b
FPL - West County Energy Center	Two-unit, 2500-MW gas-fired plant	50 miles southeast of the Glades Site	Operational	FDEP Jul 2008a
FPL - West County Energy Center, Unit 3	Single-unit, 1250-MW gas-fired plant	50 miles southeast of the Glades Site	Proposed. Unit 3 under construction, expected completion in 2011.	FDEP Jul 2008a
FPL - St. Lucie Plant	Two-unit, 1680-MW nuclear plant	67 miles northeast of the Glades Site	Operational	FPL Dec 2007
FPL - St. Lucie Uprate Project	The project will increase the net electrical generation for Units 1 & 2 by 104-MW each.	67 miles northeast of the Glades Site	Proposed. Site Certification Application approved by FPSC in 2008.	FPL Dec 2007
Highlands Ethanol Facility	39.4-MGPY cellulosic ethanol refinery	20 miles northeast of the Glades Site	Proposed. Air Construction Permit issued March 2010.	FDEP Mar 2010a

Table 9.3-9 (Sheet 2 of 12)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Glades Alternative Site

Project Name	Summary of Project	Location	Status	Reference
Indiantown Cogeneration Plant	Single-unit, 330-MW coal-fired plant with 2 gas-fired auxiliary boilers.	43 miles northeast of the Glades Site	Operational	FDEP Jan 2010
Lee County Resource Recovery Facility	Three-unit, 60-MW municipal solid waste (MSW)-fired plant	40 miles southwest of the Glades Site	Operational	FDEP Jul 2009
New Hope Power Company - Okeelanta Cogeneration Plant	Three-unit, 140-MW biomass-fired plant	31 miles southeast of the Glades Site	Operational	FDEP May 2005
Okeechobee Landfill - Landfill Gas to Energy Project	Four- unit, 25.5-MW landfill gas-fired plant	46 miles northeast of the Glades Site	Proposed. Air construction permit issued April 2010.	FDEP Apr 2010
Southeastern Renewable Fuels Biorefinery and Cogeneration Plant	22 MGPY cellulosic ethanol refinery and a 30-MW biomass-fired power plant	20 miles southeast of the Glades Site	Proposed. Application for air construction permit submitted March 2010.	Golder Mar 2010
Tampa Electric Company - J.H. Phillips Station	Two-unit, 42-MW oil-fired plant	44 miles northwest of the Glades Site	Operational	FDEP May 2009
Transportation Projects				
Arcadia Municipal Airport	General aviation airport	48 miles northwest of the Glades Site	Operational. Limited expansion would occur in the future, as described in state and local planning documents.	FDOT 2009
Immokalee Regional Airport	Air cargo and general aviation airport	30 miles southwest of the Glades Site	Operational. Expansion and construction would occur in the future, as described in state and local planning documents.	FDOT 2009
Indiantown Airport	General aviation airport	47 miles northeast of the Glades Site	Operational. Limited expansion would occur in the future, as described in state and local planning documents.	FDOT 2009
Okeechobee County Airport	General aviation airport	36 miles northeast of the Glades Site	Operational. Expansion and construction would occur in the future, as described in state and local planning documents.	FDOT 2009

Table 9.3-9 (Sheet 3 of 12)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Glades Alternative Site

Project Name	Summary of Project	Location	Status	Reference
Page Field Airport	General aviation and reliever airport for Southwest Florida International	46 miles southwest of the Glades Site	Operational. Expansion and construction would occur in the future, as described in state and local planning documents.	FDOT 2009
Palm Beach County Glades Airport	General aviation airport	29 miles east of the Glades Site	Operational. Limited expansion would occur in the future, as described in state and local planning documents.	FDOT 2009
Sebring Regional Airport	General aviation airport. The old runway system is now Sebring International Raceway.	45 miles north of the Glades Site	Operational. Limited expansion would occur in the future, as described in state and local planning documents.	FDOT 2009
Shell Creek Airpark	General aviation airport	47 miles west of the Glades Site	Operational. Limited expansion would occur in the future, as described in state and local planning documents.	FDOT 2009
Southwest Florida International Airport	Full service airport - commercial airlines, air cargo, and general aviation	41 miles southwest of the Glades Site	Operational. Expansion and construction would occur in the future, as described in state and local planning documents.	FDOT 2009
Tampa - Orlando - Miami High-Speed Intercity Passenger Rail	This project would provide high-speed rail service from Tampa to Miami (through Orlando) with stops in West Palm Beach and Ft. Lauderdale. The termini for the Orlando -Miami corridor are the Orlando International Airport (OIA) and the Miami Intermodal Center at the Miami Airport (MIA).	Route follows the Florida Turnpike corridor from Orange County through Osceola, Okeechobee, St. Lucie, Martin and Palm Beach Counties	Proposed. Phase 1 (Tampa-Orlando corridor) is ongoing. Project development for Phase 2 (Orlando-Miami corridor) began in May 2010.	FDOT May 2010
Parks and Nature Preserve Facilities				
Archbold Biological Station	An independent, non-profit research facility, devoted to long-term ecological research and conservation. The Station owns and manages a 5,000-acre preserve that is a matrix of pristine native vegetation, including oak and rosemary scrubs, pine flatwoods, and cutthroat seeps and seasonal wetlands. The station also manages the 10,500-acre MacArthur Agro-ecology Research Center (MAERC) at Buck Island Ranch.	27 miles northwest of the Glades Site	Development likely limited within this area	ABS Feb 2004

Table 9.3-9 (Sheet 4 of 12)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Glades Alternative Site

Project Name	Summary of Project	Location	Status	Reference
Arthur R. Marshall Loxahatchee National Wildlife Refuge	Management of species and habitats to enhance the native biodiversity and integrity of the Everglades ecosystem. Recreational activities include hunting, fishing, canoeing, boating, and wildlife viewing.	47 miles southeast of the Glades Site	Additional land acquisition and expansion of visitor facilities are planned. Other development would be limited within this refuge.	USFWS Sep 2000
Babcock Ranch Preserve	The 73,239-acre state conservation activities include cattle ranching, silviculture tenant farming, horticultural debris disposal, ecotourism, and natural resource based recreation such as hiking, hunting, and fishing.	25 miles west of the Glades Site	Addition of hiking, biking, and horse trails and camping facilities is planned. Other development would be limited.	FFWCC Jul 2008
Barley Barber Swamp	A one-mile boardwalk runs through a cypress swamp. On FLP owned Martin site land. Public access requires advance reservation.	36 miles northeast of the Glades Site	Development likely limited within this refuge	FFWCC Jul 2010
Big Cypress National Preserve	Over 729,000 acres of valuable habitat for a variety of threatened and endangered species, including the Florida panther, West Indian manatee, red cockaded woodpecker, and wood storks. Public recreational activities include bird watching, camping, canoeing, bicycling, off road vehicles, hunting, hiking, and wildlife observation.	41 miles south of the Glades Site	Additional facilities to further accommodate public use such as hunting, hiking, boat, and van tours are planned. Other development likely limited within property.	NPS Jun 2009
Big Water Heritage Trail	Scenic auto route circling Lake Okeechobee passing though five counties and going by multiple natural and historic sites.	2 miles east of the Glades Site	Development likely limited at specific points along the trail.	SWFRPC 2009
Dinner Island Ranch Wildlife Management Area	The 21,667-acre property was purchased as part of the Panther Glades Florida Forever Land Acquisition Project to protect and manage significant natural habitat of exotic plant and animals.	23 miles south of the Glades Site	Additional land acquisition is planned. Development likely limited within property.	FFWCC Jun 2005
DuPuis Wildlife and Environmental Area	21,875 acres managed to conserve and protect water resources as well as protect and restore land resources to its natural state. Recreation activities include hunting, fishing, horseback and bicycle riding, canoeing, camping, and hiking.	36 miles east of the Glades Site	Development likely limited within this refuge.	SFWMD Jun 2008
Estero Bay Preserve State Park	10,405 acres managed to protect Estero Bay's water quality, and its native plants and animals. Recreational opportunities include bicycling, hiking, bird watching, and nature appreciation.	Closest parcel of land is 50 miles southwest of the Glades Site	Additional land acquisition is planned. Development likely limited within property.	FDEP Dec 2004

Table 9.3-9 (Sheet 5 of 12)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Glades Alternative Site

Project Name	Summary of Project	Location	Status	Reference
Fisheating Creek Wildlife Management Area	The 18,272-acre property is used for conservation and protection of the natural communities along the shores of Fisheating Creek. Contains natural summer roosts for endangered swallowtail kites.	6 miles northwest of the Glades Site	Development limited within property.	FFWCC Feb 2003
Florida National Scenic Trail	Scenic hiking trail stretches over 1400 miles across the state and traverses nearly all of Florida's unique habitats and includes the Lake Okeechobee Scenic Trail. Portions of the trail are accessible for bicycling, horseback riding, or inline skating.	2 miles east of the Glades Site	Development likely limited at specific points along the trail.	USDAFS Feb 2006
Florida Panther National Wildlife Refuge	Home to one of the last populations of the endangered Florida panther. Established to conserve fish, wildlife, and plants which are listed as endangered or threatened species. Recreational activities are limited to hiking and wildlife viewing.	43 miles south of the Glades Site	Development likely to be minor and limited within this refuge.	USFWS Oct 1998
Highlands Hammock State Park	One of Florida's first state parks. Public outdoor recreation and conservation is the designated single use of the 9251 acre property. Recreation activities include camping, picnicking, hiking, horse and bicycle riding,	45 miles northwest of the Glades Site	Development includes, refurbishing of existing facilities, and creating an additional day use area.	FDEP Feb 2007
Hungryland Wildlife and Environmental Area	The 10,294-acre property was purchased to conserve and protect environmentally unique and irreplaceable lands including relatively undisturbed, high quality pine flatwoods. Recreation activities include hiking, horseback riding, hunting, and fishing.	47 miles east of the Glades Site	Development likely limited within this property.	FFWCC Feb 2002
J.W. Corbett Wildlife Management Area	Management of unique tropical hardwood hammocks and slash pine flatwoods habitat of the South Florida systems and recovery of the endangered and threatened species that occur there. The vast majority of the 60,288-acre property is used for wildlife management and public hunting.	41 miles east of the Glades Site	Additional land acquisition is planned. Planned public uses will include hunting, fishing, and horseback riding.	FFWCC Apr 2003
Kissimmee Prairie Preserve State Park	Public outdoor recreation and conservation is the single use of the 53,760-acre property. Recreation activities include hiking, biking and horse riding trails, camping, picnicking, and interpretive programs.	47 north of the Glades Site	Development of new visitor center is planned. Other development likely limited within this property	FDEP Apr 2005a

Table 9.3-9 (Sheet 6 of 12)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Glades Alternative Site

Project Name	Summary of Project	Location	Status	Reference
Koreshan State Historic Site	The site is comprised of a 142-acre historic district that contains natural landscapes and the remains of a utopian pioneer settlement dating to the 1890's, and 52 acres of mangrove community located at the mouth of the Estero River. Recreation activities include picnicking, fishing, camping, nature study and boating.	50 miles southwest of the Glades Site	Development likely limited within this property	FDEP Aug 2003
Lake June in Winter Scrub State Park	Some of the finest remnants of scrub habitat found in peninsular Florida and supports a significant population of Florida scrub jays and five listed plant species. The primary recreation activities focus on the shoreline of the lake.	34 miles northwest of the Glades Site	Development likely limited within this property	FDEP Feb 2004
Lake Okeechobee	Lake Okeechobee is the second largest freshwater lake within the continental United States and is a nationally recognized bass and pan fishing resource. The lake offers other recreational amenities as well. Air boat and swamp buggy rides, bike riding, hiking, picnicking, camping, and nature interpretation are popular land-based recreation activities in the region.	5 miles northeast of the Glades Site	Development likely limited within this area	FDEP Jun 2010
Lake Okeechobee Scenic Trail	A 110 mile long hiking trail circling Lake Okeechobee atop the Herbert Hoover Dike offers scenic views of lakeside and agricultural landscapes. The trail provides opportunities for hiking, bicycle and horseback riding, bird watching, and fishing.	2 miles east of the Glades Site	Development likely limited at specific points along the trail.	FDEP Jun 2010
Lake Wales Ridge National Wildlife Refuge	Management of unique scrub habitat of the Central Florida ridge systems and recovery of the endangered and threatened species that occur there. Public access to refuge is limited to guided tours only.	Closest parcel of land is 24 miles northwest of the Glades Site	Additional land acquisition is planned. Development likely limited within this area.	USFWS Apr 2010
Lake Wales Ridge Wildlife and Environmental Area	Management and restoration of unique scrub habitat of the Central Florida ridge systems and recovery of the endangered and threatened species that occur there. Public access to refuge is limited to guided tours only.	Closest parcel of land is 24 miles northwest of the Glades Site	Development likely limited within this area.	FFWCC Sep 2002

Table 9.3-9 (Sheet 7 of 12)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Glades Alternative Site

Project Name	Summary of Project	Location	Status	Reference
Okaloacoochee Slough Wildlife Management Area	A 2,923-acre property managed to maintain and restore the Okaloacoochee Slough sawgrass marsh unique lands and threatened and endangered species associated with it. Public activities include hunting, fishing, bird watching, horseback riding, hiking, nature study, wildlife viewing, picnicking, and primitive camping. Access limited to eastern side of property.	17 miles southwest of the Glades Site	Additional acquisition is planned of surrounding land. Development likely limited within this area.	FFWCC Dec 2001
Spirit of the Wild Wildlife Management Area	This 7487-acre property is managed to protect existing slough or “river grass” natural community which forms an important habitat for numerous species of special concern, as well as form a hydrological connection with protected lands to the east and south. Public recreation activities include hunting, fishing, horseback riding, hiking, nature study, wildlife viewing, picnicking, and primitive camping.	20 miles southwest of the Glades Site	Additional acquisition is planned. Development likely limited within this area.	FFWCC Sep 2006
Comprehensive Everglades Restoration Plan Projects				
C-43 Basin Aquifer Storage and Recovery	The project will consist of aquifer storage and recovery wells with a capacity of approximately 220 million gallons per day in order to capture C-43 Basin runoff and releases from Lake Okeechobee.	24 miles southwest of the Glades Site	Currently in pre-construction design. Pilot plant in operation.	USACE Undated
Caloosahatchee River (C-43) West Basin Storage	Project to establish in Hendry County, a large storage reservoir along the Caloosahatchee River to capture and store stormwater runoff from the C-43 basin and reduce excess water flow to the Caloosahatchee Estuary. It will also capture and store regulatory releases from Lake Okeechobee, reducing discharges to coastal estuaries.	21 miles southwest of the Glades Site	Proposed. Test cell completed. Construction scheduled to begin in 2011.	SFWMD Jun 2010, USACE Nov 2009
C-44 Reservoir and Storage and Treatment Area	A component of the Indian River Lagoon - South Project consisting of a 3,400-acre reservoir and 6200 acres of emergent vegetation.	49 miles east of the Glades Site	Design and land acquisition for this project is completed. Construction is anticipated to begin in 2011.	SFWMD Feb 2006, USACE Feb 2010
Everglades Agricultural Area Storage Reservoirs - Phase 1	Project consists of a large above-ground storage reservoir on former farmlands designed to provide significant additional water in the southern region of the Everglades Agricultural Area.	32 miles southeast of the Glades Site	Construction of the A-1 Reservoir was initiated in 2006, but has been subsequently suspended in since 2008 due to litigation.	SFWMD Jun 2010, USACE Nov 2009

Table 9.3-9 (Sheet 8 of 12)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Glades Alternative Site

Project Name	Summary of Project	Location	Status	Reference
Flows to Northwest and Central Water Conservation Areas 3A	Project will increase depths, extend wetland hydropatterns, and increase water supply availability in the northwest corner and west-central portions of WCA 3A.	43 miles southeast of the Glades Site	Proposed. Project design underway.	USACE Undated
Indian River Lagoon - South Project	The project includes construction of several above-ground reservoirs and stormwater treatment areas. The project will use constructed wetlands and muck removal to improve surface water management and water quality of several canal basins, as well as, improve habitat in the St. Lucie Estuary and Indian River Lagoon.	41 miles northeast of the Glades Site	Proposed. Project is scheduled to begin in 2010.	SFWMD Jun 2010, USACE Nov 2009, USACE Feb 2010
Lake Okeechobee Aquifer Storage and Recovery	Project proposes to increase regional storage while reducing both evaporation losses and the amount of land removed from current land use. This will be accomplished by a series of aquifer storage and recovery wells adjacent to Lake Okechobee with a capacity of one billion gallons per day and the associated pre- and post-water quality treatment facilities.	2 miles east of the Glades Site	Five separate ASR pilot projects have been constructed around Lake Okeechobee and have provided five years of field data. Two more pilot systems began cycle testing in 2008.	USACE Undated, USACE Jun 2008
Lake Okeechobee Watershed Project	Construction of a 1984-acre reservoir and 3975-acre treatment area in the Taylor Creek/Nubbin Slough basin; a 10,281-acre reservoir in the Kissimmee River basin; a 5416-acre reservoir and 8044-acre treatment area in the Lake Istokpoga basin, and a 3730-acre wetland restoration site in Paradise Run in order to increase aquatic and wildlife habitat, regulate lake staging, reduce phosphorus loading, and reduce damaging releases to the surrounding estuaries.	Various locations in Okeechobee County	Proposed. Project is scheduled to begin in 2019.	USACE Undated, USACE Nov 2009
Melaleuca Eradication and other Exotic Plants	Project enhances efforts to control invasive exotic species in south Florida through mass clearing and controlled release of biological agents throughout the region.	Throughout the region	Proposed. Project is scheduled to begin in 2011.	USACE Nov 2009
Miccosukee Tribal Water Management Plan	Project includes providing water storage capacity and water quality enhancement for Miccosukee Tribe's reservation discharge waters and conversion of 900 acres tribally owned cattle pasture into a managed wetland retention/detention area.	43 miles southeast of the Glades Site	Currently in pre-construction design.	USACE Undated

Table 9.3-9 (Sheet 9 of 12)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Glades Alternative Site

Project Name	Summary of Project	Location	Status	Reference
Modify Holey Land Wildlife Management Area Operation Plan	Modifications to the current operating plan for Holey Land WMA will implement rain-driven operations as needed and will be made to improve the timing and location of water depths.	35 miles southeast of the Glades Site	Project in planning stage.	USACE Undated
Modify Rotenberger Wildlife Management Area Operation Plan	Modifications to the current operating plan for the Rotenberger WMA will implement rain-driven operations as needed and will be made to improve the timing and location of water depths.	32 miles south of the Glades Site	Project in planning stage.	USACE Undated
North Palm Beach County - Part 1	Part 1 of this project includes portions of seven basins that will capture, store and treat excess water that is currently discharged to the Lake Worth Lagoon and use that water to enhance the Loxahatchee River, Loxahatchee Slough, and West Palm Beach Water Catchment Area.	46 miles east of the Glades Site	Project in pre-construction, engineering, and design phase. Part 1 construction is estimated to be completed in 2014.	USACE Undated, USACE May 2005
Central and Southern Florida (C&SF) Projects				
Herbert Hoover Dike Rehabilitation	Project to strengthen the 143-mile dike that surrounds Lake Okeechobee.	2 miles east of the Glades Site	Construction is underway on the southeast section of the dike. Completion of the project is anticipated in 2025.	USACE Nov 2009
Southern Corkscrew Regional Ecosystem Watershed (CREW)	Project consists of 28,540 acres of predominantly swale and strand swamp communities to be restored to native conditions. Public recreation activities include hiking, horseback riding, primitive camping, hunting, fishing, and nature appreciation.	44 miles southwest of the Glades Site	Project will continue to improve and restore the hydrology and ecology of the project area (along with resulting benefits to upstream and downstream lands. Additional land acquisition required to reach target goals.	SFWMD May 2006
Other Ecosystem Restoration Projects				
Kissimmee River Restoration Project	Project to restore over 40 square miles of river and floodplain ecosystem, including 43 miles of meandering river channel and 27,000 acres of wetlands. The project will reestablish a favorable environment for the flora and fauna that existed in the area prior to the 1960s, when the river was altered to provide flood protection.	Closest parcel 39 miles north of the Glades Site	Restoration efforts are underway and are expected to be completed in 2013.	USACE Nov 2009

Table 9.3-9 (Sheet 10 of 12)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Glades Alternative Site

Project Name	Summary of Project	Location	Status	Reference
Lakes Park Restoration	Project to improve water quality at Lakes Park in Lee County through a three-phased approach. Phases I and II have been completed. Phase III involves creating a 40-acre flow-way marsh, which will act as a natural filter cleansing nutrients from the lakes. Reduced nutrients and proper water elevations will aid in the control of aquatic and upland exotic plant species and improve native habitat.	48 miles southwest of the Glades Site	Proposed. Construction of the filter marsh and flow-way are anticipated to begin in 2011.	SFWMD Jun 2010
Lakeside Ranch Storage and Treatment Area	Construction of a 2700-acre wetland in western Martin County that will use emergent vegetation to remove phosphorus from stormwater runoff in the Taylor Creek/ Nubbin Slough basin before it enters Lake Okeechobee. The project has been divided into two phases, STA North and STA South.	37 miles northeast of the Glades Site	Construction of STA North began in 2009. Final design of STA South is scheduled to be completed in 2010, and construction is scheduled to begin in 2011.	SFWMD Jun 2010, USACE Nov 2009
Seminole Big Cypress Water Conservation Plan	Water management system designed to reduce flood damage and promote water conservation on the Seminole Tribe's Big Cypress Basin Reservation, the Big Cypress National Preserve, and the Everglades Protection Area. Includes construction of conveyance canals, water storage cells, and a new pump station.	34 miles south of the Glades Site	Construction expected to be completed in 2010.	USACE Nov 2009
Mining Projects				
Babcock Mine	Crushed stone mine	37 miles west of the Glades Site	Operational	USGS 2005
Bonita Pit	Crushed stone mine	48 miles southwest of the Glades Site	Operational	USGS 2005
Charlotte County Shell Quarry	Crushed stone mine	38 miles northwest of the Glades Site	Operational	USGS 2005
Coral Rock Quarry	Crushed stone mine	37 miles west of the Glades Site	Operational	USGS 2005
Florida Rock Industries, Inc. Alico Rock Quarry	Crushed stone mine	38 miles southwest of the Glades Site	Operational	USGS 2005
Lake Point Mine	Development of a 959-acre commercial limestone quarry in Martin County	37 miles northeast of the Glades Site	Proposed. CWA Section 404 permit application submitted April 2010.	
Ortona Mine & Plant	Sand and gravel mine	9 miles west of the Glades Site	Operational	USGS 2005

Table 9.3-9 (Sheet 11 of 12)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Glades Alternative Site

Project Name	Summary of Project	Location	Status	Reference
Ortona Sand Mine Expansion	154-acre expansion of sand mining operation in Glades County	8 miles west of the Glades Site	Proposed. CWA Section 404 permit application submitted March 2010.	ACOE Apr 2010b
Palmdale Sand	Sand and gravel mine	13 miles northwest of the Glades Site	Operational	USGS 2005
Rinker Materials Corp. - Alico Road Quarry	Crushed stone mine	42 miles southwest of the Glades Site	Operational	USGS 2005
RMC South Florida	Crushed stone mine	49 miles southwest of the Glades Site	Operational	USGS 2005
Sebring Tu-Co Peat Operation	Peat mine	46 miles northwest of the Glades Site	Operational	USGS 2005
Southwest Aggregates	Crushed stone mine	50 miles west of the Glades Site	Operational	USGS 2005
Star Pit	Crushed stone mine	31 miles southeast of the Glades Site	Operational	USGS 2005
Witherspoon Sand Plant	Sand and gravel mine	8 miles west of the Glades Site	Operational	USGS 2005
Other Actions/Projects				
Central and Southern Florida Flood Control Project	The C&SF Flood Control Project was authorized by Congress in 1948 to provide flood control, water supply, prevention of saltwater intrusion, and protection of fish and wildlife resources. Today the CS&F project includes 1000 miles of canals, 720 miles of levees, and almost 200 water control structures. It covers 16 counties over an 18,000-square-mile area from Orlando to the Florida Reef Tract. The existing project provides water supply, flood protection, water management and other benefits to South Florida. However, the project has had unintended negative effects on the Everglades.	Throughout the region.	Operational	HRA Jun 2006
Action Craft	Fiberglass boat manufacturer	50 miles west of the Glades Site	Operational	FDEP May 2007a
Alpha General Services, Inc.	Fiberglass tank manufacturer	48 miles northeast of the Glades Site	Operational	FDEP Sep 2006
Atlantic Sugar Association	Sugar manufacturer	34 miles southeast of the Glades Site	Operational	FDEP Jun 2007

Table 9.3-9 (Sheet 12 of 12)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Glades Alternative Site

Project Name	Summary of Project	Location	Status	Reference
E-Stone USA Corp	Cultured granite reinforced plastics manufacturer	45 miles north of the Glades Site	Operational	FDEP Nov 2009c
Everglades Sugar Refinery Inc.	Sugar manufacturer	32 miles southeast of the Glades Site	Operational	FDEP Aug 2000
Louis Dreyfus Citrus Inc. - Indiantown Citrus Processing Plant	Food Manufacturer	45 miles northeast of the Glades Site	Operational	FDEP Jul 2008b
Munters Corporation	Paper and polyvinyl chloride filter manufacturer	46 miles southwest of the Glades Site	Operational	FDEP Mar 2007a
Okeelanta Corporation	Sugar manufacturer	31 miles southeast of the Glades Site	Operational	FDEP Jan 2001
Osceola Farms Co	Sugar manufacturer	38 miles east of the Glades Site	Operational	FDEP Mar 2010b
Pall Aeropower Corporation	Filter element manufacturer	46 miles southwest of the Glades Site	Operational	FDEP Mar 2007b
Sebring International Raceway	A road course auto racing facility with three track configurations: the 12-hour Grand Prix Course, the Old Club Course, and the New Club Course.	45 miles northwest of the Glades Site	Operational	NAMP Jun 2007
Southern Gardens Citrus Processing Corp. - Clewiston Plant	Food manufacturer	6 miles southeast of the Glades Site	Operational	FDEP May 2010a
Sugar Cane Growers Cooperative of Florida	Sugar manufacturer	33 miles southeast of the Glades Site	Operational	FDEP Aug 2006
U.S. Sugar Corp. - Clewiston Mill	Sugar manufacturer	15 miles southeast of the Glades Site	Operational	FDEP Feb 2010
Water Reclamation and Wastewater Treatment Plants	Numerous plants	Within 50-mile radius of the Site.	Operational	FDEP Aug 2010a FDEP Aug 2010b
Future Urbanization	Construction of housing units and associated commercial buildings; roads, bridges and rail; construction of water and/or wastewater treatment facilities and associated pipelines.	Throughout the region.	Construction would occur in the future, as described in state and local land-use planning documents.	—
Various hospitals and industrial facilities that use radioactive materials	Medical and other isotopes	Within 50-mile radius of the Site.	Operational	—

Table 9.3-10 (Sheet 1 of 2)
Estimate of Potentially Affected Areas by Land Cover Type
Martin Alternative Site

Land Use Description	FLUCCS Code	Potentially Affected Area [acres] Entire Project including transmission corridor	Potentially Affected Area [acres] Transmission Corridor only
Fixed Single Family Units, less than 2 dwellings per acre	111	0.8	—
Mixed Units (Fixed and Mobile Home)	113	6.2	—
Fixed Single Family Units	121	0.9	—
Commercial and Services	140	13.0	—
Other Light Industrial	155	1.5	—
Race Tracks	183	0.7	—
Parks and Zoos	185	1.6	—
Improved Pastures	211	152.5	14.0
Unimproved Pastures	212	75.9	—
Woodland Pastures	213	19.2	—
Row Crops	214	3.2	—
Field Crops	215	7.6	7.6
Citrus Groves	221	2,808.5	78.6
Sod Farms	242	5.0	—
Ornamentals	243	0.6	—
Herbaceous (Dry Prairie)	310	257.9	189.7
Shrub and Brushland	320	95.8	49.6
Palmetto Prairies	321	131.2	4.6
Mixed Rangeland	330	50.5	44.0
Pine Flatwoods	411	360.2	43.4
Upland Hardwood Forests	420	13.5	0.6
Brazilian Pepper	422	10.4	—
Hardwood-Coniferous Mixed	434	63.1	9.2
Streams and Waterways	510	4.8	3.5
Lakes	520	8.6	2.7
Reservoirs	530	0.4	—
Mixed Wetland Hardwoods	617	50.5	23.8
Cypress	621	0.1	0.1
Hydric Pine Flatwoods	625	81.4	39.1
Wetland Forested Mixed	630	12.9	—
Freshwater Marshes	641	243.9	179.1
Wet Prairies	643	70.7	54.7
Emergent Aquatic Vegetation	644	17.8	17.8
Fill Areas (Highways/Railways)	744	2.8	—
Transportation	810	85.2	—
Roads and Highways	814	1.1	—
Electric Power Facilities	831	1.5	1.5

Table 9.3-10 (Sheet 2 of 2)
Estimate of Potentially Affected Areas by Land Cover Type
Martin Alternative Site

Land Use Description	FLUCCS Code	Potentially Affected Area [acres] Entire Project including transmission corridor	Potentially Affected Area [acres] Transmission Corridor only
Electrical Power Transmission Lines	832	12.6	—

Table 9.3-11 (Sheet 1 of 2)
Listed Species Documented or Reported in Martin County
August 2011

Scientific Name	Common Name	Federal Status	State Status
Amphibians			
Rana capito	Gopher Frog	N	LS
Birds			
Aphelocoma coerulescens	Florida Scrub-jay	LT	LT
Aramus guarauna	Limpkin	N	LS
Athene cunicularia floridana	Florida Burrowing Owl	N	LS
Calidris canutus rufa	Red Knot	C	—
Campephilus principalis	Ivory-billed Woodpecker	LE	—
Caracara cheriway	Crested Caracara	LT	LT
Charadrius melodus	Piping Plover	LT	LT
Dendroica kirtlandii	Kirtland's Warbler	LE	—
Egretta caerulea	Little Blue Heron	N	LS
Egretta thula	Snowy Egret	N	LS
Egretta tricolor	Tricolored Heron	N	LS
Eudocimus albus	White Ibis	N	LS
Falco sparverius paulus	Southeastern American Kestrel	N	LT
Grus americana	Whooping Crane	XN	—
Grus mbricate pratensis	Florida Sandhill Crane	N	LT
Haematopus palliates	American Oystercatcher	N	LS
Mycteria Americana	Wood Stork	LE	LE
Pelecanus occidentalis	Brown Pelican	N	LS
Picoides borealis	Red-cockaded Woodpecker	LE	LS
Platalea ajaja	Roseate Spoonbill	N	LS
Polyborus plancus audubonii	Audubon's Crested Caracara	LT	—
Rostrhamus sociabilis plumbeus	Snail Kite	LE	LE
Rynchops niger	Black Skimmer	N	LS
Sterna antillarum	Least Tern	N	LT
Fish			
Bairdiella sanctaeluciae	Striped Croaker	SC	N
Microphis brachyurus	Opossum Pipefish	SC	N
Pristis pectinata	Smalltooth Sawfish	LE	—
Invertebrates			
Anaea mbricate floridalis	Florida Leafwing Butterfly	C	—
Mammals			
Peromyscus polionotus niveiventris	Southeastern Beach Mouse	LT	—
Podomys floridanus	Florida Mouse	N	LS
Puma concolor coryi	Florida Panther	LE	LE
Puma concolor (all subsp. Except coryi)	Puma (Mountain Lion)	SAT	—
Sciurus niger shermani	Sherman's Fox Squirrel	N	LS
Trichechus manatus	Manatee	LE	LE
Plants and Lichens			
Argusia gnaphalodes	Sea Lavender	N	LE

Table 9.3-11 (Sheet 2 of 2)
Listed Species Documented or Reported in Martin County
August 2011

Scientific Name	Common Name	Federal Status	State Status
Asimina tetramera	Four-petal Pawpaw	LE	LE
Calopogon multiflorus	Many-flowered Grass-pink	N	LE
Chamaesyce cumulicola	Sand-dune Spurge	N	LE
Cladonia perforata	Perforate Reindeer Lichen	LE	LE
Coelorachis tuberculosa	Piedmont Jointgrass	N	LT
Conradina grandiflora	Large-flowered Rosemary	N	LT
Ctenitis sloanei	Florida Tree Fern	N	LE
Dicerandra immaculata	Lakela's Mint	LE	—
Eugenia confusa	Tropical Ironwood	N	LE
Glandularia maritime	Coastal Vervain	N	LE
Halophila johnsonii	Johnson's Seagrass	LT	N
Jacquemontia reclinata	Beach Jacquemontia	LE	LE
Lechea cernua	Nodding Pinweed	N	LT
Lechea divaricat	Pine Pinweed	N	LE
Linum carteri var. smallii	Small's Flax	N	LE
Ophioglossum palmatum	Hand Fern	N	LE
Peperomia humilis	Terrestrial Peperomia	N	LE
Peperomia obtusifolia	Blunt-leaved Peperomia	N	LE
Polygala smalli	Tiny Polygala	LE	LE
Pteroglossaspis ecristata	Giant Orchid	N	LT
Tephrosia angustissima var. curtissii	Coastal Hoary-pea	N	LE
Tillandsia flexuosa	Banded Wild Pine	N	LT
Tolumnia bahamensis	Dancing-lady Orchid	N	LE
Vanilla mexicana	Scentless Vanilla	N	LE
Reptiles			
Alligator mississippiensis	American Alligator	SAT	LS
Caretta caretta	Loggerhead	LT	LT
Chelonia mydas	Green Turtle	LE	LE
Crocodylus acutus	American Crocodile	LT	LE
Dermochelys coriacea	Leatherback	LE	LE
Drymarchon couperi	Eastern Indigo Snake	LT	LT
Eretmochelys mbricate	Hawksbill	LE	LE
Gopherus polyphemus	Gopher Tortoise	N	LT

FEDERAL STATUS
LE Endangered: species in danger of extinction throughout a significant portion of its range.
LT Threatened: species likely to become Endangered within the foreseeable future throughout a significant portion of its range.
SAT Treated as threatened because of similarity of appearance to a species that is federally listed so that enforcement personnel have difficulty in attempting to differentiate between the listed and unlisted species.
C Candidate species for which federal listing agencies have sufficient information on biological vulnerability and threats to support proposing to list the species as Endangered or Threatened.
XN Nonessential experimental population.
SC Not currently listed, but considered a "species of concern" to USFWS.
STATE LEGAL STATUS
LE Endangered: species, subspecies, or isolated population so few or depleted in number or so restricted in range that it is in imminent danger of extinction.
LT Threatened: species, subspecies, or isolated population facing a very high risk of extinction in the future.
LS Species of Special Concern is a species, subspecies, or isolated population which is facing a moderate risk of extinction in the future.
N Not currently listed, nor currently being considered for listing.
Sources: FNAI, 2011
USFWS, Feb 2010

Table 9.3-12 (Sheet 1 of 13)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of Martin Site

Project Name	Summary of Project	Location	Status	Reference
Energy Projects				
City of Vero Beach Municipal Utilities	Five-unit, 155-MW gas- and oil-fired plant	41 miles northeast of the Martin Site	Operational	FDEP Jan 2008c
Florida Gas Transmission - Phase VIII Expansion Project	Construction and operation of 483.2 miles of pipeline facilities, including an 89.8-mile long natural gas pipeline in a new right-of-way that runs from DeSoto County through Highlands and Okeechobee Counties to the FPL Martin Plant site.	DeSoto, Highlands, Okeechobee, and Martin Counties. Terminus collocated at the Martin Site.	Proposed. Final EIS issued September 2009.	FERC Sep 2009
Florida Gas Transmission - Station #20	Compressor station consisting of 5 internal combustion engines.	28 miles northeast of the Martin Site	Operational	FDEP May 2008
Florida Municipal Power Agency - Treasure Coast Energy Center	Single-unit, 300-MW gas-fired plant	25 miles northeast of the Martin Site	Operational	FDEP May 2010b
Floridian Natural Gas Storage Company - Natural Gas Storage Facility	Liquefied natural gas storage, liquefaction, and vaporization facility with storage capacity of eight billion cubic feet of natural gas	2 miles southeast of the Martin Site	Proposed. Final EIS issued July 2008.	FERC Jul 2008
Fort Pierce Utilities Authority - H. D. King Power Plant	Four-unit, 136-MW gas- and oil-fired plant	31 miles northeast of the Martin Site	Operational	FDEP Jan 2008d
FPL - Martin Next Generation Solar Energy Center	75-MW solar thermal plant	Collocated at the Martin Site	Proposed. Currently under construction, expected completion 3Q 2010.	FPL May 2008
FPL - Martin Plant	Five-unit, 3734-MW gas- and oil-fired plant	Collocated at the Martin Site	Operational	FDEP Nov 2009b
FPL - Riviera Plant	Two-unit, 580-MW oil- and gas-fired plant	36 miles southeast of the Martin Site	Operational. Would be replaced by the Riviera Plant Repowering Project	FDEP Jan 2009
FPL - Riviera Plant Repowering Project	A single-unit, 1250-MW gas-fired combined-cycle plant would replace the two existing boilers at the site.	36 miles southeast of the Martin Site	Proposed. Air Construction Permit issued June 2009.	FDEP Jun 2009
FPL - St. Lucie Plant	Two-unit, 1680-MW nuclear plant	27 miles northeast of the Martin Site	Operational.	FPL Dec 2007
FPL - St. Lucie Uprate Project	The project will increase the net electrical generation for Units 1 & 2 by 104-MW each.	27 miles northeast of the Martin Site	Proposed. Site Certification Application approved by FPSC in 2008.	FPL Dec 2007
FPL - West County Energy Center	Two-unit, 2500-MW gas-fired plant	27 miles southeast of the Martin Site	Operational	FDEP Jul 2008a

Table 9.3-12 (Sheet 2 of 13)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of Martin Site

Project Name	Summary of Project	Location	Status	Reference
FPL - West County Energy Center, Unit 3	Single-unit, 1250-MW gas-fired plant	27 miles southeast of the Martin Site	Proposed. Unit 3 under construction, expected completion in 2011.	FDEP Jul 2008a
Highlands Ethanol Facility	39.4-MGPY cellulosic ethanol refinery	35 miles northwest of the Martin Site	Proposed. Air Construction Permit issued March 2010.	FDEP Mar 2010a
Indiantown Cogeneration Plant	Single-unit, 330-MW coal-fired plant with 2 gas-fired auxiliary boilers.	25 miles northeast of the Martin Site	Operational	FDEP Jan 2010
INEOS New Planet Indian River County BioEnergy Facility	8-MGPY cellulosic ethanol refinery and a 5-MW biomass-fired power plant	37 miles north of the Martin Site	Proposed. Application for air construction permit submitted February 2010.	INEOS Feb 2010
Lake Worth Utilities - Tom G. Smith Power Plant	Three-unit, 105-MW gas- and oil-fired plant	42 miles southeast of the Martin Site	Operational	FDEP Jan 2008e
New Hope Power Company - Okeelanta Cogeneration Plant	Three-unit, 140-MW biomass-fired plant	31 miles southwest of the Martin Site	Operational	FDEP May 2005
Okeechobee Landfill - Landfill Gas to Energy Project	Four- unit, 25.5-MW landfill gas-fired plant.	22 miles northwest of the Martin Site	Proposed. Air construction permit issued April 2010.	FDEP Apr 2010
Solid Waste Authority of Palm Beach County - Palm Beach Renewable Energy Facility No. 1	Two-unit, 62-MW municipal solid waste (MSW)-fired plant	31 miles southeast of the Martin Site	Operational	FDEP Jul 2006
Solid Waste Authority of Palm Beach County - Palm Beach Renewable Energy Facility No. 2	Three-unit, 100-MW MSW-fired plant	31 miles southeast of the Martin Site	Proposed. Application for air construction permit submitted May 2010.	SWAPBC May 2010
Southeastern Renewable Fuels Biorefinery and Cogeneration Plant	22 MGPY cellulosic ethanol refinery and a 30-MW biomass-fired power plant	42 miles southwest of the Martin Site	Proposed. Application for air construction permit submitted March 2010.	Golder Mar 2010
Transportation Projects				
Indiantown Airport	General aviation airport.	7 miles southeast of the Martin Site	Operational. Limited expansion would occur in the future, as described in state and local planning documents.	FDOT 2009
North Palm Beach County Airport	General aviation and reliever airport for Palm Beach International	25.6 miles southeast of the Martin Site	Operational. Expansion and construction would occur in the future, as described in state and local planning documents.	FDOT 2009

Table 9.3-12 (Sheet 3 of 13)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of Martin Site

Project Name	Summary of Project	Location	Status	Reference
Okeechobee County Airport	General aviation airport.	23 miles northwest of the Martin Site	Operational. Expansion and construction would occur in the future, as described in state and local planning documents.	FDOT 2009
Palm Beach County Glades Airport	General aviation airport.	20 miles southwest of the Martin Site	Operational. Limited expansion would occur in the future, as described in state and local planning documents.	FDOT 2009
Palm Beach County Park Airport	General aviation and reliever airport for Palm Beach International	43 miles southeast of the Martin Site	Operational. Limited expansion would occur in the future, as described in state and local planning documents.	FDOT 2009
Palm Beach International Airport	Full service airport - commercial airlines, air cargo, and general aviation.	39 miles southeast of the Martin Site	Operational. Expansion and construction would occur in the future, as described in state and local planning documents.	FDOT 2009
St Lucie County International Airport	General aviation airport.	32 miles northeast of the Martin Site	Operational. Expansion and construction would occur in the future, as described in state and local planning documents.	FDOT 2009
Vero Beach Municipal Airport	Commercial and general aviation airport.	42 miles northeast of the Martin Site	Operational. Expansion and construction would occur in the future, as described in state and local planning documents.	FDOT 2009
Witham Field Airport	General aviation airport.	22 miles northeast of the Martin Site	Operational. Limited expansion would occur in the future, as described in state and local planning documents.	FDOT 2009
Port of Fort Pierce	99-acre deepwater seaport with public and private cargo terminals. Current annual cargo throughput of 0.358 million tons.	32 miles northeast of the Martin Site	Operational. Port expansion, dredging, and construction would occur in the future, as described in state and local planning documents.	FSTEDC Mar 2010

Table 9.3-12 (Sheet 4 of 13)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of Martin Site

Project Name	Summary of Project	Location	Status	Reference
Port of Palm Beach	Large full-service deepwater seaport. Current annual cargo throughput of 2.3 million tons. Cruise terminal serves 349,000 passengers annually.	37 miles southeast of the Martin Site	Operational. Port expansion, dredging, and construction would occur in the future, as described in state and local planning documents.	FSTEDC Mar 2010
Tampa - Orlando - Miami High-Speed Intercity Passenger Rail	This project would provide high-speed rail service from Tampa to Miami (through Orlando) with stops in West Palm Beach and Ft. Lauderdale. The termini for the Orlando -Miami corridor are the Orlando International Airport (OIA) and the Miami Intermodal Center at the Miami Airport (MIA).	Route follows the Florida Turnpike corridor from Orange County through Osceola, Okeechobee, St. Lucie, Martin and Palm Beach Counties	Proposed. Phase 1 (Tampa-Orlando corridor) is ongoing. Project development for Phase 2 (Orlando-Miami corridor) began in May 2010.	FDOT May 2010
Parks and Nature Preserve Facilities				
Archbold Biological Station	An independent, non-profit research facility, devoted to long-term ecological research and conservation. The Station owns and manages a 5000-acre preserve that is a matrix of pristine native vegetation, including oak and rosemary scrubs, pine flatwoods, and cutthroat seeps and seasonal wetlands. The station also manages the 10,500-acre MacArthur Agro-ecology Research Center (MAERC) at Buck Island Ranch.	50 miles northwest of the Martin Site	Development likely limited within this area	ABS Feb 2004
Arthur R. Marshall Loxahatchee National Wildlife Refuge	Management of species and habitats to enhance the native biodiversity and integrity of the Everglades ecosystem. Recreational activities include hunting, fishing, canoeing, boating, and wildlife viewing.	29 miles southeast of the Martin Site	Additional land acquisition and expansion of visitor facilities are planned. Other development would be limited within this refuge.	USFWS Sep 2000
Atlantic Ridge Preserve State Park	The preserve has not yet opened to the public due to the lack of a public access road. Once the constructed the preserve will be available for passive recreational including hiking, horseback riding, picnicking, wildlife observation, and birding.	20 miles east of the Martin Site	Development likely limited within this refuge	FDEP Dec 2005
Avalon State Park	Supports intact examples of coastal and wetland communities including a large stand of undeveloped maritime hammock. Recreational activities focus on the 6000 feet of Atlantic shoreline and include swimming, fishing, and surfing.	36 miles northeast of the Martin Site	Trail development likely within this park. Other development would be limited.	FDEP Aug 2002
Barley Barber Swamp	A one-mile boardwalk runs through a cypress swamp. On FLP owned Martin site land. Public access requires advance reservation.	Collocated at the Martin Site	Development likely limited within this refuge.	FFWCC Jul 2010

Table 9.3-12 (Sheet 5 of 13)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of Martin Site

Project Name	Summary of Project	Location	Status	Reference
Big Water Heritage Trail	Scenic auto route circling Lake Okeechobee passing though five counties and going by multiple natural and historic sites.	5 miles west of the Martin Site	Development likely limited at specific points along the trail.	SWFRPC 2009
DuPuis Wildlife and Environmental Area	21,875 acres managed to conserve and protect water resources as well as protect and restore land resources to its natural state. Recreation activities include hunting, fishing, horseback and bicycle riding, canoeing, camping, and hiking.	3 miles south of the Martin Site	Development likely limited within this refuge.	SFWMD Jun 2008
Fisheating Creek Wildlife Management Area	The 18,272-acre property is used for conservation and protection of the natural communities along the shores of Fisheating Creek. Contains natural summer roosts for endangered swallowtail kites.	35 miles west of the Martin Site	Development limited within property.	FFWCC Feb 2003
Florida National Scenic Trail	Scenic hiking trail stretches over 1400 miles across the state and traverses nearly all of Florida's unique habitats and includes the Lake Okeechobee Scenic Trail. Portions of the trail are accessible for bicycling, horseback riding, or inline skating.	5 miles west of the Martin Site	Development likely limited at specific points along the trail.	USDAFS Feb 2006
Fort Pierce Inlet State Park	Beaches used as nesting grounds for loggerhead sea turtles. Recreation activities include fishing, swimming, surfing, boating, biking, hiking, and wildlife viewing.	33 miles northeast of the Martin Site	Additional facilities for canoe access, picnicking staff housing needs, and securing reliable access to the island are planned.	FDEP Dec 2006
Hobe Sound National Wildlife Refuge	An important example of pre-contact Florida ecological environments. Sand dunes and associated lagoons are habitats for rare and threatened species as manatees, scrub jays, and leatherback sea turtles. Hiking and swimming available to public.	26 miles east of the Martin Site	Upgrades to existing beach facilities are planned.	USFWS Dec 2006
Hungryland Wildlife and Environmental Area	The 10,294-acre property was purchased to conserve and protect environmentally unique and irreplaceable lands including relatively undisturbed, high quality pine flatwoods. Recreation activities include hiking, horseback riding, hunting, and fishing.	10 miles southeast of the Martin Site	Development likely limited within this property.	FFWCC Feb 2002
Indian River County Public Shooting Range	Provides public outdoor recreation facility and a training site for hunter education students, volunteers, and law enforcement personnel.	50 miles north of the Martin Site	Development likely limited within this property.	FFWCC Aug 2008

Table 9.3-12 (Sheet 6 of 13)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of Martin Site

Project Name	Summary of Project	Location	Status	Reference
J.W. Corbett Wildlife Management Area	Management of unique tropical hardwood hammocks and slash pine flatwoods habitat of the South Florida systems and recovery of the endangered and threatened species that occur there. The vast majority of the 60,288-acre property is used for wildlife management and public hunting.	8 miles southeast of the Martin Site	Additional land acquisition is planned. Planned public uses will include hunting, fishing, and horseback riding.	FFWCC Apr 2003
John D. MacArthur Beach State Park	Park protects a unique cross section of coastal Florida landscape including 121 acres of tropical maritime hammock, the largest remaining example in the county. Nine designated plant and 20 animal species occupy the natural habitats preserved by this park. The 7000-ft sand beach and dune community attracts a large number of nesting loggerhead, green, and leatherback sea turtles. Recreation activities include swimming, snorkeling, canoeing, fishing, and bird watching.	35 miles southeast of the Martin Site	Development likely limited within this property.	FDEP Apr 2005b
Jonathan Dickenson State Park	The 11,471-acre park supports many unique natural features and significant cultural resources. Contains one the last remaining coastal sand pine scrub plant communities along the southeast coast, a 2600-acre wilderness preserve, and most of the Loxahatchee National Wild and Scenic River. Recreation activities include hiking, biking, camping, picnicking, canoe/ kayaking, and interpretive programs.	24 miles east of the Martin Site	Development likely limited within this property.	FDEP Feb 2000
Kissimmee Prairie Preserve State Park	Public outdoor recreation and conservation is the single use of the 53,760-acre property. Recreation activities include hiking, biking and horse riding trails, camping, picnicking, and interpretive programs.	40 miles northwest of the Martin Site	Development of new visitor center is planned. Other development likely limited within this property.	FDEP Apr 2005a
Koreshan State Historic Site	The site is comprised of a 142-acre historic district that contains natural landscapes and the remains of a utopian pioneer settlement dating to the 1890's, and 52 acres of mangrove community located at the mouth of the Estero River. Recreation activities include picnicking, fishing, camping, nature study and boating.	50 SW G	Development likely limited within this property.	FDEP Aug 2003

Table 9.3-12 (Sheet 7 of 13)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of Martin Site

Project Name	Summary of Project	Location	Status	Reference
Lake Okeechobee	Lake Okeechobee is the second largest freshwater lake within the continental United States and is a nationally recognized bass and pan fishing resource. The Lake offers other recreational amenities as well. Air boat and swamp buggy rides, bike riding, hiking, picnicking, camping, and nature interpretation are popular land-based recreation activities in the region.	5 miles west of the Martin Site	Development likely limited within this area.	FDEP Jun 2010
Lake Okeechobee Scenic Trail	A 110-mile-long hiking trail circling Lake Okeechobee atop the Herbert Hoover Dike offers scenic views of lakeside and agricultural landscapes. The trail provides opportunities for hiking, bicycle and horseback riding, bird watching, and fishing.	5 miles west of the Martin Site	Development likely limited at specific points along the trail.	FDEP Jun 2010
Lake Wales Ridge National Wildlife Refuge	Management of unique scrub habitat of the Central Florida ridge systems and recovery of the endangered and threatened species that occur there. Public access to refuge is limited to guided tours only.	47 miles west of the Martin Site	Additional land acquisition is planned. Development likely limited within this area.	USFWS Apr 2010
Lake Wales Ridge Wildlife and Environmental Area	Management and restoration of unique scrub habitat of the Central Florida ridge systems and recovery of the endangered and threatened species that occur there. Public access to refuge is limited to guided tours only.	49 miles west of the Martin Site	Development likely limited within this area.	FFWCC Sep 2002
Pelican Island National Wildlife Refuge	Management of habitats to sustain abundant populations of native species and to help recover threatened and endangered species. Recreational activities include hunting, fishing, canoeing, boating, and wildlife viewing.	50 miles north of the Martin Site	Expansion of visitor facilities is planned. Other development would be limited within this refuge.	USFWS Sep 2006
Savannas Preserve State Park	Property (5227 acres) encompasses portions of the Atlantic Costal Ridge and the flatwoods and savanna-like wetlands associated with it. It harbors a unique set of natural communities that include sand pine scrub, flatwoods, marsh, and wet prairies. Public recreation activities include hiking, bicycle and horseback riding, canoe/kayaking, picnicking, wildlife viewing and environmental education.	24 miles northeast of the Martin Site	Development of facilities for public use likely limited within this area.	FDEP Jun 2003
Seabranch Inlet State Park	Management of 913 acres of various different natural communities including a rare and important baygall, beach dune, and scrub communities. The park in only open to the public for hiking and nature appreciation.	24 miles east of the Martin Site	Development likely limited within this area.	FDEP Oct 2002a

Table 9.3-12 (Sheet 8 of 13)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of Martin Site

Project Name	Summary of Project	Location	Status	Reference
St. Lucie Inlet Preserve State Park	Accessible only by private boat and provides 4786 acres consisting of mangrove swamps, maritime hammock and undeveloped beach. Public recreation activities include swimming, snorkeling, scuba diving, sunbathing, fishing, primitive camping, picnicking, hiking, and nature appreciation.	25 miles east of the Martin Site	Development likely limited within this park.	FDEP Oct 2002b
St. Sebastian River Preserve State Park	Twenty archaeological sites and twenty-two distinct natural communities have been mapped in the 21,748-acre park including mesic flatwoods, prairie hammock, sandhill, scrubby flatwoods, and upland hardwood forests. Recreation activities include fishing, canoe/kayaking, horseback riding, hiking, primitive camping, and nature appreciation.	49 miles north of the Martin Site	Development likely limited within this area.	FDEP Oct 2005
Comprehensive Everglades Restoration Plan Projects				
Acme Basin B	Project will improve Everglades water quality by diverting urban stormwater runoff into the C-51 canal and then to STA-1E for treatment. The project includes construction of two new pump stations and improvements to the C-1 canal, which will increase conveyance capacity and provide connection to the C-51 canal.	35 miles southeast of the Martin Site	Proposed. Phase 1, which includes the C-51 pump station installations and C-1 canal improvements, is complete. Phase 2, involving design of the Section 24 Impoundment, is ongoing.	SFWMD Jun 2010, USACE Oct 2003
C-44 Reservoir and Storage and Treatment Area	A component of the Indian River Lagoon – South Project consisting of a 3400-acre reservoir and 6200 acres of emergent vegetation.	9 miles east of the Martin Site	Design and land acquisition for this project is completed. Construction is anticipated to begin in 2011.	SFWMD Feb 2006, USACE Feb 2010
Everglades Agricultural Area Storage Reservoirs - Phase 1	Project consists of a large above-ground storage reservoir on former farmlands designed to provide significant additional water in the southern region of the Everglades Agricultural Area.	40 miles south of the Martin Site	Construction of the A-1 Reservoir was initiated in 2006, but has been subsequently suspended in since 2008 due to litigation.	SFWMD Jun 2010, USACE Nov 2009
Flows to Northwest and Central Water Conservation Areas 3A	Project will increase depths, extend wetland hydropatterns, and increase water supply availability in the northwest corner and west-central portions of WCA 3A.	50 miles south of the Martin Site	Proposed. Project design underway.	USACE Undated

Table 9.3-12 (Sheet 9 of 13)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of Martin Site

Project Name	Summary of Project	Location	Status	Reference
Fran Reich Preserve (Site 1 Impoundment)	Construction of a 1600-acre impoundment to capture and store the excess surface water runoff from the Hillsboro Watershed and reduce water storage demands on the Arthur R. Marshall Loxahatchee National Wildlife Refuge and Lake Okeechobee.	50 miles south of the Martin Site	Proposed. Project design underway.	SFWMD Jun 2010, USACE Nov 2009
Indian River Lagoon-South Project	The project includes construction of several above-ground reservoirs and stormwater treatment areas. The project will use constructed wetlands and muck removal to improve surface water management and water quality of several canal basins, as well as, improve habitat in the St. Lucie Estuary and Indian River Lagoon.	2 miles north of the Martin Site	Proposed. Project is scheduled to begin in 2010.	SFWMD Jun 2010, USACE Nov 2009, USACE Feb 2010
Lake Okeechobee Aquifer Storage and Recovery (ASR)	Project proposes to increase regional storage while reducing both evaporation losses and the amount of land removed from current land use. This will be accomplished by a series of aquifer storage and recovery wells adjacent to Lake Okechobee with a capacity of one billion gallons per day and the associated pre- and post- water quality treatment facilities.	Nearest parcel is 4 miles west of the Martin Site	Five separate ASR pilot projects have been constructed around Lake Okeechobee and have provided five years of field data. Two more pilot systems began cycle testing in 2008.	USACE Undated, USACE Jun 2008
Lake Okeechobee Watershed Project	Construction of a 1984-acre reservoir and 3975-acre treatment area in the Taylor Creek/Nubbin Slough basin; a 10,281-acre reservoir in the Kissimmee River basin; a 5416-acre reservoir and 8,044-acre treatment area in the Lake Istokpoga basin, and a 3730-acre wetland restoration site in Paradise Run in order to increase aquatic and wildlife habitat, regulate lake staging, reduce phosphorus loading, and reduce damaging releases to the surrounding estuaries.	Various locations in Okeechobee County	Proposed. Project is scheduled to begin in 2019.	USACE Undated, USACE Nov 2009
Loxahatchee National Wildlife Refuge Internal Canal Structures	The purpose of this project is to improve the timing and location of water depths within the Refuge. It would consist of two water control structures in the northern ends of the perimeter canals encircling the Refuge.	28 miles northwest of the Martin Site	Currently in pre-construction design.	USACE Undated
Melaleuca Eradication and other Exotic Plants	Project enhances efforts to control invasive exotic species in south Florida through mass rearing and controlled release of biological agents throughout the region.	Throughout the region	Proposed. Project is scheduled to begin in 2011.	USACE Nov 2009

Table 9.3-12 (Sheet 10 of 13)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of Martin Site

Project Name	Summary of Project	Location	Status	Reference
Modify Holey Land Wildlife Management Area (WMA) Operation Plan	Modifications to the current operating plan for Holey Land WMA will implement rain-driven operations as needed and will be made to improve the timing and location of water depths.	43 miles south of the Martin Site	Project in planning stage.	USACE Undated
Modify Rotenberger Wildlife Management Area Operation Plan	Modification to the current operating plan for the Rotenberger WMA will implement rain-driven operations as needed and will be made to improve the timing and location of water depths.	48 miles southwest of the Martin Site	Project in planning stage.	USACE Undated
North Palm Beach County - Part 1	Part 1 of this project includes portions of seven basins that will capture, store and treat excess water that is currently discharged to the Lake Worth Lagoon and use that water to enhance the Loxahatchee River, Loxahatchee Slough, and West Palm Beach Water Catchment Area.	8 miles southeast of the Martin Site	Project in pre-construction, engineering, and design phase. Part 1 construction is estimated to be completed in 2014.	USACE Undated, USACE May 2005
North Palm Beach County - Part 2	Part 2 includes an ASR with a capacity of 220 million gallons per day.	39 miles southeast of the Martin Site	Project in pre-construction, engineering, and design phase.	USACE Undated
Palm Beach County (PBC) Agriculture Reserve Aquifer Storage and Recovery and Reservoir	The project will supplement water supplies for central and southern Palm Beach County by capturing and storing excess water currently discharged to the Lake Worth Lagoon. The project includes 15 aquifer storage and recovery well clusters and an above-ground reservoir.	42 miles southeast of the Martin Site	Project in pre-construction, engineering, and design phase.	USACE Undated
Strazzula Wetlands	Project will provide hydrological and ecological connectivity of the Loxahatchee National Wildlife Refuge (NWR) and act as a buffer between higher water stages to the west and urban lands to the east. The increase in spatial extent of protected natural areas provides habitat connectivity for species that require large unfragmented tracts of land for survival. The area also contains rare and important cypress habitat and sawgrass marshes in the eastern Everglades area.	36 miles southeast of the Martin Site	Project in pre-construction, engineering, and design phase.	USACE Undated, USACE Nov 2003
Central and Southern Florida (C&SF) Projects				
Herbert Hoover Dike Rehabilitation	Project to strengthen the 143-mile dike that surrounds Lake Okeechobee.	5 miles west of the Martin Site	Construction is underway on the southeast section of the dike. Completion of the project is anticipated in 2025.	USACE Nov 2009

Table 9.3-12 (Sheet 11 of 13)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of Martin Site

Project Name	Summary of Project	Location	Status	Reference
West Palm Beach Canal/ Stormwater Treatment Area - 1E	Project provides flood control, water quality and water supply to the C-51 basin in Palm Beach County.	30 miles southeast of the Martin Site	Construction is underway. Completion of the project is expected in 2010.	USACE Nov 2009
Other Ecosystem Restoration Projects				
Kissimmee River Restoration Project	Project to restore over 40 square miles of river and floodplain ecosystem, including 43 miles of meandering river channel and 27,000 acres of wetlands. The project will reestablish a favorable environment for the flora and fauna that existed in the area prior to the 1960s, when the river was altered to provide flood protection.	47 miles northwest of the Martin Site	Restoration efforts are underway and are expected to be completed in 2013.	USACE Nov 2009
Lakeside Ranch Storage and Treatment Area	Construction of a 2700-acre wetland in western Martin County that will use emergent vegetation to remove phosphorus from stormwater runoff in the Taylor Creek/ Nubbin Slough basin before it enters Lake Okeechobee. The project has been divided into two phases, STA North and STA South.	19 miles northwest of the Martin Site	Construction of STA North began in 2009. Final design of STA South is scheduled to be completed in 2010, and construction is scheduled to begin in 2011.	SFWMD Jun 2010, USACE Nov 2009
Mining Projects				
Brown Ranch Mine	Crushed stone mine	34 miles northeast of the Martin Site	Operational	USGS 2005
Capron Trails Mine	Sand and gravel mine	21 miles northeast of the Martin Site	Operational	USGS 2005
Fort Pierce Quarry	Crushed stone mine	13 miles north of the Martin Site	Operational	USGS 2005
John's Pit	Sand and gravel mine	40 miles southeast of the Martin Site	Operational	USGS 2005
Lake Point Mine	Development of a 959-acre commercial limestone quarry in Martin County	5 miles southwest of the Martin Site	Proposed. CWA Section 404 permit application submitted April 2010.	ACOE Apr 2010a
Mecca-Ryan Operation	Sand and gravel mine	23 miles southeast of the Martin Site	Operational	USGS 2005
Ortona Sand Mine Expansion	154-acre expansion of sand mining operation in Glades County	49 miles southwest of the Martin Site	Proposed. CWA Section 404 permit application submitted March 2010.	ACOE Apr 2010b
Palm Beach Mine	Crushed stone mine	28 miles southeast of the Martin Site	Operational	USGS 2005
Palmdale Sand	Sand and gravel mine	47 miles southwest of the Martin Site	Operational	USGS 2005

Table 9.3-12 (Sheet 12 of 13)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of Martin Site

Project Name	Summary of Project	Location	Status	Reference
St. Lucie Mine	Sand and gravel mine	16 miles northeast of the Martin Site	Operational	USGS 2005
Star Pit	Crushed stone mine	32 miles southwest of the Martin Site	Operational	USGS 2005
United Dredging Corp. Operation	Sand and gravel mine	46 miles southeast of the Martin Site	Operational	USGS 2005
Witherspoon Sand Plant	Sand and gravel mine	49 miles southwest of the Martin Site	Operational	USGS 2005
Other Actions/Projects				
Central and Southern Florida (C&SF) Flood Control Project	The C&SF Flood Control Project was authorized by Congress in 1948 to provide flood control, water supply, prevention of saltwater intrusion, and protection of fish and wildlife resources. Today the C&SF project includes 1000 miles of canals, 720 miles of levees, and almost 200 water control structures. It covers 16 counties over an 18,000-square-mile area from Orlando to the Florida Reef Tract. The existing project provides water supply, flood protection, water management and other benefits to South Florida. However, the project has had unintended negative effects on the Everglades and the entire south Florida ecosystem.	Throughout the region.	Operational	HRA Jun 2006
Arch Mirror South	Glass mirror manufacturer	30 miles northeast of the Martin Site	Operational	FDEP Oct 2007
Atlantic Sugar Association	Sugar manufacturer	27 miles southeast of the Martin Site	Operational	FDEP Jun 2007
Louis Dreyfus Citrus Inc. - Indiantown Citrus Processing Plant	Food Manufacturer	5 miles southeast of the Martin Site	Operational	FDEP Jul 2008b
Macho Products Inc	Protective equipment manufacturer	50 miles north of the Martin Site	Operational	FDEP May 2007b
Maverick Boat Company	Fiberglass boat manufacturer	32 miles north of the Martin Site	Operational	FDEP Jan 2006
Okeelanta Corporation	Sugar manufacturer	35 miles southwest of the Martin Site	Operational	FDEP Jan 2001
Osceola Farms Co	Sugar manufacturer	15 miles south of the Martin Site	Operational	FDEP Mar 2010b

Table 9.3-12 (Sheet 13 of 13)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of Martin Site

Project Name	Summary of Project	Location	Status	Reference
Pratt & Whitney - Area C12 & C14	Engineering, manufacturing, and testing of gas turbine and rocket engines	15 miles southeast of the Martin Site	Operational	PBCHD Jul 2004
S2 Yachts Inc. Pursuit Division	Fiberglass boat manufacturer	32 miles north of the Martin Site	Operational	FDEP Mar 2008
Southern Gardens Citrus Processing Corp. - Clewiston Plant	Food manufacturer	42 miles southwest of the Martin Site	Operational	FDEP May 2010a
Sugar Cane Growers Cooperative of Florida	Sugar manufacturer	24 miles southwest of the Martin Site	Operational	FDEP Aug 2006
Tropicana Products, Inc. - Fort Pierce Facility	Citrus product and animal feed manufacturer	24 miles northeast of the Martin Site	Operational	FDEP Oct 2006
Twin Vee Catamarans	Fiberglass boat manufacturer	28 miles northeast of the Martin Site	Operational	FDEP Oct 2008
U.S. Sugar Corp. - Clewiston Mill	Sugar manufacturer	33 miles southwest of the Martin Site	Operational	FDEP Feb 2010
Venture Marine Inc.	Fiberglass boat manufacturer	35 miles southeast of the Martin Site	Operational	PBHCD Dec 2007
Water Reclamation and Wastewater Treatment Plants	Numerous plants	Within 50-mile radius of the Site.	Operational	FDEP Aug 2010a FDEP Aug 2010b
Future Urbanization	Construction of housing units and associated commercial buildings; roads, bridges and rail; construction of water and/or wastewater treatment facilities and associated pipelines.	Throughout the region.	Construction would occur in the future, as described in state and local land-use planning documents.	—
Various hospitals and industrial facilities that use radioactive materials	Medical and other isotopes	Within 50-mile radius of the Site.	Operational	—

Table 9.3-13
Estimate of Potentially Affected Areas by Land Cover Type
Okeechobee Alternative Site

Land Use Description	FLUCCS Code	Potentially Affected Area [acres] Entire Project including transmission corridor	Potentially Affected Area [acres] Transmission Corridor only
Fixed Single Family Units, 2-5 dwellings per acre	121	7.5	—
Mixed Units (Fixed/Mobile Home)	123	4.8	—
Mobile Home Units/6 or more	132	2.6	—
Commercial and Services	140	25.4	—
Improved Pastures	211	3,509.6	1,611.2
Unimproved Pastures	212	301.6	301.6
Woodland Pastures	213	365.1	281.2
Field Crops	215	78.6	78.6
Citrus Groves	221	121.9	121.9
Dairies	252	36.1	36.1
Herbaceous (Dry Prairie)	310	24.0	21.8
Shrub and Brushland	320	0.3	0.3
Mixed Rangeland	330	3.1	—
Pine Flatwoods	411	3.1	2.2
Brazilian Pepper	422	0.2	—
Live Oak	427	17.4	17.4
Hardwood-Coniferous Mixed	434	5.6	5.6
Streams and Waterways	510	3.1	2.8
Ditches	511	12.6	0.2
Lakes	530	0.6	—
Reservoirs less than 10 acres	534	2.1	—
Bay Swamps	611	42.8	42.8
Mixed Wetland Hardwoods	617	227.1	138.1
Cypress	621	13.1	13.1
Hydric Pine Flatwoods	625	10.4	10.4
Wetland Forested Mixed	630	49.7	49.7
Freshwater Marshes	641	407.3	196.3
Wet Prairies	643	1,291.9	91.2
Roads and Highways	814	0.01	—

Table 9.3-14 (Sheet 1 of 2)
Listed Species Documented or Reported in Okeechobee County
August 2011

Scientific Name	Common Name	Federal Status	State Status
Amphibians			
Rana capito	Gopher Frog	N	LS
Birds			
Ammodramus savannarum floridanus	Florida Grasshopper Sparrow	LE	LE
Aphelocoma coerulescens	Florida Scrub-jay	LT	LT
Aramus guarauna	Limpkin	N	LS
Athene cunicularia floridana	Florida Burrowing Owl	N	LS
Campephilus principalis	Ivory-billed Woodpecker	LE	—
Caracara cheriway	Crested Caracara	LT	LT
Egretta caerulea	Little Blue Heron	N	LS
Egretta thula	Snowy Egret	N	LS
Egretta tricolor	Tricolored Heron	N	LS
Eudocimus albus	White Ibis	N	LS
Falco sparverius paulus	Southeastern American Kestrel	N	LT
Grus americana	Whooping Crane	XN	—
Grus mbricate pratensis	Florida Sandhill Crane	N	LT
Mycteria americana	Wood Stork	LE	LE
Picoides borealis	Red-cockaded Woodpecker	LE	—
Polyborus plancus audubonii	Audubon's Crested Caracara	LT	—
Rostrhamus sociabilis plumbeus	Snail Kite	LE	LE
Sterna antillarum	Least Tern	N	LT
Mammals			
Eumops floridanus	Florida Bonneted Bat	C	—
Puma concolor coryi	Florida Panther	LE	LE
Puma concolor (all subsp. Except coryi)	Puma (Mountain Lion)	SAT	—
Sciurus niger shermani	Sherman's Fox Squirrel	N	LS
Trichechus manatus	Manatee	LE	LE
Plants and Lichens			
Calopogon multiflorus	Many-flowered Grass-pink	N	LE
Conradina grandiflora	Large-flowered Rosemary	N	LT
Lechea divaricata	Pine Pinweed	N	LE
Nemastylis floridana	Celestial Lily	N	LE
Nolina atopocarpa	Florida Beargrass	N	LT
Ophioglossum palmatum	Hand Fern	N	LE
Panicum abscissum	Cutthroat Grass	N	LE
Pteroglossaspis ecristata	Giant Orchid	N	LT
Reptiles			
Alligator mississippiensis	American Alligator	SAT	LS

Table 9.3-14 (Sheet 2 of 2)
Listed Species Documented or Reported in Okeechobee County
August 2011

Scientific Name	Common Name	Federal Status	State Status
Drymarchon couperi	Eastern Indigo Snake	LT	LT
Gopherus polyphemus	Gopher Tortoise	N	LT

FEDERAL STATUS
LE Endangered: species in danger of extinction throughout a significant portion of its range.
LT Threatened: species likely to become Endangered within the foreseeable future throughout a significant portion of its range.
SAT Treated as threatened because of similarity of appearance to a species that is federally listed so that enforcement personnel have difficulty in attempting to differentiate between the listed and unlisted species.
XN Nonessential experimental population.
N Not currently listed, nor currently being considered for listing as Endangered or Threatened.

STATE LEGAL STATUS
LE Endangered: species, subspecies, or isolated population so few or depleted in number or so restricted in range that it is in imminent danger of extinction.
LT Threatened: species, subspecies, or isolated population facing a very high risk of extinction in the future.
LS Species of Special Concern is a species, subspecies, or isolated population which is facing a moderate risk of extinction in the future.

Sources:FNAI, 2011

USFWS, Feb 2010

Table 9.3-15 (Sheet 1 of 12)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Okeechobee 2 Site

Project Name	Summary of Project	Location	Status	Reference
Energy Projects				
City of Vero Beach Municipal Utilities	Five-unit, 155-MW gas- and oil-fired plant	34 miles northwest of the Okeechobee 2 Site	Operational	FDEP Jan 2008c
Florida Gas Transmission - Phase VIII Expansion Project	Construction and operation of 483.2 miles of pipeline facilities, including an 89.8-mile-long natural gas pipeline in a new right-of-way that runs from DeSoto County through Highlands and Okeechobee Counties to the FPL Martin Plant site.	DeSoto, Highlands, Okeechobee, and Martin Counties	Proposed. Final EIS issued September 2009.	FERC Sep 2009
Florida Gas Transmission - Station #20	Compressor station consisting of 5 internal combustion engines.	35 miles northeast of the Okeechobee 2 Site	Operational	FDEP May 2008
Florida Municipal Power Agency - Treasure Coast Energy Center	Single-unit, 300-MW gas-fired plant	36 miles northeast of the Okeechobee 2 Site	Operational	FDEP May 2010b
Progress Energy - Avon Park Steam Plant	Two-unit, 64-MW gas- and oil-fired plant	41 miles northwest of the Okeechobee 2 Site	Operational	FDEP Jan 2008f
Floridian Natural Gas Storage Company - Natural Gas Storage Facility	Liquefied natural gas storage, liquefaction, and vaporization facility with storage capacity of eight billion cubic feet of natural gas	30 miles southeast of the Okeechobee 2 Site	Proposed. Final EIS issued July 2008.	FERC Jul 2008
Fort Pierce Utilities Authority - H. D. King Power Plant	Four-unit, 136-MW gas- and oil-fired plant	40 miles northeast of the Okeechobee 2 Site	Operational	FDEP Jan 2008d
FPL - Martin Next Generation Solar Energy Center	75-MW solar thermal plant	26 miles southeast of the Okeechobee 2 Site	Proposed. Currently under construction, expected completion 3Q 2010.	FPL May 2008
FPL - Martin Plant	Five-unit, 3734-MW gas- and oil-fired plant	33 miles southeast of the Okeechobee 2 Site	Operational	FDEP Nov 2009b
FPL - St. Lucie Plant	Two-unit, 1680-MW nuclear plant	43 miles east of the Okeechobee 2 Site	Operational	FPL Dec 2007
FPL - St. Lucie Uprate Project	The project will increase the net electrical generation for Units 1 & 2 by 104-MW each.	43 miles east of the Okeechobee 2 Site	Proposed. Site Certification Application approved by FPSC in 2008.	FPL Dec 2007
Geoplasma-St. Lucie, LLC - St. Lucie Plasma Gasification Project	24-MW plasma arc gasification waste-to-energy (WTE) plant	35 miles northeast of the Okeechobee 2 Site	Proposed. Draft Air Construction Permit issued May 2010.	FDEP May 2010c
Highlands Ethanol Facility	39.4-MGPY cellulosic ethanol refinery	8 miles west of the Okeechobee 2 Site	Proposed. Air Construction Permit issued March 2010.	FDEP Mar 2010a
Indiantown Cogeneration Plant	Single-unit, 330-MW coal-fired plant with 2 gas-fired auxiliary boilers.	30 miles southeast of the Okeechobee 2 Site	Operational	FDEP Jan 2010

Table 9.3-15 (Sheet 2 of 12)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Okeechobee 2 Site

Project Name	Summary of Project	Location	Status	Reference
INEOS New Planet Indian River County BioEnergy Facility	8-MGPY cellulosic ethanol refinery and a 5-MW biomass-fired power plant	36 miles northwest of the Okeechobee 2 Site	Proposed. Application for air construction permit submitted February 2010.	INEOS Feb 2010
New Hope Power Company - Okeelanta Cogeneration Plant	Three-unit, 140-MW biomass-fired plant	45 miles southeast of the Okeechobee 2 Site	Operational	FDEP May 2005
Okeechobee Landfill - Landfill Gas to Energy Project	Four-unit, 25.5-MW landfill gas-fired plant.	16 miles northeast of the Okeechobee 2 Site	Proposed. Air construction permit issued April 2010.	FDEP Apr 2010
Southeastern Renewable Fuels Biorefinery and Cogeneration Plant	22 MGPY cellulosic ethanol refinery and a 30-MW biomass-fired power plant	46 miles south of the Okeechobee 2 Site	Proposed. Application for air construction permit submitted March 2010.	Golder Mar 2010
Tampa Electric Company - Dinner Lake Station	Single-unit, 12.65-MW gas- and oil-fired plant	35 miles northwest of the Okeechobee 2 Site	Permanently closed	FDEP Apr 1999
Tampa Electric Company - J.H. Phillips Station	Two-unit, 42-MW oil-fired plant	29 miles northwest of the Okeechobee 2 Site	Operational	FDEP May 2009
Transportation Projects				
Avon Park Executive Airport	General aviation airport.	43 miles northwest of the Okeechobee 2 Site	Operational. Limited expansion would occur in the future, as described in state and local planning documents.	FDOT 2009
Indiantown Airport	General aviation airport.	34 miles southeast of the Okeechobee 2 Site	Operational. Limited expansion would occur in the future, as described in state and local planning documents.	FDOT 2009
Okeechobee County Airport	General aviation airport.	6 miles northeast of the Okeechobee 2 Site	Operational. Expansion and construction would occur in the future, as described in state and local planning documents.	FDOT 2009
Palm Beach County Glades Airport	General aviation airport.	35 miles southeast of the Okeechobee 2 Site	Operational. Limited expansion would occur in the future, as described in state and local planning documents.	FDOT 2009
Sebring Regional Airport	General aviation airport.	28 miles northwest of the Okeechobee 2 Site	Operational. Limited expansion would occur in the future, as described in state and local planning documents.	FDOT 2009

Table 9.3-15 (Sheet 3 of 12)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Okeechobee 2 Site

Project Name	Summary of Project	Location	Status	Reference
St Lucie County International Airport	General aviation airport.	39 miles northeast of the Okeechobee 2 Site	Operational. Expansion and construction would occur in the future, as described in state and local planning documents.	FDOT 2009
Vero Beach Municipal Airport	Commercial and general aviation airport.	42 miles northeast of the Okeechobee 2 Site	Operational. Expansion and construction would occur in the future, as described in state and local planning documents.	FDOT 2009
Witham Field Airport	General aviation airport.	44 miles southeast of the Okeechobee 2 Site	Operational. Limited expansion would occur in the future, as described in state and local planning documents.	FDOT 2009
Port of Fort Pierce	99-acre deepwater seaport with public and private cargo terminals. Current annual cargo throughput of 0.358 million tons.	41 miles northeast of the Okeechobee 2 Site	Operational. Port expansion, dredging, and construction would occur in the future, as described in state and local planning documents.	FSTEDC Mar 2010
Tampa - Orlando - Miami High-Speed Intercity Passenger Rail	This project would provide high-speed rail service from Tampa to Miami (through Orlando) with stops in West Palm Beach and Ft. Lauderdale. The termini for the Orlando -Miami corridor are the Orlando International Airport (OIA) and the Miami Intermodal Center at the Miami Airport (MIA).	Route follows the Florida Turnpike corridor from Orange County through Osceola, Okeechobee, St. Lucie, Martin and Palm Beach Counties	Proposed. Phase 1 (Tampa-Orlando corridor) is ongoing. Project development for Phase 2 (Orlando-Miami corridor) began in May 2010.	FDOT May 2010
Parks and Nature Preserve Facilities				
Archbold Biological Station	An independent, non-profit research facility, devoted to long-term ecological research and conservation. The Station owns and manages a 5000-acre preserve that is a matrix of pristine native vegetation, including oak and rosemary scrubs, pine flatwoods, and cutthroat seeps and seasonal wetlands. The station also manages the 10,500-acre MacArthur Agro-ecology Research Center (MAERC) at Buck Island Ranch.	25 miles southwest of the Okeechobee 2 Site	Development likely limited within this area.	ABS Feb 2004

Table 9.3-15 (Sheet 4 of 12)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Okeechobee 2 Site

Project Name	Summary of Project	Location	Status	Reference
Archie Carr National Wildlife Refuge	Home to the largest nesting population of endangered loggerhead, leatherback, and green sea turtles in the U.S. Recreational activities include fishing, canoeing, swimming, and wildlife viewing. 195,000 visitors in 2006.	49 miles northeast of the Okeechobee 2 Site	Development likely limited within this refuge.	USFWS Nov 2008
Atlantic Ridge Preserve State Park	The preserve has not yet opened to the public due to the lack of a public access road. Once the constructed the preserve will be available for passive recreational including hiking, horseback riding, picnicking, wildlife observation, and birding.	43 miles southeast of the Okeechobee 2 Site	Development likely limited within this refuge.	FDEP Dec 2005
Avalon State Park	Supports intact examples of coastal and wetland communities including a large stand of undeveloped maritime hammock. Recreational activities focus on the 6000 feet of Atlantic shoreline and include swimming, fishing, and surfing.	42 miles northeast of the Okeechobee 2 Site	Trail development likely within this park. Other development would be limited.	FDEP Aug 2002
Babcock Ranch Preserve	The 73,239-acre property was purchased by the state of Florida and Lee County in 2006 and is the largest purchase of conservation land in the state's history. The property is preserved as-is with operations including cattle ranching, silviculture tenant farming, horticultural debris disposal, ecotourism, and natural resource based recreation (such as hiking, hunting, and fishing).	44 miles southwest of the Okeechobee 2 Site	Addition of hiking, biking, and horse trails and camping facilities is planned. Other development would be limited.	FFWCC Jul 2008
Barley Barber Swamp	A one-mile boardwalk runs through a cypress swamp. On FLP owned Martin site land. Public access requires advance reservation.	25 miles southeast of the Okeechobee 2 Site	Development likely limited within this refuge.	FFWCC Jul 2010
Big Water Heritage Trail	Scenic auto route circling Lake Okeechobee passing though five counties and going by multiple natural and historic sites.	7 miles southeast of the Okeechobee 2 Site	Development likely limited at specific points along the trail.	SWFRPC 2009
DuPuis Wildlife and Environmental Area	21,875 acres managed to conserve and protect water resources as well as protect and restore land resources to its natural state. Recreation activities include hunting, fishing, horseback and bicycle riding, canoeing, camping, and hiking.	28 miles southeast of the Okeechobee 2 Site	Development likely limited within this refuge.	SFWMD Jun 2008
Fisheating Creek Wildlife Management Area	The 18,272-acre property is used for conservation and protection of the natural communities along the shores of Fisheating Creek. Contains natural summer roosts for endangered swallowtail kites.	23 miles southwest of the Okeechobee 2 Site	Development limited within property.	FFWCC Feb 2003

Table 9.3-15 (Sheet 5 of 12)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Okeechobee 2 Site

Project Name	Summary of Project	Location	Status	Reference
Florida National Scenic Trail	Scenic hiking trail stretches over 1400 miles across the state, traverses nearly all of Florida's unique habitats, and includes the Lake Okeechobee Scenic Trail. Portions of the trail are accessible for bicycling, horseback riding, or inline skating.	2 miles south of the Okeechobee 2 Site	Development likely limited at specific points along the trail.	USDAFS Feb 2006
Fort Pierce Inlet State Park	Beaches used as nesting grounds for loggerhead sea turtles. Recreation activities include fishing, swimming, surfing, boating, biking, hiking, and wildlife viewing.	41 miles northeast of the Okeechobee 2 Site	Additional facilities for canoe access, picnicking staff housing needs, and securing reliable access to the island are planned.	FDEP Dec 2006
Highlands Hammock State Park	One of Florida's first state parks. Public outdoor recreation and conservation is the designated single use of the 9251-acre property. Recreation activities include camping, picnicking, hiking, horse and bicycle riding,	36 miles northwest of the Okeechobee 2 Site	Development includes, refurbishing of existing facilities, and creating an additional day use area.	FDEP Feb 2007
Hobe Sound National Wildlife Refuge	An important example of pre-contact Florida ecological environments. Sand dunes and associated lagoons are habitats for rare and threatened species such as manatees, scrub jays, and leatherback sea turtles. Hiking and swimming available to public.	49 miles east of the Okeechobee 2 Site	Upgrades to existing beach facilities are planned.	USFWS Dec 2006
Hungryland Wildlife and Environmental Area	The 10,294-acre property was purchased to conserve and protect environmentally unique and irreplaceable lands including relatively undisturbed, high-quality pine flatwoods. Recreation activities include hiking, horseback riding, hunting, and fishing.	37 miles southeast of the Okeechobee 2 Site	Development likely limited within this property.	FFWCC Feb 2002
Indian River County Public Shooting Range	Provides public outdoor recreation facility and a training site for hunter education students, volunteers, and law enforcement personnel.	44 miles northeast of the Okeechobee 2 Site	Development likely limited within this property.	FFWCC Aug 2008
J.W. Corbett Wildlife Management Area	Management of unique tropical hardwood hammocks and slash pine flatwoods habitat of the South Florida systems and recovery of the endangered and threatened species that occur there. The vast majority of the 60,288-acre property is used for wildlife management and public hunting.	35 miles southeast of the Okeechobee 2 Site	Additional land acquisition is planned. Planned public uses will include hunting, fishing, and horseback riding.	FFWCC Apr 2003

Table 9.3-15 (Sheet 6 of 12)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Okeechobee 2 Site

Project Name	Summary of Project	Location	Status	Reference
Jonathan Dickenson State Park	The 11,471-acre park supports many unique natural features and significant cultural resources. Contains one the last remaining coastal sand pine scrub plant communities along the southeast coast, a 2600-acre wilderness preserve, and most of the Loxahatchee National Wild and Scenic River. Recreation activities include hiking, biking, camping, picnicking, canoe/ kayaking, and interpretive programs.	49 miles east of the Okeechobee 2 Site	Development likely limited within this property.	FDEP Feb 2000
Kissimmee Prairie Preserve State Park	Public outdoor recreation and conservation is the single use of the 53,760-acre property. Recreation activities include hiking, biking and horse riding trails, camping, picnicking, and interpretive programs.	20 miles north of the Okeechobee 2 Site	Development of new visitor center is planned. Other development likely limited within this property.	FDEP Apr 2005a
Lake June in Winter Scrub State Park	Some of the finest remnants of scrub habitat found in peninsular Florida and supports a significant population of Florida scrub jays and five listed plant species. The primary recreation activities focus on the shoreline of the lake.	29 miles west of the Okeechobee 2 Site	Development likely limited within this property.	FDEP Feb 2004
Lake Okeechobee	Lake Okeechobee is the second largest freshwater lake within the continental United States and is a nationally recognized bass and pan fishing resource. The lake offers other recreational amenities as well. Air boat and swamp buggy rides, bike riding, hiking, picnicking, camping, and nature interpretation are popular land-based recreation activities in the region.	7 miles southeast of the Okeechobee 2 Site	Development likely limited within this area.	FDEP Jun 2010
Lake Okeechobee Scenic Trail	A 110-mile-long hiking trail circling Lake Okeechobee atop the Herbert Hoover Dike offers scenic views of lakeside and agricultural landscapes. The trail provides opportunities for hiking, bicycle and horseback riding, bird watching, and fishing.	2 miles south of the Okeechobee 2 Site	Development likely limited at specific points along the trail.	FDEP Jun 2010
Lake Wales Ridge National Wildlife Refuge	Management of unique scrub habitat of the Central Florida ridge systems and recovery of the endangered and threatened species that occur there. Public access to refuge is limited to guided tours only.	23 miles west of the Okeechobee 2 Site	Additional land acquisition is planned. Development likely limited within this area.	USFWS Apr 2010
Lake Wales Ridge Wildlife and Environmental Area	Management and restoration of unique scrub habitat of the Central Florida ridge systems and recovery of the endangered and threatened species that occur there. Public access to refuge is limited to guided tours only.	23 miles west of the Okeechobee 2 Site	Development likely limited within this area.	FFWCC Sep 2002

Table 9.3-15 (Sheet 7 of 12)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Okeechobee 2 Site

Project Name	Summary of Project	Location	Status	Reference
Okaloacoochee Slough Wildlife Management Area	A 2923-acre property managed to maintain and restore the Okalacoochee Slough sawgrass marsh unique lands and threatened and endangered species associated with it. Public activities include hunting, fishing, bird watching, horseback riding, hiking, nature study, wildlife viewing, picnicking, and primitive camping. Access limited to eastern side of property.	47 miles southwest of the Okeechobee 2 Site	Additional acquisition is planned of surrounding land. Development likely limited within this area.	FFWCC Dec 2001
Pelican Island National Wildlife Refuge	Management of habitats to sustain abundant populations of native species and to help recover threatened and endangered species. Recreational activities include hunting, fishing, canoeing, boating, and wildlife viewing.	48 miles northeast of the Okeechobee 2 Site	Expansion of visitor facilities is planned. Other development would be limited within this refuge.	USFWS Sep 2006
Savannas Preserve State Park	Property (5227 acres) encompasses portions of the Atlantic Costal Ridge and the flatwoods and savanna-like wetlands associated with it. It harbors a unique set of natural communities that include sand pine scrub, flatwoods, marsh, and wet prairies. Public recreation activities include hiking, bicycle and horseback riding, canoe/kayaking, picnicking, wildlife viewing and environmental education.	39 miles east of the Okeechobee 2 Site	Development of facilities for public use likely limited within this area.	FDEP Jun 2003
Seabranch Inlet State Park	Management of 913 acres of various different natural communities including a rare and important baygall, beach dune, and scrub communities. The park in only open to the public for hiking and nature appreciation.	47 miles east of the Okeechobee 2 Site	Development likely limited within this area.	FDEP Oct 2002a
Spirit of the Wild Wildlife Management Area	This 7486-acre property is managed to protect existing swale or “river grass” natural community which forms an important habitat for numerous species of special concern, as well as forms a hydrological connection with protected lands to the east and south. Public recreation activities include hunting, fishing, horseback riding, hiking, nature study, wildlife viewing, picnicking, and primitive camping	50 miles southwest of the Okeechobee 2 Site	Additional acquisition is planned. Development likelylimited within this area.	FFWCC Sep 2006
St. Lucie Inlet Preserve State Park	Accessible only by private boat and provides 4786 acres consisting of mangrove swamps, maritime hammock and undeveloped beach. Public recreation activities include swimming, snorkeling, scuba diving, sunbathing, fishing, primitive camping, picnicking, hiking, and nature appreciation.	47 miles east of the Okeechobee 2 Site	Development likely limited within this park.	FDEP Oct 2002b

Table 9.3-15 (Sheet 8 of 12)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Okeechobee 2 Site

Project Name	Summary of Project	Location	Status	Reference
St. Sebastian River Preserve State Park	Twenty archaeological sites and twenty-two distinct natural communities have been mapped in the 21,748-acre park including mesic flatwoods, prairie hammock, sandhill, scrubby flatwoods, and upland hardwood forests. Recreation activities include fishing, canoe/ kayaking, horseback riding, hiking, primitive camping, and nature appreciation.	42 miles northeast of the Okeechobee 2 Site	Development likely limited within this area	FDEP Oct 2005
Three Lakes Wildlife Management Area	A 50,889-acre property managed to provide environmental protection of extensive prairie, lake, and hammock habitats and maintain biodiversity while allowing compatible use by man. Recreation activities include hunting, fishing, horseback riding, hiking, canoeing, boating, wildlife viewing, picnicking, and camping.	40 miles north of the Okeechobee 2 Site	Additional acquisition is planned. Development likely limited within this area	FFWCC Jan 2001
Comprehensive Everglades Restoration Plan Projects				
C-44 Reservoir and Storage and Treatment Area	A component of the Indian River Lagoon - South Project consisting of a 3400-acre reservoir and 6200 acres of emergent vegetation.	34 miles southeast of the Okeechobee 2 Site	Design and land acquisition for this project is completed. Construction is anticipated to begin in 2011.	SFWMD Feb 2006, USACE Feb 2010
Indian River Lagoon - South Project	The project includes construction of several above-ground reservoirs and stormwater treatment areas. The project will use constructed wetlands and muck removal to improve surface water management and water quality of several canal basins, as well as improve habitat in the St. Lucie Estuary and Indian River Lagoon.	22 miles east of the Okeechobee 2 Site	Proposed. Project is scheduled to begin in 2010.	SFWMD Jun 2010, USACE Nov 2009, USACE Feb 2010
Lake Okeechobee Aquifer Storage and Recovery	Project proposes to increase regional storage while reducing both evaporation losses and the amount of land removed from current land use. This will be accomplished by a series of aquifer storage and recovery wells adjacent to Lake Okechobee with a capacity of one billion gallons per day and the associated pre- and post-water quality treatment facilities.	6 miles southeast of the Okeechobee 2 Site	Five separate ASR pilot projects have been constructed around Lake Okeechobee and have provided five years of field data. Two more pilot systems began cycle testing in 2008.	USACE Undated, USACE Jun 2008

Table 9.3-15 (Sheet 9 of 12)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Okeechobee 2 Site

Project Name	Summary of Project	Location	Status	Reference
Lake Okeechobee Watershed Project	Construction of a 1984-acre reservoir and 3975-acre treatment area in the Taylor Creek/Nubbin Slough basin; a 10,281-acre reservoir in the Kissimmee River basin; a 5416-acre reservoir and 8044-acre treatment area in the Lake Istokpoga basin, and a 3730-acre wetland restoration site in Paradise Run in order to increase aquatic and wildlife habitat, regulate lake staging, reduce phosphorus loading, and reduce damaging releases to the surrounding estuaries.	Various locations in Okeechobee County	Proposed. Project is scheduled to begin in 2019.	USACE Undated, USACE Nov 2009
Melaleuca Eradication and other Exotic Plants	Project enhances efforts to control invasive exotic species in south Florida through mass rearing and controlled release of biological agents throughout the region.	Throughout the region	Proposed. Project is scheduled to begin in 2011.	USACE Nov 2009
North Palm Beach County - Part 1	Part 1 of this project includes portions of seven basins that will capture, store and treat excess water that is currently discharged to the Lake Worth Lagoon and use that water to enhance the Loxahatchee River, Loxahatchee Slough, and West Palm Beach Water Catchment Area.	35 miles southeast of the Okeechobee 2 Site	Project in pre-construction, engineering, and design phase. Part 1 construction is estimated to be completed in 2014.	USACE Undated, USACE May 2005
Central and Southern Florida (C&SF) Projects				
Herbert Hoover Dike Rehabilitation	Project to strengthen the 143-mile dike that surrounds Lake Okeechobee.	7 miles southeast of the Okeechobee 2 Site	Construction is underway on the southeast section of the dike. Completion of the project is anticipated in 2025.	USACE Nov 2009
Other Ecosystem Restoration Projects				
Kissimmee River Restoration Project	Project to restore over 40 square miles of river and floodplain ecosystem, including 43 miles of meandering river channel and 27,000 acres of wetlands. The project will reestablish a favorable environment for the flora and fauna that existed in the area prior to the 1960s, when the river was altered to provide flood protection.	22 miles northwest of the Okeechobee 2 Site	Restoration efforts are underway and are expected to be completed in 2013.	USACE Nov 2009
Lakeside Ranch Storage and Treatment Area	Construction of a 2700-acre wetland in western Martin County that will use emergent vegetation to remove phosphorus from stormwater runoff in the Taylor Creek/ Nubbin Slough basin before it enters Lake Okeechobee. The project has been divided into two phases, STA North and STA South.	9 miles east of the Okeechobee 2 Site	Construction of STA North began in 2009. Final design of STA South is scheduled to be completed in 2010, and construction is scheduled to begin in 2011.	SFWMD Jun 2010, USACE Nov 2009

Table 9.3-15 (Sheet 10 of 12)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Okeechobee 2 Site

Project Name	Summary of Project	Location	Status	Reference
Mining Projects				
Brown Ranch Mine	Crushed stone mine	39 miles northeast of the Okeechobee 2 Site	Operational	USGS 2005
Capron Trails Mine	Sand and gravel mine	45 miles southeast of the Okeechobee 2 Site	Operational	USGS 2005
Fort Pierce Quarry	Crushed stone mine	26 miles east of the Okeechobee 2 Site	Operational	USGS 2005
Lake Point Mine	Development of a 959-acre commercial limestone quarry in Martin County	28 miles southeast of the Okeechobee 2 Site	Proposed. CWA Section 404 permit application submitted April 2010.	ACOE Apr 2010a
Mecca-Ryan Operation	Sand and gravel mine	50 miles southeast of the Okeechobee 2 Site	Operational	USGS 2005
Ortona Mine & Plant	Sand and gravel mine	38 miles southwest of the Okeechobee 2 Site	Operational	USGS 2005
Ortona Sand Mine Expansion	154-acre expansion of sand mining operation in Glades County	37 miles southwest of the Okeechobee 2 Site	Proposed. CWA Section 404 permit application submitted March 2010.	ACOE Apr 2010b
Palmdale Sand	Sand and gravel mine	30 miles southwest of the Okeechobee 2 Site	Operational	USGS 2005
Sebring Tu-Co Peat Operation	Peat mine	33 miles northwest of the Okeechobee 2 Site	Operational	USGS 2005
St. Lucie Mine	Sand and gravel mine	33 miles east of the Okeechobee 2 Site	Operational	USGS 2005
Star Pit	Crushed stone mine	46 miles southeast of the Okeechobee 2 Site	Operational	USGS 2005
Witherspoon Sand Plant	Sand and gravel mine	37 miles southwest of the Okeechobee 2 Site	Operational	USGS 2005

Table 9.3-15 (Sheet 11 of 12)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Okeechobee 2 Site

Project Name	Summary of Project	Location	Status	Reference
Other Actions/Projects				
Central and Southern Florida Flood Control Project	The C&SF Flood Control Project was authorized by Congress in 1948 to provide flood control, water supply, prevention of saltwater intrusion, and protection of fish and wildlife resources. Today the CS&F project includes 1000 miles of canals, 720 miles of levees, and almost 200 water control structures. It covers 16 counties over an 18,000-square-mile area from Orlando to the Florida Reef Tract. The existing project provides water supply, flood protection, water management and other benefits to South Florida. However, the project has had unintended negative effects on the Everglades and the entire south Florida ecosystem.	Throughout the region.	Operational	HRA Jun 2006
Alpha General Services, Inc.	Fiberglass tank manufacturer	34 miles northwest of the Okeechobee 2 Site	Operational	FDEP Sep 2006
Arch Mirror South	Glass mirror manufacturer	36 miles northeast of the Okeechobee 2 Site	Operational	FDEP Oct 2007
Atlantic Sugar Association	Sugar manufacturer	44 miles southeast of the Okeechobee 2 Site	Operational	FDEP Jun 2007
Avon Park Air Force Range	106,000-acre bombing and gunnery range and air-ground training complex. Approximately 82,000 acres are open for public access on a regular basis for hiking, hunting, fishing, camping, and other related activities.	25 miles northwest of the Okeechobee 2 Site	Operational	Global Security undated
Cargill Juice America, Inc. - Avon Park Citrus Processing Facility	Citrus juice products and animal feed manufacturer	45 miles northwest of the Okeechobee 2 Site	Operational	FDEP May 2007c
Cargill Juice America, Inc. - Frostproof Plant	Food manufacturer	49 miles northwest of the Okeechobee 2 Site	Operational	FDEP Apr 2006
E-Stone USA Corp	Cultured granite reinforced plastics manufacturer	29 miles northwest of the Okeechobee 2 Site	Operational	FDEP Nov 2009c
Genpak LLC	Polystyrene foam packaging materials manufacturer	37 miles northwest of the Okeechobee 2 Site	Operational	FDEP Jul 2005
Louis Dreyfus Citrus Inc. - Indiantown Citrus Processing Plant	Food manufacturer	33 miles southeast of the Okeechobee 2 Site	Operational	FDEP Jul 2008b
Macho Products Inc	Protective equipment manufacturer	44 miles northeast of the Okeechobee 2 Site	Operational	FDEP May 2007b

Table 9.3-15 (Sheet 12 of 12)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the Okeechobee 2 Site

Project Name	Summary of Project	Location	Status	Reference
Maverick Boat Company	Fiberglass boat manufacturer	39 miles northeast of the Okeechobee 2 Site	Operational	FDEP Jan 2006
Okeelanta Corporation	Sugar manufacturer	48 miles southeast of the Okeechobee 2 Site	Operational	FDEP Jan 2001
Osceola Farms Co	Sugar manufacturer	38 miles southeast of the Okeechobee 2 Site	Operational	FDEP Mar 2010b
Pratt & Whitney - Area C12 & C14	Engineering, manufacturing, and testing of gas turbine and rocket engines	43 miles southeast of the Okeechobee 2 Site	Operational	PBCHD Jul 2004
S2 Yachts Inc. Pursuit Division	Fiberglass boat manufacturer	39 miles northeast of the Okeechobee 2 Site	Operational	FDEP Mar 2008
Sebring International Raceway	A road course auto racing facility with three track configurations: the 12-hour Grand Prix Course, the Old Club Course, and the New Club Course.	29 miles northeast of the Okeechobee 2 Site	Operational	NAMP Jun 2007
Southern Gardens Citrus Processing Corp. - Clewiston Plant	Food manufacturer	37 miles southwest of the Okeechobee 2 Site	Operational	FDEP May 2010a
Sugar Cane Growers Cooperative of Florida	Sugar manufacturer	41 miles southeast of the Okeechobee 2 Site	Operational	FDEP Aug 2006
Tropicana Products, Inc. - Fort Pierce Facility	Citrus product and animal feed manufacturer	35 miles northeast of the Okeechobee 2 Site	Operational	FDEP Oct 2006
Twin Vee Catamarans	Fiberglass boat manufacturer	39 miles northeast of the Okeechobee 2 Site	Operational	FDEP Oct 2008
U.S. Sugar Corp. - Clewiston Mill	Sugar manufacturer	35 miles south of the Okeechobee 2 Site	Operational	FDEP Feb 2010
Wellcraft Marine Corp	Fiberglass boat manufacturer	43 miles northwest of the Okeechobee 2 Site	Operational	FDEP Jul 1999
Water Reclamation and Wastewater Treatment Plants	Numerous plants	Within 50-mile radius of the Site	Operational	FDEP Aug 2010a FDEP Aug 2010b
Future Urbanization	Construction of housing units and associated commercial buildings; roads, bridges and rail; construction of water and/or wastewater treatment facilities and associated pipelines.	Throughout the region.	Construction would occur in the future, as described in state and local land-use planning documents.	—
Various hospitals and industrial facilities that use radioactive materials	Medical and other isotopes	Within 50-mile radius of the Site.	Operational	—

Table 9.3-16 (Sheet 1 of 2)
Estimate of Potentially Affected Areas by Land Cover Type
St. Lucie Alternative Site

Land Use Description	FLUCCS Code	Potentially Affected Area [acres] Entire Project including transmission corridor	Potentially Affected Area [acres] Entire Project Transmission Corridor only
Fixed Single Family Units, less than 2 dwellings per acre	111	14.4	6.6
Fixed Single Family Units, 2-5 dwellings per acre	121	14.0	1.9
Fixed Single Family Units, 6 or more dwellings per acre	131	2.7	—
Mobile Home Units, 6 or more dwellings per acre	132	8.9	—
Multiple dwelling units, low rise	133	14.0	—
Multiple dwelling units, high rise	134	5.5	—
High density under construction	139	6.2	—
Commercial and Services	140	19.5	0.1
Retail and Services	141	4.9	—
Commercial and Services under construction	149	0.04	—
Other Light Industrial	155	6.2	6.2
Institutional	170	1.6	—
Educational	171	0.1	0.1
Golf Courses	182	10.3	4.8
Parks and Zoos	185	8.3	—
Improved Pastures	211	214.8	214.8
Unimproved Pastures	212	83.3	83.3
Woodland Pastures	213	29.0	29.0
Field Crops	215	7.6	7.6
Citrus Groves	221	172.3	172.3
Herbaceous (Dry Prairie)	310	396.0	392.1
Shrub and Brushland	320	127.0	127.0
Palmetto Prairies	321	36.0	36.0
Coastal Scrub	322	45.2	41.5
Mixed Rangeland	330	46.3	46.3
Pine Flatwoods	411	260.7	260.7
Upland Hardwood Forests	420	28.2	7.0
Brazilian Pepper	422	25.0	20.1
Tropical Hardwoods	426	0.04	—
Cabbage Palm	428	5.2	—
Hardwood-Coniferous Mixed	434	23.4	23.4
Australian Pines	437	3.4	—
Streams and Waterways	510	5.4	4.8

**Table 9.3-16 (Sheet 2 of 2)
Estimate of Potentially Affected Areas by Land Cover Type
St. Lucie Alternative Site**

Land Use Description	FLUCCS Code	Potentially Affected Area [acres] Entire Project including transmission corridor	Potentially Affected Area [acres] Entire Project Transmission Corridor only
Ditches	511	3.9	3.9
Lakes	520	2.7	2.7
Reservoirs	530	6.3	2.9
Embayments opening directly into Gulf or Atlantic Ocean	541	186.5	157.4
Embayments not opening directly into Gulf or Atlantic Ocean	542	40.2	—
Enclosed Saltwater Ponds within Salt Marsh	543	0.1	—
Mangrove Swamps	612	419.9	14.7
Mixed Wetland Hardwoods	617	63.3	63.3
Cypress	621	0.1	0.1
Hydric Pine Flatwoods	625	41.1	41.1
Freshwater Marshes	641	282.5	282.5
Wet Prairies	643	78.3	78.3
Emergent Aquatic Vegetation	644	32.4	32.4
Disturbed Land	740	3.2	3.2
Transportation	810	1.3	1.3
Roads and Highways	814	24.0	11.1
Utilities	830	0.1	0.1
Electric Power Facilities	831	12.0	4.8
Electrical Power Transmission Lines	832	1.5	1.5
Sewage Treatment	834	2.8	—

Table 9.3-17 (Sheet 1 of 2)
Listed Species Documented or Reported in St. Lucie County
August 2011

Scientific Name	Common Name	Federal Status	State Status
Amphibians			
Rana capito	Gopher Frog	N	LS
Birds			
Aphelocoma coerulescens	Florida Scrub-jay	LT	LT
Aramus guarauna	Limpkin	N	LS
Athene cunicularia floridana	Florida Burrowing Owl	N	LS
Calidris canutus rufa	Red Knot	C	—
Caracara cheriway	Crested Caracara	LT	LT
Charadrius melodus	Piping Plover	LT	LT
Dendroica kirtlandii	Kirtland's Warbler	LE	—
Egretta caerulea	Little Blue Heron	N	LS
Egretta thula	Snowy Egret	N	LS
Egretta tricolor	Tricolored Heron	N	LS
Eudocimus albus	White Ibis	N	LS
Falco sparverius paulus	Southeastern American Kestrel	N	LT
Grus americana	Whooping Crane	XN	—
Grus mbricate pratensis	Florida Sandhill Crane	N	LT
Haematopus mbricate	American Oystercatcher	N	LS
Mycteria americana	Wood Stork	LE	LE
Pelecanus occidentalis	Brown Pelican	N	LS
Picoides borealis	Red-cockaded Woodpecker	LE	—
Platalea ajaja	Roseate Spoonbill	N	LS
Polyborus plancus audubonii	Audubon's Crested Caracara	LT	—
Rostrhamus sociabilis plumbeus	Snail Kite	LE	LE
Rynchops niger	Black Skimmer	N	LS
Sterna antillarum	Least Tern	N	LT
Fish			
Bairdiella sanctaeluciae	Striped Croaker	SC	N
Microphis brachyurus	Opossum Pipefish	SC	N
Rivulus marmoratus	Mangrove Rivulus	C	LS
Mammals			
Peromyscus polionotus niveiventris	Southeastern Beach Mouse	LT	LT
Podomys floridanus	Florida Mouse	N	LS
Puma concolor coryi	Florida Panther	LE	—
Puma concolor (all subsp. Except coryi)	Puma (Mountain Lion)	SAT	—
Sciurus niger shermani	Sherman's Fox Squirrel	N	LS
Trichechus manatus	Manatee	LE	LE
Plants and Lichens			
Argusia gnaphalodes	Sea Lavender	N	LE
Chamaesyce cumulicola	Sand-dune Spurge	N	LE
Coelorachis tuberculosa	Piedmont Jointgrass	N	LT
Conradina grandiflora	Large-flowered Rosemary	N	LT
Dicerandra immaculata	Lakela's Mint	LE	LE

Table 9.3-17 (Sheet 2 of 2)
Listed Species Documented or Reported in St. Lucie County
August 2011

Scientific Name	Common Name	Federal Status	State Status
Glandularia maritima	Coastal Vervain	N	LE
Halophila johnsonii	Johnson's Seagrass	LT	N
Harrisia fragrans	Fragrant Prickly Apple	LE	LE
Lechea cernua	Nodding Pinweed	N	LT
Okenia hypogaea	Burrowing Four-o'clock	N	LE
Peperomia obtusifolia	Blunt-leaved Peperomia	N	LE
Polygala smallii	Tiny Polygala	LE	LE
Pteroglossaspis ecristata	Giant Orchid	N	LT
Schizachyrium niveum	Scrub Bluestem	N	LE
Tephrosia angustissima var. curtissii	Coastal Hoary-pea	N	LE
Reptiles			
Alligator mississippiensis	American Alligator	SAT	LT (S/A)
Caretta caretta	Loggerhead	LT	LT
Chelonia mydas	Green Turtle	LE	LE
Crocodylus acutus	American Crocodile (FL population)	LT	—
Dermochelys coriacea	Leatherback	LE	LE
Drymarchon couperi	Eastern Indigo Snake	LT	LT
Eretmochelys mbricate	Hawksbill	LE	LE
Gopherus polyphemus	Gopher Tortoise	N	LT
Lepidochelys kempii	Kemp's Ridley	LE	LE
Pituophis melanoleucus mugitus	Florida Pine Snake	N	LS

FEDERAL STATUS
LE Endangered: species in danger of extinction throughout a significant portion of its range.
LT Threatened: species likely to become Endangered within the foreseeable future throughout a significant portion of its range.
SAT Treated as threatened because of similarity of appearance to a species that is federally listed so that enforcement personnel have difficulty in attempting to differentiate between the listed and unlisted species.
C Candidate species for which federal listing agencies have sufficient information on biological vulnerability and threats to support proposing to list the species as Endangered or Threatened.
XN Nonessential experimental population.
SC Not currently listed, but considered a "species of concern" to USFWS.
N Not currently listed, nor currently being considered for listing as Endangered or Threatened.

STATE LEGAL STATUS
LE Endangered: species, subspecies, or isolated population so few or depleted in number or so restricted in range that it is in imminent danger of extinction.
LT Threatened: species, subspecies, or isolated population facing a very high risk of extinction in the future.
LS Species of Special Concern is a species, subspecies, or isolated population which is facing a moderate risk of extinction in the future.
N Not currently listed, nor currently being considered for listing.

Sources:FNAI, 2011 [last updated June 2011; last accessed August 15, 2011]
USFWS, Feb 2011 [last updated August 15, 2011; accessed August 15, 2011]

Table 9.3-18 (Sheet 1 of 11)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the St. Lucie Site

Project Name	Summary of Project	Location	Status	Reference
Energy Projects				
City of Vero Beach Municipal Utilities	Five-unit, 155-MW gas- and oil-fired plant	21 miles northwest of the St. Lucie Site	Operational	FDEP Jan 2008c
Florida Gas Transmission - Phase VIII Expansion Project	Construction and operation of 483.2 miles of pipeline facilities, including an 89.8-mile long natural gas pipeline in a new right-of-way that runs from DeSoto County through Highlands and Okeechobee Counties to the FPL Martin Plant site.	DeSoto, Highlands, Okeechobee, and Martin Counties	Proposed. Final EIS issued September 2009.	FERC Sep 2009
Florida Gas Transmission - Station #20	Compressor station consisting of 5 internal combustion engines.	12 miles northwest of the St. Lucie Site	Operational	FDEP May 2008
Florida Municipal Power Agency - Treasure Coast Energy Center	Single-unit, 300-MW gas-fired plant	8 miles northwest of the St. Lucie Site	Operational	FDEP May 2010b
Floridian Natural Gas Storage Company - Natural Gas Storage Facility	Liquefied natural gas storage, liquefaction, and vaporization facility with storage capacity of eight billion cubic feet of natural gas	26 miles southwest of the St. Lucie Site	Proposed. Final EIS issued July 2008.	FERC Jul 2008
Fort Pierce Utilities Authority - H. D. King Power Plant	Four-unit, 136-MW gas- and oil-fired plant	9 miles northwest of the St. Lucie Site	Operational	FDEP Jan 2008d
FPL - Martin Next Generation Solar Energy Center	75-MW solar thermal plant	28 miles southwest of the St. Lucie Site	Proposed. Currently under construction, expected completion 3Q 2010.	FPL May 2008
FPL - Martin Plant	Five-unit, 3734-MW gas- and oil-fired plant	26 miles southwest of the St. Lucie Site	Operational	FDEP Nov 2009b
FPL - Riviera Plant	Two-unit, 580-MW oil- and gas-fired plant	42 miles southeast of the St. Lucie Site	Operational. Would be replaced by the Riviera Plant Repowering Project	FDEP Jan 2009
FPL - Riviera Plant Repowering Project	A single-unit, 1250-MW gas-fired combined-cycle plant would replace the two existing boilers at the site.	42 miles southeast of the St. Lucie Site	Proposed. Air Construction Permit issued June 2009.	FDEP Jun 2009
FPL - St. Lucie Plant	Two-unit, 1680-MW nuclear plant	Collocated with existing units at the St. Lucie Site	Operational	FPL Dec 2007
FPL - St. Lucie Uprate Project	The project will increase the net electrical generation for Units 1 & 2 by 104-MW each.	Collocated with existing units at the St. Lucie Site	Proposed. Site Certification Application approved by FPSC in 2008.	FPL Dec 2007
FPL - West County Energy Center	Two-unit, 2500-MW gas-fired plant	45 miles southwest of the St. Lucie Site	Operational	FDEP Jul 2008a

Table 9.3-18 (Sheet 2 of 11)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the St. Lucie Site

Project Name	Summary of Project	Location	Status	Reference
FPL - West County Energy Center, Unit 3	Single-unit, 1250-MW gas-fired plant	45 miles southwest of the St. Lucie Site	Proposed. Unit 3 under construction, expected completion in 2011.	FDEP Jul 2008a
Geoplasma-St. Lucie, LLC - St. Lucie Plasma Gasification Project	24-MW plasma arc gasification waste-to-energy (WTE) plant	9 miles northwest of the St. Lucie Site	Proposed. Draft Air Construction Permit issued May 2010.	FDEP May 2010c
Indiantown Cogeneration Plant	Single-unit, 330-MW coal-fired plant with 2 gas-fired auxiliary boilers.	26 miles southwest of the St. Lucie Site	Operational	FDEP Jan 2010
INEOS New Planet Indian River County BioEnergy Facility	8-MGPY cellulosic ethanol refinery and a 5-MW biomass-fired power plant	22 miles northwest of the St. Lucie Site	Proposed. Application for air construction permit submitted February 2010.	INEOS Feb 2010
Okeechobee Landfill - Landfill Gas to Energy Project	Four- unit, 25.5-MW landfill gas-fired plant.	27 miles west of the St. Lucie Site	Proposed. Air construction permit issued April 2010.	FDEP Apr 2010
Sea Gen St. Lucie Hydroelectric Project	Installation, 25 miles off shore near St. Lucie County, of 20 to 40 submerged hydrokinetic generating units with a total capacity of 20- to 40-MW	31 miles east of the St. Lucie Site	Proposed. Preliminary permit issued February 2005.	FERC Feb 2005a
Sea Gen St. Sebastian Hydroelectric Project	Installation, 25 miles off shore near Indian River County, of 20 to 40 submerged hydrokinetic generating units with a total capacity of 20- to 40-MW	41 miles northeast of the St. Lucie Site	Proposed. Preliminary permit issued February 2005.	FERC Feb 2005b
Solid Waste Authority of Palm Beach County - Palm Beach Renewable Energy Facility No. 1	Two-unit, 62-MW municipal solid waste (MSW)-fired plant	39 miles southeast of the St. Lucie Site	Operational	FDEP Jul 2006
Solid Waste Authority of Palm Beach County - Palm Beach Renewable Energy Facility No. 2	Three-unit, 100-MW MSW-fired plant	39 miles southeast of the St. Lucie Site	Proposed. Application for air construction permit submitted May 2010.	SWAPBC May 2010
Transportation Projects				
Indiantown Airport	General aviation airport.	25 miles northwest of the St. Lucie Site	Operational. Limited expansion would occur in the future, as described in state and local planning documents.	FDOT 2009
North Palm Beach County Airport	General aviation and reliever airport for Palm Beach International	34 miles south of the St. Lucie Site	Operational. Expansion and construction would occur in the future, as described in state and local planning documents.	FDOT 2009

Table 9.3-18 (Sheet 3 of 11)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the St. Lucie Site

Project Name	Summary of Project	Location	Status	Reference
Okeechobee County Airport	General aviation airport.	37 miles southwest of the St. Lucie Site	Operational. Expansion and construction would occur in the future, as described in state and local planning documents.	FDOT 2009
Palm Beach County Glades Airport	General aviation airport.	47 miles southwest of the St. Lucie Site	Operational. Limited expansion would occur in the future, as described in state and local planning documents.	FDOT 2009
Palm Beach International Airport	Full service airport - commercial airlines, air cargo, and general aviation	46 miles south of the St. Lucie Site	Operational. Expansion and construction would occur in the future, as described in state and local planning documents.	FDOT 2009
St Lucie County International Airport	General aviation airport.	12 miles northwest of the St. Lucie Site	Operational. Expansion and construction would occur in the future, as described in state and local planning documents.	FDOT 2009
Valkaria Airport	General aviation airport.	46 miles northwest of the St. Lucie Site	Operational. Expansion and construction would occur in the future, as described in state and local planning documents.	FDOT 2009
Vero Beach Municipal Airport	Commercial and general aviation airport.	23 miles northwest of the St. Lucie Site	Operational. Expansion and construction would occur in the future, as described in state and local planning documents.	FDOT 2009
Witham Field Airport	General aviation airport.	12 miles south of the St. Lucie Site	Operational. Limited expansion would occur in the future, as described in state and local planning documents.	FDOT 2009
Port of Fort Pierce	99-acre deepwater seaport with public and private cargo terminals. Current annual cargo throughput of 0.358 million tons.	9 miles northwest of the St. Lucie Site	Operational. Port expansion, dredging, and construction would occur in the future, as described in state and local planning documents.	FSTEDC Mar 2010

Table 9.3-18 (Sheet 4 of 11)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the St. Lucie Site

Project Name	Summary of Project	Location	Status	Reference
Port of Palm Beach	Large full-service deepwater seaport. Current annual cargo throughput of 2.3 million tons. Cruise terminal serves 349,000 passengers annually.	42 miles southeast of the St. Lucie Site	Operational. Port expansion, dredging, and construction would occur in the future, as described in state and local planning documents.	FSTEDC Mar 2010
Tampa - Orlando - Miami High-Speed Intercity Passenger Rail	This project would provide high-speed rail service from Tampa to Miami (through Orlando) with stops in West Palm Beach and Ft. Lauderdale. The termini for the Orlando -Miami corridor are the Orlando International Airport (OIA) and the Miami Intermodal Center at the Miami Airport (MIA).	Route follows the Florida Turnpike corridor from Orange County through Osceola, Okeechobee, St. Lucie, Martin and Palm Beach Counties	Proposed. Phase 1 (Tampa-Orlando corridor) is ongoing. Project development for Phase 2 (Orlando-Miami corridor) began in May 2010.	FDOT May 2010
Parks and Nature Preserve Facilities				
Archie Carr National Wildlife Refuge	Home to the largest nesting population of endangered loggerhead, leatherback, and green sea turtles in the U.S. Recreational activities include fishing, canoeing, swimming, and wildlife viewing. 195,000 visitors in 2006.	31 miles northeast of the St. Lucie Site	Development likely limited within this refuge.	USFWS Nov 2008
Arthur R. Marshall Loxahatchee National Wildlife Refuge	Management of species and habitats to enhance the native biodiversity and integrity of the Everglades ecosystem. Recreational activities include hunting, fishing, canoeing, boating, and wildlife viewing.	46 miles south of the St. Lucie Site	Additional land acquisition and expansion of visitor facilities are planned. Other development would be limited within this refuge.	USFWS Sep 2000
Atlantic Ridge Preserve State Park	The preserve has not yet opened to the public due to the lack of a public access road. Once the road is constructed, the preserve will be available for passive recreational activities including hiking, horseback riding, picnicking, wildlife observation, and birding.	16 miles south of the St. Lucie Site	Development likely limited within this refuge.	FDEP Dec 2005
Avalon State Park	Supports intact examples of coastal and wetland communities including a large stand of undeveloped maritime hammock. Recreational activities focus on the 6,000 feet of Atlantic shoreline and include swimming, fishing, and surfing.	14 miles northwest of the St. Lucie Site	Trail development likely within this park. Other development would be limited.	FDEP Aug 2002
Barley Barber Swamp	A one-mile boardwalk runs through a cypress swamp. On FLP owned Martin site land. Public access requires advance reservation.	29 miles southwest of the St. Lucie Site	Development likely limited within this refuge.	FFWCC Jul 2010
Big Water Heritage Trail	Scenic auto route circling Lake Okeechobee passing though five counties and going by multiple natural and historic sites.	30 miles southwest of the St. Lucie Site	Development likely limited at specific points along the trail.	SWFRPC 2009

Table 9.3-18 (Sheet 5 of 11)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the St. Lucie Site

Project Name	Summary of Project	Location	Status	Reference
DuPuis Wildlife and Environmental Area	21,875 acres managed to conserve and protect water resources as well as protect and restore land resources to its natural state. Recreation activities include hunting, fishing, horseback and bicycle riding, canoeing, camping, and hiking.	29 miles southwest of the St. Lucie Site	Development likely limited within this refuge.	SFWMD Jun 2008
Florida National Scenic Trail	Scenic hiking trail stretches over 1400 miles across the state and traverses nearly all of Florida's unique habitats and includes the Lake Okeechobee Scenic Trail. Portions of the trail are accessible for bicycling, horseback riding, or inline skating.	22 miles south of the St. Lucie Site	Development likely limited at specific points along the trail.	USDAFS Feb 2006
Fort Pierce Inlet State Park	Beaches used as nesting grounds for loggerhead sea turtles. Recreation activities include fishing, swimming, surfing, boating, biking, hiking, and wildlife viewing.	9 miles north of the St. Lucie Site	Additional facilities for canoe access, picnicking staff housing needs, and securing reliable access to the island are planned.	FDEP Dec 2006
Hobe Sound National Wildlife Refuge	An important example of pre-contact Florida ecological environments. Sand dunes and associated lagoons are habitats for rare and threatened species such as manatees, scrub jays, and leatherback sea turtles. Hiking and swimming available to public.	17 miles southeast of the St. Lucie Site	Upgrades to existing beach facilities are planned.	USFWS Dec 2006
Hungryland Wildlife and Environmental Area	The 10,294-acre property was purchased to conserve and protect environmentally unique and irreplaceable lands including relatively undisturbed, high quality pine flatwoods. Recreation activities include hiking, horseback riding, hunting, and fishing.	24 miles south of the St. Lucie Site	Development likely limited within this property.	FFWCC Feb 2002
Indian River County Public Shooting Range	Provides public outdoor recreation facility and a training site for hunter education students, volunteers, and law enforcement personnel.	35 miles northwest of the St. Lucie Site	Development likely limited within this property.	FFWCC Aug 2008
Indian River Lagoon State Park	Two miles of undeveloped frontage (402 acres) along the Indian River Lagoon purchased to preserve and improve the aquatic natural communities. A third of the country's manatee population lives in the Indian River Lagoon. Public use limited to picnicking, hiking, bank fishing, and camping at undeveloped sites.	42 miles north of the St. Lucie Site	31 acres of additional land acquisition is planned. Development likely limited within this property.	FDEP Jan 2004

Table 9.3-18 (Sheet 6 of 11)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the St. Lucie Site

Project Name	Summary of Project	Location	Status	Reference
J.W. Corbett Wildlife Management Area	Management of unique tropical hardwood hammocks and slash pine flatwoods habitat of the South Florida systems and recovery of the endangered and threatened species that occur there. The vast majority of the 60,288-acre property is used for wildlife management and public hunting.	28 miles south of the St. Lucie Site	Additional land acquisition is planned. Planned public uses will include hunting, fishing, and horseback riding.	FFWCC Apr 2003
John D. MacArthur Beach State Park	Park protects a unique cross section of coastal Florida landscape including 121 acres of tropical maritime hammock, the largest remaining example in the county. Nine designated plant and 20 animal species occupy the natural habitats preserved by this park. The 7,000-ft sand beach and dune community attracts a large number of nesting loggerhead, green, and leatherback sea turtles. Recreation activities include swimming, snorkeling, canoeing, fishing, and bird watching.	37 miles south of the St. Lucie Site	Development likely limited within this property	FDEP Apr 2005b
Jonathan Dickenson State Park	The 11,471-acre park supports many unique natural features and significant cultural resources. Contains one the last remaining coastal sand pine scrub plant communities along the southeast coast, a 2600-acre wilderness preserve, and most of the Loxahatchee National Wild and Scenic River. Recreation activities include hiking, biking, camping, picnicking, canoe/ kayaking, and interpretive programs.	22 miles south of the St. Lucie Site	Development likely limited within this property	FDEP Feb 2000
Kissimmee Prairie Preserve State Park	Public outdoor recreation and conservation is the single use of the 53,760-acre property. Recreation activities include hiking, biking and horse riding trails, camping, picnicking, and interpretive programs.	44 miles west of the St. Lucie Site	Development of new visitor center is planned. Other development likely limited within this property.	FDEP Apr 2005a
Lake Okeechobee	Lake Okeechobee is the second largest freshwater lake within the continental United States and is a nationally recognized bass and pan fishing resource. The lake offers other recreational amenities as well. Air boat and swamp buggy rides, bike riding, hiking, picnicking, camping, and nature interpretation are popular land-based recreation activities in the region.	31 miles southwest of the St. Lucie Site	Development likely limited within this area.	FDEP Jun 2010

Table 9.3-18 (Sheet 7 of 11)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the St. Lucie Site

Project Name	Summary of Project	Location	Status	Reference
Lake Okeechobee Scenic Trail	A 110-mile-long hiking trail circling Lake Okeechobee atop the Herbert Hoover Dike offers scenic views of lakeside and agricultural landscapes. The trail provides opportunities for hiking, bicycle and horseback riding, bird watching, and fishing.	31 miles southwest of the St. Lucie Site	Development likely limited at specific points along the trail.	FDEP Jun 2010
Pelican Island National Wildlife Refuge	Management of habitats to sustain abundant populations of native species and to help recover threatened and endangered species. Recreational activities include hunting, fishing, canoeing, boating, and wildlife viewing.	31 miles north of the St. Lucie Site	Expansion of visitor facilities is planned. Other development would be limited within this refuge.	USFWS Sep 2006
Savannas Preserve State Park	Property (5227 acres) encompasses portions of the Atlantic Costal Ridge and the flatwoods and savanna-like wetlands associated with it. It harbors a unique set of natural communities that include sand pine scrub, flatwoods, marsh, and wet prairies. Public recreation activities include hiking, bicycle and horseback riding, canoe/kayaking, picnicking, wildlife viewing and environmental education.	2 miles west of the St. Lucie Site	Development of facilities for public use likely limited within this area.	FDEP Jun 2003
Seabranch Inlet State Park	Management of 913 acres of various different natural communities including a rare and important baygall, beach dune, and scrub communities. The park in only open to the public for hiking and nature appreciation.	14 miles south of the St. Lucie Site	Development likely limited within this area.	FDEP Oct 2002a
Sebastian Inlet State Park	This 971-acre park provides the typical recreational resources of Florida's coastal barrier islands with beach frontage on the Atlantic Ocean. Public recreation activities include hiking, biking, picnicking, camping, and bird watching in the upland communities.	35 miles north of the St. Lucie Site	Development likely limited within this area.	FDEP Dec 2008
St. Lucie Inlet Preserve State Park	Accessible only by private boat and provides 4786 acres consisting of mangrove swamps, maritime hammock, and undeveloped beach. Public recreation activities include swimming, snorkeling, scuba diving, sunbathing, fishing, primitive camping, picnicking, hiking, and nature appreciation.	14 miles south of the St. Lucie Site	Development likely limited within this park.	FDEP Oct 2002b

Table 9.3-18 (Sheet 8 of 11)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the St. Lucie Site

Project Name	Summary of Project	Location	Status	Reference
St. Sebastian River Preserve State Park	Twenty archaeological sites and twenty-two distinct natural communities have been mapped in the 21,748-acre park including mesic flatwoods, prairie hammock, sandhill, scrubby flatwoods, and upland hardwood forests. Recreation activities include fishing, canoe/ kayaking, horseback riding, hiking, primitive camping, and nature appreciation.	33 miles northwest of the St. Lucie Site	Development likely limited within this area.	FDEP Oct 2005
Comprehensive Everglades Restoration Plan Projects				
C-44 Reservoir and Storage and Treatment Area	A component of the Indian River Lagoon - South Project consisting of a 3400-acre reservoir and 6200 acres of emergent vegetation.	20 miles south of the St. Lucie Site	Design and land acquisition for this project is completed. Construction is anticipated to begin in 2011.	SFWMD Feb 2006, USACE Feb 2010
Indian River Lagoon - South Project	The project includes construction of several above-ground reservoirs and stormwater treatment areas. The project will use constructed wetlands and muck removal to improve surface water management and water quality of several canal basins, as well as improve habitat in the St. Lucie Estuary and Indian River Lagoon.	16 miles southwest of the St. Lucie Site	Proposed. Project is scheduled to begin in 2010.	SFWMD Jun 2010, USACE Nov 2009, USACE Feb 2010
Lake Okeechobee Aquifer Storage and Recovery	Project proposes to increase regional storage while reducing both evaporation losses and the amount of land removed from current land use. This will be accomplished by a series of aquifer storage and recovery wells adjacent to Lake Okechobee with a capacity of one billion gallons per day and the associated pre- and post-water quality treatment facilities.	30 miles southwest of the St. Lucie Site	Five separate ASR pilot projects have been constructed around Lake Okeechobee and have provided five years of field data. Two more pilot systems began cycle testing in 2008.	USACE Undated, USACE Jun 2008
Lake Okeechobee Watershed Project	Construction of a 1984-acre reservoir and 3975-acre treatment area in the Taylor Creek/Nubbin Slough basin; a 10,281-acre reservoir in the Kissimmee River basin; a 5416-acre reservoir and 8044-acre treatment area in the Lake Istokpoga basin, and a 3730-acre wetland restoration site in Paradise Run in order to increase aquatic and wildlife habitat, regulate lake staging, reduce phosphorus loading, and reduce damaging releases to the surrounding estuaries.	Various locations in Okeechobee County	Proposed. Project is scheduled to begin in 2019.	USACE Undated, USACE Nov 2009

Table 9.3-18 (Sheet 9 of 11)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the St. Lucie Site

Project Name	Summary of Project	Location	Status	Reference
Melaleuca Eradication and other Exotic Plants	Project enhances efforts to control invasive exotic species in south Florida through mass rearing and controlled release of biological agents throughout the region.	Throughout the region	Proposed. Project is scheduled to begin in 2011.	USACE Nov 2009
North Palm Beach County - Part 1	Part 1 of this project includes portions of seven basins that will capture, store and treat excess water that is currently discharged to the Lake Worth Lagoon and use that water to enhance the Loxahatchee River, Loxahatchee Slough, and West Palm Beach Water Catchment Area.	26 miles south of the St. Lucie Site	Project in pre-construction, engineering, and design phase. Part 1 construction is estimated to be completed in 2014.	USACE Undated, USACE May 2005
North Palm Beach County - Part 2	Part 2 includes aquifer storage and recovery (ASR) with a capacity of 220 million gallons per day.	47 miles south of the St. Lucie Site	Project in pre-construction, engineering, and design phase.	USACE Undated
Central and Southern Florida (C&SF) Projects				
Herbert Hoover Dike Rehabilitation	Project to strengthen the 143-mile dike that surrounds Lake Okeechobee.	30.4 miles southwest of the St. Lucie Site	Construction is underway on the southeast section of the dike. Completion of the project is anticipated in 2025.	USACE Nov 2009
West Palm Beach Canal/ Stormwater Treatment Area - 1E	Project provides flood control, water quality and water supply to the C-51 basin in Palm Beach County.	45 miles south of the St. Lucie Site	Construction is underway. Completion of the project is expected in 2010.	USACE Nov 2009
Other Ecosystem Restoration Projects				
Lakeside Ranch Storage and Treatment Area	Construction of a 2700-acre wetland in western Martin County that will use emergent vegetation to remove phosphorus from stormwater runoff in the Taylor Creek/ Nubbin Slough basin before it enters Lake Okeechobee. The project has been divided into two phases, STA North and STA South.	37 miles west of the St. Lucie Site	Construction of STA North began in 2009. Final design of STA South is scheduled to be completed in 2010, and construction is scheduled to begin in 2011.	SFWMD Jun 2010, USACE Nov 2009
Mining Projects				
Brown Ranch Mine	Crushed stone mine	15 miles northwest of the St. Lucie Site	Operational	USGS 2005
Capron Trails Mine	Sand and gravel mine	12 miles south of the St. Lucie Site	Operational	USGS 2005
Fort Pierce Quarry	Crushed stone mine	18 miles southwest of the St. Lucie Site	Operational	USGS 2005

Table 9.3-18 (Sheet 10 of 11)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the St. Lucie Site

Project Name	Summary of Project	Location	Status	Reference
Lake Point Mine	Development of a 959-acre commercial limestone quarry in Martin County	32 miles southwest of the St. Lucie Site	Proposed. CWA Section 404 permit application submitted April 2010.	ACOE Apr 2010a
Mecca-Ryan Operation	Sand and gravel mine	37 miles south of the St. Lucie Site	Operational	USGS 2005
Palm Beach Mine	Crushed stone mine	46 miles southwest of the St. Lucie Site	Operational	USGS 2005
St. Lucie Mine	Sand and gravel mine	12 miles southwest of the St. Lucie Site	Operational	USGS 2005
Other Actions/Projects				
Central and Southern Florida Flood Control Project	The C&SF Flood Control Project was authorized by Congress in 1948 to provide flood control, water supply, prevention of saltwater intrusion, and protection of fish and wildlife resources. Today the CS&F project includes 1000 miles of canals, 720 miles of levees, and almost 200 water control structures. It covers 16 counties over an 18,000-square-mile area from Orlando to the Florida Reef Tract. The existing project provides water supply, flood protection, water management and other benefits to South Florida. However, the project has had unintended negative effects on the Everglades and the entire south Florida ecosystem.	Throughout the region.	Operational	HRA Jun 2006
Arch Mirror South	Glass mirror manufacturer	13 miles northwest of the St. Lucie Site	Operational	FDEP Oct 2007
Louis Dreyfus Citrus Inc. - Indiantown Citrus Processing Plant	Food Manufacturer	26 miles southwest of the St. Lucie Site	Operational	FDEP Jul 2008b
Macho Products Inc	Protective equipment manufacturer	35 miles northeast of the St. Lucie Site	Operational	FDEP May 2007b
Maverick Boat Company	Fiberglass boat manufacturer	12 miles northeast of the St. Lucie Site	Operational	FDEP Jan 2006
Osceola Farms Co	Sugar manufacturer	40 miles southwest of the St. Lucie Site	Operational	FDEP Mar 2010b
Pratt & Whitney - Area C12 & C14	Engineering, manufacturing, and testing of gas turbine and rocket engines	29 miles south of the St. Lucie Site	Operational	PBCHD Jul 2004

Table 9.3-18 (Sheet 11 of 11)
Past, Present, and Reasonably Foreseeable Projects and Other Actions in the Vicinity of the St. Lucie Site

Project Name	Summary of Project	Location	Status	Reference
S2 Yachts Inc. Pursuit Division	Fiberglass boat manufacturer	12 miles northwest of the St. Lucie Site	Operational	FDEP Mar 2008
Sugar Cane Growers Cooperative of Florida	Sugar manufacturer	50 miles southwest of the St. Lucie Site	Operational	FDEP Aug 2006
Tropicana Products, Inc. - Fort Pierce Facility	Citrus product and animal feed manufacturer	9 miles northwest of the St. Lucie Site	Operational	FDEP Oct 2006
Twin Vee Catamarans	Fiberglass boat manufacturer	7 miles northwest of the St. Lucie Site	Operational	FDEP Oct 2008
Venture Marine Inc.	Fiberglass boat manufacturer	41 miles southeast of the St. Lucie Site	Operational	PBHCD Dec 2007
Water Reclamation and Wastewater Treatment Plants	Numerous plants	Within 50-mile radius of the Site.	Operational	FDEP Aug 2010a FDEP Aug 2010b
Future Urbanization	Construction of housing units and associated commercial buildings; roads, bridges and rail; construction of water and/or wastewater treatment facilities and associated pipelines.	Throughout the region.	Construction would occur in the future, as described in state and local land-use planning documents.	—
Various hospitals and industrial facilities that use radioactive materials	Medical and other isotopes	Within 50-mile radius of the Site.	Operational	—

Table 9.3-19
Characterization of Construction Impacts for the Proposed and Alternative Sites

Category	Turkey Point	Glades	Martin	Okeechobee 2	St. Lucie
Land Use Impacts					
The Site and Vicinity	SMALL	LARGE	MODERATE	LARGE	SMALL
Air Impacts					
Air Quality	SMALL	SMALL	SMALL	SMALL	SMALL
Water-Related Impacts					
Water Use	SMALL	SMALL	SMALL	SMALL	SMALL
Water Quality	SMALL	SMALL	SMALL	SMALL	SMALL
Ecological Impacts					
Terrestrial Ecosystems	SMALL	MODERATE	SMALL	MODERATE	SMALL
Aquatic Ecosystems	SMALL	SMALL	SMALL	SMALL	SMALL
Threatened and Endangered Species	SMALL	SMALL	SMALL	SMALL	SMALL
Socioeconomic Impacts					
Physical Impacts	SMALL	SMALL	SMALL	SMALL	SMALL
Demography	SMALL	SMALL	SMALL	SMALL	SMALL
Economy	SMALL (beneficial)	SMALL (beneficial)	SMALL (beneficial)	SMALL (beneficial)	SMALL (beneficial)
Taxes	SMALL (beneficial)	LARGE (beneficial)	SMALL (beneficial)	LARGE (beneficial)	SMALL (beneficial)
Transportation (assuming no road improvements)	MODERATE	MODERATE	LARGE	LARGE	MODERATE
Aesthetics	SMALL	SMALL	SMALL	MODERATE	SMALL
Recreation	SMALL	SMALL	SMALL	SMALL	SMALL
Housing	SMALL	SMALL	SMALL	SMALL	SMALL
Public and Social Services	SMALL	SMALL	SMALL	SMALL	SMALL
Education	SMALL	SMALL	SMALL	SMALL	SMALL
Historic and Cultural Resources	SMALL	SMALL (cultural resources) LARGE (visual impact on historic character)	SMALL	SMALL (cultural resources) LARGE (visual impact on historic character)	MODERATE
Environmental Justice	SMALL	SMALL	SMALL	SMALL	SMALL

Table 9.3-20
Characterization of Operations Impacts for the Proposed and Alternative Sites

Category	Turkey Point	Glades	Martin	Okeechobee 2	St. Lucie
Land Use Impacts					
The Site and Vicinity	SMALL	LARGE	MODERATE	LARGE	SMALL
Air Impacts					
Air Quality	SMALL	SMALL	SMALL	SMALL	SMALL
Water-Related Impacts					
Water Use	SMALL	SMALL	SMALL	SMALL	SMALL
Water Quality	SMALL	SMALL	SMALL	SMALL	SMALL
Ecological Impacts					
Terrestrial Ecosystems	SMALL	MODERATE	SMALL	MODERATE	SMALL
Aquatic Ecosystems	SMALL	SMALL	SMALL	SMALL	SMALL
Threatened and Endangered Species	SMALL	SMALL	SMALL	SMALL	SMALL
Socioeconomic Impacts					
Physical Impacts	SMALL	SMALL	SMALL	SMALL	SMALL
Demography	SMALL	SMALL	SMALL	SMALL	SMALL
Economy	SMALL (beneficial)	SMALL (beneficial)	SMALL (beneficial)	SMALL (beneficial)	SMALL (beneficial)
Taxes	SMALL (beneficial)	LARGE (beneficial)	SMALL (beneficial)	LARGE (beneficial)	SMALL (beneficial)
Transportation (assuming no road improvements)	MODERATE	MODERATE	LARGE	LARGE	MODERATE
Aesthetics	SMALL	SMALL	SMALL	MODERATE	SMALL
Recreation	SMALL	SMALL	SMALL	SMALL	SMALL
Housing	SMALL	SMALL	SMALL	SMALL	SMALL
Public and Social Services	SMALL	SMALL	SMALL	SMALL	SMALL
Education	SMALL	SMALL	SMALL	SMALL	SMALL
Historic and Cultural Resources	SMALL	SMALL (cultural resources) LARGE (visual impact on historic character)	SMALL	SMALL (cultural resources) LARGE (visual impact on historic character)	MODERATE
Environmental Justice	SMALL	SMALL	SMALL	SMALL	SMALL

Figure 9.3-1
Florida Power & Light Company Service Territory

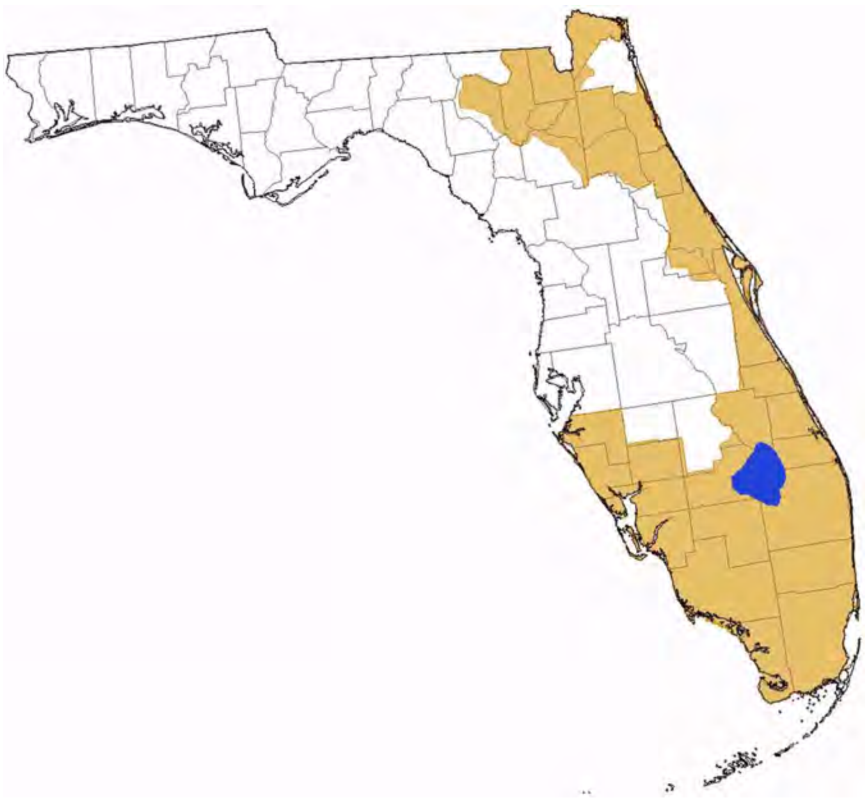


Figure 9.3-2
Transmission System in the FPL Service Territory

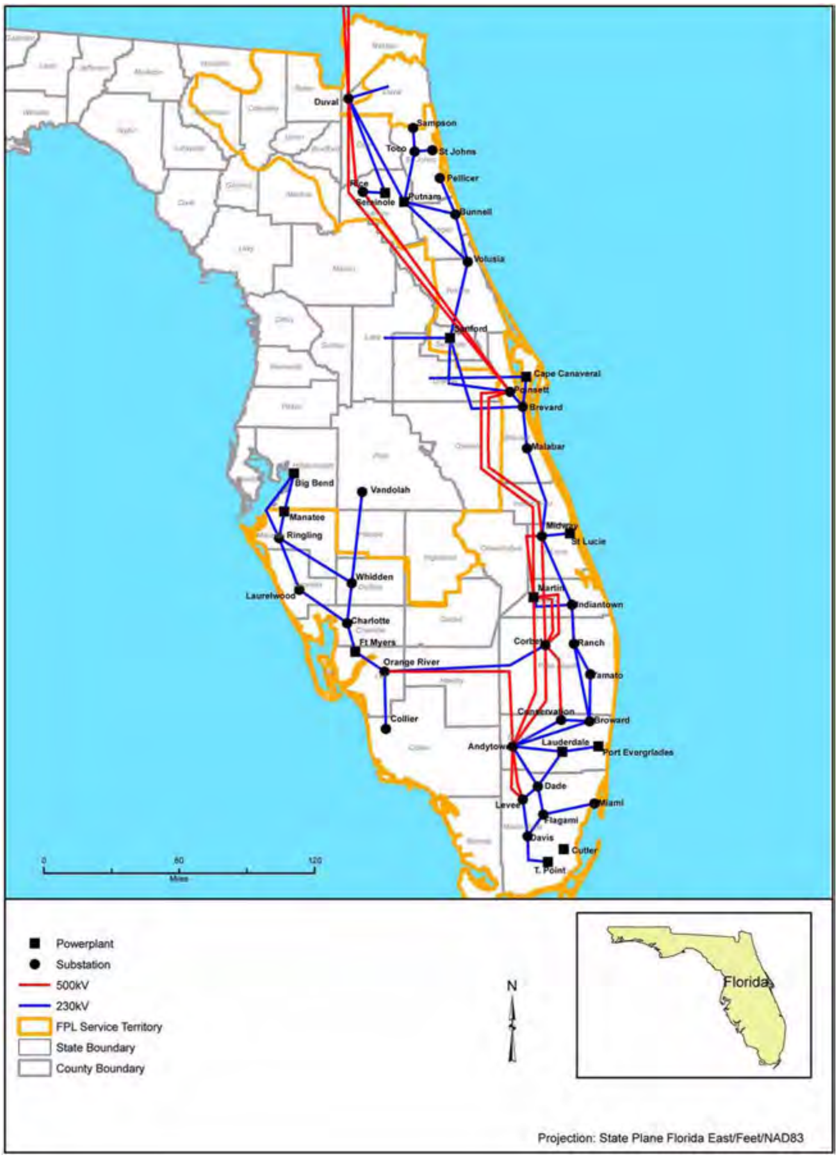


Figure 9.3-3
ROI Regional Screening Results - Southern Service Territory

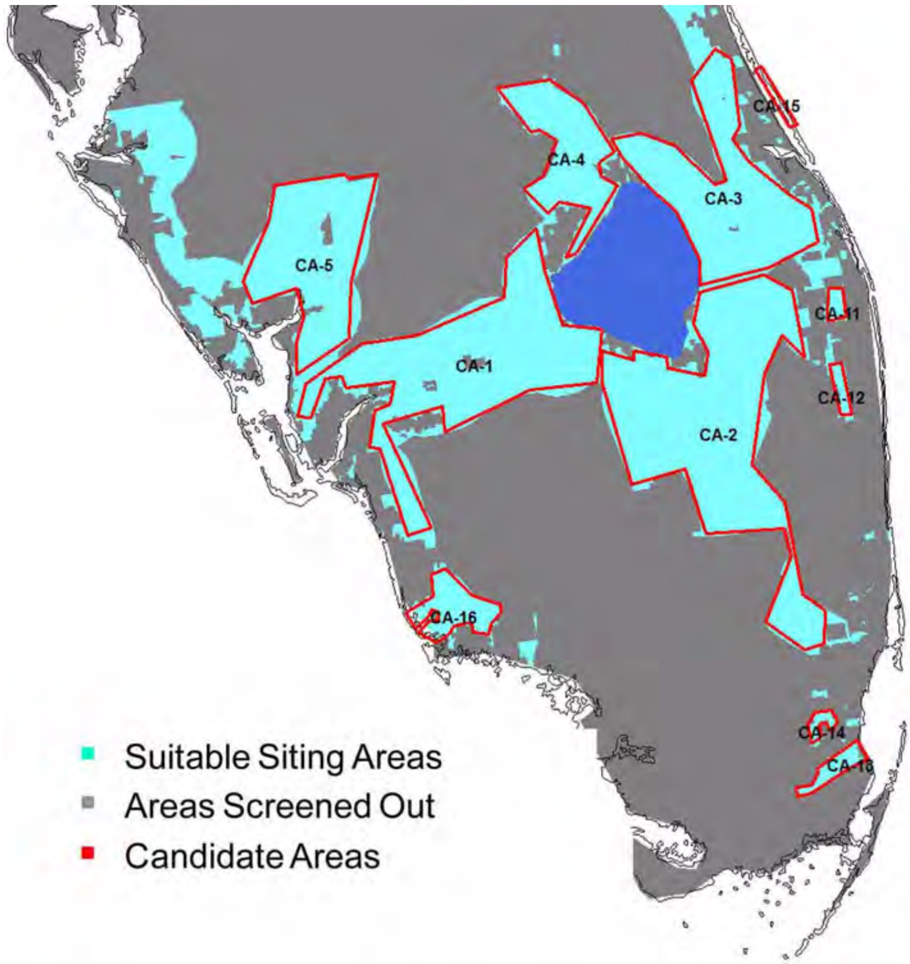
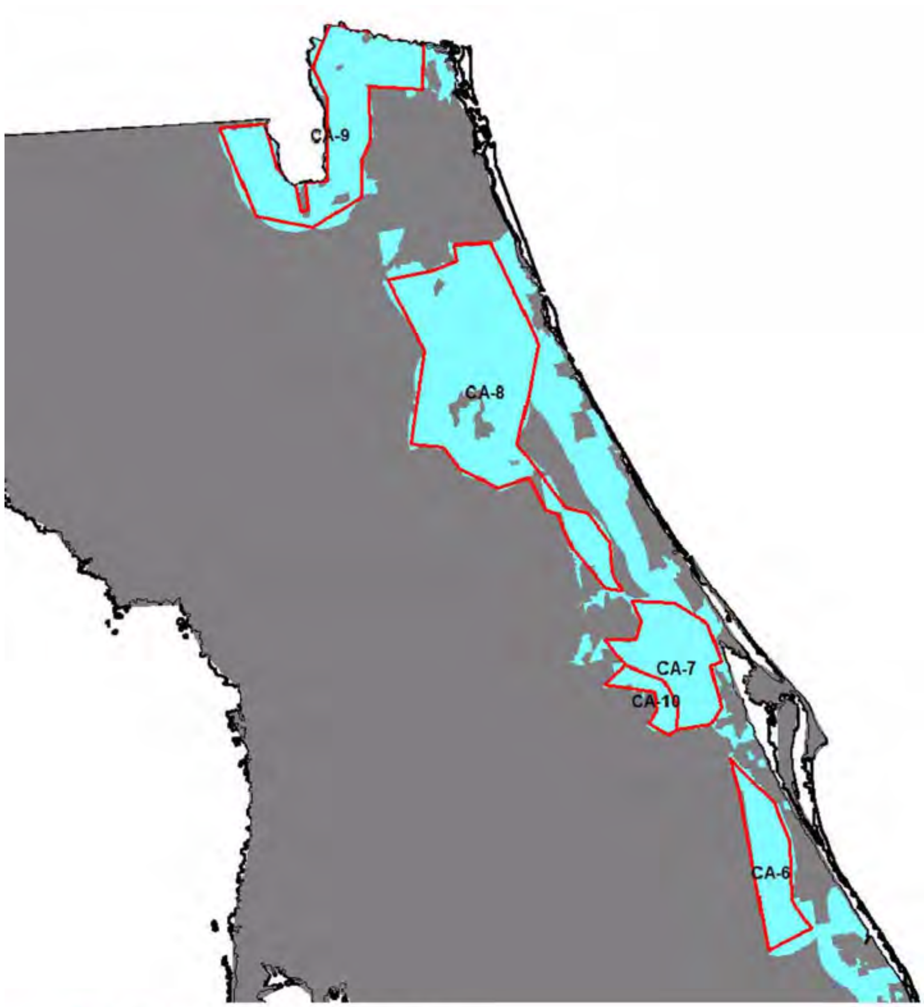


Figure 9.3-4
ROI Regional Screening Results - Northern Service Territory



- Suitable Siting Areas
- Areas Screened Out
- Candidate Areas

Figure 9.3-5
Potential Site Locations

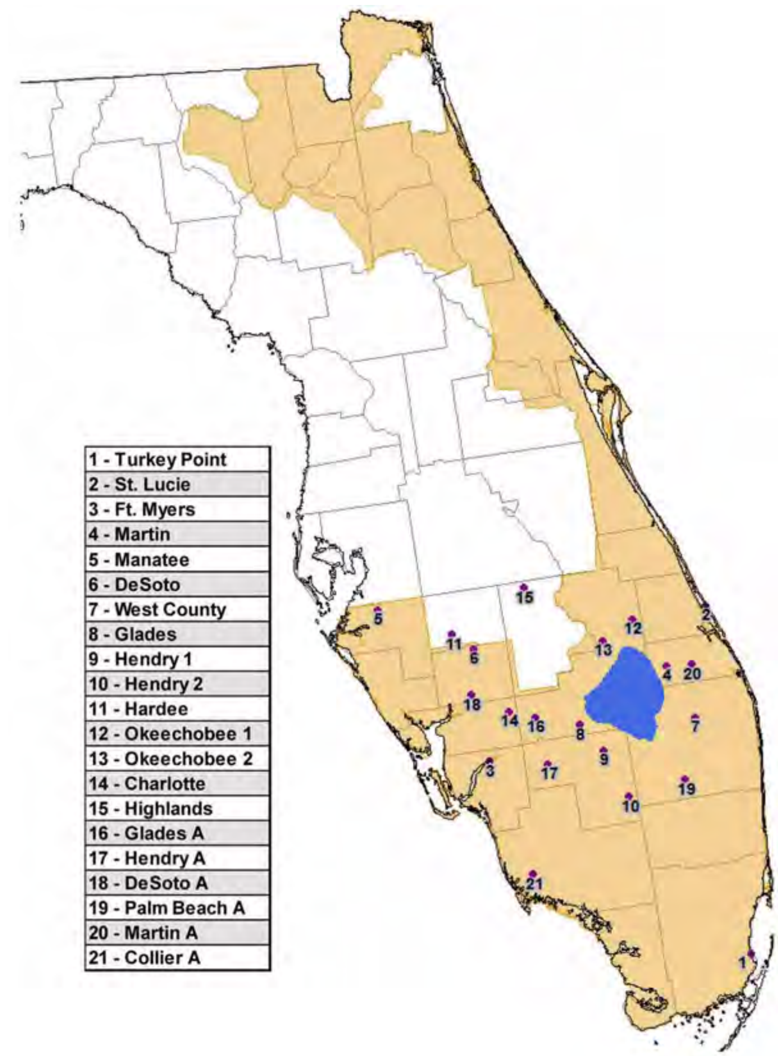


Figure 9.3-6 Screening Criteria Evaluation

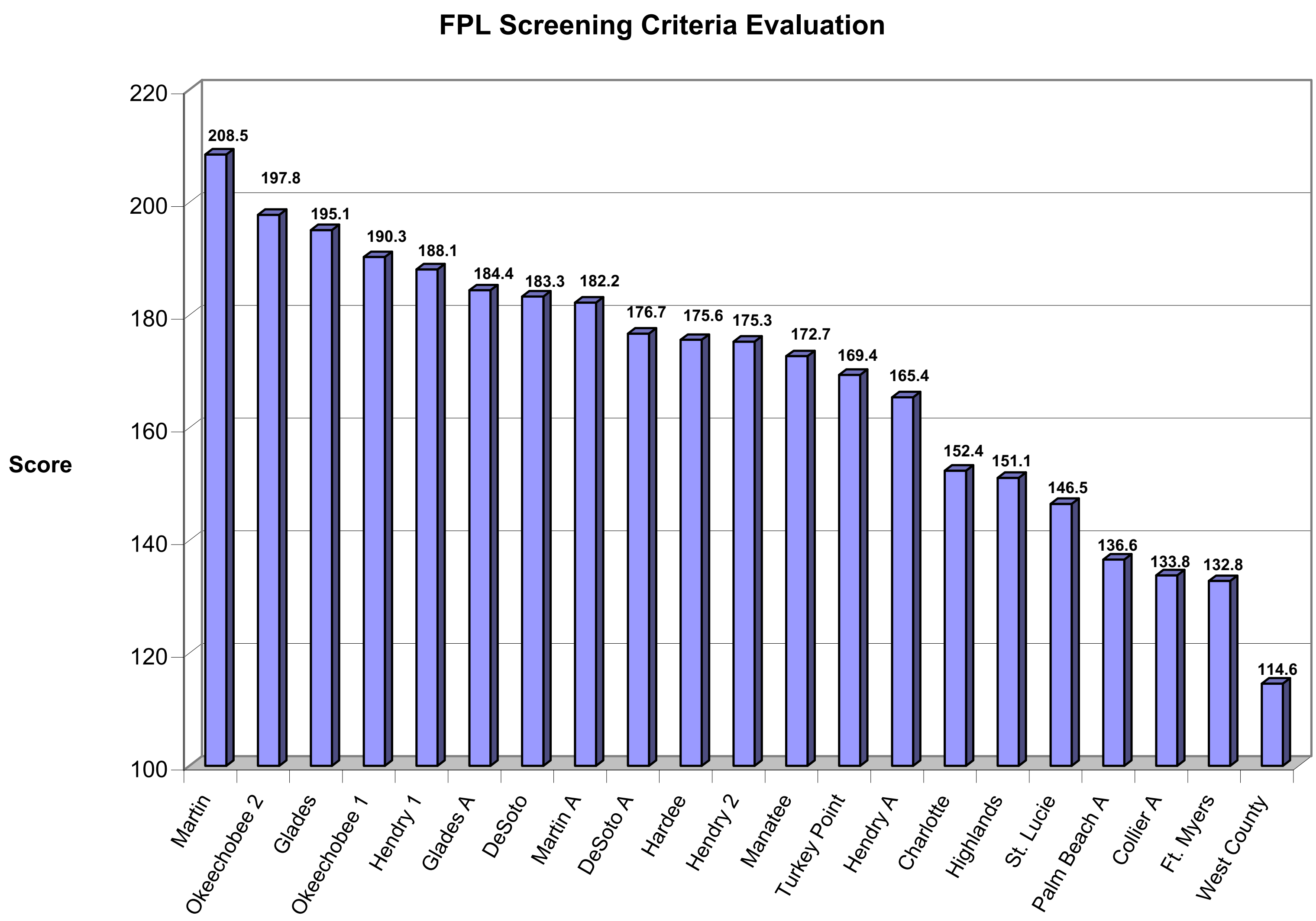


Figure 9.3-7 General Siting Criteria Ratings

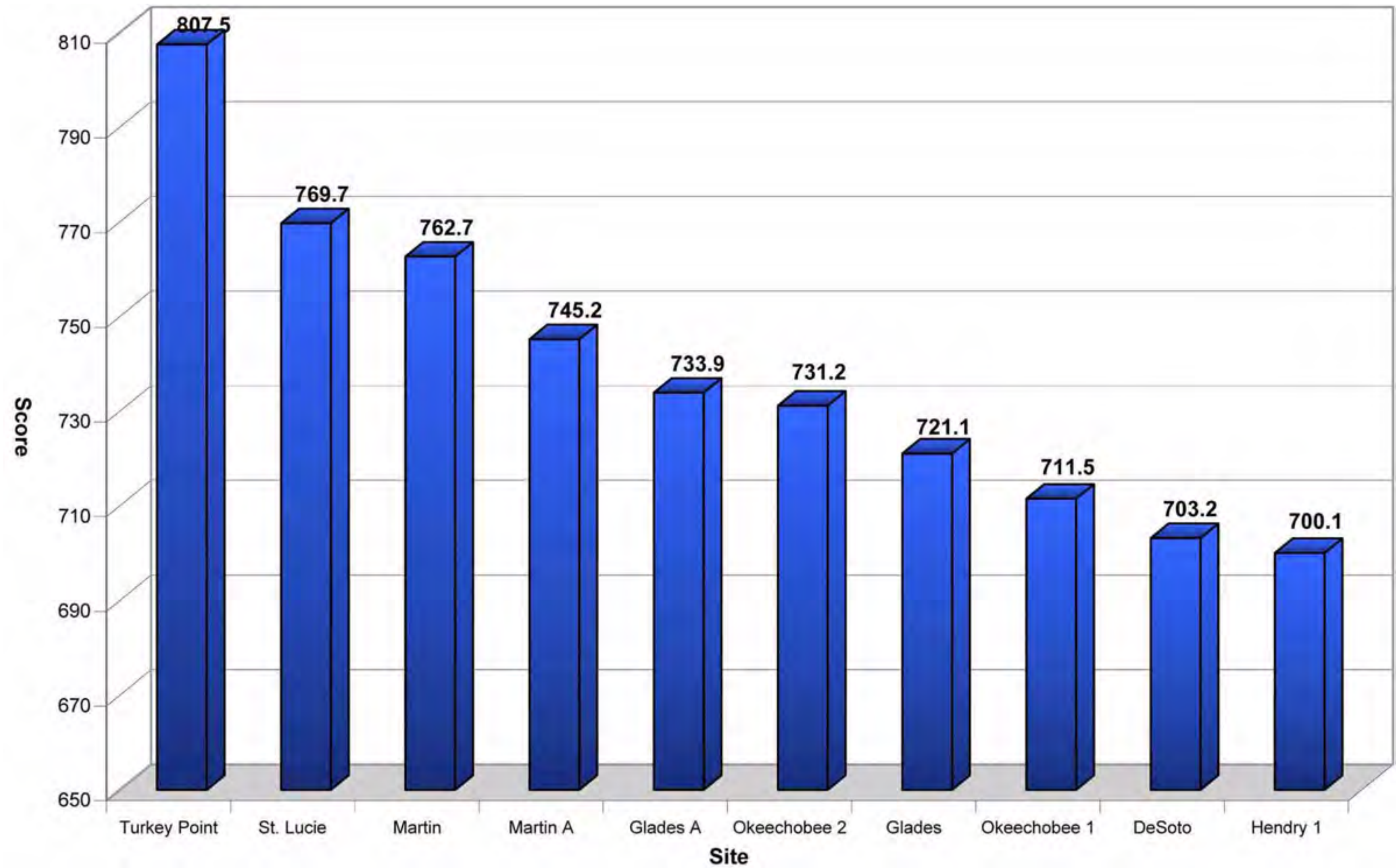


Figure 9.3-8 Glades Alternative Site

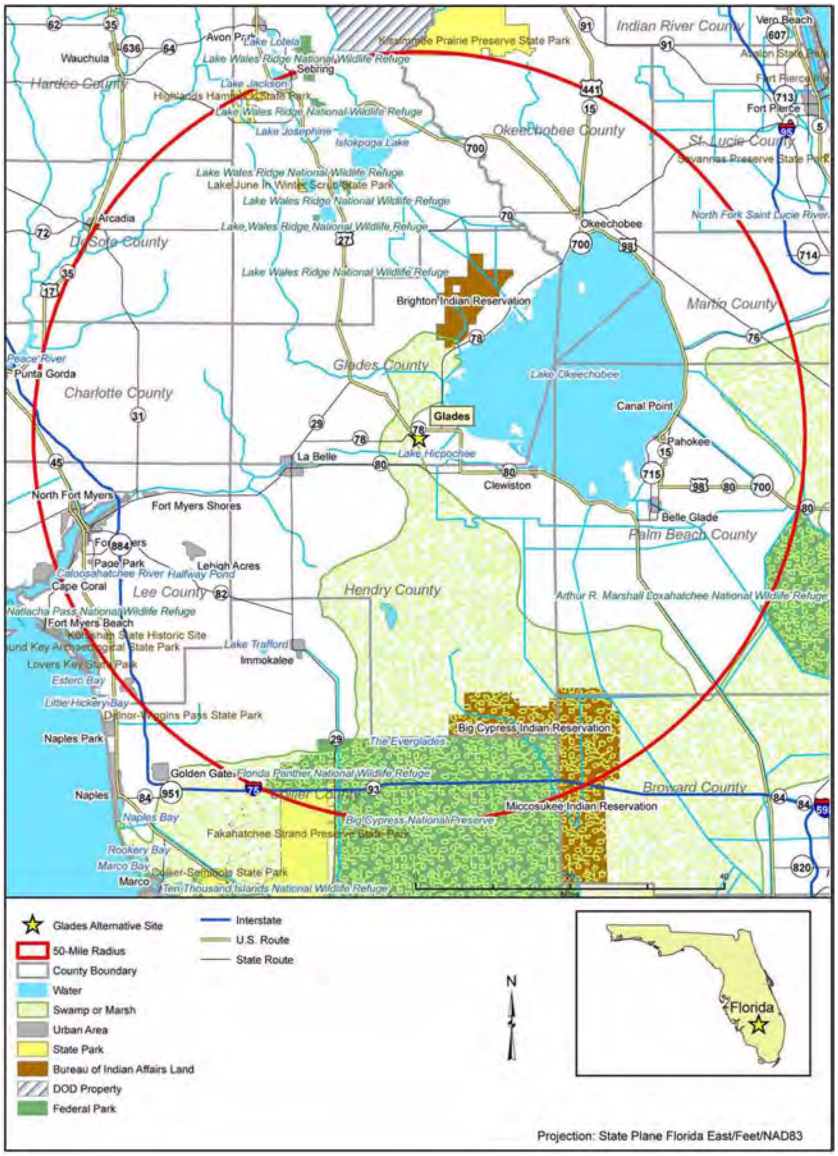


Figure 9.3-9 Glades Alternative Site Significant Minority Populations

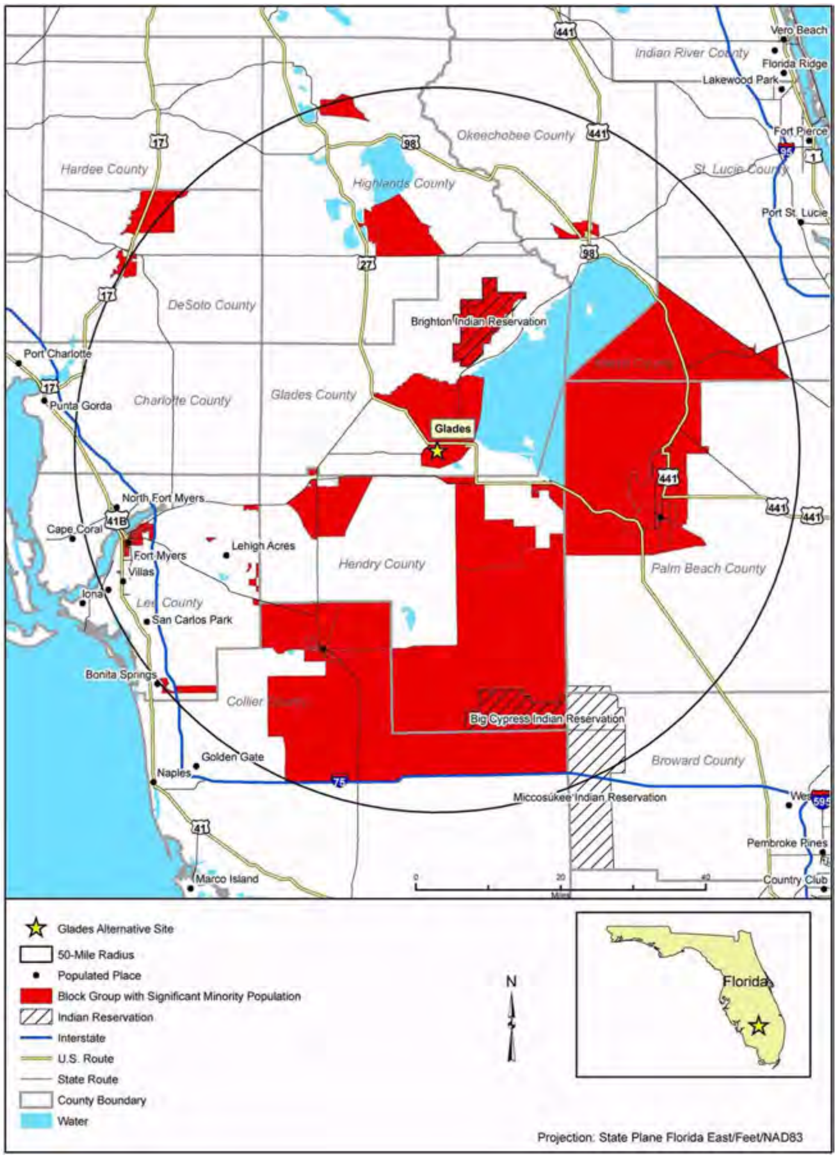


Figure 9.3-10 Glades Alternative Site Significant Low-Income Populations

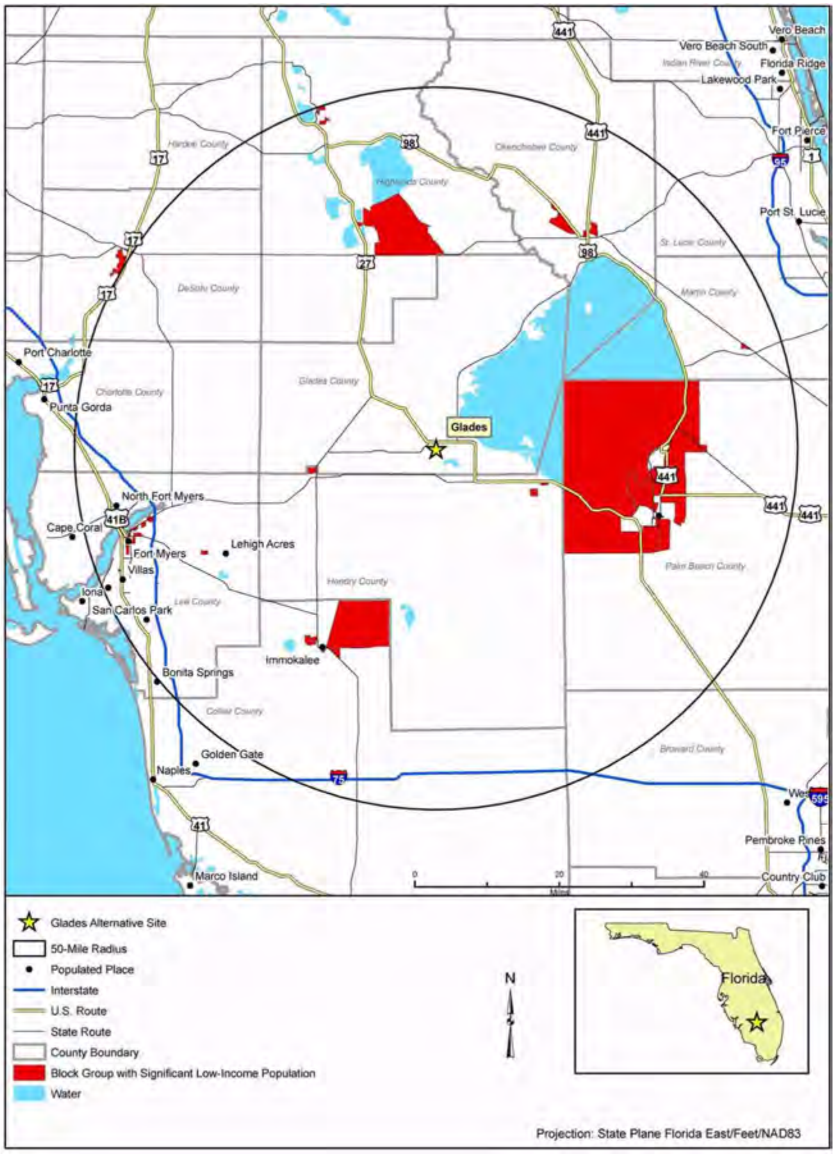


Figure 9.3-11 Martin Alternative Site

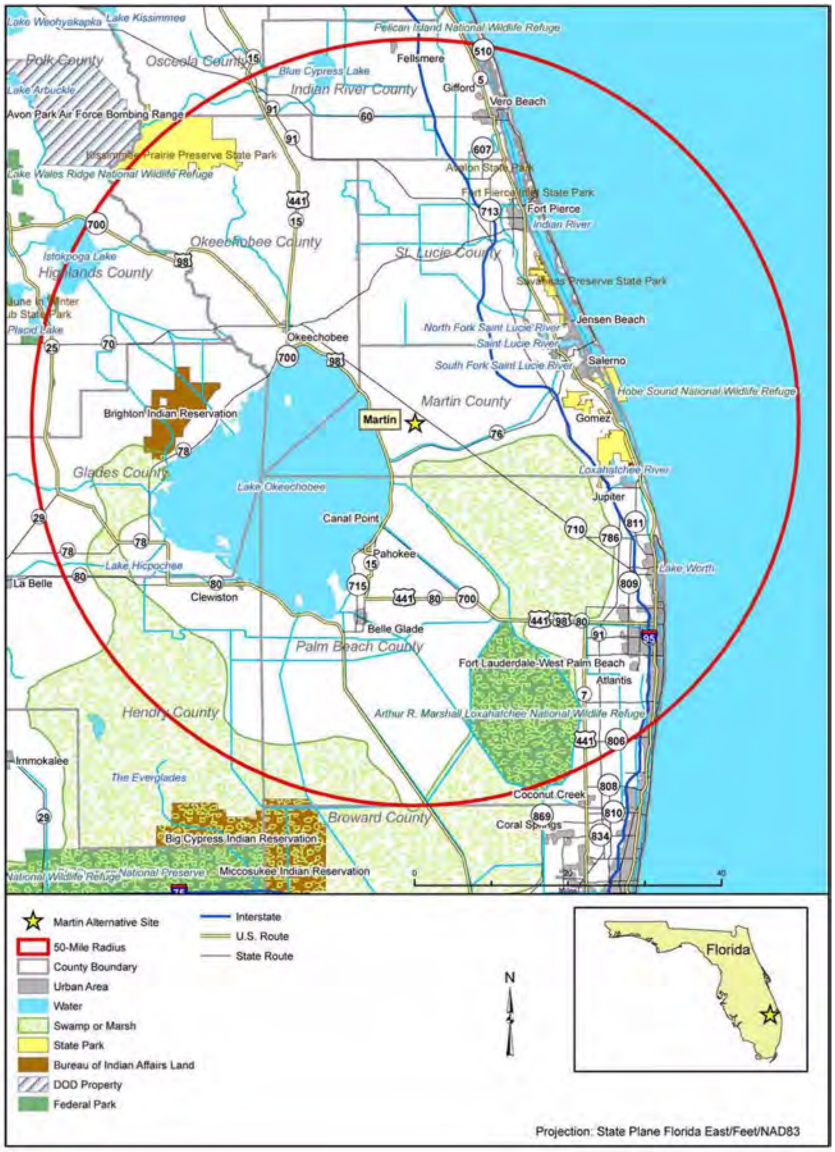


Figure 9.3-12 Martin Alternative Site Significant Minority Populations

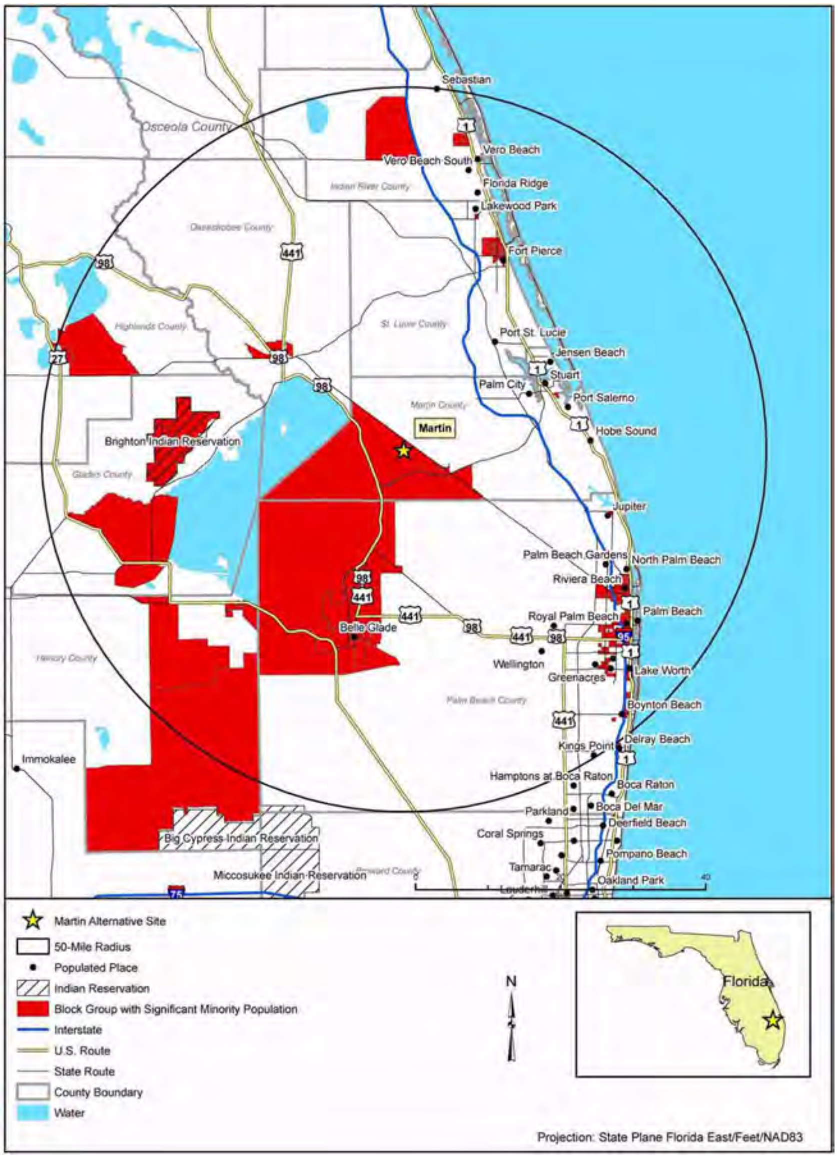


**Figure 9.3-13 Martin Alternative Site
Low-Income Populations**

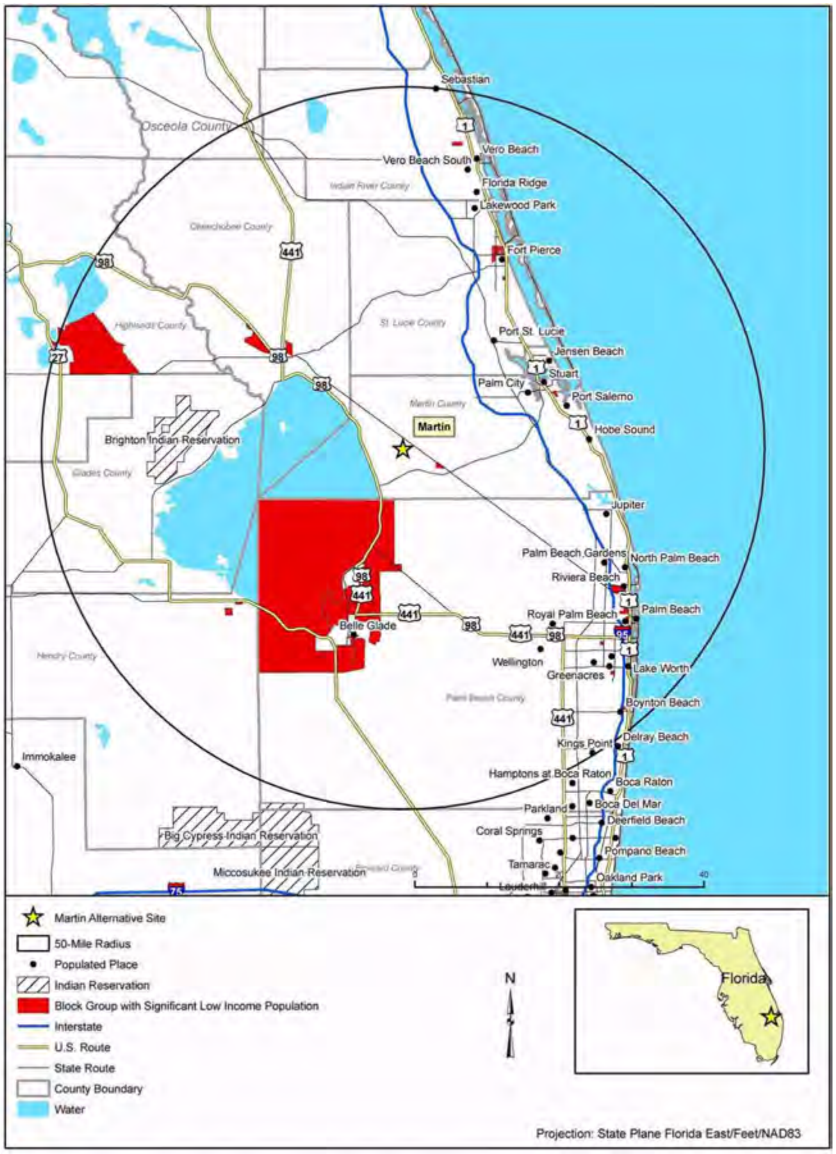


Figure 9.3-14 Okeechobee 2 Alternative Site

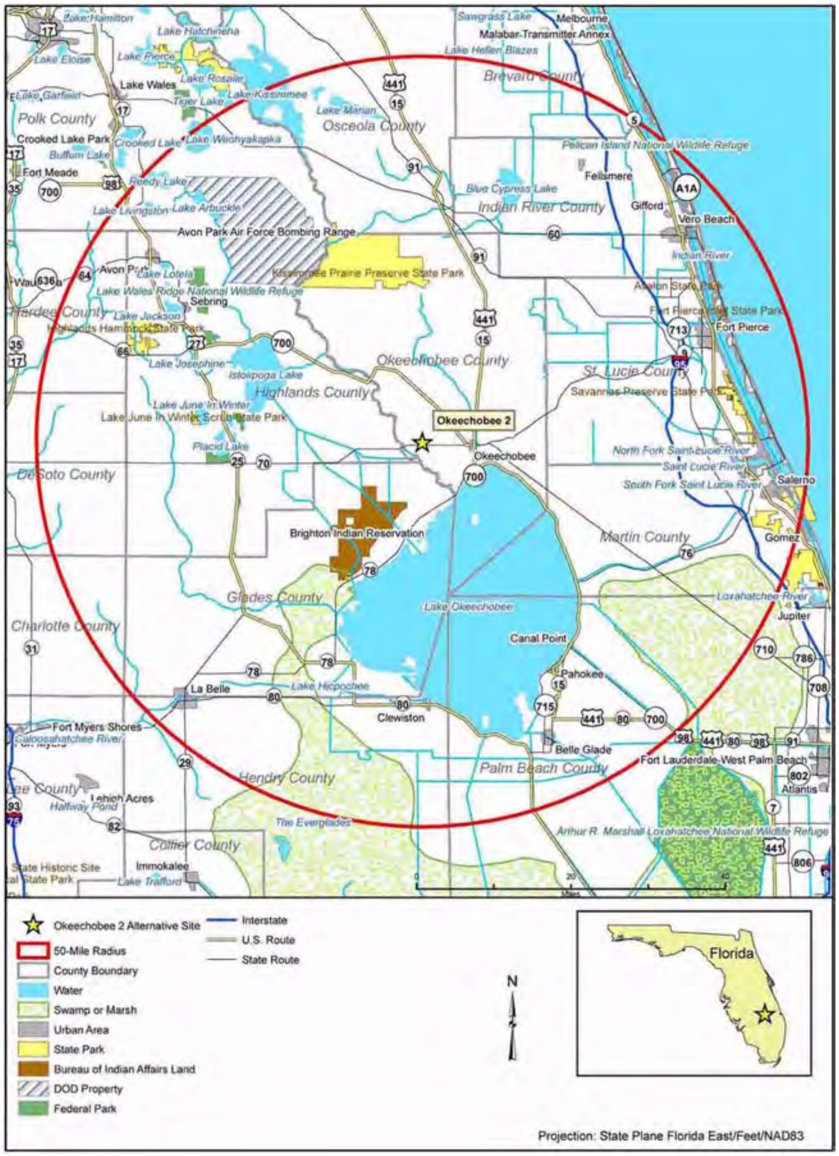


Figure 9.3-15 Okeechobee 2 Alternative Site Significant Minority Populations

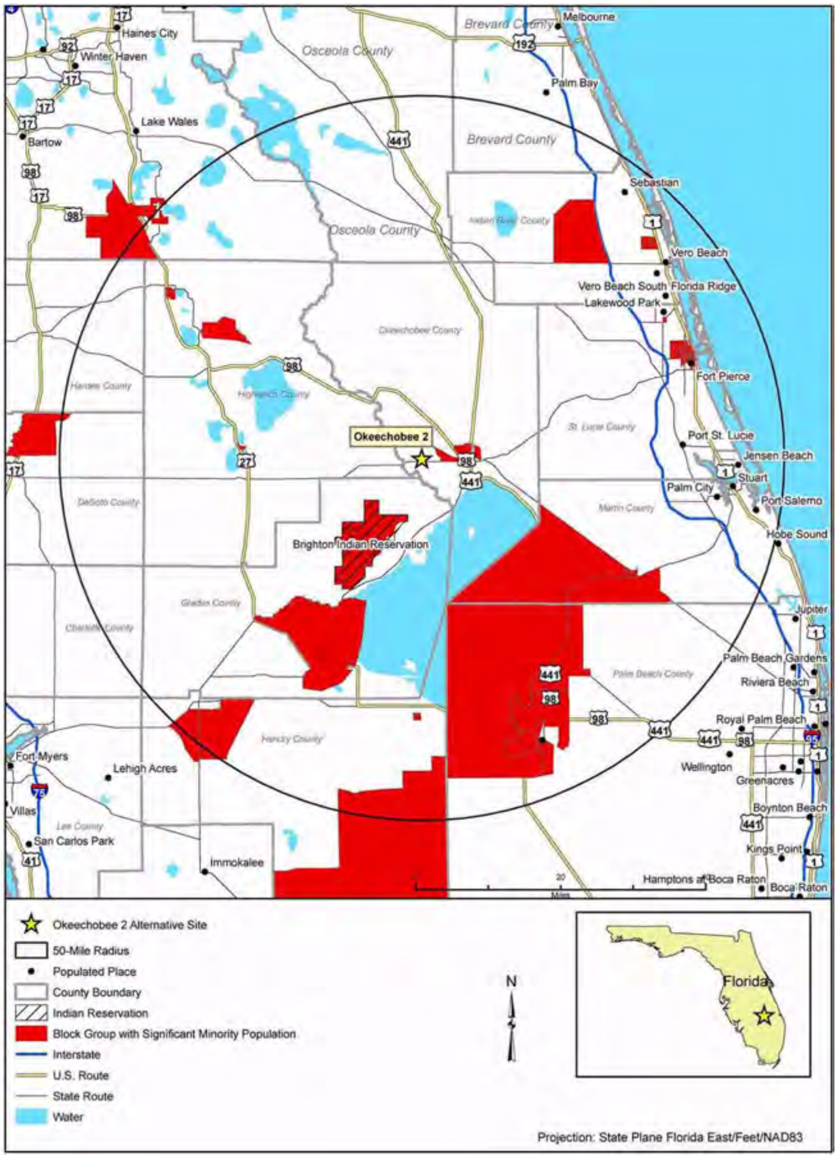


Figure 9.3-16 Okeechobee 2 Alternative Site Significant Low-Income Populations

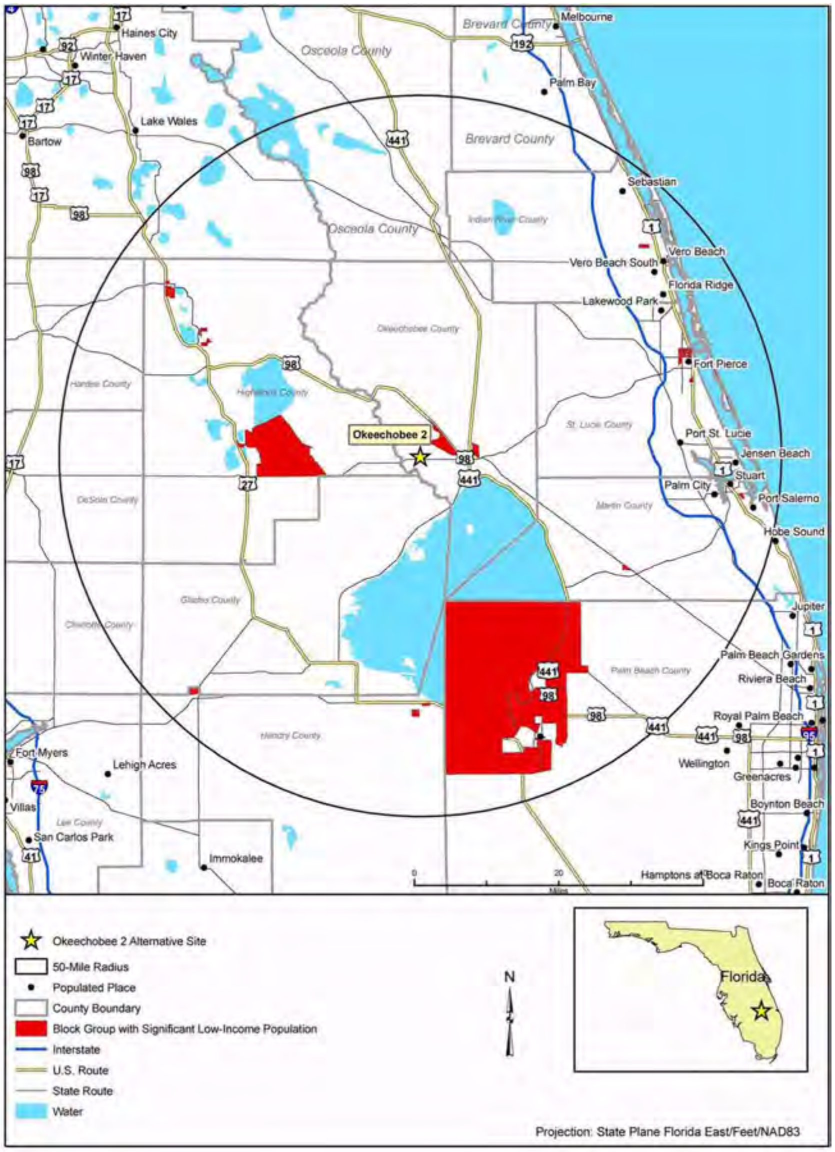


Figure 9.3-17 St. Lucie Alternative Site

Figure 9.3-18 St. Lucie Alternative Site Significant Minority Populations

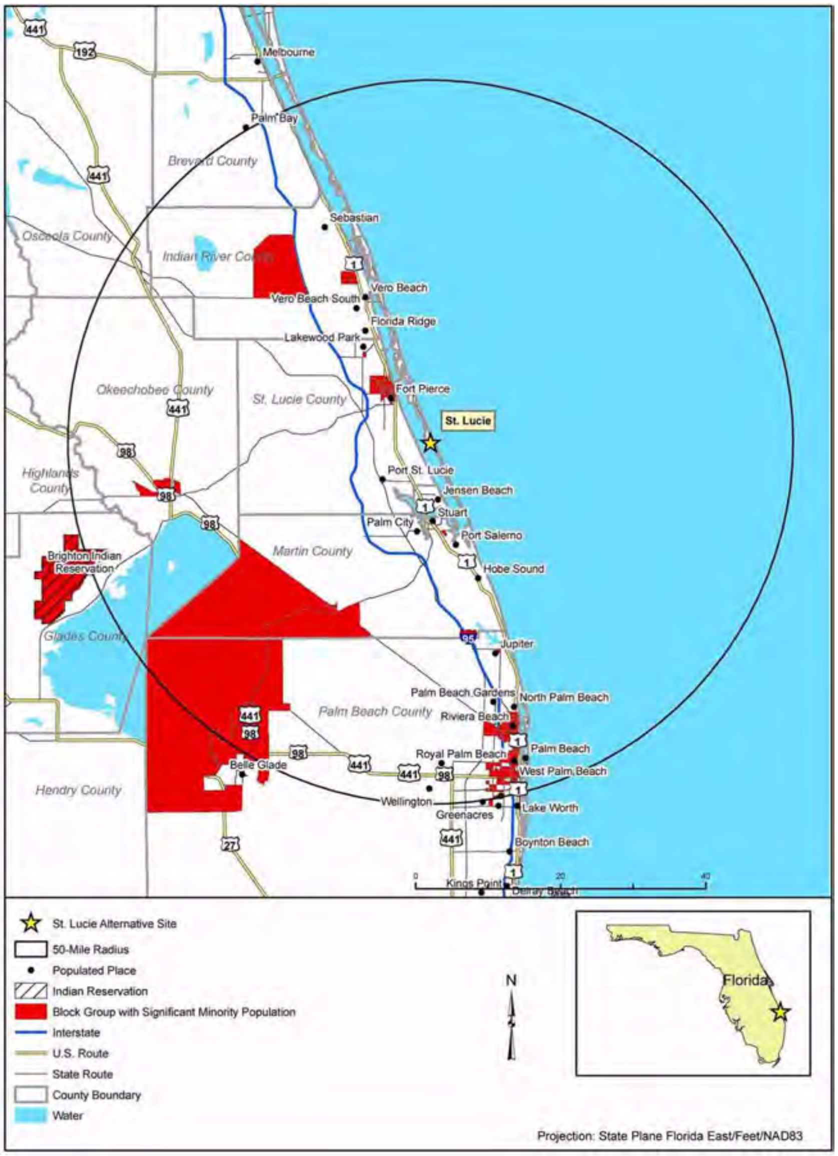
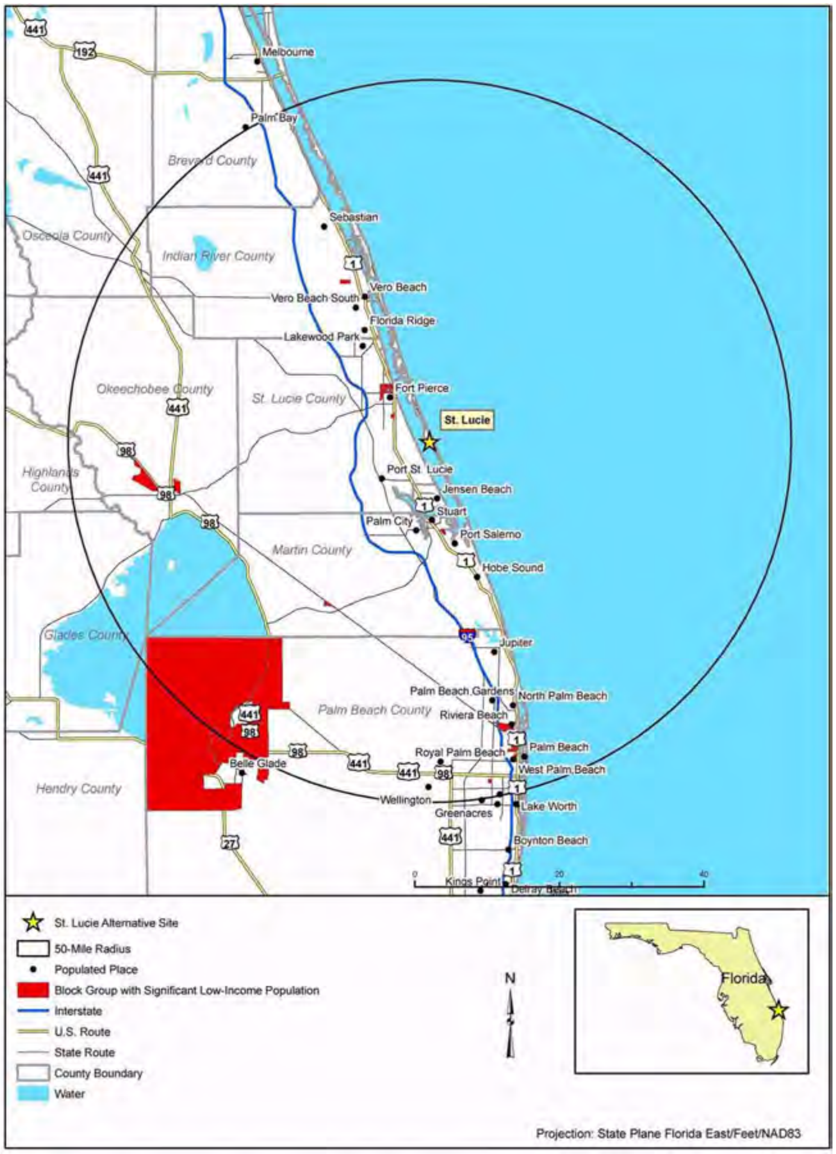


Figure 9.3-19 St. Lucie Alternative Site Significant Low-Income Populations



9.4 ALTERNATIVE PLANT AND TRANSMISSION SYSTEMS

This section provides an analysis of alternative plant and transmission systems in relation to the proposed Units 6 & 7 in order to provide a determination as to whether any of these alternatives are environmentally equivalent or environmentally preferable to the proposed system. An environmental screening process was conducted for each potential alternative. Potential alternatives that were considered feasible for construction and operation at the proposed plant site that (1) are not prohibited by federal, state, regional, or local regulations, or Native American tribal agreements, (2) are consistent with any findings of the Federal Water Pollution Control Act, and (3) can be judged as practical from a technical standpoint with respect to the proposed dates of plant construction and operation were further evaluated to determine whether any of the potential plant and transmission system alternatives were environmentally preferable to the proposed system. If any of the potential alternatives are deemed to be environmentally preferable with the proposed system, a benefit-cost basis is provided to determine if any such system should be considered as a preferred alternative to the proposed system.

Subsection 9.4.1 evaluates alternative heat dissipation systems, Subsection 9.4.2 evaluates alternative circulating water systems, and Subsection 9.4.3 evaluates alternative transmission systems for comparison with the proposed plant and transmission systems. The proposed heat dissipation system for the Units 6 & 7 site is the round mechanical draft cooling tower. Water pumped from radial collector wells and/or a reclaimed water treatment plant (Subsection 9.4.2.1.1) is the proposed water supply for makeup water. The makeup water replaces water lost by evaporation, drift, and blowdown from the cooling towers. The proposed water discharge system for blowdown water is to the Boulder Zone of the Lower Floridan aquifer at a depth of approximately 2800–3450 feet (Subsection 9.4.2.2).

9.4.1 HEAT DISSIPATION SYSTEMS

9.4.1.1 Screening of Alternative Heat Dissipation Systems

This subsection presents alternatives to the proposed heat dissipation system (Section 3.4) based on the guidance provided in NUREG-1555. Alternatives considered are those generally included in the broad categories of once-through and closed-cycle systems. This subsection includes evaluation of alternatives, in comparison with the proposed system, to identify those systems that are environmentally preferable to the proposed system. In addition to once through cooling, the following closed-cycle category heat dissipation systems were considered:

- Cooling ponds
- Spray ponds
- Dry cooling towers

- Wet and Hybrid (Wet/Dry) Cooling Towers
  - Natural draft
  - Mechanical draft
  - Fan-assisted natural draft
  - Hybrid

An initial environmental screening of the alternative designs was done to eliminate those systems that are obviously unsuitable for use at the Units 6 & 7 site. In accordance with NUREG-1555, factors such as the following were considered in the initial screening process:

- Land use (e.g., site size and terrain)
- Water use (e.g., availability of cooling water)
- Legislative restrictions

This initial screen is described in the following paragraphs.

9.4.1.1.1 Proposed Heat Dissipation System

For comparison, the round mechanical draft cooling tower is the proposed heat dissipation system for the Units 6 & 7 site. As presented in Section 3.4, six mechanical draft cooling towers would be required to dissipate a maximum waste heat load of up to 1.53E10 Btu/hour from the two units, would operate with approximately a 7.1°F approach temperature, and provide a less than 91°F return temperature at design ambient conditions. The circulating water system cooling towers will be octagonal and would rise approximately 67 feet above the top of the basin curb. Heat dissipation with wet cooling towers relies on evaporation for heat transfer. The water from the cooling system lost to the atmosphere through evaporation must be replaced. In addition, this evaporation would result in an increase in the concentration of solids in the circulating water. To control solids, a portion of the recirculated water must be removed, blown down, and replaced with make-up water from the raw water system. In addition to the blowndown and evaporative losses, a small percentage of water in the form of droplets (drift) is lost from the cooling towers.

9.4.1.1.2 Alternative Heat Dissipation Systems

9.4.1.1.2.1 Once-Through Cooling

The water requirements for a once-through cooling system for an AP1000 unit would be 850,000 gpm (WEC 2003). Once-through water requirements for both Units 6 & 7 would be 1,700,000 gpm, or about 3790 cubic feet per second. This withdrawal rate is approximately 44 times and 20 times the average makeup water withdrawal rate of 38,400 gpm and 86,400 gpm under normal operating conditions, with a reclaimed water and a marine water source; respectively, for the proposed system. The only water body in the vicinity of Units 6 & 7 that could supply this quantity of water is the Biscayne Bay, which is designated as an aquatic preserve.

In addition, once-through cooling water would pose risks of thermal effects and damage to aquatic organisms because of changes in water quality, impingement, and entrainment. Compliance with Section 316(a) of the Clean Water Act would apply and would prove difficult to attain.

9.4.1.1.2.2 Cooling Ponds

Turkey Point Units 1 through 4 currently operate with 5900-acre cooling canals. A pond of similar size would be required to support Units 6 & 7. The amount of land required for a cooling pond is not available at the proposed site. For this reason, cooling ponds were eliminated from further consideration.

9.4.1.1.2.3 Spray Ponds

This alternative is similar to cooling ponds because it involves creating new surface water bodies. Assuming sufficient heat dissipation could be achieved with a spray pond size of approximately 1 acre per 15 MWe (AEC 1973), Units 6 & 7 would require approximately 160 acres of spray pond. However efficiency may be lower due to the local climate. Spray modules promote evaporative cooling in the pond that reduces the land requirement relative to cooling ponds; however, this advantage is offset by higher operating and maintenance costs. This alternative would not reduce the environmental impacts relative to the proposed system. For these reasons, cooling ponds were eliminated from further consideration.

9.4.1.1.2.4 Dry Cooling Towers

This alternative is not suitable for the reasons described in the EPA's preamble to the final rule addressing cooling water intake structures for new facilities (66 FR 65256; December 18, 2001). Dry cooling carries high capital and operating and maintenance costs that are sufficient to pose a barrier to entry to the marketplace for some facilities. In addition, dry cooling has a detrimental effect on electricity production by reducing the efficiency of steam turbines. Dry cooling tower performance is dependent on the ambient dry bulb temperature. Thermal performance limitations under high ambient air temperature conditions would result in a very large dry tower array and the plant efficiency may be significantly reduced due to high circulating water temperature which increases steam turbine backpressure. The higher humidity in the area would also impact tower performance and cost. Dry cooling towers cause the facility to generate less energy than would be generated with wet cooling towers. This energy penalty is significant in the warmer southern regions during summer months when the demand for electricity is at its peak and would result in an increase in environmental impacts as replacement generating capacity would be needed to offset the loss in efficiency from dry cooling. Therefore, dry cooling towers at the Units 6 & 7 site do not warrant further consideration.

9.4.1.1.2.5 Wet and Hybrid (Wet/Dry) Cooling Towers

Wet and wet-dry hybrid cooling towers are potential alternate heat dissipation systems for the Units 6 & 7 and are described below:

Natural Draft Cooling Tower

This design is the most commonly used cooling tower in nuclear power plants in the United States. Favorable features include the absence of fans, which provides for very low operating cost, low auxiliary power requirements, and minimal noise impact. Natural draft towers are very tall and may have negative public perception because the towers and plume are visible from a great distance. However, the height can be favorable in terms of environmental impact because the drift is dispersed at such a great height that the concentration that accumulates around the tower is lower than other tower designs. Traditional natural draft cooling towers cannot be used at the Units 6 & 7 site because of a site permit height restriction of 350 feet (MDC 2007), therefore, natural draft cooling towers are eliminated from further consideration.

Mechanical Draft Cooling Tower

Mechanical draft cooling towers are often the cooling tower design for power applications and the relatively low profile makes these a good choice when aesthetics are a major concern. This type of tower is in widespread use in industry, and many cooling tower vendors would be able to supply mechanical draft cooling towers. If necessary, this type of tower could be designed to be plume abated. Plume abatement should be considered when towers are located so that the plume will visually disturb surrounding communities or if the plume can settle on roadways, causing dangerous fogging and icing conditions. The use of traditional rectilinear mechanical draft cooling towers is not feasible because the area needed for the arrangement (spacing) of these towers to prevent recirculation and interference of moist hot air exiting the towers is not available at the Units 6 & 7 site versus the round mechanical draft cooling towers, the proposed heat dissipation system, that require less footprint.

Fan-Assisted Natural Draft Cooling Tower

The hyperbolic shell of the fan-assisted natural draft cooling tower achieves a natural draft effect which supports the fans arranged around the circumference of the cooling tower shell. Advantages of this design include reduced power consumption, favorable space requirements, minimized recirculation effects, optimum operational behavior for saltwater application, and aesthetics. However, the extra section of fans results in a high auxiliary power load and makes this design taller than a rectilinear tower. The round design minimizes required spacing in between the towers. This type of tower is a feasible alternative for Units 6 & 7.

Hybrid (Wet-Dry) Cooling Tower

In this design, the circulating water flows in series first through a dry tower and then through a round forced draft cooling tower. This system provides the important benefit of water savings because when the dry tower is used, the duty on the round tower is lowered, decreasing evaporation. However, the dry tower component of the hybrid design is very large, requiring additional fans and resulting in higher overall power consumption. This design has the highest capital costs. The water usage of a hybrid system is generally one-third to one-half that for wet cooling towers. However, the comparative cost increases of the hybrid systems to the wet cooling systems do not outweigh water use savings of approximately one-half to two-thirds (U.S. EPA 2001a). Additionally, the EPA does not consider hybrid cooling towers as a candidate for best available technology for heat dissipation at new generating plants of the size proposed for the Units 6 & 7 site. Reasons include the lack of adequate demonstration of this technology's use at similar sized power plants. The EPA does note, however, that there is distinct potential for the use of hybrid cooling systems, especially in cases where plume abatement is concerned (U.S. EPA 2001b). Since most advantages to be gained by hybrid cooling towers are in areas of reduced fogging and icing and neither of these problems is of sufficient magnitude at Units 6 & 7 and because this system is not considered a best available technology by the EPA, this cooling tower is precluded from further analysis.

9.4.1.2 Feasible Alternatives

The results of the initial environmental screening process indicate that the round mechanical draft and fan-assisted natural draft cooling towers are suitable heat dissipation system alternatives for Units 6 & 7. The round mechanical draft cooling tower is the proposed primary heat dissipation system (Subsections 3.4.1 and 5.3.3.1). In accordance with NUREG-1555, the fan-assisted natural draft alternative cooling tower design is evaluated for land use, water use, and other environmental requirements for comparison with the proposed heat dissipation system (Table 9.4-1).

9.4.1.3 Summary

Table 9.4-1 offers a summary comparison of the relative environmental impacts and regulatory considerations for the base case and the identified potential alternative heat dissipation system for Units 6 & 7. The results of the evaluation indicate that the alternate design (fan-assisted natural draft cooling tower) is not environmentally equivalent or preferable to the proposed design (round mechanical draft cooling towers). It should be noted that a cost comparison has not been included since no alternate was found to be environmentally preferable to the primary design.

9.4.2 CIRCULATING WATER SYSTEMS

In accordance with NUREG-1555, this subsection considers alternatives to the plant circulating water system in order to identify systems that are environmentally preferable or environmentally equivalent to the proposed system. The review includes an investigation of the following plant circulating water systems:

- Intake systems
- Discharge systems
- Water supply
- Water treatment

NUREG-1555 indicates that the applicant should consider only those alternatives that are applicable at the proposed site and are compatible with the proposed heat dissipation system. As described in Subsection 9.4.1, the round mechanical draft cooling tower is the proposed heat dissipation system for the Units 6 & 7 site. An initial environmental screening was performed for each alternative of the component of the circulating water system to eliminate those systems or components that are unsuitable for use at the proposed site. Those systems or components that were determined to be feasible after the initial screening process were analyzed further to determine if they are environmentally preferable or equivalent to the proposed system. That analysis is described below.

9.4.2.1 Intake Systems

9.4.2.1.1 Screening of Alternate Intake Systems

The most important elements of the intake system are its location and configuration. The following factors were considered in siting the alternate intake systems:

- Water availability
- Water quality
- Intake hydraulics
- Constructability and cost

- Maintenance and dredging
- Operation and maintenance

Water availability and water quality considerations are addressed in Subsection 9.4.2.3.

The results of this analysis indicate that in addition to the proposed intake system from the selected water sources—reclaimed water and/or saltwater supplied by radial collector wells, there are two alternate water sources which were found feasible for operation at Units 6 & 7: the Lower Floridan aquifer (Boulder Zone, a groundwater source), and the Card Sound Canal (a surface water source). Two different types of intake systems are conceptualized to withdraw water from the Card Sound Canal. These intake systems are conventional shoreline intake structures with active screens, and intake with passive panel-type screens equipped with air back flush. The proposed circulating water intake system and the three alternative intake systems (two alternatives for Card Sound Canal and one for the Lower Floridan aquifer Boulder Zone production wells) are presented below.

9.4.2.1.2 Proposed Intake System

The proposed raw water for the circulating water system would be supplied from two different sources, reclaimed water and saltwater. When reclaimed water cannot supply the quantity and/or quality of water needed for the circulating water system, additional makeup water would be saltwater supplied from radial collector wells. Reclaimed water would be provided from the Miami-Dade Water and Sewer District (MDWASD) with further water treatment provided at an FPL reclaimed water treatment facility. The treated reclaimed water would be supplied to and stored in the makeup water reservoir. Pumps for each unit would provide the required makeup water by transferring treated reclaimed water from the makeup water reservoir to the circulating water system.

The saltwater would be supplied by radial collector wells. A radial collector well consists of a central reinforced concrete caisson, extending below the ground to target depth. The conceptual design for a radial collector well is further presented in Subsection 3.4.2.1.1.2. The wells would be recharged from the marine environment (Biscayne Bay), combining the desirable features of extremely high well yields with induced seabed filtration of suspended particulates. This improves the raw water quality and simplifies the treatment process.

The proposed conceptual design for Units 6 & 7 consists of four 33 1/3 percent radial collector wells with a capacity of 30,000 gpm per well. Three wells would meet the makeup water requirements for the circulating water systems; the fourth would be an installed spare. Two 50 percent pumps (15,000 gpm capacity per pump) in each well caisson would transfer the saltwater to the circulating water system.

Each radial collector well would consist of a central reinforced concrete caisson extending below the ground level with laterals projecting from the caisson. The well laterals would be advanced horizontally a distance of up to 900 feet and installed at a depth of approximately 25 to 40 feet below the bottom of Biscayne Bay. The design for a typical radial collector well is illustrated in Figure 3.4-2. The wells would be designed and located to induce recharge from Biscayne Bay.

These two proposed raw water makeup sources do not require any cooling water intake structures as defined by 40 CFR 125.83. Because the proposed raw water makeup sources do not require a cooling water intake structure as defined by 40 CFR 125.83, there would be no construction-related, aquatic ecology, threatened or endangered species, and minimal water use impacts as a result of constructing/operating a cooling water intake structure. As described in Chapter 4, the environmental impacts of constructing the reclaimed water pipeline and radial collector wells would be SMALL.

9.4.2.1.3 Alternate Intake Systems

9.4.2.1.3.1 Lower Floridan Aquifer Boulder Zone

As described in Subsection 9.4.2.3, deep groundwater from the Boulder Zone in the Lower Floridan aquifer could alternatively supply the cooling water for Units 6 & 7. The conceptual design for a Boulder Zone cooling water supply system consists of a groundwater production well field adjacent to the nuclear island and shown in Figure 9.4-1. The well field would consist of approximately 15 wells, each capable of producing 10 mgd. At any time, two wells would operate in standby mode and act as reserve wells in the event of unplanned well outages or scheduled maintenance events. Because of the very high Boulder Zone transmissivities, projected drawdown is insignificant, and there is significant flexibility in selecting final well location placement and spacing. Production wells would be constructed with telescoping steel casings to protect drinking water resources in the overlying Upper Floridan and surficial (Biscayne) aquifers from cross-contamination with the Boulder Zone groundwater. The well boreholes would extend past the bottom of the final lower casing to ensure adequate communication between the open borehole and the cavernous water producing intervals of the Boulder Zone. Well casings would be cemented in place from top to bottom with sulfate/corrosion resistant cement.

The Boulder Zone production wells are not considered a cooling water intake structure as defined by 40 CFR 125.83. There would be no aquatic ecology, threatened or endangered species, or water use impacts of construction and operation. There would be no costs associated with intake construction and operating a cooling water intake structure, and Section 316(b) of the Clean Water Act would not apply. It is unknown at this time if use of the Boulder Zone as a source of makeup water for Units 6 & 7 and as a discharge location for regional wastewater and Units 6 & 7 would impact water quality and affect long-term plant operations.

9.4.2.1.3.2 Card Sound Canal

Card Sound Canal is a canal that runs from the southern end of the Turkey Point Units 1 through 4 cooling canals to Card Sound. Card Sound Canal is not hydraulically connected to the Units 1 through 4 cooling canals; however, it is connected to Card Sound. Card Sound Canal was created to serve as the cooling water discharge canal for Units 1, 2, 3, and 4 as part of an open-cycle cooling system. This cooling system was subsequently abandoned, leaving a 1-mile reach of abandoned canal in hydraulic connection with Card Sound, which is approximately 4 miles south of the site. The canal is 200 feet wide and 20 feet deep. Makeup water to Units 6 & 7 could be supplied from an intake located in the northernmost end of the canal where it meets the cooling canals for Units 1 through 4. A pipeline would connect the intake to Units 6 & 7. Figure 9.4-2 is a conceptual layout of the pipeline and intake structures.

There are two alternative intake structures proposed to withdraw water from Card Sound Canal:

- Conventional shoreline intake structure
- Intake with passive panel type screens equipped with air back flush

Conventional Shoreline Intake Structure on Card Sound Canal

The conventional shoreline pump intake would be located on the east bank of the canal on an existing wetland and convey water to the site by pipeline routed by the east side of the canal. The intake system would consist of a trash rack and a raking system, traveling water screens and screen wash pumps, baffle blocks and curtain walls, and pumping systems. Three 50-percent pumps along with two 50-percent traveling screens are considered for each unit with a common forebay for the two units. The conceptual plan view and sectional view of the intake system are shown in Figures 9.4-3 and 9.4-4. A canal width of 200 feet and a canal bottom elevation of –20 feet NAVD 88 are considered in developing the conceptual design.

Conventional shoreline-type intake systems with traveling screens are widely used in power plant applications and their performance behavior is well documented. In order to comply with the Clean Water Act Article 316(b), fine mesh screens with a velocity less than 0.5 feet per second and with fish return capability would be used. The intake system would meet the requirements of Article 316(b) of the Clean Water Act relating to impingement, entrainment, and aquatic monitoring.

Passive Panel-Type Screens with Air Flush on Card Sound Canal

An alternate intake system on Card Sound Canal would consist of passive panel screens with polyhedron-shaped screens supported on a stainless steel frame and an air backwash unit. The polyhedron sides that are directed to the water surface are equipped with the screen panels made with special cling-free elements. The sides that are directed to the canal bed remain closed to avoid debris (sediment) ingress from the bed and for the optimum performance of air backwash. Air spray nozzles are arranged inside the polyhedron enabling a particularly effective screen backwash by pressurized air pulses. A compressor generates the air pressure pulses. The system is suitable for brackish or ocean environment because of its screen element types and polyhedron shape that have been optimized to respond to the fouling topology in surface water. The system is also considered superior over the traditional cylindrical wedge wire screens where fouling tends to develop over the screen drum surface and inside the drum. The number and size of the polyhedron are designed based on the required flow rate and available minimum water depth. The modular structure of the panel screen system would facilitate maintenance of the screens.

The polyhedron screen system conveys water to a wet well onshore, which is then pumped to the site. Flow to the wet well is controlled by the difference in hydraulic head between the well and the canal. Operating the air backwash system would be automated based on the pressure difference between the polyhedron and the wet well representing debris accumulation on the screen as well as on a timer, which is typically two to three times a day. Because the polyhedron is closed at the bottom, air backwash is more effective in removing debris from the screen surfaces compared to the traditional wedge wire screen where the air flush is outside the screen drum.

Although the panel-type intake system is a relatively new technology compared to the cylindrical wedge wire screens such as Johnson screens, its operation would be advantageous in reducing debris, biofouling, and ease of maintenance in a marine environment. In addition, passive screens are considered superior in minimizing impingement and entrainment, and would be environmentally preferable over traditional shoreline intake with active screens. Use of passive screens also eliminates the need for a fish return capability and the associated impacts on fish. The plan view and sectional view of the conceptual panel type intake system are shown in Figures 9.4-5 and 9.4-6.

9.4.2.1.4 Feasible Alternatives

The results of the initial environmental screening process indicate that alternate intake structures in the Boulder Zone and Card Sound Canal (conventional and passive intake structures) may be suitable for Units 6 & 7. In accordance with NUREG-1555, the feasible alternative intake structures are evaluated for comparison with the proposed intake structure system. The details of that evaluation are presented in Table 9.4-2.

9.4.2.1.5 Summary

A comparison of these alternative circulating water intake structures for Units 6 & 7 for construction-related, aquatic ecology, threatened or endangered species, and water use impacts is provided Table 9.4-2. Based on the analysis, the alternate intake structures (Boulder Zone and Card Sound Canal) are not environmentally preferable to the proposed intake structures. Therefore, no cost comparison has been provided. The proposed intakes would have minimal impact on ecological resources when compared to the alternate surface water intakes. The Boulder Zone intake alternative would be considered as environmentally equivalent as the proposed alternatives. However, it is unknown at this time if use of the Boulder Zone as a source of makeup water for Units 6 & 7 and as a discharge location for regional wastewater and Units 6 & 7 would impact water quality and affect long-term plant operations.

9.4.2.2 Discharge Systems

9.4.2.2.1 Screening of Alternative Discharge Systems

This subsection describes potential alternatives for discharge from the circulating water system and compares these alternatives to the proposed system. Alternatives for the discharge of blowdown from the circulating water system were identified. The potential blowdown receiving water bodies were selected from those within proximity of Units 6 & 7. The following discharge alternatives were considered. The initial screen is described in the following paragraphs.

9.4.2.2.1.1 Proposed Discharge System

The proposed circulating water system for Units 6 & 7 would discharge to the Boulder Zone of the Lower Floridan aquifer. Blowdown from the cooling tower would be injected into deep wells onsite. Subsection 2.3.1.2 provided details on subsurface injection in south Florida.

Class I injection wells would be developed in the proposed Units 6 & 7 power block area (Figure 3.1-3). Individual Class I injection wells would be designed and constructed to maintain an injection rate of approximately 6750 gpm. Injection wells would be located so that they would be separated from adjacent injection wells by at least 150 feet. However, the high Boulder Zone permeability allows significant flexibility in selecting the final well location placement in the event that suitable land availability is an issue.

Twelve wells would be installed for the proposed intake system for discharge to the Boulder Zone. Ten of the twelve wells would be used to accommodate 57,600 gpm of projected blowdown, and two wells would be used as backup. The injection zone, or interval, would be accessed via an open borehole spanning the entire vertical extent of the Boulder Zone. At the Units 6 & 7 site, this interval lies at an approximate elevation 2900 feet MSL and is presumed to be approximately 200 feet thick. A 24-inch-diameter injection casing with an 18-inch diameter liner pipe would convey the blowdown to the top of the Boulder Zone. Class I injection wells would be constructed with telescoping steel casings cemented in place from top to bottom with sulfate, heat, and corrosion resistant cement. Figure 3.4-3 presents a schematic cross-sectional view of the conceptual design for a Class I injection well constructed in the Boulder Zone. Preliminary design showing operational characteristics and details of the Boulder Zone injection wells are provided in Subsection 2.3.2.

9.4.2.2.1.2 Alternate Discharge Systems

9.4.2.2.1.2.1 Biscayne Bay

Blowdown from the circulating water system would be discharged to Biscayne Bay using a shoreline or offshore diffuser. Construction of either type of diffuser would require alteration of, or construction on, the seabed. Rule 62-4.242, Florida Administrative Code prohibits activities, such as the dredging required to construct a shoreline or offshore diffuser that would degrade water quality of Outstanding Florida Waters. Therefore, this discharge system is eliminated from further consideration.

9.4.2.2.1.2.2 Card Sound

Blowdown from the circulating water system would be discharged to Card Sound using a shoreline or offshore diffuser. Construction of either type of diffuser would require alteration of, or construction on, the seabed and is therefore eliminated from further consideration.

9.4.2.2.1.2.3 Atlantic Ocean

Blowdown from the circulating water system would be discharged to the Atlantic Ocean via an offshore diffuser located outside the boundary of the Florida Keys National Marine Sanctuary, a distance of about 14.5 miles from the proposed plant site. Construction of the pipeline conveying blowdown from the circulating water system to the offshore diffuser would require dredging and burial of the pipe in the seafloor, or directional drilling or tunneling beneath the seabed to avoid disturbance of the seabed within park or sanctuary boundaries and is therefore eliminated from further consideration.

9.4.2.2.1.2.4 Card Sound Canal

Blowdown from the circulating water system would be discharged to Card Sound Canal using a shoreline discharge structure or a diffuser at the canal bed located at the north end of the canal. This blowdown discharge alternative could not be used in conjunction with the Card Sound Canal makeup water supply alternative due to the potential for recirculating the concentrated, dissolved constituents in the blowdown back to the makeup water intake.

9.4.2.2.1.2.5 Turning Basin

Blowdown from the circulating water system would be discharged to the turning basin using a shoreline discharge structure located at the southwest end of the basin. This blowdown water discharge alternative could not be used in conjunction with the turning basin makeup water supply alternative due to the potential for recirculating the concentrated, dissolved constituents in the blowdown back to the makeup water intake. Extensive construction and/or dredging within the canal would be required along with resulting thermal impacts; this alternative is therefore eliminated from further consideration.

9.4.2.2.1.2.6 Wastewater Treatment Plant

Blowdown water from the Units 6 & 7 cooling towers could be returned to the MDWASD for disposal via their existing effluent disposal wells as an alternate circulating water discharge. The same pipeline route for the conveyance of makeup water supply would be used to return the blowdown water discharge. The location the MDWASD is shown in Figure 9.4-7 along with the FPL right-of-way.

Water quality acceptance criteria and capacity restrictions on wastewater treatment plant discharges by deep well injection could restrict the use of this option for blowdown discharge if the makeup water for the circulating water system is supplied from a saltwater source such as radial collector wells, Boulder Zone, or the Card Sound Canal.

9.4.2.2.1.2.7 Cooling Canals

The onsite cooling canals are part of the closed-cycle circulating water system for Units 1 through 4. Because the temperature of the discharge water from the new Units 6 & 7 would be lower than the temperature of the existing (Units 1 through 4) circulating water discharges, the cooling canals could be used as an option for blowdown discharge.

The cooling canals are considered viable only when the makeup water supply is obtained from the MDWASD. Use of reclaimed water would allow higher cycles of concentration in the cooling tower resulting in a smaller blowdown discharge rate. Even at four cycles of concentration, the salinity of the blowdown (on the order of 4000 milligram/liter (mg/L) total dissolved solids) would be significantly less than the current salinity of the cooling canals (approximately 55,000 mg/L total dissolved solids). The blowdown water would be released to the discharge (hot) side of the existing cooling canals to initiate maximum mixing. The conceptual designs of the blowdown pipeline route and diffuser details are shown in Figures 9.4-8 and 9.4-9.

When reclaimed water cannot supply the quantity and/or quality of water needed for the circulating water system, additional makeup water would be saltwater supplied from radial collector wells. The proposed backup water supply source provides saltwater, thus a backup discharge option (i.e. Boulder Zone discharge) would also be necessary.

9.4.2.2.1.2.8 Wetlands Rehydration

One of the alternatives of the Biscayne Bay Coastal Wetlands Restoration project requires a source of fresh water to rehydrate wetlands in the vicinity of Units 6 & 7. This blowdown discharge alternative entails conveying cooling tower blowdown via canals or pipelines to the wetlands north and west of Units 6 & 7 to rehydrate these wetlands. Because fresh water is required for rehydration purposes, any makeup water supply alternative using brackish or saltwater sources would be precluded for this blowdown discharge alternative. Also, the need to apply water to the wetlands exists only during the dry months of the year. During wet periods, water would need to be discharged to a different receiving water body. Additionally, the blowdown discharge may need to be treated to a level suitable for use in the restoration project. For these reasons, this alternative is eliminated from further consideration.

9.4.2.2.2 Feasible Alternatives

A screening analysis of the potential blowdown discharge alternatives was conducted to identify the feasible blowdown discharge alternatives. The objective of the screening analysis was to identify the feasible blowdown discharge alternatives to be considered for further environmental assessment. The results of the initial environmental screening process indicate that three were determined to be feasible. The three feasible alternative wastewater discharge systems were identified for Units 6 & 7 as follows:

- Cooling Canals
- Card Sound Canal
- Wastewater treatment plant

In accordance with NUREG-1555, the three feasible alternatives are evaluated for comparison with the proposed discharge system (Table 9.4-3). A comparison of these alternative circulating water discharge structures for Units 6 & 7 for construction-related, aquatic ecology, threatened or endangered species, and water use impacts is provided in Table 9.4-3. Based on the comparison, no discharge alternative was found to be environmentally equivalent or preferable to the proposed alternative; therefore no cost comparison has been provided. The proposed discharge structure would have minimal impact on ecological resources when compared to the alternative discharge structures.

9.4.2.2.3 Summary

Table 9.4-3 offers a summary comparison of the relative environmental impacts and regulatory considerations for the proposed discharge system and the alternative discharge systems for Units 6 & 7. The results of the evaluation indicate that the alternate discharge systems are not environmentally preferable to the proposed discharge system. Thus, a cost comparison has not been included.

9.4.2.3 Water Supply

9.4.2.3.1 Screening of Alternative Water Supply Systems

This subsection presents potential alternatives for water supply to the circulating water system and compares these alternatives to the proposed system. The proposed water supply for Units 6 & 7 will use reclaimed water from the MDWASD South District Wastewater Treatment Plant as makeup water for the circulating water system. Another fully operational water supply system will be saltwater supplied from radial collector wells. The circulating water system will be designed to accommodate 100 percent supply from reclaimed water, saltwater, or a combination of the two sources, based on operation of the units. The ratio of water supplied by the two makeup water sources will vary based on the availability of reclaimed water from the MDWASD South District Wastewater Treatment Plant.

Potential sources were identified and organized into five categories based on the original source of the makeup water supply. These identified potential alternative makeup water sources are those water bodies or water sources within proximity to the proposed plant site that are capable of supplying the makeup water needs of the units. The categories of the makeup water supply sources identified the following:

- Marine source
- Groundwater source
- Reclaimed water source
- Onsite surface water source
- Offsite surface water source

An initial environmental screening of the alternative designs was done to eliminate those systems that are unsuitable for use at the Units 6 & 7 site. The initial screen is described in the following paragraphs.

9.4.2.3.2 Proposed Water Supply System

Each of the two proposed water supplies to the circulating water system is described below:

Reclaimed Water — Proposed Raw Water System

Reclaimed water would be from the MDWASD South District Wastewater Treatment Plant, which is located approximately 9 miles north of the site.

Conceptually, the supply water would be conveyed from the MDWASD South District Wastewater Treatment Plant to the site by a pipeline that would be generally follow an existing FPL right-of-way. Locating the MDWASD South District Wastewater Treatment Plant and the right-of-way is shown in Figure 9.4-10.

There are no known current or future restrictions on use of this water for this application. However, to ensure uninterrupted water supply for plant operation, water supply from a backup source is highly desirable. When reclaimed water cannot supply the quantity and/or quality of water needed for the circulating water system, additional makeup water would be saltwater supplied from radial collector wells.

Radial Collector Well — Proposed Raw Water System

As presented in Subsection 2.3.1, water derived from a radial collector well—a substratum collector of saltwater—from the geological formations underlying Biscayne Bay will supply the required backup cooling water for Units 6 & 7. The water bearing units of interest include the Pleistocene Miami Oolite and Fort Thompson formation. Water in these formations is saltwater at the proposed plant site, with salinity concentrations transitioning to freshwater levels several miles west of the site. The water bearing formations extend from approximately –5.0 feet to –115 feet below MSL NAVD 88. Transmissivities of these formations have been estimated to range from 4.8E04 square feet per day to greater than 2.0E06 square feet per day.

Saltwater cooling water sources in the Pleistocene Miami Oolite and Fort Thompson formation would be supplied by a series of radial collector wells (see Subsection 2.3.1 for details of the radial collector wells). A radial collector well consist of a central reinforced concrete caisson, approximately 25 feet inside diameter, extending below the ground to the target depth. Well screens project laterally outward into the surrounding earth materials in a radial pattern at the target depth. The well screen typically ranges from 12 to 30 inches in diameter and typically extends as far from the caisson as horizontal drilling conditions allow. In seawater applications, the caisson is constructed in an above grade watertight fashion and completed with a pump house.

There are no present or known future restrictions on use of water from the radial collector wells. Projected yield for the radial collector wells is provided in Subsection 2.3.1.

9.4.2.3.3 Marine Sources

Biscayne Bay

The Biscayne Bay is a shallow coastal lagoon that lies immediately east of the proposed Units 6 & 7 site. The bay is bounded on the west by the mainland and on the east by a series of barrier islands including Elliott Key that forms the northern limit of Florida Keys. In the vicinity of the plant site, the bay is about 6 miles in width and relatively shallow, having a maximum depth of about 9 feet.

The bay adjacent to the Units 6 & 7 site is within the boundary of Biscayne National Park. This portion of the bay also serves as part of the Intracoastal Waterway. Makeup water would be supplied from either a shoreline or offshore intake. Due to the shallowness of the bay, a shoreline intake would require dredging a channel in the seafloor to ensure sufficient capacity and is therefore eliminated from further consideration.

Card Sound

Card Sound is located south of Biscayne Bay and south-southeast of the proposed plant site for Units 6 & 7, and is part of the Biscayne Bay Aquatic Preserve. Card Sound is about 3.5 miles wide, bounded on the northwest by the mainland and on the southeast by Key Largo, and relatively shallow with a maximum depth of approximately 11 feet. A portion of the Intracoastal Waterway traverses the entire length of Card Sound. Makeup water for the circulating water system would be supplied from either a shoreline or offshore intake. Due to the shallowness of the bay, a shoreline intake would require dredging a channel in the seafloor to ensure sufficient capacity and is therefore eliminated from further consideration.

Atlantic Ocean

The portion of the Atlantic Ocean considered as a potential makeup water supply alternative for the circulating water system (CWS) lies approximately 14.5 miles east of the proposed plant site and outside the eastern boundary of the Florida Keys National Marine Sanctuary, which is defined by the 300-foot isobath. Makeup water would be supplied by an offshore intake.

The 14.5-mile-long pipeline conveying makeup water from the offshore intake to the plant site would traverse the 13-mile width of Biscayne National Park and a 1.5-mile-wide portion of the Florida Keys National Marine Sanctuary. Construction of the pipeline would require dredging and burial of the pipe in the seafloor, or directional drilling or tunneling beneath the seabed to avoid disturbance of the seabed within park or sanctuary boundaries and is therefore eliminated from further consideration.

Card Sound Canal

Card Sound Canal was originally intended to serve as the cooling water discharge canal for Turkey Point Units 1, 2, 3, and 4 as part of an open-cycle cooling system. This cooling system was subsequently abandoned, leaving an approximately 1-mile reach of remnant canal in hydraulic connection with Card Sound. The canal is located about 4 miles south of the site and lies within FPL property. The canal is 200 feet wide and 20 feet deep. Makeup water for the circulating water system would be supplied from an intake located in the northernmost end of the canal where it dead ends.

Since Card Sound Canal is in hydrological connection with Card Sound, Biscayne Bay, and ultimately the Atlantic Ocean, there is plentiful marine water supply for Units 6 & 7 makeup to the cooling towers and there are no present or future water restrictions on use of water from this source.

Turning Basin

The turning basin is about 0.5 miles northeast of the proposed Units 6 & 7 and in hydraulic connection with Biscayne Bay. The basin lies within FPL property and is about 0.3 mile in length. Makeup water for the CWS would be supplied from an intake located in the southwestern end of the basin. Construction and/or maintenance dredging within the basin could be required and is therefore eliminated from further consideration.

9.4.2.3.4 Groundwater Sources

Biscayne Aquifer

The Biscayne aquifer is a shallow, unconfined aquifer consisting of highly permeable limestone and less permeable sandstone and sand. The area of the aquifer is approximately 4000 square miles, and is the principal water source for Dade and Broward counties and the southeastern part of Palm Beach County.

The quality of water in Biscayne aquifer is classified as fresh, however, in the vicinity of the plant site and beneath Biscayne Bay, groundwater contained in the hydrogeologic units equivalent to the Biscayne aquifer increases in salinity approaching the bay. The salinity of the groundwater adjacent to and underlying the bay is roughly equal to that of seawater.

At the site, the water bearing zone extends from slightly below ground surface to about 115 feet below sea level. Being in direct hydraulic connection with the ocean, the quality of water produced from these units underlying the bay would be saltwater. The portion of the Biscayne aquifer that is designated as an EPA “sole source aquifer” is by definition the fresh (potable) portion of the aquifer. Circulating water system makeup water from the freshwater portion of the Biscayne aquifer would be derived from an inland well field of vertical water supply wells. Miami-Dade County Resolution Z-56-07, condition 4 requires that FPL shall not apply for any water withdrawals from the Biscayne Aquifer as a source of cooling water for the proposed facilities and is therefore eliminated from further consideration.

Upper Floridan Aquifer

The Upper Floridan aquifer underlies the Biscayne aquifer. It is comprised of a thick sequence of carbonate rocks (limestone and dolomite) generally 500 to 600 feet thick and consisting of several thin water-bearing zones of high permeability interlaid with thick zones of low permeability.

The most transmissive permeable zone is found at the top of the Upper Floridan aquifer and is associated with the unconformity at the top of the rocks of Eocene age. The quality of water produced from the Upper Floridan aquifer is classified as brackish. Makeup water for the circulating water system would be obtained from an onsite well field. Miami-Dade County Resolution Z-56-07, Condition 5 requires that any withdrawals from the Floridan aquifer will not interfere with current legal users of that source and meet the substantive requirements of Section 24-43.2 of the Code. An aquifer performance test would be required to demonstrate that no legal users of the aquifer would be affected and another water supply source would likely be required to supplement that supplied from the Floridan aquifer and therefore this water source is eliminated from further consideration

Lower Floridan Aquifer (Boulder Zone)

Deep groundwater from the Boulder Zone in the Lower Floridan aquifer is an alternative water supply for cooling water to Units 6 & 7. The Boulder Zone consists of a deeply buried zone of highly transmissive, cavernous limestone, and dolomites of the lower Eocene Oldsmar Formation. The Boulder Zone occurs under confined conditions. Transmissivities of greater than 3E06 square feet per day are typically reported. The Boulder Zone underlies a 13-county area in southern Florida and lies at a depth of approximately 2800 feet to 3450 feet at the Turkey Point site. Average dissolved solids concentration of Boulder Zone groundwater is approximately 37,000 mg/L total dissolved solids.

The conceptual design for a Boulder Zone cooling water supply consists of a groundwater production well field adjacent to the nuclear island (Figure 9.4-1). Details of the well field are described above with intake structures.

There are no permitted users, other than FPL of the Floridan aquifer within approximately 5 miles of Units 6 & 7. The cavernous nature of this formation suggests that this source could provide

100 percent of the cooling tower makeup water demand for Units 6 & 7. However, aquifer pumping tests would be required to characterize the hydrogeologic properties of the Boulder Zone and finalize the well and production well designs. This information is also needed to support groundwater modeling. Sampling and analysis of the Boulder Zone groundwater would be necessary to characterize the water quality, evaluate whether water pretreatment may be needed and to support any treatment system design, if needed. Initial evaluations indicate a strong possibility for recirculation of wastewater into the cooling water supply if the Boulder Zone were to be used for discharge of cooling tower blowdown. However, aquifer testing and groundwater modeling have not been conducted to determine exact aquifer yield since this water supply is not environmentally equivalent to using reclaimed water/radial collector well water.

9.4.2.3.5 Onsite Surface Water Sources

Cooling Canals

The hypersaline surface water currently in the cooling canals would be used as makeup for the circulating water system via direct withdrawal. This withdrawal would necessarily increase the volume of groundwater that infiltrates into the cooling canals from the surficial aquifer. The increased groundwater infiltration to the cooling canals would decrease the fresh water groundwater inflow to the Biscayne Bay. The impacts of the reduced inflow to Biscayne Bay may not be acceptable and is therefore eliminated from further consideration.

Deepened Cooling Canals

This alternative would entail deepening a portion of the cooling canals to increase the hydraulic connectivity between the surface water in the cooling canals and the groundwater in the surficial aquifer. The hypersaline surface water in the cooling canals would be used as makeup for the circulating water system via direct withdrawal, which would necessarily increase the volume of groundwater that infiltrates into the cooling canals. The increased groundwater infiltration to the cooling canals would decrease the fresh water groundwater inflow to the Biscayne Bay. The impacts of the reduced inflow to Biscayne Bay may not be acceptable and is therefore eliminated from further consideration.

9.4.2.3.6 Offsite Water Sources

Comprehensive Everglades Restoration Plan

The Biscayne Bay Coastal Wetlands preferred plan, Alternative O, includes plans to rehydrate wetlands in the vicinity of the proposed plant site. Fresh water would be obtained by building a new reservoir or expanding the Florida City Canal in an area northwest of the proposed plant site. In either case, the water would be used jointly by the South Florida Water Management District and Units 6 & 7, with makeup water being obtained from an intake at the shoreline of the reservoir and conveyed to the circulating water system. However, because South Florida Water Management District plans and Comprehensive Everglades Restoration Projects require use of fresh water for public water supply and environmental restoration projects, it is unlikely that the required makeup water supply would be permitted for industrial use and is therefore eliminated from further consideration.

Private Property Reservoir

Fresh water would be provided by expanding an existing surface water reservoir located about 7 miles west of the proposed plant site, or by constructing a new reservoir on private property in an undetermined location. Makeup water would be withdrawn from reservoir using an intake at the shoreline of the reservoir, and conveyed to the circulating water system by pipeline. However, because South Florida Water Management District plans and Comprehensive Everglades Restoration Projects require use of fresh water for public water supply and environmental restoration projects, it is unlikely that the required makeup water supply would be permitted for industrial use and is therefore eliminated from further consideration.

9.4.2.3.7 Feasible Water Supply Systems

A screening analysis of the potential water supply system alternatives was conducted to identify the feasible water supply alternatives. The objective of the screening analysis was to identify the feasible water supply alternatives to be considered for further environmental assessment. The results of the initial environmental screening process indicate that two alternatives were determined to be feasible. In addition to the proposed water supplies, the two feasible alternative water supply systems were identified for Units 6 & 7 as follows:

- Boulder Zone Groundwater Source (saltwater)
- Card Sound Canal Marine Source (saltwater)

9.4.2.3.8 Summary

Table 9.4-4 summarizes the details of the evaluation of the proposed and alternative water supplies. The results of the evaluation indicate that the alternative water supplies are not environmentally preferable to the proposed water supply. Thus, a cost comparison has not been included.

9.4.2.4 Water Treatment

Evaporating water from cooling towers leads to an increase in chemical and solids concentrations in the circulating water, which in turn increases the scaling tendencies of the water. The circulating water system for Units 6 & 7 would be operated so that the concentration of solids in the circulating water would be approximately four to one-and-a-half times the concentration of solids in the makeup (e.g., four to one-and-a-half cycles of concentration). The cooling tower would be operated at a maximum of four cycles of concentration when 100 percent of the makeup water is MDWASD South District Wastewater Treatment Plant reclaimed water and operated at a minimum of one-and-a-half cycles of concentration when 100 percent of the makeup water is from the radial collector wells. When makeup is a mixture of MDWASD South District Wastewater Treatment Plant reclaimed wastewater and radial collector wells, the cooling tower would operate at cycle of concentrations required for proper water chemistry determined by the makeup water quality of the mixture of the two sources of water.

As described in Subsection 3.3.2.1, reclaimed water from the MDWASD would be treated at the FPL reclaimed water treatment facility and used as circulating water system cooling tower makeup. The makeup water for the circulating water cooling towers will receive treatment to prevent biofouling in the intake structure and raw water supply piping to the circulating water cooling towers. The Miami-Dade potable water supply will provide water for the service water cooling towers, potable water system, fire protection system, demineralized water system, and other miscellaneous water users. The makeup water for the service water cooling towers will receive treatment to prevent biofouling in the intake structure and raw water supply piping to the service water cooling towers.

Additional treatment for biofouling, scaling, and suspended matter with biocides, antiscalants, and dispersants, respectively, will be performed at the water treatment facility as needed for the circulating water system. This treatment normally occurs through injecting chemicals into the system piping during circulation of the water withdrawn from the basins through the circulating water and service water systems. The cooling tower cycles of concentration would be adjusted to prevent scale formation or deposition from affecting tower performance.

Sodium hypochlorite would be used to control biological growth in the circulating water system for Units 6 & 7. Alternative biocides could include hydrogen peroxide or ozone. The final choice of water treatment chemicals or combination of chemicals is dictated by makeup water conditions, technical feasibility, economics, and discharge permit requirements. If alternative treatment chemicals are to be used to improve the conditions of the makeup water, they would have to be chosen from those that can be approved by the EPA or the state of Florida, and the volume and concentration of each chemical constituent discharged to the environment would meet the requirements established in the applicable permits. The anticipated aquatic impacts of alternative chemical use would be environmentally equivalent to those resulting from the use of the proposed chemicals described in Subsection 3.3.2. Since all blowdown from the circulating water system will be discharged to the Boulder Zone (proposed method of discharge), there would be minimal-to-no environmental impacts. Mechanical treatment and other non-chemical treatment such as ultraviolet are not viable options due to the large quantity of water requiring treatment, and, hence the large scale water treatment system necessary for the plant’s cooling system. No further alternatives are proposed since it is unlikely that any other water treatment alternatives would be preferable when compared against the proposed treatment system.

9.4.3 TRANSMISSION SYSTEMS

As specified in the guidelines in NUREG-1555, ESRP 9.4.3, this summary discussion identifies the feasible and legislatively compliant alternative transmission systems. Detailed descriptions of the transmission line system are described in Subsection 2.2.2 and Section 3.7, and associated environmental impacts are described in Chapters 4 and 5. Corridors are defined as transmission line routes of variable widths, which are sufficient to contain the eventual rights-of-way (NUREG-1555, Section 3.7.I, Note (a)). New transmission line corridors will be required to integrate Units 6 & 7 to the Florida electrical grid system, as described in Subsection 2.2.2 and Section 3.7.

Approval of transmission line corridors is under authority of the Florida Power Plant Siting Act, §403.501-518, F.S. A route study and corridor selection process was performed for the new lines under the requirements of this Act. The results of these analyses are presented in the following paragraphs.

9.4.3.1 Alternatives to the Proposed Transmission System Design

FPL has performed an interconnection and integration study that examined multiple alternatives for integrating Units 6 & 7 into the FPL transmission system. The study incorporated the latest data provided for the Units 6 & 7 project. Models used for the analysis were based on the latest available load forecasts, generation expansion plan, and system plans for 10 years into the future. As the load forecasts and system plans are updated (e.g., topological changes, generation retirements, or additions) in the coming years, the performance of the system will be reviewed as part of the normal transmission system assessment to ensure compliance with the North American Electric Reliability Corporation (NERC) and Florida Reliability Coordinating Council (FRCC) reliability standards and the effectiveness of the proposed transmission plan. To the extent necessary, adjustments to the results of this study may be warranted. In such circumstances, adjustments will be communicated to the relevant stakeholders, including the NERC and FRCC.

The evaluation process used to develop the transmission-related requirements for the Units 6 & 7 interconnection and integration plan considers factors associated with planning, construction, and operating the electric system. The process began with an evaluation team, including engineers from transmission and substation planning, operations, engineering, project management, permitting, and siting, who together performed the evaluation and developed a transmission interconnection and integration plan. The evaluation process considers many factors, as outlined below, in order to develop an effective transmission plan. The resultant plan is in compliance with NERC and FRCC reliability standards.

Generally, the process was to evaluate the proposed generating plant site location to determine its proximity to existing transmission facilities. To the extent there are existing transmission facilities nearby, those facilities are assessed to determine their capabilities for reliably interconnecting and integrating the proposed new generation into the transmission system as a firm FPL generation resource. Other factors, such as those listed below are considered (as applicable):

- Amount of generation (MW) being added at the new generation site, and the dispatch profile of the new generation resource relative to FPL's other generation resources in serving FPL's load
- Capabilities to upgrade existing facilities
- Capability of transmission lines needed, right-of-way requirements, existing right-of-way capabilities, siting of new right-of-way, permitting requirements, and expected time frame to acquire right-of-way and necessary permits
- Ability to transmit power efficiently
- Existing and new substation requirements, capabilities, and availability
- Impact on existing facilities
- Constructability
- Overall compatibility with the system (e.g., do the new facilities require new material stocking requirements or the need for new tools to maintain?)
- Compliance with NERC and FRCC reliability standards
- Operating considerations (e.g., what are the maintenance requirements of the proposed interconnection and integration facilities and how will they impact the ongoing operation of the system)
- Expected in-service testing and commercial operations dates for new generation (e.g., which transmission facilities necessary for interconnection and integration need to be in-service before the commercial operation in-service date for testing)
- Material adverse impact on third party transmission owner(s)
- Initial and recurring costs of facilities and operations

Taking into account these factors, a feasible interconnection and integration plan was developed and power flow studies for a proposed plan were performed. These power flow studies were used to evaluate the performance of the system and to converge on specific new system facilities and upgrades that would be needed to interconnect and integrate the new generation into the transmission system.

9.4.3.1.1 Assumptions

The project consisted of two nuclear generating units each with a total net summer continuous capability of 1100 MW, with June 2018 and June 2020 in-service dates. The proposed plan tested for interconnecting and integrating the Units 6 & 7 to the FPL network was connecting the units to a new 500/230 kV substation known as Clear Sky substation.

The latest available peak case model for the summer of 2017 from the 2007 FRCC databank with firm long-term contractual obligations was used to create a base case model for the power flow analysis. The model was modified to reflect the 2020 load forecasts for FPL. The model was also updated to include the most up-to-date information on the FPL system (e.g., planned new transmission facilities and upgrades, committed new generation, confirmed transmission service obligations, etc.). The resulting model is the reference base case.

The study case was derived from the aforementioned base case while also modeling Units 6 & 7, which were modeled as two generating units with a total net generating capacity of approximately 2200 MWe.

9.4.3.1.2 Acceptance Criteria

The study was performed by conducting a single contingency power flow analysis. Studied contingencies include each generating unit outage (including the largest generating unit), and each transmission line outage (including the most critical transmission line outage). The performance of the system must meet NERC reliability standards for normal and single contingency operation. Overloads greater than 100 percent of a facility rating (and not evident before Units 6 & 7) that were materially aggravated (more than 3 percent) when compared to the reference case, for the same contingency, were attributed to the new units. Similarly, low voltages that were materially lower (more than 1.5 percent) when compared to the reference case, for the same contingency, are attributed to Units 6 & 7.

9.4.3.1.3 Interconnection and Integration Study Results

The tested interconnection and integration plan for Units 6 & 7 would require constructing a new Clear Sky substation with two 500/230 kV autotransformers. Two new 500 kV lines, approximately 43 miles long, will be constructed to connect the Clear Sky substation to the Levee 500 kV substation. A new 230 kV line will be constructed between the Clear Sky substation and the Davis 230 kV substation, continuing on to the Miami substation. A second new 230 kV line will be constructed between the Clear Sky substation and Pennsuco 230 kV substation. A new line will also be constructed to the Turkey Point substation from Clear Sky. The results are summarized below:

Transmission Line (kV)	Termination Point	Length (miles)
Clear Sky-Levee # 1 (500 kV)	Levee 500 kV	43
Clear Sky-Levee # 2 (500 kV)	Levee 500 kV	43
Clear Sky-Davis (230 kV)	Davis 230 kV	19
Davis-Miami (230 kV)	Miami 230 kV	18
Clear Sky-Pennsuco (230 kV)	Pennsuco 230 kV	52
Clear Sky-Turkey Point (230 kV)	Turkey Point	0.4

9.4.3.2 Corridor Selection

Turkey Point Units 6 & 7 will require new transmission facilities to reliably interconnect and integrate the project into FPL's transmission system, as described in Subsection 9.4.3.1. The requirement to add transmission facilities is the result of the necessity to deliver approximately 2200 MWe net capacity of new generation from the site to FPL's load centers. It should be noted that the Clear Sky substation is on the Units 6 & 7 plant area and therefore is not further considered in the selection process.

The preferred corridors for the Turkey Point project were selected by a multidisciplinary transmission line siting team consisting of experts in land use, engineering, and the environment.

The objective of the corridor selection study was to select certifiable corridors that balance land use, socioeconomic, environmental, engineering, and cost considerations. Corridor selection methods were designed to be:

- Integrative of multidisciplinary siting criteria
- Rational and objective in decision making
- Sensitive to social and environmental conditions
- Responsive to regulatory requirements
- Reflective of community concerns and issues
- Capable of accurate documentation and verification

The corridor selection process consisted of four major tasks:

- Transmission study area definition
- Resource mapping and alternative route delineation
- Evaluating alternative routes and selecting the preferred corridors
- Community outreach

A summary describing each of these major tasks is presented in the following subsections. The transmission line siting team was assisted throughout this process by members of the public who participated in a public outreach program developed specifically for this transmission line routing study.

Transmission Study Area Definition

As presented in Subsection 9.4.3.1, FPL determined the best option to integrate this power to the FPL transmission system was to build a new onsite substation (Clear Sky) and new transmission lines to the existing Davis, Miami, Levee, and Pennsuco substations. The Clear Sky to Levee and Pennsuco substations corridor is known as the West Preferred Corridor. The Clear Sky to Davis and Miami substations corridor is known as the East Preferred Corridor. The following paragraphs discuss the transmission corridor selection.

West Preferred Corridor

The corridor selection process was based primarily on the geographic location of the starting and ending substations. A study area was first selected that incorporated the Clear Sky, Levee, and Pennsuco substations and FPL's existing transmission lines into those substations. Since much of the west study area is dominated by low-density residential development, agricultural and nursery operations, conservation lands, mining activities, and relatively few existing linear features (roads, other transmission lines) with which to collocate, there were immediately only a few obvious choices for routes. FPL has an existing 230 kV transmission line on a 330-foot-wide right-of-way leaving the Turkey Point site and intersecting with a 138 kV line which continues west and north for several miles. A portion of this available right-of-way, which was acquired by FPL in the 1960s and early 1970s, traverses what became the Everglades National Park (ENP) expansion area. From the Levee substation, there are also existing transmission lines and roads that provide potential routes to the Pennsuco substation.

East Preferred Corridor

The corridor selection process was based primarily on the geographic configuration of the starting and ending substations. A study area was first selected that incorporated the Clear Sky, Turkey Point, Davis, and Miami substations and FPL's existing transmission lines into those substations. Since much of the east study area is dominated by high-density residential development, there are several existing linear features (roads, railroads, other transmission lines) with which to collocate. FPL has existing 230 kV transmission lines on a 330-foot-wide right-of-way leaving the Turkey Point site all the way to the Davis substation. From there, FPL has available transmission line, roadway, railway, or other linear features to follow to the Miami substation.

Resource Mapping and Alternative Route Delineation

FPL first evaluated the study areas for all such opportunities and constraints in a regional screening mapping exercise. Resource mapping information was obtained from available information sources, including local, state, and federal agency data files, particularly Miami-Dade County's geographic information system (GIS); the Florida Geographic Data Library (FGDL); the Florida Natural Areas Inventory (FNAI); SFWMD; and other commercial non-agency databases. FPL used a technique of overlay mapping through the use of computer mapping software programs such as AutoCAD® and ArcView®. Use of computer mapping allowed flexibility in adding new information as it became available and modifying coverage to analyze certain constraints or opportunities. Table 9.4-5 provides a listing of the types of resources mapped. Once those resources were mapped, the team developed alternative routes that attempted to best avoid or minimize certain constraints and take advantage of certain opportunities. Figures 9.4-11 and 9.4-12 depict the west and east alternative routes studied, respectively.

Then using predetermined route selection guidelines summarized in Table 9.4-6, FPL developed several alternative route segments that when combined could connect the substations.

Based on the results of the alternative route identification, 34 route segments were identified, comprising 99 potential alternative route alignments between the Clear Sky substation and the existing Levee and Pennsuco substations.

Thirty five route segments were identified, comprising 134 potential alternative route alignments between the Clear Sky substation site and the existing Davis and Miami substations.

Finally, using predetermined route selection guidelines contained in Table 9.4-6, FPL developed several alternative route segments that when combined could connect these substations.

Alternative Route Evaluation and Preferred Corridor Selection

The objective of this task was to evaluate, in detail, the routes identified and ultimately select a West and East Preferred Corridor.

The first step of the alternative route evaluation process was to perform a systematic, quantitative evaluation of each route alternative using environmental, land use, cost, and engineering criteria.

Table 9.4-7 presents the criteria used in this evaluation. These criteria are based on application of accepted transmission line siting factors used on projects across Florida.

Data used to apply these criteria came from the regional screening map data, recent digital aerial photography for the study area, input from agencies and local governments, ground surveys of routes, and input from the community outreach program. Each segment was then analyzed for each of the criteria listed in Table 9.4-7, and the value for each criterion was recorded by segment.

The relative weight (importance) of each criterion to be used in the alternative route evaluation was then established by the multidisciplinary transmission line siting team. These criteria and weights were validated through input from the community obtained as part of the community outreach program, discussed in Subsection 9.4.3.4.

The routes were ranked according to their weighted composite score on all criteria. This score represented a route's potential for impacting a combination of all the relevant resources (Table 9.4-7), with the lowest score being the most favorable.

Recognizing that the quantitative evaluation alone does not provide a true indication of the potential suitability of the routes, the transmission line siting team then began evaluation of the alternatives with a qualitative assessment of more site-specific conditions. This evaluation included analyses of site-specific siting issues and opportunities, additional ground and aerial surveys, and feedback and comments received at agency meetings, the nine community open houses, and individual meetings with area residents and property owners. Table 9.4-8 depicts a list of the types of criteria evaluated at this stage.

After evaluation of all the identified route alignments and significant public input throughout the route selection process, the West Preferred, West Secondary and East Preferred routes were selected (see Figures 9.4-13 and 9.4-14).

Finally, corridor boundaries were delineated along the West and East routes. The West/East Preferred Corridors are of variable width, being wider in certain areas to give FPL an appropriate amount of flexibility in accommodating site-specific conditions or taking advantage of certain opportunities, and narrower in other areas to avoid existing siting constraints or to utilize existing FPL rights-of-way.

9.4.3.3 Preferred Corridors

Based on the results of the first three tasks discussed above, East and West Preferred Corridors were selected. The corridors are depicted on Figures 9.4-13 and 9.4-14. The following paragraphs discuss the preferred corridors selected.

West Preferred Corridor Description

The proposed corridor width varies from a minimum of 170 feet to a maximum of 3700 feet along the length of the West Preferred Corridor. This allows FPL the ability to maximize use of existing FPL rights-of-way, avoid constraints in some areas, and provide FPL the necessary flexibility to locate a right-of-way consistent with local conditions and landowner and agency input. Once a corridor is certified, FPL expects to use a combination of existing and relocated right-of-way of approximately 330 feet in width from Clear Sky to Levee and then use an existing right-of-way of approximately 170-feet minimum width between the Levee and Pennsuco substations. The total length of the West Preferred Corridor is approximately 52 miles; between Clear Sky and Levee is about 44 miles, and between Levee and Pennsuco is about 8 miles.

<u>West Preferred Corridor from Clear Sky Substation to Levee Substation</u>

The West Preferred Corridor begins within the Turkey Point plant property at the boundary of the Units 6 & 7 plant area. The proposed location of the West Preferred Corridor is on FPL's Turkey Point plant property for a distance of approximately 3.2 miles. For the first mile, the corridor is 3700 ft wide. The remainder of the corridor on the Turkey Point plant property is approximately 500 ft wide.

FPL has an existing approximately 330- to 370-ft-wide right-of-way running west from the Turkey Point plant property for several miles. There is currently one single-pole, 230-kV line in that right-of-way that runs for a distance of approximately 4.5 miles. The West Preferred Corridor is collocated with this existing transmission right-of-way. The two 500-kV lines and the 230-kV line can be constructed within this available right-of-way alongside the existing 230-kV line. Therefore, the corridor is limited to FPL's existing right-of-way boundaries in this location, and no additional property will be necessary.

The West Preferred Corridor continues to run due west for another approximately 4.25 miles following FPL's existing right-of-way containing a 138-kV line. Just west of SW 202nd Avenue, the West Preferred Corridor and existing 138-kV line turn to the north and then run due north for approximately 14.5 miles to SW 136th Street where the 138-kV line turns due east and departs the West Preferred Corridor. The West Preferred Corridor then continues for approximately 1 mile to SW 120th Street.

The width of the West Preferred Corridor in this area remains 330 to 370 feet, collocated with FPL's existing right-of-way. Adjacent to the Miami-Dade County Natural Forest Community (NFC) north of SW 304th Street, the corridor is expanded by 50 feet to the west to allow flexibility in accessing the transmission line within the NFC.

Although FPL currently owns sufficient right-of-way in fee or by easement for this project through the ENP and the Water Conservation Area 3B (WCA-3B), FPL has been working cooperatively with multiple federal and state agencies to relocate this portion of the right-of-way to outside the ENP. To that end, these agencies have entered into agreements with FPL to implement the relocation. This land exchange has been authorized by the federal Omnibus Public Land Management Act of 2009. As a result of relocating the 7.4-mile portion of the right-of-way now within the ENP Expansion Area to outside the ENP, contiguous portions of the existing right-of-way to the north and south must also be relocated to provide a continuous right-of-way. FPL is agreeable to the proposed right-of-way exchange in this area if this can be accomplished in a timely manner and is therefore proposing the relocated right-of-way as its West Preferred Corridor.

At SW 120th Street, the West Preferred Corridor turns due east and continues to the SFWMD L-31N Canal right-of-way and is approximately 900 to 1000 feet wide. This alignment will allow FPL to locate the proposed transmission lines at the periphery of the ENP and provide the opportunity to use the existing SFWMD L-31N levee as an access road.

The West Preferred Corridor continues to follow the L-31N Canal right-of-way for several miles, crossing U.S. Highway 41/Tamiami Trail, and then runs parallel to the L-30 Canal right-of-way. In this area, the West Preferred Corridor is approximately 900 to 1000 feet wide and provides the opportunity to use the existing SFWMD L-30N levee as an access road.

Approximately 3 miles north of U.S. Highway 41/Tamiami Trail, the West Preferred Corridor turns due east along an existing FPL right-of-way (at approximately NW 41st Street) and proceeds to the Levee substation. In this area, the West Preferred Corridor is limited to the existing FPL 330- to 1100-foot-wide right-of-way. At the Levee substation, the two 500-kV lines terminate, but the corridor expands around the substation to approximately 1750 feet (to accommodate the proposed Clear Sky-Pennsuco 230-kV line bypassing the substation) and lies entirely within FPL property.

From Clear Sky to Levee, the West Preferred Corridor crosses the jurisdictions of Miami-Dade County and Florida City.

<u>West Preferred Corridor from Levee to Pennsuco</u>

Beginning at the existing Levee substation area, the West Preferred Corridor exits the substation property heading east approximately 4.4 miles within an existing FPL right-of-way along NW 41st Street between NW 147th Avenue and NW 137th Avenue and NW 50th Street between NW 137th Avenue and NW 107th Avenue. The right-of-way within this portion of the West Preferred Corridor, which ranges from approximately 170 to 1750 feet (exiting the Levee substation) wide, currently accommodates multiple transmission lines and has room to accommodate the new 230-kV line.

At NW 107th Avenue, the corridor turns due north and follows the existing FPL right-of-way paralleling NW 107th Avenue approximately 4 miles to the existing Pennsuco substation. The West Preferred Corridor paralleling NW 107th Avenue averages 170 feet wide and is wholly located within FPL's existing right-of-way.

From the Levee substation to Pennsuco substation, the West Preferred Corridor crosses the jurisdictions of Miami-Dade County, Doral, and Medley.

West Secondary Corridor

FPL is proposing one alternate corridor to its West Preferred Corridor, which is referred to as the "West Secondary Corridor."

The West Secondary Corridor is an alternate for the West Preferred Corridor in the ENP and WCA-3B areas. The West Secondary Corridor deviates from the West Preferred Corridor at SW 120th Street in the 8.5 SMA and continues to follow FPL's existing right-of-way directly northward through the ENP Expansion Area for approximately 7.4 miles to U.S. Highway 41/Tamiami Trail. There, the West Secondary Corridor crosses U.S. Highway 41/Tamiami Trail and then turns northeastward along FPL's existing right-of-way to its intersection with the West Preferred Corridor along Krome Avenue. The West Secondary Corridor is approximately 330 to 370 feet wide and is wholly located within existing FPL right-of-way. The total length of FPL's West Secondary Corridor is approximately 51 miles; the length where it differs from the West Preferred Corridor is 12 miles.

The West Secondary Corridor is being proposed as an alternative option in the event the previously described proposed right-of-way exchange is not completed on a timely basis.

East Preferred Corridor

The proposed corridor width varies from approximately 150 to a maximum of 2200 feet along the length of the East Preferred Corridor. This allows FPL the ability to maximize use of existing FPL rights-of-way, avoid constraints in some areas, and provide the necessary flexibility to locate a right-of-way consistent with local conditions and landowner and agency input. Once a corridor is certified, FPL expects to use an existing FPL 330-foot-wide right-of-way from the Turkey Point plant property to the Davis substation. From the Davis substation FPL proposes to use an existing FPL right-of-way of variable width north and east to U.S. Highway 1. After reaching U.S. Highway 1, FPL generally plans to locate within an existing transportation right-of-way of variable width northeast to the vicinity where Interstate 95 (I-95) and Metrorail diverge. The corridor is expanded, however, around the Metrorail stations (Dadeland South, Dadeland North, Douglas Road, Coconut Grove, Vizcaya, and Brickell). This is to provide flexibility in locating the right-of-way at these congested areas, while also maintaining the ability to accommodate potential future development associated with these mass transit stations. In the vicinity where

I-95 and Metrorail diverge, the corridor expands to provide flexibility in locating the right-of-way as it approaches the Miami substation. The total length of the East Preferred Corridor is approximately 36.7 miles; between Clear Sky and Davis is about 19 miles, and between Davis and Miami is about 18 miles.

East Preferred Corridor from Clear Sky to Davis

The East Preferred Corridor begins within the Turkey Point plant property at the boundary of the Units 6 & 7 plant area. The first 1.8 miles of the East Preferred Corridor is entirely within the Turkey Point plant property and will accommodate both the Clear Sky-Turkey Point 230-kV and Clear Sky-Davis 230-kV transmission lines. In this area, the corridor varies from 330 to 800 feet in width. FPL has a multi-circuit transmission line right-of-way running north from the Turkey Point substation for approximately 17 miles to the Davis substation. North of the Turkey Point plant property, the East Preferred Corridor is limited to that existing transmission line right-of-way, which is approximately 330 feet in width, and will accommodate the Clear Sky-Davis 230-kV transmission line.

After exiting the Turkey Point plant property, the corridor continues due north for several miles and then turns west along SW 261st Street until the corridor crosses Florida's Turnpike (Homestead Extension) and turns northwestward to U.S. Highway 1. After crossing U.S. Highway 1, the corridor again proceeds due north to approximately SW 212th Street, where it turns northwest to SW 208th Street and then north again. It continues due north to approximately SW 164th Street, where it turns northeast to the Davis substation. At this point, the corridor includes the entire FPL property surrounding Davis substation. The corridor from Clear Sky to Davis is within the jurisdiction of Miami-Dade County.

East Preferred Corridor from Davis to Miami

North of the Davis substation along SW 131st Street, the corridor turns eastward along an existing FPL multi-circuit transmission line easement of varying widths for about 4.4 miles to U.S. Highway 1. At this point, FPL's existing easement and two transmission lines cross U.S. Highway 1 and continue east, while FPL's East Preferred Corridor heads northeastward along U.S. Highway 1.

Along U.S. Highway 1, the corridor encompasses the U.S. Highway 1/Busway right-of-way and is generally widened to include an additional 30 feet on either side of this transportation corridor. It is FPL's intent to locate its right-of-way along the Busway right-of-way immediately west of the U.S. Highway 1 right-of-way. However, since the authority to place the new line within the Busway right-of-way has not yet been secured, and to provide flexibility in a relatively congested siting area, the East Preferred Corridor is approximately 260 feet wide in this portion of the route.

Along the east side of U.S. Highway 1, the corridor includes a narrow strip of the jurisdictions of Palmetto Bay and Pinecrest.

When the corridor reaches the Palmetto Expressway/Dadeland area, it is widened to approximately 2200 feet. The east corridor boundary in this area remains generally 30 feet east of the U.S. Highway 1 right-of-way. The west corridor boundary expands to approximately 30 feet west of the SW 77th Avenue right-of-way. After crossing Kendall Drive, the boundary turns east approximately 30 feet north of the Kendall Drive right-of-way and then turns north approximately 30 feet west of the Palmetto Expressway right-of-way. When the west corridor boundary reaches the middle of the Snapper Creek Canal, it turns back to the east following the centerline of the Snapper Creek Canal (parallel to Dadeland Mall Road) to the Florida East Coast (FEC) right-of-way located along SW 70th Avenue. The corridor boundary then proceeds north approximately 30 feet west of the FEC right-of-way to the centerline of SW 80th Street and then proceeds east back to 30 feet west of the U.S. Highway 1/Metrorail right-of-way. The widening of the corridor in this area will provide flexibility in siting the transmission line in a heavily congested area.

Proceeding northeastward along U.S. Highway 1 from the Dadeland area, the corridor generally includes the area from 30 feet east of the east right-of-way boundary of U.S. Highway 1 to 30 feet west of the west boundary of the Metrorail right-of-way. The corridor crosses the jurisdiction of South Miami at this point. The corridor varies in width depending on the widths of those transportation rights-of-way. FPL also expands the corridor to include the centerline of Ponce de Leon Boulevard beginning at SW 57th Avenue/Red Road northeast to Ruiz Avenue. This expansion of the corridor will provide the opportunity to collocate the new transmission line with the existing 138-kV transmission line on the east side of Ponce de Leon Boulevard. This area crosses the jurisdiction of Coral Gables.

The corridor is further expanded to accommodate siting constraints around the Douglas Road Metrorail station and provide the opportunity to incorporate other transmission improvements planned independent of the Units 6 & 7 project, thereby avoiding another transmission line segment in this area. The west corridor boundary in this area expands to include approximately 30 feet north of Ruiz Avenue, approximately 30 feet west of SW 38th Avenue, and approximately 100 feet north of Bird Road/SW 40th Street until it reaches a point approximately 30 feet west of the Metrorail/U.S. Highway 1 right-of-way. From this location to the Miami substation, the East Preferred Corridor lies within the jurisdiction of the City of Miami.

Further north, the corridor is again expanded at the Coconut Grove Metrorail station both to the north and south of the U.S. Highway 1/Metrorail transportation corridor to provide flexibility in a relatively congested area. In this area, the west corridor boundary proceeds approximately 30 feet west of the SW 29th Avenue right-of-way, approximately 30 feet north of the SW 27th Terrace right-of-way and then approximately 250 feet east of the SW 27th Avenue right-of-way until the boundary reaches 30 feet north of the Metrorail/U.S. Highway 1 transportation corridor, at which point it again proceeds approximately 30 feet west of the Metrorail right-of-way boundary. South of U.S. Highway 1 in this location, the corridor boundary proceeds approximately 30 feet south of the SW 28th Terrace right-of-way, approximately 30 feet east of the SW 27th Avenue right-of-way, approximately 30 feet south of the SW 28th Street right-of-way, and then approximately 30 feet east of the SW 26th Avenue right-of-way until the boundary reaches 30 feet south of the U.S. Highway 1 right-of-way.

Proceeding northeastward, the corridor is again expanded in the vicinity of the Vizcaya Metrorail station to provide flexibility around the station. The corridor is expanded to include a short stretch of SW 1st Avenue and the Metrorail parking lot on the north (west) side of U.S. Highway 1.

Just north of the Vizcaya Metrorail station, I-95 intersects the East Preferred Corridor. Here the west (north) corridor boundary widens to proceed approximately 30 feet north (west) of the SW 1st Avenue right-of-way and to a point approximately 30 feet west of the intersection with the I-95 right-of-way. The east (south) corridor boundary in this area proceeds approximately 30 feet south of the U.S. Highway 1 right-of-way, and then turns east approximately 30 feet east of the South Miami Avenue right-of-way. Approximately 30 feet north (east) of the SW 26th Road right-of-way, the east corridor boundary proceeds west to approximately 30 feet east of the I-95 right-of-way. The east corridor boundary then proceeds north (east) approximately 30 feet east of the I-95 right-of-way boundary. In the area of SW 19th Road, I-95 and the east corridor boundary turn to the west. The east corridor boundary then proceeds north (east) approximately 30 feet south of the Metrorail right-of-way.

Where I-95 crosses over to the west side of Metrorail, the East Preferred Corridor is again widened to allow flexibility in the approach to the Miami substation. The west edge of the corridor crosses I-95 from west to east and borders the east right-of-way boundary of I-95 north to SW 5th Street. From there, the west edge of the corridor turns northeast across the Miami River into the Miami substation property.

Along the east side of the corridor in this area, the corridor boundary extends approximately 30 feet east of the Metrorail right-of-way past Simpson Park and then east approximately 30 feet south of the SW 15th Road right-of-way to 30 feet east of the SW 1st Avenue right-of-way, where it turns north to SW 7th Street. The corridor boundary then turns northeast for a short distance along the east road right-of-way of South Miami Avenue, then turns north to the west of South Miami Place, and then turns northwest to cross the river. This alignment continues due north along the east boundary of the Metrorail property north of the Miami River and then to the Miami substation.

The East Preferred Corridor in this area of Miami allows flexibility in siting an overhead route to the Miami River, the crossing of which is at present proposed to be subaqueous.

The total length of the East Preferred Corridor is approximately 37 miles.

9.4.3.4 Community Outreach Program

FPL extended considerable effort to inform and involve the public during the route selection process that produced the preferred corridors. FPL used direct mail, a community e-survey, nine open houses, a newspaper advertisement, a project Web page, two agency workshops, meetings with local governments and regional and state agencies, a project e-mail address, and a toll free telephone number to share information and provide an opportunity for interested persons to learn more about the project and express their views.

Initially, using the Miami-Dade County Property Appraisers' and FPL customer databases, more than 260,000 letters were sent to FPL customers and property owners within 0.5 mile from the potential routes that were under consideration. This letter was sent in English and Spanish, introduced the transmission line improvement project, and invited people to attend upcoming open houses. Enclosed with the letter was a map of Miami-Dade County showing the potential routes being studied and a list of the locations, dates, and times for the nine open houses.

Prior to the open houses, the team was able to identify from the FPL database those customers within a half mile of the routes who have provided their e-mail addresses and allow unsolicited e-mail. These 64,000 customer accounts were sent an e-survey that asked people which of the selection criteria the respondents thought were more important. These surveys generated results that validated the route selection criteria used.

Nine open houses were held in November and December 2008 with the intent of spreading them out to different geographical sites along the potential routes. More than 350 people attended these open houses. During the open houses, visitors were able to talk directly, informally, and one-on-one with FPL project team members. They could learn about the project and the routes being considered, view maps and aerial photographs of the routes being evaluated, and specifically identify on Google Earth® their home or property in relation to the alternative routes under consideration. Engineers, biologists, land use planners and other FPL representatives in attendance were there to answer questions and review information provided about the project and FPL on display boards and in brochures. Attendees could express their views and provide feedback to FPL for consideration in the route selection process.

Two agency workshops were held with local, regional, and state government staff at the initiation of the route selection process and after the open houses as the team began to narrow their focus. The staff personnel provided valuable input regarding special features and community values of their jurisdiction, future plans for development, and ways to communicate with their constituents.

Additional one-on-one meetings and contacts with local, regional, and state governments were held throughout the selection process, not only to collect relevant data and maps, but to also seek input on route selection issues. Agencies and local governments provided important information about the routes FPL was studying, as well as individuals and groups who might have specific interest in the project. Some of the agencies and local government representatives proposed alternate routes that were considered and studied by FPL.

FPL representatives were also available to meet with community groups, homeowner associations, and property owners upon request to discuss the project route selection and route selection process, as well as the Florida Electrical Power Plant Siting Act (PPSA) process.

The FPL project team incorporated what they learned through the community outreach program into the preferred corridor selection decision. Members of the public and governmental agencies who participated through the various components of the program were able to suggest the following to the team:

- Places to consider or avoid in routing.
- Other linear facilities to consider for collocation with the proposed line.
- Which evaluation criteria should be considered as more important.
- Specific routes to evaluate.
- Unique or important study area features or characteristics that should be given consideration in route selection.
- Areas under consideration for future development that could potentially affect a route.
- Existing operational considerations for land uses on or near the rights-of-way.
- Preferences on structure design for the 500 kV lines.
- Ways to effectively communicate with the public regarding the project.

Section 9.4 References

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Table 9.4-1 (Sheet 1 of 2)
Analysis of Heat Dissipation System Alternatives

Factors Affecting System Selection	Round Mechanical Draft Cooling Towers — Proposed	Fan-Assisted Natural Draft Towers — Alternate
Land Use		
Onsite land requirements	The round mechanical draft would require approximately 30 acres to support 2 AP1000 units.	The fan-assisted natural draft would require approximately 30 acres to support 2 AP1000 units.
Terrain considerations	Terrain features of the Units 6 & 7 site are suitable for the round mechanical draft.	Terrain features of the Units 6 & 7 site are suitable for a fan-assisted natural draft system.
Floodplain Alterations	The round mechanical draft cooling tower would not result in modifications of the floodplain (site will be raised to elevation above floodplain).	The fan-assisted natural draft cooling tower would not result in modifications of the floodplain (site will be raised to elevation above floodplain).
Wetlands or Critical Habitat Issues	The Units 6 & 7 site is a critical non-nesting habitat for the American crocodile so constructing the round mechanical draft would disturb approximately 30 acres of critical habitat land during construction and slightly less during operation.	The Units 6 & 7 site is a critical non-nesting habitat for the American crocodile so constructing the fan-assisted natural draft would disturb approximately 30 acres of critical habitat land during construction and slightly less during operation.
Terrestrial Biota	Impacts to terrestrial biota are presented in Subsection 4.3.1.	Impacts to terrestrial biota are described in Subsection 4.3.1. Impacts from constructing and operating the fan-assisted natural draft would be similar to impacts from constructing and operating the round mechanical draft.
Water Use	Intake requirements for round mechanical draft would be for makeup water and would consist of pumps, piping, and valves. There are no foreseen impacts to aquatic biota associated with constructing or operating the saltwater wells (radial collector wells) or the reclaimed water source. Circulating water makeup quantity (to replace water lost by evaporation and drift) for the proposed system is provided in Table 3.3-1. The discharge water quality is provided in Section 3.6 and the quantity is provided in Table 3.3-1.	Intake requirements for the fan-assisted natural draft would be for makeup water and would consist of pumps, piping and valves. There are no foreseen impacts to aquatic biota associated with constructing or operating the saltwater wells (radial collector wells) or the reclaimed water source. Circulating water makeup and discharge quantity for the fan-assisted natural drafts expected to be approximately the same or less than the proposed round mechanical draft system. The discharge water quality for the fan-assisted natural draft is expected to be the same as for the proposed round mechanical draft.

Table 9.4-1 (Sheet 2 of 2)
Analysis of Heat Dissipation System Alternatives

Factors Affecting System Selection	Round Mechanical Draft Cooling Towers — Proposed	Fan-Assisted Natural Draft Towers — Alternate
Atmospheric Effects	The round mechanical draft system would emit water droplets (drift) and intermittently produce a visible vapor plume. As provided in Subsection 5.3.3, the drift droplets would be a minor source of particulate matter and salt deposits. The water vapor plume would result in minimal additional fogging but no icing conditions on local road systems.	Similar to the round mechanical draft system, fan-assisted natural draft would emit water droplets (drift) and intermittently produce a visible vapor plume. It is expected that, similar to the round mechanical draft, the drift droplets would be a minor source of particulate matter and salt deposits. The water vapor plume would result in minimal additional fogging but no icing conditions on local road systems.
Thermal and Physical Effects	The discharge to the Boulder Zone of the Lower Floridan aquifer would meet the requirement of Florida's Department of Environment Deep Well Injection Control, Chapter 62-528.	The discharge to the Boulder Zone of the Lower Floridan aquifer would meet the requirement of Florida's Department of Environment Deep Well Injection Control, Chapter 62-528.
Noise Levels	Sound pressure level is estimated at 85 decibels adjusted (dBA) at 3 feet from the tower.	Sound pressure level is estimated at 97 dBA at 3 feet from the tower.
Aesthetic and Recreational Benefits	Aesthetic impacts from the visible plume would be small. There are no recreational benefits to the round mechanical draft cooling tower.	Aesthetic impacts from the visible plume would be small. There are no recreational benefits to the fan-assisted natural draft cooling tower.
Operating and Maintenance Experience	Established technology in the U.S. with highly reliable experience with operation and maintenance and plentiful installations throughout the U.S.	Considered an emerging technology in the U.S.; however, there is successful operation and maintenance experience outside the U.S.
Generating Efficiency (per AP1000 unit)	Total Fan Auxiliary Power Requirement (MW): 6.7 Total Pump Auxiliary Power Requirement (MW): 16.5.	Total Fan Auxiliary Power Requirement (MW): 8.0 Total Pump Auxiliary Power Requirement (MW): 24.7.
Legislative Restrictions	The proposed raw water makeup sources (reclaimed and radial collector well) do not require an intake system as defined by 40 CFR 125.83 so there would be no construction-related, aquatic ecology, threatened or endangered species, or water use impacts and Section 316(b) of the Clean Water Act does not apply. Cooling tower blowdown would discharge to the Boulder Zone of the Lower Floridan aquifer and, therefore not impact aquatic biota. The regulatory restrictions would not negatively impact applying this heat dissipation system.	The proposed raw water makeup sources (reclaimed and radial collector wells) do not require an intake system as defined by 40 CFR 125.83 so there would be no construction-related, aquatic ecology, threatened or endangered species, or water use impacts and Section 316(b) of the Clean Water Act does not apply. Cooling tower blowdown, which may be less than the preferred alternative, would discharge to the Boulder Zone of the Lower Floridan aquifer and therefore, not impact aquatic biota. The regulatory restrictions would not negatively impact applying this heat dissipation system.
Is this a suitable alternative for the Units 6 & 7 site?	Yes.	Yes.

Table 9.4-2
Comparison of Proposed Water Intake Alternatives

Impact	MDWASD Reclaimed Water — Proposed Raw Water System	Biscayne Aquifer (Radial Collector Well) — Proposed Raw Water System	Lower Floridan Aquifer (Boulder Zone) — Alternate System	Card Sound Canal Conventional Intake — Alternate System	Card Sound Canal Passive Screen Intake — Alternate System
Construction Impacts	No intake system is required. There would be no construction impacts related to intake structures. However, construction impacts would include land disturbance along the pipeline route.	A cooling water intake structure as defined by 40 CFR 125.83 does not exist for this alternative; however, construction impacts include land disturbance and associated ecological impacts in the vicinity of the caissons and along pipeline route to plant site. Construction impacts would be low.	No intake system is required. There would be no construction impacts related to intake structures. However, construction impacts of this system would be limited to localized land disturbance.	Construction impacts include land disturbance on east bank of canal at intake location and along pipeline route. Construction impacts would be low.	Construction impacts include land disturbance on east bank of canal at intake location and along pipeline route to plant site (about 4 miles), and canal bed disturbance in area of passive screens. Construction impacts would be low.
Aquatic Impacts	No intake system is required. There would be no aquatic impacts.	Operation would induce flow from Biscayne Bay into the seabed. Induced flow would be distributed over a very large area. Aquatic impacts are not foreseen.	No intake system is required. There would be no aquatic impacts.	Aquatic impacts include impingement and entrainment. Use of a closed-cycle cooling system and compliance with EPA 316(b) cooling water intake structure requirements would mitigate aquatic impacts to low levels.	Aquatic impacts include impingement and entrainment. Use of a closed-cycle cooling system and compliance with EPA 316(b) cooling water intake structure requirements would mitigate aquatic impacts to low levels.
Water-Use Impacts	No intake system is required. There would be no water-use impacts.	There are no other consumptive water uses and operation would not interfere with non-consumptive uses. There would be no water-use impacts.	No intake system is required. There could be water use impacts from Boulder zone discharge option if used simultaneously with this option from recirculation effects.	There are no other consumptive or nonconsumption water uses of Card Sound Canal. There would be no water use impacts.	There are no other consumptive or nonconsumption water uses of Card Sound Canal. There would be no water use impacts.
Compliance with Regulations	Not applicable.	Not applicable.	Not applicable.	The intake would need to comply with Article 316(b) of the Clean Water Act as applied to new facilities.	The intake would need to comply with Article 316(b) of the Clean Water Act as applied to new facilities.

Table 9.4-3
Comparison of Water Discharge Alternatives

Impact	Lower Floridan Aquifer (Boulder Zone) — Proposed System	MDWASD Wastewater Treatment Plant — Alternate System	Cooling Canals — Alternate System	Card Sound Canal — Alternate System
Construction Impacts	Construction impacts limited to localized land disturbance in the vicinity of the deep injection wells and along the discharge pipeline route. Construction impacts would be low.	Construction impacts include land and traffic disturbance along the pipeline route (Approx. 9 miles of public right-of-way in urbanized areas or FPL transmission corridors). Construction impacts would be moderate.	Construction impacts limited to the short pipeline route between the plant site and the discharge side of the existing cooling canals. Construction impacts would be low.	Construction impacts include land disturbance on canal bank at discharge location and along pipeline route to plant site (about 4 miles). Construction impacts would be low.
Aquatic Impacts	The Boulder Zone is a deep saltwater aquifer that has no interaction with aquatic systems. There would be no aquatic impacts.	There would be no site-related aquatic impacts.	Temperature and salinity of blowdown would be less than the ambient levels in cooling canals. Assuming that blowdown discharge would be treated for nutrient limits, aquatic impacts would be low, although pollutants unique to reclaimed water may require consideration.	Water temperatures would be elevated as a result of discharging blowdown, but within thermal compliance limits at the point of discharge to Card Sound. Water quality of the blowdown is less saline than ambient levels. Aquatic impacts would be low.
Water-Use Impacts	Other than potentially Units 6 & 7, there are no other water users in the region. There would be no water use impacts.	Currently, the wastewater treatment plants do not have the capacity to accept blowdown from Units 6 & 7. However, if reclaimed water is used for water supply, the blowdown could be returned to the wastewater treatment plant for disposal. Water quality acceptance criteria and capacity restrictions on wastewater plant discharges could restrict the use of this option. Also, returning water to the MDWASD would deprive other potential users of the beneficial use of this water (e.g., for wetlands rehydration).	Turkey Point Units 1 through 4 are the sole users of the cooling canals. The additional flow would supplement their supply. There would be no water use impacts.	There are no other consumptive or non-consumptive water uses of the Card Sound Canal. There would be no water-use impacts.
Compliance with Regulations	Discharge must comply with Class I injection well concentration limits. Compliance monitoring required.	Water returned to the MDWASD for disposal would need to meet the requirements of their pretreatment.	The current industrial wastewater permit would require modification to accept blowdown from Units 6 & 7.	The discharge of blowdown from a recirculated cooling water system would need to comply with Rule 62-4.242, F.A.C.

Table 9.4-4
Comparison of Water Supply Alternatives

Impacts	Reclaimed Water — Proposed Supply	Radial Collector Wells — Proposed Supply	Boulder Zone — Alternate Supply	Card Sound Canal — Alternate Supply
Construction Impacts	Construction impacts include land and traffic disturbance along the pipeline route (Approx. 9 miles of public right-of-way in urbanized areas or FPL transmission corridors) and land disturbance at the MDWASD where new treatment facilities would be constructed. Given that the pipeline would follow a majority of an existing corridor, clearing of new corridors and /or expansion of existing corridors would include use of best management practices to reduce impacts to sensitive habitats. Therefore, impacts would be low.	Construction impacts include land disturbance in the vicinity of the caissons and along pipeline route to plant site. Construction impacts would be low.	Construction impacts limited to localized land disturbance in the vicinity of the supply wells and along pipeline route to plant site. Construction impacts would be low.	Construction impacts include land disturbance on east bank of canal at intake location and along pipeline route to plant site (about 4 miles), and canal bed disturbance in area of passive screens. Construction impacts would be low.
Aquatic Impacts	There would be no adverse aquatic impacts associated with the use of reclaimed water. Using reclaimed water would eliminate the volume of treated effluent discharged by ocean outfall and positively impact those receiving water bodies.	Operation would induce flow from Biscayne Bay or Card Sound into the seabed. Induced flow would be distributed over a very large area. Aquatic impacts would be low.	The Boulder Zone is a deep saltwater aquifer that has no interaction with aquatic systems. There would be no aquatic impacts.	Aquatic impacts include impingement and entrainment. Use of a closed-cycle cooling system and compliance with EPA 316(b) cooling water intake structure requirements would mitigate aquatic impacts to low levels.
Water-Use Impacts	Reclaimed water use would allow MDWASD to meet a portion of its water reuse requirements while supplying the plant site with makeup water. There would be no consumptive water-use impacts.	There are no other consumptive water users and operation would not interfere with nonconsumptive uses. There would be no water use impacts.	The Boulder Zone is a saltwater aquifer that is not used for water supply. There would be no consumptive or nonconsumptive water use impacts. There could be re-circulation impacts if Boulder Zone discharge option used simultaneously.	There are no other consumptive or nonconsumptive water uses of Card Sound Canal. There would be no water use impacts.
Compliance with Regulations	The use of reclaimed water used in open cooling towers would need to comply with Rule 62-610.668, F.A.C.	The water supply system would not need to comply with Article 316(b) of the Clean Water Act as applied to new facilities.	Not Applicable	The cooling water intake system would need to comply with Article 316(b) of the Clean Water Act as applied to new facilities.

Table 9.4-5
Area Resources Mapped

Category	Resource
Base map information	• Highways, roads, streets • County boundaries • City boundaries • Railroads, airports, heliports • Existing and proposed FPL substations • Existing FPL transmission lines • Existing FPL properties, rights-of-way, and easements • Water bodies, rivers, streams, canals
Land use information	• Existing and proposed development for which local approvals are pending • Planned unit developments and developments of regional impact • Property boundaries • Existing school properties • National parks, wildlife refuges, estuarine sanctuaries, landmarks, or historical sites • State parks, preserves, proposed and existing Florida Forever lands, • Areas of Critical State Concern, Conservation and Recreation Lands, Save Our Rivers lands, aquatic preserves • SFMWD-owned lands • Miami-Dade County lands, parks, recreation areas, and mitigation lands • Native American lands • Private designated wetland mitigation areas • Privately owned environmental preserves/sanctuaries • Military properties
Environmental information	• Listed federal and state species and unique habitats, U.S. Fish and Wildlife Service (USFWS)-designated critical habitats • Wetlands as delineated on USFWS national wetlands inventory maps

Table 9.4-6
Alternative Route Identification

- Maximize collocation with certain linear features (existing FPL transmission lines, easements, or rights-of-way, roads, canals, etc.)
- Follow parcel or section lines where practicable and when other collocation opportunities do not exist
- Minimize crossing of constraints identified as a result of regional screening (e.g., environmentally sensitive lands, existing development, and proposed development for which local approvals are pending)
- Avoid known airports and private airstrips consistent with Federal Aviation Administration and other applicable regulations
- Follow disturbed alignments (ditches, roads) through wetlands, where practicable
- Minimize crossing of existing transmission lines

Table 9.4-7
Alternate Route Evaluation Criteria — West/East Routes

- Number of buildings in proximity
- Number of school properties in proximity
- Number of non-FPL parcels/lots crossed
- Length of route not following FPL-owned right-of-way or other transmission line easements
- Length of route not following other linear features (roads, railroads, canals, etc.)
- Length of route through existing parks/recreation areas/designated conservation lands
- Length of forested wetlands crossed
- Length of non-forested wetlands crossed
- Number of eagle nests/wading bird colonies in proximity
- Engineering costs

Table 9.4-8 (Sheet 1 of 2)
Qualitative Criteria Used to Evaluate — West/East Alternate Routes

West Alternate Routes
• Available space within existing FPL rights-of-way, easements, or fee-owned property • Available right-of-way along roads, transmission lines, and railroads • Road plans (new roads, extensions, widening) • Proposed development plans • Proximity of existing development to collocation rights-of-way • Types of development in proximity • Proximity and orientation of public airports and private airstrips • Ingress to substations • Bridge crossings • Constructability • Acquisition status of existing and proposed conservation lands and/or greenways • Availability of multi-agency land exchange • Ability to avoid or minimize wetland impacts • Ability to avoid or minimize impacts to parks, recreation, and conservation lands • Proximity to historical districts, roads, and/or structures • Review of potential underground scenarios where overhead is not feasible • Potential listed species presence • Crossing of Native American lands • Potential use of local access roads/trails • Proximity to known archaeological sites • Vegetative landscapes along streets (tall trees)

Table 9.4-8 (Sheet 2 of 2)
Qualitative Criteria Used to Evaluate — West/East Alternate Routes

East Alternate Routes
• Available space within existing FPL rights-of-way, easements, or fee-owned property
• Available right-of-way along roads, transmission lines, and railroads
• Road plans (new roads, extensions, widening)
• Proposed development plans
• Proximity of existing development to collocation rights-of-way
• Types of development in proximity
• Proximity and orientation of public airports and private airstrips
• Ingress to Miami substation and crossing the Miami River
• Bridge crossings
• Constructability
• Acquisition status of existing and proposed conservation lands and/or greenways
• Ability to avoid or minimize wetland impacts
• Ability to avoid or minimize impacts to parks, recreation, and conservation lands
• Proximity to historical districts, roads, and/or structures
• Review of potential underground scenarios where overhead is not feasible
• Potential listed species presence
• Crossing of Native American lands
• Potential use of local access roads/trails
• Proximity to known archaeological sites
• Miami-Dade Metrorail and/or Busway right-of-way availability and use
• Vegetative landscapes along streets (tall trees)

Figure 9.4-1 Boulder Zone Production Well Field Location

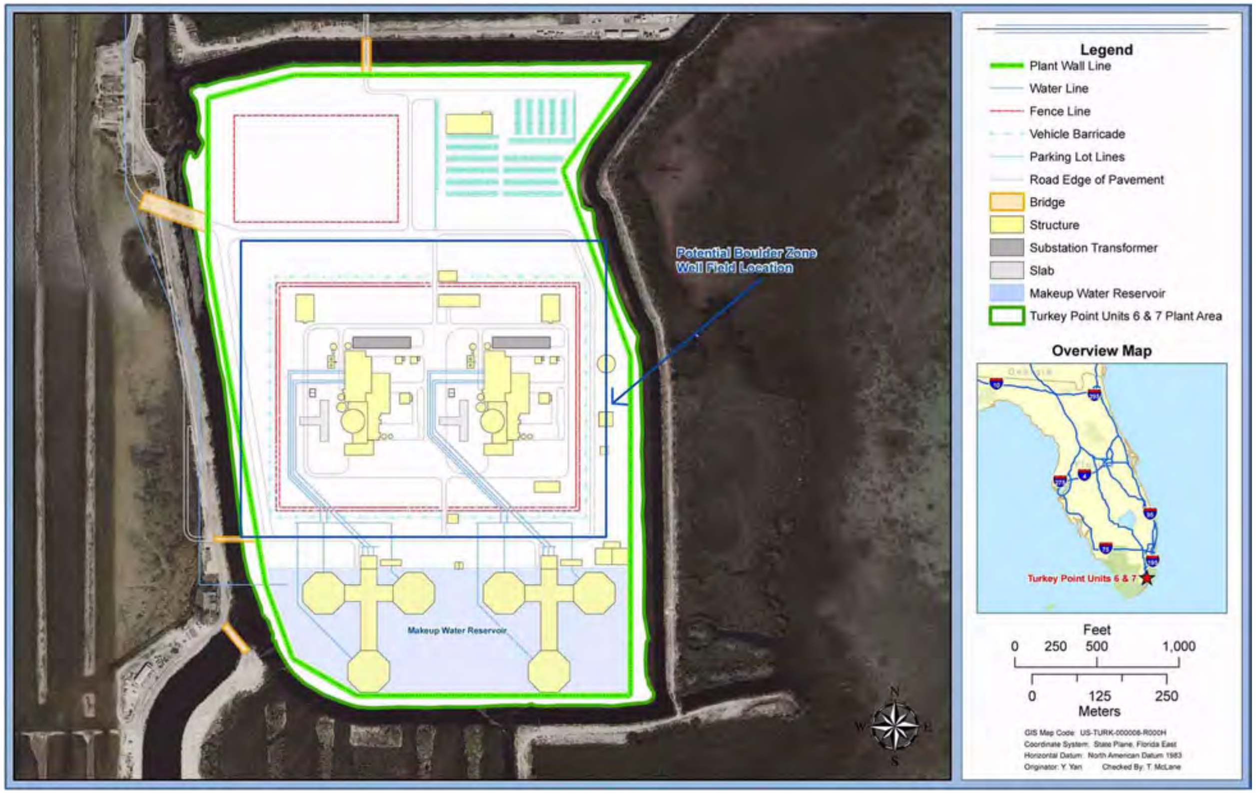


Figure 9.4-2 Water Supply for Turkey Point Power Plant Card Sound Canal Intake

Figure 9.4-3 Conventional Shoreline Pump Intake on Card Sound Canal — Conceptual Plan View

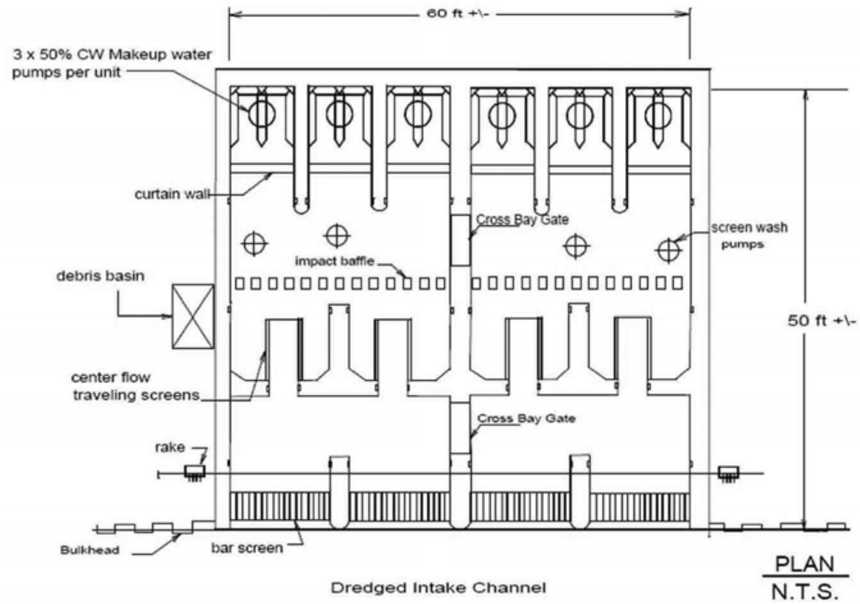


Figure 9.4-4 Conventional Shoreline Pump Intake on Card Sound Canal — Conceptual Sectional View

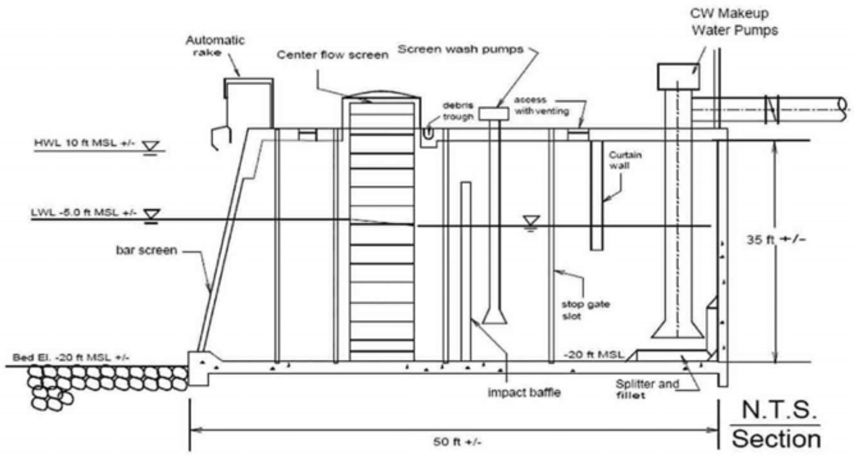


Figure 9.4-5 Panel-Type Shoreline Pump Intake on Card Sound Canal — Conceptual Plan View

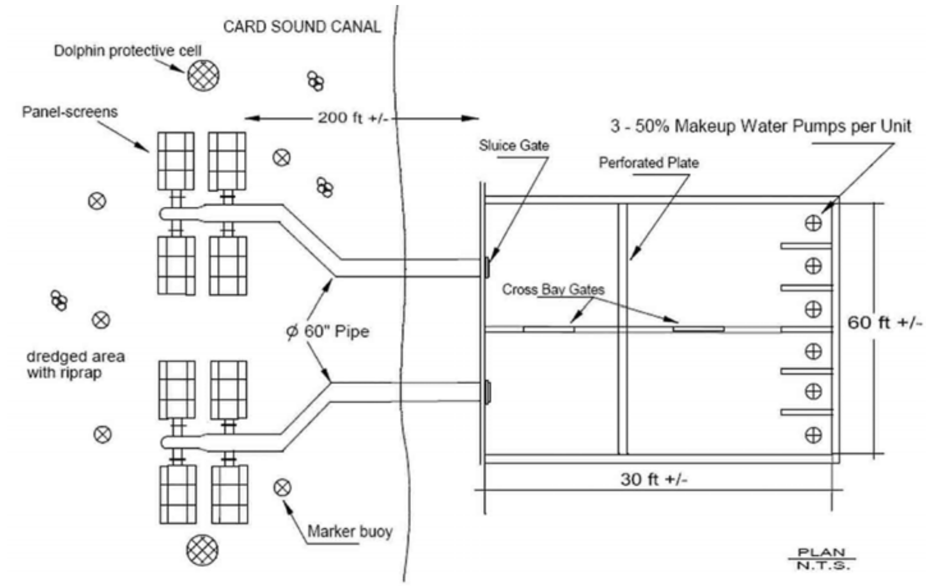


Figure 9.4-6 Panel-Type Shoreline Pump Intake on Card Sound Canal — Conceptual Sectional View

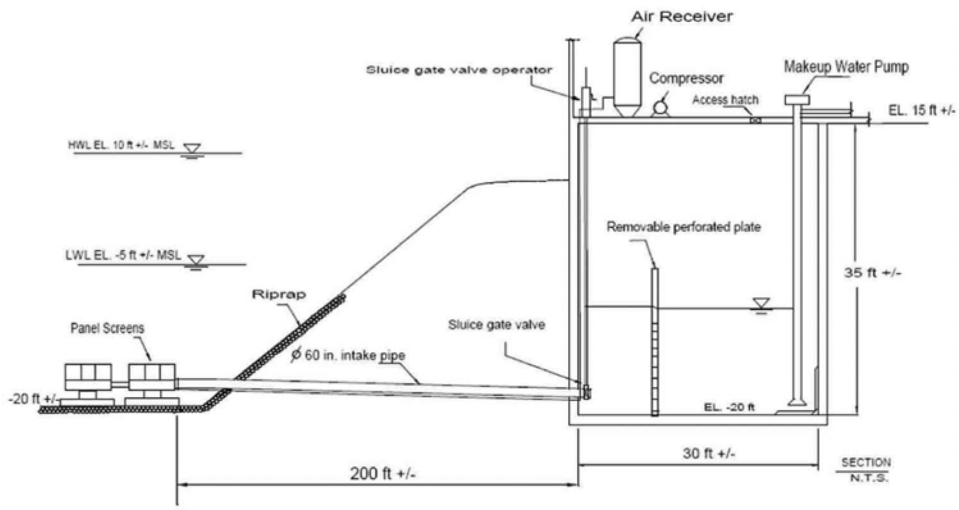


Figure 9.4-7 Blowdown Discharge to Miami-Dade Water and Sewer District (MDWASD)

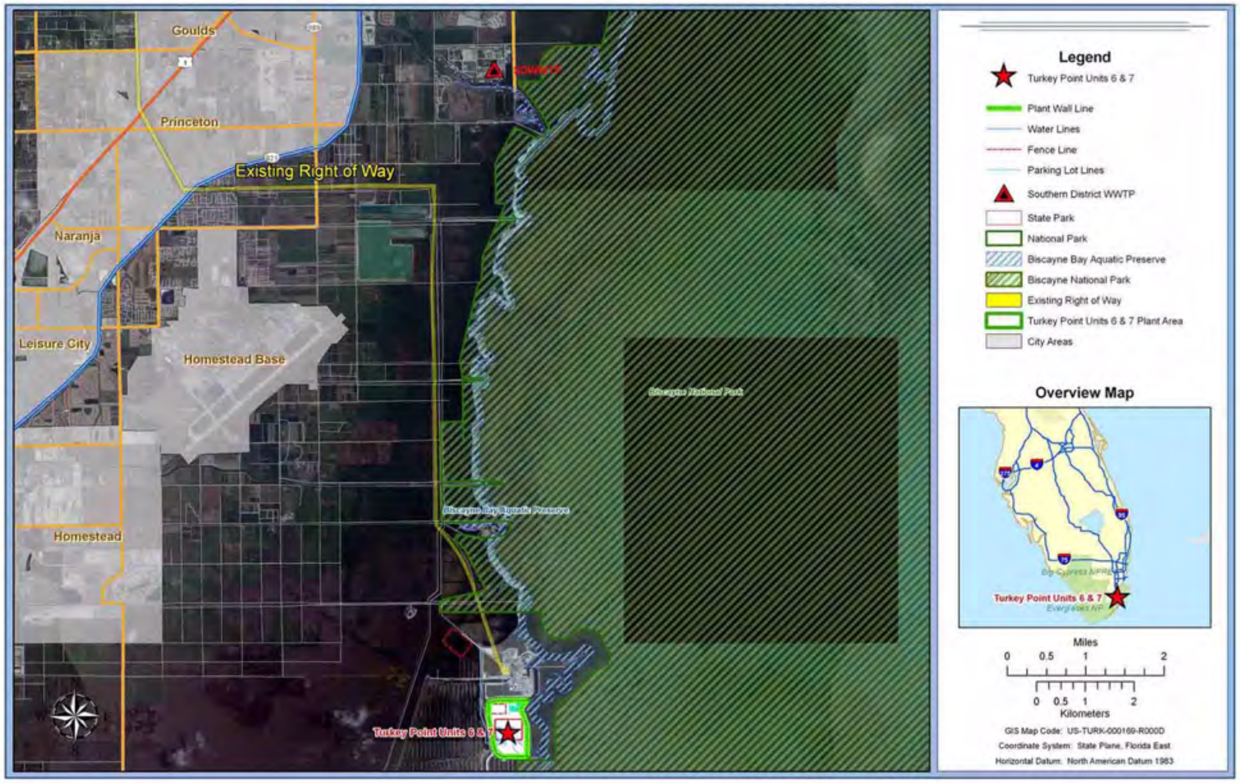


Figure 9.4-8 Water Discharge for Turkey Point Power Plant Cooling Canals

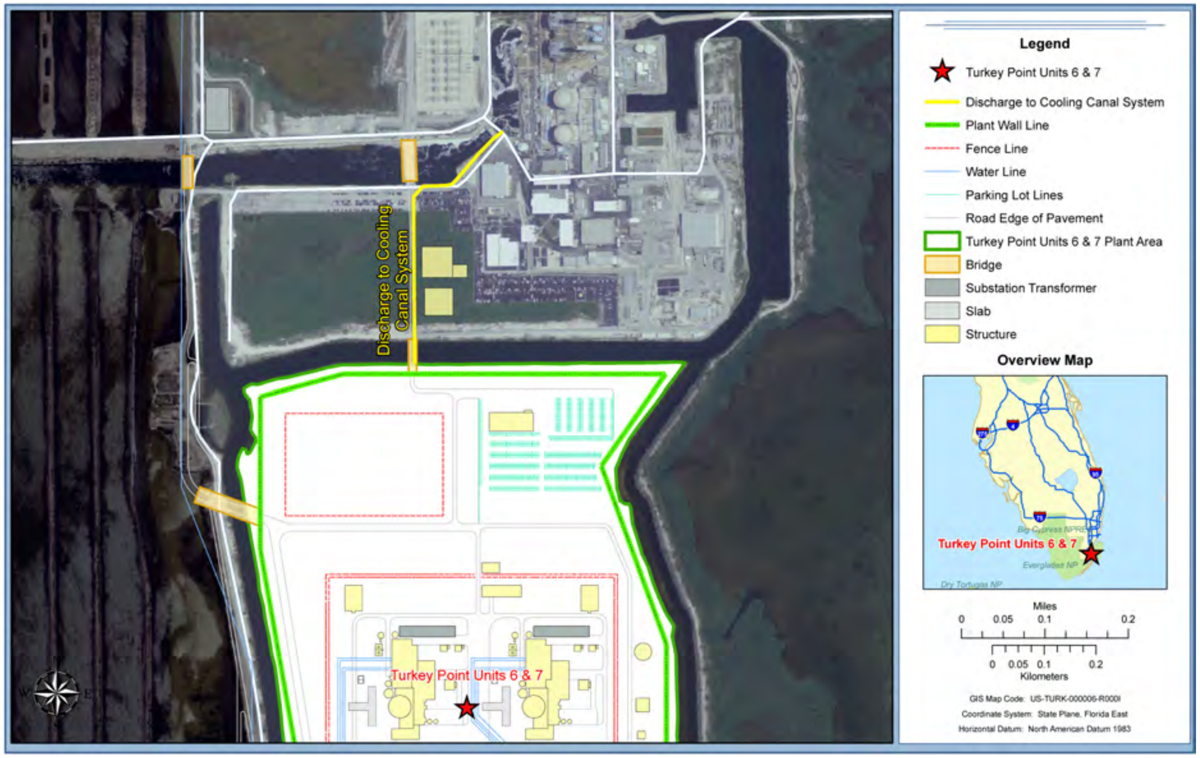


Figure 9.4-9 Blowdown Discharge to the Cooling Canals — Outlet Detail

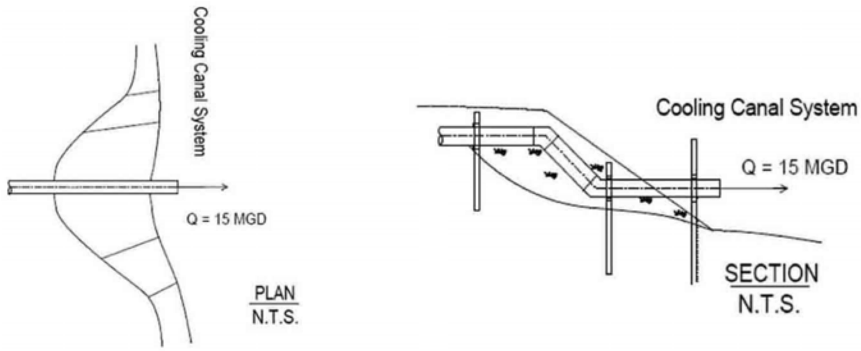


Figure 9.4-10 Water Discharge for Turkey Point Power Plant — Southern District WWTP

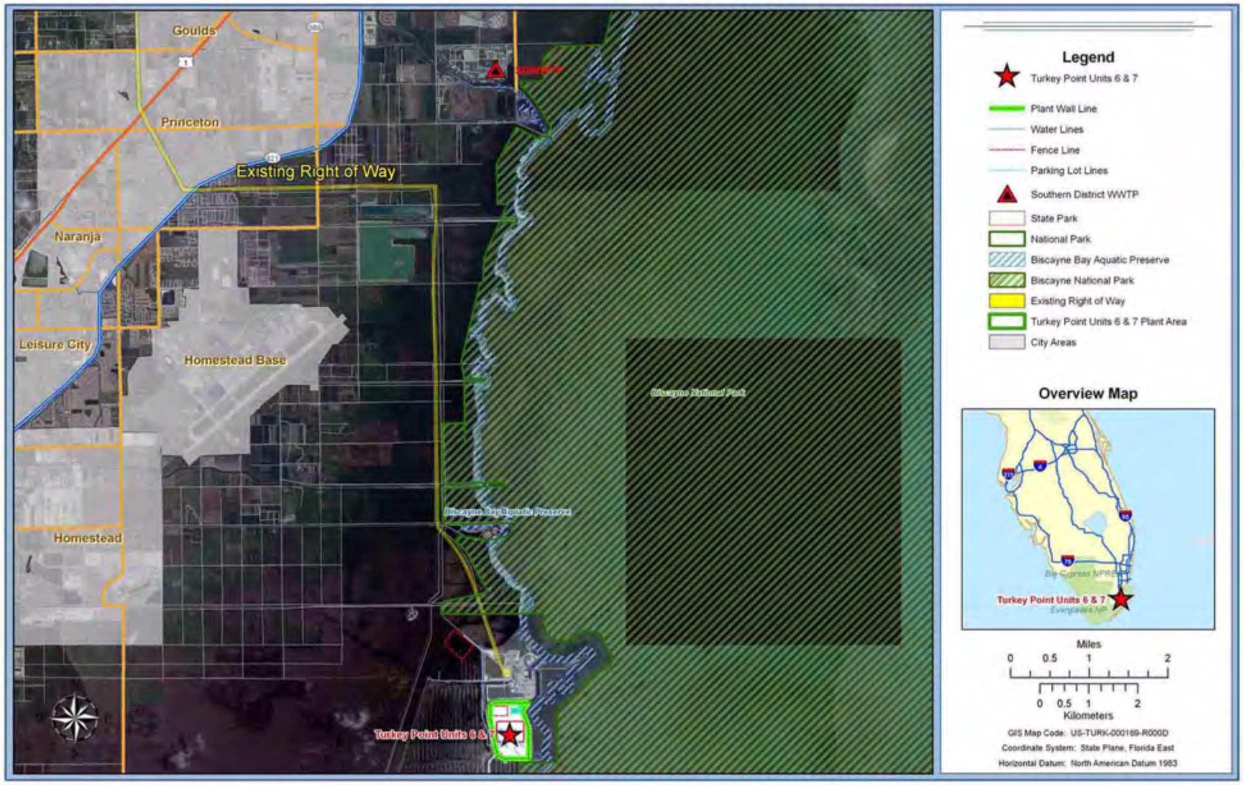


Figure 9.4-11 West Regional Alternative Routes

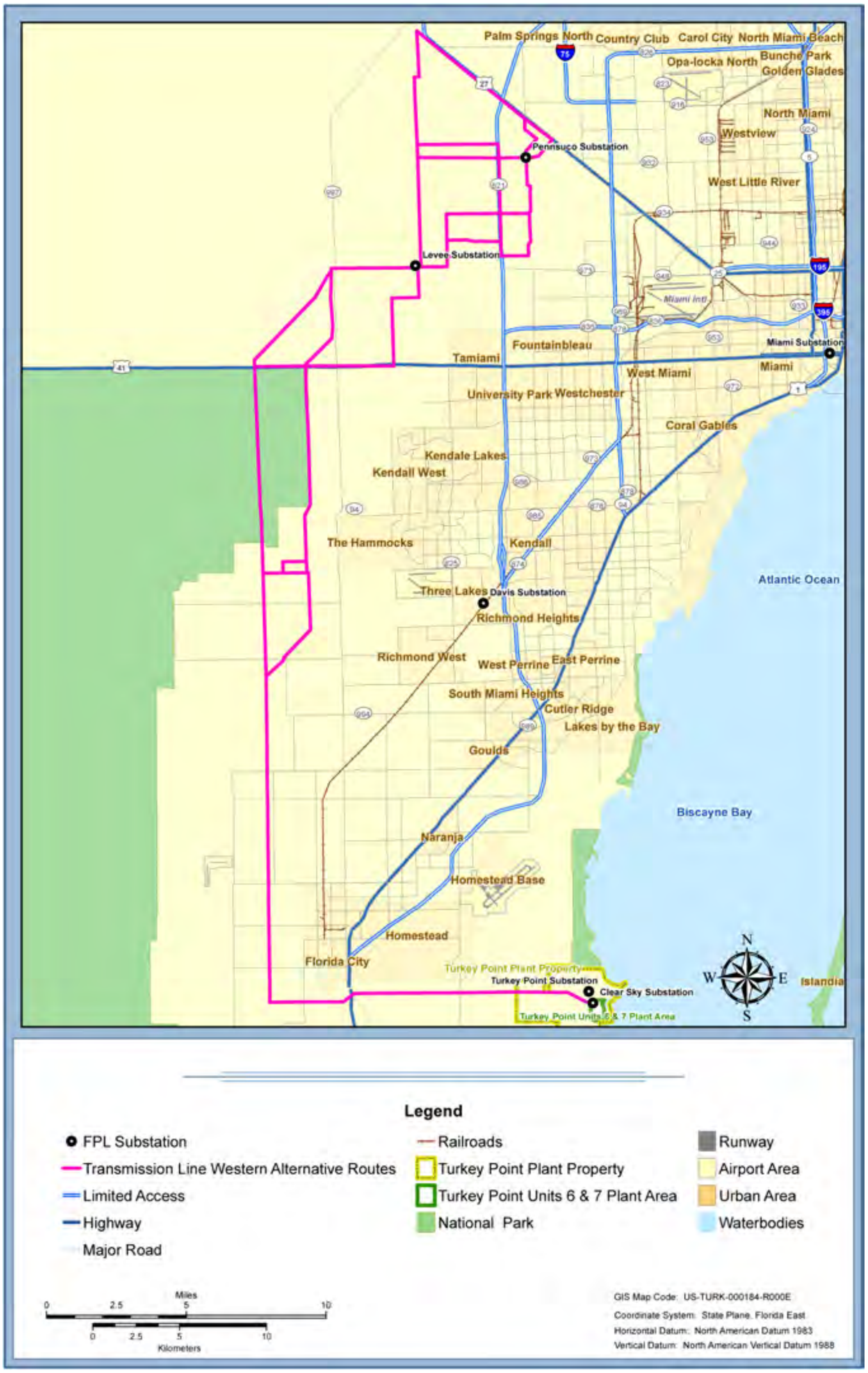


Figure 9.4-12 East Regional Alternative Routes

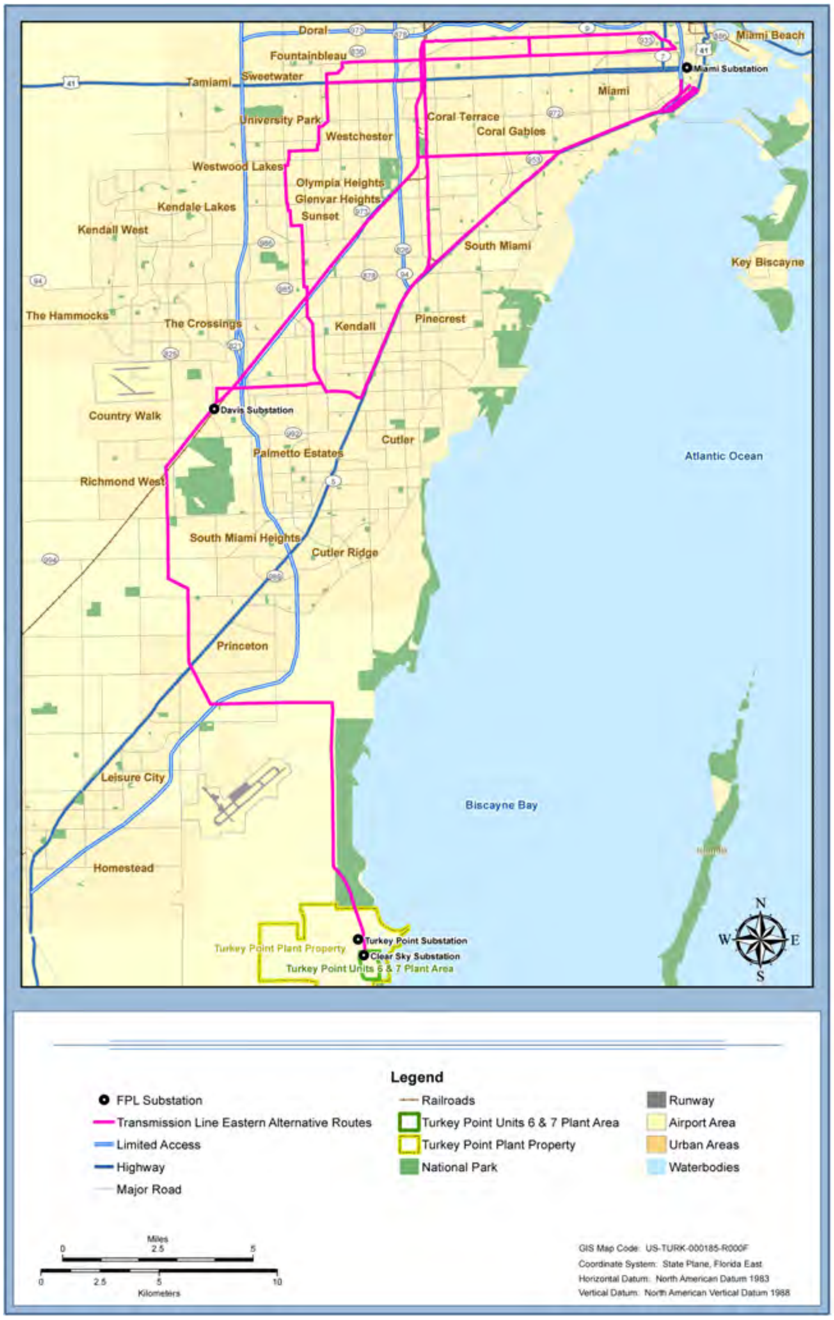
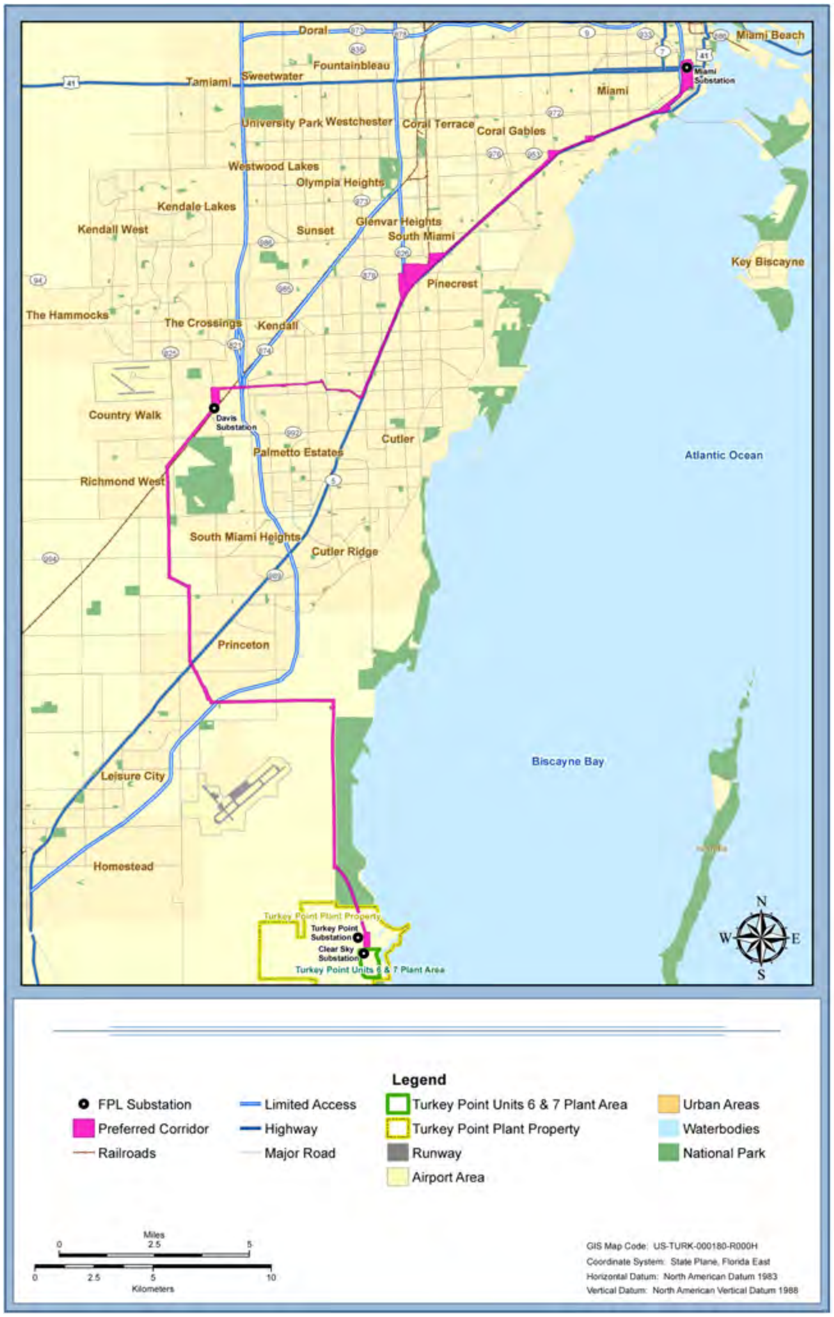


Figure 9.4-13 West Preferred and West Secondary Corridors

Figure 9.4-14 East Preferred Corridor



CHAPTER 10: ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION
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CHAPTER 10 ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION

In accordance with NUREG-1555, this chapter presents the potential environmental consequences from construction and operation of Units 6 & 7. This chapter describes the environmental consequences in four major subsections:

- Unavoidable adverse environmental impacts of construction and operations (10.1)
- Irreversible and irretrievable commitments of resources (10.2)
- Relationship between short-term uses and long-term productivity of the human environment (10.3)
- Benefit-cost balance (10.4)

Environmental impacts are quantified to the maximum extent practical and further categorized on a three-level standard of significance—SMALL, MODERATE, or LARGE. This standard of significance was developed based on the Council on Environmental Quality guidelines set forth in the footnotes to Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, as shown below:

- **SMALL** — Environmental effects are not detectable or are so minor they will neither destabilize nor noticeably alter any important attribute of the resource.
- **MODERATE** — Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
- **LARGE** — Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

10.1 UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS

Unavoidable adverse impacts are predicted adverse environmental impacts that cannot be avoided and for which there are no practical means of mitigation. This section considers unavoidable adverse impacts from construction and operation of Units 6 & 7 and associated facilities and offsite facilities such as transmission corridors, potable and reclaimed water pipelines, FPL-owned fill source, and access roads.

10.1.1 UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS OF CONSTRUCTION

This subsection and Table 10.1-1 are based on the details of construction impacts presented in Chapter 4, focusing on unavoidable adverse impacts. Full and detailed descriptions of impacts are presented by resource area in Chapter 4, which include both positive and adverse impacts as well as applicable mitigation measures. Table 4.6-1 summarizes the impacts and mitigation measures by section. The impacts of segregation of construction activities, as summarized in Table 4.6-2, are not considered here since this is considered a subset of the activities and mitigation measured summarized in Table 4.6-1. Table 10.1-1 summarizes the predicted adverse impacts associated with construction, grouping the impacts by the impact categories of land use, hydrological and water use, terrestrial and aquatic ecological, socioeconomic, radiological, atmospheric and meteorological, and environmental justice as provided for by NUREG-1555. For each predicted adverse impact, Table 10.1-1 presents a brief statement(s) of actions that would be taken to mitigate the impacts and finally identifies and quantifies, when practical, those adverse impacts that would remain even after the effective implementation of the mitigation measures.

Construction of Units 6 & 7 and associated facilities on the plant property, along with the new transmission lines, reclaimed and potable water pipelines, access roads, and FPL-owned fill source would produce unavoidable adverse impacts. Construction impacts would be limited to Miami-Dade County. Areas affected by construction of new transmission lines, reclaimed and potable water pipelines, access roads, and FPL-owned fill source could experience temporary localized impacts such as loss of natural habitat, loss or displacement of wildlife, and temporary increased noise and pollutant emissions (fugitive dust and equipment exhaust).

Selection of the transmission corridors was guided by a corridor selection process and is consistent with the requirements of the Florida Power Plant Siting Act. The objective of the corridor selection process was to select certifiable corridors that balance land use/ socioeconomic, environmental, engineering and cost considerations.

Adverse impacts attributable to construction activities would generally be SMALL. Exceptions are a MODERATE ecological impact as a result of construction activities and traffic near American crocodile habitat including construction of transmission lines across the cooling canals of the industrial wastewater facility, a MODERATE ecological impact on wetlands habitat, both on the Turkey Point plant property and at offsite construction locations, a MODERATE visual impact on aethestics from construction within transmission corridors and a MODERATE transportation impact on local roadways as a result of additional commuter traffic and material delivery vehicles once new road improvements are available. Based on the road improvements being completed, the traffic impacts would be temporary and MODERATE.

10.1.2 UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS OF OPERATIONS

This subsection is based on the details of operation impacts presented in Chapter 5, focusing on unavoidable adverse impacts. Full and detailed descriptions of impacts are presented by resource area in Chapter 5, which includes both positive and adverse impacts and potentially applicable mitigation measures. Table 5.10-1 summarizes the impacts and mitigation measures by section.

Table 10.1-2 summarizes the predicted adverse impacts associated with operation of Units 6 & 7, grouping the impacts by the impact categories of land use, hydrological and water use, terrestrial and aquatic ecological, socioeconomic, radiological, atmospheric and meteorological, and environmental justice as provided for by NUREG 1555. For each predicted adverse impact, Table 10.1-2 presents a brief statement(s) of actions that could be taken to mitigate the impacts and finally identifies and quantifies, when practical, those adverse impacts that would remain even after the effective implementation of the mitigation measures. Unavoidable adverse impacts from the operation of Units 6 & 7 include

- Permanent dedication of land
- Withdrawal of water from beneath Biscayne Bay to provide makeup water for the cooling system
- Disturbance of terrestrial ecosystems from permanent land dedication
- Salt deposits and noise from operation of the cooling towers
- Radiological and air pollutant emissions
- Radioactive and nonradioactive waste that requires disposal
- Increased demands on public infrastructure from population increase and plant water needs
- Increases in local traffic volume
- Visual impacts on the landscape from industrial structures

Operation of Units 6 & 7 and associated facilities on the plant property, along with the new transmission lines, reclaimed and potable water pipelines, and access roads would produce unavoidable adverse impacts. Operation impacts would be limited to Miami-Dade County. Areas affected by operation of new transmission lines, reclaimed and potable water pipelines, and access roads could experience localized permanent impacts such as loss of natural habitat.

Unavoidable adverse impacts attributable to operation activities would generally be SMALL. Exceptions include a SMALL to MODERATE impact on terrestrial ecosystems, and a MODERATE transportation impact on traffic levels for local roadways.

Table 10.1-1 (Sheet 1 of 6)
Construction-Related Unavoidable Adverse Environmental Impacts

Category	Adverse Impact	Actions to Mitigate Impacts	Unavoidable Adverse Environmental Impact
Land Use	Earth would be disturbed on Turkey Point plant property, transmission corridors, reclaimed and potable water pipelines, access roads, and FPL-owned fill source.	Environmental controls such as stormwater management systems; construction practices including erosion control and dust control; control plant access for personnel and vehicular traffic; and restrict construction activities to specified areas to would be used to minimize impacts. Procedures to address inadvertent discovery of historic, archaeological, or paleontological resource would be developed.	Disturbance of acreage including wetlands that are mitigated through regional mitigation opportunities, disturbance of land for fill materials, additional acreage for transmission lines and pipelines rights-of-way.
	Construction activities on Turkey Point plant property, transmission corridors, reclaimed and potable water pipelines, access roads, FPL-owned fill source in and near wetlands would impact wetlands.	Turkey Point Plant Property and offsite areas: Wetland impacts would be avoided and minimized to the extent practicable, for the transmission lines (to the extent practicable, existing corridors would be used), reclaimed and potable water pipelines, access roads, FPL-owned fill source, and by restricting construction activities to specified areas. Use environmental best management practices for clearing and construction to minimize impacts. Use equipment that minimizes environmental impacts such as erosion-control devices, mattings, and wide-track vehicles when crossing wetlands. Conduct restoration activities where necessary after construction. Offset the potential loss of any disturbed wetlands with regional mitigation opportunities.	Though wetland impacts are unavoidable, losses would be offset with regional mitigation opportunities.

Table 10.1-1 (Sheet 2 of 6)
Construction-Related Unavoidable Adverse Environmental Impacts

Category	Adverse Impact	Actions to Mitigate Impacts	Unavoidable Adverse Environmental Impact
Hydrological and Water Use	Hydrological alterations as a result of site preparation and construction activities including excavation, dewatering, filling, and elevating land surface as well as creation of a reservoir onsite.	Turkey Point plant property: water drainage from spoils areas, FPL reclaimed water treatment facility, nuclear administration and training buildings would be directed to the existing cooling canals of the industrial wastewater facility. Water drainage from the radial collector wells would be controlled by environmental best management practices. Also the berm east of the return canal would serve to mitigate impacts from construction activities within the Units 6 & 7 plant area. Access Roads: Existing roads would be used to the extent practicable. Ditches and the use of culverts would allow stormwater drainage to be maintained along the road route. During construction on Turkey Point plant property, stormwater runoff would be directed to retention basins or other erosion control devised before release to the cooling canals of the industrial wastewater facility. Should modification to the existing drainage ditches or drainage features be required, the impacts would be temporary and the disturbed areas could be returned to preconstruction conditions. Re-vegetation could be required. All work would be performed in accordance with site-obtained permits. Transmission lines and reclaimed/potable water pipelines: Standard construction industry practices would be used. A Stormwater Pollution Prevention Plan (SWPPP) for the proposed construction activities would be developed or the work would be performed under existing FPL permits/plans for these types of activities. FPL-owned fill source: Standard construction industry practices would be used. Surface water flow would be controlled through the use as such practices as berms, drainage ditches, and/or stormwater retention basins.	Hydrological alterations as a result of site preparation and construction activities including excavation, dewatering, filling, and elevating land surface as well as creation of a reservoir onsite.

Table 10.1-1 (Sheet 3 of 6)
Construction-Related Unavoidable Adverse Environmental Impacts

Category	Adverse Impact	Actions to Mitigate Impacts	Unavoidable Adverse Environmental Impact
Hydrological and Water Use (cont.)	Impacts to surface water and groundwater from sediment and pollutants as a result of site preparation and construction activities including excavation, dewatering, filling, and elevating land surface as well as creation of an onsite reservoir.	Develop an erosion, sedimentation, and pollution control plan. Implement environmental best management practices, including structural (i.e., erosion-control devices and detention ponds) and operational controls to prevent the movement of pollutants (including sediments) into wetlands and water bodies via stormwater runoff. Dewatering activities and enlargement of the equipment barge unloading area would include use of a slurry wall, and cutoff wall techniques, as appropriate. The water from dewatering activities would be directed to the cooling canals of the industrial wastewater facility.	None
	Installation of deep injection wells.	The deep injection wells and the required monitoring wells would be installed in accordance with a Florida Department of Environmental Protection (FDEP) injection well permit requirements and any local permit requirements. During the construction of the injection wells and delivery system, any stormwater runoff would be released to the cooling canals of the industrial wastewater facility.	None
	Accidental spills could adversely impact surface waters and groundwater.	Construction activities would be performed under a new SWPPP and associated spill prevention plan that could include oil and fuel containment. Any minor spills of diesel fuel, hydraulic fluid, lubricants, or other construction-related pollutants during construction of the project would be cleaned up quickly to prevent them from moving into the groundwater. This would also mitigate impacts to local surface water because spills would be quickly attended to and not allowed to flow to nearby surface water.	None

Table 10.1-1 (Sheet 4 of 6)
Construction-Related Unavoidable Adverse Environmental Impacts

Category	Adverse Impact	Actions to Mitigate Impacts	Unavoidable Adverse Environmental Impact
Terrestrial Ecological	Conversion of land, including wetlands for construction of Units 6 & 7 and supporting structures.	Restrict construction activities to specified areas. Loss of wetlands could be offset with the regional mitigation opportunities.	Construction activities for Units 6 & 7 would impact wetlands, primarily hypersaline mudflats.
	Crocodiles and listed species could be disturbed by site preparation and construction activities and traffic.	A project-specific management plan for crocodiles and other listed species was created for this construction activity. Mitigation measures may include creation of freshwater refugia on the berms for young crocodiles, vegetation management on the berms to promote a native plant community that is more conducive to crocodile use, use of warning signs and education material (for construction personnel) as to the presence and status of crocodiles and restrictions of nocturnal activities around the cooling canals of the industrial wastewater facility. Traffic on access road at the north end of the cooling canals of the industrial wastewater facility may pose a threat to crocodiles crossing this road and would be mitigated by installation of a wildlife corridor to provide pathways for crocodiles to travel between wetlands on either side of this road. Construction of transmission facilities within the cooling canals of the industrial wastewater facility would avoid known crocodile nests and be conducted between nesting seasons.	None
	Construction noise and vibration could displace some wildlife and tall structures and cranes and light pollution could affect birds.	Measures to reduce noise and vibration levels during construction may include staggering work activities, and use of noise dampeners and noise control equipment on vehicles and equipment. To the extent practicable, unnecessary lights would be turned off at night, lights turned downward or hooded (directing light downward), and lower-power lights used.	Some wildlife individuals would be displaced.

Table 10.1-1 (Sheet 5 of 6)
Construction-Related Unavoidable Adverse Environmental Impacts

Category	Adverse Impact	Actions to Mitigate Impacts	Unavoidable Adverse Environmental Impact
Terrestrial Ecological (cont.)	Transmission lines would be located within nine wood stork colonies' core foraging area.	Impacts to wetlands within the core foraging area would be mitigated as prescribed by regulatory agencies. To mitigate the potential for collisions or electrocutions, avian-friendly design features would be used as provided for in the FPL Avian Protection Plan.	None
Aquatic Ecological	Equipment barge unloading area enlargement activities, increased barge traffic, and dredging, if needed, could disturb manatees.	A management plan has been prepared to minimize impacts on manatees as a result of the expansion and increased use of the turning basin.	None
Socioeconomic Impacts	Exposure of construction workers to temporary elevated noise levels, fugitive dust and fine particulate matter emissions from construction activities, and other occupational hazards.	Construction activities would be conducted in accordance with Occupational Safety and Health Administration safety standards. Develop and implement a dust control plan, or similar planning document to minimize dust.	None
	Increased population and subsequent increased demand for public water, wastewater treatment, police and fire services, medical services, and increase in student population.	The construction workforce will gradually increase. Communication would be maintained with local and regional governmental officials about the Units 6 & 7 construction and its schedules, allowing local and regional officials opportunity to plan for the population influx. Increased property and sales/use tax revenues generated during construction could be used to fund additional law enforcement officers and firefighters. Communication would be maintained with local and regional nongovernmental organizations, including Department of Community and Economic Development, to disseminate project information in a timely manner. This would allow these organizations to be given the opportunity to plan accordingly.	Population increase in Miami-Dade County 5139. Number estimated to settle in Homestead-Florida City area 2199.
	Increased traffic in roads due to construction personnel and deliveries of borrow fill and materials.	Improvements would be made to local access roads, including existing road widening and the addition of turn lanes.	Additional vehicles would travel to Units 6 & 7 and result in moderate impacts to traffic once the new access road and other road improvements are available.
	Using public water supply for construction activities.	None	Peak construction activities would require an estimated 565 gpm of potable water from the Miami-Dade County.

Table 10.1-1 (Sheet 6 of 6)
Construction-Related Unavoidable Adverse Environmental Impacts

Category	Adverse Impact	Actions to Mitigate Impacts	Unavoidable Adverse Environmental Impact
Radiological	Potential radiation exposure to Units 6 & 7 construction workers as a result of the operation of Units 3 & 4 and from Unit 6 after it becomes operational.	None	Potential radiation exposure from operating units.
Atmospheric and Meteorological	Temporary and localized noise, fugitive dust, and exhaust emissions during construction.	Measures to reduce noise and vibration levels during construction may include staggering work activities, and use of noise dampeners and noise control equipment on vehicles and equipment. Develop and implement a dust-control plan, or similar planning document to minimize dust.	Temporary and localized noise, fugitive dust, and exhaust emissions during construction.
Environmental Justice	No disproportionately high or adverse impacts to minority or low-income populations were identified.	None	None

Table 10.1-2 (Sheet 1 of 4)
Operations-Related Unavoidable Adverse Environmental Impacts

Category	Adverse Impact	Actions to Mitigate Impacts	Unavoidable Adverse Environmental Impact
Land Use	Land use would be permanently dedicated to Units 6 & 7 and associated facilities until decommissioning.	None	Land dedicated to Units 6 & 7 and associated facilities.
	Land use for transmission lines and access roads would be dedicated to these uses, precluding the land from being developed as residential, industrial, or certain agricultural properties.	None	Land dedicated to transmission infrastructure that is not currently in FPL-owned rights-of-way.
	Deposits of low concentrations of salt from operation of the cooling towers.	None	Salt deposits would occur at the southern end of the plant area. Salt deposits of 10 kg/ha/month are generally confined to the plant property and in the cooling canals of the industrial wastewater facility, with the exception of the eastern and southeastern perimeters of the plant property.
	Generation of nonradiological and low-level radioactive waste that would require disposal in offsite permitted facilities.	Implement waste minimization plan.	Landfill space would be used for disposal of radioactive and nonradioactive wastes from Units 6 & 7 and not available for disposal of other wastes.
	Generation of spent fuel requiring disposal in a DOE facility licensed by NRC.	None	Disposal facility capacity would be used by disposal of spent fuel.
	Permanent commitment of land per year for each AP1000 due to the operations and processes associated with provision, utilization, and ultimate disposal of fuel.	None	Permanent commitment of 34 acres of land per year for fuel cycle operations and processes that would support Units 6 & 7.
Hydrological and Water Use	As a second 100 percent source of makeup water for the cooling system, water would be withdrawn from a saltwater aquifer beneath Biscayne Bay via radial collector wells.	Compliance with permit requirements.	Maximum of 86,400 gpm would be withdrawn when this source of makeup water is needed.
	Operation of the radial collector wells could impact the Biscayne aquifer and surface water (Biscayne Bay and the cooling canals).	Compliance with permit requirements as applicable and monitoring of local groundwater and surface water.	None
	Public potable water would be supplied to the site by Miami-Dade County for the operation of Units 6 & 7, except for use as cooling water.	None	Public water in the amount of 936 gpm (1.35 mgd) to 2553 gpm (3.68 mgd) would be supplied.
	Operation of the deep injection wells could impact the upper Floridan aquifer	Compliance with UIC permit requirements including monitoring at the plant area to ensure proper operation of the injections wells	None

Table 10.1-2 (Sheet 2 of 4)
Operations-Related Unavoidable Adverse Environmental Impacts

Category	Adverse Impact	Actions to Mitigate Impacts	Unavoidable Adverse Environmental Impact
Hydrological and Water Use (cont.)	Some maintenance activities could involve earth moving and dewatering and could lead to temporary hydrological alterations and impacts to surface water and/or groundwater quality on the plant property and offsite areas.	Soil retention and erosion control measures such as silt barriers would be used to reduce impacts in accordance with an SWPPP developed for Units 6 & 7 and/or offsite facilities. Water from the dewatering process would be routed to the cooling canals of the industrial wastewater facility (if onsite) or handled by environmental best management practices and any applicable permits.	None
	Any contaminants (e.g., diesel fuel, hydraulic fluid, antifreeze, lubricants, or other pollutant) spilled during operations, and not contained or remediated, could affect the groundwater and surface water quality.	Operational activities would be performed under an SWPPP and a spill prevention plan. Any minor spills of diesel fuel, hydraulic fluid, lubricants, or other construction-related pollutants during operations Units 6 & 7 would be cleaned up quickly.	None
	Water consumption and discharges during fuel cycle activities.	None	Annual water use would be 2.95E10 gallons for both units.
Terrestrial Ecological	Salt deposits from operation of the cooling towers would not impact salinity levels of the cooling canals of the industrial wastewater facility significantly, which are critical habitat for the threatened American crocodile.	Continue FPL crocodile program that mitigates the impacts to American crocodile hatchlings from the existing elevated salinity levels.	None
	Potential impacts to wildlife from noise from the Units 6 & 7 cooling towers. Noise from cooling towers at greater than 200 feet would be less than the level known to startle or frighten some birds and small mammals.	None	None
	Maintenance activities would be conducted in transmission corridors and the reclaimed water pipelines rights-of-way potentially impacting soils and wetlands.	Environmental best management practices would be implemented to reduce soil erosion and sedimentation. FPL has right-of-way vegetation management programs and procedures intended to minimize impacts. The same procedure establishes strict guidelines for use of herbicides, application according to federal, state, and local regulations.	None

Table 10.1-2 (Sheet 3 of 4)
Operations-Related Unavoidable Adverse Environmental Impacts

Category	Adverse Impact	Actions to Mitigate Impacts	Unavoidable Adverse Environmental Impact
Aquatic Ecological	Salt deposits from operation of the cooling towers would not impact salinity levels of the cooling canals of the industrial wastewater facility significantly.	None	None
	Maintenance activities would be conducted in transmission and the reclaimed and potable water pipelines corridors potentially at or near water bodies, wetlands, and the South Florida Water Management District (SFWMD) canals and could potentially impact water quality.	Vegetation management in forested wetlands will be in compliance with Florida Statute 403.814 General permits. Mangrove areas will be maintained below 14 feet. Herbicides approved for the site by federal and state rules will be used on exotic and incompatible species. Care will be taken to retain a cover of compatible species. Vegetation fuel loads will periodically be evaluated and mitigated to protect the reliability of the lines and surrounding private property. The same procedure establishes strict guidelines for use of herbicides, application according to federal, state, and local regulations.	None
Socioeconomics	Potential impact to members of the public from noise emitted by Units 6 & 7 cooling towers.	None	Noise levels beyond 400 feet from the cooling towers are estimated to be <65 decibels adjusted (dBA), a level characterized by NRC in NUREG-1555 as of small significance.
	New transmission lines may induce shock in objects beneath or near lines, could emit corona-induced noise at very low or inaudible levels, and would have visual impacts.	Build new transmission lines to the National Electrical Safety Code to limit shock from induced currents. Other impacts have no mitigation.	None
	Potential for occupational injuries and illnesses.	Implement existing Units 3 & 4 industrial safety program at Units 6 & 7.	None
	Increased population and subsequent increased demand for public water, wastewater treatment, police and fire services, medical services, and increase in student population.	Increased property, sales/use, and corporate tax revenues could be used to fund additional law enforcement officers and firefighters.	Population increase in Miami-Dade County 1310. Number estimated to settle in Homestead-Florida City area 559.
	Increased traffic on local roads used to access Turkey Point.	Road improvements would be developed for the construction traffic and these or a portion of these may remain in service during operations.	Traffic would increase due to additional operations and outage workers.
	Additional structures would be within the viewscape.	None	Additional structures would be within the viewscape.

Table 10.1-2 (Sheet 4 of 4)
Operations-Related Unavoidable Adverse Environmental Impacts

Category	Adverse Impact	Actions to Mitigate Impacts	Unavoidable Adverse Environmental Impact
Radiological	Potential health impacts to members of the public from exposure to radiological releases.	Conduct radiological monitoring program as required. Conduct meteorological monitoring.	Modeling using the design and operational parameters of Units 6 & 7 results in estimated doses to the public that are within the design objectives of 10 CFR Part 50 Appendix I and within regulatory limits of 40 CFR Part 190.
	Potential doses to biota from gaseous effluents would be less than the 100 millirad/day.	Conduct radiological monitoring program as required.	Potential doses to biota from Units 6 & 7 would be well within the 100 millirad/day guideline from the International Atomic Energy Agency.
	Potential health impacts to workers from radiation exposure.	Conduct radiological monitoring program as required.	Maximum annual occupational dose to operations workers of 67 person-rem per unit.
Atmospheric and Meteorological	Plumes from Units 6 & 7 cooling towers.	None	Plumes would remain primarily on site and minimal ground-level fogging and no icing was predicted.
	Air emissions due to intermittent operation of auxiliary systems such as emergency diesel generators.	Comply with state of Florida permit limits and regulations for operating air emission sources.	Small quantities of pollutants emitted during intermittent operation of auxiliary systems.
	Relatively small quantities of air pollutants would result from the uranium fuel cycle.	None	Potential impacts to air and water quality from uranium fuel cycle. Gaseous effluents would be less than 0.08 percent of all 2005 U.S. sulfur dioxide emissions and less than 0.02 percent of all 2006 U.S. nitrogen oxide emissions.
Environmental Justice	There would be no disproportionately high and adverse impacts to minority or low-income populations within 50 miles of the proposed site via soil, water, or air pathways that would affect the health and environment of populations.	None	None
	There would be no disproportionately high and adverse impacts to minority or low-income populations from operations-related activities with the exception of transportation.	None	Increased traffic could lead to impacts along the commuting routes.

10.2 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

This section describes the predicted irreversible and irretrievable environmental resource commitments that would result from construction and operation of Units 6 & 7. The term *irreversible commitments* of resources describes environmental resources that would be potentially changed by the construction or operation of Units 6 & 7 and that could not be restored at some later time to the condition present before construction or operation. Irretrievable commitments of resources are generally materials that would be used for Units 6 & 7 in such a way that they could not, by practical means, be recycled or restored for other uses.

10.2.1 IRREVERSIBLE COMMITMENTS OF RESOURCES

In addition to the materials used for the nuclear fuel, irreversible commitments of environmental resources associated with Units 6 & 7 are described in Subsections 10.2.1.1 through 10.2.1.7.

10.2.1.1 Land Use

Land designated for spent nuclear fuel storage and radioactive and nonradioactive waste disposal would be committed to those uses and could not be used for other purposes. When Units 6 & 7 cease operations and the plant is decommissioned in accordance with NRC requirements, the land that supports the power plant facilities could be returned to support other industrial or non-industrial uses. If the need for the transmission lines, substations, and access roads cease, the land occupied by these facilities could also be returned to support other industrial or non-industrial uses. Below grade structures such as the reclaimed water and potable water pipelines have little to no impact on land use. The FPL-owned fill source would become a water management area and hence serve as a beneficial long-term resource.

10.2.1.2 Hydrological and Water Use

Site preparation activities (e.g., excavation and filling, dewatering, land surface modifications) would pose hydrologic alterations; however, these impacts would be temporary and SMALL. All of the cooling water (reclaimed and saltwater) would be consumed either through cooling tower drift, evaporation, system blowdown, or disposal via deep injection wells. Additionally, potable water would be consumed during the construction and operation of Units 6 & 7. Because the use of these resources is entirely consumptive, they would not be available for other uses. The impact to the resource would be SMALL for the operational life of the plant, and impacts would cease when operations cease.

It is expected that normal releases of contaminants into the environment from Units 6 & 7 will have negligible effects on surface and groundwater uses and will be in compliance with an Underground Injection Control (UIC) permit issued by the Florida Department of Environmental Protection (FDEP). Sections 3.6 and 5.5 discuss the FDEP requirements for a UIC permit. This permit will ensure that discharges are controlled from systems such as discharge lines, sewage treatment facilities, radwaste treatment systems, water treatment waste systems, and facility service water. The effect on water quality due to the operation of the Units 6 & 7 will be monitored to ensure compliance with the issued UIC permit for construction and operation.

10.2.1.3 Aquatic and Terrestrial Biota

Land preparation activities would include the removal of present ground surface materials and the import of fill material to elevate the Turkey Point plant area ground level above the current elevation. Land preparation and construction activities would displace some wildlife, and would temporarily and adversely affect the abundance and distribution of local flora and fauna at several locations on the Turkey Point plant property. Permanent replacement of mangrove habitats and aquatic habitats at several filled-in canals would occur. Adverse impacts to the American crocodile are not anticipated at the Turkey Point plant property since the mitigation programs already in place would continue.

Similar impacts would occur on the new transmission corridors, access roads, water supply pipeline corridors, and FPL-owned fill source. When construction is complete, flora and fauna would recover in areas that are not directly adjacent to or part of operations.

Impacts to aquatic and terrestrial Biota would be SMALL, with the exceptions as previously described.

10.2.1.4 Socioeconomic

Because five power generation units exist on the Turkey Point plant property, construction of Units 6 & 7 would pose only a slight alteration of the regional viewscape. The change in viewscape could be restored after plant operations cease and the facilities are decommissioned. The construction and operation of Units 6 & 7 would also create short-term and long-term changes in the population, the nature and character of the local community, and the local socioeconomic structure. Indirect or secondary growth and associated changes in the character of the socioeconomic structure would also occur. Some of the impacts on infrastructure and services are mitigated through property and worker taxes and payments made in lieu of taxes. Other changes such as noise and traffic congestion would only be partially mitigated.

10.2.1.5 Releases to Air and Surface Water

Vehicle and construction equipment operation would release GHGs and other air pollutants to the air from land preparation and other construction activities. Surface water runoff could increase sedimentation to local surface waters. These impacts would be localized and temporary. Operations would also produce low-quantity emissions (e.g., diesel generator exhaust and vehicle exhaust would release GHG emissions and other air pollutants). Very small quantities of low-concentration radioactive gases and particulates would also be released to the air and surface water.

Water vapor from mechanical draft cooling towers would be the main constituent of emissions during operation. Under some weather conditions, water vapor from these towers could form a visible plume that would vary in size and opacity. The frequency of the occurrence and length of these visible plumes would generally be greatest in the winter months when the ambient air temperatures are cooler.

The release of treated hazardous and radioactive effluents would represent a SMALL adverse impact on water quality. The release of hazardous and radioactive air emissions would represent a SMALL adverse impact on air quality. Hazardous and radioactive air and water constituents would be monitored at their release points. All releases from Units 6 & 7 would comply with issued permits and are not expected to measurably affect the air and surface water resources

10.2.1.6 Disposal of Hazardous and Radioactively Contaminated Waste

Units 6 & 7 would generate radioactive, hazardous, and non-hazardous waste. Each waste type will require proper storage, on-site management, and disposal or treatment in accordance with applicable permits and regulations. Radioactive waste will be disposed in radioactive landfills in accordance with regulations governing radioactive waste. Final disposition of hazardous waste will be managed in accordance with the permit and regulatory requirements governing permitted hazardous waste treatment, storage, and disposal facilities. Non-hazardous waste will be beneficially used, recycled, or disposed of in accordance with applicable permits and regulations governing non-hazardous waste. Universal wastes generated by the facility may be recycled with an authorized universal waste handler in lieu of land disposal in a FDEP-permitted industrial landfill. Used oil may be recycled via permitted used-oil handlers. Land committed to the disposal of radioactive and hazardous waste is an irreversible impact because it is committed to that use and can be used for few other purposes.

10.2.1.7 Uranium Fuel Cycle

The uranium fuel cycle involves several stages, and each stage poses environmental impacts. At the uranium mine, uranium ore is extracted from the ground and typically milled. The product is then prepared into uranium hexafluoride and processed for isotopic enrichment. The enriched uranium product is then fabricated into fuel and loaded into a nuclear power plant. When the fuel is spent, it is removed from the reactor and stored on site. Each stage of the uranium fuel cycle generates various forms of low-level and high-level waste.

10.2.2 IRRETRIEVABLE COMMITMENTS OF RESOURCES

As shown in Table 10.2-1, large quantities of metals, concrete and other construction materials would be required to construct Units 6 & 7. Asbestos and other materials considered hazardous would generally not be used, or would be used in limited quantities and in accordance with safety regulations and practices. Some of the construction materials would ultimately become contaminated or irradiated over the life of power plant operations. Based on current technology, these materials could not be reused or recycled. Instead, these materials would, therefore, require isolation from the biosphere for hundreds or thousands of years, and would represent an irretrievable commitment of resources.

Although the total quantity of construction materials is large, use of such quantities in large-scale construction projects such as nuclear reactors, hydroelectric and coal-fired plants, and many large industrial facilities (e.g., refineries and manufacturing plants) represents a relatively small incremental increase in the overall use of such materials. Even if these materials are eventually routed for disposal, the impact would be SMALL with respect to the national or global consumption of these materials.

The primary resources that are irreversibly and irretrievably committed by operations would be the uranium used in fuel and the energy required to create the fuel. The estimated consumption of enriched uranium for Units 6 & 7 is 25.35 tons per year. The World Nuclear Association studies supply and demand of uranium and states that an 80-year supply of uranium is available based on known deposits and current usage. Exploration for uranium deposits has increased in recent years and it is expected to continue and lead to greater supplies as the demand increases (World Nuclear Association 2008). Therefore, the uranium that would be used to generate power by Units 6 & 7, although irretrievable, would have a SMALL impact with respect to the long-term availability of uranium worldwide.

Other irretrievable commitments of resources include materials used for the normal industrial operations of the plant that cannot be recovered or recycled or that are consumed or reduced to unrecoverable forms, such as elemental materials that would become radioactive.

Section 10.2 References

World Nuclear Association 2008. *Supply of Uranium*. Available at http://www.world-nuclear.org/info/inf75.html, accessed February 16, 2009.

Table 10.2-1
Material Quantities Required for Construction of Units 6 & 7

Materials	Quantity Required
Concrete	154,400 cubic yards
Rebar	20,000 tons
Structural steel	12,800 tons
Power cable	1,620,000 linear feet
Small bore pipe (less than 3-inch diameter)	460,000 linear feet
Large bore pipe (3-inch diameter or larger)	136,000 linear feet
Aluminum, boron, titanium, tungsten, and other natural resources	Small quantities

10.3 RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY OF THE HUMAN ENVIRONMENT

This environmental report has focused on the analyses and conclusions associated with the environmental and socioeconomic impacts from activities during the construction and operation of Units 6 & 7. These activities are considered to be short-term uses for purpose of this section. In this section, the long-term is considered to begin at the moment Units 6 & 7 have been decommissioned.

This section includes an evaluation of the extent to which the short-term uses preclude any options for future use of the Units 6 & 7 plant area and associated facilities. Construction and operation of an independent spent fuel storage installation (ISFSI) are not part of the proposed action and are therefore not discussed in this section. The ISFSI is described in Sections 4.7 and 5.11.

10.3.1 CONSTRUCTION OF UNITS 6 AND 7 AND LONG-TERM PRODUCTIVITY

Subsection 10.1.1 summarizes the potential unavoidable adverse environmental impacts of construction of Units 6 & 7 and the mitigative measures proposed to reduce those impacts. Some adverse environmental impacts would remain after all practical measures to avoid or mitigate the impacts have been applied. However, none of these impacts represent a long-term effect that would preclude any options for future use of land associated with Units 6 & 7. The acreage disturbed by construction activities would be larger than that required for the actual structures, associated facilities, and offsite facilities (e.g. FPL-owned fill source, transmission lines, access roads, reclaimed and potable water pipelines) because of the need for such facilities as construction laydown, support areas, and parking areas for the construction workforce. Clearing this acreage, in addition to the noise of the construction, would displace some wildlife and remove vegetation. Once the construction activities are completed, some disturbed areas could be restored. It is expected that wildlife would then return to the restored areas.

Noise generated by some construction activities would increase the ambient noise levels in the vicinity of the plant property. However, upon completion of these activities, the ambient levels would return to the levels comparable to the preconstruction ambient noise levels. The workforce would be protected by adherence to the 29 CFR 1910.95 requirements for occupational noise exposure. There would be no effects on the long-term productivity of Units 6 & 7 as a result of these impacts

Increased traffic volume as a result of construction personnel and material deliveries would increase congestion and traffic delays on local roadways. Additional traffic associated with plant operations would also contribute to congestion and traffic delays on local roadways, but at a lower level than construction.

Construction of Units 6 & 7 would be beneficial to the local area through the generation of new construction-related jobs, local purchases by the construction workforce, and payment of taxes to the area. Some socioeconomic impacts that occur as a result of increased population due to construction would cease once construction is complete and the workforce leaves the area. However, some changes incurred because of increased tax revenues would persist into the foreseeable future. In those cases, construction would have some positive impact on the long-term economic productivity of the area. Construction would not affect long-term productivity of the environment.

10.3.2 OPERATION OF UNITS 6 & 7 AND LONG-TERM PRODUCTIVITY

Subsection 10.1.2 summarizes the potential unavoidable adverse environmental impacts of operation of Units 6 & 7 and the measures proposed to reduce or eliminate those impacts. Some adverse environmental impacts could remain after all practical measures to avoid or mitigate them have been applied. However, none of these impacts would pose long-term effects that would preclude any options for future use of the Turkey Point plant property.

The Turkey Point plant property currently supports five large power generation facilities—two oil/gas-fired units, one combined-cycle unit, and two nuclear units. Therefore, operation of Units 6 & 7 would represent a continuation of the current and planned use of the land. However, once Units 6 & 7 cease to operate and the plant is decommissioned to NRC standards, the land would be available for other industrial or non-industrial uses.

Units 6 & 7 would require large volumes of water for heat rejection. This requirement would be satisfied by a combination of reclaimed water delivered from Miami-Dade County and saltwater withdrawn from radial collector wells under Biscayne Bay. All of this water would be consumed through cooling tower drift, evaporation, system blowdown, or disposal via deep injection wells. Additionally, potable water would be consumed during the construction and operation of Units 6 & 7. Because the use of these resources are entirely consumptive, they would not be available for other uses, and would therefore impact the availability of water for other uses. After Units 6 & 7 cease to operate and the plant is decommissioned, water withdrawals for Units 6 & 7 would cease.

The operation of Units 6 & 7 would slightly increase annual air emissions because of emergency diesel generators. These generators would be operated infrequently and usually for short duration. This equipment would be operated in accordance with applicable federal, state, and local regulations, and would not create any measurable impacts on regional air quality. In addition, as described in Subsection 5.3.3, precipitation and atmospheric dispersion would limit the accumulation of salt in the soil near the cooling towers. In addition, the salt deposition analysis has determined that salt deposit levels attributable to salt drift from the cooling towers would remain below levels at which ecological impacts might occur, and would therefore pose no long-term ecological impacts. No future issues for the long-term uses of the site would result from the impacts of increased air emissions or salt deposits. Once the plant ceases to operate and is decommissioned, impacts to the air quality would cease.

The operation of the deep injection wells installed on Turkey Point plant property for effluent disposal and wastewater disposal into the Boulder Zone could potentially impact groundwater within the Boulder Zone over the life of the plant but would not impact the Biscayne aquifer. Well systems would be installed to monitor the impacts attributable to operation of the deep injection wells and the radial collector wells. Once the plant ceases to operate and is decommissioned, impacts to groundwater and surface waters would cease.

Impacts as a result of radiological emissions would be SMALL because the Units 6 & 7 would be operated in accordance with state and federal regulations and a program would be implemented to monitor radiological emissions and their impact of land, flora, fauna, and air. Data would be analyzed against previous results to identify concerns. Once the plant ceases to operate and is decommissioned, radiological releases would cease. No future issues associated with the radiological emissions from operation Units 6 & 7 would affect the long-term uses of the Turkey Point plant property.

Some socioeconomic changes associated with the operation of the plant would likely continue after the plant is decommissioned. Property taxes paid by FPL to Miami-Dade County would provide revenues to the county for the foreseeable future to sustain services that support the Miami-Dade County population.

Taxes paid by FPL to Miami-Dade County would have a long-term effect on the productivity of the county. Workers that establish residence in Miami-Dade County would not only spend a portion of their income in the county, but would also pay property, sales, and use taxes. Long-term tax revenues would depend on the number of operations personnel that remain in Miami-Dade County and their ability to obtain employment at the same pay level they received as plant operations employees. The economic impacts to Miami-Dade County from Units 6 & 7 would be considered a benefit.

10.3.3 SUMMARY OF RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

The impacts attributable to construction and operation of Units 6 & 7 would result in some adverse short-term impacts. The principal short-term benefit is the production of electrical energy. The economic benefit of Units 6 & 7 and the associated workforce is large compared with the economic benefit from other potential uses for the site. The economic benefit is expected to be the type that would continue even after Units 6 & 7 are decommissioned, such as the continuation of commercial establishments that arose as a result of Units 6 & 7 service of power production, the presence of retired and former workforce in the area, and the presence of a well-trained and educated workforce for the benefit of subsequent employers. Because the plant would eventually be decommissioned and restored, there would be no impacts to long-term productivity of the site.

10.4 BENEFIT–COST BALANCE

This section provides the benefit-cost analysis for construction and operation of Units 6 & 7 on the Turkey Point plant property. Subsection 10.4.1 describes the benefits of constructing and operating new nuclear units. Subsection 10.4.2 describes costs of constructing and operating the units.Subsection 10.4.3 provides a high-level summary of the benefits and costs addressed in Subsections 10.4.1 and 10.4.2.

10.4.1 BENEFITS

10.4.1.1 Need for Power

As described in Chapter 8, FPL submitted its Petition to Determine Need for Units 6 & 7 Electrical Power Plant (FPL Oct 2007c) to the Florida Public Service Commission (FPSC) in October 2007. The FPSC granted FPL's petition by a final order in April 2008. The factors for consideration by the FPSC included: (1) the need for electric system reliability and integrity, (2) the need for fuel diversity and supply reliability, (3) the need for baseload generating capacity, (4) the need for adequate electricity at a reasonable cost, and (5) whether the proposed plant is the most cost-effective alternative available. The FPSC also annually reviews FPL's resource planning process, which is described in detail in FPL's annual Ten Year Power Plant Site Plan. The most current version was filed in April 2010 (FPL Apr 2010).

The Final Order Granting Petition for Determination of Need for Proposed Nuclear Power Plants includes the following:

- Florida has a well-defined, systematic, and comprehensive resource planning program that adequately reviews resources and growing demand for additional base load, eliminating the need for additional NRC review.

- FPL has the need for 8350 MW of additional capacity for the period 2011–2020 to meet its reserve margin criteria.

- The FPSC, statutorily charged by the state of Florida with determining whether Units 6 & 7 would be necessary, has reviewed the pertinent information and has determined a need for the proposed units. Further, the Florida Reliability Coordinating Council process for gathering need-for-power data provides further satisfaction of NRC criteria at the regional level.

- The integrated resource planning process gives NRC the assurance that the need for power is real and that the benefits of satisfying that need would be realized.

- The benefits to be derived from the addition of Units 6 & 7 include fuel savings, emissions avoidance, enhanced fuel diversity, and improved system reliability.

Also, a summary of the 2010 Ten Year Power Plant Site Plan and integrated resource plan indicates that FPL's need for power is further based on the following (FPL Apr 2010):

- Within FPL's service territory, the projected load growth for the summer peak is projected to increase to 25,785 MW by 2019 with an increase of 3434 MW over the 2009 actual summer peak.
- There are no other additional new generating units proposed that meet capacity needs in the 2015 through 2019 time period.
- FPL's resource plan reflects concern for maintaining and enhancing fuel diversity in the FPL system and maintaining a balance between load and generating capacity in Southeastern Florida. FPL recognizes that the addition of new nuclear units will result in significant system fuel savings, system emission savings (including CO_2), and gains in system fuel diversity. FPL has addressed the revised in-service dates for Turkey Point Units 6 & 7 for planning purposes in the May 3, 2010 nuclear cost recovery filing with the FPSC (FPL May 2010a).

10.4.1.2 Fuel Diversity

Fuel diversity is the key to affordable and reliable electricity. A diverse fuel mix protects electric companies and consumers from contingencies such as fuel unavailability, price fluctuations, and changes in regulatory practices (EEI Mar 2003). History teaches that it is risky to develop an over-reliance on any one energy source. Industry experience over the past 30 years has demonstrated that a balanced energy portfolio is the key to providing America with a growing supply of affordable electricity (NRRI Mar 2005).

An electric system that relies on one or two fuels to generate a significant portion of the electricity needed to meet its customers' demand, all else being equal, is less reliable than a system that uses a more balanced, fuel-diverse generation portfolio (FPL Oct 2007a). An over-reliance on a single fuel source is a potential vulnerability to the long-term security of the nation's energy supply (USDOE 2008).

The Florida legislature, as part of the 2006 Florida Energy Act, amended Florida statutes to explicitly require the FPSC to consider the need for fuel diversity when making its determination of need for new electricity generating capacity (FPL Oct 2007b). At the same time, the legislature directed the commission to establish alternative mechanisms for recovering nuclear power plant costs (FPL Oct 2007c), a change that helps ensure availability of nuclear power as an option in maintaining fuel diversity in Florida.

There are only a few technologies suited to providing baseload capacity in Florida today and in the foreseeable future: nuclear, gas-fired combined-cycle, and advanced, clean coal technology such as supercritical pulverized coal or integrated gasification combined-cycle (IGCC).

The FPSC denied FPL's request to construct advanced clean coal units. This action further limits the number of available technologies. In addition, IGCC continues to present many unanswered questions about its commercial viability and operational reliability. FPL today depends upon natural gas for most of its energy needs. This dependence is expected to grow to 70 percent by 2024 if FPL does not build Units 6 & 7 and, instead, adds an equivalent capacity of combined-cycle generation.

In summary, fuel diversity is recognized nationally and within Florida as critical to attaining a reliable electrical system. Nuclear power is the key to maintaining fuel diversity. The construction and operation of Units 6 & 7 would provide the benefit of fuel diversity to FPL and the state.

10.4.1.3 Avoided Emissions

Nuclear power generation results in significant local and national air quality benefits. Power plants that use natural gas and coal for electrical generation produce air emissions (e.g., nitrogen oxides, sulfur dioxide, and carbon dioxide). Of increasing concern is carbon dioxide due to its contribution as a greenhouse gas.

It is reasonably anticipated by most electric industry observers and others that there will be some form of greenhouse gas regulation. Whether it is federal, regional, or state, it is anticipated that such regulation will include requirements for significant greenhouse gas reductions within the timeframe that FPL must plan for additional capacity. The Florida governor, by executive order, has established aggressive greenhouse gas reduction targets (FPL Oct 2007d):

By 2017: Reduce greenhouse gas emissions to 2000 levels

By 2025: Reduce greenhouse emissions to 1990 levels

By 2050: Reduce greenhouse emissions to 80 percent of 1990 levels

Nuclear generation is generally considered a "non-emitting" technology because nuclear units emit no greenhouse gas as they operate to produce electricity (FPL Oct 2007e). Subsection 9.2.3.1 indicates that a coal-fired alternative to Units 6 & 7 would emit approximately 14 million tons of carbon dioxide per year and Subsection 9.2.3.2 indicates that the gas-fired alternative would emit approximately 6 million tons per year. In other words, a substantial benefit of Units 6 & 7, if constructed, is the avoidance of 6 to 14 million tons of greenhouse gas emission per year. However, there is no plausible scenario in which the state's greenhouse gas targets could be achieved in a cost-effective manner without new nuclear resources (FPL Oct 2007d).

10.4.1.4 Advantage of Nuclear Power

Concerns about greenhouse gases and global climate change make it reasonable to expect that, eventually, the United States may have to strictly curb emissions from fossil-fuel electric generation plants, conceivably to the point of displacing coal- and gas-fired electricity generation. (If environmental policies restrict carbon emissions in the future, the cost of building and operating fossil-fired plants could increase by 50 to 100 percent.) Nuclear power is the only technology currently available that is a viable alternative to fossil-fired plants for baseload generation. The long lead time required to bring a new nuclear power plant online to displace fossil fuel power is one of the reasons for national concern with maintaining a nuclear energy capability (UC Aug 2004).

10.4.1.5 Tax Payments

As described in Subsection 4.4.2.2, construction and operation-related activities would generate sales tax revenue. Corporate income taxes are a second source of revenue for the state, while property taxes are primarily paid to Miami-Dade County.

During the 123-month construction period, workers and their families would spend part of their income in the region on taxable items from restaurants, hotels, and retail shops, contributing to tax revenue. Increased sales and use tax could result from the purchase of taxable materials and services to construct Units 6 & 7. Sales and use tax collections from the construction and operation of Units 6 & 7 would contribute less than 1 percent to Florida sales tax revenue. Some of this revenue would be returned to the counties to help fund local services.

FPL would pay increased corporate income taxes to the state of Florida once Units 6 & 7 generate additional income by producing power. However, to the extent that FPL purchases goods and services in the state during the construction phase, this contributes to the earnings of other corporations. Similarly, the purchases made by the construction workforce and other households whose jobs are indirectly related to the construction activity would contribute toward corporate income. The Florida sales tax revenue collected from the construction of Units 6 & 7 would generate an estimated $175.1–$255.5 million to the state. Also the Miami-Dade County sales tax revenue collected during construction would generate an estimated $29.2–$42.6 million for the county.

As addressed in Subsection 5.8.2, several sources of tax revenue and public expenditure are related to the operation of Units 6 & 7. These include sales taxes, property taxes, and corporate income taxes. Sales taxes would be levied on materials purchased during operation of Units 6 & 7 as well as on goods and services purchased by workers. Sales taxes on such purchases would be a beneficial impact to the local economy. Similarly, there may be direct and indirect beneficial economic impacts from sales tax revenue generated from goods and services purchased by workers who do not currently work in the region.

FPL would pay corporate income taxes on its increased net state income. However, as described in Subsection 4.4.2.2.2.1, any tax increase attributable to the increased income of Units 6 & 7 would be paid at the consolidated entity level. The Turkey Point property tax revenue would be generated from real property and tangible personal property of FPL.

10.4.1.6 Local and State Economy

In all, construction and operations workers during Units 6 & 7 construction period would earn a total of more than $709.3 million over the 123-month construction period. Depending on the proportion of wages spent, the creation of Units 6 & 7 jobs would inject approximately $1.3 billion into the economy during the life of the construction project. In addition, the injection of new income would create jobs in the economy and create business opportunities for housing and service-related industries. The construction of Units 6 & 7 would contribute positively to the regional economy through purchases of capital and materials that are produced in the region.

As described in Subsection 5.8.2, the operation workforce for Units 6 & 7 would consist of 806 employees, with an estimated 50 percent of the workers migrating into Miami-Dade County to support the operation of Units 6 & 7. FPL anticipates that 172 (43 percent of the 50 percent in-migrant workers) would migrate to the Homestead and Florida City area. The remaining 50 percent of the workers would be expected to be current residents in the area. In addition, in-migration of 403 workers would create additional indirect jobs in the region because of the multiplier effect. FPL estimates that the influx of 403 workers would create approximately 874 indirect jobs in Miami-Dade County for a total of 1277 new jobs.

Construction and operation workers are expected to live and spend most of their salaries within the local area and surrounding region. In addition, these workers are likely to spend some portion of their salaries in the local area for gasoline, beverages, food, and incidental items. Because construction workers would be at this location for some time, there would be a multiplier effect where money is spent and re-spent in the local area and later in the region. By patronizing local retail and service sector businesses, construction workers may temporarily increase sales. The economic multiplier effect is one way of measuring secondary effects and means that every dollar earned by in-migrant construction and operation worker results in the creation of an additional 1.5902 dollars in the regional economy.

10.4.1.7 Other Benefits

Section 10.3 describes the relationship between short-term uses and long-term productivity of the human environment. Additional benefits not described in Section 10.3 include:

- Reduced dependence on foreign energy supplies.
- Reduced foreign trade deficit.
- Reduced depletion of finite fossil fuel supplies.

10.4.1.8 Benefit Summary

Table 10.4-1 is a summary of the benefits of the proposed action. In Subsection 9.3.3, FPL evaluated environmental impacts of construction and operation of the proposed project at four alternative sites (Glades, Martin, Okeechobee 2, and St. Lucie). Table 10.4-1 also provides a comparison of the costs of construction and operation of the project as opposed to those at the four alternative sites.

10.4.2 COSTS

10.4.2.1 Internal Costs — Proposed Action

10.4.2.1.1 Introduction

Construction costs and operation costs are generally described using established cost information developed by several resources. There are many cost studies available in the literature with a wide range of cost estimates. While the Final Order Granting Petition for Determination of Need for Proposed Nuclear Power Plants confirms that the proposed action is the preferred alternative in nearly all future fuel cost and environmental compliance cost scenarios, the following is a sampling of studies that examines these costs:

- New Nuclear Power Plant Licensing Demonstration Project ABWR Cost/Schedule/COL Project at TVA's Bellefonte Site, Tennessee Valley Authority (TVA) (TVA Aug 2005)
- Nuclear Power's Role in Generating Electricity, Congressional Budget Office (CBO May 2008)
- Study of Projected Electricity Generating Costs, Organization for Economic Co-operation and Development, Nuclear Energy Agency (NEA) (NEA 2005)
- The Economic Future of Nuclear Power, University of Chicago (UC) (UC Aug 2004)
- The Future of Nuclear Power, an Interdisciplinary MIT Study, Massachusetts Institute of Technology (MIT) (MIT 2003)
- Annual Energy Outlook, Energy Information Administration (EIA) (EIA Jan 2004)

- Nuclear Power Joint Fact Finding, The Keystone Center (Keystone 2007)
- Power Plants: Characteristics and Costs, Congressional Research Service (CRS 2008)

The CBO, Chicago, MIT, and NEA studies are based on costs for plants recently constructed overseas and use input from the EIA. The TVA study was a bottom-up estimate based on materials and labor costs. The Congressional Research Service study was based on, when available, submittals to state public service commissions.

It is frequently difficult to compare study results because of differing assumptions and analytic approaches. In addition, studies do not always identify inputs that would facilitate explanation of the reason for differing results. As the Congressional Research Service states, published information on plant costs often do not clearly distinguish which components are included in an estimate, or different analysts may use different definitions (CRS 2008). Therefore, FPL relies most heavily on the estimate of Units 6 & 7 costs that it prepared for approval by the FPSC (FPL Oct 2007f for detail; FPL Oct 2007g for summary).

Commonly used terminology to explain the different cost includes:

- **Overnight cost** — Sometimes called “overnight capital cost,” this is a convention for expressing the cost of construction as if the plant could be built overnight. The cost is expressed as an absolute dollar value or a dollar value per unit of net (exclusive onsite use) electrical generation capacity, such as dollars per kilowatt or dollars per megawatt. The cost does not include escalation or interest costs during construction or during the time between estimate and assumed start of construction. The data are useful for comparing costs of alternative nuclear technologies and becomes the basis for broader cost estimates. Variables affecting interpretation of published information include whether basis is recent construction history or materials and labor costs buildup; inclusion of owner's costs (e.g., licensing, land, site preparation, cooling system, switchyard, transmission facilities, project management, and contingencies); economies of scale due to number of units to be built at site; and dollar-year of estimate.
- **Construction cost** — Sometimes called “all-in cost,” this adds to overnight cost escalation and interest during construction and during the time between a cost estimate and the start of construction. It is expressed in the same units as overnight cost and is useful for identifying total cost of construction and for determining the effects of construction delays. Variables affecting interpretation of published information include completeness of overnight cost estimate; assumptions on escalation and interest rates, debt/equity ratio, length of construction period, and contingencies; and dollar-year of estimate.

- **Levelized Cost** — Sometimes called "levelized annual cost," this is the constant real wholesale price needed to recover construction and operation costs of the plant. The cost is expressed as cent or dollar value per amount of net electrical generation over time, such as cents per kW-hour. Levelized cost has been used in the past for comparing cost-competitiveness between alternative generation technologies (e.g., nuclear versus coal). Variables affecting interpretation of published information include completeness of intermediary cost estimates (overnight and construction), choices for discount rate, construction duration, plant life span, capacity factor, cost of debt and equity and split between debt and equity financing, depreciation time, tax rates, and premium for uncertainty. Estimates include decommissioning but, because of the effect of discounting a cost that would occur as much as 40 years in the future, decommissioning costs have relatively little effect on the levelized cost.

  For various reasons, levelized cost estimates are being recognized as an inadequate analytical approach to use in comparing competing resource options. Estimate methodologies historically have been based on the premise that construction cost recovery begins upon start of commercial operation. However, some states are beginning to allow recovery of construction costs as they are incurred to reduce overall project costs (by reducing carrying charges) and to reduce ratepayer "sticker shock" once operation begins. This change also means that cost recovery is not necessarily "levelized" in the traditional sense. Finally, such changes in state practices are not always consistent between alternative generation technologies, making cross-technologies estimates using traditional levelized cost methodologies even more problematic.

The studies report cost estimates for different years, such as $1800 in 2003 dollars. In order to compare estimates from different studies, FPL escalated or discounted all estimates to 2007 dollars.

10.4.2.1.2 Overnight Cost

The general studies present a range of overnight cost estimates from $2000 to almost $6000 per kW in 2007 dollars. As with a levelized cost approach on a per kW-hour basis, a comparison of overnight cost on a per kW-basis is an inadequate approach for comparing resource options. For example, there are two limitations to applying these overnight cost figures to Units 6 & 7. First, it is not clear how completely some of the studies incorporate the cost of land. It is reasonable to conclude that construction costs for completed reactors would include owner's costs and that, therefore, EIA projections include owner's costs. The FPL study expressly includes $0 for land cost because FPL would use a site of an existing power plant. The second limitation to the overnight cost information is that it does not include the cost of transmission facilities. It is noted that, while NRC has historically considered transmission costs to be internal costs, transmission costs might be excluded from estimates for publicly owned utilities. FPL would need to incur internal cost for additional transmission lines, land within the transmission corridor, and any construction needed for substation expansion or renovation.

Total overnight cost would range from $7.9 to $11.4 billion, as shown in Table 10.4-2.

10.4.2.1.3 Construction Cost

FPL estimated the construction cost for Units 6 & 7 to range from $5823 to $8497 per kW in 2012 dollars as shown in Table 10.4-2. Total construction cost would range from $12.8 to $18.7 billion as shown in Table 10.4-2.

10.4.2.1.4 Levelized Cost

Overnight capital costs account for a third of the levelized cost, and interest costs on the overnight costs account for another 25 percent (UC Aug 2004). The general studies identified show a wide range of operation cost estimates. Levelized cost of electricity estimates range from $36 to $83 per megawatt hour (3.6 to 8.3 cents per kWh).

Due to the fundamental problems inherent in a levelized cost approach to comparing, the state of Florida and FPL did not use levelized cost in their evaluation of the need for Units 6 & 7 and an estimate has not been generated. Instead, FPL has modeled a number of economic scenarios that incorporate a range of potential fuel prices and possible environmental compliance costs, including a range of greenhouse gas emission reduction costs. As part of this analysis, a range of economic outcomes in which one fuel technology (nuclear or combined-cycle) is the cost-preferred solution relative to the other in reducing the capacity gap was identified. The results of the analysis were presented as a breakeven capital cost for each individual case.

10.4.2.2 Internal Costs — Generation Alternatives

NRC precedent has established that project cost information for alternatives is relevant only if the alternatives are environmentally preferable to the proposed action (NRC Feb 2009). As described in Section 9.2, FPL has concluded that coal- and gas-fired generation were not environmentally preferable alternatives to the proposed action. In keeping with NRC precedent, FPL has not included internal cost estimates for the generation alternatives.

10.4.2.3 External Costs

10.4.2.3.1 Land Use

Disturbance of land is one of the costs of constructing the new nuclear reactor units and appurtenant structures. Units 6 & 7 would be part of the Turkey Point plant property that is currently zoned by Miami-Dade County for permitted use for nuclear reactors. As described in Sections 4.1 and 5.1, locating the new reactors on the Turkey Point Plant Property is expected to have SMALL adverse impacts. Appropriate best environmental management practices would be implemented to minimize the potential for land use impacts including erosion and sedimentation and any unavoidable impacts to wetlands would require mitigation.

10.4.2.3.2 Hydrological and Water Use

There are costs associated with providing water for various needs during construction and operation of the new units. As described in Sections 4.2 and 4.4, construction of Units 6 & 7 is estimated to require a maximum of 565 gpm of potable water, used for such activities as dust abatement, mixing concrete, hydrotesting and flushing, and potable water used by the construction workforce. Miami-Dade County would be the source for construction water requirements.

As described in Section 3.3, water consumption during operations activities would total 2.95E10 gallons annually for both units. Cooling water makeup sources are reclaimed water and saltwater using radial collector wells. Potable water in the amount of 936 gpm (1.35 mgd) to 2553 gpm (3.68 mgd) would be supplied for non-cooling water use. Units 6 & 7 wastewater would be injected underground via permitted deep injection wells. Hydrological and water use impacts are anticipated to be SMALL.

10.4.2.3.3 Terrestrial and Aquatic Biology

Some costs associated with loss of terrestrial and aquatic populations and habitats during construction are anticipated. As described in Section 4.3, conversion of approximately 300 acres of primarily mudflat and wetland habitat would occur. However, these impacts would not significantly reduce the regional diversity of plants or plant communities due to the scarce natural conditions of the site. The potential losses from the project are not expected to be large enough to affect the long-term stability of terrestrial and aquatic resources in the area and the overall impact is anticipated to be SMALL.

10.4.2.3.4 Air Emissions

Relatively small amounts of air emissions from diesel generators and vehicles would be generated during construction and operation of the facilities. Cooling tower drift deposits salt on the plant property and adjacent areas, but the levels are not likely to result in any measurable impact on vegetation. Air emission impacts are anticipated to be SMALL.

10.4.2.3.5 Radioactive Emissions, Effluents, and Wastes

Minor radioactive air emissions are released into the atmosphere and discharged into deep injection wells. Low-level and high-level radioactive wastes are generated and need to be disposed of according to local, state, and federal permitting regulations. Overall radioactive emissions, effluents, and waste impacts are anticipated to be SMALL.

10.4.2.3.6 Socioeconomic

It is anticipated that the region affords necessary infrastructure and services to meet the demands of the construction and operation workforce. If additional infrastructure and services are needed to meet the demands of the people moving into the area to support the construction and operation of the new units, these costs would be offset by the beneficial increased tax revenues to the local economy and the overall beneficial economic input to the region from those individuals and families.

10.4.2.4 Alternative Sites

In Subsection 9.3.3, the environmental impacts of construction and operation of the proposed project at four alternative sites (Glades, Martin, Okeechobee 2, and St. Lucie) were evaluated. Table 10.4-1 identifies the unavoidable adverse environmental impacts of construction and operation of the project as proposed at the four alternative sites.

10.4.3 SUMMARY

In accordance with guidance provided in NUREG-1555, Rev. 1, (ESRP 10.4), this section summarizes the benefits and costs of the proposed construction and operation of Units 6 & 7. This table also provides information regarding selected mitigation measures for potential impacts. Costs that are environmental impacts are those anticipated after proposed mitigation measures are implemented.

The costs of mitigation are not easily determined at this time. It is anticipated that mitigation would be built into the overall design (for example, scheduling to ensure construction is completed in the shortest possible time, using construction best management practices to limit erosion, fugitive dust, runoff, spills, and air emissions, and providing first-aid stations at the construction site). Relying on early and frequent communication between FPL and the affected communities could help to minimize cost and ensure effective management of the construction and operation of Units 6 & 7.

In summary, there is a resource need in the region of influence by 2022, with that need increasing every year thereafter. Following a comprehensive review and consideration of the factors discussed earlier, the FPSC determined that Turkey Point Units 6 & 7 will provide needed system reliability, fuel diversity, baseload capacity, reasonable affordable electricity, and the most cost-effective sources of power (FPSC 2008). It has been determined that the new nuclear facility should be located at the existing plant property in Miami-Dade County, Florida. Units 6 & 7 will result in a reduction in emissions with respect to comparably sized coal- or gas-fired alternative power generating facilities.

While the additional direct and indirect creation of jobs for the construction and operation of the new facility may place a temporary burden on local services and infrastructures, the annual taxes and revenue generated by the new workers contribute to the local economy and the region's productivity.

In conclusion, the construction and operation of the proposed project is needed by the service area and the benefits outweigh the economic, environmental, and social costs.

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Table 10.4-1 (Sheet 1 of 18)
Summary of the Benefits and Costs of the Construction and Operation of Units 6 & 7

Category	Turkey Point Units 6 & 7	Glades	Martin	Okeechobee 2	St. Lucie
Project Description	Units 6 & 7 are at an existing fossil fuel and nuclear power generating facility, located in Miami-Dade County, Florida. The site is owned by FPL.	The Glades site is a greenfield site in Glades County, Florida.	The Martin site is an existing fossil fuel power generating facility in Martin County, Florida. The site is owned by FPL.	The Okeechobee 2 site is a greenfield site in Okeechobee County, Florida.	The St. Lucie site is an existing nuclear power generating facility in St. Lucie County, Florida. The site is owned by FPL.
Benefits					
Electricity Generated and Generating Capacity	Westinghouse AP1000 reactors for Units 6 & 7 have a rated total gross thermal megawatt output per unit of 3,415 MWt with a gross electrical output each of approximately 1,100 MWe.	The electricity generated and generating capacity would be similar to that of Units 6 & 7.	The electricity generated and generating capacity would be similar to that of Units 6 & 7.	The electricity generated and generating capacity would be similar to that of Units 6 & 7.	The electricity generated and generating capacity would be similar to that of Units 6 & 7.
Fuel Diversity	Nuclear generation provides an option to either a natural gas or coal baseload facility for electricity supply. Does not have price volatility of natural gas and reduces emissions. Unlike coal, fuel availability issues are limited.	Nuclear generation provides an option to either a natural gas or coal baseload facility for electricity supply. Does not have price volatility of natural gas and reduces emissions. Unlike coal, fuel availability issues are limited.	Nuclear generation provides an option to either a natural gas or coal baseload facility for electricity supply. Does not have price volatility of natural gas and reduces emissions. Unlike coal, fuel availability issues are limited.	Nuclear generation provides an option to either a natural gas or coal baseload facility for electricity supply. Does not have price volatility of natural gas and reduces emissions. Unlike coal, fuel availability issues are limited.	Nuclear generation provides an option to either a natural gas or coal baseload facility for electricity supply. Does not have price volatility of natural gas and reduces emissions. Unlike coal, fuel availability issues are limited.
Licensing Certainty	Resolution of design criteria through certification; resolution of site, construction and operational issues in COL Application; reliance on nuclear as generation.	Resolution of design criteria through certification; resolution of site, construction, and operational issues in COL Application; reliance on nuclear as generation.	Resolution of design criteria through certification; resolution of site, construction, and operational issues in COL Application; reliance on nuclear as generation.	Resolution of design criteria through certification; resolution of site, construction, and operational issues in COL Application; reliance on nuclear as generation.	Resolution of design criteria through certification; resolution of site, construction, and operational issues in COL Application; reliance on nuclear as generation.
Carbon Reduction	Nuclear power reduces carbon emissions by not producing 14 million tons per year CO_2 as coal or 6 million tons per year CO_2 as natural gas.	Carbon emissions reduction would be similar to Units 6 & 7.	Carbon emissions reduction would be similar to Units 6 & 7.	Carbon emissions reduction would be similar to Units 6 & 7.	Carbon emissions reduction would be similar to Units 6 & 7.
Increased Customer Choice	Retail choice of “clean” energy source in addition to menu of renewable sources.	Retail choice of “clean” energy source in addition to menu of renewable sources.	Retail choice of “clean” energy source in addition to menu of renewable sources.	Retail choice of “clean” energy source in addition to menu of renewable sources.	Retail choice of “clean” energy source in addition to menu of renewable sources.

Table 10.4-1 (Sheet 2 of 18)
Summary of the Benefits and Costs of the Construction and Operation of Units 6 & 7

Category	Turkey Point Units 6 & 7	Glades	Martin	Okeechobee 2	St. Lucie
Benefits (cont.)					
Local Economy	Addition of 3950 new employees to the workforce for construction of the new units. A workforce of approximately 806 employees would be needed for operation. Construction and operation workforce provide an economic benefit to the community.	A similar size workforce as Units 6 & 7 is anticipated.	A similar size workforce as Units 6 & 7 is anticipated.	A similar size workforce as Units 6 & 7 is anticipated.	A similar size workforce as Units 6 & 7 is anticipated.
Aesthetic Values	Selection of design and cooling tower technology allows for minimal aesthetic impacts. Site contains existing nuclear power facility structures.	Selection of design and cooling tower technology allows for minimal aesthetic impacts. No current facilities on site.	Selection of design and cooling tower technology allows for minimal aesthetic impacts. Site contains existing fossil fuel power facility structures.	Selection of design and cooling tower technology allows for minimal aesthetic impacts. No current facilities on site.	Selection of design and cooling tower technology allows for minimal aesthetic impacts. Site contains existing nuclear power facility structures.
Air Quality	Major beneficial impact in terms of avoidance of power plant emissions.	Major beneficial impact in terms of avoidance of power plant emissions.	Major beneficial impact in terms of avoidance of power plant emissions.	Major beneficial impact in terms of avoidance of power plant emissions.	Major beneficial impact in terms of avoidance of power plant emissions.
Land Use	Land to be used for Units 6 & 7 is owned by FPL and would be part of the existing power generating facility.	The Glades County site is on land that is currently a greenfield site. The land would need to be rezoned for development of the nuclear units.	Land to be used for the Martin site would be part of the existing power generating facility. Additional lands would need to be obtained for a cooling water storage reservoir.	The Okeechobee 2 site is on land that is currently a greenfield site. The land would need to be rezoned for development of the nuclear units.	Land to be used for the St. Lucie site is owned by FPL and would be part of the existing power generating facility.

Table 10.4-1 (Sheet 3 of 18)
Summary of the Benefits and Costs of the Construction and Operation of Units 6 & 7

Category	Turkey Point Units 6 & 7	Glades	Martin	Okeechobee 2	St. Lucie
Benefits (cont.)					
State/Local Tax Payments during Construction and Operations	Construction will generate tax revenues from sources including income tax, retail sales tax on materials, supplies, and selected construction services; retail sales tax on expenditures by workers; and corporate income taxes paid by contractors. During operation of the facility, local government tax revenues will accrue from property taxes and permitting and impact fees. Tax payments would occur annually over the life of the new reactor units. The impacts to the local tax base are considered SMALL and beneficial.	Construction will generate tax revenues from sources including income tax, retail sales tax on materials, supplies, and selected construction services; retail sales tax on expenditures by workers; and corporate income taxes paid by contractors. During operation of the facility, local government tax revenues will accrue from property taxes and permitting and impact fees. Tax payments would occur annually over the life of the new reactor units. The impact to the local tax base is considered LARGE and beneficial.	Construction will generate tax revenues from sources including income tax, retail sales tax on materials, supplies, and selected construction services; retail sales tax on expenditures by workers; and corporate income taxes paid by contractors. During operation of the facility, local government tax revenues will accrue from property taxes and permitting and impact fees. Tax payments would occur annually over the life of the new reactor units. The impact to the local tax base is considered SMALL and beneficial.	Construction will generate tax revenues from sources including income tax, retail sales tax on materials, supplies, and selected construction services; retail sales tax on expenditures by workers; and corporate income taxes paid by contractors. During operation of the facility, local government tax revenues will accrue from property taxes and permitting and impact fees. Tax payments would occur annually over the life of the new reactor units. The impact to the local tax base is considered LARGE and beneficial.	Construction will generate tax revenues from sources including income tax, retail sales tax on materials, supplies, and selected construction services; retail sales tax on expenditures by workers; and corporate income taxes paid by contractors. During operation of the facility, local government tax revenues will accrue from property taxes and permitting and impact fees. Tax payments would occur annually over the life of the new reactor units. The impact to the local tax base is considered SMALL and beneficial.

Table 10.4-1 (Sheet 4 of 18)
Summary of the Benefits and Costs of the Construction and Operation of Units 6 & 7

Category	Turkey Point Units 6 & 7	Glades	Martin	Okeechobee 2	St. Lucie
Benefits (cont.)					
Effects on Regional Productivity	Anticipate an increase in regional productivity through the influx of construction and station operation workers. Workers will create additional new indirect (service-related) jobs in the region through the multiplier effect of direct employment. Construction workforce and their families will increase the population in the area. The expenditures of construction and facility operation workers for food, shelter, and services will create jobs, which will have a SMALL positive impact on the region's economy. Job creation will inject millions of dollars in the region's economy, reducing unemployment and creating business opportunities.	Anticipate an increase in regional productivity through the influx of construction and station operation workers. Workers will create additional new indirect (service-related) jobs in the region through the multiplier effect of direct employment. Construction workforce and their families will increase the population in the area. The expenditures of construction and facility operation workers for food, shelter, and services will create jobs, which will have a SMALL positive impact on the region's economy. Job creation will inject millions of dollars in the region's economy, reducing unemployment and creating business opportunities.	Anticipate an increase in regional productivity through the influx of construction and station operation workers. Workers will create additional new indirect (service-related) jobs in the region through the multiplier effect of direct employment. Construction workforce and their families will increase the population in the area. The expenditures of construction and facility operation workers for food, shelter, and services will create jobs, which will have a SMALL positive impact on the region's economy. Job creation will inject millions of dollars in the region's economy, reducing unemployment and creating business opportunities.	Anticipate an increase in regional productivity through the influx of construction and station operation workers. Workers will create additional new indirect (service-related) jobs in the region through the multiplier effect of direct employment. Construction workforce and their families will increase the population in the area. The expenditures of construction and facility operation workers for food, shelter, and services will create jobs, which will have a SMALL positive impact on the region's economy. Job creation will inject millions of dollars in the region's economy, reducing unemployment and creating business opportunities.	Anticipate an increase in regional productivity through the influx of construction and station operation workers. Workers will create additional new indirect (service-related) jobs in the region through the multiplier effect of direct employment. Construction workforce and their families will increase the population in the area. The expenditures of construction and facility operation workers for food, shelter, and services will create jobs, which will have a SMALL positive impact on the region's economy. Job creation will inject millions of dollars in the region's economy, reducing unemployment and creating business opportunities.

Table 10.4-1 (Sheet 5 of 18)
Summary of the Benefits and Costs of the Construction and Operation of Units 6 & 7

Category	Turkey Point Units 6 & 7	Glades	Martin	Okeechobee 2	St. Lucie
Benefits (cont.)					
Technical and Other Non-monetary Improvements (for example, New Recreational Facilities and Improvements to Local Facilities)	Anticipate that existing local and county police, fire, and medical facilities and/or personnel would be able to accommodate the influx of construction and facility operation workers. Anticipate that the existing water supply and wastewater treatment facilities can accommodate the added increase in population. Anticipate that the existing education and social service facilities can accommodate the increase in population. Construction and operation activities should not have long-term, adverse impacts to recreational use of the surrounding area. Neither technical developments nor recreational enhancements are anticipated at this time from the construction and operation of the proposed nuclear facility. In addition, minor road improvements would occur near the proposed nuclear facility, on an as-needed basis, to support construction and operation activities.	Anticipate that existing local and county police, fire, and medical facilities and/or personnel would be able to accommodate the influx of construction and facility operation workers. Anticipate that the existing water supply and wastewater treatment facilities can accommodate the added increase in population. Anticipate that the existing education and social service facilities can accommodate the increase in population. Construction and operation activities should not have long-term, adverse impacts to recreational use of the surrounding area. Neither technical developments nor recreational enhancements are anticipated at this time from the construction and operation of the proposed nuclear facility. In addition, minor road improvements would occur near the proposed nuclear facility, on an as-needed basis, to support construction and operation activities.	Anticipate that existing local and county police, fire, and medical facilities and/or personnel would be able to accommodate the influx of construction and facility operation workers. Anticipate that the existing water supply and wastewater treatment facilities can accommodate the added increase in population. Anticipate that the existing education and social service facilities can accommodate the increase in population. Construction and operation activities should not have long-term, adverse impacts to recreational use of the surrounding area. Neither technical developments nor recreational enhancements are anticipated at this time from the construction and operation of the proposed nuclear facility. In addition, minor road improvements would occur near the proposed nuclear facility, on an as-needed basis, to support construction and operation activities.	Anticipate that existing local and county police, fire, and medical facilities and/or personnel would be able to accommodate the influx of construction and facility operation workers. Anticipate that the existing water supply and wastewater treatment facilities can accommodate the added increase in population. Anticipate that the existing education and social service facilities can accommodate the increase in population. Construction and operation activities should not have long-term, adverse impacts to recreational use of the surrounding area. Neither technical developments nor recreational enhancements are anticipated at this time from the construction and operation of the proposed nuclear facility. In addition, minor road improvements would occur near the proposed nuclear facility, on an as-needed basis, to support construction and operation activities.	Anticipate that existing local and county police, fire, and medical facilities and/or personnel would be able to accommodate the influx of construction and facility operation workers. Anticipate that the existing water supply and wastewater treatment facilities can accommodate the added increase in population. Anticipate that the existing education and social service facilities can accommodate the increase in population. Construction and operation activities should not have long-term, adverse impacts to recreational use of the surrounding area. Neither technical developments nor recreational enhancements are anticipated at this time from the construction and operation of the proposed nuclear facility. In addition, minor road improvements would occur near the proposed nuclear facility, on an as-needed basis, to support construction and operation activities.

Table 10.4-1 (Sheet 6 of 18)
Summary of the Benefits and Costs of the Construction and Operation of Units 6 & 7

Category	Turkey Point Units 6 & 7	Glades	Martin	Okeechobee 2	St. Lucie
Benefits (cont.)					
Environmental Enhancement	Reduction in carbon emissions with the use of nuclear power. It is necessary to transport fill material to this site to increase the site elevation before construction for tidal purposes. Land acquisition would not be required at the Units 6 & 7 site because the site is already owned by FPL and is designated for power plant activities. Units 6 & 7 would use a combination of sources for cooling water makeup: reclaimed water obtained from treated wastewater and water obtained from the seawater aquifer under Biscayne Bay using radial collector wells. For heat rejection, a closed-loop system with mechanical draft cooling towers would be used.	Reduction in carbon emissions with the use of nuclear power. Because portions of the Glades site are within the 100-year floodplain, it is necessary to utilize fill material to increase the site elevation before construction. Fill material is assumed to be available from on-site excavations. Because this site is a greenfield site, it is estimated that 3,360 acres of land acquisition would be required. Freshwater sources (surface or groundwater) are available to supply the water needs for the Glades site, including the Caloosahatchee River/Canal, and the water would be transferred to the site via underground pipelines. For heat rejection, a closed-loop system with mechanical draft cooling towers would be used.	Reduction in carbon emissions with the use of nuclear power. The Martin site is outside of the 100-year floodplain and would, therefore, not require modification to site elevation. Land acquisition would be required at the Martin site for the cooling water storage reservoir. It is estimated that approximately 2,800 acres of land acquisition would be required. Freshwater sources (surface or groundwater) are available to supply the water needs for the Martin site, including the St. Lucie Canal, and the water would be transferred to the site via underground pipelines. For heat rejection, a closed-loop system with mechanical draft cooling towers would be used.	Reduction in carbon emissions with the use of nuclear power. Because portions of the Okeechobee site are within the 100-year floodplain, it may be necessary to utilize fill material to increase the site elevation before construction. Fill material is assumed to be available from on-site excavations. Because this site is a greenfield site, it is estimated that 3,360 acres of land acquisition would be required. Freshwater sources (surface or groundwater) are available to supply the water needs for the Okeechobee site, including the Kissimmee River, and the water would be transferred to the site via underground pipelines. For heat rejection, a closed-loop system with mechanical draft cooling towers would be used.	Reduction in carbon emissions with the use of nuclear power. Because the St. Lucie site is within the 100-year floodplain, it is necessary to transport fill material to this site to increase the site elevation before construction. Land acquisition would not be required at the St. Lucie site because the site is already owned by FPL and is designated for power plant activities. The St. Lucie site would employ the same type of ocean water intake and canal transfer system used for existing St. Lucie Units 1 & 2. For heat rejection, a closed-loop system with mechanical draft cooling towers would be used.

Table 10.4-1 (Sheet 7 of 18)
Summary of the Benefits and Costs of the Construction and Operation of Units 6 & 7

Category	Turkey Point Units 6 & 7	Glades	Martin	Okeechobee 2	St. Lucie
Benefits (cont.)					
Construction Cost Note: Cost value is a roll-up of the internal cost values for constructing the facility, which include land, labor, materials, and equipment.	The proposed reactors at Units 6 & 7 will each be rated with a net electrical output of greater than or equal to 1,000 MWe. In accordance with Subsection 4.4.2, FPL estimates a total escalated construction cost of $18.7 billion, which includes the cost of constructing Units 6 & 7.	The proposed reactors will be similar to the proposed reactors at the Units 6 & 7 site (net electrical output of greater than or equal to 1,000 MWe). Construction costs will be similar to the Units 6 & 7 site.	The proposed reactors will be similar to the proposed reactors at the Units 6 & 7 site (net electrical output of greater than or equal to 1,000 MWe). Construction costs will be similar to the Units 6 & 7 site.	The proposed reactors will be similar to the proposed reactors at the Units 6 & 7 site (net electrical output of greater than or equal to 1,000 MWe). Construction costs will be similar to the Units 6 & 7 site.	The proposed reactors will be similar to the proposed reactors at the Units 6 & 7 site (net electrical output of greater than or equal to 1,000 MWe). Construction costs will be similar to the Units 6 & 7 site.
Transmission System	The Units 6 & 7 site would require a transmission system, consisting of three additional 230 kV transmission lines and two additional 500 kV lines to connect the new nuclear units to the existing FPL transmission system. The lines would be routed approximately 89 miles along two separate transmission corridors.	It was assumed that the Glades site would require approximately 121 miles of new transmission corridor to connect the new nuclear units to the existing FPL transmission system at the Andytown Substation in Broward County.	It was assumed that the Martin site would require approximately 31 miles of new transmission corridor to connect the new nuclear units to the existing FPL transmission system at the Corbett substation in Palm Beach County.	It was assumed that the Okeechobee 2 site would require approximately 38 miles of new transmission corridor to connect the new nuclear units to the existing FPL transmission system at the Corbett substation in Palm Beach County.	It was assumed that the St. Lucie site would require approximately 63 miles of new transmission corridor to connect the new nuclear units to the existing FPL transmission system at the Corbett substation in Palm Beach County.
Operating Cost Note: Cost value is a roll-up of the Internal cost values for operating the facility which include labor, materials, and services.	The nuclear industry's average production cost in 2007 was 1.68 cents per kWh.	Costs would be similar to the Units 6 & 7 site.	Costs would be similar to the Units 6 & 7 site.	Costs would be similar to the Units 6 & 7 site.	Costs would be similar to the Units 6 & 7 site.

Table 10.4-1 (Sheet 8 of 18)
Summary of the Benefits and Costs of the Construction and Operation of Units 6 & 7

Category	Turkey Point Units 6 & 7	Glades	Martin	Okeechobee 2	St. Lucie
Benefits (cont.)					
Land Use	The Units 6 & 7 plant area is a 220-acre area located on the existing FPL-owned 9400-acre plant property, on which five electric generating units are currently operational. The site is currently zoned for permitted use for nuclear reactors through an unusual use approval by Miami-Dade County (Section 4.1). The site consists of hypersaline mudflats; open water, dwarf mangroves, upland and wetlands spoils areas, man-made remnant canals, mangrove heads, and fill areas/roadways (Section 2.2). Most of the site (61 percent) is comprised of mudflats surrounded by man-made cooling canals. Based on land disturbance totals and the change of land use from agricultural to industrial, land use impacts from the project are anticipated to be SMALL.	The Glades site is approximately 3,360 acres (excluding offsite project components) and is developed for agricultural and farm use. The topography of the site is generally flat with a mean elevation of 15 feet. Approximately 306 acres of wetlands are within the project area, excluding the conceptual transmission corridor. The site is surrounded by sugarcane fields. Based on a potentially affected area of approximately 9,287 acres (including the conceptual transmission corridor) and the permanent change of land use from agricultural to industrial, land use impacts at the Glades site and the transmission corridor would be LARGE.	The Martin site is an existing 11,300-acre area that includes five fossil-fired power units and a solar unit. The plant site is owned by FPL although additional land would need to be acquired given that a new 3,000-acre cooling water storage reservoir would be required. The site includes an area of mixed pine flat wood and scattered small wetlands, a 1,200-acre area that has been set aside as a mitigation area, and a 400-acre peninsula of wetland forest, the Barley Barber Swamp, that is preserved as a natural area. Approximately 163 acres of wetlands are within the project area, excluding the conceptual transmission corridor. Because the site already hosts multiple power generation units, construction of additional power units would not alter site land use. Based on a potentially affected area of approximately 4,674 acres, most of which would occur off the existing Martin plant site	The Okeechobee 2 site is a 3,360-acre undeveloped site (excluding offsite project components). The site is not owned by FPL but is considered potentially available. The site is used primarily for farmland and agriculture. The county has substantial cattle, dairy, and citrus operations. The site is generally flat with a mean elevation of 28 feet. Approximately 1,500 acres of wetlands are within the project area, excluding the conceptual transmission corridor. Based on a potentially affected area of approximately 6,567 acres (including the conceptual transmission corridor) and the permanent change of land use from agricultural to industrial, land use impacts at the Okeechobee 2 site and the transmission corridor would be LARGE.	The St. Lucie site is an FPL-owned nuclear power generation station located on the 1,130-acre site on Hutchinson Island. The site is bordered by the Atlantic Ocean and the Indian River Lagoon. The nominal site elevation is 0 to 5 feet above sea level, which falls within the 100-year floodplain. West of the facility, the land gradually slopes downward to a mangrove fringe bordering the intertidal shoreline of the Indian River Lagoon. East of the facility, land rises from the ocean shore to form dunes and ridges approximately 15 feet above mean low water. Two county parks with beach access lie within the property boundary. Because the site already hosts nuclear power generation units, construction of additional power units would not alter area land use. Based on a potentially affected area of approximately 2,828 acres (including the conceptual transmission corridor and

Table 10.4-1 (Sheet 9 of 18)
Summary of the Benefits and Costs of the Construction and Operation of Units 6 & 7

Category	Turkey Point Units 6 & 7	Glades	Martin	Okeechobee 2	St. Lucie
Benefits (cont.)					
Land Use (cont.)			(including the reservoir, conceptual transmission corridor, and approximately 39 miles of access road improvements), land use impacts at the Martin site and the transmission corridor would be MODERATE.		access road improvements), land use impacts at the St. Lucie site and the transmission corridor would be SMALL.
Materials	Construction materials include concrete, fill material, aggregate, rebar, conduit, cable, piping, building supplies, and tools. Operating materials include uranium.	Construction materials include concrete, fill material, aggregate, rebar, conduit, cable, piping, building supplies, and tools. Operating materials include uranium.	Construction materials include concrete, aggregate, rebar, conduit, cable, piping, building supplies, and tools. Operating materials include uranium.	Construction materials include concrete, fill material, aggregate, rebar, conduit, cable, piping, building supplies, and tools. Operating materials include uranium.	Construction materials include concrete, fill, material, aggregate, rebar, conduit, cable, piping, building supplies, and tools. Operating materials include uranium.
Equipment	Typical construction equipment will include cranes, cement trucks, excavation equipment, dump truck, and graders. Equipment for the new facility would include the necessary components for the facility such as the reactors, turbines, cooling systems, water processing/treatment systems, and cooling towers.	Typical construction equipment will include cranes, cement trucks, excavation equipment, dump truck, and graders. Equipment for the new facility would include the necessary components for the facility such as the reactors, turbines, cooling systems, water processing/treatment systems, and cooling towers.	Typical construction equipment will include cranes, cement trucks, excavation equipment, dump truck, and graders. Equipment for the new facility would include the necessary components for the facility such as the reactors, turbines, cooling systems, water processing/treatment systems, and cooling towers.	Typical construction equipment will include cranes, cement trucks, excavation equipment, dump truck, and graders. Equipment for the new facility would include the necessary components for the facility such as the reactors, turbines, cooling systems, water processing/treatment systems, and cooling towers.	Typical construction equipment will include cranes, cement trucks, excavation equipment, dump truck, and graders. Equipment for the new facility would include the necessary components for the facility such as the reactors, turbines, cooling systems, water processing/treatment systems, and cooling towers.
Services	Support services and supplies would be needed during construction. Security, maintenance, trash removal, and/or landscaping services may be needed during operation of the facility.	Support services and supplies would be needed during construction. Security, maintenance, trash removal, and/or landscaping services may be needed during operation of the facility.	Support services and supplies would be needed during construction. Security, maintenance, trash removal, and/or landscaping services may be needed during operation of the facility.	Support services and supplies would be needed during construction. Security, maintenance, trash removal, and/or landscaping services may be needed during operation of the facility.	Support services and supplies would be needed during construction. Security, maintenance, trash removal, and/or landscaping services may be needed during operation of the facility.

Table 10.4-1 (Sheet 10 of 18)
Summary of the Benefits and Costs of the Construction and Operation of Units 6 & 7

Category	Turkey Point Units 6 & 7	Glades	Martin	Okeechobee 2	St. Lucie
Benefits (cont.)					
Water Use	Construction for Units 6 & 7 is estimated to require a maximum of 565 gpm of water, used for such activities as dust abatement, mixing concrete, hydrotesting and flushing, and potable water use by the construction force. Miami-Dade County would be the source for construction water requirements (Section 4.2). As described in Section 3.3, water consumption during fuel cycle activities would total 2.95E10 gallons annually for both units. Cooling water makeup sources are reclaimed water from county-treated wastewater and water drawn from the seawater aquifer underlying Biscayne Bay using radial collector wells. Public water in the amount of 936 gpm (1.35 mgd) to 2,553 gpm (3.68 mgd) would be supplied for non-cooling water use. Units 6 & 7 wastewater will be injected underground via permitted deep injection wells. Hydrological and water use impacts are anticipated to be SMALL.	Consumptive water use for a nuclear facility at the Glades site would be similar to that which is proposed for Units 6 & 7 at the Turkey Point site. Major freshwater surface water sources exist that could meet the water use needs of the facility. Lake Okeechobee offers a potential water supply of more than 360 cfs, and the annual average flow of the Caloosahatchee River/Canal near the site is approximately 592 cfs. The estimated groundwater potential at the Glades site is approximately 155 cfs. These water sources are suitable to satisfy potable and process water demands associated with construction and operation at the Glades site. Water use impacts are anticipated to be SMALL.	Consumptive water use for a nuclear facility at the Martin County site would be similar to that which is proposed for Units 6 & 7 at the Turkey Point site. Major freshwater surface water sources exist that could meet the water use needs of the facility. Lake Okeechobee offers a potential water supply of more than 360 cfs, and the annual average flow of the St. Lucie Canal near the site is approximately 842 cfs. The estimated groundwater potential at the Martin site is approximately 155 cfs. These water sources are suitable to satisfy potable and process water demands associated with construction and operation at the Martin site. Water use impacts are anticipated to be SMALL.	Consumptive water use for a nuclear facility at the Okeechobee 2 site would be similar to that which is proposed for Units 6 & 7 at the Turkey Point site. Major freshwater surface water sources exist that could meet the water use needs of the facility. Lake Okeechobee offers a potential water supply of more than 360 cfs, and the annual average flow of the Kissimmee River near the site is approximately 919 cfs. The estimated groundwater potential at the Okeechobee 2 site is approximately 155 cfs. These water sources are suitable to satisfy potable and process water demands associated with construction and operation at the Okeechobee 2 site. Water use impacts are anticipated to be SMALL.	Consumptive water use for a nuclear facility at the St. Lucie site would be similar to that which is proposed for Units 6 & 7 at the Turkey Point site. Existing St. Lucie Units 1 & 2 receive water from the city of Ft. Pierce and the Ft. Pierce Utilities Authority for potable and service uses at the plant. The freshwater is derived from groundwater sources on the mainland, and plant operations do not involve any additional groundwater withdrawal. Average potable water usage at the plant is approximately 131,500 gpd with no restrictions on supply. The addition of two more power units would nominally double this daily potable water requirement. Water is withdrawn from the Atlantic Ocean in a once-through arrangement to cool St. Lucie Units 1 & 2. A closed loop, tower-cooled system would be developed for the new power units, whereby consumptive losses are replaced from the Atlantic Ocean and blowdown water is routed to the Atlantic Ocean. Water use impacts are anticipated to be SMALL.

Table 10.4-1 (Sheet 11 of 18)
Summary of the Benefits and Costs of the Construction and Operation of Units 6 & 7

Category	Turkey Point Units 6 & 7	Glades	Martin	Okeechobee 2	St. Lucie
External Costs					
Air Quality	The construction and operation of the power facility would meet applicable federal, state, and local air quality permitting regulations.	The construction and operation of the power facility would meet applicable federal, state, and local air quality permitting regulations.	The construction and operation of the power facility would meet applicable federal, state, and local air quality permitting regulations.	The construction and operation of the power facility would meet applicable federal, state, and local air quality permitting regulations.	The construction and operation of the power facility would meet applicable federal, state, and local air quality permitting regulations.
Terrestrial Biology	Terrestrial species that are listed as threatened or endangered by the U.S. Fish and Wildlife Service (USFWS) and the state of Florida and have the potential to occur within the Units 6 & 7 site and vicinity are described in Subsection 2.4.1. Conversion of approximately 300 acres of primarily mudflat habitat would not significantly reduce the regional diversity of plants and plant communities (Section 4.3). Some potential impacts to wetlands and sensitive species may occur, but mitigation is available to offset any affects. Impacts from the project to terrestrial ecological resources are anticipated to be SMALL (Sections 4.3, 5.3, and 5.6).	Terrestrial species that are listed as threatened or endangered by the USFWS and the state of Florida and have the potential to occur within Glades County are presented in Table 9.3-8. Glades County has a low number of sensitive species, there are no known sensitive species onsite, and the transmission corridor is relatively short; however, up to 1,873 acres of wetlands (approximately 650 acres of high quality wetlands) could be affected by project construction and operation (including those found in the conceptual transmission corridor). Impacts to terrestrial resources, including threatened and endangered species from construction and operation of the nuclear plant and transmission corridor at the Glades site, would be MODERATE.	Terrestrial species that are listed as threatened or endangered by the USFWS and the state of Florida and have the potential to occur within Martin County are presented in Table 9.3-10. There are no known sensitive species onsite, and the transmission corridors would be relatively short. Impacts to terrestrial resources, including threatened and endangered species from construction and operation of the nuclear plant and transmission corridor at the Martin site, would be SMALL.	Terrestrial species that are listed as threatened or endangered by the USFWS and the state of Florida and have the potential to occur within Okeechobee County are presented in Table 9.3-12. Okeechobee County has a low number of sensitive species; there are no known sensitive species onsite. The site area includes a relatively small area of undisturbed woodlands that could be potentially affected by project construction and operation. However, it also includes over 2,000 acres of wetlands, including approximately 1,300 acres of wet prairies and 300 acres of high quality wetlands that could be potentially affected. Impacts to terrestrial resources, including threatened and endangered species from construction and operation of the nuclear plant and transmission corridor at the Okeechobee 2 site, would be MODERATE.	Terrestrial species that are listed as threatened or endangered by the USFWS and the state of Florida and have the potential to occur within St. Lucie County are presented in Table 9.3-14. There are no designated critical terrestrial habitats for endangered species in the vicinity of St. Lucie Units 1 & 2. Important wetland habitat (mangrove) would be permanently lost from plant construction and the widening of SR A1A. There are beach and dunes, mangrove, and tropical hammock habitats that are important, as they represent important coastal ecosystems that have been reduced by development. Also, these habitats support a variety of animal species. Impacts to terrestrial resources, including threatened and endangered species from construction and operation of the nuclear plant and transmission corridor at the St. Lucie site, would be MODERATE.

Table 10.4-1 (Sheet 12 of 18)
Summary of the Benefits and Costs of the Construction and Operation of Units 6 & 7

Category	Turkey Point Units 6 & 7	Glades	Martin	Okeechobee 2	St. Lucie
External Costs (cont.)					
Terrestrial Biology (cont.)		Most of the site is an active sugarcane field that is unsuitable habitat for most wildlife species because of the lack of native vegetation and the amount and frequency of human disturbance. The site has been modified to allow for irrigation using an irrigation/ drainage ditch network throughout the site. Any wetland functions that are impacted during construction would be replaced or restored.			St. Lucie County has a low number of sensitive species, but endangered species are present at the site and important coastal habitat is found nearby. The project would impact nearly 1,000 acres of wetlands from onsite and offsite construction activities, including over 400 acres of mangrove habitat. Construction of the transmission corridor would also potentially affect over 2,000 acres. Impacts from construction would be MODERATE. Impacts from operation include drift from vapor plumes that would be high in salt and minerals. However, surrounding ecosystem is adapted to higher salinity and use of drift eliminators would help reduce impacts to SMALL.

Table 10.4-1 (Sheet 13 of 18)
Summary of the Benefits and Costs of the Construction and Operation of Units 6 & 7

Category	Turkey Point Units 6 & 7	Glades	Martin	Okeechobee 2	St. Lucie
External Costs (cont.)					
Aquatic Biology	Aquatic species that are listed as threatened or endangered by the USFWS and the state of Florida and have the potential to occur within the Units 6 & 7 site and vicinity are described in Subsection 2.4.2. Units 6 & 7 wastewater, including cooling water tower blowdown discharge, will be injected underground via permitted deep injection wells, so there will be no discharge impacts to aquatic resources. Cooling water makeup sources are reclaimed water from county-treated wastewater and water drawn from the seawater aquifer underlying Biscayne Bay using radial collector wells, so there will be no entrainment or impingement of aquatic organisms and no resultant disruption of existing populations. Impacts from project to aquatic ecological resources are anticipated to be SMALL (Sections 4.3 and 5.3).	Aquatic species that are listed as threatened or endangered by the USFWS and the state of Florida and have the potential to occur in Glades County are presented in Table 9.3-8. Wastewater, including cooling water tower blowdown discharge, will be injected underground via permitted deep injection wells, so there will be no discharge impacts to aquatic resources. Proposed facilities at the site will include cooling towers that would reduce the amount of cooling water withdrawal required for plant operation. Through the use of cooling towers with an appropriate intake design, potential adverse impacts from entrainment or impingement of aquatic organism would be SMALL and would not significantly disrupt existing populations.	Aquatic species that are listed as threatened or endangered by the USFWS and the state of Florida and have the potential to occur in Martin County are presented in Table 9.3-10. Wastewater, including cooling water tower blowdown discharge, will be injected underground via permitted deep injection wells, so there will be no discharge impacts to aquatic resources. Proposed facilities at the site will include cooling towers that would reduce the amount of cooling water withdrawal required for plant operation. Through the use of cooling towers with an appropriate intake design, potential adverse impacts from entrainment or impingement of aquatic organism would be SMALL and would not significantly disrupt existing populations	Aquatic species that are listed as threatened or endangered by the USFWS and the state of Florida and have the potential to occur in Okeechobee County are presented in Table 9.3-14. Wastewater, including cooling water tower blowdown discharge, will be injected underground via permitted deep injection wells, so there will be no discharge impacts to aquatic resources. Proposed facilities at the site will include cooling towers that would reduce the amount of cooling water withdrawal required for plant operation. Through the use of cooling towers with an appropriate intake design, potential adverse impacts from entrainment or impingement of aquatic organism would be SMALL and would not significantly disrupt existing populations.	Aquatic species that are listed as threatened or endangered by the USFWS and the state of Florida and have the potential to occur in St. Lucie County are presented in Table 9.3-14. Operation under the NPDES permit should result in the maintenance of a balanced, indigenous population of fish, shellfish, and other aquatic organisms in the vicinity of the discharge structure. Proposed facilities at the site will include cooling towers that would reduce the amount of cooling water withdrawal required for plant operation. Through the use of cooling towers with an appropriate intake design, potential adverse impacts from entrainment or impingement of aquatic organism would be minor and would not significantly disrupt existing populations. However, because of the known presence of endangered species at the site, the impact from plant construction would be considered MODERATE.

Table 10.4-1 (Sheet 14 of 18)
Summary of the Benefits and Costs of the Construction and Operation of Units 6 & 7

Category	Turkey Point Units 6 & 7	Glades	Martin	Okeechobee 2	St. Lucie
External Costs (cont.)					
Aquatic Biology (cont.)					Plant operation is not expected to entrain more turtles, fish or cause more takes, and impacts from operations would be considered SMALL.
Socioeconomic	Socioeconomic impacts associated with the construction and operation of Units 6 & 7 is described in Sections 4.4 and 5.8. The overall population level is anticipated to be sufficiently large that the impact on area employment from construction and operation of Units 6 & 7 would be low. It is expected that the impact on housing and community services would be negligible. The site area appears to have sufficient population centers within commuting distance such that its public services sector would be able to absorb the population in-migration associated with plant construction and operation with minimal impact.	The region of influence that includes Glades, Hendry, Lee, and Okeechobee Counties has a 2006 population estimate of 663,439, which is a 26.7 percent increase from the 2000 population. The economies of the four counties in the region of influence are dominated primarily by educational, health, and social services; agriculture, forestry, fishing and hunting, and mining; and retail trade. Most of the labor force resides in Lee County.	The region of influence that includes Martin, Okeechobee, Palm Beach, and St. Lucie Counties has a 2006 population estimate of 1,706,536, which is a 14.8 percent increase from the 2000 population. The economies of the four counties in the region of influence are dominated primarily by educational, health, and social services; agriculture, forestry, fishing and hunting, and mining; and retail trade. Most of the labor force resides in Palm Beach County.	The region of influence that includes Martin, Okeechobee, Palm Beach, and St. Lucie Counties has a 2006 population estimate of 402,347, which is a 23.2 percent increase from the 2000 population. The economies of the four counties in the region of influence are dominated primarily by educational, health, and social services; retail trade; and agriculture, forestry, fishing and hunting, and mining. Most of the labor force resides in St. Lucie County.	The region of influence that includes St. Lucie, Martin, Indian River, and Palm Beach Counties has a 2006 population estimate of 1,796,230, which is a 14.9 percent increase from the 2000 population. The economies of the four counties in the region of influence are dominated primarily by educational, health, and social services; agriculture, forestry, fishing and hunting, and mining; and retail trade. Most of the labor force resides in St. Lucie County.

Table 10.4-1 (Sheet 15 of 18)
Summary of the Benefits and Costs of the Construction and Operation of Units 6 & 7

Category	Turkey Point Units 6 & 7	Glades	Martin	Okeechobee 2	St. Lucie
External Costs (cont.)					
Socioeconomic (cont.)	The region affords necessary infrastructure and services to meet the demands of the construction and operation workforce. If additional infrastructure and services are needed to meet the demands of the people moving into the area to support the construction and operation of the new facility, these costs should be offset by the beneficial increased tax revenues to the local economy and the overall beneficial economic input to the region from those individuals and families. Socioeconomic impacts from construction and operational activities of the project are anticipated to be SMALL and beneficial for all aspects but transportation. A negative MODERATE impact of the project to the local area could occur from increased traffic.	70 percent of the construction workers and 85 percent of the operation workers would relocate from outside the region of influence. The total projected increase in population attributable to the peak total construction workforce at the Glades site would be 6,669 people, a 1.3 percent increase in the region of influence population. This would pose a SMALL impact on the population for the region of influence. The total population increase attributable to project operations is 2,901 people, posing a SMALL impact on population for the region of influence.	Because of the location of the Martin site to population centers, 50 percent of the construction workers and operation workers would relocate from outside the region of influence. The total projected increase in population attributable to the peak total construction workforce at the Martin site would be 4,729 people, a 0.3 percent increase in the region of influence population. This would pose a SMALL impact on the population for the region of influence. The total population increase attributable to project operations is 1,706 people, posing a SMALL impact on population for the region of influence.	70 percent of the construction workers and 85 percent of the operation workers would relocate from outside the region of influence. The total projected increase in population attributable to the peak total construction workforce at the Okeechobee 2 site would be 6,669 people, a 2.0 percent increase in the region of influence population. This would pose a SMALL impact on the population for the region of influence. The total population increase attributable to project operations is 2,901 people, posing a SMALL impact on population for the region of influence.	50 percent of the construction workers and operation workers would relocate from outside the region of influence. The total projected increase in population attributable to the peak total construction workforce at the St. Lucie site would be 4,729 people, a 0.3 percent increase in the region of influence population. This would pose a SMALL impact on the population for the region of influence. The total population increase attributable to project operations is 1,310 people, posing a SMALL impact on population for the region of influence.

Table 10.4-1 (Sheet 16 of 18)
Summary of the Benefits and Costs of the Construction and Operation of Units 6 & 7

Category	Turkey Point Units 6 & 7	Glades	Martin	Okeechobee 2	St. Lucie
External Costs (cont.)					
Socioeconomic (cont.)		The creation of direct and indirect jobs is projected at 4574 new jobs in the region of influence during the peak construction period, a 2 percent increase in the total labor force. This would potentially reduce unemployment and would likely create business opportunities for goods and service-related industries and the housing industry. Overall, the economic benefits attributable to project construction would be beneficial and SMALL within the region of influence. An estimated 1,050 workers would be required for the operation of the two nuclear power units. This is projected to result in a total of 2055 jobs in the region, a 0.9 percent increase in the total labor force in the region of influence. The socioeconomic impacts attributable to project operation would be beneficial and SMALL.	The creation of direct and indirect jobs is projected at 3208 new jobs in the region of influence during the peak construction period, a 0.5 percent increase in the total labor force. This would potentially reduce unemployment and would likely create business opportunities for goods and service-related industries and the housing industry. Overall, the economic benefits attributable to project construction would be beneficial and MODERATE in Okeechobee County and SMALL in the other counties within the region of influence. An estimated 1,050 workers would be required for the operation of the two nuclear power units. This is projected to result in a total of 1197 jobs in the region, a 0.2 percent increase in the total labor force in the region of influence.	The creation of direct and indirect jobs is projected at 4259 new jobs in the region of influence during the peak construction period, a 3.2 percent increase in the total labor force. This would potentially reduce unemployment and would likely create business opportunities for goods and service-related industries and the housing industry. Overall, the economic benefits attributable to project construction would by beneficial and SMALL within the region of influence. An estimated 1,050 workers would be required for the operation of the two nuclear power units. This is projected to result in a total of 2203 jobs in the region, a 1.7 percent increase in the total labor force in the region of influence. The socioeconomic impacts attributable to project operation would be beneficial and SMALL.	The creation of direct and indirect jobs is projected at 3178 new jobs in the region of influence during the peak construction period, a 0.5 percent increase in the total labor force. This would potentially reduce unemployment and would likely create business opportunities for goods and service-related industries and the housing industry. Overall, the economic benefits attributable to project construction would by beneficial and SMALL within the region of influence. An estimated 806 workers would be required for the operation of the two nuclear power units. This is projected to result in a total of 907 new jobs in the region, a 0.1 percent increase in the total labor force in the region of influence. The socioeconomic impacts attributable to project operation would be beneficial and SMALL.

Table 10.4-1 (Sheet 17 of 18)
Summary of the Benefits and Costs of the Construction and Operation of Units 6 & 7

Category	Turkey Point Units 6 & 7	Glades	Martin	Okeechobee 2	St. Lucie
External Costs (cont.)					
Socioeconomic (cont.)		The impact on housing and community services would be negligible. The site area appears to have sufficient population centers within commuting distance such that its public services sector would be able to absorb the population in-migration associated with plant construction and operation with minimal impact.	The impact on housing and community services would be negligible. The site area appears to have sufficient population centers within commuting distance such that its public services sector would be able to absorb the population in-migration associated with plant construction and operation with minimal impact.	The impact on housing and community services would be negligible. The site area appears to have sufficient population centers within commuting distance such that its public services sector would be able to absorb the population in-migration associated with plant construction and operation with minimal impact.	The impact on housing and community services would be negligible. The site area appears to have sufficient population centers within commuting distance such that its public services sector would be able to absorb the population in-migration associated with plant construction and operation with minimal impact.
Environmental Justice	No anticipated short-term impact on availability of housing units in the area during construction.	No anticipated short-term impact on availability of housing units in the area during construction.	No anticipated short-term impact on availability of housing units in the area during construction.	No anticipated short-term impact on availability of housing units in the area during construction.	No anticipated short-term impact on availability of housing units in the area during construction.
	Local infrastructure surrounding Units 6 & 7 site is described in Section 2.2. There are sufficient roads that provide access to plant property. However, some additional construction of local access roads to the Units 6 & 7 site would be required. The impact of the construction and operations workforces on transportation would be MODERATE (Sections 4.4 and 5.8).	There are sufficient roads that provide main access to the proposed Glades site. However, construction of local access roads would be required. Railroad spurs would also be required. The impact of the construction and operations workforces on transportation would be MODERATE.	There are sufficient roads that provide main access to the Martin site. However, construction of local access roads would be required. Railroad spurs would also be required. The impact of the construction and operations workforces on transportation would be LARGE.	There are sufficient roads that provide main access to the proposed Okeechobee 2 site. However, construction of local access roads would be required. The impact of the construction and operations workforces on transportation would be LARGE.	There are sufficient roads that provide main access to the St. Lucie site. However, improvement to local roads would be required. The impact of the construction and operations workforces on transportation would be MODERATE.
	Radiological exposure would be below limits to workers and public.	Radiological exposure would be below limits to workers and public.	Radiological exposure would be below limits to workers and public.	Radiological exposure would be below limits to workers and public.	Radiological exposure would be below limits to workers and public.

Table 10.4-1 (Sheet 18 of 18)
Summary of the Benefits and Costs of the Construction and Operation of Units 6 & 7

Category	Turkey Point Units 6 & 7	Glades	Martin	Okeechobee 2	St. Lucie
External Costs (cont.)					
Environmental Justice (cont.)	Loss of resources is described in Section 10.1, 10.2, and 10.3. It is expected that losses will be mitigated to minimize the impact of the loss.	Loss of resources is described in Section 10.1, 10.2, and 10.3. It is expected that losses will be mitigated to minimize the impact of the loss.	Loss of resources is described in Section 10.1, 10.2, and 10.3. It is expected that losses will be mitigated to minimize the impact of the loss.	Loss of resources is described in Section 10.1, 10.2, and 10.3. It is expected that losses will be mitigated to minimize the impact of the loss.	Loss of resources is described in Section 10.1, 10.2, and 10.3. It is expected that losses will be mitigated to minimize the impact of the loss.

Table 10.4-2
Turkey Point Nuclear Units 6 & 7 Cost Estimate Range

	Low Range		**High Range**	
	Total Dollars	**Cost per kW**	**Total Dollars**	**Cost per kW**
Power Plant Island and Supporting Construction	$6,202,567,649		$9,034,535,498	
Transmission and General Plant Costs	$1,615,537,787		$2,340,204,748	
Nuclear fuel inventory cost for the first core[(a)]	$34,998,943		$42,752,556	
Total Overnight Cost (2012$)	$7,853,104,379	$3,570	$11,417,492,801	$5,190
Escalation	$1,374,646,749		$2,020,718,864	
AFUDC	$3,583,932,972		$5,256,076,173	
Total Estimated Project Cost (Year Spent$)	$12,811,684,100	$5,823	$18,694,287,838	$8,497

(a) Leased fuel assumed