United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
Nebraska Field Office
203 West Second Street
Grand Island, Nebraska 68801

June 16, 2006

Memorandum

To: Michael J. Ryan, Regional Director, Great Plains Region, U.S. Bureau of Reclamation; and

Mike Stempel, Assistant Regional Director, Fisheries and Ecological Services, Region 6, U.S. Fish and Wildlife Service

From: Steve Anschutz, Field Supervisor, Nebraska Ecological Services Field Office, U.S. Fish and Wildlife Service

Subject: Biological Opinion on the Platte River Recovery Implementation Program

In accordance with section 7 of the Endangered Species Act (ESA) of 1973 (87 Stat.884, as amended; 16 U.S.C. 1531 et seq.), this transmits the U.S. Fish and Wildlife Service's (Service) biological opinion on the effects of the Federal action identified in the Platte River Recovery Implementation Program Final Environmental Impact Statement on federally listed species and designated critical habitat. The Federal action includes: a) the effects of the Platte River Recovery Implementation Program (Program) on all listed species in the action area; and b) the effects of the continued operations of existing and certain new water-related activities that elect to participate in the Program, including Service and U.S. Bureau of Reclamation (Reclamation) projects on the North Platte and South Platte rivers, as they affect the target species and critical habitat in the action area and other federally listed species associated with the central and lower Platte River. Copies of this biological opinion are being made available to all of the Platte River Governance Committee participants via the Service's FTP website at: http://www.fws.gov/filedownloads/ftp_region6_upload.

With the Program in effect, ESA section 7 consultation involving the continued operation of existing Service and Reclamation projects on the North Platte, South Platte, and Platte Rivers during the first increment of the Program is complete regarding the effects of Service and Reclamation "existing water-related activities" on the target species and critical habitat in the action area and other federally listed species associated with the central and lower Platte River. Future Reclamation and Service actions during the first increment involving existing water-related activities included within the scope of this biological opinion are not subject to further section 7 consultation for the target species, critical habitat, and other listed species associated with the central and lower Platte River (e.g., renewal of Reclamation water service contracts). However, the action agency will need to provide written documentation of such actions to the Service.

Issuance of this biological opinion and the implementation of the Program do not eliminate the need for other Federal agencies to consult with the Service on the effects of existing and future water resource development projects on federally listed species and designated critical habitats in the Platte River basin. With the Program in effect, ESA section 7 consultations involving certain "new water-related activities" of Reclamation and the Service, other Federal agency activities with a federal-nexus (both existing and certain new water-related activities), and their effects on listed species and designated critical habitat in the central and lower Platte River will be able to proceed in a streamlined manner and "tier" from this programmatic biological opinion. For those projects that are within the scope of this biological opinion, ESA compliance applies only to water-related activities as they affect the target species and their critical habitat in the action area, and other listed species in the central and lower Platte River in Nebraska. As noted above, other impacts (e.g., footprint impacts) on any federally listed or proposed threatened or endangered species, or designated or proposed critical habitats are not within the scope of this biological opinion. They will need to be evaluated separately via section 7 consultation with the appropriate Service office.

Lastly, I wish to thank all of the Service and Reclamation staff members who contributed toward the successful completion of this consultation effort, and everyone's efforts to begin a Program for the conservation and recovery of the target species and their associated Platte River habitats.

Attachment

cc: USFWS; Lakewood, CO (Attn: Mitch King)
USFWS; Lakewood, CO (Attn: Susan Linner)
USFWS; Cheyenne, WY (Attn: Brian Kelly)
USFWS; Lakewood, CO (Attn: Mark Butler)
USBR; Billings, MT (Attn: Gary Davis)
USBR; Mills, WY (Attn: John Lawson)
USBR; Lakewood, CO (Attn: Curt Brown)

# Biological Opinion
# on the

# Platte River Recovery Implementation Program

**June 16, 2006**

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# I. Introduction

The continued existence and recovery of the whooping crane (*Grus americana*), interior least tern (*Sterna antillarum*), northern Great Plains population of the piping plover (*Charadrius melodus*), and pallid sturgeon (*Scaphirynchus albus*), collectively referred to as the "target species," depends on protecting and restoring the central and lower Platte River ecosystem. The existing degraded habitat in the Platte River ecosystem has resulted primarily from extensive development of Platte River basin water resources. The existing trends and conditions of Platte River habitat and ecosystem processes, and the status of the populations of the four target species lead the U.S. Fish and Wildlife Service (Service) to conclude that the survival and future recovery of these species cannot be ensured without significant changes made to improve current environmental conditions.

For more than two decades, discussions regarding the establishment of a comprehensive, basin-wide recovery and research program have occurred among the numerous and diverse parties involved with water use and management in the Platte River basin. While the parties have not agreed regarding the need for remedial measures to conserve federally listed species that use the Platte River, they have generally agreed that the objectives of the various parties can best be met through the implementation of a basin-wide, cooperative recovery and research program. The framework for the development of such a program was provided through a Memorandum of Agreement (1994) and Cooperative Agreement (1997) which were signed by the Governors of the three Platte River basin states (i.e., Colorado, Nebraska, and Wyoming) and the Secretary of the Department of the Interior (Interior) on June 10, 1994, and July 1, 1997, respectively. Subsequent negotiations among the parties resulted in the Platte River Recovery Implementation Program (Program), the principal component of the Federal action addressed by this biological opinion.

The intent of the Program is to protect, conserve, and assist in the recovery of the four target species associated with the central and lower reaches of the Platte River by implementing certain aspects of the Service's recovery plans that relate to their Platte River associated habitats. By providing habitat-related benefits for the target species, the Program would help offset the adverse impacts to the Platte River ecosystem from the continued operation of existing and certain new water-related activities that occur in the basins upstream of the Loup River confluence located near Columbus, Nebraska[1], and thereby, provide Endangered Species Act (ESA) compliance for such projects for 13 years, the first stage of the Program. The Program is also intended to protect designated critical habitat for the whooping crane and help prevent the need to list additional Platte River basin associated species pursuant to the ESA.

In addition to evaluating the effects of the Program on federally listed species and designated critical habitat, this programmatic biological opinion is intended to provide ESA compliance for continuation of existing and certain new water-related activities which elect to participate in the Program, including Bureau of Reclamation (Reclamation) and Service water projects on the

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[1] Water-related activities in the Loup River basin and other drainages that affect the Platte River only downstream of Columbus, Nebraska are outside the scope of this biological opinion.

North Platte and South Platte rivers (i.e., the North Platte, Glendo, Kendrick, Kortes, and Colorado-Big Thompson projects), insofar as they affect the target species and their critical habitat in the Platte River basin and other federally listed species associated with the central and lower Platte River in Nebraska.

The purpose of this programmatic biological opinion is to determine whether the Federal action (i.e., participation by Interior, through Reclamation and the Service, in funding and implementing the Program, and continued operation of existing and certain new Federal water-related activities, including Reclamation and Service projects in the Platte River basin upstream of the Loup River confluence) is likely to jeopardize the continued existence of federally listed threatened and endangered species and/or adversely modify designated critical habitat in the action area[2]. The action area includes the Platte River basin upstream of the confluence with the Loup River in Nebraska, and the mainstem of the Platte River downstream of the Loup River confluence. The evaluation includes effects on all federally listed species and designated critical habitats in the action area from full implementation of the Program for 13 years. Also, included are the effects from the continued operations of Reclamation, Service, and other water-related activities on the target species and their critical habitat in the action area and other federally-listed species in the central and lower reaches of the Platte River.

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[2] For reasons explained in the *Consultation History* section, the scope of ESA compliance for effects of continued operations of Reclamation and Service projects on non-target species is limited to the central and lower Platte River.

# II. Consultation History

A history of consultation includes: a) any informal consultation or formal consultations on the action; b) documentation of the initiation date of formal consultation; c) a chronology of subsequent requests for additional data, extensions; and d) other applicable past or current actions by the action agency.

Since 1978, the Service has consistently found through formal section 7 consultations with other Federal agencies that actions resulting in depletions to flows in the Platte River system are likely to jeopardize the continued existence of one or more federally listed threatened or endangered species and adversely modify designated critical habitat. These include the whooping crane, interior least tern, northern Great Plains population of the piping plover, pallid sturgeon, and federally designated critical habitat for the whooping crane. The Service's conclusions on the effects of depletions to the Platte River are well documented in a number of biological opinions resulting from the formal section 7 consultations. Some of the more notable consultations involving major Federal actions are highlighted below.

The first Federal action to generate such a conclusion by the Service was the Basin Electric Power Cooperative's (Cooperative) proposed Gray Rocks Dam and Reservoir Project on the Laramie River in Wyoming. A major purpose of this $1.6 billion project was to provide cooling water for a coal-fired electric-generating station. Following an out-of-court settlement over a lawsuit among the Cooperative, U.S. Army Corps of Engineers (Corps), Rural Electrification Administration (REA), the State of Nebraska, and the National Wildlife Federation, the Service issued a jeopardy biological opinion to both the Corps and the REA on December 8, 1978 (USFWS 1978b and 1978c), for project-related impacts stemming from 23,250 acre-feet of annual water depletions and their negative effects upon the endangered whooping crane and its critical habitat on the central Platte River, located over 300 miles downstream from the project site. Included within that biological opinion was a reasonable and prudent alternative which called for the project to establish a $7.5 million trust fund for maintaining and protecting whooping crane habitat. This reasonable and prudent alternative was one of several conditions included as part of the aforementioned settlement which, among other things, led to the establishment of the Platte River Whooping Crane Critical Habitat Maintenance Trust, Inc (Crane Trust).

Less than five years after the Gray Rocks biological opinion was issued, the Service provided a biological opinion to Reclamation on January 20, 1983 (USFWS 1983a) for the proposed Narrows Unit Project on the South Platte River in northeastern Colorado. The Service determined that the proposed multi-purpose project would result in an annual depletion of 91,900 acre-feet to the central Platte River and, like the Gray Rocks Project, would likely jeopardize the continued existence of the endangered whooping crane and adversely modify its critical habitat in Nebraska, approximately 300 miles downstream of the project site. The Service proposed as a reasonable and prudent alternative that water storage be designed in the Narrows Unit Reservoir to provide needed supplemental Platte River flows for whooping crane roosting habitat and for channel width maintenance. The need for a reservoir storage operation study to precisely determine how to support the instream flow requirements also was included as part of the reasonable and prudent alternative. In addition, it was recommended that Service representatives be included in the planning for any resultant scheduled water releases and that the Service and Reclamation work together to ensure that the water releases would reach whooping crane habitat. As a result of this section 7 consultation, the Platte River Management Joint Study (Joint Study) was initiated by Reclamation and the Service in cooperation with the States of Nebraska, Colorado, and Wyoming. The intent of the Joint Study effort was to develop a fish and wildlife management plan for the Platte River system in central Nebraska that encompassed alternatives that would offset adverse project-related impacts on the whooping crane and the species' federally designated critical habitat. Funding for the proposed Narrows Unit Project has not been appropriated.

On July 20, 1987, the Service issued a "not likely to jeopardize" biological opinion to the Corps on the Wyoming Water Development Commission's (Commission) proposed Deer Creek Dam and Reservoir Project (USFWS 1987a). The purpose of the proposed project (to be sited along Deer Creek, a North Platte River tributary in eastern Wyoming) was to provide a water supply for Casper during dry years when the city could not obtain sufficient water from its surface or groundwater rights. The Service determined that the project could annually deplete an average of 9,600 acre-feet of water from the Platte River system and would have a significant negative impact on the whooping crane and the species' federally designated critical habitat in central Nebraska. The Service further determined that the seasonal amounts and timing of these instream flow depletions would not likely jeopardize the least tern and piping plover due to impacts on the availability or suitability of nesting and foraging habitats of the least tern and piping plover, and would not significantly affect flows needed to sustain least tern forage fish populations. The proposed project also would not likely jeopardize the bald eagle (*Haliaeetus leucocephalus*) due to impacts on foraging habitat or the species' forage fish populations. However, in order to preclude the likelihood of jeopardy for the whooping crane and adverse modification of designated critical habitat, the Service agreed to accept the Commission's formal offer to fund the acquisition, restoration, and maintenance of a 24-acre whooping crane habitat area along the central Platte River (the "Wyoming" property). The Commission's proposal was incorporated into the biological opinion as conservation measures which were subsequently accomplished. As part of the settlement of Nebraska v. Wyoming, the Commission agreed to forego the Deer Creek project if Pathfinder Dam is modified as described in the proposed action.

Shortly after the section 7 consultation was completed on the Deer Creek Dam and Reservoir Project, the Service issued another biological opinion to the Corps on October 14, 1987 (USFWS 1987b), for the Denver Water Department's proposed Two Forks Project on the South Platte River in Colorado's "front range." The intended purpose for the proposed dam and 1.1 million-acre-foot reservoir was to provide a source of water for future growth and development in the Denver metropolitan area. The Service's biological opinion concluded that the project would not likely jeopardize the bald eagle, least tern, piping plover, and whooping crane, or adversely modify designated critical habitat for the whooping crane. The determination that the proposed project would not likely jeopardize the whooping crane or adversely modify the species' designated critical habitat was predicated on the Service's acceptance of the Denver Water Department's formal offer to offset the anticipated adverse effects that would result from the project's water depletions to the central Platte River through implementation of conservation measures described in the biological opinion. These measures called for the Denver Water Department to acquire, restore, and maintain approximately 221 acres of whooping crane habitat (i.e., roosting and wetland meadow habitat) along the central Platte River. The proposed project was not authorized because the Environmental Protection Agency (EPA) vetoed the Corps' issuance of a Section 404 permit for the project. This veto was legally challenged and upheld.

On May 27, 1988, Reclamation initiated informal consultation with the Service regarding operations of Reclamation facilities on the North Platte River and the East Slope facilities of the Colorado-Big Thompson Project that may affect threatened or endangered species in Platte River habitats. These species included, but were not limited to, the bald eagle, whooping crane, interior least tern and piping plover. In its request, Reclamation cited correspondence with the Service on October 2, 1980, and November 4, 1980, which initiated consultation on the operation of various facilities along the east and west slopes of the Rocky Mountains, although consultation on the North Platte facilities was subsequently postponed. The effects of continued operation of Reclamation projects on federally listed endangered or threatened species and designated critical habitat in the central and lower reaches of the Platte River, are included as part of the Federal action addressed by this biological opinion (see bulleted description of the Federal action, below).

On June 2 and July 1, 1994, the Service issued final biological opinions to the U.S. Forest Service (USFS) for its proposal to reauthorize special use permits for six water-related projects in the Arapaho-Roosevelt National Forests of Colorado's "front range" area (USFWS 1994a-f). These biological opinions concluded that water depletions resulting from the existing projects were likely to jeopardize the continued existence of the whooping crane, least tern, piping plover, and pallid sturgeon. The Service also determined that the projects were likely to destroy or adversely modify whooping crane critical habitat along the central Platte River in Nebraska. In addition, the biological opinions concluded that the projects may adversely affect, but would not likely jeopardize the continued existence of the western prairie fringed orchid (*Platanthera praeclara*), bald eagle, American burying beetle (*Nicrophorus americanus*), and the Eskimo curlew (*Numenius borealis*). The Service concurred with the USFS's "no effect" determination for the peregrine falcon (*Falco peregrinus*).

The reasonable and prudent alternatives included in these six biological opinions called for each of the permittees to make an annual contribution of funds (over an interim period) to an account established at the National Fish and Wildlife Foundation (Foundation) through a cooperative agreement with the Service. The financial contribution for each project was based on the ratio of its water depletions to total basin-wide depletions. Funds from the Foundation account are dedicated toward the acquisition, conservation, recovery, and maintenance of aquatic and terrestrial habitats for federally listed species and other fish and wildlife resources occurring along the central Platte River in Nebraska.

During the course of informal consultations with other Federal agencies the Service learned that there were over 1,000 projects which may require formal consultation in the future. For example, the USFS determined that about 600 individual livestock grazing permits may require formal consultation. Informal consultations with the USFS, Natural Resources Conservation Service (NRCS), U.S. Bureau of Land Management (BLM), and the Corps revealed that most of the actions which may require formal consultation in the immediate future were likely to result in individual project depletions of 25 acre-feet or less per year. Based on available information, it appeared as though these actions would be independent from one another and widely scattered throughout the Platte River basin. The large number of pending or anticipated project proposals that would require separate section 7 consultations, combined with a limited Service staff, justified the development of a more efficient approach to facilitate the accomplishment of an immense workload. A streamlined approach was developed and implemented to allow section 7 consultations to be accomplished more efficiently under ESA and provide a mechanism for offsetting the adverse impacts of each Federal agency action on listed species and federally designated critical habitat.

On June 13, 1996, the Service issued a biological opinion on the impacts to federally listed species and designated critical habitat resulting from Federal agency actions which individually result in annual water depletions of 25 acre-feet or less to the Platte River system. The Service concluded that these minor water depletions were likely to jeopardize the continued existence of the federally listed whooping crane, least tern, piping plover, and pallid sturgeon, and destroy or adversely modify whooping crane critical habitat along the Platte River in Nebraska. The biological opinion was subsequently amended on May 21, 1997, and September 22, 1999, and revised on March 11, 2002. The reasonable and prudent alternatives identified in the biological opinion included replacement of water depleted from the Platte River or funding of land and water conservation measures in the central Platte River area.

Through the analysis of all the section 7 consultations described above, the Service has repeatedly concluded that the Platte River resource is (and has been for some time) significantly degraded and unable to adequately support both the aquatic and terrestrial habitats necessary for survival and recovery of the target species without the implementation of conservation measures that would offset these effects. Federal agency actions resulting in water depletions to the Platte River will further or continue the deterioration of the remaining stressed habitat conditions unless they incorporate adequate offsetting measures or adopt reasonable and prudent measures to ensure compliance with ESA.

In addition to the interim funding of conservation measures described above, the reasonable and prudent alternatives for the USFS projects consulted on in 1994, and the majority of subsequent biological opinions, included participation in a basin-wide, research and recovery Program for the whooping crane, interior least tern, piping plover and pallid sturgeon. The need for such a basin-wide approach eventually led to the development of the Program evaluated in this final biological opinion.

CNPPID hydrocycles to generate power when water supply is low. Recently, discussions between the Service and CNPPID have been initiated to develop an agreement to address the effects of hydrocycling on the avian target species in the central Platte River by avoiding or minimizing effects of hydrocycling to listed species and to Program benefits. CNPPID’s practice of hydrocycling is not part of this Federal action (i.e., the proposed Program), but is related to a different Federal action (i.e., the license for FERC Project No. 1417 discussed below). The effects of hydrocycling are included as part of the environmental baseline in this biological opinion.

## *A. Development of a Basin-Wide Recovery Program*

Since 1994, the Service has issued numerous biological opinions on the impacts of Federal projects which result in water depletions to the Platte River system. Each of those opinions concluded that the project would likely jeopardize the continued existence of one or more of the four target species (i.e., the whooping crane, interior least tern, piping plover and pallid sturgeon) and result in the destruction or adverse modification of designated or proposed critical habitat. In addition, each of those opinions identified the need for the development and implementation of a basin-wide Program, and participation of the project proponent in that Program, as part of a reasonable and prudent alternative. The projects that depend on the implementation of the Program as part of a reasonable and prudent alternative to avoid the likelihood of jeopardy to one or more of the target species and adverse modification of critical habitat are identified in Appendix C.

On July 25, 1997, the Service issued a final biological opinion to the Federal Energy Regulatory Commission (FERC) for its proposal to relicense hydroelectric projects owned and operated by the Central Nebraska Public Power and Irrigation District (CNPPID) and the Nebraska Public Power District (NPPD)(USFWS 1997). The Service concluded that water depletions resulting from the existing projects were likely to jeopardize the continued existence of the whooping crane, least tern, piping plover, and pallid sturgeon, and result in the destruction or adverse modification of whooping crane critical habitat along the central Platte River in Nebraska. The reasonable and prudent alternative for the proposed relicensing action was partially based on implementation of a Memorandum of Agreement (1994) and Cooperative Agreement that was signed by the Secretary of the Interior and the Governors of the three Platte River basin states (i.e., Colorado, Nebraska, and Wyoming [States]) on June 10, 1994, and July 1, 1997, respectively, and the ultimate implementation of a Program. The intent of this Program is to protect, conserve and assist recovery of the federally listed whooping crane, interior least tern, piping plover, and pallid sturgeon and their associated habitats in the central and lower reaches of the Platte River in Nebraska. The Program is also intended to protect designated critical habitat for the whooping crane and help prevent the need to list additional Platte River basin associated species pursuant to ESA.

The original Cooperative Agreement was to expire on July 1, 2000, but was extended through mutual agreement among the participants until December 31, 2000, and then, subsequently, until: June 30, 2003; July 31, 2003; August 31, 2003; December 31, 2003; June 30, 2005; December 31, 2005; and most recently, October 1, 2006.

The Program is intended to improve habitat conditions sufficiently during the first increment to provide ESA compliance for existing and certain new water-related activities in the Platte River basin upstream of the Loup River confluence that elect to participate in the Program. These existing and certain new water-related activities include:

a) All Federal actions that have previously undergone formal section 7 consultations and were found by the Service to likely jeopardize one or more of the target species and which are dependent on the Program to serve as the reasonable and prudent alternative for their continued operation. Appendix C lists those actions resulting in annual depletions in excess of 25 acre-feet and actions resulting in annual depletions of 25 acre-feet or less.

b) Operation of existing water-related activities (i.e., operating as of July 1, 1997) occurring upstream of the confluence of the Loup and Platte rivers that have not undergone section 7 consultation.

c) New water-related projects (Federal, State, and private) or expansion of existing water-related projects that occur on or after July 1, 1997, and which are covered by the Federal or the respective States' new depletion plans. New water-related activities beyond the scope of the new depletion plans will be addressed through separate section 7 consultations.

Beginning in 1998, Reclamation and Service biologists developed an initial comprehensive list of federally listed or proposed species in the Platte River basin. As specifics of the Program were developed, the comprehensive list was amended to include only those listed species in the action area whose habitats may be directly or indirectly affected by the Federal action. These species and their critical habitats are discussed at the end of this Consultation History section.

On July 6, 2004, the Service and Reclamation requested initiation of formal consultation pursuant to section 7(a)(2) of the ESA on the effects of the Program as well as the continued operation of certain Service and Reclamation water-related activities on federally listed species and designated critical habitat in the central and lower reaches of the Platte River. Attached to that letter of initiation were a Draft Environmental Impact Statement (DEIS) dated December 2003, (which served as the draft biological assessment (BA) of the effects of the Federal action for the draft biological opinion); draft Program documents dated in December, 2003, and June 17, 2004, describing a Program still under development; and Reclamation project descriptions for the Colorado-Big Thompson Project, the North Platte Project, the Glendo Project, the Kendrick Project, and the Kortes Project.

A working draft biological opinion on the draft Program and DEIS was made available on August 6, 2004, for review by the Governance Committee (including Reclamation and the Service) of the Program. On August 31, 2004, the Service decided not to issue the working draft biological opinion, but to wait until the Final Program details were developed and approved by the Program participants and a final EIS prepared on the effects of that approved Program.

On December 27, 2005, the letter of initiation was updated and included the following description of the Federal action:

- The participation of the Interior, through Reclamation and the Service, in funding and implementing the Platte River Recovery Implementation Program to improve and maintain habitat for the whooping crane, interior least tern, piping plover, and pallid sturgeon (the target species). The first stage of the Program spans a period of 13 years, and is to begin on October 1, 2006, following completion of a final biological opinion (FBO), a record of decision, and a signed Program Agreement between Interior and the States of Colorado, Nebraska, and Wyoming.

- The continued operation of existing and certain new Federal water-related activities during the first 13-year stage of the Program, including Reclamation and Service projects in the action area.

The continued operation of existing and certain new Federal water-related activities are included in this consultation only "…insofar as they affect the target species and critical habitat in the action area and other federally-listed species associated with the central and lower Platte River." (page 2, December 27, 2005, letter of initiation). Not within the scope of this programmatic biological opinion are the effects from continued operation of Reclamation and other Federal water related activities to other (non-target) listed species and critical habitats outside of the central and lower reaches of the Platte River. Reclamation has determined that sufficient information does not exist to determine the effects of some operational activities on upstream species (e.g., Preble's meadow jumping mouse, Ute ladies'-tresses orchid, Colorado butterfly plant and bald eagle) and critical habitat (e.g., Preble's meadow jumping mouse, Colorado butterfly plant) and informal consultation begun in 1988 on those effects continues. Reclamation has begun to collect needed information and will conduct the necessary field investigations in 2007 and 2008. Upon collection and analysis of this information, Reclamation will determine if operations of the identified Reclamation projects adversely affect non-target, federally listed or proposed species, or designated or proposed critical habitats, and take appropriate actions if effects to listed species are identified.

On February 15, 2006, the letter(s) of initiation was amended to provide information relevant to the consultation that was not previously available. The new information relates to the location of water leasing activities in the North Platte basin in Wyoming that may occur as part of the Program and how it may or may not affect three listed species in Wyoming (described in the *Determinations of Effects from the Federal Action* section below).

This final biological opinion is based on the information included in the July 6, 2004, letter initiating formal consultation, as amended and updated on December 27, 2005 and February 15, 2006. Attachments to the December 27, 2005, letter included the final Program proposal, as approved by the Program participants, on December 7, 2005, and a draft Final Environmental Impact Statement (FEIS), dated December 2005, which serves as the biological assessment (BA) of the effects of the Federal action. The December 2005, final Program documents and the December 2005, draft of the FEIS supersede previous drafts of these documents and constitute the most current information available at the time this biological opinion evaluation was done.

Notable changes to the species information in the draft FEIS include: a) removal of the discussion of effects on the black-tailed prairie dog because the species was found to be not warranted for listing on August 18, 2004; b) addition of information to describe effects to critical habitat that was designated for the Colorado butterfly plant (*Gaura neomexicana* spp. *coloradensis*) on January 11, 2005; c) removal of the Eskimo curlew from the species list by the Service due to a lack of acknowledged sightings in the action area for a prolonged period of time; and, d) modification to designated critical habitat for the piping plover, because critical habitat designated for the species in Nebraska was vacated by the Nebraska District Court on October 13, 2005, and remanded to the Service for redesignation.

### *B. Determinations of Effects from the Federal Action*

The water management and land management components of the Program are expected to provide benefits as well as adversely affect listed species in the central and lower reaches of the Platte River. When both beneficial and adverse effects are likely, regardless of the net effect, the appropriate effects determination is "may affect, likely to adversely affect" and the requirement to formally consult under section 7 of the ESA is triggered. Therefore, the Service concurs with the FEIS determinations that implementation of the full array of recovery actions identified in the Program may affect, and is likely to adversely affect, the following federally listed endangered or threatened species in the central and lower reaches of the Platte River: the whooping crane and its designated critical habitat, the interior least tern, the northern Great Plains population of the piping plover, the pallid sturgeon, the western prairie fringed orchid, and the bald eagle.

The leasing of water rights to increase available water supply is a site-specific Program activity that may occur in Wyoming and Nebraska. For a variety of reasons (i.e., institutional constraints and Wyoming water law, as described in the FEIS; and information contained in the Boyle Report (1999) and Water Plan), the likelihood of any Program water leasing occurring outside of the Kendrick Project area in the North Platte River basin in Wyoming (i.e., between Seminoe Reservoir and the City of Casper) is considered to be discountable. The Kendrick Project area is not within the range of occurrence of the Preble's meadow jumping mouse (*Zapus hudsonius preblei*), the threatened Colorado butterfly plant, and the critical habitat designated for these species, and water leasing within the Kendrick Project will not have direct or indirect effects on these species or their critical habitats that occur downstream. Therefore, the Service concurs with the FEIS determination that the Program may affect, but is not likely to adversely affect, the Preble's meadow jumping mouse, the Colorado butterfly plant, or the critical habitats designated for these species.

The Kendrick Project area is within the range of the threatened Ute ladies'-tresses orchid (*Spiranthes diluvialis*); however, no populations of this species have been documented there. The amount of riparian habitat for species within the Kendrick Project area is very limited, and the suitability of potential habitat in this area is reduced further due to selenium contamination and poor soil quality. In addition, due to the short-term duration (two years maximum) of temporary water leasing activities allowed by Wyoming water law, the likelihood of adverse effects to the Ute ladies'-tresses orchid is low, even if water leasing occurred in an area where the species occurred. Therefore, the likelihood of water leasing adversely affecting suitable and/or occupied habitat of the species is likewise discountable and/or insignificant, and the Service concurs with the FEIS determination that the Program may affect, but is not likely to adversely affect the Ute ladies'-tresses orchid.

In its July 6, 2004, letter of initiation (pages 8 and 9), Reclamation and the Service proposed to avoid adverse effects to the habitat of the critically endangered Wyoming toad (*Bufo baxteri*) from Program activities by avoiding water leasing within occupied habitat of the species, the only potential effect to the Wyoming toad identified. The proposed measure would avoid water leasing within occupied habitat of the Wyoming toad. On the basis of the assurance to avoid adverse impacts to this species, the Service concurs with the effects determinations in the FEIS that the Program may affect but is not likely to adversely affect the Wyoming toad. Table II-B1 includes the list of species, the determination of the effects of the Federal action on these species, and the rationale.

**Table II-1. List of species and critical habitat in the action area, their status, the Service's determination of the effects of the Federal action, and supporting information.**

| Species | Status | Effects Determination | Comments |
|---|---|---|---|
| **Target Species** | | | |
| Least tern (*Sterna antillarum*) | Endangered | Likely to adversely affect | ▸ Beneficial and adverse effects to species are likely from one or more elements of the Federal action, including Program water and land management activities |
| Pallid sturgeon (*Scaphirynchus albus*) | Endangered | Likely to adversely affect | |
| Piping plover (*Charadrius melodus*) | Threatened | Likely to adversely affect | |
| Whooping crane (*Grus americana*) | Endangered | Likely to adversely affect | |
| **Other Listed Species** | | | |
| Western prairie fringed orchid (*Platanthera praeclara)* | Threatened | Likely to adversely affect | ▸ Beneficial and adverse effects are likely from one or more elements of the Federal action, including Program water and land management activities |
| Bald eagle (*Haliaeetus leucocephalus*) | Threatened | Likely to adversely affect | ▸ Beneficial and adverse effects are likely from one or more elements of the Program, including water and land management activities<br>▸ Effects of continued operations of Reclamation and Service projects upstream of the central Platte River on this species are beyond the scope of this biological opinion and were not considered. |
| Preble's meadow jumping mouse (*Zapus hudsonius preblei*) | Threatened | Not likely to adversely affect | ▸ The likelihood of Program water leasing activities occurring within the range of these species is insignificant or discountable.<br>▸ No other Program activities are expected to occur within these species range.<br>▸ In the Platte River basin, only occurs upstream of the central Platte River reach.<br>▸ Effects of continued operations of Reclamation and Service projects upstream of the central Platte River on these species are beyond the scope of this biological opinion and were not considered. |
| Colorado butterfly plant (*Gaura neomexicanus* spp. *coloradensis*) | Threatened | Not likely to adversely affect | |

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| Ute ladies' tresses (*Spiranthes diluvialis*) | Threatened | Not likely to adversely affect | ▸ Probability of Program activities adversely affecting this species is discountable or insignificant, based on habitat availability, and 2-year limits on water leasing.<br>▸ In the Platte River basin, only occurs upstream of the central Platte River reach.<br>▸ Effects of continued operations of Reclamation and Service projects upstream of the central Platte River on this species are beyond the scope of this biological opinion and were not considered. |
| Wyoming toad (*Bufo baxteri*) | Endangered | Not likely to adversely affect | ▸ The action agencies agree to avoid adverse effects to this species' habitat by declining any Program water leases that would affect occupied habitat of the species.<br>▸ In the Platte River basin, only occurs upstream of the central Platte River reach.<br>▸ Effects of continued operations of Reclamation and Service projects upstream of the central Platte River on this species are beyond the scope of this biological opinion and were not considered. |
| American burying beetle (*Nicrophorus americanus*) | Endangered | Not likely to adversely affect | ▸ Likely effects from Program are anticipated to be wholly beneficial because the species uses grasslands that are expected to increase under Program land and water activities.<br>▸ Continued operation of Reclamation and Service projects have no effect on this species because operations do not affect the species habitat. |
| Black-footed ferret (*Mustela nigripes*) | Endangered | No effect | ▸ Although the species occur within the Platte River basin, these species are not expected to be affected by components of the Program because Program actions will not occur in habitat used by these species.<br>▸ In the Platte River basin, only occurs upstream of the central Platte River reach.<br>▸ Effects of continued operations of Reclamation and Service projects upstream of the central Platte River on this species are beyond the scope of this biological opinion and were not considered. |
| Canada lynx (*Lynx canadensis*) | Threatened | No Effect | |
| North Park phacelia (*Phacelia formosula*) | Endangered | No effect | |
| Eskimo curlew (*Numenius borealis*) | Endangered | No effect | ▸ Believed to be extirpated from Nebraska due to lack of confirmed (accepted) sightings since 1926. |

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|---|---|---|---|
| **Critical Habitat** | | | |
| Whooping crane critical habitat | Designated | Likely to adversely affect | ▸ Beneficial and adverse effects to the primary constituent elements are anticipated from the Federal action, including one or more elements of the Program. |
| Preble's meadow jumping mouse critical habitat | Designated | Not likely to adversely affect | ▸ The likelihood of Program water leasing activities occurring within designated critical habitat is insignificant or discountable.<br>▸ In the Platte River basin, only occurs upstream of the central Platte River reach.<br>▸ Effects on critical habitat from continued operations of Reclamation and Service projects upstream of the central Platte River were not considered. |
| Colorado butterfly plant critical habitat | Designated | Not Likely to adversely affect | |

# III. Scope of the Biological Opinion

The scope of this programmatic, intra-Departmental section 7(a)(2)consultation is somewhat unusual due to the complexity, intent, and incremental nature of the Program. Consequently, the scope of this biological opinion serves several functions. These functions include:

a) To determine whether the Federal action, as defined in the following chapter, will likely jeopardize the continued existence of federally listed species in the Platte River basin, or adversely modify their critical habitats. This consultation covers: a) implementation of the Program for 13 years, the anticipated first stage of the Program; and b) continued operation of existing and certain new Federal water-related activities including, but not limited to Reclamation and Service projects that are (or may become) dependent on the Program for ESA compliance during the first 13-year stage of the Program for their effects on the target species and other listed species that rely on central and lower Platte River habitats.

b) To determine if full implementation of the Program can reasonably be expected during the first 13 years of the Program to provide ESA compliance for effects to the target species and other listed species and critical habitat in the central and lower Platte River from existing water-related activities and new water-related activities that are covered by the Federal and State's new depletion plans.

c) To define the types of water-related activities that are, and are not, within the scope of this consultation.

d) To describe which aspects of the Program are, and are not, within the scope of this consultation.

e) For those water-related activities within the scope of this consultation, to describe the streamlined consultation process to be used subsequent to implementation of the Program for those consultations where applicants elect to participate in the Program.

## *A. Program Effects on Threatened or Endangered Species*

Section 7(a)(2) of the ESA requires that Federal agencies satisfy two standards in carrying out their programs. Federal agencies must insure that the activities that they authorize, fund, or carryout are not likely to: a) jeopardize the continued existence of any listed species; or b) result in destruction or adverse modification of designated critical habitat.

The pertinent terms are defined as follows:

> "Jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the

survival and recovery of a listed species in the wild by reducing the reproduction, numbers or distribution of that species (50 CFR § 402.02).

"Survival" is the species persistence with sufficient resilience to allow recovery from endangerment. In other words, it is the condition in which a species continues to exist indefinitely into the future, while retaining the potential for recovery, and is characterized by favorable population parameters and an environment that provides all requirements for completion of the species entire lifecycle (Endangered Species Consultation Handbook, USFWS and NMFS, 1998, p 4-35)

"Recovery" is the process by which species ecosystems are restored and threats to the species are removed so self-sustaining and self-regulating populations of listed species can be supported as persistent members of native biotic communities (50 CFR § 402.02).

"Critical habitat" refers to: a) the specific areas within the geographic area occupied by a species, at the time it is listed in accordance with the ESA, on which are found those physical or biological features (1) essential to conserve the species and, (2) that may require special management considerations or protection; and b) specific areas outside the geographic area occupied by a species at the time it is listed, upon determination that such areas are essential to conserve the species (16 U.S.C. 1531, et seq).

"Take" is defined by the ESA (section 3(19)) to mean "*to harass, harm, pursue, hunt, shoot, wound, kill trap, capture, or collect, or attempt to engage in any such conduct.*" Incidental take statements are included in all formal consultations, except those only involving plants, and exempt action agencies and their permittees from ESA's section 9 prohibitions if they comply with the reasonable and prudent measures and the implementing terms and conditions of incidental take statements (Endangered Species Consultation Handbook, USFWS and NMFS, 1998, pages 4-45 to 4-52).

This biological opinion does not rely on the regulatory definition of "destruction or adverse modification of critical habitat" at 50 C.F.R. 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the analysis with respect to critical habitat.

In determining whether the Federal action is likely to jeopardize the continued existence of any listed species or adversely modify any critical habitat, the Service examined the effects of the Program in combination with the aggregate effects of all factors that have led to the current status of the species and their habitat. These factors include the status of the species, the environmental baseline, and the cumulative effects of other anticipated State and private actions in the action area.

The action area for this consultation is the Platte River basin upstream of the confluence with the Loup River in Nebraska, and the mainstem of the Platte River downstream of the Loup River confluence.

A comprehensive list of all of the federally listed or proposed threatened or endangered species in the Platte River basin was developed and evaluated for potential impacts from the Program.

The comprehensive list was further refined to include only those listed species in the action area whose habitats may be directly or indirectly affected by the Federal action. This biological opinion assesses effects of the Program on the endangered whooping crane, interior least tern, pallid sturgeon, Wyoming toad, American burying beetle, and western prairie fringed orchid; the threatened northern Great Plains population of the piping plover, bald eagle, Preble's meadow jumping mouse, Ute ladies'-tresses, and Colorado butterfly plant; and federally designated critical habitats for the whooping crane, Preble's meadow jumping mouse, and Colorado butterfly plant.

The Program is designed to be implemented in stages, the first of which is planned for a period of 13 years. All pertinent information, including information collected through monitoring and research accomplished by the Program, will be used near the end of the first 13 years to evaluate the effects of management activities and to design Program objectives and activities for development of a potential second increment. Components of the first 13 years of the Program are the subject of this consultation. Management actions to be applied during the next stage of the Program will be evaluated through a separate section 7 consultation prior to implementation of that stage.

## *B. ESA Compliance*

As discussed above, the intent of the Program is to provide measures that offset the adverse effects of water resources development in the basin sufficiently to provide ESA compliance during the first 13 years of the Program for continued operation of existing water-related activities and new Federal, State, and private water-related activities that are or will be covered by the State or Federal new depletions plans. This programmatic biological opinion provides ESA compliance for the Federal action for, a) the effects of the Program on all listed species in the action area and, b) the effects of the continued operations of existing and certain new water-related activities that elect to participate in the Program, including Service and Reclamation projects on the North Platte and South Platte rivers, as they affect the target species and critical habitat in the action area and other federally listed species associated with the central and lower Platte River. The effects from continued operation of certain Reclamation projects on other (non-target) listed species and critical habitats outside of the central and lower reaches of the Platte River are not within the scope of this programmatic biological opinion. The Service and Reclamation are currently involved in informal consultation regarding those effects as described in the *Consultation History* section of this biological opinion.

The effects of some Program components have not yet been described in the detail necessary to evaluate their site-specific effects. For example, various water supply and conservation projects have been generally described at the reconnaissance-level in the Program's Water Action Plan, but the specifics regarding location and/or operation of the projects are yet to be determined. Separate section 7 consultation will need to be conducted on the direct physical effects ("footprints") of each such project as it moves from the reconnaissance to the feasibility phase in planning during the first Program stage. Similarly, the specific locations of certain Program components described in the Program documents and FEIS are not known at this time (e.g., site-specific impacts from management plans for Program lands and downstream impacts of water leasing on specific tracts). Because footprint impacts from these activities to federally listed species and designated critical habitats cannot be evaluated at this time, we do not exempt take at the project level for these activities. The impacts of these Program-related activities will need to be reviewed by the Service prior to their implementation, pursuant to section 7 and 9 of the ESA, for take to be accurately estimated and exempted. Future consultations on these Program activities will tier from this programmatic biological opinion and will be conducted, as needed, when those activities are specifically identified and proposed.

## *C. Section 7 Consultation Procedures Following Implementation of the Program*

With the Program in effect, ESA section 7 consultation involving the continued operation of existing Service and Reclamation projects on the North Platte, South Platte, and Platte Rivers during the first increment of the Program is complete regarding effects of Service and Reclamation "existing water-related activities"[3] on the target species and critical habitat in the action area and other federally listed species associated with the central and lower Platte River. Future Reclamation and Service actions during the first increment involving existing water-related activities included within the scope of this biological opinion are not subject to further section 7 consultation for the target species, critical habitat, and other listed species associated with the central and lower Platte River (e.g., renewal of Reclamation water service contracts). The action agency will provide written documentation of such actions to the Service.

Issuance of this biological opinion and the implementation of the Program does not eliminate the need for other Federal agencies to consult with the Service on the effects of existing and future water resource development projects on federally listed species and designated critical habitats in the Platte River basin. With the Program in effect, ESA section 7 consultations involving certain "new water-related activities" of Reclamation and the Service, other Federal agency activities with a federal-nexus (both existing and certain new water-related activities), and their effects on listed species and designated critical habitat in the central and lower Platte River would proceed in a streamlined manner and "tier" from this programmatic biological opinion. For those projects that are within the scope of this biological opinion, ESA compliance applies only to water-related activities as they affect the target species and their critical habitat in the action area, and other listed species in the central and lower Platte River in Nebraska. As noted above, other impacts (e.g., footprint impacts) on any federally listed or proposed threatened or

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[3] The term "water-related activities" means activities and aspects of activities which (1) occur in the Platte River basin upstream of the confluence of the Loup River with the Platte River; and (2) may affect Platte River flow quantity or timing, including, but not limited to, water diversion, storage and use activities, and land use activities. Changes in temperature and sediment transport will be considered impacts of a "water related activity" to the extent that such changes are caused by activities affecting flow quantity or timing. Impacts of "water related activities" do not include those components of land use activities or discharges of pollutants that do not affect flow quantity or timing. "Existing water related activities" include surface water or hydrologically connected groundwater activities implemented on or before July 1, 1997. "New water-related activities" include new surface water or hydrologically connected groundwater activities including both new projects and expansion of existing projects, both those subject to and not subject to section 7(a)(2) of the ESA, which may affect the quantity or timing of water reaching the associated habitats and which are implemented after July 1, 1997.

endangered species, or designated or proposed critical habitats are not within the scope of this biological opinion. They will need to be evaluated separately via section 7 consultation with the appropriate Service office.

A subset of new and existing water-related projects includes several specific projects which have undergone formal interagency section 7 consultation for annual depletions greater than 25 acre-feet. Since June 2, 1994, over 40 such Federal actions which result in such depletions to the Platte River flows have undergone formal section 7 consultation and resulted in determinations by the Service that those projects are likely to jeopardize the continued existence of the target species, and adversely modify federally designated critical habitat of the whooping crane. Depletions to the Platte River from these projects total approximately 47,010 acre-feet annually (Appendix C, Table 2; total not including depletions resulting from relicensing of Kingsley Dam). Where applicable, the Service has included the project sponsors' future participation in the Program as part of the reasonable and prudent alternative to alleviate the likelihood of jeopardizing the continued existence of the target species and adversely modifying to critical habitat from these projects. The Service anticipates that the sponsors of these projects will choose to participate in the Program and assume any obligations required of Program participants. Project sponsors will need to contact the appropriate Service office to indicate whether they are interested in participating in the Program. Project sponsors who choose not to participate in the Program will need to reinitiate formal consultation with the Service regarding adequate alternative means of offsetting adverse effects of their projects on the target species and designated critical habitat.

Each State and Federal new depletions plan (Attachment 5, Sections 7 through 10 of the Program documents) describes the means by which new Platte River basin water related activities, both those subject to and those not subject to section 7, will be addressed following implementation of the Program. One purpose of these future consultations will be to ascertain whether the proposed activity falls within the scope of this programmatic biological opinion. An example of an action not within the scope includes any new water-related activity resulting in depletions to the Platte River in excess of the responsible State or Federal new depletions plan to offset that depletion relative to species and annual pulse flows, as specified in each State and Federal new depletions plan and analyzed in this opinion. A secondary purpose of the future consultations is for the Service to assess and provide a project-specific incidental take statement for the future activity if needed when sufficient project details are known to allow us to do so.

Additionally, neither the Federal or States' new depletion plans cover Federal or private water conservation activities implemented on agricultural lands in the Platte River basin that may result in new depletions. It will remain the responsibility of Federal agencies to initiate section 7 consultation with the Service, as needed, for such Federal actions.

Participation in the Program is voluntary. Federal actions proposed by non-participating entities in the Program will require individual ESA compliance measures. Non-participating projects without a Federal nexus will need to avoid violations of the section 9 prohibitions of ESA. While all Program participants and entities who are responsible for actions identified in this biological opinion have agreed to implement the recovery action, nothing contained in the biological opinion alters or amends the voluntary and discretionary nature of the Program as described in the Program Document. If the proposed Program either is not implemented or is subsequently terminated, then this biological opinion becomes invalid and the affected Federal agencies are responsible for reinitiating section 7 consultations on their individual Federal actions.

Similarly, this biological opinion is dependent on the efficient and complete implementation of Program activities. ESA compliance provided by this biological opinion is only valid for all water-related activities participating in the Program if all Program Signatories and entities that are responsible for actions identified in this biological opinion carry out their obligations agreed to under the Program.

# IV. Description of the Federal Action

The Federal action addressed by this consultation is: a) the participation by Interior, through Reclamation and the Service, in funding and implementing the Platte River Recovery Implementation Program and, b) the continued operation of existing and certain new water-related activities that elect to participate in the Program during the first increment, including Reclamation and Service projects in the Platte River basin insofar as they affect the target species and their critical habitat in the Platte River basin and other federally-listed species associated with the central and lower reaches of the Platte River. The Program, when implemented, is intended to satisfy Reclamation's and the Service's ESA formal consultation requirements for the continued operation of existing water-related activities and provide a process for ESA compliance for certain new water-related activities during the13 year increment of the Program and to the extent described above. Participation in the Program and implementation of the recovery actions discussed in this biological opinion address Reclamation's and the Service's application of section 7(a)(1) of the ESA.

This biological opinion is based on the description of the Program provided in the "Platte River Recovery Implementation Program" document (Program Document and its attachments), dated December 7, 2005, and the information and analyses of effects for the Governance Committee Alternative in the FEIS (GC Alternative). Full implementation of the Program will involve participation by the Signatories of the Cooperative Agreement, as well as non-governmental organizations representing various environmental groups, water users, and the public.

The Program Document is included in its entirety in Appendix D of this biological opinion. A complete list of the Program Document and its attachments can be found in Table IV-1 below. An interpretive summary of these documents, to the extent possible, is provided in Sections C and D below. The Description of the Program in section C, below, does not alter or amend the provisions in the Program Document.

## *A. Description of the Program in the FEIS*

The description of the Program in the FEIS (i.e., GC Alternative) and the analyses of its effects on the target species and their central and lower Platte River habitats from full implementation is the primary source of information upon which this biological opinion is based. Because the FEIS analyzes the effects of the Program in combination with all existing water-related activities in the Platte River basin, it serves as the biological assessment for the effects of Reclamation and Service activities on the target species and other listed species associated with the central and lower Platte River (the Federal action) and can serve as the same for other water-related activities in the basin (Federal and non-Federal) which require ESA consultation and elect to participate in the Program.

The goals and objectives of the Program were used to guide formulation of the GC Alternative. Generally, the Program includes the following elements:

a) long and short-term objectives and goals;

b) a first Program stage of 13 years with an intent for future stages;

c) a funding commitment and commitment by the States and Interior to cooperate on implementing the Program;

d) milestones for completion of Program elements;

e) an integrated monitoring and research program to monitor habitats and species' use of the action area to determine the effect of Program measures and the needs of pallid sturgeon, and to provide information necessary to support an effective adaptive management process;

f) specific remedial measures to offset the adverse effects of existing water-related activities in the Platte River basin, including:

   1) a land component consisting of protection and restoration of 10,000 acres of habitat during the first stage; and

   2) a water plan, consisting of a variety of activities to reduce shortages to target flows;

g) depletion plans developed by the States and Federal government to offset future depletions from new water-related activities; and

h) an organizational structure.

The Program also incorporates the intent of the Program participants (and other project sponsors, should they choose to participate) that the Program will provide ESA compliance for effects on the target species and federally designated critical habitat in the central and lower Platte River for 13 years from flow depletions caused by existing and new water-related activities, as defined previously. The remedial measures provided by the Program via the Water Plan and Land Plan are intended to offset the adverse impacts of existing water-related activities, while the State and Federal new depletions plans are designed to prevent or offset adverse impacts from new water-related activities.

The effects of the Program on the target species and their habitats can vary significantly depending on how land and water management actions are implemented. For example, Program land acquisition must be accomplished via willing buyer-willing seller arrangements; therefore, the location and restoration of specific parcels of land cannot be definitively identified prior to Program implementation. Based upon meeting the overall objectives for habitat, an illustrative scenario for land acquisition and management was analyzed in the FEIS. While the ultimate plan implemented for the Program will differ in specific location and management of each land parcel, the overall scale of actions, the types of actions, and, hence, their overall effect on key habitat characteristics should be similar to those produced by this scenario. For this reason, this biological opinion evaluates the impacts described in the FEIS analyses as the GC Alternative, which provides a reasonable approach to the full 13-year Program implementation, to determine whether or not the Program is likely to jeopardize the continued existence of any federally listed species or adversely modify designated critical habitat in the action area.

Governance Committee Alternative:

Inherent aspects of the Program (e.g., the willing seller/buyer provision and adaptive management component) make it challenging to project the degree and location of habitat improvement that may be accomplished during the first stage of the Program and the environmental consequences that would likely result. Three variables were modeled to determine the Program's assumed effects for the first 13-year stage: a) the location of Program lands; b) the extent of habitat restoration; and c) the Program's ability to deliver water to the habitat. A detailed description of the GC Alternative is found on pages 3-29 through 3-56 of the FEIS.

For the GC Alternative, an emphasis is placed on managing lands in the upstream reach of the habitat area, on restoration of habitat lands, on increasing channel capacity at North Platte, and increasing the Program's ability to create short-term high flows near bankfull capacity in the habitat reach. This implementation scenario illustrates reasonable outcomes and environmental impacts for the Program in terms of the extent of land restoration, channel restoration, sediment distribution, and impacts on the flows in the habitat area.

Location of Program Lands:

Program land interests are focused on the river above Minden, Nebraska, with a target of 6,400 acres of Program habitat complexes in this reach and the remaining 2,800 acres between Minden and Chapman, Nebraska.

Extent of Habitat Restoration:

The focus is on restoration of habitat, as opposed to merely protection of existing habitat, with roughly 50 percent of Program lands undergoing significant restoration or enhancement (change in cover type or land category) during the Program's first stage. Restoration of riverine habitat includes both clearing vegetation from islands and banks and lowering the elevation of cleared islands to improve open view across the channel area and to return island sand (i.e., sediment) back to the river. Sand from these islands is moved back into the river channel to help offset the downcutting of the river in the habitat reach. Restoration of Program lands under the GC Alternative is described on pages 3-53 to 3-55 of the FEIS.

Program Capacity to Move Water:

The FEIS analysis assumes that two water-related objectives are accomplished: a) the safe channel capacity of the North Platte River at North Platte is increased to 3,500 cfs; and b) the Program can deliver 5,000 cfs of Program water for three days to the upper end of the associated habitat (at Overton gauge) for pulse flows when other demands for conveyance of water deliveries are low (normally September 1 to May 31) and quantities of Program water are likely to yield 800 cfs at the central Platte River habitat area during the irrigation season.[4] Also assumed is that water is conveyed to the habitat area without fluctuations due to hydrocycling. (The FEIS did not analyze potential impacts associated with future hydrocycling operations from the J-2 Return). These and other modeling assumptions are discussed in VII. *Effects of the Action*, and B.2. *Assumptions Used in Modeling and Analysis*.

The Program's capacity to create short-duration, high flows near bankfull in the habitat area is increased by using various facilities in the CNPPID and NPPD system (Lake Maloney, Johnson Lake, and Plum Creek Lake) to store and release a two-day pulse from the Jeffrey and J-2 return canals in combination with EA releases from Lake McConaughy. The options for accomplishing this are described in more detail on pages 3-37 and 3-40 of the FEIS.

## *B. Interdependent and Interrelated Actions*

In determining the effects of a Federal action, the Service must analyze the effects of activities which are interrelated and interdependent with the Federal action. Interrelated actions are part of a larger action and depend on the larger action for their justification. Interdependent actions have no independent utility apart from the action under consideration (50 CFR § 402.02). The effects of interrelated and interdependent actions are combined with the effects of the Federal action subject to consultation.

Included as interrelated with the Federal action are non-Federal projects such as existing and certain new non-Federal water-related activities (i.e., those with no Federal nexus). These non-Federal water-related projects are dependent on the Program and therefore are analyzed in this biological opinion.

## *C. Program Document*

The Program Document and its attachments are listed in Table IV-1. The Cooperative Agreement is included which is to be signed by the Signatories (i.e., the Governors of Wyoming, Colorado, and Nebraska, and the Secretary of the Department of the Interior) to document their agreement to participate in and implement the Program. For full text detail of the various Program documents, see Appendix D of this biological opinion.

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[4] The GC Alternative commits to restoring at least 3,000 cfs of safe-channel conveyance capacity in the North Platte River by year 5 of the Program as part of a suite of activities to test the Program's ability to deliver 5,000 cfs of Program water to the habitat reach for 3 days during the nonirrigation season. For the FEIS analysis, the conveyance capacity of this reach was set at 3,500 cfs to facilitate modeling the quantity of water required to achieve the 5,000 cfs target. However, it is recognized that measures other than establishing this conveyance capacity are likely to be tested as viable alternatives during the Program's first increment (FEIS Chapter 5).

**Table IV-1. Platte River Recovery Implementation Program, December 7, 2005**

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| **Agreement** | Platte River Recovery Implementation Program Cooperative Agreement | |
| **Program Document** | Final Draft Platte River Recovery Implementation Program | |
| **Attachment 1** | | Finance Document, Crediting and Exit Principles, and Program Budget |
| **Attachment 2** | | Milestones Document |
| **Attachment 3** | | Adaptive Management Plan (December 16, 2005) |
| | Appendix A | Peer-Review Guidelines |
| | Appendix B | Models |
| | Appendix C | Additional Hypotheses Identified |
| | Appendix D | Protocols |
| **Attachment 4** | | Land Plan |
| | Appendix A | Platte River Program Land Evaluation Worksheet |
| | Appendix B | Examples of Federal, State, and Local Programs that may Contribute Protected Land or Funds Toward Habitat Restoration During the Program |
| | Appendix C | Compatible Use of Program Lands |
| | Appendix D | Species of Concern – Initial List |
| | Appendix E | Land Plan Glossary |
| | Appendix F | Map List and Source |
| | Tabs 1 – 4 | Excerpts – Program Goals and Objectives, Land Component, Adaptive Management, Draft Land Advisory Committee Charter |
| **Attachment 5** | | Water Plan |
| | Section 1 | Program Water Management Process |
| | Section 2 | Channel Capacity of the North Platte River |
| | Section 3 | Colorado's Initial Water Project (Tamarack I) |
| | Section 4 | Wyoming's Pathfinder Modification Project |
| | Section 5 | An Environmental Account for Storage Reservoirs on the Platte River System in Nebraska |
| | Section 6 | Reconnaissance-Level Water Action Plan (September 14, 2000) |
| | Section 7 | Depletions Plan, Platte River, Wyoming (Wyoming's Depletions Plan) |
| | Section 8 | Nebraska New Depletion Plan |
| | Section 9 | Colorado's Plan for Future Depletions |
| | Section 10 | Federal Depletions Plan for the Platte River Recovery Implementation Program |
| | Section 11 | Water Plan Reference Materials |
| **Attachment 6** | | Organizational Structure for the Platte River Recovery Implementation Program |

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| Appendix A | Process for Selection of Environmental Entities to the Governance Committee |
| Appendix B | Process for Selection of Upper Platte Water Users Representatives to the Governance Committee |
| Appendix C | Process for Selection of Colorado Water Uses Representatives to the Governance Committee |
| Appendix D | Identification of the Downstream Water Users Representatives to the Governance Committee |
| Appendix E | Finance Committee Charter |
| Appendix F | Land Advisory Committee Charter |
| Appendix G | Technical Advisory Committee Charter |
| Appendix H | Water Advisory Committee Charter |
| Appendix I | Independent Scientific Advisory Committee Charter |

## C1. Final Draft Platte River Recovery Implementation Program

The Program Document is the principal document directing the Program. It will control, unless the Governance Committee decides otherwise, all its attachments and referenced materials. This document describes the purposes, goals, and objectives of the Program and other aspects of the Program including how Program objectives might be modified during the first stage, the concept of flexibility and change during the first stage, and certain details related to how the Program's Adaptive Management Plan, Land Plan, and Water Plan will be implemented. It also provides information about evaluating the first stage, developing subsequent stages, and expected ESA compliance provided by the Program.

## C2. Program Purposes

The purpose of the Program is to implement certain aspects of the Service's recovery plans for the target species that relate to their associated Platte River habitats by providing for the following:

a) securing defined benefits for the target species and their associated habitats[5] to assist in their conservation and recovery through a basin-wide cooperative approach agreed to by the three States and Interior;

[5] For purposes of the Program Document and its attachments, the term "associated habitats" means, with respect to the interior least tern, whooping crane, and piping plover, the Platte River valley beginning at the junction of U.S. Highway 283 and Interstate 80 near Lexington, Nebraska, and extending eastward to Chapman, Nebraska, including designated critical habitat for the whooping crane and that portion of any designated critical habitat for piping plover within that Lexington to Chapman reach. With respect to the pallid sturgeon, the term "associated habitat" means the lower Platte River between its confluence with the Elkhorn River and its confluence with the Missouri River. "Associated habitats" may, to the extent approved by the Governance Committee, include any critical habitat in the Lexington to Chapman reach of the Platte River basin which is subsequently designated by the Service for the target species. The Governance Committee may agree to undertake, fund or give credit for land activities outside the associated habitats to provide biological benefits to the target species.

b) providing ESA compliance[6] for existing and new water-related activities[7] in the Platte River basin[8];

c) helping prevent the need to list more basin associated species pursuant to the ESA;

d) mitigating the adverse impacts of new water-related activities on a) the occurrence of Service target flows; and b) the effectiveness of the Program in reducing shortages to those flows, such mitigation to occur in the manner and to the extent described in Section III.E.3 of the Program document and in the approved depletion plans; and

e) establishing and maintaining an organizational structure that will ensure appropriate State and Federal government and stakeholder involvement in the implementation of the Program.

When doing so will not reduce resources available to target species, the Program will also manage Program lands to benefit non-target listed species and non-listed species of concern to reduce the likelihood of future listing. When feasible, the Program will provide regulatory certainty for water-related impacts to the central and lower Platte River with respect to other federally-listed, non-target species.

## C3. Program Goals

The Program's long-term goal is to improve and maintain the associated habitats. This goal includes: a) improving and maintaining migrational habitat for whooping cranes, and reproductive habitat for least terns and piping plovers; b) reducing the likelihood of future

[6] For purposes of the Program document and its attachments, "ESA compliance" for the Program means: (1) serving as the reasonable and prudent alternative to offset the effects of water-related activities that Service found were likely to cause jeopardy to one or more of the target species or to adversely modify critical habitat before the Program was in place; (2) providing offsetting measures to avoid the likelihood of jeopardy to one or more of the target species or adverse modification of the critical habitat in the Platte River basin for new or existing water-related activities evaluated under the ESA after the Program was in place; and (3) avoiding any prohibited take of target species in the Platte River basin.

[7] For purposes of the Program Document and its attachments, the term "water related activities" means activities and aspects of activities which (1) occur in the Platte River basin upstream of the confluence of the Loup River with the Platte River; and (2) may affect Platte River flow quantity or timing, including, but not limited to, water diversion, storage and use activities, and land use activities. Changes in temperature and sediment transport will be considered impacts of a "water related activity" to the extent that such changes are caused by activities affecting flow quantity or timing. Impacts of "water related activities" do not include those components of land use activities or discharges of pollutants that do not affect flow quantity or timing. "Existing water related activities" include surface water or hydrologically connected groundwater activities implemented on or before July 1, 1997. "New water related activities" include new surface water or hydrologically connected groundwater activities including both new projects and expansion of existing projects, both those subject to and not subject to section 7(a)(2) of the ESA, which may affect the quantity or timing of water reaching the associated habitats and which are implemented after July 1, 1997.

[8] Platte River basin includes the basins of the South, North, and Platte Rivers.

listings of other species found in this area; and c) testing the assumption that managing flow in the central Platte River also improves habitat for the pallid sturgeon's lower Platte River habitat[9].

## C4. Program Elements

The Program Elements section of the Program Document is 20 pages long and includes six main headings (i.e., General Description, Modification of the Program, Flexibility and Change During the First Increment, Land, Water, Evaluation of First Increment and Development of Subsequent Increments). Numerous subheadings are included under each of the main headings.

**General Description:**

*Elements* - The Program has three elements: a) increasing streamflows in the central Platte River during relevant time periods through reregulation and water conservation/supply projects; b) enhancing, restoring and protecting habitat lands for the target species; and c) accommodating new water-related activities in a manner consistent with long-term Program goals.

*Increments* - The Program will be implemented in stages (referred to as "increments" in the Program documents). The first increment of the Program begins October 1, 2006, and shall continue for 13 years from that date or until any later date agreed to by the Governance Committee and as codified in an approved extension to the Program.

*Long Term Objectives* –

a) to provide sufficient water to and through the central Platte River habitat area to meet the general goal set forth in Section II (Program Goals) by reregulation and water conservation/ supply projects; and

b) to perpetually protect, restore where appropriate, and maintain approximately 29,000 acres of suitable habitat primarily in habitat complexes in the central Platte River area located between Lexington and Chapman, Nebraska[10].

*First Increment Objectives* – DOI and the States commit to achieving these objectives by the end of the first increment of the Program.

a) providing water capable of improving the occurrence of Platte River flows in the central Platte River associated habitats relative to the present occurrence of species

[9] The Integrated Monitoring and Research Plan (Attachment 3, Section V) addresses how the assumption is to be tested, including steps that will be taken to determine habitat needs of the pallid sturgeon.

[10] Non-complex habitat approved for acquisition by the Governance Committee will count toward the 29,000 acre objective because it will provide demonstrable benefits to target species as determined by Adaptive Management Plan monitoring and testing. The definitions of complex and non-complex habitat are initially set forth in the Land Plan (Attachment 4). These definitions are subject to change during the first increment through investigations in the Adaptive Management Plan.

and annual pulse target flows[11] (hereinafter referred to as "reducing shortages to target flows") by an average of 130,000 to 150,000 acre-feet per year at Grand Island, through reregulation and water conservation/supply projects[12]; and,

b) protecting, restoring where appropriate, and maintaining at least 10,000 acres of habitat in the central Platte River area between Lexington and Chapman, Nebraska.

*Subsequent Increments* - DOI and the States agree that the objectives of any subsequent Program increment will be defined before the conclusion of an increment.

*Progress toward Meeting Objectives and ESA Compliance* - ESA compliance will be measured through the achievement of the first increment Milestones (Attachment 2 of the Program document). Any milestones or other measures of ESA compliance to be used during subsequent increments will be developed prior to the beginning of such increments. Milestones may be revised by the Governance Committee so long as they are consistent with the Program and first increment objectives.

**Modification of the Program:**

*Modification of the Program by the Signatories* - The following changes during the first increment of the Program will require unanimous consent by the Secretary of the Interior and the Governors of Colorado, Nebraska and Wyoming, and will require a formal amendment of the Program Agreement and the Program Document:

a) a) Change of the first increment objectives of providing water capable of reducing the shortage to target flows by an average of 130,000 to 150,000 acre feet per year and of protecting, restoring where appropriate, and maintaining 10,000 acres of habitat for the target species;

b) Change to Section IV of the Program Document regarding regulatory certainty afforded under the Program;

c) Change to underlying principles of the Program that limit it to acquiring interest in land only from willing participants (Section III.D), that provide that the Program will pay taxes or their equivalent (per Section III.D.1.c), and that define July 1, 1997 as the date for new and existing water-related activities;

d) Increase of Signatories' funding responsibilities under the Program; or

e) Establishment of a subsequent increment of the Program.

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[11] See "Water Plan Reference Materials" (Attachment 5, Section 11). The states have not agreed that these recommendations are biologically or hydrologically necessary to benefit or recover the target species.

[12] To the extent that Service uses Program water for purposes other than reducing shortages to target flows, such use shall not decrease the target flow shortage reduction credited to the Program's initial three water projects or to any subsequently approved Program water project.

*Modifications by the Governance Committee* - Changes to the Program not reserved to the Signatories above may be made by the Governance Committee.

**Flexibility and Change During the First Increment:**

The Governance Committee will administer the Program during the first increment using a flexible and incremental approach. To further the first increment objectives, the Program Document and its attachments describe certain "activities and criteria" (e.g., milestones, Adaptive Management Plan, Land Plan, Water Plan, land and water acquisition and management criteria, management actions, and others). Except as noted in Section III.B.1 (Modification of Program above), the Governance Committee may change the Program's first increment milestones and other "activities and criteria," provided such changes are consistent with accomplishing the first increment objectives. These changes may be made and the Program will continue to provide ESA compliance during the first increment, so long as the first increment milestones, as they may be amended, are being met.

*Adaptive Management Plan* - Attachment 3 of the Program document describes a systematic process administered by the Program for continually improving management by: a) designing certain Program management activities to test hypotheses; and b) applying information learned from research and monitoring of Program management. Under a scientific-based adaptive management process, changes in management activities are expected. The Governance Committee recognizes the importance of implementing the Adaptive Management Plan (AMP) in attempting to achieve the following overall management objectives for the target species:

a) Improving production of least tern and piping plover from the central Platte River.

b) Improving survival of whooping crane during migration.

c) Avoiding adverse impacts from the Program actions on pallid sturgeon populations.

Two supporting documents are mentioned in the Program document. The "Habitat and Species Baseline" provides a summary of available information about the target species and their habitats as of 1997 (the Program uses a 1997 starting point, where possible, to assess its effects). The "Integrated Monitoring and Research Plan and Protocols" is a section of the AMP (Section V) that describes how the Program's land and water activities will be monitored and evaluated to determine species and habitat response. The monitoring and research protocols and other aspects of the AMP may be modified by the Governance Committee per Section III.B.2 (i.e., changes to the Program not reserved to the Signatories may be made by the Governance Committee).

Achieving particular results through implementation of the AMP is not the basis for determining ESA compliance during the first increment. The AMP includes investigations of alternative hypotheses that reflect differing views on the biological and other scientific aspects of the Program.

*Assessments of Activities and Criteria During the First Increment* - Program activities and criteria that guide all Program activities will be periodically evaluated by the Governance Committee. Changes to planned activities and their implementation schedule will be peer reviewed as appropriate under the Scientific Peer Review Guidelines (Attachment 3, Appendix A of the Program document) prior to action by the Governance Committee.

*Target Flows* - During the first increment, the Service's species and annual pulse target flows (Program Attachment 5, Section 11 of the Water Plan) will serve as an initial reference point for determining periods of excess and shortage in the operation of Program reregulation and water conservation/supply projects. The target flows are subject to Program peer review (during the first increment or later) and review through the AMP, and may be modified by the Service accordingly.

*Program Peer Review* - The Governance Committee may submit any Program activity or criteria, and the Service's recommended flows for peer review. Such peer review shall be conducted pursuant to the Program's Peer Review Guidelines.

*Day-to-Day Flexibility* - Documents implementing the Program provide the flexibility for day-to-day management (e.g., decisions related to weed control or grazing on a particular parcel of land). This type of management will typically not require Governance Committee approval unless they implicate a change in Program policy, increase the budget, or impact the ability of the Program to provide the offsetting measures for ESA compliance purposes.

**Land:**

Program objectives for habitat will be met through land interest acquisition, restoration, management, and maintenance. Annual progress will be dependent upon real estate market conditions and availability of willing participants. Habitat acquisition is to be on a willing seller/willing lessor basis. The Governance Committee may also agree to undertake, fund or give credit for activities outside the Lexington to Chapman reach to provide biological benefit to the target species. The land component of the Program is described in the Land Plan (Attachment 4 of the Program document).

*Acquisition of Interests in Land* - The initial focus will be on obtaining interests in and protecting wet meadow and channel habitat between Lexington and Chapman, Nebraska, which are suitable for development into "habitat complexes" as described in the Land Plan, but acquisition of non-complex lands is also expected to occur to the extent permitted in the Land Plan. Acquisition may be in the form of purchase, lease, easement or other arrangement, as described in the Land Plan. A legal entity or entities will, on behalf of the Program, hold title or other interests in land acquired by or contributed to the Program.

When less than fee simple interest in land is acquired, agreements or plans must include at least a description of land uses and management to assure that non-Program and Program uses of the land are compatible. Appendix C (Compatible Use of Program Land) contains broad descriptions of the types of provisions that the Program might negotiate to assure compatible use of Program land. Actual provisions of the agreement or other arrangements with the landowner will explicitly describe activities that are allowed, allowed with prior coordination, restricted in time or place, or prohibited, so that both the landowner and the Program have clear expectations. Compatible use activities will be negotiated on a case-by-case basis at the time the agreement or other arrangement is developed.

*Restoration and Protection of Program Lands* - Habitat management plans for managing each parcel of Program land will identify the habitat baseline for the parcel in question, adapting the appropriate recommendations of the Land Plan for the specific characteristics of the land, and developing site-specific monitoring and maintenance requirements. The Milestones explanatory information states that a management and restoration plan specific to each parcel of land protected will be prepared within one year of acquisition and implemented as provided in the plan. Habitat management practices will be evaluated as part of the Program's AMP.

*Credit Toward Program Objectives* -

a. Land protected and managed prior to July 1, 1997, for the benefit of endangered and threatened species by the Platte River Whooping Crane Critical Habitat Maintenance Trust, the National Audubon Society, and The Nature Conservancy within the associated habitats and the CNPPID (Jeffrey Island) will be credited to the Program's long-term objectives if such land meets criteria established by the Governance Committee, but not toward the objectives of the first Program increment. Lands acquired by these entities after July 1, 1997, may be contributed to the Program and counted toward first increment objectives with the approval of the Governance Committee and the managing entity.

b. Land acquired by or on behalf of existing water related activities completing section 7 consultation prior to or during the term of the July 1997 Cooperative Agreement, including NPPD's Cottonwood Ranch Property habitat lands, tern and plover islands and sandpits, lands acquired by Wyoming and any lands acquired in the associated habitats using funds contributed prior to the Program as a result of ESA consultation, will be credited to both the Program's long-term objective of 29,000 acres and the first increment objective of 10,000 acres (Table IV-2).

**Table IV-2. Existing lands to be credited toward the 10,000-acre first increment goal at Program start (i.e., 9,200 acres of habitat complexes and 800 acres of non-complex habitat).**

| First Increment Habitat Complex Lands (not less than 9,200 acres) | |
|---|---|
| NPPD's Cottonwood Ranch | 2,650 acres |
| Wyoming Property | 470 acres |
| Total | 3,120 acres |
| Non-Complex Lands (up to 800 acres) | |
| NPPD FERC License Requirement – manage tern and plover nesting habitat | |
| - Leased (Lexington Sandpit, 14.4 acres; Overton Island, 9.5 acres; and Johnson Sandpit, 9.3 acres) | 33.2 acres |
| - Owned (Elm Creek Island, 2.0 acres; Lexington Island, 3.5 acres; Blue Hole Island; 8.0 acres) | 13.5 acres |
| Total | 46.7 acres |

*Restoration on Existing Lands (i.e., to be credited towards the 10,000-acre goal at Program start)* - The Program will use management plans to describe the appropriate restoration, maintenance, and other management activities for each parcel of Program land. Any agreements, management plans, or other arrangements must be satisfactory to the Governance Committee and assure Program access and management consistent with the Program's goals and objectives. Assurances may be provided through the management plans that are required by a regulatory agency (such as the FERC-proved plan in place for NPPD's Cottonwood Ranch property) or prepared by a Signatory Project Sponsor's designated responsible agency.

Under the direction of the Executive Director, Program staff, and/or Program contractors (or Sponsors of sponsored Program lands) will carry out restoration, maintenance and management as called for in the management plans, and participate in monitoring and research. Sponsors managing Program lands pursuant to a required management plan, such as the Cottonwood Ranch property management plan, may implement their management plans directly, in accordance with their approved plans; however, periodic progress and status reports by the contractor or Sponsor will be required to ensure consistency with the Program's goals and objectives and adaptive management concepts.

**Water:**

This section under Program Elements includes the following three main headings: a) The First Increment Program Water Objective, FWS Instream Flow Recommendations for Central Platte River, and Lower Platte River Flows; b) Program Water Operations to Meet First Increment Objectives; and c) Depletions Plans to Mitigate the Impacts of New Water Related Activities).

Numerous subheadings are included under each of the main headings. For full text detail refer to Appendix D of this biological opinion.

During the first increment, progress toward meeting Program water objectives will be measured against the water-related Milestones. Program objectives for addressing the impacts of existing water related activities will be met through a combination of three initial Program projects (i.e., Tamarack I in Colorado, Pathfinder Modification in Wyoming, and the Environmental Account in Nebraska) and other water conservation/supply projects. The impacts of new water-related activities will be addressed by the States' and the Federal government through each of their respective new depletions plans.

*The First Increment Program Water Objective, FWS Instream Flow Recommendations for Central Platte River, and Lower Platte River Flows* - The entire suite of Service flow recommendations for the central Platte River are articulated in two Service documents (Bowman, 1994; Bowman and Carlson 1994). Collectively, these recommendations are intended to achieve the flow-dependent goal of "rehabilitating and maintaining the structure and function, patterns and processes, and habitat of the central Platte River Valley ecosystem." They are further described and quantified for the Program in the Water Plan (Attachment 5, Section 11 of the Program document).

a. Target Flow Recommendations: The term "target flows" refers to the Service's recommended species and annual pulse flows for the central Platte River. The Program's First increment water objective is to provide water capable of reducing shortages to those target flows by an average of 130,000 to 150,000 acre-feet per year. Program water will be used to reduce those shortages.

b. Peak and Other Flow Recommendations: The Service's instream flow recommendations for the central Platte River also include the periodic occurrence of peak flows at certain times of the year that are additive to the target flows. The Service has also identified additional flows such as short-term channel management "pulses" that are lower than peak flows and considered important to the creation and/or maintenance of habitat for the target species in the central Platte. While not specifically part of the first increment water objective (i.e., reducing shortages to species and annual pulse flows), Program water may be used to reduce shortages to the Service's recommended peak, pulse, or other flows in the central Platte River as part of an attempt to achieve a more normalized flow regime (one closer to the former structure of the hydrograph).

   The Program will integrate land and water management activities consistent with the Program's AMP and system constraints (storage capacity, water rights and the need to avoid property damage) to allow for the evaluation of utilizing flows to: a) avoid loss of existing associated habitats due to channel narrowing, incision, and vegetation encroachment; and b) maintain Program improvements in channel and wet meadow habitats. The Districts may be requested to bypass Program water at their diversion structures to enhance peak, pulse or other short-duration high flows. If Program water is bypassed, the Program will pay CNPPID and NPPD an amount equivalent to lost power production, increased power acquisition costs, and other associated costs.

c. Lower Platte River Flows: The Service has determined, through previous section 7 consultations on Federal water resource development projects, that reduced flows in the lower Platte River during the months of February through July as a result of water-related activities in the basin adversely impact the pallid sturgeon. Program provisions to address the pallid sturgeon and its lower Platte River habitat during the first increment are as follows:

1) Impacts to the pallid sturgeon that are caused by Program activities or by new water-related activities covered by the States or Federal depletions plans will be assessed. The assessment will be conducted through the pallid sturgeon research and monitoring activities described in the Program's AMP and complimentary research conducted by others involved with the Missouri River and its tributaries.

2) An assessment stage change study will be completed by the end of the third year during the first increment. If such impacts are deemed to adversely affect the pallid sturgeon, appropriate conservation measures that either negate or offset the occurrence of adverse impacts on the pallid sturgeon will developed and implemented during the first increment.

d. Impact of Program Activities on the Service's Recommended Flows: Because the Program's water component primarily involves the re-regulation and re-timing of flows, it is recognized that in order to achieve the Program's first increment water objectives, there may be times that adverse impacts may occur to one or more of the recommended flows for the central Platte River or on flows in the lower Platte River. The Service agrees that those adverse impacts are acceptable as long as such operation and implementation is in accordance with the Program Water Plan, including the depletions plans, and Governance Committee approved operating rules and/or procedures, and other Program activities.

<u>Program Water Operations to Meet First Increment Water Objectives:</u>

a. Initial Program Projects: The implementation and operation of the three initial water projects, Tamarack I, Pathfinder Modification, and the Nebraska Environmental Account, as described in the Program's Water Plan, are intended to provide 80,000 acre-feet of water per year toward the first increment water objective of providing water capable of reducing shortages to target flows by an average of 130,000 to 150,000 acre-feet per year.

b. Water Conservation/Supply Activities: The remaining portion of the Program's first increment water objectives will be met through a program of incentive-based water conservation and water supply activities. The "Reconnaissance-Level Water Action Plan" included in the Program Water Plan describes potential water conservation/supply projects that may be included in the Program. Governance Committee approval is required before any water conservation/supply project can be included in the Program. The Program will only include projects that yield a quantifiable net water benefit toward the Program's first increment water objectives.

c. Operation of Program Water Conservation/Supply Projects. The operations of all the Program's water activities will be coordinated as described in the "Program Water Management Process" included in the Program Water Plan. Not all water regulated for Program purposes will be storable in that Environmental Account and that water does not need to be stored to contribute toward Program objectives.

*Delivery of Program Water* - The Program seeks to deliver Program water at the appropriate time, place, and in the appropriate quantity, to secure defined benefits for the target avian species and their associated habitats. The Program will use its AMP to study the geomorphologic processes of the Platte River, including the feasibility of using Program water or other tools to provide those benefits. The Program intends to select and implement an effective suite of activities including the delivery of Program water that, in conjunction with other Program actions, will achieve the Program's species and habitat goals.

Water projects throughout the Platte River basin are operated by various entities in accordance with each state's water laws. The responsibility for accounting, tracking, regulating, and protecting Program water rests with each state's water administration. How Program water is delivered to the habitat area is largely dependent on CNPPID and NPPD's operational practices which generally routes Program water through their canal systems. Program provisions were developed to allow for some flexibility in how Program water is delivered (e.g., EA bypass to enhance peak, pulse or other flows as described in the Water Plan).

*Channel Capacity of the North Platte River Upstream of Highway 83* - The Program will complete a study by the end of the second year to evaluate the feasibility of delivering by the end of the fifth year during the first increment: a) 5000 cfs of Program water for three days to the upper end of the associated habitat (at Overton gage) for pulse flows when other demands on water are low (normally September 1 – May 31); and b) 800 cfs of Program water to the habitat during the irrigation season. The study process includes:

a. The first phase of the study, to be completed by the end of the first year, will identify alternative means for achieving those delivery goals using water provided by the three initial Program projects and projects from the Water Action Plan.

b. If the Governance Committee determines the deliveries identified in the first phase are not feasible, the study may be expanded to a second phase. In the second phase, if necessary, new water supply and conservation projects and/or other means to increase the ability to deliver water will be identified.

c. Based on the results of the study/studies and the adaptive management process, a plan to achieve the delivery goals (i.e., ability to deliver the 5,000 cfs and 800 cfs by the end of the fifth year) will be developed and implemented.

d. If the Governance Committee determines these water deliveries are not feasible or unnecessary, it will commit to develop other means of providing similar benefits (i.e., to increase the ability to deliver water to the habitat area) for the target avian species and their associated habitats.

Section 2 of the Program's Water Plan (Final North Platte Channel Capacity Study for the Water Management Committee, J.F. Sato and Associates, Inc. 2005) identifies capital investment and maintenance measures designed to increase the channel capacity of the North Platte River upstream of Highway 83 to 3,000 cfs. Implementation of these measures will begin in the first year of the Program. These maintenance measures will continue until the plan to achieve the delivery goals (i.e., ability to deliver the 5,000 cfs and 800 cfs to the habitat area) is implemented, or until alternative means of providing similar benefits to the target avian species and their associated habitats have been developed in the event the situation described in the preceding subparagraph d. occurs.

Depletions Plans to Mitigate the Impacts of New Water Related Activities:

The three States and the Federal government have developed plans to address the impacts of new water related activities, both those subject to and not subject to section 7(a)(2) of the ESA. Each plan specifies the means by which new water related activities, both those subject to and those not subject to Section 7(a)(2) of the ESA, will be addressed under that plan. The States and the Federal agencies are responsible for the implementation of their respective depletions plans and all mitigation measures will be implemented in the State where the depletion(s) being mitigated occur. Any proposed amendments to any of the new depletions plans must be approved by the Governance Committee.

The water yields provided for mitigation of new water related activities will not count toward the Program's first increment water objectives, as those yields will be used to mitigate the impacts of new water related activities, not existing ones. The plans explain how, with a Program in place, water-related activities subject to the requirements of section 7(a)(2) of ESA will proceed through the consultation process.

The plans describe the process for determining whether a water related activity can rely on the Program and this biological opinion for ESA compliance. To the extent a water-related activity subject to section 7(a)(2) consultation may effect other listed species not covered by this biological opinion in any of the three States, impacts to those species must be addressed separately in that Federal project's biological opinion as required by ESA.

For any new water-related activity that is not covered by an approved new depletions plan, but is subject to section 7(a)(2) of ESA, the project proponent may proceed with consultation on its own and shall mitigate project impacts in accordance with the results of that consultation and without any reliance on Program activities for such mitigation. In the alternative, the activity may be covered by the Program if the Governance Committee approves an amendment to the applicable depletions plan that would address the impacts of that activity.

**Evaluation of First Increment and Development of Subsequent Increments:**

*Evaluation of Effectiveness of the First Increment and Review of Goals, Objectives, Activities and Criteria* - At least three years before the end of the first increment, the Governance Committee will develop a process and timeframe for evaluating the first increment. The evaluation process will need to take into account the Service's responsibility to carry out independent ESA assessments, NEPA compliance, and other statutory obligations for a potential second Program increment.

*Definition of Second Increment Components and Term* - Before expiration of the first increment, the Governance Committee will identify goals, objectives, activities and criteria, and milestones or other measures for ESA compliance for a potential second Program increment.

*Decision to Enter Into a Second Increment* - Any decision to enter into a second increment will be made by the Signatories prior to the expiration of the first increment.

## C5. Regulatory Certainty

DOI and the States intend for the Program to provide regulatory certainty for participating entities under sections 7 and 9 of the ESA for the target species and other listed species in the central and lower Platte River for existing water-related activities and for new water-related activities that are covered by a State or Federal depletions plan for the first Program increment of 13 years. The Signatories anticipate that any future Program increments will provide similar compliance pursuant to ESA consultation with the Service for those increments. The Program is to provide ESA compliance for the target species during the first increment by the following mechanisms:

a) For existing Water-Related Activities (i.e., water-related activities existing as of July 1, 1997): Certain existing water-related activities underwent section 7 consultation prior to the effective date of the Program. Under the Program, some of these activities may be covered through compliance with the terms of existing Federal consultations and others will be subject to revised consultations whereby the Program is to provide ESA compliance for the target species.

b) For certain specified New Water-Related Activities through the depletions plans of each State and the Federal government as described for the Program: Certain new water-related activities underwent section 7 consultation prior to the effective date of the Program. Under the Program, some of these activities may be covered through the terms of existing Federal consultations and others will be subject to revised consultations whereby it will be determined if the new water related activities are covered by a depletions plan and this Program.

c) Although ESA compliance is anticipated for all projects electing to participate and that result in depletions to the Platte River above Columbus, Nebraska, the Nebraska New Depletions Plan does not offset, to any degree, reductions to Platte River flows that are caused by ground water development occurring after July 1, 1997, and that only affect the river downstream of Chapman, Nebraska. The sub-basin drainage areas excluded from offset include the Wood River, Silver Creek, Prairie Creek, Moore Creek and Warm Slough, and cover all of Merrick County, the majority of Hall and Buffalo counties and the northeast corner of Dawson County. Because groundwater development in this area is covered by the Program in terms of ESA compliance, the unmitigated reductions in flow to the lower Platte River from groundwater wells are considered interrelated with the action, and will be considered in the Effects of the Action chapter of this biological opinion.

d) DOI and the States intend that ESA compliance will be provided through achievement of the milestones.

e) If the milestones are not being met, the Service will inform the Governance Committee and a mutual attempt at resolution will be made. If resolution cannot be achieved at that level, an attempt at resolution will be made by the Oversight Committee (i.e., the Secretary of the Interior and the three Governors). If no resolution can be achieved and the Program is terminated, the Service will request reinitiation for all water-related activities relying on the Program for ESA compliance.

The milestones can be changed by the Governance Committee during the first increment as described in the Program documents. A change in milestones within the first increment may necessitate a determination on whether or not the change is within the scope of this biological opinion and if reinitiated section 7 consultation would be required.

If reinitiation is requested, the Service intends to expeditiously pursue consultation. If new or additional measures are identified, the Service will pursue all means to amend or modify the agency authorizations. If a State agrees to continue to carry out the responsibilities it had under the Program, that State assumes that ESA compliance will continue during the consultation period. In any reinitiated section 7 consultation, the Service will consider such undertakings by a State.

f) Any time the Service reinitiates ESA section 7 consultation, a new biological opinion will be prepared based on current conditions and in accordance with all applicable Federal laws and policies.

g) In developing any new measures to meet the requirements of ESA, the Service agrees to consider any contributions made by the parties and the degree to which each party met its obligations under the July 1997 Cooperative Agreement and/or the Program.

h) Program participation and reliance on the Program for ESA compliance is voluntary. For water-related activities that choose not to rely on the Program, any

ESA compliance that would have been provided by the Program is removed and the Service will reinitiate section 7 consultation under ESA.

i) The Service will encourage other agencies to rely on the Program when considering agency actions affecting the target species.

j) The Governance Committee will review accomplishments annually, including consideration of the schedules, operations of the initial Program water projects, and other Water Plan and Land Plan projects. Accomplishments will be compared with the milestones and measures will be implemented to correct shortfalls, if needed, and, as necessary, the Governance Committee will revise milestones so long as such revisions are consistent with the Program's long-term and first increment goals and objectives (Section 2.D, Structures Document).

As part of the Program's annual review process, the Service will evaluate the Program's land, water, and administrative accomplishments in order to track progress and provide information to be used by the Governance Committee and the Service during the first increment. The framework of the Service's reviews of the Program will be based, in part, on the information provided in the Milestones Document (Attachment 2 of the Program Document). The milestones and explanatory language will serve as a means to track Program accomplishments during the first increment. As part of the annual review process, the Service will also consider other measures of progress. Examples include, but are not limited to:

1) Progress toward the integration of the implementation of the land and water management activities to assist in restoring system processes through the acquisition and restoration of habitats and implementation of water projects.

2) In the event individual projects identified in the Water Action Plan are determined to be not feasible through the reconnaissance, planning, and implementation processes, a replacement project of equivalent or greater water yield is described, and a feasibility report for that proposed substitute project is submitted to the Governance Committee for approval within one year of the date a project was determined not feasible.

3) Habitat restoration and management plans are developed and implemented within one year following the acquisition of each parcel of land by the Program.

4) The Governance Committee will select and enter into an agreement with a land interest holding entity within six months following the date of Program implementation.

5) Protection and restoration of land into habitat complexes is occurring in a timely manner (e.g., on an average annual basis through the end of year 9,

acquisition of approximately 676 acres per year would be needed to procure the remaining 6,080 acres land for restoration into habitat complexes).

6) Site specific plans for each land and water action are developed during the planning phase of the proposed project before any on-the-ground management occurs.

Concerns or shortcomings regarding Program implementation and accomplishment will be formally conveyed by the Service to the Executive Director for inclusion in the draft annual report to the Governance Committee regarding Program progress and plans for the coming year. The Service will also review and provide comments to the Executive Director regarding the content of each draft annual report that will be provided to the Governance Committee for its consideration and approval.

### C6. Program Cost Share and Exit Strategy

DOI and the States have determined that each share joint responsibility for the success of the Program and that contributions for implementing Program elements addressing existing water-related activities should be made to the Program on an equitable basis. Crediting of contributions, exit principles, program budget, and the cash and cash equivalent contributions of the Signatories can be found in the Finance Document (Attachment 1 of the Program Document).

### C7. Conforming Federal Funding or Authorization

In general, a project that receives Federal funding or a Federal authorization and wants to rely on the Program for ESA compliance, must address how to reopen consultation if the Program is terminated because the milestones are not being met. That is, every project depending on the Program for ESA compliance is bound by the same Program rules as long as they elect to participate in the Program for ESA compliance. This provision does not restrain any party from taking positions adverse to each other in proceedings regarding re-opening authority and will not prevent any party from withdrawing reliance on the Program if they so chose (subsequent reinitiation of their ESA consultation with the Service will occur).

### C8. Consistency of Documents

The Governance Committee has the authority to resolve any inconsistencies between the Program Document and its attachments or referenced materials. The Program Document will control, unless the Governance Committee decides otherwise.

## *D. Attachments to the Program Document*

In the December 7, 2005, Program Document, references are made to attached and appended documents which describe the Program elements in detail (Table IV-A1). For reasons of convenience and clarity, the Program Document, along with Program Attachments 1 through 6 (i.e., documents detailing the Finances, Milestones, AMP, Land Plan, Water Plan and Organizational Structure) are included in this biological opinion as Appendix D.

## D1. Finance Document, Crediting, and Exit Principles, and Program Budget (Attachment 1)

The purposes of this attachment are to: a) establish credits for certain cash, cash equivalent, water, and land contributions made by or on behalf of the parties to the Program; b) provide guidance for use in determining other credits earned by or on behalf of the parties during the first increment of the Program; c) establish principles for disposition should the Program terminate, of assets acquired or contributed to accomplish the objectives of the Program; d) provide guidance on the ESA credits that might be available for use in consultation with the Service should the Program terminate; and e) detail the Program budget and the cash flow requirements for the first increment of the Program.

## D2. Milestones Document (Attachment 2)

This attachment describes the purpose of the Program milestones, lists ten milestones, and provides additional explanatory material and schedules associated with each milestone. The Milestone Document states that, "The Program will continue to serve as the ESA compliance for water-related activities upstream of the confluence of the Loup River in Nebraska, so long as the milestones are being met." The Governance Committee may change the first increment milestones; however, provided such changes are consistent with accomplishing the first increment objectives. As per Section III.C of the Program Document, "these changes may be made and the Program will continue to provide ESA compliance during the first increment, so long as the first increment milestones, as they may be amended, are being met." To make changes, nine of the ten representatives to the Governance Committee, including the representative or alternate appointed by each Governor and the representatives or alternates for the Service and Reclamation, must vote in the affirmative for the Governance Committee to act. Thus, each of the Signatories including the Service, is provided the authority to veto decisions with which they disagree.

Explanatory materials and estimated time frames for anticipated interim steps that will be taken towards meeting each milestone are also included to assist the Governance Committee in managing, assessing, and, as appropriate, adjusting work carried out during the first increment. Specifically stated, the explanatory information and related interim steps and schedules are included as background information only and are not to be considered as individual milestones for purposes of ESA compliance.

Milestones:

1) The Pathfinder Modification Project will be operational and physically and legally capable of providing water to the Program by no later than the end of year 4 of the first increment.

2) Colorado will complete construction of the Tamarack Phase I Project and commence full Phase I operations by the end of year 4 of the first increment.

3) CNPPID and NPPD will implement an Environmental Account for Storage Reservoirs on the Platte System in Nebraska as provided in the licenses for FERC Project Nos. 1417 and 1835.

4) The Reconnaissance-Level Water Action Plan, as may be amended by the Governance Committee, will be implemented and capable of providing at least an average of 50,000 acre-feet per year of shortage reduction to target flows, or other Program purposes, by not later than the end of the first increment.

5) The Land Action Plan, as may be amended by the Governance Committee, will be implemented to protect and, where appropriate, restore 10,000 aces of habitat by no later than the end of the first increment.

6) The Integrated Monitoring and Research Plan, as may be amended by the Governance Committee, will be implemented beginning year 1 of the Program.

7) The Wyoming Future Depletions Plan, as may be amended by the Governance Committee, will be operated during the first increment of the Program.

8) The Colorado Future Depletions Plan, as may be amended by the Governance Committee, will be operated during the first increment of the Program

9) The Nebraska Future Depletions Plan, as may be amended by the Governance Committee, will be operated during the first increment of the Program

10) The Federal Future Depletions Plan, as may be amended by the Governance Committee, will be operated during the first increment of the Program

## D3. Adaptive Management Plan (Attachment 3)

The December 16, 2005, AMP, reviewed for this biological opinion, is described as preliminary. As stated in the plan, the AMP will be completed and ready for implementation prior to the beginning of the Program through a collaborative process, described in the plan, involving a group of technical representatives of Program stakeholders with assistance from the Executive Director and adaptive management experts, collectively referred to as the Adaptive Management Work Group (AMWG). Peer review will occur during the completion process by the adaptive management experts and thereafter, as needed, following established peer review guidelines (Appendix A of the AMP).

In its current state, the AMP provides a fundamental framework necessary for developing, integrating, and implementing Program actions during the first increment using scientific adaptive management practices and principles. Additional detail to be added prior to Program implementation will include initial operating plans that identify specific management objectives for Program lands, specific management actions to be taken to achieve the management objectives, and specific monitoring and research activities that will be used in the evaluation of the management. The process for finalizing the AMP prior to Program implementation is described in Section I.F.1 of the AMP.

Scientific Adaptive Management:

For the purposes of implementing the Program's AMP, scientific adaptive management is defined as a series of scientifically driven management actions (within policy and resource constraints) that use monitoring and research results provided by the Integrated Monitoring and Research Plan (IMRP; Section V of the AMP) to test priority hypotheses related to management decisions and actions, and apply the resulting information to improve management. Adaptive management works iteratively as illustrated in the "six steps" of adaptive management (Figure 1a of the AMP). Science-based adaptive management for the Program will operate on the basic premises that:

a) Uncertainty exists in a managed system, and reduction of uncertainty can improve management;

b) Uncertainty can be reduced through adaptive management but can never be eliminated;

c) Management decisions must be made despite the uncertainty;

d) Monitoring and research programs are in place to evaluate management decisions and to continually improve the knowledge (e.g., underlying conceptual ecological models, computer models) on which these decisions should be based; and

e) Learning about the effects of management will hasten improvement of management decisions in the future resulting in more rapid and cost-effective attainment of management objectives.

By design, the AMP is a strategic document that provides an adaptive management framework for developing and implementing management plans. It is intended to be a dynamic document that will be finalized before Program implementation, and may change throughout the first increment of the Program.

Program Goals and Objectives:

The first increment Program objectives of protecting and restoring 10,000 acres of habitat for the three avian target species and providing water capable of reducing shortages to the Service's target flows by an annual average of 130,000 to 150,000 acre-feet provide the overarching foundation upon which the AMP is based. The Program objectives cannot be changed except through a formal amendment to the Program as a result of unanimous consent by the Secretary of the Interior and the Governors of Colorado, Nebraska and Wyoming.

To achieve the Program's primary goal of improving and maintaining migrational habitat for whooping cranes and reproductive habitat for terns and plovers in the central Platte River area (see FEIS, pages 2-3 to 2-9 for a description of theses habitats), a combination of land and water actions will be implemented during the first increment. These individual management actions (or treatments) will be designed and implemented to gain the greatest understanding of the response of the target species and their habitats to the actions through monitoring and research. Analysis of information provided by the AMP may be used to change the initial characteristics of habitat and/or guidelines contained in the Land and Water Plans that were developed prior to Program implementation.

The Governance Committee may also agree to undertake, fund or give credit for activities outside the Lexington to Chapman reach to provide biological benefit to the target species and/or gain a better understanding of the response of the target species and their habitats to the actions through monitoring and research.

National Academies of Science Review:

In 2004, the National Academies of Sciences (NAS) National Research Council (NRC) conducted an 18-month review of the science related to the target species use of the Platte River, the Service's criteria for suitable habitat and target river flows, and the science related to the geomorphology of the river. The findings of the NRC support the Service's identified species/habitat criteria/needs (USFWS 2000a, 2000b) and the characteristics of the target species habitat and guidelines that will be used initially by the Program at the onset of the first increment. The findings and recommendations of the NRC independent peer review were considered in the development of the AMP and will be a source of information used to implement adaptive management during the Program.

The majority of the recommendations included in the NRC review related to monitoring and research are incorporated into the AMP. For example, the NRC recommended that issues regarding other species of concern be considered in the Platte River area. The monitoring and research effort was modified to include additional effort for monitoring other species (i.e., species in addition to the target species). Additional funds and efforts have also been added to the monitoring and research budget to monitor water quality on Program lands.

While most items identified as important by the NRC are addressed in the AMP, a few items remain that have not been incorporated directly because they are considered to be outside the scope of this Program. In the future, the Program may choose to participate with other groups to address these issues. These issues include:

a) Monitoring throughout geographic area of the target species' range using radio telemetry or banding;

b) Contribution of contaminants to current rate of least tern and piping plover mortality;

c) Monitoring of direct human influence (e.g., harvest of wild fish) for pallid sturgeon;

d) Determining the role of the Platte River in recovery of the pallid sturgeon; and

e) Impacts of long-term climatic influences (the Program will monitor year to year changes in weather, as these are important covariates in determining year-to-year fluctuations in monitoring and research results).

Geographic Scope:

Land acquisition and management for the target bird species will occur in the central Platte River reach (Lexington to Chapman, Nebraska), and Program water activities will be designed to provide benefits for the target bird species in that river reach with subsequent benefits to the pallid sturgeon in the lower Platte River reach (below the confluence with the Elkhorn River). These areas are generally known as the “associated habitats” and comprise the study area for the AMP. Adaptive management actions may occur at the system, program, or project level, or a combination of scales.

Adaptive Management Framework for the Program:

*Conceptual Ecological Models* - or CEMs are distinguishable from numerous other “models” associated with the Platte River, including computer models, statistical models, biological models, and physical models such as OPSTUDY, Cooperative Hydrology Study (COHYST), and Reclamation’s Sediment/Vegetation model (SED/VEG) (Appendix B of the AMP). These other models may be used as tools in evaluations under the AMP and/or as a means to develop management predictions. CEMs provide a visual framework or graphical representation for the current or hypothesized understanding of the central and lower Platte River associated habitats relative to target species, including the underlying hypotheses on how the driving forces, relationships, and processes impact the valued ecosystem components. CEMs are used in the AMP to identify competing hypotheses and research questions to be addressed by management, monitoring, and research. During Program implementation, CEMs will be reviewed and evaluated, as information becomes available, and new questions, models, and hypotheses will be formulated that may be used to modify management actions and monitoring and research based upon findings within scientific adaptive management implementation..

The December 16, 2005, AMP includes draft CEMs, developed by the Adaptive Management Working Group (AMWG), for each target species, wet meadow habitat, and physical processes in the central Platte River (Figures 4-10 of the AMP). These, as well as additional CEMs, will be modified and/or added to the AMP as they are developed by the AMWG prior to Program implementation.

*Hypotheses* - CEMs were used by the AMWG to develop hypotheses on how the system works and how it may respond to management practices as well as to identify areas of uncertainty and disagreement. The AMP includes competing hypotheses regarding how the system “works” and what management practices should be used to achieve Program goals and objectives. As the Program progresses, additional hypotheses are likely to be added or modifications made to the existing hypotheses based on scientific adaptive management practices and principles outlined in the AMP.

The AMP includes summary hypotheses developed by the AMWG (Tables in Sections III.C.1 to III.C.4 of the AMP). Besides these hypotheses, the AMWG, Governance Committee, and other individuals have identified many other hypotheses that have not been prioritized or completely drafted and reviewed (Appendix C of the AMP). The list of priority hypotheses, to be tested initially, will be further developed, prioritized, and described in the AMP by the AMWG prior to Program implementation using the process for finalizing the AMP (Section I.F.1 of the AMP) and technical and policy guidelines (Section III.B of the AMP).

*Management Objectives and Indicators, and Management Actions for Program Lands* - Initial management objectives, indicators (performance measures), and initially proposed management actions to be evaluated through adaptive management during the first increment are included in Section IV of the AMP. During Program implementation, additional management objectives, indicators, and proposed management actions will likely be developed through the adaptive management process of testing hypotheses and refining CEMs and indicators, accordingly.

*Management objectives* are broad descriptions of what the Program is trying to achieve. They provide a means to evaluate effectiveness of different Program actions within an adaptive management framework. Management objectives represent the desired outcome of one or a combination of management actions expressed in quantitative and measurable terms. Management objectives are not synonymous with Program objectives. Management objectives relate to management actions and provide the linkage between the purpose of management and the Program goals and objectives.

*Indicators* are measurable parameters within the objectives that will be used to gauge the ability of the management actions to meet the management objectives, and ultimately the Program goals and objectives. The preliminary list of overall management objectives and indicators for the first increment of the Program include:

1) Improve production of least tern and piping plover from the central Platte River
    a. Increase number of fledged least tern and piping plover chicks
        1. Increase nesting pairs (indicator is nesting pairs)
        2. Increase fledge ratios (indicator is chicks successfully produced per unit adult, nest or pair) and reduce chick mortality from causes such as flooding, predation, weather, inadequate forage.
    b. Reduce adult mortality
        1. Reduce predation (indicator is nesting pairs)

2) Improve survival of whooping cranes during migration
    a. Increase availability of whooping crane migration habitat along the central Platte River (indicators are the area of suitable roosting habitat, area of suitable foraging habitat, proportion of population, crane use days, etc. Additional detail will be added prior to Program implementation).

3) Avoid adverse impacts from Program actions on pallid sturgeon populations
    a. Indicators have not been identified as more research is needed to determine what potential indicators the Program may affect.

4) Improve and maintain overall ecosystem condition in the central Platte River
   a. Indicators have not been identified. If indicators can not be identified for this objective that are different than for the objectives 1-3 above, this may be removed.

*Management actions* are designed to achieve management objectives. Two different "strategies" (a logical package of management actions) are described to achieve management objectives. It is the intent of the Governance Committee to implement and test the management actions of these two strategies in parallel using a "stair-step" approach (Figure 11 of the AMP). This parallel implementation is consistent with the preferred means of implementing adaptive management experiments (i.e., active adaptive management). For more detail of these management actions, see AMP Sections IV.B.1 and IV.B.2, respectively.

1) The *flow-sediment-mechanical approach* attempts to rehabilitate the Platte River towards a braided channel morphology as the underpinnings of restoring habitat for key management species (commonly referred to as "Clear/Level/Pulse"). Management actions include mechanical, sediment augmentation, and flows. The following describes the objectives of the flows-sediment-mechanical pulse approach:

   a. Create and maintain where possible a wide braided channel with a high width/depth ratio. The main channel width would be sized for sustainability, based on available bankfull flows (as augmented by the Program), and considering habitat and landscape characteristics. The desired braided plan form may require consolidation of the flow and river channels to maximize stream power and aided by removal of wooded banks and islands and addition of sediment.

   b. Offset the existing sediment imbalance by increasing sediment inputs to the habitat area from one or more of the following sources:

      1. sand augmentation through mechanical actions- island and bank clearing and leveling,
      2. sand augmentation from bank and island actions not directly related to bank cutting and island leveling (an example could be excavation associated with wetland development), or
      3. reducing the imbalance through channel plan form changes, tributary delivery improvements, or flow routing changes.

   c. Use the EA and other Program water to create annual peaks as large as can be sustained over many years, likely through the creation of annual, short-duration high flows within existing banks. Try to ensure that the spring peak flow is higher than any subsequent summer flow.

      The focus of this concept is on several overall management objectives for Program lands including: a) improvement of river channel areas on Program lands toward habitat complex characteristics described in Table 1 of the Land Plan (increased availability of areas of wide, shallow channel with unobstructed view and sandbars suitable for roosting and nesting); b) maintain those improvements; and, c) minimize or offset current river processes that tend to diminish channel areas on Program lands approximating Land Plan Table 1 characteristics.

2) The *mechanical creation and maintenance approach* attempts to achieve similar management objectives by mechanical creation and maintenance of habitat for target species, which may or may not depend on the Platte River (although all actions will occur in the Platte River associated habitats). This strategy has commonly been referred to as the "clear/level/mechanical maintenance" or "clear/level/plow," although a better term may simply be "mechanical creation and maintenance" such that the clear/level portion is not hard-wired into the strategy. Management actions include sandpit management, creating and maintaining islands and channel width, and creating and maintaining inundated wetlands. Part of this approach will consider management actions implemented by other groups outside of the Program.

The AMP states that prior to Program implementation, additional management objectives, indicators, and proposed management actions will likely be developed by the AMWG through the process of refining CEMs and identifying priority hypotheses. The CEMS and hypotheses developed in the assessment stage will be integrated with the design of actions and be used in the design stage to determine what monitoring and research will be accomplished (following the six-step adaptive management process described in Figure 1a of the AMP). This will occur prior to Program implementation using the process described in Section I.F.1 of the AMP.

Integrated Monitoring and Research Plan (IMRP):

This section of the AMP focuses on the biological response monitoring and research for the Program. A considerable amount of general information is provided on monitoring and research methods, experimental design, data analysis techniques, and monitoring and research protocols related to the target species and their habitats. Information derived using the IMRP along with information from the Service, State agencies, and others regarding the species biology, status, and recovery in the region, will be used to adaptively manage Program lands, Program activities, and the overall Program during the first increment and for evaluating the Program at the end of the first increment.

Included in the AMP as part of the IMRP are: a) a comprehensive list of potential monitoring and research activities, and estimated budgets (Table 1 of the AMP); b) a general discussion of first increment monitoring and research planned for each of seven specific resource areas including whooping crane, least tern and piping plover, pallid sturgeon, other listed and non-listed species of concern, in-channel characteristics, habitat comparisons, and channel capacity (Section V.K); and c) six fully-developed monitoring and research protocols (Appendix D of the AMP). Additional protocols will be identified and developed as needed during the Program.

Prior to Program implementation, the seven specific resource sections will be fully developed using hypotheses developed through the CEMs to discuss the monitoring and research for each species and their associated habitats.

Organizational Structure for Implementing the AMP:

Various entities involved in implementing the AMP are described in Section I.C of the AMP. Entities identified include the Governance Committee, Executive Director, Independent Scientific Advisory Committee (ISAC), the Land, Water, and Technical Advisory Committees, and the Environmental Account Manager. The primary roles and responsibilities include:

1) As stated in the AMP, the Governance Committee makes policy decisions to implement the Program and will make all decisions related to adaptive management, unless expressly delegated to the Program's Executive Director, including changes to budgets and Program activities and criteria. As a part of its annual review of Program implementation and accomplishments, the Governance Committee will approve budgets and work schedules for staff necessary for implementation of the plan for the subsequent year or other defined budgetary cycles. Considering the magnitude and nature of implementing the myriad of Program land and water management activities under a scientific adaptive management regime, delegation to the Executive Director and Program staff of the majority of intra-year implementation decision-making is expected.

2) The Executive Director will direct and supervise a staff capable of implementing the Program. This will include providing staff support, coordinating activities with the advisory committees, ISAC, and Environmental Account Manager to effectively implement the scientific component of the AMP, and providing annual reviews of AMP implementation. The Executive Director will also coordinate adaptive management activities with cooperators and provide oversight of contracts and contractors. During the annual reviews, the Executive Director will provide Program tasks status and will make recommendations on adaptive management decisions. Any recommendations being brought forward to the Governance Committee will reflect the views of all those involved in the adaptive management program and all views, majority and minority, will be presented clearly and fairly. The Executive Director may establish ad hoc committees, as needed, with Governance Committee approval.

3) The purpose of the ISAC is to ensure scientific integrity and quality in the Program by providing independent reviews of the Program's processes and products. The ISAC will provide independent scientific advice to the Governance Committee through the Executive Director on scientific issues, including adaptive management, in accordance with its charter (Organizational Structures, Attachment 6, Appendix I of the Program Document). The ISAC will be composed of approximately five independent scientists knowledgeable in technical areas critical to the implementation of the AMP.

4) Most management actions and adaptive management experiments to test hypotheses will depend on the Environmental Account Manager being an integral part of the advisory process because the EA Manager determines when water will be released. The Service's instream flow recommendations and flow priorities are used as the reference point for determining flow shortages and EA releases. Generally, water releases will be made within the overall management framework established by the AMP. The EA Manager, in consultation with the Executive Director, will develop an annual operating plan (AOP) for the Program in accordance with a process described in the Program's Water Plan (Attachment 5, Section 1 of the Program Document). Managers of other Program water resources will coordinate their water projects through the Executive Director and EA Manager, as appropriate, to facilitate monitoring and research.

Annual Reviews:

At least annually, the Program's management activities, and the criteria that guide those Program activities, such as land and water acquisition and management criteria, as described in the Program Document and its attachments (e.g., Milestones Document, Land Plan, and Water Plan) will be evaluated. Opinions of the ISAC, and peer reviewers, if any, will be compiled and summarized as part of the evaluation process. Evaluations will:

1) Assess whether the Program activities and criteria being examined are working as originally envisioned;

2) Make modifications based on new information;

3) Determine whether there are other or better uses for the resources committed to the activity and criteria;

4) Considering available information including any reviews from advisory groups, assess whether success or failure could be determined by monitoring over the time period evaluated; and,

5) Develop alternative activities and criteria in accordance with adaptive management.

Process for Modifying the AMP During the First Increment of the Program:

The Executive Director will update the AMP and operating and implementation plans through a collaborative process involving representatives of the LAC, WAC, and TAC. The process will also include review input from the ISAC and other peer reviewers as appropriate. The process will be based on the products resulting from the implementation of the Program's operating and implementation plans. The work plans will be developed by the Executive Director, using the AMP as a strategic planning template. Budgets will be updated annually, reflecting the accumulating evidence for priority hypotheses, and making or modifying the plans for the subsequent year or years. Section I.F.2 of the AMP describes the steps involved in making changes to the AMP.

Monitoring and Research Storage:

The Program will undertake a large number of biological monitoring and research activities. The collection of such large amounts of data during the Program's first increment by potentially numerous contractors, cooperators, agencies, and staff necessitates a centralized database management system that will permanently store, organize, and distribute Program data and information. A conceptual design and implementation methods for such a database management system for all administrative information and data and reports created under the biological monitoring and research component of the Program is well described in Section VI of the AMP.

### D4. Land Plan (Attachment 4)

The Land Plan begins with a section describing its purpose. This section is followed by a section delineating various processes involved with land acquisition, such as: a) the process of identifying and evaluating potential Program lands; b) the process used to make decisions regarding land acquisitions and whether the lands will be considered complex or non-complex habitats; and c) the process of acquiring, holding and disposing of interests in Program lands. Habitat restoration, maintenance, and other habitat management issues are discussed in the third section of the plan, including a process for addressing habitat restoration, maintenance and management, guidance for developing and implementing management plans, and the tracking of land acquisition and restoration. The final sections of the plan address potential adverse impacts of implementing the land plan, and describe a preliminary budget for the first increment land plan. Additional sections appended to the plan, but not included in this biological opinion, are listed in Table IV-1.

Habitat Complexes:

The long-term land-related objective of the Program is to perpetually protect, restore where appropriate, and maintain approximately 29,000 acres of suitable habitat primarily in habitat complexes in the central Platte River area located between Lexington and Chapman, Nebraska. The area of interest lies within approximately 3.5 miles of the centerline of the Platte River or within 2 miles of the side channels. The habitat objective for the first increment of the Program is to acquire interests in 10,000 acres of this habitat. Of this 10,000 acres, up to 800 acres may constitute non-complex land during the first increment as described below (these definitions are subject to change during the first increment through investigations in the AMP).

The initial focus of the Program is to protect and restore (as appropriate) habitat in habitat complexes for the three avian target species in and along the central reach of the Platte River. Habitat complexes are assemblages of relevant habitat types important to the target species, and consist of channel areas, wet meadows and buffers. Channel area is defined by the Program as that portion of the river that conducts flow and is bounded on either side by stable banks or permanent islands with vegetation that obstructs view. Wet meadows are areas with a generally level or low-lying, undulating topography consisting of a mosaic of swale with wetland soils and vegetation, and ridges with upland native or restored grasslands. Buffer areas are used to shield wet meadow or channel habitat areas from potential disturbances. A more detailed description of habitat complex lands is provided in the Land Plan. Information in Table 1 of the Land Plan will be used as guidelines for development and restoration of suitable habitat complexes, although the Land Plan also states that, "Generally, riverine habitat will be considered habitat complex land." (Footnote 5 of the Land Plan).

Non-Complex Habitat Land:

During the first increment, Program resources may also be used to acquire or manage up to 800 acres of non-complex habitat. These areas consist of sandpits for nesting least terns and piping plovers, and off channel roost or foraging areas for whooping cranes. The Governance Committee will determine whether parcels of protected habitat will be credited toward the 800-acre limit for non-complex habitat. The Governance Committee may acquire certain non-riverine wetlands or sandpits within a reasonable distance from a habitat complex that function with that complex, and may, on a case-by-case basis, consider those lands as habitat complex lands. Non-complex lands may be reclassified as complex lands if a habitat complex is later developed in the area. More specific characteristics of non-complex habitats are found in Table 2 of the Land Plan.

Protection, Restoration, and Maintenance of Program Lands:

A variety of means are available for protection of Program lands. Options for acquiring interest in lands range from short-term protection (i.e., leases and management agreements) to perpetual protection through conservation easements or land ownership. Land transactions will be conducted on a willing-seller/willing-lessor basis only. In addition, acceptable arrangements include management and/or access agreements with Program cooperators who dedicate their lands to the Program, but retain ownership. The Program may also consider lands protected by other federal, state or local programs and managed under regulatory oversight as habitat, or lands protected by non-profit conservation groups or government agencies. All such lands must be protected and, managed in a manner consistent with the Program's goals and objectives, and owned by a Program cooperator or sponsor.

As described in the Land Plan, at least nine factors will be considered when deciding whether to acquire a particular parcel of land. For the purposes of acquiring land in the first increment, it is preferred to space habitat complexes with no more than one per "bridge segment" (river reach between two bridges) in ten bridge segments between Lexington and Chapman, Nebraska. Preferred bridge segments are:

1) those bridge segments located near the upstream end of the associated habitats;

2) those with habitat that can be most reasonably improved and that is not already being protected for target species purposes by another entity;

3) those bridge segments with existing habitat that is not already being protected for target species purposes by another entity and that appears likely to be lost or degraded without Program protections; and

4) those bridge segments that do not currently have any protected habitat.

The Milestones explanatory material states that plans for the restoration, management, and maintenance of each parcel protected by the Program will be developed for each land parcel within one year of protection. Implementation of management plans is to begin within two years of protection. Management plans will be developed by the Executive Director, with input from the LAC, and approved by the Governance Committee.

### D5. Water Plan (Attachment 5)

The Program Water Plan describes elements of the Program that provide and/or manage water to improve flows to and through the central reach of the Platte River. The major water elements of the Water Plan are described and summarized in Table IV-3.

Program Water Management Process:

Section 1 of the Water Plan describes the Program's water management process and its relationship with the Service's EA Manager. The EA Manager and associated coordinating committees (i.e., Environmental Account Committee and Reservoir Coordinating Committee), created to meet FERC relicensing requirements, will continue to exist with or without the Program. The Program's water operation process builds upon that existing structure and integrates it into the Program; thereby, expanding the current role of the EA Manager. The process for annual coordination among Program water management entities and development of an annual operation plan for the Program is described in detail in Section 1. Also, described are procedures for bypassing EA flows for enhancing peak, pulse or other short-duration high flows.[13]

Channel Capacity of the North Platte River Upstream of Highway 83:

Section 2 of the Water Plan describes the capital investment and maintenance measures designed to increase the channel capacity of the North Platte River upstream of Highway 83 to 3,000 cfs (encompassed within 2005 Final North Platte Channel Capacity Study prepared by J.F. Sato and Associates, Inc.). Implementation of these measures will begin in the first year of the Program and continue until an evaluation is made and a plan to achieve the delivery goals (i.e., ability to deliver 5,000 cfs of Program water at Overton and 800 cfs at the habitat area) is implemented (described in Section III.E.2.d.iii of the Program Document), or until alternative means of providing similar benefits to the target avian species and their associated habitats have been developed in the event the situation described in the preceding subparagraph d. occurs.

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[13] EA Bypass Flows are created when CNPPID and/or Nebraska Public Power District (NPPD) (Districts), or both, at the request of the EA Manager, waive the discretion provided by their licenses to divert Environmental Account (EA) water that could have been routed through their systems, and instead route the EA water via the North Platte and/or Platte River. Consistent with Program Document Section III.E.1.b, the EA Manager may request CNPPID and/or the NPPD to bypass EA water to enhance peak, pulse or other short-duration high flows..

**Table IV-3. Water elements for the Program and average annual improvement toward species and annual target flows**

| **Program Water Features and Elements** | **Projected Improvement Toward Target Flows (Average Acre-Feet Per Year)** |
|---|---|
| **State Projects** | |
| **Total for these elements:**<br>Lake McConaughy EA<br>Pathfinder Modification Project<br>Tamarack Project, Phase I | **80,000** |
| **Water Action Plan Conservation/Supply Activities** | |
| **Total for these elements:**<br>**Colorado**<br>1. Tamarack Project, Phase III<br>**Nebraska**<br>1. Offstream Reservoir in the Central Platte<br>2. Water Leasing<br>3. Water Management Incentives<br>4. Groundwater Management in the Central Platte Groundwater Mound Area<br>5. Dry Creek/Fort Kearney Cutoffs<br>6. Dawson and Gothenburg Canal Groundwater Recharge<br>7. Central Platte Power Interference<br>8. Net Controllable Conserved Water<br>**Wyoming**<br>1. Pathfinder Wyoming Account<br>2. Glendo Reservoir Storage<br>3. Water Leasing<br>4. La Prele Reservoir Leasing | **70,000*** |
| **Total** | **150,000*** |

*This is the reconnaissance-level estimate of improvement toward target flows produced by the Water Action Plan. These estimates would be confirmed or further refined through feasibility-level studies as the Program is implemented.

<u>Water Reregulation Projects:</u>

The States of Wyoming, Colorado, and Nebraska, each provide a water reregulation project to the Program. If implemented as described, these three State projects increase achievement of target flows by roughly 80,000 acre-feet on an average annual basis. Details of the operation of the three State projects can be found in Sections 3 through 5 of the Water Plan.

►Wyoming (Section 4)—Pathfinder Reservoir EA: Pathfinder Dam was completed in 1909 and is located on the North Platte River about 3 miles below the confluence with the Sweetwater River and about 47 miles southwest of Casper, Wyoming. In the years since construction, accumulated sediment has reduced the reservoir's original storage capacity from 1,070,000 acre-feet to 1,016,507 acre-feet—a loss of 53,493 acre-feet. The approximately 54,000 acre-feet of storage capacity in Pathfinder Reservoir that has been lost to sediment and that will be recaptured by the Pathfinder Modification Project will be used for environmental, municipal, and other purposes as described in Appendix F to the Final Settlement Stipulation in Nebraska v. Wyoming No. 108, Orig., 534 U.S.40 (2001). The modification would raise the elevation of the existing spillway by approximately 2.4 feet. Approximately 34,000 acre-feet of the proposed 54,000-acre-foot modification would be accounted for in an EA and operated for the benefit of the target species and their Platte River habitats in Nebraska, while the remaining 20,000 acre-feet could be used for municipal and other uses in Wyoming. In any year that the demand for municipal use is less than 9,600 acre-feet, the remaining balance of the annual firm yield may be used by Wyoming for depletion replacement or release for endangered species in central Nebraska.

►Colorado (Section 3)—Tamarack Project, Phase I: Colorado's Tamarack Project, Phase I, involves diversion of water during periods when flows at Grand Island, Nebraska, are in excess of the Service's flow targets and when available under the South Platte River Compact. The water is diverted to small storage/recharge ponds and then infiltrates into the surrounding alluvial aquifer and returns to the river during other time periods. Water that has been recharged and returns to the river at times of shortage to flow targets can then offset target flow shortages.

Tamarack Project, Phase I, components would be developed along the South Platte River within the approximately 40 miles above the Colorado-Nebraska state line, in and near the Tamarack Ranch State Wildlife Area and the Pony Express State Wildlife Area, owned by the Colorado Division of Wildlife. During Phase I, the Tamarack Project would divert approximately 30,000 acre-feet per year of the South Platte River flows for retiming of river flows to offset shortages. Colorado would coordinate operation of the Tamarack Project in consultation with the Service's EA Manager.

Through procedures to be developed by the Governance Committee, water developed by the Tamarack Project may be exchanged for waters stored in Lake McConaughy, adding to the EA in Lake McConaughy. The State of Colorado has prepared an environmental assessment on the Tamarack Project, Phase I.

►Nebraska (Section 5)—Lake McConaughy EA: Nebraska's project, an EA in Lake McConaughy, is already in operation as part of the FERC license requirements currently in effect for CNPPID and NPPD Project Nos. 1417 and 1835, respectively. Implementation of the Program would increase the volume of water stored in and managed from the EA. The EA receives 10 percent of the storable inflows to Lake McConaughy during the months of October through April, up to a maximum of 100 kaf in any one year. The amount in the account also would be set at 100 kaf anytime Lake McConaughy fills. Water not released from the EA in one year carries over to the next year as long as the total capacity limit of 200 kaf is not exceeded. Waters released from the Pathfinder Reservoir EA, plus the retimed flows from the Tamarack Project that can be exchanged for Lake McConaughy storage, and contributions from elements of the Water Action Plan, can also be stored in the Lake McConaughy EA, subject to certain limits including the 200 kaf capacity limit for the contents of the EA. Those waters would also be released at times that would improve achievement of target flows for the species.

Following established guidelines, the Service's EA Manager determines when water is to be released from that account. The Program's water management process and relationship with the EA Manager are described in Attachment 5 of the Water Plan and Section I.C.2 of the AMP.

Reconnaissance-Level Water Action Plan:

The Program includes a Reconnaissance-Level Water Action Plan (Section 6 of the Water Plan) that contains 13 water supply and conservation projects and activities to supply an additional average of 50,000 to 70,000 acre-feet per year of improvement toward meeting target flows. As summarized, the 13 presently identified conservation and water supply projects are expected to yield 70,000 acre-feet of improvement toward target flows. Described below (by State) are, the individual projects and how they were analyzed for the Biological Assessment (i.e., FEIS).

Nebraska Water Supply and Conservation Projects:

*Offstream Reservoir in the Central Platte* - The Water Action Plan identified six possible sites for offstream storage reservoirs in the Brady to Lexington reach of the Platte River. For the purpose of the analysis, the FEIS used a reservoir located near the Johnson-2 (J-2) Return Channel, with a storage capacity of 1,718 acre-feet. The capacity is one-half of the capacity presented in the Water Action Plan in order to simulate the yield to the Program from this project. The reservoir would store excess flows from the canal to be released back to the river at times that are advantageous to the species. The project is expected to yield about 7,000 acre-feet per year of improvements to target flows for the Program. The State of Nebraska has reserved approximately one-half of the yield (an additional 7,000 acre-feet) from this project to offset future depletions.

*Water Leasing in Nebraska* - Under this activity, willing irrigators/farmers would have the opportunity to lease some of their water rights to the Program. Of the water leased to the Program, only the portion that would have been consumed through irrigation of crops would be allocated to the Program for management. The Water Action Plan includes leasing sufficient rights to obtain Program management of approximately 8,400 acre-feet (af) per year of water that would otherwise be consumptively used. After accounting for transit losses, this amount would yield an average of 7,000 acre-feet per year improvement toward target flows at Grand Island, Nebraska.

*Water Management Incentives in Nebraska* - Water management incentives would include paying willing irrigators/farmers with storage rights in Lake McConaughy to reduce their need for irrigation deliveries by adopting water-saving measures. Conservation measures could include conservation cropping, deficit irrigation, land fallowing, or improving irrigation technology. Only the avoided consumptive use of water would be available to the Program for management. The expected yield, through a combination of these measures, is an average improvement toward target flows of 7,000 acre-feet on an average annual basis.

*Groundwater Management in the Central Platte Groundwater Mound* - Additional groundwater management would be implemented in the high groundwater area south of the central Platte River ("groundwater mound") that has built up, due to percolation of irrigation water and seepage from canals and reservoirs. Management would be implemented to avoid permanent "mining" of the groundwater table and may include:

a) Pumping water from the Mound (where it is judged to be too high or a nuisance) into creeks that drain back to the Platte River;

b) Paying willing irrigators/farmers to dryland farm every other year and using their water supplies for Program purposes;

c) Paying willing irrigators/farmers to use groundwater instead of their Lake McConaughy storage water, which would be allocated to the Program; and

d) Diverting excess water from CNPPID's canals in the fall and winter and recharging the groundwater mound, then pumping an equivalent amount from the mound during the following irrigation season. This strategy would allow water normally released from Lake McConaughy in the summer for irrigation to be managed by the Program without causing long-term declines in the groundwater table.

The goal for these options is to provide an average improvement toward target flows by 6,000 af on an average annual basis, of which 1,400 af per year would be allocated to the Program; the remainder would be reserved by the State of Nebraska to offset future depletions to the Platte.

*Dry Creek/Fort Kearney Cutoffs* - The Dry Creek/Fort Kearney Cutoffs consist of two options. The first option, just south of Kearney, involves a "cutoff" (creating a small drainage channel) from Lost Creek to North Dry Creek, and the second option involves a cutoff from Lost Creek to the Fort Kearny Improvement Project Area. The two options could return existing flows in Lost Creek or releases from the Funk Waterfowl Production Area to the Platte River, providing an estimated annual average of 2,200 acre-feet per year of water to the Platte River habitat area (based on yield tables in the Water Action Plan).

*Dawson and Gothenburg Canal Groundwater Recharge* - The Gothenburg and Dawson canals divert water from the central Platte River just upstream of the habitat area. The recharge project would involve diverting river flows into the canals outside of the irrigation season, when flows in the river are in excess of target flows. Much like the Tamarack Project, these waters would return to the river through groundwater flows over a period of years, with approximately 28 percent of return flows occurring within nine years. The average diversions to the Gothenburg and Dawson canals would be approximately 14,000 and 19,000 af per year, respectively, providing an estimated additional average of 2,600 af per year to target flows, of which 1,800 af would be allocated to the Program.

*Central Platte Power Interference* - Year-round releases are made from Lake McConaughy that generate hydropower at the Kingsley Dam hydropower plant and at the CNPPID and NPPD canal power plants. Water not diverted to irrigation returns to the Platte River above the habitat area. Under the Central Platte Power Interference element, the Program would pay the Districts to modify their schedule of water releases to shift some of the river flows from periods of excess to periods of flow shortage, thus improving the overall attainment of target flows by an average of 1,400 af per year.

*Net Controllable Conserved Water* - CNPPID has undertaken various conservation measures to reduce its total diversions from the Platte River, based on an agreement with the National Wildlife Federation. These measures have included:

a) revised operations for Elwood Reservoir to minimize seepage;

b) installed pipelines, earth compaction, membrane lining, and related canal improvements; and

c) made on-farm irrigation system improvements, such as installation of center pivots, gated pipe, flow meters, and surge valves, and management improvements such as changes in irrigation scheduling, adjustments to irrigation set times, and alternate flow irrigation.

The current estimate is that these measures have resulted in an average of 5,000 af per year of target flow shortage reduction that could be made available to the Program.

## Wyoming Water Supply and Conservation Projects:

*Pathfinder Modification Project, Wyoming Account* - The Pathfinder Modification Project would restore the original storage capacity of the reservoir by raising the spillway crest. This action would yield an additional 20,000 af of storage space (over current conditions) for a State of Wyoming municipal water supply account with a firm annual water yield of 9,600 af per year. Because the current demand for additional municipal water is less than 9,600 af per year, a portion of the balance of the annual firm yield may be used by Wyoming for release to benefit target species as part of the Program. Wyoming could annually lease the unneeded portion to the Program (an estimated average of 4,800 af per year for the first increment of the Program) when the water is not needed to meet municipal demands.

*Glendo Reservoir Storage* - Glendo Dam and Reservoir are located on the North Platte River about 4.5 miles southeast of the town of Glendo, Wyoming. Wyoming would annually lease the excess portion of its share of Glendo storage water to the Program (an estimated average of 2,650 af per year for the first increment of the Program) when the water is not needed to meet long-term contracts or other obligations in Wyoming.

*Water Leasing* - The members of irrigation districts or individual farmers willing to participate in temporary water leasing as part of the Program are not known. An incentive program would be established for willing Wyoming irrigators to make temporary leases of their water to the Program. The goal would be to lease approximately 16,500 af of water per year. The Program would obtain control of the amount corresponding to consumptive use of this water, or approximately 8,200 af, and the remaining portion would be released to maintain return flows. The shortage reduction at the habitat area would be about 3,900 af on an average annual basis.

*La Prele Reservoir Water Leasing* - La Prele is an existing irrigation and industrial supply reservoir in Wyoming located on La Prele Creek, approximately 13 miles upstream of the confluence with the North Platte River. Under La Prele leasing, the Panhandle Eastern Pipeline Company, which holds the right to 5,000 af of storage space in La Prele Reservoir, would lease the space to the Program. The average annual yield from this space is estimated at 1,865 af per year at the reservoir.

Colorado Water Supply and Conservation Projects:

*Tamarack Project, Phase III* - Colorado proposes to provide an estimated average of 17,000 af of water per year to the Program via an expanded Tamarack Project, involving a mix of several projects. The potential projects include groundwater recharge management on public and private lands and acquisition of water previously developed by private individuals and ditch and reservoir companies from approximately Fort Morgan, Colorado, to the Nebraska state line. Most activities would likely occur within a few miles of the South Platte River.

Depletion Management Plans:

In addition to the water elements that improve achievement of target flows, the Program seeks to ensure that other water-related actions do not reduce achievement of target flows. The State and Federal agencies have developed plans to mitigate or avoid any future depletions that increase shortages to the species and annual pulse flow targets or otherwise undermine Program flow improvements. Each plan is designed to avoid increasing ESA compliance burdens on other States and compensate for any adverse impacts they might have on the Program's water projects. Separate plans from Nebraska, Wyoming, Colorado, and the Federal government for offsetting impacts of future depletions are described in Sections 7 through 10 of the Water Plan, respectively.

New depletions associated with surface water, in the Nebraska New Depletion Plan (NE NDP) is defined as any direct diversion of surface water that will result in an increased shortage to the Service's annual target flows. The NE NDP allows for some surface water reductions to peak flows as a result of Program-approved reservoirs as long as the storage capacities of all other Nebraska reservoirs constructed or permitted for construction in that part of the basin after Program initiation do not collectively exceed a 10,000 af limit. In addition, any reductions to peak flows below Chapman, Nebraska, will not be offset by the NE NDP. New depletions associated with groundwater extraction after December 31, 2005, are defined using the 28/40 line developed Cooperative Hydrology Model (COHYST). The 28/40 line consists of 28 percent or greater of the total groundwater consumed that result in depletions to base flow tributaries upstream of Chapman when consumption is conducted over the span of 40 years. Offsets for new-use depletions begun after December 31, 2005, occurring outside of the 28/40 line are not required under the NE NDP in the first increment. Nebraska anticipates that depletions outside the 28/40 line will have little effect to the Platte River during the first increment. For subsequent increments, the NE NDP states that Nebraska understands the depletion exemption for new or expanded uses that exceed an average of 2,000 acre-feet per year outside the 28/40 line may not be acceptable to the Governance Committee.

For the South Platte River, the Colorado New Depletion Plan (CO NDP) will allow for 98,010 af in gross water supplies annually from diversions to storage or wastewater exchange and reuse during the February-through-July period to meet anticipated new water demands associated with Colorado's population increase. Additionally, the CO NDP does not cover the construction of major on-stream reservoirs (i.e., greater than 2,000 af) located on the main stem of the South Platte River anywhere downstream of Denver, Colorado. In the North Platte River basin, Colorado does not anticipate an expansion of irrigated acreage beyond the 134,468 acres (which represent the maximum number of acres irrigated in any one year since 1945) or the population to exceed 2,022 in the first increment. They also do not anticipate "significant" non-nexus increases in piscatorial, wildlife, or other environmental uses that may result in new depletions. Only water uses in excess of these North Platte baselines will require offsetting in conformance with Colorado's NDP.

Each State has agreed to work with Interior and cooperating Federal agencies in the process of securing up to 350 acre-feet of water annually, if needed, to offset new Federal depletions in each State according to their respective new depletions plans. If new Federal depletions cumulatively exceed 1,050 acre-feet/year, the Federal new depletions plan will not be available for the purposes of ESA compliance for those new depletions in excess of this total.

Service Mountain Prairie Region Instream Flow Recommendations and Usage for the Program:

This document is contained in Section 11 of Appendix G and provides an explanation of the use of Service instream flow recommendations, and target flows, by the Program. As noted in the document, only target flows (species flows and annual pulse flows) are used as a basis for:

a) Calculating "historic shortages to target flows";

b) Establishing replacement obligations for projects covered by State and Federal future depletions plans;

c) Reconnaissance-level evaluations of potential Program flow augmentation projects (Boyle's "Water Conservation/Supply Reconnaissance Study, Final Report"; and

d) "Scoring" the Program and alternatives relative to the Service's goals.

Nonetheless, peak flow recommendations are identified as an essential component of the suite of flow recommendations established by the Service for the central Platte River because of their importance for the maintenance of river-associated habitat. Thus, they also will be evaluated in terms of Program benefits for the target species. It remains an objective of the Service to a) minimize reductions in the frequency and magnitude of the highest peak flows; and b) improve the long-term running average annual peak flow magnitudes in the central Platte River, because the Service considers peak flows an essential factor in conserving the ecosystems upon which the target species and other species depend. Future evaluations of the Program will require a balanced assessment of the positive effects on species and annual pulse flows versus the negative effects on peak flows.

## D6. Organizational Structure for the Program (Attachment 6)

This Program attachment describes an organizational structure for making decisions and carrying out activities related to the Program. This document also identifies the responsibilities and authorities of each component of the structure. Entities include: Governance Committee, Signatories, Oversight Committee, Executive Director, Finance Committee, Advisory Committees including a Land Advisory Committee, Water Advisory Committee, and Technical Advisory Committee, and Independent Scientific Advisory Committee.

<u>Signatories/Oversight Committee</u>:

The Signatories are the States of Colorado, Nebraska, and Wyoming, and the Department of the Interior. The Oversight Committee is made up of the Governors of the three States and the Secretary of the Department of the Interior.

<u>Governance Committee</u>:

The Governance Committee makes Program decisions and implements the Program. This 11-member committee is composed of one representative each from the States of Wyoming, Colorado, and Nebraska, selected by each respective Governor (three votes); one representative each from the Service and Reclamation, selected by the Secretary of the Interior (two votes); a total of three representatives from environmental entities in the three States, collectively having two votes on the committee (two votes); one member representing the "Upper Platte Water Users" (one vote); one member representing the "Colorado Water Users" (one vote); and one member representing the "Downstream Water Users" (one vote). Appendices A through D of the Organizational Structures document describes the selection processes for the environmental and water user representatives. The responsibilities of the Governance Committee include, but are not necessarily limited to, the following:

a) Meet as needed but no less than on a quarterly basis for the first year of the Program and twice a year thereafter.

b) Elect a chair and vice chair annually.

c) Adopt rules for carrying out its responsibilities.

d) Select an Executive Director, a land interest holding entity, a financial management entity, and other contractors as it deems appropriate, and request that the Signatories enter into agreements for these services.

e) Establish four standing advisory committees (i.e., the Land Advisory Committee and Water Advisory Committee and Technical Advisory Committee, and the Independent Scientific Advisory Committee), and ad hoc committees, as needed.

f) Approve budgets and request funds or financing from the Signatories for Program purposes, which would be provided pursuant to applicable Federal and State procedures and subject to the availability of appropriated funds.

g) Approve Program activities and criteria (such as land and water acquisition and management criteria, management actions, and revisions to milestones or land and water plans through Program Adaptive Management), after considering recommendations from the Executive Director and committees.

h) Review accomplishments annually, including consideration of the schedules, operations of the initial Program water projects, and other Water Plan projects and Land Plan projects.

i) Evaluate Program management activities, as described in the AMP, and take action as appropriate using the procedures described in that plan.

j) Annually compare accomplishments with the milestones, and implement measures to correct shortfalls, if needed, and as necessary revise milestones so long as such revisions are consistent with the Program's long-term and first increment goals and objectives.

k) Review implementation of the States' and Federal government's depletions plans and the; approve modifications to plans; and provide a forum for resolution of any issues related to implementation and modification of the plans.

l) Assess the need to extend the term of a Program increment to assure transition to any subsequent Program increment. The Governance Committee may extend the term of a Program increment if the extension does not require the commitment of additional funds by the Signatories.

m) Develop milestones and recommend to the Signatories the duration, goals, and objectives for future increments as appropriate, to ensure that the Program can continue to provide ESA compliance for new and existing water-related activities.

The Governance Committee will attempt to operate by informal consensus. Votes will be taken when appropriate. For the purpose of voting on any issue, a quorum shall consist of the representative or alternate appointed by each Governor, the representatives or alternates of the Service and Reclamation and two (2) other representatives or their alternates. Nine of the ten representatives to the Governance Committee, including the representative or alternate appointed by each Governor and the representatives or alternates for the Service and Reclamation, must vote in the affirmative for the Governance Committee to act. Each of the Signatories, including the Service, is provided the authority to veto decisions with which they disagree. For votes related to financial matters, the affirmative vote by a Governance Committee representative of a Signatory constitutes authorization to use that Signatory's funds. If a representative and alternate of a water user or environmental member are absent from a meeting, abstain from voting or the seat is vacant, the voting requirements will be reduced accordingly.

Executive Director:

The Governance Committee will select an Executive Director who will serve at the pleasure of the Governance Committee. The Executive Director's responsibilities include, but are not necessarily limited to, the following:

a) Carry-out the directions of the Governance Committee.

b) Facilitate day-to-day communication among Program participants.

c) Coordinate Program activities with the Governance Committee's advisory committees by regularly collaborating with the committees on activities for which they have advisory responsibilities.

d) Provide staff support for the Program and committees.

e) Communicate with local governments, the public, the media, and Federal and State agencies.

f) Prepare budgets for review by the Finance Committee and approval by the Governance Committee.

g) Prepare contractor selection procedures for review by the Finance Committee and approval by the Governance Committee.

h) Prepare and provide outreach/public education activities for the Program.

i) Prepare agreements/contracts and amendments.

j) Review invoices for accuracy and consistency with work accomplishments and compliance with contracts and amendments. Submit the approved invoices for payment.

k) Prepare quarterly expenditure reports and submit them to the Finance Committee and Governance Committee.

l) Maintain a Program office and manage Program staff.

m) Provide recommendations and advice to the Governance Committee.

n) Provide a review of Program tasks and periodically report on the status and progress of each task to the Governance Committee.

o) Perform such other functions as requested by the Governance Committee.

Finance Committee:

The Governance Committee, in its present form, has no legal authority to enter into contracts, collect and retain funds, or incur debt. The Signatories intend to perform these Program functions through an agreement with a financial management entity (FME), and other entities as needed on behalf of and as authorized by the Governance Committee. A Finance Committee will be established to monitor the FME and to assist the Governance Committee and Signatories with financial matters. The Finance Committee charter is provided in Appendix E of the Organizational Structures document.

Advisory Committees:

The Governance Committee will establish four standing Advisory Committees to provide advice on Program activities. The Governance Committee may also, from time to time, establish ad hoc committees to deal with individual or time specific issues. The standing Advisory Committees and the Organizational Structures Document appendix where their charters can be found are as follows:

a) Land Advisory Committee – Appendix F

b) Water Advisory Committee – Appendix G

c) Technical Advisory Committee – Appendix H

d) Independent Scientific Advisory Committee – Appendix I

Relationship of Program to Other Entities and Participants:

The Signatories may enter into agreements with other entities to facilitate the completion of the Program activities.

a) Financial Management Entity. The Governance Committee may enter into an agreement with a financial management entity to provide financial management services.

b) Land Interest Holding Entity. The Signatories may enter into an agreement with a land interest holding entity to hold title to Program lands, or to enter into leases, easements, and other land-holding transactions.

c) Water Project Sponsors. Sponsors of Program water projects are: a) entities or individuals who construct, modify or make operational changes in water projects to yield water for the Program, while retaining ownership of the water project itself; or, b) entities that have entered into water supply contracts or management agreements with water users or water rights holders to obtain water for the Program. Signatory agencies or non-Signatories may sponsor Program water projects. In both cases, appropriate assurances of management consistent with the Program's goals and objectives are required. The Water Plan describes provisions to be addressed in sponsorship arrangements. Sponsors of water projects include CNPPID (Environmental Account in Lake McConaughy), the State of Colorado (Tamarack I), and the State of Wyoming, as contractor with the Reclamation (Pathfinder Modification Project).

d) Sponsors of Program Lands. Sponsors of Program lands are entities or individuals who dedicate the use of such lands to the Program, but retain ownership of the property rights that allow Program use of the lands. Sponsored lands must be protected by other Federal, State or local programs, managed under regulatory oversight as habitat, or protected by non-profit conservation groups or government agencies. Signatory agencies and non-Signatories may sponsor Program lands. In both cases, management plans, agreements, or other arrangements must be satisfactory to the Governance Committee and assure Program access and management consistent with the Program's goals and objectives. The Land Plan describes provisions to be addressed in sponsorship arrangements. Program lands owned by Sponsors include lands acquired by Wyoming (470 acres) and NPPD's Cottonwood Ranch Property (2,650 acres) and least tern and piping plover islands and sandpits.

e) Land Management. Arrangements will be made to implement land management activities as described in the Land Plan.

# V. Status of the Species/Critical Habitat

## *A. Whooping Crane Biological Status*

Unless otherwise indicated, information on the whooping crane status is drawn from the Whooping Crane Recovery Plan (USFWS 1994g). ). The importance of the Platte River ecosystem to whooping cranes is discussed in the *Environmental Baseline* section of this biological opinion.

### A1. Species and Critical Habitat Description

The whooping crane is in the Family *Gruidae*, Order *Gruiformes*, and is the rarest of the world's 15 crane species. It is the tallest North American bird at approximately 5 feet in height. Adult plumage is snowy white overall except for black primaries, black or grayish alulae, sparse black bristly feathers on the carmine crown and malar region, and a dark gray patch on the nape. The bill and long legs are olive-gray. The sexes are alike, with males generally larger than females. Juveniles have reddish plumage initially with white feathers appearing gradually through the first winter and spring. Full adult plumage is not typically attained until late in the birds second summer (USFWS 1994g).

<u>Current Legal Status:</u>

The whooping crane was listed in the United States as threatened with extinction on March 11, 1967 (32 FR 4001), and as endangered in 1970 (35 FR 16047). The Department of the Interior designated critical habitat for the species on May 15, 1978 (43 FR 20938).

The whooping crane is also legally protected at various national and international levels by the Convention on International Trade in Endangered Species (1975); the Migratory Bird Treaty Act (1918); the Canadian National Parks Act (1930); the Canada Wildlife Act (1972); and the

Canadian Migratory Birds Convention Act (1994). Although the species no longer occurs in Mexico, it is legally protected there.

Concern over the near extinction of the whooping crane has prompted a broad range of conservation actions, including national and international legal protections, comprehensive scientific research and monitoring programs, protection of key habitats, development of whooping crane recovery teams and comprehensive recovery plans, programs for captive breeding and reintroduction, and extensive public education campaigns. Legal protection was obtained and habitat acquisitions and intensive management instituted for important wintering, breeding, and migrational habitats.

<u>Designated Critical Habitat:</u>

Five areas have been federally designated as critical habitat for the whooping crane (50 CFR 17.95). In designating these areas the Service considered the physiological, behavioral, ecological and evolutionary requirements of the survival and recovery of whooping cranes (43 FR 870). These whooping crane requirements include, but are not limited to: a) space for individual and population growth and for normal behavior; b) food, water, air, light, minerals, or other nutritional and physiological requirements; c) cover or shelter; d) sites for breeding, reproduction, or rearing of offspring; and generally, e) habitats that are protected from disturbances or are representative of the geographical distribution.

The federally designated critical habitat areas include the wintering area at Aransas National Wildlife Refuge (NWR) and the following four migrational habitat areas: Salt Plains NWR, Oklahoma; Quivira NWR and Cheyenne Bottoms State Wildlife Area, Kansas; and the Platte River valley, Nebraska. These areas have geographic importance and are observed to have the highest frequency of crane use of any areas in the species' migrational path (Allen 1952, Stehn 2003, Austin and Richert 2001).

Critical habitat along the central Platte River was officially designated as follows:

> *An area of land, water, and air-space in Dawson, Buffalo, Hall, Phelps, Kearny, and Adams Counties with the following boundaries: Platte River bottoms - a strip of river bottom with a north-south width 3 miles, a south boundary paralleling Interstate 80, beginning at the junction of U.S. Highway 283 and Interstate 80 near Lexington, and extending eastward along Interstate 80 to the interchange for Shelton and Denman, Nebr. near the Buffalo-Hall County line (43 FR 20938).*

The following elements were considered in making the critical habitat determination for the Platte River:

1. <u>Nutritional Requirements</u>--The Platte River bottoms provide a dependable source of food, water, and other nutritional or physiological needs for the whooping crane during spring and fall migrations. Insects, crayfish, frogs, small fish, and other small animals as well as some aquatic vegetation and some cereal crops in adjacent croplands appear to be major items taken during the migration period;

2. Cover or Shelter--Under certain flow regimes, the Platte River generally provides whooping cranes with the required open expanse for nightly roosting. The availability of shallow, submerged sand and gravel bars in rivers and lakes appears to be one of the major factors determining whooping crane use of these habitats as roosting sites. Cranes observed during migration are most often found within short flight distances of these wetland areas; and

3. Space for Normal Behavior--The Platte River provides needed isolation. Whooping cranes do not readily tolerate human disturbances. A human on foot, at distances of over 0.25-mile, can quickly put a crane to flight.

The designation of migrational habitats recognizes the critical role that these areas play in the long-term survival and conservation and recovery of the species. Lewis et al. (1992) observed that 83 percent of adult whooping crane mortality occurs during the 7-month period between when cranes leave the wintering area in the spring and their return in the fall. Whooping cranes are territorial on the breeding range and each bird or breeding pair occupies a distinct area in Wood Buffalo Park that is surveyed during the species' nesting season. Because adult mortality is not often observed on the nesting grounds, crane biologists believe that most mortality occurs during migration. The Whooping Crane Recovery Team considers habitat modification a factor that affects loss of individuals and decline of the species, and that a key to whooping crane recovery and survival is reduction of mortality during migration (USFWS 1994g).

The importance of maintaining traditional habitats such as the Platte River and the other high-use areas is amplified by the impact of ongoing human conversion of wetlands and grasslands to crop production which has made nearly all of the whooping cranes original nesting range unsuitable for use by the species.

Former and Current Range of the Species:

The species occurs exclusively in North America. Historically, the species bred primarily in wetlands of the northern tall- and mixed-grass prairies and aspen parklands of the northern Great Plains. The principal historic breeding range extended from central Illinois northwestward through northern Iowa, western Minnesota, northeastern North Dakota, southern Manitoba and Saskatchewan, the general vicinity of Edmonton, Alberta, to the nesting area presently remaining in Wood Buffalo National Park (Figure V-A1). There were several migration routes. Winter distribution was primarily along the Gulf of Mexico from Louisiana to northeastern Mexico. A lesser migration route crossed the Appalachian Mountains to wintering areas along the Atlantic Coast. Some whooping cranes were believed to have migrated to the interior of Mexico following the migration route of sandhill cranes (*Grus canadensis*). A nonmigratory population occurred in southwestern Louisiana (Drewien et al. 2001).

In addition, a non-migratory population that inhabited southwest Louisiana declined following a storm event in August 1940. The last remaining individual was taken into captivity in March 1950 and the sub-population became extinct upon its death. With the loss of the Louisiana population the whooping crane as a wild and self-sustaining species was reduced to a single population that nests at Wood Buffalo National Park, Canada, and winters on and near the Aransas NWR (NWR) along the Texas gulf coast (Figure V-A2 and Figure V-A3). This population is referred to as the Aransas-Wood Buffalo population (AWB population) and migrates through the federal action area twice each year.

The AWB population nests in remote areas almost exclusively within the borders of Wood Buffalo National Park at the northernmost extreme of the bird’s historic breeding range. Nesting territories occupy poorly drained areas where muskeg and boreal forests intermix (Allen 1956, Novakowski 1966, Kuyt 1981a). The cranes nest in emergent vegetation (primarily bulrush and sedges) in the shallow portions of ponds, small lakes, and wet meadows (Kuyt 1995). Nests are usually constructed of bulrush (Scirpus spp.) and other surrounding wetland vegetation in shallow (14-28 cm) water (Allen 1956; Kuyt 1981a, 1981b, 1995).

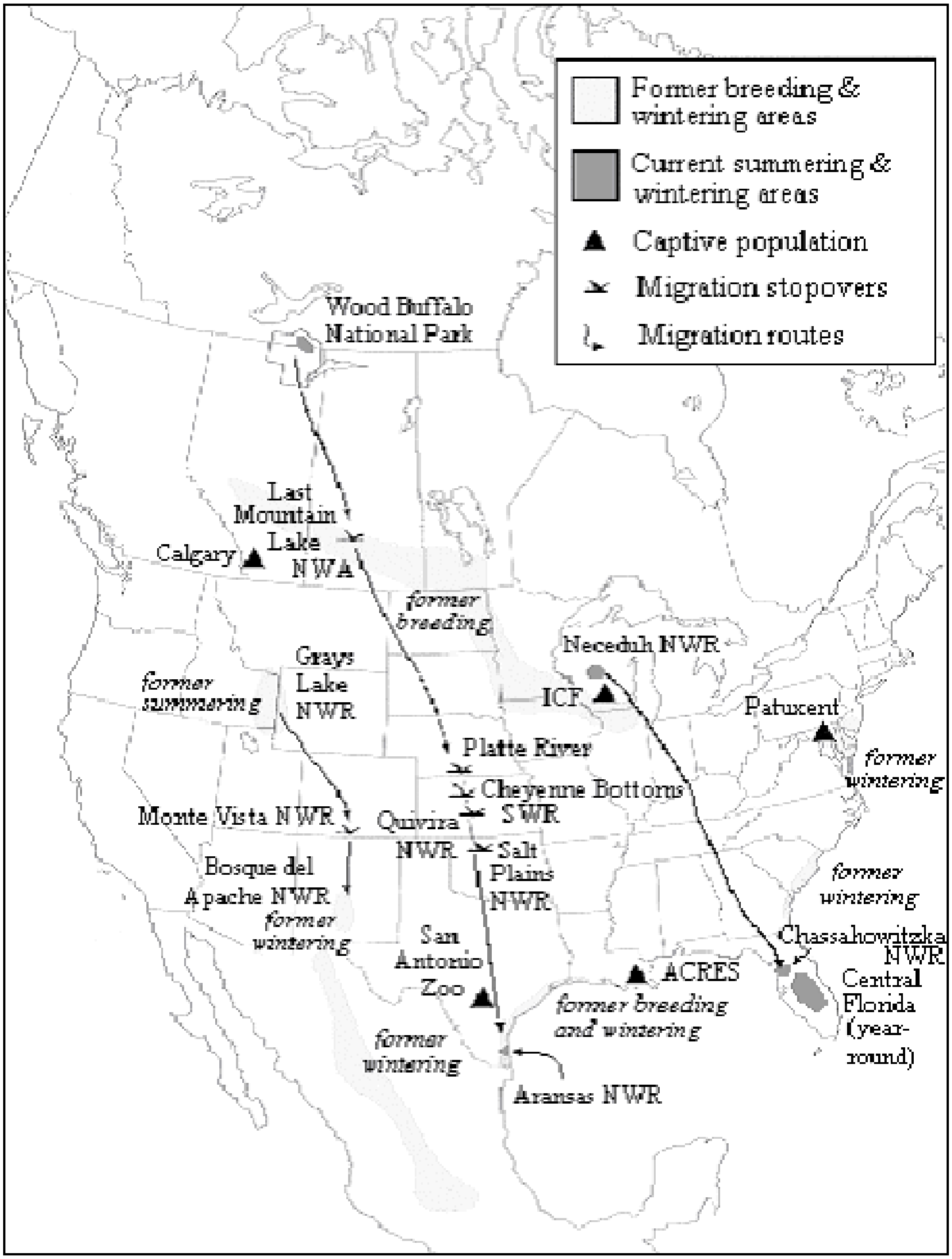


**Figure V-A1. The principal known breeding and wintering areas of the whooping crane (Grus americana) (adapted from Meine and Archibald 1996).**

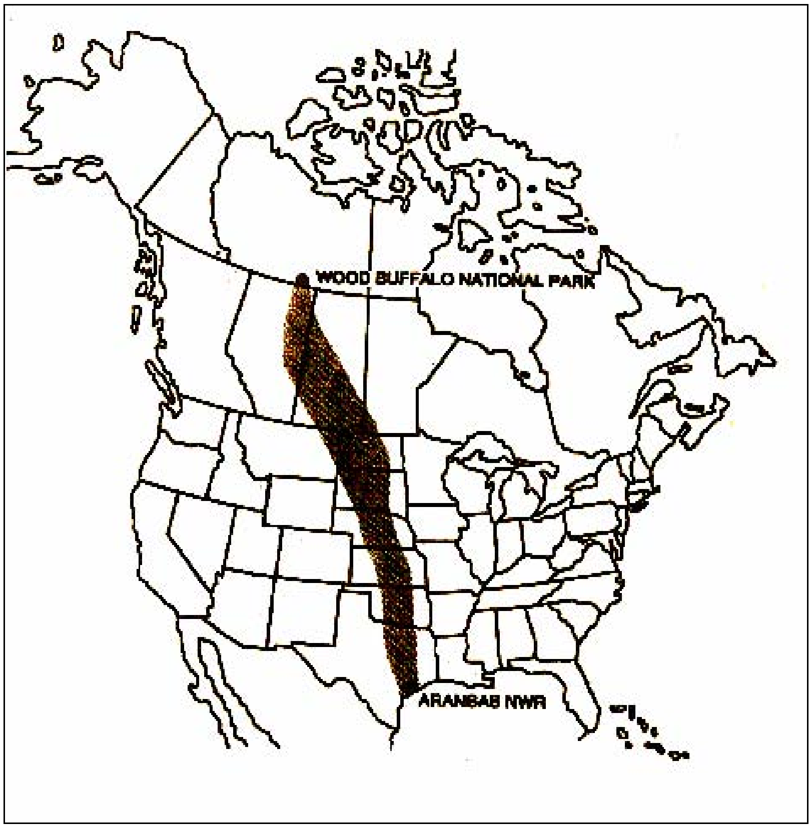


**Figure V-A2. Migration route of the whooping crane between nesting grounds at Wood Buffalo National Park, Canada, and wintering area at Aransas NWR, Texas.**

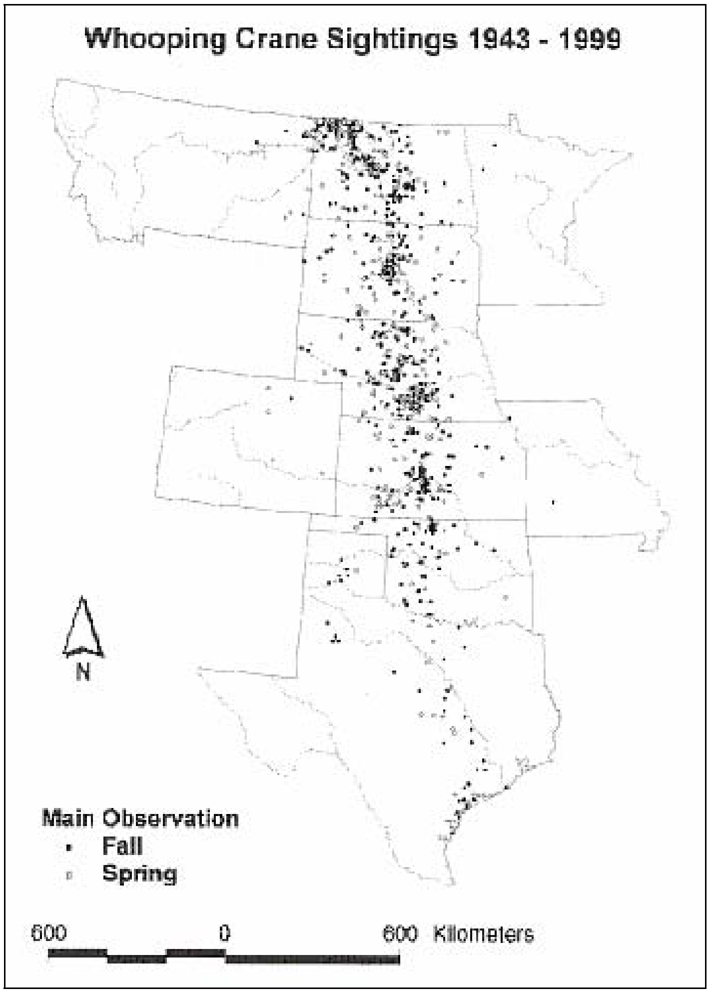


**Figure V-A3. Distribution of whooping crane sighting reports in the United States based on the Cooperative Whooping Crane Migration Monitoring Project of the Whooping Crane Recovery Team database (Source: Austin and Richert 2001).**

## A2. Life History

Migration:

During migration, the AWB population uses a variety of feeding and roosting habitats, including croplands, marshes, shallow reservoirs and sheet-water areas, and submerged sandbars in rivers along the migration route. Aquatic roosting areas free of disturbances and with open vistas appear to be the primary attraction of migrational stopover sites. The AWB population winters in bays and coastal marshes in and near the Aransas National Wildlife Refuge on the Texas Gulf Coast. Experimental attempts are being made to establish other wild populations through captive propagation and release of pen-reared birds.

The entire AWB population migrates each fall and spring over a 2,500-mile distance. The spring or northward migration from the Aransas NWR area begins in late March with whooping cranes arriving at Wood Buffalo National Park in late April. The fall or southward migration from Wood Buffalo National Park begins in mid September and whooping cranes begin arriving in the Aransas NWR area during October.

Migrating cranes usually are observed as separate flocks of two to eight sub-adults or unsuccessful breeding adults, family groups (two adults, one juvenile), or single birds (Armbruster 1990). Up to 19 individuals have been reported in a single group. Whooping cranes of the AWB population occasionally associate with sandhill cranes during migration. In rare occasions single whooping cranes--probably sub-adults--associate with over-wintering sandhill cranes.

The primary migration corridor of the AWB population runs in a relatively narrow (50-180-mile-wide) band across the United States and Canada, crossing Alberta and Saskatchewan, and from extreme northeastern Montana, south through North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and Texas. In Nebraska the primary corridor averages 170 miles wide, angles approximately 15° west of north, and overlies the stretch of the Platte River from just west of the City of North Platte to just east of Grand Island. Johnson (1982) estimated that 82 percent of all recent confirmed sightings had been made within the primary corridor and the remaining sightings have been predominantly to the west.

Armbruster (1990), Johns et al. (1997), Howe (1989) and Johnson and Temple (1980) are among those that have characterized migrational habitats used by whooping cranes. In 1975, the U.S. Whooping Crane Recovery Team implemented a long-term Whooping Crane Migration Cooperative Monitoring Project to improve the understanding of crane migration and migration management needs. While virtually all of the whooping crane data are collected through chance observations and limitations apply to the interpretations that can be made, these data are the primary data on which long-term and broad-scale knowledge of the crane migration has accrued and serve as part of the best available information regarding the species migrational range, timing, and habitats used. Austin and Richert (2001) present a comprehensive review of 1943-1999 whooping crane migratory use-site information using information collected by the Monitoring Project and earlier data.

Whooping cranes use a variety of habitats during migration. A common feature of the vast majority of sites used by whooping cranes during migration is the proximity to wetlands that provide undisturbed habitat for roosting. Such sites likely provide both seclusion from disturbance by humans and predators and a food supply (USFWS 1994g). During migration whooping cranes often select palustrine wetlands and riverine habitats for roosting that are generally at sites removed from human intrusion (USFWS 1994g).

An evaluation of ten known whooping crane riverine roosting sites identified the following characteristics (Johnson and Temple 1980, USFWS 1981):

1. Wide channel; nine of ten roost sites measured were between 510 and 1,200 feet wide;

2. Unvegetated channel bed;

3. Fine substrate, usually sand;

4. Good horizontal visibility unobstructed from riverbank to riverbank and at least a few hundred yards upstream and downstream (or to a bend in the river) at all sites;

5. Good overhead visibility, absence of tall trees, tall and dense shrubs, or high banks near the roost;

6. Shallow water except in the main channel (all sites evaluated were less than 12 inches deep and six of nine sites were 2 to 6 inches deep); water in the main channel may be considerably deeper;

7. Slow flow where the cranes stand, although water in the main channel may be flowing faster;

8. Proximity (usually 1 mile) to suitable feeding sites;

9. The presence of unvegetated sandbar with very low elevation above water and near the middle of the river;

10. A distance of at least 0.25-mile from roads, houses, and railroad tracks.

Since this original description by Temple and Johnson, the Cooperative Monitoring Project has continued to conduct site evaluations of whooping crane riverine and wetland habitat use sites. The database of accrued sightings on the Platte River and other rivers supports the importance of the riverine characteristics originally described. A summary of Platte River information is given in Appendix E.

Whooping crane family groups migrating southward in the fall require habitats that provide the nutritional and security needs of the young. Howe (1989) found that family groups appeared to select more vegetated wetlands during fall migration than non-families. Though the reason for this is not known, vegetated wetlands likely yield higher densities of protein-rich invertebrates. Invertebrates could be important in the fall to juveniles that are not fully grown (Howe 1989). Vegetated wetlands may also provide better cover for young birds and thus reduce detection by predators.

The biannual migrations are the periods when individuals are probably exposed to the greatest number of risks and most deaths of juvenile and adult cranes occur (Lewis 1992). Long-lived individuals travel this route 40 to 50 times or more during their lifespan. In addition to physiological stress, migrating whooping cranes are exposed to a variety of potential hazards that include power lines, environmental contamination, contagious disease, and shooting. Like other migratory birds with delayed sexual maturity and life-long pair bonds, whooping cranes adhere to ancestral breeding areas, migratory routes, and wintering grounds, leaving little possibility of pioneering into new regions.

Foods and Feeding Habits:

Whooping cranes are omnivorous and take a variety of both invertebrate and vertebrate animals as well as plant tubers and berries (Walkinshaw 1973). On breeding grounds they feed primarily on mollusks and crustaceans, insects, minnows, frogs, and snakes (Allen 1956, Novakowski 1966). Adult and nymph life stages of aquatic insects appear to compose a large proportion of the diet of young cranes (Bergeson et al. 2001).

During migration whooping cranes forage in small-grain croplands, upland grasslands, and wetland habitat areas. The actual items eaten are not known but presumably include waste agricultural grains, insects and soil invertebrates, vertebrates such as small fish and frogs, and plant tubers and other plant parts.

A major part of the whooping crane's energy requirements during migration across the Great Plains may come from waste grain found on agricultural croplands. Although the proportions of plant and animal food in the diet are not known, whooping cranes require animal matter to satisfy critical nutritional needs. Based on the general knowledge of the biology of sandhill cranes and other water birds, breeding adults likely have nutritional requirements that must be met during spring migration to ensure that the birds arrive at the nesting grounds in good reproductive condition. Like waterfowl and other migratory birds, physiological conditioning during migration and prior to breeding is important to successful whooping crane reproduction. Breeding adults require adequate body fat reserves to sustain them upon their arrival on the breeding grounds when the breeding area is often still frozen and little food is available. In addition to caloric requirements, females must accumulate calcium each spring to adequately sustain migration and to produce healthy eggs and chicks. Numerous studies have confirmed that sandhill cranes acquire substantial fat reserves and calcium while staging along the Platte River (Krapu et al.1982, Krapu et al.1984, Reinecke and Krapu 1986, and Tacha et al. 1992).

Causes of Mortality:

The National Research Council (2005) observed that although the total mortality of the Aransas-Wood Buffalo birds' annual cycle is well known, the causes of death are more problematic. Nesting is rather well monitored and mortality on breeding areas is assumed to be low.

Other known causes of direct mortality are gunshot injuries, ingestion of toxic material, infectious bacteria (Snyder et al., 1997), and viral disease (Lewis 1992). Other hazards include exposure to storm events and, in combination with a variety of other factors, the physiological stress of migration. Whooping crane may be susceptible to a variety of diseases known to occur in sandhill cranes and other waterbirds (Olsen et al., 2001).

Predation is by far the greatest principal cause of mortality for captive-reared birds released to the resident population in Florida (Nesbitt et al., 2001 and Gee et al., 2001). The losses of captive-bred birds released into a Wisconsin-Florida migratory population have been attributed to predation (7), powerline strike (1) and capture myopathy (1) (Stehn 2005). Two mortalities in the Wisconsin-Florida population remain under investigation.

## A3. Population Dynamics

Population Size:

Although whooping cranes probably were never very abundant, Allen (1952) estimated populations of 1,300 to 1,500 individuals between the years of 1860 and 1870. Banks (1978) used two independent techniques of population estimation to derive estimates of 500 to 700 whooping cranes in 1870.

With the loss of the non-migratory Louisiana population in 1950, the whooping crane as a species was reduced to a single naturally reproducing population: the Aransas-Wood Buffalo population. In 1941, the AWB population reached a low of 15 individuals with six to eight breeding birds. Through intensive management, legal protection, formal protection of breeding, wintering, and migrational habitats, and research, the number of individuals in this population has slowly increased.

The population numbered 43 at the time of critical habitat determination in 1978. In the latest complete count (winter 2006) the population numbered 220 birds (Table V-A1). All of these birds are descendants from the original six to eight breeding birds, and therefore their genetic composition is from that small founding population. The present population includes 146 territorial adults (73 breeding pair).

**Table V-A1. Peak winter count of the Aransas-Wood Buffalo (AWB) population and other wild native populations, 1938-2006.**

| | AWB Population | | | Other Wild Populations* | | |
|---|---|---|---|---|---|---|
| Winter | Adult | Young | Subtotal | Adult | Young | Subtotal |
| 1938-39 | 14 | 4 | 18 | 11 | | 11 |
| 1939-40 | 15 | 7 | 22 | 13 | | 13 |
| 1940-41 | 21 | 5 | 26 | 6 | | 6 |
| 1941-42a | 14(13) | 2 | 16(15) | 6 | | 6 |
| 1942-43 | 15 | 4 | 19 | 5 | | 5 |
| 1943-44 | 16 | 5 | 21 | 4 | | 4 |
| 1944-45 | 15 | 3 | 18 | 3 | | 3 |
| 1945-46 | 18(14) | 4(3) | 22(17) | 2 | | 2 |
| 1946-47 | 22 | 3 | 25 | 2 | | 2 |
| 1947-48 | 25 | 6 | 31 | 1 | | 1 |
| 1948-49 | 27 | 3 | 30 | 1 | | 1 |
| 1949-50 | 30 | 4 | 34 | | | |
| 1950-51 | 26 | 5 | 31 | | | |
| 1951-52 | 20 | 5 | 25 | | | |
| 1952-53 | 19 | 2 | 21 | | | |
| 1953-54 | 21 | 3 | 24 | | | |
| 1954-55 | 21 | 0 | 21 | | | |
| 1955-56 | 20 | 8 | 28 | | | |
| 1956-57 | 22 | 2 | 24 | | | |

| Winter | AWB Population | | | Other Wild Populations* | | |
|---|---|---|---|---|---|---|
| | Adult | Young | Subtotal | Adult | Young | Subtotal |
| 1957-58 | 22 | 4 | 26 | | | |
| 1958-59 | 23 | 9 | 32 | | | |
| 1959-60 | 31 | 2 | 33 | | | |
| 1960-61 | 30 | 6 | 36 | | | |
| 1961-62 | 34 | 5 | 39 | | | |
| 1962-63 | 32 | 0 | 32 | | | |
| 1963-64 | 26(28) | 7 | 33(35) | | | |
| 1964-65 | 32 | 10 | 42 | | | |
| 1965-66 | 36 | 8 | 44 | | | |
| 1966-67 | 38 | 5 | 43 | | | |
| 1967-68 | 39 | 9 | 48 | | | |
| 1968-69 | 44 | 6 | 50 | | | |
| 1969-70 | 48 | 8 | 56 | | | |
| 1970-71 | 51 | 6 | 57 | | | |
| 1971-72 | 54 | 5 | 59 | | | |
| 1972-73 | 46 | 5 | 51 | | | |
| 1973-74 | 47 | 2 | 49 | | | |
| 1974-75 | 47 | 2 | 49 | | | |
| 1975-76 | 49 | 8 | 57 | | | |
| 1976-77 | 57 | 12 | 69 | | | |
| 1977-78 | 62 | 10 | 72 | | | |
| 1978-79 | 68 | 7 | 75 | | | |
| 1979-80 | 70 | 6 | 76 | | | |
| 1980-81 | 72 | 6 | 78 | | | |
| 1981-82 | 71 | 2 | 73 | | | |
| 1982-83 | 67 | 6 | 73 | | | |
| 1983-84 | 68 | 7 | 75 | | | |
| 1984-85 | 71 | 15 | 86 | | | |
| 1985-86 | 81 | 16 | 97 | | | |
| 1986-87 | 89 | 21 | 110 | | | |
| 1987-88 | 109 | 25 | 134 | | | |
| 1988-89 | 116 | 18 | 134 | | | |
| 1989-90 | 126 | 20 | 146 | | | |
| 1990-91 | 133 | 13 | 146 | | | |
| 1991-92 | 124 | 8 | 132 | | | |
| 1992-93 | 121 | 15 | 136 | | | |
| 1993-94 | 127 | 16 | 143 | | | |
| 1994-95 | 125 | 8 | 133 | | | |
| 1995-96 | 130 | 28 | 158 | | | |
| 1996-97 | 144 | 16 | 160 | | | |
| 1997-98 | 152 | 30 | 182 | | | |
| 1998-99 | 165 | 18 | 183 | | | |
| 1999- | 171 | 18 | 188 | | | |

| Winter | AWB Population | | | Other Wild Populations* | | |
|---|---|---|---|---|---|---|
| | Adult | Young | Subtotal | Adult | Young | Subtotal |
| 2000 | | | | | | |
| 2000-01 | 171 | 9 | 180 | | | |
| 2001-02 | 161 | 15 | 176 | | | |
| 2002-03 | 169 | 16 | 185 | | | |
| 2003-04 | 169 | 25 | 194 | | | |
| 2004-05 | 182 | 33 | 217 | | | |
| 2005-06 | 190 | 30 | 220 | | | |

*Includes the Louisiana non-migratory population (1938-1949).

With only one wild naturally breeding population remaining, the species survival is vulnerable to a range of potential catastrophic events or chronic pressure.  Three experimental efforts have been initiated in the hope of restoring other wild breeding populations.

The first experimental effort was undertaken in the inter-mountain region of the Rocky Mountains during 1975-1995.  Eggs were transplanted from whooping crane nests in Canada and from the captive flock at the Patuxent Wildlife Research Center to sandhill crane nests in Idaho to be hatched and reared.  This technique was termed ‘cross-fostering.’  A total of 210 transplanted eggs hatched and 84 of the chicks survived to fledging.  The experimental project ultimately failed due to high mortality rates and the lack of reproduction of the cross-fostered whooping cranes.  Lack of success caused the project to be terminated.  The last individual of the 84 cross-fostered whooping cranes that fledged died in 2002.

Although the high mortality in the Rocky Mountain flyway made it unsuitable for further reintroductions, other experimental restoration efforts have been initiated in Wisconsin and Florida.  These whooping crane flocks consist of captive, pen-reared birds that have been released to re-establish wild populations.  The experiments are still in very early stages and the ability of these birds to function as wild and self-sustaining populations is not known.  In the spring of 2006, the two experimental populations totaled 122 birds and there were 135 additional birds in seven separate captive populations at research and breeding facilities (Table V-A2).

In the second experiment, 262 young were released in an effort to establish a non-migratory population in palmetto grasslands, savannahs, and shallow marshes in the Kissimmee Prairie region of central Florida (1993-2003).  Predation has been a significant factor for this population.  Some of these birds have paired and nested and as of 2003, four young have successfully fledged.  This population declined to about 58 birds in 2006 and continues to have problems with high predation.  No whooping cranes produced at the captive centers were reintroduced into this population in 2005 due to the high mortality the population continues to suffer.

**Table V-A2. Current numbers in whooping crane populations***

| Population /Flock | Adults and sub-adults | Young | Total |
|---|---|---|---|
| Aransas/Wood Buffalo | 189 | 25 | 214 |
| Rocky Mountain[a] | 0 | 0 | 0 |
| Florida non-migratory[b] | 58 | 0 | 58 |
| Wisconsin/Florida migratory[a] | 41 | 23 | 64 |
| Wild cranes subtotal | 288 | 48 | 336 |
| Captive Whooping Cranes | 125 | 10 | 135 |
| Total Whooping Cranes | 413 | 58 | 471 |

* As of April 1, 2006 for AWB
[a] experimental release population
[b] estimated, because not all birds can be located on a regular basis

The third experiment is the establishment of a wild migratory population between northwestern Florida and Wisconsin. Captive-reared whooping cranes were first introduced in the eastern U.S. and trained to migrate by following an ultra-light aircraft in 2001. Other captive-reared birds have been added and this flock numbered 64 subadult birds in the spring of 2006.

As of 2005, 11 of the 53 total captive-reared birds released into the Florida-Wisconsin flock to that point had been lost to mortality. As previously mentioned, these losses resulted from predation (7), powerline strike (1), capture myopathy (1), and 2 mortalities that remain under investigation (Stehn 2005). Twenty-four additional captive-reared young birds were transported for release into this flock in the fall of 2005.

Population Variability (Recruitment and Survivorship):

The whooping crane is considered a "K-selected" species. It has a relatively long life span with low fecundity due to delayed age at which sexual maturity and reproduction is reached, a small clutch size, and low recruitment rates. Like other K-selected species, survivorship of adult cranes is an important factor of population maintenance. Mortality of adult breeding birds can significantly affect population growth.

Due to the breeding population structure and the bird's long life span, chronic impacts that affect the species reproduction could have a delayed manifestation in the population trend. This delay means there would be a time-lag of many years between the advent of adverse impacts and the time that impacts are detected and fully reflected in bird numbers within the population. Likewise, many years may be needed for the population to reflect improved conditions.

Whooping cranes are monogamous and mate for life but will re-mate upon the death of their partner (Blankinship 1976). Egg-laying usually starts in the fourth year of life and a two-egg clutch is the norm. Full breeding potential is often not reached until about seven years of age. Only one clutch is produced per year and occasionally mated pairs skip a nesting season for no apparent reason (USFWS 1994g). Most mortality occurs soon after hatching. Rarely does more than one young chick from a single nest survive to fledging. About one in four chicks hatched survive to reach the wintering grounds. Maximum longevity in the wild has been estimated at 22 to 24 years (Binkley and Miller 1983).

The AWB population has increased by an average of 4 percent annually during the 1970s and 1980s (Binkley and Miller 1983). This rate is also the approximate long-term average population growth rate from the mid-1940s to present (Table V-A3). The standard deviation of population growth (s.d. = 0.081) is about double the mean growth rate, indicating that in some years the population declines.

Since 1938, the AWB population long-term recruitment rate measured as the proportion of young-of-the-year to the total population is about 0.130. This average rate of recruitment has exhibited a general downward trend following the earliest period of the population recovery. Recruitment averaged 0.161 (range = 0.0 to 0.318) from 1938 to 1967 and 0.115 (range = 0.027 to 0.191) from 1968 to 1992 (Drewien et al. 1995). Since 1992, the 10-year running average of the recruitment rate is 0.105 (range=0.05 to 0.177).

Annual survivorship since 1950 has varied between 0.54 and 1.0. Although the causes remain unknown, studies suggest that the population has a 10-year cycle in the rate of survivorship (Boyce and Miller 1985, Boyce 1987, Nedelman et al. 1987). The 10-year running average of survivorship reached its highest point (0.94) in the mid 1980s and is currently about 0.92.

See Figure V-A4 for statistical parameters of the Aransas-Wood Buffalo Whooping Crane Population.

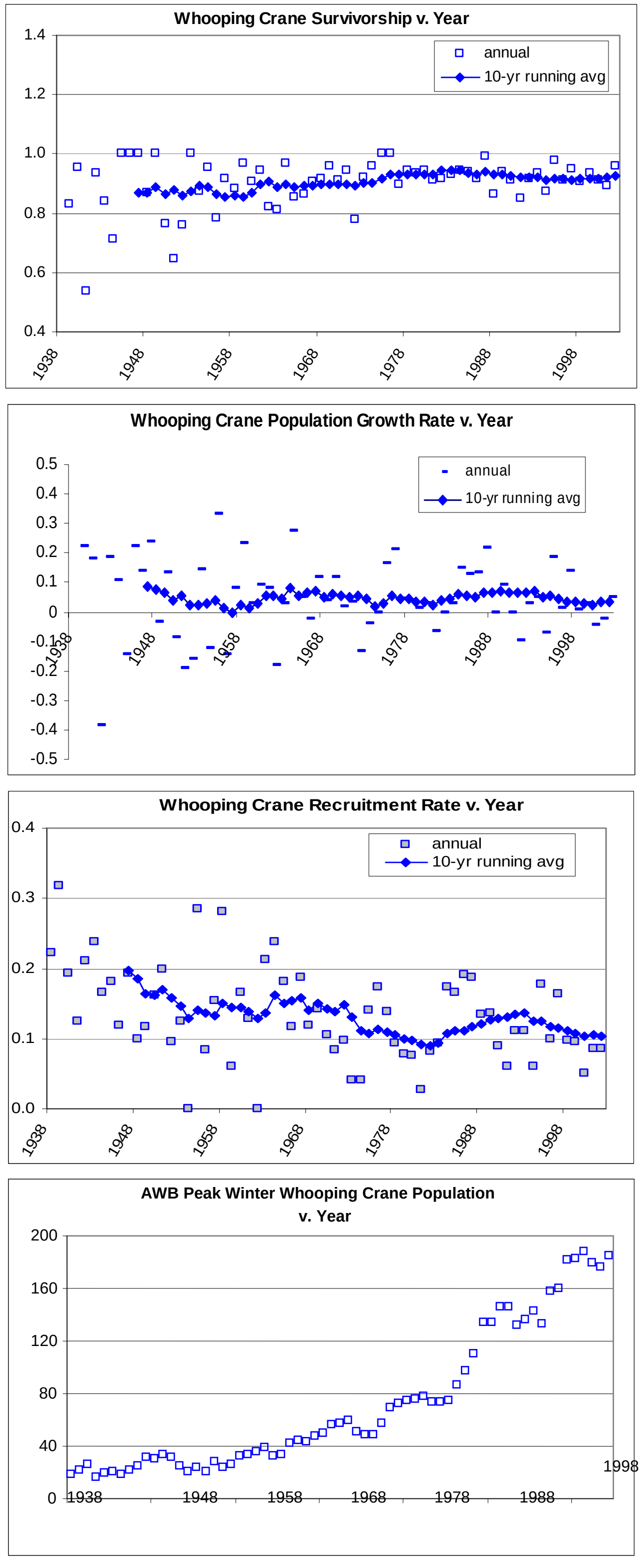


**Figure V-A4. Statistical parameters of the Aransas-Wood Buffalo whooping crane population.**

Genetic Viability:

For most of the 1930s to 1950s, the AWB population teetered on the brink of extinction. All whooping cranes, both the wild population and the stock held in captivity, are derived from an estimated six to eight founders at Aransas in 1941 and one female from the Louisiana population. There is concern that the limited genetic material of the whooping crane may lead to reduced productivity in Wood Buffalo National Park and may also contribute to increasing difficulties in captive propagation.

Extinction in small populations has led to the theory of minimum viable population size, defined as the smallest number of individuals necessary to give a population a high probability of surviving over a specified time (Primack 1993). Small populations are subject to rapid decline due to three main causes: a) genetic fluctuations (e.g., genetic drift, inbreeding); b) demographic fluctuations (e.g., variations in birth and death rates); and, c) environmental fluctuations in predation, disease, competition, food supply, and natural catastrophes.

As a population increases, the threat of extinction due to stochastic events diminishes and loss of genetic diversity slows, thereby increasing species security. Genetic theories suggest that small populations can continue to lose genetic diversity with each generation and that continued loss of genetic material leads to inbreeding depression and declining productivity (Jimenez et al. 1994, Frankham 1995, Lacy 1997, Brook et al. 2002, Woodworth et al. 2002).

In 1991 the U.S. and Canadian Whooping Crane Recovery Teams, the Service and Canadian Wildlife Service, ICF, other captive breeding programs, and the IUCN/SSC Conservation Breeding Specialist Group conducted a Conservation Viability Assessment workshop. The workshop report (Mirande et al. 1993) analyzed genetic and demographic characteristics of both the wild and captive populations. The report included priorities for management and research of wild and captive populations as a meta-population to maximize retention of genetic heterozygocity and minimize the risk of extinction.

As a consequence of the population bottleneck, the population is estimated to have lost 66 percent of all genetic material (Mirande et al. 1993, Glenn et al. 1999). The most common modern haplotype among a set of sampled whooping cranes following 1939 was in low frequency in the pre-bottleneck population. Glenn et al. (1999) concluded that the change in frequency demonstrates the powerful effect of genetic drift in changing allele frequencies in very small populations.

Due to unprecedented potential for introduced diseases and other stressors, the AWB population is challenged to grow to a level where the creation of new alleles through mutation will offset its past, current, and future losses in genetic diversity. It is estimated that approximately 87 percent of the species' genetic diversity that survived the bottleneck persisted as of 1990. The cumulative genetic loss is equivalent to that which would be expected from one generation of mating between half-siblings. At the same time, the captive-hatched descendants have retained about 96 percent of the genetic diversity present in the post-bottleneck wild flock.

Population Recovery Goals:

The goal of the ESA is to recover (and subsequently preserve) endangered and threatened species and the ecosystems on which they depend. Recovery is defined in the ESA as improvement in the status of listed species to the point at which listing is no longer appropriate under the criteria set out in section 4(a)(1) of ESA (i.e., the threats that contributed to the species listing are removed) [50 CFR 402.02]. This process involves population growth to self-sustainable levels and removal of key threats to the species' persistence in the wild.

The first population goal of whooping crane recovery is to downlist the population status from endangered to threatened. For down-listing to occur the Recovery Plan calls for 90 breeding pairs to be maintained in three separate, migratory or non-migratory, self-sustaining wild populations, and for these three breeding populations to be attained for a period of ten consecutive years (USFWS 1994g). If a second and third population cannot be established, then for down-listing to occur the AWB population must remain above 1,000 individuals. The goal of this objective is to minimize the risks of population loss from future catastrophic events.

A further step in the recovery of listed species is delisting. Delisting is improvement in the status of the species to a level where the protective provisions of the ESA are no longer appropriate. Full recovery involves the removal of threats to the species. No goals have yet been identified for whooping crane delisting. One recent study suggests a needed population of 7,000+ individuals (Reed et al. 2003). The Whooping Crane Recovery Team has indicated that there is no minimum number of birds that would be sufficient to ensure persistence of the species in the wild as long as only one self-sustaining wild population remains.

To identify, protect, and manage habitat (explicitly including migratory stopover habitat) is a primary conservation objective of both the Canadian National Plan for the Recovery of the whooping crane (Edwards et al. 1994), and the U.S. Whooping Crane Recovery Plan (USFWS 1994g). The U.S. Recovery Plan identifies several habitat conservation objectives that apply either directly or indirectly to the Platte River. These objectives are discussed in the "Whooping Crane" portions of the Environmental Baseline section of this biological opinion.

## A4. Status and Distribution

Reasons For Listing:

Whooping cranes were eliminated from their breeding grounds as settlement and agricultural development spread across the northern Great Plains region of the U.S. and Canada (Allen 1952). Habitat loss throughout most of its former breeding range in central North America contributed to population declines. The whooping crane became endangered as a result of human activities that adversely altered or destroyed whooping crane habitat and because of unregulated shooting. The factors involved were increased shooting of birds and collecting of eggs; loss of nesting habitat in the northern Great Plains of the U.S. and prairie provinces of Canada due to expanding human settlement and agricultural development; loss of wintering habitat due to agricultural expansion; and increased hazards of migration as a result of human development activities within the migration route.

New and Continuing Threats:

Currently, expanding human populations throughout the range of the whooping cranes continue to threaten survival and recovery of the birds. Factors that continue to affect whooping crane survival and recovery include the potential for catastrophic loss of birds or habitat due to severe climatic events, infectious disease, and environmental contamination; chronic habitat loss due to development and human encroachment; and loss and degradation of wetland and other suitable migrational habitats.

Direct threats to individual birds include flight-collision hazards such as fences and power lines, and other aerial lines and structures; severe weather events; disease; and predation. Accidental shooting by waterfowl hunters also is a risk during migration.

*Breeding Habitat* - The impact of human conversion of wetland and grassland to crop production throughout North America, and the species' sensitivity to human disturbances, have made nearly all of the whooping crane's original breeding range unsuitable for the species. Disruptive practices included draining wetlands, fencing, plowing, sowing, cultivation, harvesting, and other activities associated with these operations (USFWS 1994g).

Whooping cranes' sensitivity to disturbance and adherence to ancestral breeding and wintering grounds suggest that re-colonization of the former breeding range is unlikely without purposeful human intervention. As the breeding range decreased only a relict population occupying a remote breeding area in Wood Buffalo National Park, Canada, remained. Though the Park itself was established 1922, the existence of the breeding ground at the Park was not identified until 1954.

The threat of rapid global climate change may adversely affect the water regime of Wood Buffalo National Park, with potentially severe impacts on whooping crane reproduction. For example, permanently lowered water tables would shrink wetlands, reduce the availability of quality nesting sites, reduce invertebrate food availability, and allow predators to access nests and young. Parks Canada has launched a project to identify the extent of suitable unoccupied habitat within the Park.

*Wintering Habitat* - The Aransas NWR, established in 1937, protects the main wintering grounds. Additional habitat surrounding Aransas NWR has been purchased by the U.S. government and the State of Texas with the assistance of The Nature Conservancy (Doughty 1989). The National Audubon Society has also entered into leasing arrangements on lands near Aransas. At Aransas NWR and adjacent Matagorda Island, habitat protection and management measures include prescribed burning of upland habitats to improve cover characteristics and enhance food production (principally acorns).

Pollution is a significant threat to the wintering cranes at Aransas NWR. Since its construction, the Gulf Intracoastal Waterway has become a very heavily used barge traffic route. Much of the cargo consists of petrochemical products. Contaminants have been detected in the waters of the refuge and small-scale spills have occurred in the past (Ramirez et al. 1993). A large-scale accident in or near the refuge could have catastrophic effects on the cranes and/or their habitat and food supply. In 1993 the Fish and Wildlife Service developed contingency plans for responding to oil spills at Aransas NWR (Robertson et al. 1993). Loss of shoreline to erosion is occurring along the intercoastal waterway and critical habitat is being lost at rates of 1.0 to 1.6 ha annually (Evans 1997, USFWS 1994g, Lewis 1995).

Rapid global climate change and associated sea level rise combined with land subsidence could substantially affect Texas coast habitats and alter habitat composition. Freshwater inflows, primarily from the Guadalupe and San Antonio rivers to Aransas, are also needed to maintain the proper salinity gradients, nutrient loadings, and sediments for productive coastal waters and produce foods used by the whooping cranes. Coastal water with low saline levels, which whooping cranes can drink rather than fly inland for freshwater, is maintained by these in-stream flows. Reduced rainfall or reservoir construction and water diversions for agriculture uses would reduce these inflows and thereby effect the blue crab population that is a major crane food source.

*Migrational Habitat* - Whooping cranes have been observed to use a variety of water bodies at migrational stopover sites including rivers, seasonal, temporary, and permanent wetlands, shallow ponds, and others. Diverse wetland types are associated with broad-scale geographic features distributed in the flyway. These range from palustrine and playa wetlands in southern farmland to remote sandhills lakes and rivers in Nebraska and the Missouri River valley corridor in the Dakotas (Austin and Richert 2001).

While much of the critical nesting and wintering habitats of the species is contained within protected areas, this is not true for migrational habitat. The dynamic nature of environmental and habitat conditions of the Great Plains suggests some individual wetlands may not be suitable, indeed may not exist, from season to season or year to year due to various local or regional environmental conditions: annual rainfall patterns, disease, contamination, or the effects of prolonged drought.

Because most Great Plains wetlands are in private ownership, they are also subject to human activities of draining, filling, or changing agricultural or wetland protection policies and threats not predictable (Lingle 1987). Palustrine emergent wetlands declined at a rapid rate during the 20th century. While the current national wetland policy is no net loss, the National Wetland Inventory found a reduced but, nevertheless, continuing rate of loss (4-5 percent) in the most recent ten-year analysis (Dahle 2000).

In some situations of the Central Flyway, migratory water birds concentrate during spring in areas where wetland losses have been very high. A very large palustrine wetland complex occupying several counties in south-central Nebraska (i.e., Rainwater Basin area), for example, has been diminished by 90 percent. Another notable area is the nearby Platte River where private environmental groups and partnerships have actively sought to restore and maintain habitat since the early 1980s (Faanes 1992).

Whooping cranes exhibit learned migrational behaviors. Though data of the nature needed to verify the observations does not exist, personal experience and the body of historical sighting information leads crane authorities to believe that the cranes have tendencies to reuse migrational stopover sites that have met the innate migrational requisites of the species (J. Lewis, T. Stehn pers. comm.). In contrast to the likelihood of whooping crane use of individual wetlands, which is highly improbable and unpredictable, there are several identifiable areas that are predictably used year-to-year by members of the AWB population, and this is probably due to their stability and geographic location.

For example, the Last Mountain Lake National Wildlife Area in Saskatchwan protects a significant stopover site. Several other whooping crane migrational stopover areas are protected under Saskatchewan's Wildlife Habitat Protection Act of 1992 (B. Johns pers. comm.). In the U.S., the five habitat areas with the highest crane use are federally designated as critical habitat. Four of the five areas (all excepting the Gulf Coast wintering area) are located at intervals within the migration corridor to assist migration movements. The stability of permanently protected areas provides an added level of protection that contributes to the ecological, evolutionary, physiological, and behavioral migration requirements of the species. Critical habitat designation is further discussed, below.

*Contagious Disease*- Contagious disease is a threat to the whooping cranes that use some migration habitats. Whooping cranes are known to be susceptible to avian tuberculosis and to bacterial infection causing fowl cholera (Snyder et al. 1985). Equine encephalitis, mycotoxicosis, and coccidian are other disease concerns. In south-central Nebraska, die-offs from fowl cholera of large numbers of migratory waterfowl occur regularly in the Rainwater Basins wetlands (Farrar 1982). Rainwater Basin wetlands are located in the 17-county area that is adjacent and south of the central Platte River valley area. Since 1975, federal and state personnel have recovered more than 100,000 dead waterfowl from these wetlands (Randy Stutheit and Jeff Drahota, pers. comm.), although only a small proportion of those killed by cholera are actually recovered.

Waterfowl staging during the spring often move between the Rainwater Basins and the Platte River. With over 90 percent of the Rainwater Basin wetland habitat destroyed, waterfowl and crane populations are concentrated into the relative small habitat base that remains, increasing the potential for disease outbreaks. Drawdown of water from drought, and ice on wetlands, are other conditions that limit available wetlands and concentrate waterfowl populations in these areas. The Platte River provides habitat to which the waterfowl disperse under these conditions, especially during drought when early spring river flows are below normal (Farrar 1982). At times, the Platte River provides habitat for from one to three million staging waterfowl (Mark Vrtiska, pers. comm.).

Meine et al. (1996) summarized various threats to whooping cranes and habitat as follows:

- *Habitat loss and alteration continue to be sources of concern. The threat is greatest at Aransas NWR. In 1941, the Gulf Intracoastal Waterway was dredged through the core of the winter range. Due mainly to construction and maintenance of the waterway, an estimated net loss of 11% of crane habitat had occurred at Aransas*

*NWR as of 1986 (Sherrod and Medina 1992). Heavy use of the waterway has also resulted in erosion of the tidal marsh shoreline, a process that may be accelerating (Zang et al. 1993). Habitat alteration is also a major threat along the Platte River and at other migration stopovers (Currier et al. 1985, Faanes 1988, Faanes and Bowman 1992; for further discussion, see the sandhill crane species account).*

- *Pollution is a major threat to the wintering cranes at Aransas NWR. Since its construction, the Gulf Intracoastal Waterway has become one of the most heavily used barge traffic routes in the world. Much of the cargo consists of petrochemical products. Contaminants have been detected in the waters of the refuge, and small-scale spills have occurred in the past (Ramirez et al. 1993). A large-scale accident in or near the refuge could have catastrophic effects on the cranes and/or their habitat and food supply. The U.S. Whooping Crane Recovery Plan (1994) notes that the adoption of the North American Free Trade Agreement may increase the amount of traffic and the risk of accidents in the waterway.*

- *Oil drilling and extraction in and near Aransas NWR poses a potential threat to the AWB population's winter habitat. Drilling operations are prohibited when Whooping Cranes are present.*

- *The potential loss of freshwater inflow is an important long-term threat to the health and productivity of the bay systems in and near the Aransas NWR. Water flowing from the rivers into the bay is subject to rising demand for irrigation and for residential, commercial, and industrial development. Such withdrawals are predicted to have significant impacts on habitat conditions and the availability of food (especially blue crabs) for Whooping Cranes (T. Stehn pers. comm.).*

- *Human disturbance in the form of increased tourism, recreational and commercial boat traffic, waterfowl hunting, and other activities also poses a threat in and around Aransas NWR. Some of these disturbances cause cranes to leave the area, while other biological effects may be more subtle (USFWS 1994). The U.S. Recovery Plan notes that "[the] sources and intensity of disturbance are expected to increase in the future."*

- *Collision with utility lines has been the principal known cause of Whooping Crane mortality during migration (Howe 1989, USFWS 1994, Brown and Drewien 1995). Since 1956, at least 19 Whooping Cranes have been killed or seriously injured by such collisions. In a study of radio-marked juveniles conducted in the early 1980s, 2 of 9 individuals died as a result of collisions within their first 18 months of life (Kuyt 1992). Collisions with barbed-wire fences have also resulted in death (Allen and Ramirez 1990).*

- *Illegal and accidental shooting has occurred along the migration routes and near Aransas NWR. As hunting of Sandhill Cranes has expanded in recent years, the risk to Whooping Cranes has increased (Konrad 1987b). Inexperienced hunters are liable to mistake Whooping Cranes for Sandhill Cranes, snow geese, or tundra* *swans.*

- *According to Brand et al. (1991), "disease appears to be a significant, but insufficiently investigated factor adversely affecting the successful recovery of the Whooping Crane." Avian tuberculosis probably poses the greatest threat to wild Whooping Cranes. Avian cholera is of concern in the springtime, when cranes and waterfowl are concentrated along the Platte River. Mycotoxicosis and coccidia are also of significant concern. Unvaccinated Whooping Cranes appear to be extremely susceptible to the eastern equine encephalitis virus in areas where the mosquito vector is present. This is of special concern for the experimental flock in Florida, where repeated vaccinations will be difficult.*

- *Loss of genetic diversity and subsequent inbreeding depression are general concerns for the small and narrowly based Whooping Crane population (Mirande et al. 1993). Having come through an extreme genetic bottleneck -- the current population is derived from at most 12 (and more likely 6-8) founding individuals -- the species is susceptible to inbreeding effects. The incidence of scoliosis and tracheal deformities among captive Whooping Cranes is higher than would be expected based on studies of wild Whooping Cranes and other cranes. The distribution of scoliosis cases among captive birds suggests that there may an inherited susceptibility in the population.*

- *Population models developed for the Whooping Crane Population Viability Analysis explored the potential impact of different degrees of inbreeding on population dynamics (Mirande et al. 1993). Estimates of genetic variability in the Whooping Crane population, along with data on the degree of relatedness of living Whooping Cranes, are now being gathered to evaluate these effects (see "Population Viability Analysis" discussion below). Recent mitochondrial DNA analysis (Snowbank 1995) indicates that only one maternal haplotype may be present in living birds.*

- *Drought on the breeding grounds of the AWP could have a critical impact on the population by reducing nesting habitat, reducing food supplies, forcing newly hatched chicks and their parents to move to other wetlands, and increasing the susceptibility of chicks to predation (E. Kuyt pers. comm.). Drought also poses a threat at Aransas NWR, mainly by altering salinity levels and food supplies in coastal wetlands and bays. The three populations are vulnerable to catastrophic events, including hurricanes and other extreme weather events.*

## *B. Least Tern Biological Status*

### B1. Species Description

Least terns are the smallest members of the subfamily Sterninae and family Laridae of the order Charadriiformes, measuring only 21-24 cm long, with a wingspan of 51 cm. The species is characterized by a black crown, white forehead, dark gray wings and back, and black outer primaries. Sexes are alike except for the intensity of bill and leg color, which varies from orange in males to orange-yellows in females, and a slight difference in bill size. Most bills are tipped in black (USFWS 1990).

The American Ornithologists' Union (AOU) recognizes three subspecies of the least tern, California (*S. a. browni*), eastern (*S. a. antillarum*), and the interior (*S. a. athalassos*). Although the AOU recognizes three subspecies; the Service decided not to specify subspecies in its 1985 final listing rule due to taxonomic uncertainty. On May 28, 1985, the Service designated as an endangered species the population of least tern occurring in the interior of the United States (50 F.R. 21792). The recovery plan for the interior population of the least tern was published in 1990 (USFWS 1990). Unless otherwise indicated, this section discusses the interior population of the least tern.

Critical habitat has not been federally designated for this species.

All three populations of the least tern (California, interior, and eastern) are migratory, and spend from 4 to 5 months in their breeding ranges. The interior population historically nested along the Mississippi, Red, and Rio Grande river systems and rivers of central Texas. The breeding range extended from Texas to Montana and from eastern Colorado and New Mexico to southern Indiana. Today, least terns occupy scattered remnants of their former range where they nest on sparsely vegetated riverine sandbars, sand and gravel spoil piles, fly-ash disposal sites of power plants, dike fields, and reservoir shorelines (Figure V-B1). ). The importance of the Platte River ecosystem to interior least terns is discussed in the *Environmental Baseline* section of this biological opinion.

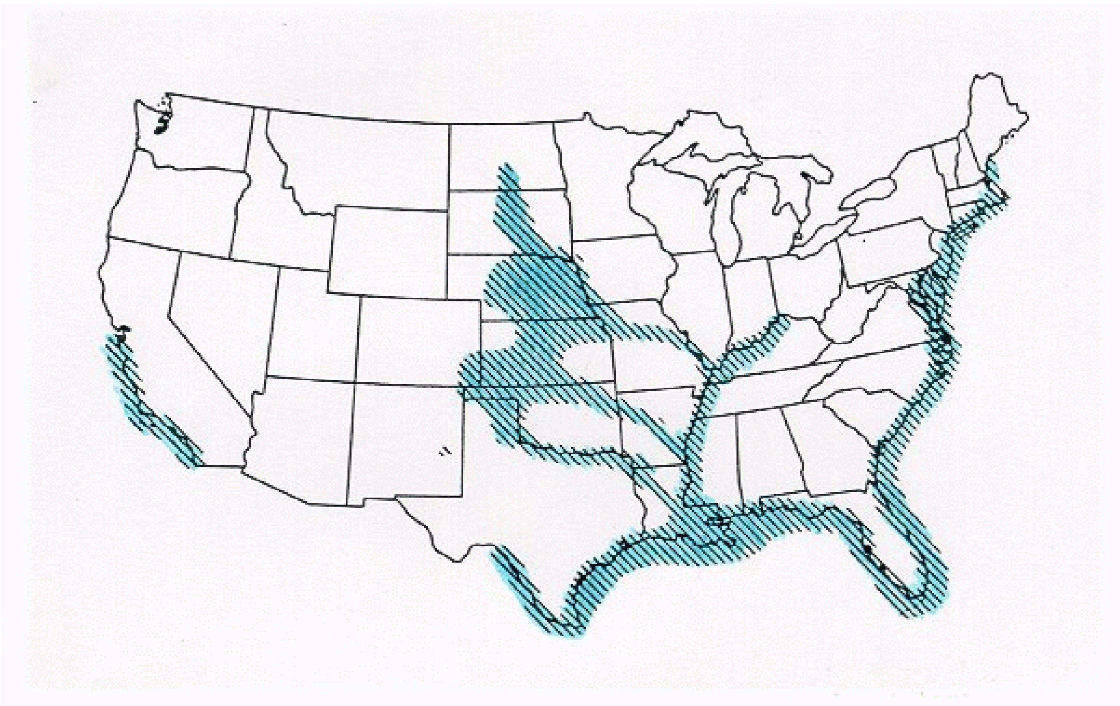

**Figure V-B1. Approximate breeding range of the least tern in the United States (adapted from Thompson et al. 1997).**

## B2. Life History

Reproductive Biology:

Least terns spend 4 to 5 months at their nesting sites. They arrive at breeding areas from late April to early June (Youngworth 1930, Wycoff 1960, Faanes 1983, Wilson 1984, USFWS 1987c, as summarized in USFWS 2003). Courtship occurs at the nest site or at some distance from the nest site (Tomkins 1959). It includes the fish flight, an aerial display involving pursuit and maneuvers culminating in a fish transfer on the ground between the two displaying birds. Other courtship behaviors include nest scraping, copulation, and a variety of postures and vocalizations (Hardy 1957, Wolk 1974, Ducey 1981, as summarized in USFWS 2003).

Least terns nest in colonies as small as a single pair of birds to 100-plus pairs, and nests can be as close as just a few feet apart or widely scattered up to hundreds of feet (Ducey 1988, Anderson 1983, Hardy 1957, Kirsch 1990, Smith and Renken 1990, Stiles 1939, as summarized in USFWS 2000). The birds usually lay two to three eggs in a shallow, inconspicuous depression. Small stones, twigs, pieces of wood, and debris usually lie near the nest. Both sexes share the role of incubation, which generally lasts 20-25 days, but has ranged from 17 to 28 days (Moser 1940, Hardy 1957, Faanes 1983, Schwalbach 1988, as cited in USFWS 2003). Eggs in the same clutch hatch within one day of each other. Departure from colonies by both adults and fledglings varies, but is usually complete by early September (Bent 1921, Stiles 1939, Hardy 1957, as cited in USFWS 2000).

Food and Feeding Habits:

Least terns forage almost exclusively upon small, narrow bodied, schooling fish (Atwood and Kelly 1984, Wilson et al. 1993, Schweitzer and Leslie 1996). Least terns are viewed as opportunistic feeders, exploiting any fish within a certain size range. Important prey fish genera include: *Fundulus*, *Notropis*, *Campostoma*, *Pimephales*, *Cyprinella*, *Morone*, *Dorosoma*, *Lepomis*, and *Carpiodes*. Foraging usually occurs in close proximity to the nesting colony; however, birds nesting at sand and gravel mining sites and other artificial habitats may fly up to 3.2 km to forage at riverine sites (Smith and Renken 1990). Lingle (1988) and Wilson (1991) observed that least terns nesting at sand pits frequently foraged in the Platte River.

Growth and Longevity:

Young least terns are somewhat precocial and are brooded for about six days after hatching. At that time, they are strong enough to wander from the nest on their own (USFWS 2000). Chicks are able to fly by about 20-21 days after hatching, but do not become competent at fishing until after migrating from the breeding grounds in the fall (Hardy 1957, Tomkins 1959, Massey 1972, 1974). They depend on some parental care even after they have become strong fliers. Paige (1968) has noted young eastern least terns actively foraging for themselves by about five weeks of age.

Tomkins (1959) recovered two eastern least terns in Georgia that ranged in age from five to ten years old. Massey (1973) recovered five banded California least terns ranging from 5 to 15-years-old. Three of these birds were 13-years-old or older. Boyd (1983) recovered two interior least terns in Kansas that were six years-old. The record longevity for a least tern is 24 years for a bird that was banded in Massachusetts and recovered in New Jersey (Klimiewicz and Futcher 1989). In addition, Dugger et al. (2000) estimated chick survival from hatching to fledging for least terns nesting at two sites on the lower Mississippi River in Missouri using mark-recapture methods. They found the mean survival rate for least tern chicks at river kilometer (Rkm) 1431 was 0.951 and 0.972 at Rkm 1481. The estimated survival rate of least tern chicks throughout the entire 17-day fledging interval was 0.43 at Rkm 1431 and 0.62 at Rkm 1481.

Movements/Dispersal Patterns:

Least terns are thought to be highly philopatric, but limited data indicate that the degree and spatial scale of breeding site fidelity vary among breeding populations in different geographic areas (Thompson et al. 1997). Breeding site fidelity of coastal and California least terns is very high (Atwood et al. 1984, Burger et al. 1984). Massey (1992) found that 95 percent of banded least tern chicks returned to nest within 75 km of their natal colony at Huntington Beach, California. Renken and Smith (1995) reported that 97 percent of 78 banded terns returned to within 1.5 to 80 km of the colony where they were banded. On the central Platte River in Nebraska, 28 percent of 109 adults returned to their natal colony (Lingle 1993b).

Band returns on interior least terns, although limited, show movement within the interior least tern population. Chicks banded in Nebraska nested in Kansas (Boyd 1993, Lingle 1993b), and a chick banded on the Missouri River in South Dakota nested on the lower Platte River in Nebraska (Thompson 1997). An interior least tern banded in 1988 as a breeding adult on the Missouri River in North Dakota returned in 1989 to breed on a Missouri River sandbar in North Dakota (Mayer and Dryer 1990). In the Mississippi River valley, a bird banded as a breeding adult in 1987 was observed nesting at the same site in 1989, and three others banded as breeding adults in 1988 returned to nest within the same stretch of the Mississippi River in 1989 (Smith and Renken 1990). Two of those birds had returned to within 4.8 km of their former nesting site. One least tern captured in 1987 as a breeding adult at a Mississippi River colony in Missouri had been banded as a chick in 1980; this bird was nesting at a site 131 km upriver from its natal Tennessee colony (Smith 1987, Smith and Renken 1990). Chick dispersal may be as far as that reported by Boyd and Thompson (1985) for a breeding Kansas bird that had been banded as a chick on the Texas coast. Based on 163 sightings of 109 individuals banded along the central Platte River, distances of nesting birds from their banding origin extended from 0 to 273 km for least terns (Lingle 1993b). Interchange between eastern least terns and interior populations may explain the positive population trends on the lower Mississippi River that have not been accounted for through local reproduction (Kirsch and Sidle 1999).

New genetic information suggests dispersal among interior, eastern, and California least tern populations. Whittier (2001) proposed that the three subspecies of least terns do not differ genetically, although the rate of genetic exchange appears to be lower between interior and California least terns than between eastern and interior, and eastern and California subspecies.

Movements of least terns between breeding sites, both between and within the nesting season, are poorly understood. The ephemeral nature of river systems in the Great Plains demonstrates why specific rivers or river reaches in the breeding range may not be available in consecutive years. Hardy (1957) hypothesized that localized shifts in least tern distribution result from the interplay of several related ecological factors. Those factors include the presence of suitable sandbars, the existence of favorable water conditions during the nesting season, and the availability of food. Changes in the microhabitat and social structure in the breeding areas often lead to birds changing sites if suitable habitat of higher quality is available elsewhere (Prindiville 1986, as cited in USFWS 2000).

Nesting Habitat:

Physical habitat requirements of the interior least tern are difficult to describe and are often confused by regional variation. Nesting habitats tend to be ephemeral in quality and abundance. Beaches, sand and gravel spoil piles, sandbars, peninsulas or other open sandy areas, gravelly patches or exposed flats are the principal breeding habitats for all least tern populations or subspecies. Interior least terns nest on sandbars with little vegetation within the main channel areas of large alluvial rivers. This habitat is continually changing, and is formed and maintained by the hydrology of the river and the movement of its alluvial bedload. Unconsolidated material such as small stones, gravel, sand, debris, and shells comprise the nesting substrate. Lack of vegetative cover (Dirks 1990, Ziewitz et al. 1992), substrate composition and homogeneity

(Adolf 1998, Adolf et al. 1999), and proximity to stable food sources (Faanes 1983, Dugger 1997, Adolf 1998), have been identified as important physical components of least tern habitat.

Interior least tern colony sites are usually located in open expanses of sand or pebble beach within the river channel or reservoir shoreline. Habitat sites that are well-drained and well back from the water line are preferred by least terns. Bacon (1996) found channel bars chosen for nesting sites by least terns on the Yellowstone River were exposed above river level longer throughout the breeding season than non-nesting habitats. Similarly, Smith and Renken (1991) found that least tern colonies along the lower Mississippi River were located on sand islands and sandbars that differed from unused sand islands by the length of time sites were continuously exposed above the river. Most nest colonies on the Yellowstone River occurred in a river reach where channel sinuosity began to increase and there was a higher incidence of channel bars and overlapping islands surrounded by irregular channel activity. Recent habitat investigations by the U.S. Corps of Engineers (Corps) (C. Kruse, pers. comm. 2000) support Ziewitz et al. (1992) that large habitat blocks occurring in complexes or ‘hemi’ bars are selected for at rates exceeding their availability on a random basis.

Least terns usually nest on sites devoid of vegetation, but have been found on sites with up to 30 percent vegetative cover (Schulenberg and Placek 1984, Dryer and Dryer 1985, Landin et al. 1985, Rumancik 1985). Vegetative cover is usually less than 20 percent at the time of nest initiation (Faanes 1983, Gochfeld 1983, and Ducey 1989). Vegetation, if present, is usually located well away from the colony (Hardy 1957, Anderson 1983, Rumancik 1985, Smith and Shepard 1985). However, widely dispersed annual vegetation or young saplings may commonly be found within or near some interior least tern colonies (Wycoff 1950, Faanes 1983, Evans 1984, Dryer and Dryer 1985). Least tern colonies in denser vegetation may be a response to habitat loss or a function of site tenacity. Eventually, least terns will abandon heavily vegetated nesting sites.

The interior least tern also nests in dike fields along the Mississippi River (Smith and Stucky 1988, Smith and Renken 1990); at sand and gravel pits; ash disposal areas of power plants (Wilson 1984, Johnson 1987, Dinsmore and Dinsmore 1988); along the shores of reservoirs (Chase and Loeffler 1978, Neck and Riskind 1981, Boyd 1987, Schwalbach 1988); and at other man-made habitat (Shomo 1988). It is unknown to what extent those alternative habitats have replaced productive natural habitat.

Climatic conditions that influence river hydrology are a major factor influencing the distribution, abundance, and quality of nesting habitat. During periods of high rainfall events, such as occurred over much of the Great Plains in the mid-1990s [and on the Platte River in 1983], existing sandbars are scoured (which replenishes sand and removes vegetation) and new sandbars are created. During a drought period, as is currently being experienced in the upper Great Plains, spring flows that form and maintain sandbars are reduced or absent. During these low flow periods, vegetation increases on sandbars, reducing their quality for nesting terns. Climatic cycles and the seasonal ebb and flow of these alluvial rivers are two of the driving forces for least tern nesting habitat.

Least tern nesting habitat can be impacted by any action that changes river hydrology and morphology. The construction and operation of reservoirs have major impacts to least tern nesting habitat on several rivers within the species' range. A substantial hydrologic effect of these reservoirs on nesting habitat is the reduction in the magnitude, frequency, and duration of peak flows that are necessary to move sediments for new sandbars and scour existing sandbars. Reservoirs and diversion canals also retain large volumes of sediment (sand) that normally would be distributed throughout the river. This sediment is the basic building block of least tern nesting habitat. The substantial reduction of sediment input by these reservoirs and diversion canals impact the distribution, abundance, and quality of least tern nesting habitat (USFWS 2003).

Within the range of the least tern, large reservoirs occur on the Missouri, Arkansas, Red, Platte, Kansas, and Canadian river. Although terns nest on river segments downstream of these reservoirs, the amount and quality of nesting habitats may have declined since these rivers were regulated. Nesting habitat in close proximity to the dams is most impacted because the effects of the reservoirs attenuate further downstream with increased tributary influence. Except on the Missouri and North Platte rivers, shorelines of main stem reservoirs are not frequently used by nesting least terns. During periods of low Missouri River reservoir levels, a considerable amount of exposed, unvegetated shoreline is used by nesting least terns (USFWS 2003). Such conditions currently exist on these reservoirs due to the drought in the upper Missouri River basin. Lake McConaughy, on the North Platte River in Nebraska, experiences the same habitat availability trends as its reservoir levels fluctuate.

River segments that do not have altered hydrology and sediment transport by reservoirs retain many of the dynamic processes that form and maintain nesting habitat. Such river segments include the Canadian River in Oklahoma and Texas, the Cimarron River in Oklahoma and Kansas and the Red River/Prairie Dog Town Fork of the Red River above Lake Texoma in Oklahoma and Texas. The Platte River is impacted by reservoirs upstream on the Platte and North Platte rivers, and their tributaries. These effects are somewhat attenuated downstream and the lower reach of the Platte River is fed by the Loup and Elkhorn rivers which currently provide sufficient flows at relatively natural time periods to create and maintain sandbar habitat for nesting. Although the lower Mississippi River is not affected by a mainstem reservoir, its morphology has been impacted by the construction of extensive river training structures including dikes, bendway weirs, and bank stabilization (USFWS 2003).

Thompson et al. (1997) surmised that habitats used by least terns for nesting have changed through time as human development has encroached on breeding areas and natural ecological changes have occurred. Least terns have nested in a variety of man-made environments, including dredge piles, and graveled rooftops (Thompson 1997, Jackson and Jackson 1985). However, nesting success at these locations is not well documented. Lingle (1988) reported that least tern nest losses varied between natural and artificial habitats. The major cause of nest failure on natural riverine sandbars was flooding, while nest failure at sandpits was the result of predation and abandonment. Specifically, Lingle (1988) found 67 percent of the losses to be from predation, and 77 percent of the losses from abandonment occurred at sandpits. Riverine habitat losses have continued on the Platte River, and Lingle (1993a) speculated that nest success might be higher on sandpits than riverine sandbars where water management operations could result in flooding mortality. Thompson (1997) discussed that least tern productivity on artificial habitat is likely related to its proximity to forage-fish sources. The effectiveness of habitat intentionally constructed for least tern nesting on the Missouri River has not been tested, but is likely to depend upon design features to provide nearby forage fish habitat, safety from predators, and avoidance of flooding. Similar artificial habitats have been created and/or managed for least tern nesting along the Platte River. These areas are addressed in the Environmental Baseline section of this biological opinion.

Foraging Habitat:

Foraging habitat for least terns includes side channels, sloughs, tributaries, shallow-water habitats adjacent to sand islands and the main channel (Dugger 1997). To successfully reproduce, productive foraging habitat must be located within a short distance of a colony (Dugger 1997). In a study of eastern least terns in North Carolina, all 61 of the colonies observed were within 820 feet (250 meters) of a large expanse of shallow water (Jernigan et al. 1978). In Georgia, eastern least terns foraged a maximum distance of 1,345 feet (410 meters) from the colony (Tomkins 1959). Least terns in Nebraska generally were observed foraging within 328 feet (100 meters) of the colony (Faanes 1983). Armbruster (1986) recommends that feeding areas for terns be present within 1,312 feet (400 meters) of the nesting colony.

The presence of a healthy forage fish community is imperative to the success of least tern nesting efforts. Elevated water temperatures affect fish physiology, which influences survival rate, growth rate, embryonic development, and susceptibility to parasites, disease, and pollutants. Studies have also shown that although low oxygen is an important factor in reproductive success, it exerts less survival pressure than does temperature (Fry 1971, Andrews and Stickney 1972, Matthews et al. 1982, Armour 1991). Water temperature fluctuation can also result in behavioral changes with respect to habitat utilization, distribution, species interactions, timing of spawning, and duration of incubation (Fry 1971, Crawshaw 1977, Matthews and Hill 1979, Matthews and Maness 1979, Adams et al. 1982, Stauffer et al. 1984, Armour 1991). Matthews and Maness (1979) proposed that the synergistic effects of elevated temperatures and reduced oxygen limits fishes in streams of the Great Plains. Tolerances for these limiting factors could enable some species to achieve reproductive success when and where others species cannot tolerate the extremes. Studies linking the health of the forage fish community to flows in the Platte River are discussed in the Environmental Baseline section of this biological opinion.

In addition to the relationship between flows and temperature, studies have shown a relationship between flows and least tern foraging efficiency. Prey detectability for least terns and other piscivorous plunge-divers is influenced by water clarity and search height; with shallow-water habitats being less turbid than deep-water habitats (Tibbs 1995, Dugger 1997). Least terns may be particularly vulnerable to fluctuations in food supply because they are surface plunge-divers with limited foraging ranges, and small body sizes. Nesting coincides with the timing of lowest flows in major river systems (historically, in the summer), providing easy access to forage species for the least tern (Dugger 1997).

## B3. Population Dynamics

Population Size:

The least tern is a difficult species to census accurately. The least tern frequently shifts nesting sites and timing of nesting varies locally as a result of weather, habitat availability (e.g., seasonal duration and timing of flooding of sandbar habitats), and latitude (Thompson et al. 1997). Consistent timing and coverage of surveys is logistically difficult. The nesting colonies of interior least terns are ephemeral and occur over a large geographic area that contains remote riverine habitats.

Until recently, no comprehensive, annual, or regularly scheduled rangewide census for the interior least tern existed. Several river segments were surveyed on an annual basis, and information on least terns was also collected during the International Piping Plover Census which occurs every five years (beginning in 1991). Rivers regularly surveyed by the Corps include the Missouri River; the Arkansas River in Oklahoma; the Red River from Denison Dam to Index, Arkansas; and the lower Mississippi River. Least tern surveys are also regularly conducted on the Kansas River, Platte River, North Platte River and Lake McConaughy, the Canadian River below Eufaula Dam, and on three NWRs (i.e. Salt Plains, Quivira, and Bitter Lake). But, regular survey coverage are still incomplete across the large breeding range of the interior least tern, which limits the ability to assess the conservation status and trends for this population.

In 2005, the first complete range-wide survey for interior least terns was conducted during the last two weeks of June and the first week of July (Lott 2006). The primary objectives of the survey were: a) to provide a minimum count of the number of adult interior least terns occurring in North America during the breeding season; b) to document the range-wide distribution of nesting colonies; and c) to describe the types of habitats that are being used for nesting (Lott 2006).

A total of 17,587 interior least terns were counted in association with 491 different colonies. Just over 62 percent of these birds occurred on the lower Mississippi River (10,960 birds on 770+ river miles). Four additional river systems accounted for 33.9 percent of the remaining least terns, with 12.1 percent on the Arkansas River system, 10.4 percent on the Red River system, 7.1 percent on the Missouri River system, and 4.3 percent on the Platte River system. Lesser numbers of terns were counted on the Ohio River system (1.5 percent), the Trinity River system in Texas (1.5 percent), the Rio Grande/Pecos river system in New Mexico and Texas (0.8 percent), and the Kansas River system (0.5 percent). A majority of adult least terns were counted on rivers (89.9 percent), with much smaller numbers at sand pits (3.7 percent), reservoirs (2.7 percent), salt flats (2.1 percent), industrial sites (1.5 percent), and roof- tops (0.3 percent) (Lott 2006).

For reasons presented above, summing population estimates within years, and comparisons between areas and years should be viewed with caution. Nevertheless, results of least tern surveys from various areas throughout its interior range from 1984 to 2005 are presented in Appendix F.

Since 1991, at five-year increments, the International Piping Plover Census has collected information on the number and distribution of least terns where they occur with piping plovers. Based on these and other surveys, the largest number of least terns in the interior population occurs along the lower Mississippi River (52-79 percent). The Platte River in Nebraska accounted for the second largest number of least terns (6.2-13.6 percent) (Kirsch and Sidle 1999, Jones 2001).

In 1996, 701 least terns were surveyed along the North Platte, South Platte, Platte, Loup, North Loup and Elkhorn rivers in Nebraska, and another 321 birds were found along the Niobrara River, resulting in a total of 1,022 birds surveyed in Nebraska during 1996 (Appendix F). The 290 least terns surveyed along the lower Platte River represented 65 percent of the total number of birds on the North Platte, South Platte, and Platte rivers combined, and 41 percent of the statewide population.

In 2001, 615 least terns were surveyed along the North Platte, South Platte, Platte, Loup, North Loup and Elkhorn rivers, and another 150 birds along the Niobrara River, resulting in a total of 765 terns being counted in Nebraska (Appendix F). This total represents a decrease of 25 percent from the 1996 census.

<u>Egg and Chick Mortality:</u>

Predation is usually the greatest cause of nest failure on sand pits followed by human disturbance and weather. Lingle (1993a) studied least tern and piping plover nest success along the central Platte River and adjacent sandpits from 1985 through 1990; during which time he reported that 37 percent of nest losses were due to flooding, with an equal 37 percent lost due to predation. Lingle (1993a) also reported that dogs or coyotes (*Canis latrans*) were suspected in 78 percent of the cases; skunks (*Mephitis spp.*) in 6 percent; raccoon (*Procyon lotor*), great-horned owl (*Bubo virginianus*), and American crow (*Corvus brachyrhynchos*) in 4 percent each; and great blue heron (*Ardea herodias*) and snakes in 2 percent of the cases. In addition, Renken and Smith (1995) have reported predation by barred owls (*Strix varia*). Other potential predators include mink (*Mustela vison*), American kestrel (*Falco sparverius*), black-billed magpie (*Pica pica*), bull snake (*Pituophis melanoleucus sayi*), and garter snake (*Thamnophis spp.*).

The flooding of nests is a natural phenomenon to which least terns and piping plovers are adapted through re-nesting and other reproductive strategies (Sidle et al. 1992, Kirsch and Sidle 1999). However, the frequencies of these flow events has been increased by water development, and are responsible for significant egg and chick mortality. In five of the seven years from 1985 through 1991, flooding inundated eggs and/or chicks of least terns and piping plovers along the central Platte River (Lingle 1993a). Flooding resulted in nest failure in 37 percent of least tern and 61 percent of piping plover nests. The worst nest losses occurred in 1988 when 79 percent of the least tern and 75 percent of the piping plover nests were flooded. The summer of 1988 was characterized by multiple spikes in the hydrograph for the central Platte River. Weather may take a larger toll on sand pit nests because uniform substrates and slopes are more susceptible to wind and water erosion than riverine substrates (Lingle 1993b).

Selenium may also be contributing to low recruitment of least terns in the Great Plains. Allen et al. (1998) evaluated concentrations of arsenic, mercury, and selenium in 104 least tern eggs and chlorinated hydrocarbon compounds in 78 eggs from Kansas, Nebraska, North Dakota, South Dakota, and Montana from 1992 through 1994. Of the contaminants studied, Allen et al. (1998) believed all but selenium were unlikely to be affecting least tern productivity during the study. Selenium concentrations exceeded 3 µg/g dry-weight (the recommended threshold for selenium impacts on avian reproduction) in every state in each year except Kansas in 1993 and Montana in 1994. Low hatching success has been associated with selenium concentrations of 2.4 µg/g wet-weight in black-necked stilts (Himantopus mexicanus) and American avocets (*Recurvirostra americana*). The mean selenium concentrations for Nebraska were 4.3 µg/g, 4.2 µg/g, and 4.6 µg/g for 1992 through 1994, respectively.

Fannin and Esmoil (1993) found that addled least tern eggs collected from nests along the Platte River and adjacent sandpits had selenium and mercury concentrations elevated above background levels. They also reported that selenium in particular may be causing embryo mortality without gross embryological defects being observed. They further noted that impacts of contaminants, combined with habitat degradation, may accelerate population declines. Therefore, selenium concentrations should be considered as a potential factor in low productivity in the Great Plains, including Nebraska. The source of this selenium is not known.

Adult Mortality:

Adult mortality is an important consideration and impacts the viability of this species' population. Least tern population trends are more sensitive to variations in adult and fledged juvenile survival than to fledging success. However, statistics on adult and fledged juvenile survival are not known (Kirsch and Sidle 1999). The loss of a chick reduces the number of birds which will be added into the gene pool, and any future chicks that bird might have produced had it survived into adulthood. The loss of an adult, however, is more significant because that individual has already beaten the odds, surviving into its reproductive years. Therefore, the loss of even one adult bird is substantial. Unfortunately, the number of adult birds lost in any given year is difficult to determine. Anecdotal passages in reports are typically all that is known regarding adult loss due to natural predation, weather events, or human disturbance/predation. In most instances this information can only be documented if a researcher happens to visit the colony shortly after the incident has happened while predator or tire tracks are still visible in the sand; or in the case of weather events such as hail storms, before scavengers remove any remains. Many times nests are logged as "abandoned" with an unknown cause.

Lingle (1993b) reported that about 53 percent of adult least tern and piping plover deaths along the central Platte River were due to predation, another 33 percent from weather, and 13 percent of adult deaths could be attributed to humans. Adult mortality has also occurred during severe weather events due to hail. Both species have been documented as having been pelted to death during hail storms, some with crushed eggs beneath them. Adult least terns have also been killed under the tires of all-terrain vehicles while incubating nests, in addition to documented deaths from shooting (Lingle 1993b, Smith and Renken 1993).

Population Status and Trends:

The overall population trend for the interior least tern is positive across its range, but habitat protection and restoration is still required for species survival and recovery.

In evaluating the status and trend of interior least terns, several authors have studied the level of reproduction (as measured by the number of fledglings produced per breeding pair) necessary to result in a stable or increasing population, given estimates of juvenile and adult survival. Thompson (1982) hypothesized that 0.5 fledglings per adult (1.0 fledglings per pair) would result in a stable population. Dugger (1997) used a deterministic population model, assumed a survival rate of 0.85 for adults and a survival rate of 0.30 for juveniles (fledglings to age 2, generated by Thompson 1982), and concluded that 1.0 fledglings per pair were necessary to support a stable population.

Kirsch (1996) also used a deterministic population model with a range of adult and juvenile survival rates, together with the average 0.5 fledglings per pair she had observed on the Platte River in Nebraska, and found that a stable or increasing population was achieved only when survival rates were fairly high. For example, at 0.5 fledglings per pair, an adult survival rate of 0.85 only achieved a stable population when the juvenile survival rate was at 0.80, and an adult survival rate of 0.90 achieved a stable or increasing population when juvenile survival was at 0.65. From this she concluded that 0.5 fledglings per pair was a conservative estimate of the minimum level needed to achieve population stability or growth. Because most estimates of adult tern survival do not exceed 0.85, and since few estimates of juvenile survival are available, it is unlikely that juvenile survival is as high as adult survival. On the Platte River, post-fledging survival must be very high for the observed level of productivity (0.5) to sustain the population (Kirsch 1996). Kirsch (1996) also recognized that this population may be a sink, and thus supported by immigration from other areas.

Kirsch and Sidle (1999) summarized the status of the interior least tern. Of the six geographic areas for which a population trend could be determined, four had fledge ratios that would not support the observed trend. In addition, observed fledge ratios in many local areas were below the 0.5 fledglings per pair conservatively thought necessary for population stability. Observed fledge ratios on the lower Mississippi River were not sufficient to support the observed population trend in that drainage basin. The overall trend for the interior least tern population was positive; but this was primarily due to increases on the lower Mississippi River. The increase in the population of interior least terns is most likely due to surges of immigration from birds along the Gulf coast (Kirsch and Sidle 1999). The Gulf coast population is large, and whose numbers are stable to increasing. Only one published record of a least tern moving between the Gulf coast and interior breeding areas has been reported (Boyd and Thompson 1985). However, recent data on genetic exchange between eastern least terns and interior least terns indicates greater than three migrants per generation are moving between populations (Whittier 2001).

The long-standing theory that adult longevity coupled with occasional high recruitment can offset generally low levels of production was investigated by Whittier (2001). Data from interior least terns at Salt Plains NWR in Oklahoma, Quivira NWR in Kansas, and along the

Missouri River in South Dakota, demonstrated that longevity and periodic high recruitment counteracted lower productivity estimates in the model for terns at Salt Plains and Quivira NWRs, and indicated that the population would persist despite low productivity. However, Whittier (2001) hypothesized that longevity could not counteract low productivity in the Missouri River due to lower overall productivity and no peaks in productivity compared to other sites. Using data collected on the Missouri River from 1986-1992, Whittier's (2001) analysis showed an estimated 0.20 to 0.64 fledglings/pair. Since that time, data indicate a greater range of productivity estimates for this, and other reaches of the Missouri River, particularly in the years since the 1997 flood. Analysis of a longer time series of data may provide different results for this population.

Kirsch and Sidle (1999) compiled estimated fledglings per pair for selected areas from 1980-1996. A review of these and more recent estimates presented in USFWS (2003) shows that few areas have exceeded an average fledge ratio of 1.0, with the exception of post 1997 data from the Missouri River system. The highly productive years following 1997 are believed to be a result of record basin runoff and subsequent high discharges from 1995-1997 that created extensive nesting habitat downstream of Garrison, Fort Randall, and Gavins Point dams. Subsequent to these flows, estimates of least tern production increased to levels greater than 1.0 until 2003, when the fledgling/pair ratio decreased to 0.87; presumably as a result of gradual degradation of the newly formed riverine habitat.

The literature referenced above concludes that most observed fledge ratios would not support a stable or increasing population trend unless post-fledging survival estimates are quite high, or the population is being supported by immigration from elsewhere (e.g., the Gulf coast). The hypothesis that longevity and intermittent periods of peak productivity can maintain a stable population even when average productivity is fairly low is possible for some areas. Regardless, management actions to increase least tern fledging rates in interior areas are recommended to ensure that this population stabilizes or increases.

The NRC (2005) reviewed population viability analyses (PVAs) for interior least terns conducted by Boyce et al. (2002) and Akçakaya et al. (2003). A PVA commissioned by the NRC committee suggested that the interior least tern metapopulation is likely to persist for 200 years and that birds produced on the Platte and Loup rivers under current conditions contribute minimally to its persistence (NRC 2005).

Recovery Objectives:

In 1990, the Service published the *Interior Population of the Least Tern Recovery Plan* (USFWS 1990). That plan includes recovery goals for the least tern along major river systems throughout the species range. Major recovery steps outlined in the plan include: a) determine population trend and habitat requirement; b) protect, enhance, and increase populations during breeding; c) manage reservoir and river water levels to the benefit of the species; d) develop public awareness and implement educational programs about the least tern, and; e) implement law enforcement actions at nesting areas where there are conflicts with high public use.

The recovery plan further recommends the removal of the least tern from the list of threatened and endangered species if essential habitat throughout its range is properly protected and managed, and species distribution and population goals are reached and maintained for a period of ten years. Specifically, the recovery plan recommends that the following distribution and numbers of adult birds be maintained for ten years:

Missouri River system - 2,100
Lower Mississippi system - 2,200-2,500
Arkansas River system - 1,600
Red River system - 300
Rio Grande River system - 500

The recovery plan also specifies a geographic distribution of these totals within each river system. Within the Missouri River system, the plan calls for 1,120 of the 2,100 adult terns to be distributed in Nebraska, as follows:

Missouri River - 400 (shared with South Dakota on the Missouri River)
Niobrara River - 200
Loup River - 170
Platte River – 750

Kirsch and Sidle (1999) noted that low individual site fidelity and substantial fluctuations in local least tern numbers suggest considerable movement between breeding areas. Those factors can further confound the understanding of the species status based on short-term trends. Therefore, long-term information on bird numbers, distribution, and reproductive success is an important factor in determining when the least tern has successfully achieved its recovery goals.

Although not every location is surveyed every year, total numbers of adult least terns rangewide have ranged from a low of 5,550 counted in 1997 to 12,305 in 2003 (Appendix F). A large portion of this positive rangewide trend is due to increases in numbers of least terns on the lower Mississippi River from an estimated 3,653 in 1992 to a high of 8,082 in 2003 (Appendix F).

Although recent counts of least terns (approximately 12,305 terns in 2003) exceed the overall recovery objective of 7,000 birds, the established recovery goals are not being attained for least terns in the following river systems: Missouri, Arkansas, Red, and the Rio Grande. In addition, populations have not remained stable for 10 years, as called for in the recovery plan.

## B4. Status and Distribution

Reasons for Listing:

Historically, the least tern was hunted in the 1800s for the commercial use of its feathers to decorate ladies' hats (USFWS 1990). Since the early 1900s, habitat alteration and destruction in the form of river channelization and the construction of reservoirs for hydropower, flood control, and irrigation has had detrimental effects on the species' habitat. Hydropower demands are unpredictable, resulting in fluctuating flows, and flow regimes that differ greatly from historic regimes. Present day water management practices allow upstream releases of water which can result in high flows extending into the nesting season. The impoundment and removal of water from the Platte River have severely altered its hydrograph and resulted in the disappearance of landscape features that sustain least terns and piping plovers (USFWS 1988a, USFWS 1990, NRC 2004). Reservoir storage of flows has led to vegetative encroachment on riverine sandbars as a result of reduced scouring flows and ice. In addition, large amounts of sediment which enter the reservoirs settle out, leaving clean, sediment free water downstream. This sediment-hungry water results in reduced aggradation and increased degradation in the river bed. These processes prevent the formation and maintenance of sandbar nesting habitat.

Channelization, irrigation, and the construction of reservoirs have contributed to the elimination of much of the riverine nesting habitat for least terns in the Missouri River system as well. The Missouri River Bank Stabilization and Navigation Project is an example; the wide, braided character of the Missouri River has been engineered into reservoirs and a single, narrow navigation channel. Missouri River sandbars have virtually disappeared between Sioux City, Iowa, and St. Louis, Missouri.

In addition to the effects of habitat and flow alterations, human disturbance has played a role in the species' decline. Carney and Sydeman (1999) conducted a literature review on the effects of human disturbance and found that human presence reduced reproductive success in *Charadriiformes*. Disturbance of nesting terns included the following effects: startling adults from the nest and potentially resulting in overheating or chilling of nest contents, alerting predators to the location of nests, and direct loss (Mayer and Dryer 1988, Smith and Renken 1990). Direct losses resulting from human presence include trampling under foot, crushing of nests by all-terrain vehicles, and predation by dogs accompanying the humans. Rodgers and Smith (1997) studied flushing distances for loafing and foraging waterbirds, increased energy expenditure of flushed birds, and the importance of disturbance free foraging areas to secure prey for developing chicks. They went on to suggest that availability and access to undisturbed foraging grounds may be as important as disturbance free-nesting sites.

<u>Continuing Threats:</u>

*Habitat Loss and Degradation* - Channelization, diversion of river flows for irrigation and hydropower production, construction of reservoirs and pools, and managed river flows have contributed to the elimination of much of the least tern's sandbar nesting habitat (Funk and Robinson 1974, Hallberg et al. 1979, Sandheinrich and Atchison 1986). For example, Ducey (1985), describes the changes in channel characteristics of the Missouri River since the early 1900s under the Missouri River Bank Stabilization and Navigation Project. The wide, braided character of the Missouri River was engineered into a single, narrow navigation channel. Most sandbars virtually disappeared between Sioux City, Iowa, and St. Louis, Missouri (Sandheinrich and Atchison 1986, Smith and Stucky 1988). The middle Mississippi River and the lower Mississippi River have experienced similar effects due to channelization. Interior least terns along the Arkansas River in Oklahoma and Arkansas contend with dam discharges and altered hydrographs, similar to the Missouri River (USFWS 1990).

Reservoir storage and irrigation project depletions of flows responsible for scouring sandbars have resulted in encroachment of vegetation onto sandbars along many rivers, including the Platte River, further reducing least tern nesting habitat (Eschner et al. 1981, Currier et al. 1985, O'Brien and Currier 1987, Stinnett et al. 1987, Lyons and Randle 1988, Sidle et al. 1989). According to Smith and Stucky (1988), the process of dike field terrestrialization is also well underway at several least tern colony sites in the lower Mississippi River. In addition, river main stem reservoirs now trap much of the sediment load resulting in less aggradation and more degradation of the river bed, reducing formation of suitable sandbar nesting habitat. With the loss of much least tern nesting habitat, predation has become a significant factor affecting least tern productivity in many locations (Massey and Atwood 1979, Jenks-Jay 1982). Further loss of riverine foraging habitat could have adverse consequences for least terns on the central Platte River.

Since 2000, the continued drought over a large portion of the Great Plains has reduced the quality and suitability of nesting and forage habitat in several rivers. Sandbar habitat that was created with the high flow events in the 1980s on the Platte River and from 1995-1997 on the Missouri River is now being degraded by the lack of replenishing flow due to the drought. Large stretches of the Platte River went dry from Kearney to Columbus, for more than two months during 2002. The Platte River again experienced lower than average flows during the 2003 winter and spring periods. Very low to zero flows were recorded by the gage at Duncan for 78 days, Kearney for 38 days, and at Grand Island for 75 days during the summer and fall of 2003. In addition, no discernable natural "spring rise" occurred in the central Platte River in 2001, 2002, or 2003.

In May and June of 2003, the negative effects on channel habitat from prolonged low flows were demonstrated by early proliferation of dense vegetative growth on islands and sandbars in the river. It appears that plant communities establishing on islands and sandbars within the river channel have been directly influenced by the timing and duration of inundation during the growing seasons.

Most birds on the central Platte River currently nest on sandpits upstream of Shelton. Because perennial water sources exist in the upper half of the central Platte River, these birds appear to have found sufficient fish densities to sustain them through the remainder of the nesting season. Monitoring efforts conducted by the CNPPID and NPPD on their managed sandpits did not report instances of starvation, although fitness of adults or fledglings has not been measured empirically. In addition, productivity was not reduced beyond recent ranges for the sandpits observed. These considerations do not however, capture any longer term or more subtle effects of limited prey resources.

*Human Disturbance* - Human disturbance affects tern productivity in many locations, including the Missouri River (Massey and Atwood 1979, Goodrich 1982, Burger 1984, Dryer and Dryer 1985, Dirks and Higgins 1988, Schwalbach 1988, Mayer and Dryer 1990). Many rivers have become the focus of recreational activities, and sandbars, where they exist, are fast becoming the recreational counterpart of coastal beaches. Human presence reduces reproductive success (Mayer and Dryer 1988, Smith and Renken 1990). Human disturbance, particularly pedestrians, is frequently the key hurdle facing piping plover chicks and other shorebirds attempting to forage along the waters' edge (Elliot 1999, Fackelmann 1991, Rodgers and Smith 1995). Domestic pet disturbance and trampling by grazing cattle are other factors that have contributed to the population decline.

*Pollution/Contaminants* - Pollutants entering the waterways within and upstream of breeding areas can negatively impact water quality and fish populations in nearby foraging areas. Strip mining, urban and industrial pollutants, and sediments from non-point sources can all degrade water quality and fish habitat, thereby impacting small-fish populations on which least terns depend (Wilbur 1974, Erwin 1983). In addition, because least terns are relatively high on the food chain, they are in a position to bioaccumulate contaminants which may render eggs infertile or otherwise affect reproduction and chick survival (USFWS 1983, Dryer and Dryer 1985). The extent of this impact, however, is undocumented. Mercury residues have been found in least terns from the Cheyenne River watershed in South Dakota. Dichlorodiphenyldichloroethylene (DDEs) and polychlorinated biphenyls (PCBs) have also been found in the two coastal subspecies in South Carolina and California (USFWS 1983). Elevated selenium and PCB concentrations were noted in least tern eggs collected on the Missouri River in South Dakota (Ruelle 1991). Allen and Blackford (1997) found 81 percent of 104 least tern eggs collected from the Missouri River exceeded 3µg/g dry weight selenium concentration, the level currently considered safe for avian reproductive success.

*Disease* - Eleven dead piping plovers were found on the Missouri River in 2003. One of these was suitable for analysis by the U.S. Geological Survey (USGS) National Wildlife Health Center in Madison, Wisconsin. Preliminary results were positive for West Nile virus from multiple tissues, although the final report has not been released. Although no dead least terns were found, the potential for least tern mortality as a result of West Nile virus exists, as the presence of the virus within the range has been documented.

## *C. Piping Plover Biological Status*

### C1. Species Description

The piping plover is a migratory shorebird of the family Charadriidae. Adult birds weigh between 43 and 63 grams, are 17-18 centimeters (cm) long, and have a wingspan 11.0-12.7 cm long. Both sexes are sand-colored with white undersides, and the legs are orange. During the breeding season, adults develop an orange bill, and a single black forehead band and breast band. In general, males have more complete bands than females, and inland birds have more complete bands than Atlantic coast birds (Prater et al. 1977, Haig and Oring 1988a). Breeding birds lose the orange bill and bands after the breeding season, but are easily distinguished from related plover species by their slightly larger size and orange legs (Prater et al. 1977). Juvenile plumage is similar to adult nonbreeding plumage (USFWS 1988a). Juveniles acquire adult plumage the spring after they fledge (Prater et al. 1977) (USFWS 2000). The importance of the Platte River ecosystem to piping plovers is discussed in the *Environmental Baseline* section of this biological opinion.

The piping plover is one of six North American belted plovers, and breeds in three regions (Atlantic, Great Plains, and Great Lakes) in North America. First considered a separate species by Ord (1824), the piping plover binomial was recorded by the American Ornithologist's Union (AOU) Checklist as *Charadrius melodus* in 1931. Scientists have debated for years the validity of the designation of two subspecies, *C. m. melodus* (Atlantic birds), and *C. m. circumcintus* (inland birds), which the AOU adopted in 1957 (USFWS 2000). In 1998, the AOU returned to the single-species designation after genetics were reported similar between the groups (Haig 1988, AOU 1998). Ongoing research, using more sophisticated genetic techniques, may clarify this issue in the near future (USFWS 2000).

Designated Critical Habitat:

Critical habitat was federally designated for the Northern Great Plains population on September 11, 2002, 67 FR 57638 (USFWS 2002a). That designation identified physical and biological features (primary constituent elements) that are essential to the conservation of the species. According to the final rule for critical habitat:

> The one overriding primary constituent element (biological) that must be present at all sites is the dynamic ecological processes that create and maintain piping plover habitat. Without this biological process the physical components of the primary constituent elements would not be able to develop. These processes develop a mosaic of habitats on the landscape that provide the essential combination of prey, forage, nesting, brooding and chick-rearing areas. The annual, seasonal, daily, and even hourly availability of the habitat patches is dependent on local weather, hydrological conditions and cycles, and geological processes.
>
> The biological primary constituent element, i.e., dynamic ecological processes, creates different physical primary constituent elements on the landscape. These physical primary constituent elements exist on different habitat types found in the northern Great Plains, including mixosaline to hypersaline wetlands (Cowardin et al. 1979), rivers, reservoirs, and inland lakes. These habitat types or physical primary constituent elements that sustain the northern Great Plains breeding population of piping plovers are described as follows:
>
> On prairie alkali lakes and wetlands, the physical primary constituent elements include – (1) Shallow, seasonally to permanently flooded, mixosaline to hypersaline wetlands with sandy to gravelly, sparsely vegetated beaches, salt-encrusted mud flats, and/or gravelly salt flats: (2) springs and fens along edges of alkali lakes and wetlands; and (3) adjacent uplands 299 ft (61m) above the high water mark of the alkali lake or wetland.
>
> On rivers, the physical primary constituent elements include sparsely vegetated channel sandbars, sand and gravel beaches on islands, temporary pools on sandbars and islands, and the interface with the river.
>
> On reservoirs, the physical primary constituent elements include sparsely vegetated shoreline beaches, peninsulas, islands composed of sand, gravel, or shale, and their interface with the water bodies."
>
> The interactive nature of the biological primary constituent element or the dynamic ecological processes creates the physical primary constituent elements. On the northern Great Plains, the suitability of beaches, sandbars, shoreline, and flats as piping plover habitat types also is dependent on a dynamic hydrological system of wet-to-dry cycles. Habitat area, abundance and availability of insect foods, brood and nesting cover, and lack of vegetation are all linked to these water cycles. On rivers, one site becomes flooded and erodes away as another is created. More importantly, high flows on rivers create a complex of habitats for feeding, nesting, and brooding (Pavelka 2002 and Vander

Lee et al. 2002). The dynamic nature of rivers is important to long-term habitat creation and maintenance for piping plovers. On alkali lakes, the complex of different wetland types is especially important for providing areas for plovers feeding, nesting, and brooding in all years, as site availability cannot be predicted or selected at a given time, due to varying water cycles.

Critical habitat areas were designated in Nebraska in 2002 and included the Platte River from the Lexington bridge to the Platte River confluence with the Missouri River, 252 miles downstream. The NRC (2005) concluded that the Service used appropriate scientific knowledge when designating critical habitat for the piping plover. The Service's conviction that the "presence of dynamic ecological processes" is the over-arching PCE, was described by the NRC (2005) as scientifically valid, and "an accurate, reasonable decision supported by published studies and agency reports." (p 207).

In response to a lawsuit brought by a consortium of water users in Nebraska (the Nebraska Habitat Conservation Coalition), an October 13, 2005, court ruling vacated the Nebraska portion of the piping plover critical habitat designation, and remanded that portion to the Service for redesignation.

## C2. Life History

Reproductive Biology:

Piping plovers are territorial shorebirds that spend three to four months on northern United States and southern Canada breeding sites. Piping plovers begin arriving on the breeding grounds in late April and early May. Adults may return to the same nest areas in succeeding years (Wilcox 1959, Cairns 1982, Haig and Oring 1988b, Wiens and Cuthbert 1988). Courtship behavior includes aerial flights, digging of several nest scrapes, and ritualized stone-tossing (Cairns 1977, 1982; Haig and Plissner 1992). Piping plovers exhibit a predominantly monogamous mating system, although mate switching may occur during the breeding season (Haig and Oring 1988a) or between years (Wilcox 1959, Wiens 1986, Haig and Oring 1988a) (USFWS 2000). Haig and Oring (1988a) found that new pair-bonds are established from year-to-year regardless of previous nesting success.

Nest initiation may begin by late April and continue until early July (USACE 1998). Finished nest scrapes or bowls are shallow depressions approximately 2 cm deep and 6 cm in diameter, frequently lined with small pebbles or shell fragments (USFWS 1988a). Both adults actively defend the nesting territory. Egg laying typically begins the second or third week of May. Females lay an egg every other day until a four-egg clutch is complete. Both sexes share incubation responsibilities, which can last for 25 to 31 days (Wilcox 1959, Cairns 1977, Wiens 1986, Haig and Oring 1988a) (USFWS 2000).

Eggs within a clutch typically hatch within four to eight hours of one another, but the hatching period may be delayed up to 48 hours (USFWS 1988a). Piping plover chicks are precocial, leave the nest almost immediately, and are able to feed themselves within a few hours. Males and females both defend and brood the chicks until they fledge. Adults will accompany the chicks and lead them to and from foraging locations, provide shelter during inclement weather, and attempt to protect them from predators (Wilcox 1959, Cairns 1982). Most adults raise only one brood of up to four chicks per nesting season, although one pair in Nebraska raised two broods (Lingle 1990). Upon the loss of eggs or newly hatched chicks, a pair may renest up to four times. Renesting efforts characteristically result in fewer than the typical four eggs being produced (Lingle 1988, USFWS 1988a). Reproductive maturity is reached the year following fledging, but little information indicating reproduction by first-year birds on the Great Plains is available (C. Kruse pers. comm.).

By July and August, piping plovers begin fall migration (Cairns 1982, Prindiville-Gaines and Ryan 1988). Breeding adults in Minnesota were observed departing the nesting grounds as early as mid-July and the majority had left by early August (Wiens 1986). Juveniles departed a few weeks later and had largely disappeared by late August (Wiens 1986). Adult males in Manitoba were observed to remain with broods until after fledging and were frequently seen moving into nonbreeding flocks with their chicks (Haig 1987) (USFWS 2000).

Growth and Longevity:

Time from hatching to fledging is estimated to be approximately 21 days in Nebraska (Wilson, pers comm.). Current estimates of piping plover survival rates are limited, although a mean annual survival rate of 0.664 was estimated for the northern Great Plains population (Root et al. 1992). Recent studies indicate that overwinter survival can be very high (Drake 1999). In New York, in the 1930s through 1950s, 13 percent of 149 females and 28 percent of 139 males lived to at least age 5; twelve of those lived at least 8 to 11 years (Wilcox 1959, USFWS 2000).

Movement and Dispersal Patterns:

In the central Platte River there has only been one banding effort conducted. Lingle (1993b) banded least terns and piping plovers between Lexington and Grand Island, Nebraska, from 1984 to 1989. He found distances of nesting birds from their banding origin extended from 0 to 200 km for piping plovers (based on 71 sightings of 57 individuals). Fourteen percent of the re-sighted birds were banded as chicks, and 32 percent returned to their banding origin in future breeding seasons. Plovers banded as adults had an even higher rate, as 43 percent returned to their banding origin (Lingle 1988). Lingle (1988) confirmed the movement of piping plovers upstream and downstream in the Platte River valley.

Piping plovers winter along the Gulf and southern Atlantic Coasts, as well as in eastern Mexico and some Caribbean Islands. Banded piping plovers from the northern Great Plains and Canada Prairie have been observed in virtually all the southern states, most have been reported along the Gulf Coast (Haig and Oring 1988b).

Nesting Habitat Characteristics:

Piping plovers are semi-colonial and, like least terns, nest on sparsely vegetated sandbars, aggregate mining spoil piles, and reservoir shorelines. Nesting habitats on the Platte, Niobrara, and Missouri rivers typically are dry sandbars located midstream in wide, open channels, with less than 25 percent vegetative cover (Faanes 1983, Schwalbach 1988, Ziewitz et al. 1992). The optimum range for vegetative cover on nesting habitat has been estimated at 0 to 10 percent (Armbruster 1986), and Ziewitz et al. (1992) noted vegetated cover on nesting islands was usually less than 25 percent. Schwalbach (1988) and Ziewitz et al. (1992) suggest that birds select a higher nest site when available and sites away from the water's edge. Those conditions provide the essential requirements of wide, horizontal visibility; protection from terrestrial predators; isolation from human disturbance; and (when sandbars are of sufficient height) sufficient protection from rises in river levels (USFWS 2000 and 2003a).

Food and Foraging:

The diet and foraging behavior are not well studied, largely because the species' status and sensitivity to disturbance have precluded the collection of birds for stomach contents analysis (USFWS 2000). Open, wet, sandy areas provide feeding habitat for plovers on river systems and throughout most of the bird's nesting range. Piping plovers forage visually for invertebrates in shallow water and associated moist substrates (Cairns 1977, Cuthbert et al. 1999, Whyte 1985). Along the central Platte River, prey consists primarily of beetles and small soft-bodied invertebrates from the waterline and opportunistically taken prey from dryer sites at sandpits (Lingle 1988).

Corn and Armbruster (1993a and 1993b) identified several patterns of invertebrate distribution and abundance of significance to piping plover foraging and breeding success. Although the food base is similar taxonomically between sandbars and spoil piles, invertebrate catch rates and densities are higher on river channel sites. Invertebrates are distributed more or less uniformly across riverine foraging habitat, but decline with increasing distance from the water's edge at sand pit locations. Invertebrate catch rates increased more dramatically over the course of the summer on riverine sites than on sand pit sites. These patterns of invertebrate occurrence translated into greater foraging activity on river channel sites even when birds nested off the river (Corn and Armbruster 1993b). Their research emphasizes the importance of river channel habitat for foraging. Lingle (1988) observed banded piping plovers known to be nesting at sandpits foraging 0.5-mile away in riverine habitat.

Substrate moisture most likely explains the differences in invertebrate catch rates between the river and spoil pile sites. The dominant invertebrate taxa collected from both sites were shore-inhabiting and semi-aquatic species associated with moist, sandy environments. Piping plover foraging activity correlates with moisture of the foraging substrate. Piping plovers using aggregate mining locations concentrated their foraging effort along sand pit shorelines, where substrate moisture was highest. Piping plovers foraging on river channel sites, where substrate moisture did not vary as much with distances from the water's edge, tended to forage at all distances from the water's edge. Aggregate mining locations likely had lower invertebrate abundance of dominant taxa because of reduced area of moist sand on sand pit shorelines relative to river channel shorelines (Corn and Armbruster 1993b).

Food availability can be critical to the survival and reproduction of piping plovers. Chick mortality is correlated with reduced growth rates (Cairns 1982), potentially a result of reduced prey availability. Piping plover chicks studied on the Atlantic coast typically tripled their weight during the first two weeks after hatching; and chicks that failed to achieve at least 60 percent of this weight gain by day 12 were unlikely to survive (USFWS 1996a). During the breeding season, energy demands on shorebirds are typically higher than intake rates (Ashkenazie and Safriel 1979), and even on the best of foraging habitats, breeding shorebirds may not be able to forage efficiently enough to meet those demands (Evans 1976). In areas where invertebrate densities are not high, lowered feeding efficiency (Goss-Custard 1977a and 1977b, Connors et al. 1981) exacerbates the energy deficit during the breeding season.

Sightings of color-banded piping plovers (N=19) by Lingle (1988) revealed movement and dispersal patterns; in about 80 percent of the observations, birds moved from sand pit to riverine sites. Post-fledging chick movements were generally to the river from sand and gravel sites. The exception was when high flows forced the birds off the river to the spoil piles. Once chicks attain flight, they accompany adults to the river (Lingle 1988).

## C3. Population Dynamics

Ryan et al. (1993) modeled population growth and found that the northern Great Plains piping plover population is declining 7 percent annually. Unchecked, this rate of decline would result in extirpation of the species in approximately 80 years. They used the simulation model to predict reproductive and survival rates necessary to stabilize and increase the population. Ryan et al. (1993) stated: "When recent adult (0.66) and immature (0.60) survival rates were held constant, a 31 percent increase--from 0.86 to 1.13 chicks fledged per pair--was needed to stabilize the population. Annual population increases of 1 percent and 2 percent required 1.16 and 1.19 chicks per pair, respectively. Such growth would result in the northern Great Plains population reaching the level--(2,550) pairs--needed for de-listing ESA protection in 53 and 30 years, respectively. One- and five-year delays in the initiation of 1 percent population growth caused 13- and 67-year delays respectively in reaching recovery."

Larson et al. (2000) conducted an updated analysis of piping plover populations in the northern Great Plains. They concluded that previous analyses (Ryan et al. 1993, Plissner and Haig 2000) of population persistence for northern Great Plains piping plovers may have been overly pessimistic based on their (Larson et al. 2000) revised survival estimate for adult piping plovers (0.737 versus 0.66). Larson et al. (2000) concluded that the likelihood of recovering the northern Great Plains population is greater than previously thought. Sensitivity of population growth levels to adult mortality, however, these efforts must be adjusted locally to minimize predation of incubating adults (USFWS 2003).

Population Size:

No estimates of piping plover population sizes exist prior to the early 1980s (USFWS 1988a). Breeding surveys in the early 1980s reported 2,137 to 2,684 adult plovers in the Northern Great Plains/Prairie region, 28 adults in the Great Lakes region, and 1,370 to 1,435 adults along the Atlantic Coast (Haig and Oring 1985) (USFWS 2000).

In 1991, the first International Piping Plover Census was conducted by the Great Lakes & northern Great Plains and the Atlantic Coast Piping Plover Recovery Teams (United States) and the Prairie and Atlantic Canada Piping Plover Recovery Teams (Canada) (Haig and Plissner 1993). This census was an important step for surveying piping plovers on breeding and wintering grounds because census methods and timing were similar in all areas. Results of the 1991 breeding ground surveys were: a) 1,975 adults in the Atlantic Coast region; b) 40 adults in the Great Lakes region; and, c) 3,467 adults in the northern Great Plains/Prairie region (Haig and Plissner 1993). On the wintering grounds 3,451 plovers were recorded, with the majority in Texas (Haig and Plissner 1993). A second International Census took place in 1996. Results of the 1996 breeding ground surveys were: a) 2,581 adults in the Atlantic Coast region; b) 48 adults in the Great Lakes region; and, c) 3,284 adults in the northern Great Plains region (Plissner and Haig 1997). On the wintering grounds, 2,515 plovers were counted (Plissner and Haig 1997) (USFWS 2000).

The third International Census was conducted in 2001 (Ferland and Haig 2002). The census documented 5,945 adult piping plovers. From the United States northern Great Plains/Prairie Canada, 2,953 individuals were counted. The Atlantic Coast (including Canada) accounted for 2,920 individuals. The Great Lakes reported 72 individuals. On the wintering grounds, 2,389 piping plovers were located. Table V-C1 compares breeding survey results among 1991, 1996, and 2001 for the United States northern Great Plains/Prairie Canada piping plovers (USFWS 2003).

**Table V-C1. International Piping Plover Census results 1991-2001.**

| **Location** | **Adults** | | | **Trends** | | |
|---|---|---|---|---|---|---|
| | **1991** | **1996** | **2001** | **1991-1996** | **1996-2001** | **1991-2001** |
| United States Northern Great Plains/ Prairie Canada | 3,469 | 3,286 | 2,953 | -5.3 % | -10.1 % | -14.9 % |

Population fluctuations are prominent in prairie habitat because precipitation and drought can significantly influence annual habitat availability (Goossen et al. 2002). Populations on the Elkhorn, Loup and central Platte River areas declined between 1996 and 2001, while the population on the Missouri River increased several fold (Appendix F). The large increase on the Missouri River is likely due to substantial increases in habitat availability due to flood events in 1997.

Recovery Goals:

The Service finalized a recovery plan for the Great Lakes and Northern Great Plains Piping Plover in (USFWS 1988a). The 1988 plan established a recovery goal for the northern Great Plains piping plover population of 1,300 pairs. Although the number of breeding pairs documented during the 2001 census exceeds the total number of piping plover identified in the recovery plan, the geographic and temporal elements of the recovery goals have not been met.

The recovery plan states that the population must remain stable for a period of at least 15 years, but the population has declined with each rangewide census (Table V-C1). The geographic goals in the recovery plan 1,300 pairs are to be distributed in the following locations. The number of pairs documented during the 2001 census is in italics for comparison.

Montana - 60 pairs (*57 pairs*)
North Dakota - 650 pairs (*522 pairs*)
    Missouri River - 100 pairs (*298 pairs*)
    Missouri Coteau - 550 pairs (*224 pairs*)
South Dakota -350 pairs (including 250 pairs shared with Nebraska on the Missouri River)
        (*138 pairs including pairs shared with Nebraska on the Missouri River*)
    Missouri River below Gavin's Point - 250 pairs (shared with Nebraska) (*105 pairs*)
    Other Missouri River sites - 75 pairs (*86 pairs*)
    Other sites - 25 pairs (*no off river pairs were observed*)
Nebraska - 465 pairs (including 250 pairs shared with South Dakota on the Missouri River)
(*271 pairs including pairs shared with South Dakota on the Missouri River*)
Platte River - 140 pairs (*47 pairs*)
    Niobrara River - 50 pairs (*43 pairs*)
    Missouri River - 250 pairs (*138 pairs*)
    Loup River system - 25 pairs (*23 pairs*)
Minnesota - 25 pairs at Lake of the Woods (*3 pairs*)

The above recovery goals include 465 pairs of piping plovers to be maintained over a period of 15 years in Nebraska, including 165 pairs on the Platte River and its tributaries. The coordinated censuses to date have documented populations below these levels for Nebraska and the Platte River basin.

The Canadian Recovery Objective for its prairie population is 1,626 adults (813 pairs) maintained over two additional international censuses with no net loss of habitat due to human action and to increase and maintain a median chick fledging rate of greater than 1.25 chicks/pair/year (Goossen et al. 2002).

## C4. Status and Distribution

Federal Status:

The Service identified the piping plover as a candidate species for addition to the list of threatened and endangered wildlife in December 1982 (47 FR 58454). On January 10, 1986, the Service listed piping plovers on the Great Lakes as endangered, while the remaining Atlantic and northern Great Plains birds were listed as threatened (50 FR 50726-34). Plovers on migration and in wintering areas were classified as threatened (USFWS 2003).

Although the piping plover was listed (50 CFR 17.11) as endangered in the Great Lakes and threatened everywhere else the species occurs, the Service has indicated that it considers the listed entities to be comprised of three separate breeding populations. Since listing the piping plover, the Service has completed two recovery plans that identified recovery goals for three populations (i.e., northern Great Plains, Great Lakes, and Atlantic Coast piping plovers). Further, in September 2002, critical habitat was designated separately for the northern Great Plains and Great Lakes populations, but not for the Atlantic Coast population, satisfying the requirement (USFWS Consultation Handbook, page 4-36) that notice be given through the *Federal Register* of the Service's intent to issue biological opinions on a population that differs from the entity listed in 50 CFR 17.11. Therefore, the Service has determined that the northern Great Plains population of the piping plover is the appropriate population to consider for purposes of this section 7 consultation (USFWS 2003).

Historic and Current Range Wide Distribution:

Piping plovers historically bred in three areas of North America: a) Atlantic coastal beaches from Newfoundland to South Carolina; b) beaches of the Great Lakes; and c) the northern Great Plains/Prairie region from Alberta to Ontario and south to Nebraska (USFWS 1988a) (Figure V-7). Winter sites were not well described although piping plovers were generally seen along the Gulf of Mexico, on southern Atlantic coastal beaches from North Carolina to Florida, in eastern Mexico, and on scattered Caribbean Islands (Haig and Oring 1985) (USFWS 2000)

Currently, the species' range remains similar to historic range accounts, except that plovers nesting in the Great Lakes have almost disappeared (Haig and Oring 1988a). In 1996, northern Michigan had the only viable nesting population of plovers in the Great Lakes area. Wintering grounds have received less attention than breeding grounds in the past, so all possible wintering areas may not yet been surveyed (USFWS 1988a) (USFWS 2000).

All three populations are migratory, but the Atlantic birds migrate to a lesser extent. The current breeding range for the northern Great Plains population extends from alkali wetlands in southeastern Alberta through southern Saskatchewan and Manitoba to Lake of the Woods in southwestern Ontario, Canada and in the United States from northwestern Minnesota, south along major prairie rivers (i.e., Yellowstone, Missouri, Niobrara, North Platte [Lake McConaughy], Platte, and Loup), to reservoirs in southeastern Colorado, and alkali wetlands in northeastern Montana, North Dakota, and South Dakota (Figure V-C2). Occasional breeding has occurred in Oklahoma and northern Saskatchewan in the United States and Canada, respectively. The piping plover winters along Gulf Coast beaches and sand/mudflats from Florida into northern Mexico (Laguna Madre). Large numbers of piping plovers winter along the Texas coast.

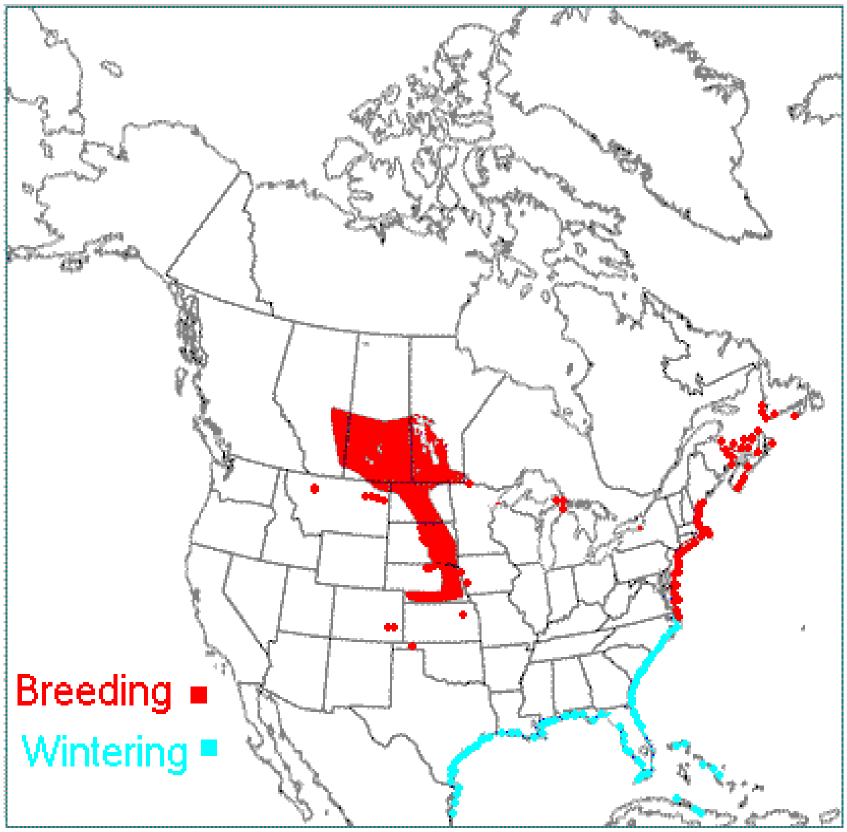


**Figure V-C1. Approximate breeding and wintering range of the piping plover in North America.**

<u>Reasons for Listing:</u>

Historically, the piping plover was over hunted (USFWS 1988a). Since the early 1900s, habitat alteration and destruction from channelization, irrigation, and the construction of reservoirs on our nation's large river systems is listed in the Recovery Plan as the primary reason for the species' decline and current status. Hydropower demands are unpredictable, resulting in fluctuating flows, and hydrologic regimes that differ greatly from historic regimes. Present day high flows may extend into the nesting season, resulting in inundated or reduced riverine nesting sandbar habitat, and flooding of nests, eggs, and chicks (USFWS 1988a, USFWS 1990). Reservoir storage of flows has also significantly reduced high spring flows from historic levels (Murphy et al. 2004), which in turn has led to vegetative encroachment on riverine sandbars as a result of reduced scouring flows. In addition, large amounts of sediment which enter the reservoirs settle out, leaving clean sediment-free water downstream. This results in reduced aggradation and increased degradation in the river bed, which prevents or diminishes the formation of new sandbar nesting habitat (Murphy et al. 2004).

In addition to the effects of habitat and flow alterations, human disturbance has also played a role in the species' decline. Carney and Sydeman (1999) conducted a literature review on the effects of human disturbance and found that human presence reduced reproductive success in *Charadriiformes*. Disturbance of nesting plovers included the following effects: a) startling adults from the nest and potentially resulting in overheating or chilling of nest contents; b) alerting predators to the location of nests; and c) direct loss (Mayer and Dryer 1988, Smith and Renken 1990). Direct losses resulting from human presence include trampling under foot, crushing of nests by all-terrain vehicles, and predation by dogs. Rodgers and Smith (1997) studied flushing distances and energy expenditure for loafing, foraging, and flushed waterbirds. They concluded availability and access to disturbance-free foraging grounds may be as important as disturbance-free nesting sites.

Rangewide Population Trend:

An overall assessment of population increase or decrease has been difficult because of a lack of continent-wide surveys prior to the implementation of the international census in 1991. Although three international censuses have now been completed, much remains to be learned about the nesting and wintering habitats of the species; thus, care must be taken when attempting to assess population trends. For example, birds were found in areas during the 1991 and 1996 survey efforts where they had not been previously reported. However, most nesting sites on the prairies that have been monitored for ten years or more have experienced a decline; with an overall decrease of 13 percent between 1987 and 1991 (Haig and Plissner 1992).

Conducted in 1991, 1996 and 2001, the International Piping Plover Censuses provide the most reliable information on rangewide population trends. These censuses indicate a consistent rangewide decline in the northern Great Plains/Prairie Canada population. The 2001 census revealed a decrease of 18 percent and 25 percent from the 1996 and 1991 census totals, respectively.

Continuing Threats:

*Habitat Destruction* - Reservoirs, river channelization, and modified river flows have eliminated sandbar nesting habitat along hundreds of kilometers of the Missouri and Platte rivers in the Dakotas, Iowa, and Nebraska. Diversion of peak flows that scour river sandbars has resulted in vegetation encroachment. In addition, river main stem reservoirs now trap much of the sediment load resulting in less aggradation and more degradation of the river bed, and subsequently less sandbar nesting habitat. Consequently, piping plovers are often faced with finding a nest site outside the channel or not nesting at all (USFWS 2000).

In many places across Prairie Canada in 2001, extensive and ongoing drought has resulted in complete drying of piping plover habitat and encroachment of vegetation (Ferland and Haig 2002). Conversely, at other sites in Prairie Canada, severe flooding has taken a toll on previously good habitat.

Goossen et al. (2002) identified several factors influencing the status of the piping plover in Canada, including water management activities. Stabilizing water levels on Lake Manitoba, Canada, has threatened piping plover nesting habitat by allowing vegetation encroachment onto beaches. Moreover, water management at Lake Diefenbaker, Canada, threatens one of the larger concentrations of piping plovers in North America. In Canada, a widespread problem is the disturbance of beaches by cattle. The disturbed beach substrate becomes more prone to vegetation growth, thus reducing or eliminating its value for piping plover nesting habitat.

However, cattle grazing after the breeding season may actually reduce vegetation growth if beach substrates are firm (Goossen et al. 2002).

*Human Disturbance* - As noted above, human disturbance has and continues to play a role in the species' decline. Human disturbance affects piping plover productivity in many locations, including the Missouri River (Massey and Atwood 1979, Goodrich 1982, Burger 1984, Dryer and Dryer 1985, Dirks and Higgins 1988, Schwalbach 1988, Mayer and Dryer 1990). Many rivers have become the focus of recreational activities, and sandbars, where they exist, are fast becoming the recreational counterpart of coastal beaches. Human presence reduces reproductive success (Mayer and Dryer 1988, Smith and Renken 1990). Domestic pet disturbance and trampling by grazing cattle are other factors that have contributed to the population decline.

*Pollution/Contaminants* - In the northern Great Plains, most of the nesting habitat used by the piping plover is surrounded by agriculture and/or urbanization. Proximity to these land uses puts nesting birds at risk of exposure to numerous fertilizers, pesticides, herbicides, and other chemicals found in agricultural and urban environments.

Fannin and Esmoil (1993) found that addled piping plover eggs collected from nests along the Platte River and adjacent sandpits had selenium and mercury concentrations elevated above background. They reported that selenium in particular may be causing embryo mortality without gross embryological defects being observed. They also reported that impacts of contaminants, combined with habitat degradation, may accelerate population declines.

Although the following work was not specifically conducted on piping plovers, it includes contaminant results from a nest associate, the least tern. Allen et al. (1998) evaluated concentrations of arsenic, mercury, and selenium in 104 least tern eggs and chlorinated hydrocarbon compounds in 78 eggs from Kansas, Nebraska, North Dakota, South Dakota, and Montana from 1992 through 1994. Allen et al. (1998) studied a number of contaminants and found concentrations of selenium high enough to cause concern regarding their effects to least tern productivity. The recommended threshold for selenium impacts on avian reproduction is 3 µg/g dry-weight (Allen et al. 1998). Selenium concentrations exceeded 3 µg/g dry-weight in every state in each year except Kansas in 1993 and Montana in 1994. These levels are noteworthy in light of low hatching success being associated with selenium concentrations of 2.4 µg/g wet-weight in black-necked stilts (*Himantopus mexicanus*) and American avocets (*Recurvirostra americana*). The mean selenium concentrations for Nebraska were 4.3 µg/g, 4.2 µg/g, and 4.6 µg/g for 1992 through 1994, respectively. Therefore, selenium concentrations should be considered as a potential factor in low reproduction in least terns and piping plovers in the northern Great Plains, including Nebraska.

## *D. Pallid Sturgeon Biological Status*

### D1. Species Description

Pallid sturgeon are similar in appearance to the more common shovelnose sturgeon (*S. platyrhynchus*) and have five rows of scutes that run the entire length of the body. Like the shovelnose sturgeon, it possesses a spade-like rostrum, dorsoventrally flattened body, and tough skin. These morphological adaptations allow the species to survive the swift current and moving substrate of the bottom of swift waters in large, turbid, free-flowing rivers. The sturgeons' reduced eyes and large outer barbels are believed to be adaptations for feeding in turbid, sediment-laden waters (Keenlyne 1989). Pflieger (1997) reported the principal features distinguishing pallid sturgeon from shovelnose are the relative lack of scutes on the belly, 24 or more anal fin rays, and 37 or more dorsal fin rays. Other features used to distinguish pallid sturgeon from shovelnose sturgeon include coloration, barbel length and relative position, and relative length of the rostrum (Bailey and Cross 1954). The importance of the Platte River ecosystem to pallid sturgeon is discussed in the *Environmental Baseline* section of this biological opinion.

The pallid sturgeon is endemic to the Missouri River, the lower reaches of the Platte, Kansas, and Yellowstone rivers, the Mississippi River below the confluence with the Missouri River, and the Atchafalaya River near its divergence from the Mississippi River (Figure V-D1). Duffy, et al. (1996) stated that the historic range of pallid sturgeon once included the Mississippi River upstream to Keokuk, Iowa, before the river was converted into a series of locks and dams for commercial navigation. Although the species' range is large, catch records are extremely rare, with few captures of sub-adults in recent years. The species appears to be nearly extirpated from large segments of its former range, and may be close to extinction (USFWS 1993).

Since 1980, reported pallid sturgeon observations have most frequently occurred from the Missouri River between the Marias River and Fort Peck Reservoir, between Fort Peck Dam and Lake Sakakawea, within the lower 70 miles of the Yellowstone River to downstream of Fallon, Montana, in the headwaters of Lake Sharpe, from the Missouri and Platte rivers near

Plattsmouth, Nebraska, from the Mississippi River below the confluence with the Missouri River, and the Atchafalaya River near its divergence from the Mississippi River.

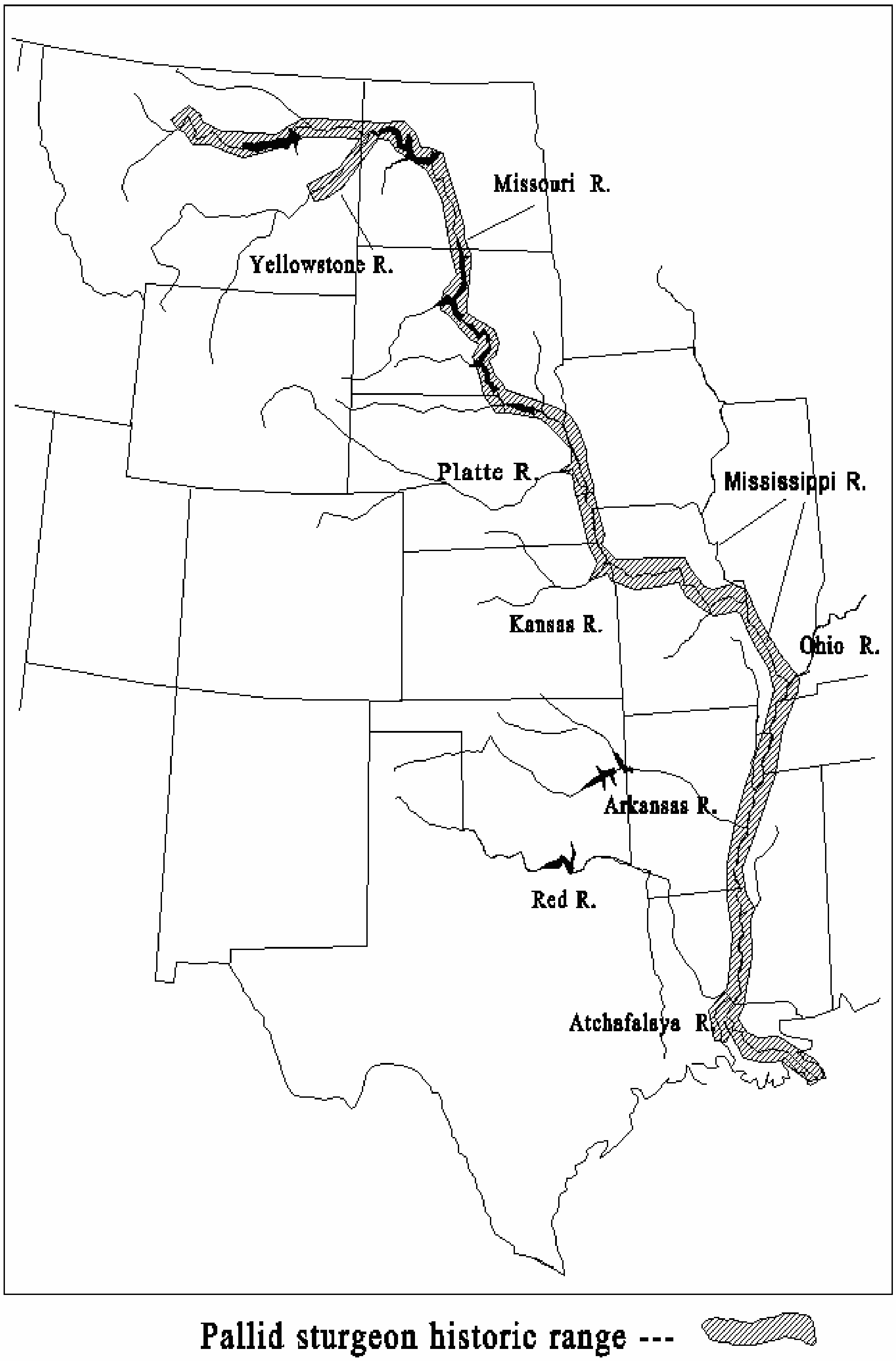


**Figure V-D1. Historic range for the pallid sturgeon.**

Although critical habitat has not been designated, six Recovery-Priority Management Areas (RPMAs) (Figure V-D2) have been identified (U.S. Fish and Wildlife Service 1993). These RPMAs were selected based upon recent pallid sturgeon records and the probability that these areas still provide suitable physical habitat for restoration and recovery of the species. These areas are the least degraded and in some reaches still exhibit a channel configuration of sandbars, side channels, and varied depths. The RPMAs also have one or more major tributaries affecting their hydrology, physical, and chemical characteristics.

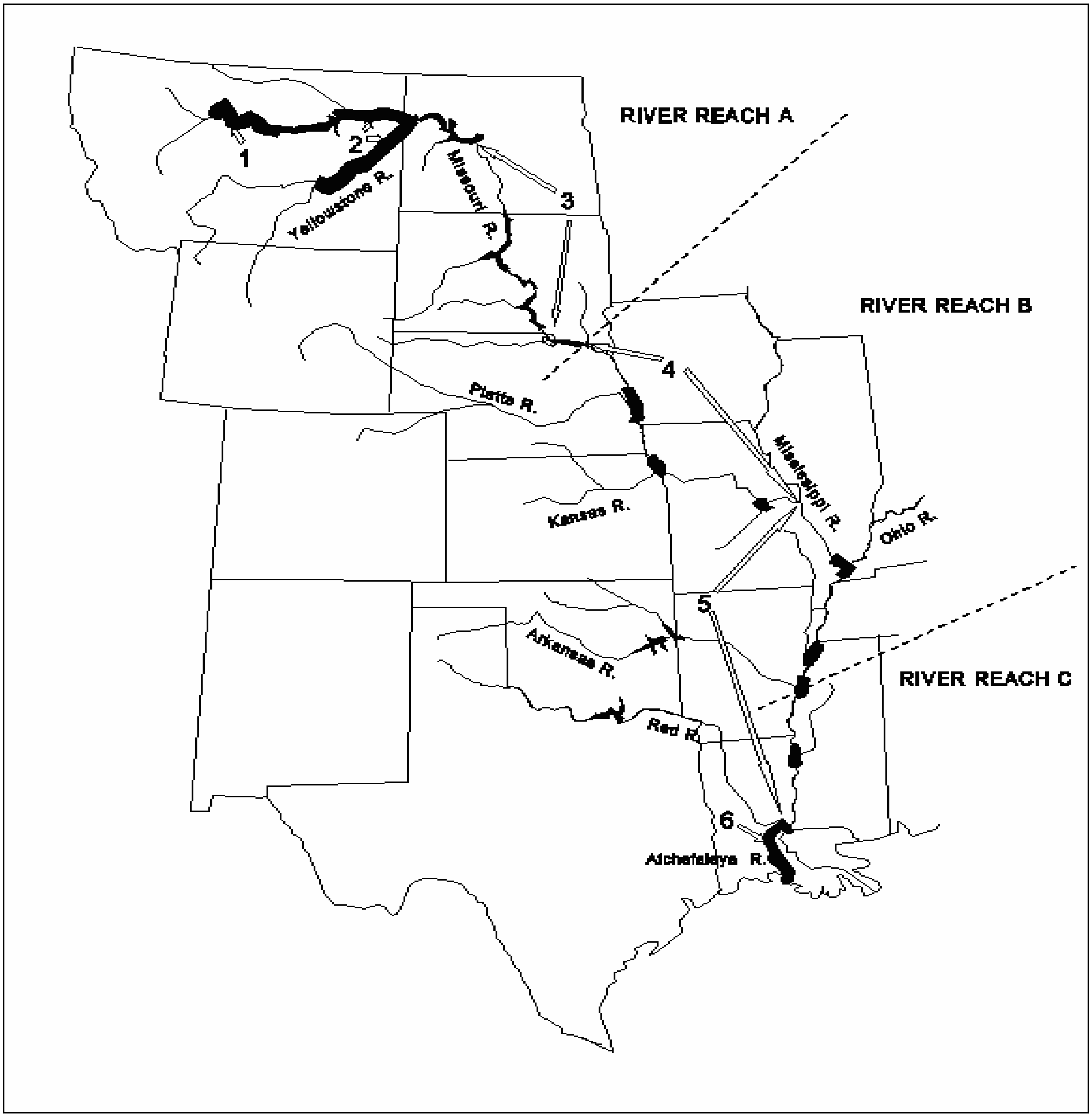


**Figure V-D2. Recovery-Priority management areas and reach designations for propagation and stocking plans.**

The confluence areas of major tributaries to the lower Missouri and Mississippi rivers are highlighted in the recovery plan for the pallid sturgeon because of their importance as feeding and nursery areas for large river fish (USFWS 1993). RPMA number four, as described in the recovery plan, is the Missouri River below Gavins Point Dam to its confluence with the Mississippi River; most importantly, within 20 miles upstream and downstream of major tributary mouths, including, but not limited to the Platte, Kansas, and Osage Rivers (USFWS 1993) (Figure V-E2).

Much of the Platte River system was probably used by large-river fish species of the Missouri River system before water resource development projects were constructed. A thorough discussion of the status of the species in the Platte River (the action area), and the relative importance of the Platte River to the persistence and recovery of the species can be found in the Environmental Baseline section of this document.

Of 43 occurrences of pallid sturgeon reported in the lower Missouri River Basin (below Gavins Point Dam) in Nebraska from 1979 through 2001, 23 are from the Platte River, Elkhorn River, or the Missouri River near the Platte River confluence (Table V-D1). Thus, 53 percent of the observations in Nebraska are from an area representing about 10 percent of the species range in the state. In theory, pallid sturgeons could travel upstream in the Platte River as far as the Kearney Diversion Dam, located just downstream from Elm Creek, Nebraska. From 2002 through 2004, significant numbers of hatchery reared pallid sturgeon were stocked in the Missouri River in Nebraska, including areas near the mouth of the Platte River. As a result, we cannot determine if numerous captures during this time frame represent habitat specifically selected by pallid sturgeon, or if they may contain individuals simply dispersing from release sites. Therefore the 2002 through 2005 captures are not included in Table V-D1.

**Table V-D1. Occurrence of pallid sturgeon in the lower Missouri River in Nebraska from 1979 to 2001. (Source: Nebraska Natural Heritage Program (NNHP), and pallid sturgeon recovery team (USFWS).**

| Date | Location | River Mile* | Source |
|---|---|---|---|
| 05/10/79 | Platte River, Interstate 80 bridge | 21.0+ | NNHP |
| 06/00/82 | Missouri River; mouth of the Platte River | 594.0 | USFWS |
| 05/29/84 | Missouri River; mouth of the Platte River | 594.0 | NNHP |
| 06/29/85 | Missouri River; Washington County | 647.0 | NNHP |
| 04/00/87 | Missouri River; Dixon County | 750.0 | USFWS |
| 04/05/87 | Missouri River | 725.0 | USFWS |
| 05/02/87 | Missouri River; 3 miles upstream of mouth of Platte River | 597.5 | NNHP |
| 09/10/88 | Missouri River; Vermillion River | 772.0 | USFWS |
| 11/02/88 | Gavins Point tailwater | 811.0 | USFWS |
| 05/06/90 | Elkhorn River near Waterloo, Nebraska | - | USFWS |
| 05/15/90 | Platte River; 0.25-mile above confluence with Missouri River | 0.3+ | USFWS |
| 03/31/91 | Missouri River; Otoe County | 549.6 | NNHP |
| 04/06/91 | Missouri River; Cass County; 4.5 miles below Platte R mouth | 589.5 | NNHP |
| 05/01/91 | Platte River near mouth | 0.0+ | USFWS |
| 04/14/92 | Missouri River; Nemaha County | 525.7 | NNHP |
| 05/24/92 | Missouri River; Douglas County | 613.5 | NNHP |
| 05/25/93 | Platte River; 1 mile below the mouth of the Elkhorn River | 32.0+ | NNHP |
| 05/29/94 | Missouri River; Cedar County, at mouth of Bow Creek | 789.0 | NNHP |

| | | | |
|---|---|---|---|
| 04/15/95 | Platte River; upstream from Hwy 50 bridge at Louisville | 17.0+ | NNHP |
| 04/15 95 | Missouri River; mouth of Platte River | 592.5 | NNHP |
| 04/16/95 | Missouri River; south of Nebraska City | 549.4 | NNHP |
| 05/29/95 | Missouri River; Harrison Co., IA (Burt Co., NE) | 661.0 | NNHP |
| 06/08/96 | Missouri River; Burt County | 672.8 | NNHP |
| 10/24/96 | Missouri River; Union Co., SD (Dixon Co., NE) | 751.0 | NNHP |
| 11/15/96 | Missouri River; Dakota County | 737.0 | NNHP |
| 05/10/97 | Platte River; 150 yards below mouth of Elkhorn River | 32.8+ | NNHP |
| 05/25/97 | Platte River; 0.5-mile below mouth of Elkhorn River | 32.2+ | NNHP |
| 07/09/97 | Missouri River; Cedar County | 811.0 | NNHP |
| 05/16/99 | Missouri River, mouth of Platte River | 594.0 | NNHP |
| 05/22/99 | Platte River, one mile east of Ak-Sar-Ben aquarium | 20.0+ | NNHP |
| 05/24/99 | Missouri River, Cass County | 590.5 | NNHP |
| 07/02/99 | Missouri River, Cass County | 585.0 | NNHP |
| 07/02/99 | Missouri River, Cass County | 585.0 | NNHP |
| 09/05/99 | Elkhorn River, 3 miles north of hwy. 36 bridge | - | NNHP |
| 09/16/99 | Missouri River, Cass County | 590.0 | NNHP |
| 01/14/00 | Missouri River, Gavins Point tailwater | 811.0 | NNHP |
| 04/02/00 | Missouri River, Cass County | 593.0 | NNHP |
| 05/17/00 | Missouri River, Cass County | 588.0 | NNHP |
| 04/22/01 | Missouri River, Cass County | 594.0 | NNHP |
| 04/23/01 | Missouri River, Cass County | 592.0 | NNHP |
| 05/03/01 | Platte River downstream from Hwy 50 bridge | 16.0+ | NNHP |
| 06/23/01 | Missouri River, Burt County | 691.5 | NNHP |
| 06/30/01 | Missouri River, Cedar County | 811.0 | NNHP |

* River miles are for Missouri River (Corps of Engineers), except where noted as Platte River (+) or Elkhorn River (-).

## D2. Life History

<u>Longevity, Age, and Growth:</u>

Little is known about the longevity of pallid sturgeon. Sturgeon are generally long-lived, and researchers have estimated pallid sturgeon longevity to be in excess of 40 years (USFWS 1993). In 1999, Dennis Scarneccia (University of Idaho, pers. comm. 1999) estimated the age of a deceased female pallid sturgeon from North Dakota at over 50 years and possibly as high as 60.

Similarly, little is known about age and growth of pallid sturgeon. This lack of knowledge is primarily due to the lack of sturgeon tissues that allow the determination of age. Attempts to use the leading ray of the pectoral spine have provided estimates; however, the Pallid Sturgeon Recovery Team has not supported the collection of this tissue due to the uncertainties of the overall affects to the fish. Most of the information regarding ages have been estimated from deceased specimens. Using hatchery reared fish, Hurley (1999) determined that the majority of age estimates based on pectoral fin rays were incorrect by approximately three years, but a three to four-year variation in age estimates may not be significant given the long life span of pallid sturgeon (40-50 years).

Using pectoral fin ray cross sections, Fogle (1963) found growth of fish in Lake Oahe was relatively rapid during the first four years, but annual increments decreased to approximately 70 millimeters per year between ages five and ten. Carlson and Pflieger (1981) found in a small sample size (n=8), that pallid sturgeon from the Missouri and Mississippi rivers in Missouri showed slightly slower growth than those from South Dakota. Keenlyne and Jenkins (1993) found that male pallid sturgeon (captured in Louisiana, Missouri and North Dakota) showed rapid growth from ages five to seven until sexual maturity. Carlson et al. (1985) found the total length of pallid sturgeon to be significantly greater than that of shovelnose in the lower Missouri and Mississippi rivers for each age group in which comparable data were available.

Reproductive Biology:

Because the pallid sturgeon has become so rare and its riverine habitat fragmented, little is known about reproduction or spawning activities. Basic parameters such as spawning locations, substrate preference, water temperature, or time of year have not been extensively documented. No spawning beds have been located and few larval pallid sturgeon have been recorded by investigators. Instances of reproduction have only been documented in the last several years. The Missouri Department of Conservation (MDC), through a sturgeon monitoring program, has documented larval and young-of-the year pallid sturgeon in the lower Missouri River (Robert Hrabik, MDC, pers. comm. 2003). Montana Fish, Wildlife & Parks also has documented young-of-the-year pallid sturgeon from the 2002 sampling season (Pat Braaten, USGS, pers. comm. 2003). Keenlyne (1989) concluded that, "because of their low reproductive potential, meeting reproductive needs may be a delicate but crucial strand in the success of sturgeon species, including the pallid sturgeon."

Pflieger (1997) reports that as pallid and shovelnose sturgeon are known to hybridize, spawning conditions must be similar, at least in the highly modified system in existence today. Therefore, information on shovelnose sturgeon spawning behavior can be used to make inferences about pallid sturgeon behavior. All sturgeon species spawn in the spring or early summer, are multiple spawners, and release their eggs at intervals. The larvae of Acipenserids are generally pelagic, becoming buoyant or active immediately after hatching (Moyle and Cech 1982). Although the downstream migration and behavior of young sturgeon is poorly understood, recent work by Kynard et al. (1998) indicates that the downstream migrational period for larval pallid sturgeon begins at hatching and continues up to day 13, with a decline after day 8.

Time of spawning is not well documented, but is believed to occur sometime from March through July, depending on location (Forbes and Richardson 1905, Gilbraith et al. 1988). Females collected in June and July in Lake Sharpe, South Dakota, contained mature ova and presumably were in spawning condition. However, 10 years of sampling for young-of-the-year fish in Lake Sharpe have provided no evidence of successful reproduction (Kallemeyn 1983). A telemetered pallid sturgeon, captured by a paddlefish angler on May 29, 1993, on the Yellowstone River was gravid, with fully developed eggs. Bramblett (1996) found pallid sturgeon aggregation areas in the Yellowstone River during spring and early summer that may indicate potential spawning areas. A female pallid sturgeon was captured in the Platte River on May 3, 2001 (E. Peters, University of Nebraska, personal communication, 2001). While surgically implanting a transmitter in order to track the fish, Peters determined that it was gravid, containing eggs that were ready to spawn. Based on capture the capture record, flow record, and temperature patterns in the Platte River, spawning would be most likely to occur in April or May, although year to year variation would be expected based on climatological conditions.

Kallemeyn (1983) reported that pallid sturgeon males reach sexual maturity at 53.3 to 58.4 cm. Keenlyne and Jenkins (1993) reported that sexual maturity for males is reached at five to seven years. They estimated that females are nine to twelve-years-old before egg development begins and first spawn may not occur until age seventeen or older. Both males and females probably do not spawn annually (Keenlyne and Jenkins 1993). Observations of pallid sturgeon at Gavins Point National Fish Hatchery (NFH) suggest that males could be induced to spawn annually, but females would likely be able to spawn once every three to seven years or more (H. Bollig, USFWS, pers. comm. 2000). Time of pallid sturgeon sexual maturity and the length of intervals between spawning is likely influenced by available prey, environmental conditions, and other factors (USFWS 1993).

Keenlyne et al. (1992) estimated fecundity for a female pallid sturgeon taken from the upper Missouri River. They found the mass of mature eggs weighed 1,952 g, which represented 11.4 percent of total body weight. Total fecundity for the individual was estimated at 170,000 eggs.

Very little information is available describing pallid sturgeon spawning requirements. Initiation of pallid sturgeon spawning migrations has been associated with seasonal spring flow differences in rivers (Peterman 1977, Zakharyan 1972, Gilbraith et al. 1988). In the controlled environment at Gavins Point NFH, the highest survival of pallid sturgeon larvae has been observed when spawning is conducted in the third week of June. Eggs held at 14°C generally hatch eight to ten days after spawning (H. Bollig, USFWS, pers. comm. 2000). Experiences have indicated that ideal spawning temperatures in the hatchery environment range from 15.5 to 18.5°C immediately prior to the spawning (S. Krentz, USFWS, pers. comm. 2001).

Sturgeons generally are K-strategists, a term used to describe species exhibiting slower development, delayed and repeated reproduction, larger body size, greater individual competitive ability, relatively low mortality rates, and long life spans. Because of this combination of life history traits, pallid sturgeon have a relatively low capacity for population increase (Boreman 1997).

<u>Habitat:</u>

Forbes and Richardson (1905), Kallemeyn (1983), and Gilbraith et al. (1988) describe pallid sturgeon as being well adapted to life on the bottom in swift waters of large, turbid, free-flowing rivers. Pallid sturgeon evolved in the diverse environments of the Missouri and Mississippi rivers. Floodplains, backwaters, chutes, sloughs, islands, sandbars, and main channel waters formed the large-river ecosystem that provided macrohabitat requirements for pallid sturgeon and other native large-river fish. Historically, these habitats were in a constant state of change. Mayden and Kuhajda (1997) describe the natural habitats to which the pallid sturgeon are adapted as: braided channels, irregular flow patterns, flooding of terrestrial habitats, extensive microhabitat diversity, and turbid waters. Today, these habitats and much of the previously functioning ecosystem has been changed by human developments.

Below Omaha, Nebraska, ecological effects of Missouri River mainstem dams are gradually moderated to some degree by in-flowing tributaries. For example, the Missouri River channel bed below Gavins Point Dam has degraded about 9 10 feet, severing floodplain functions. However, degradation ceases just above the lower Platte River near Omaha, likely influenced by Platte River sediment and inflows. Flooding in the Missouri River floodplain is most prevalent from the mouth of the Platte River downstream to the Kansas border, due to flows in the Missouri combined with inflows of the Platte River and/or other tributaries, and because of a narrow channel and levees.

Suspended sediment concentrations in the lower Platte River increase three- to four-fold during the spring. Concentrations during spring average about 1,100 to 1,500 milligrams/liter (mg/l) (USGS, Louisville gage 1972 to 1976), approximately 35 percent higher than that of the Missouri River at Omaha. These springtime sediment concentrations are equivalent to those found in the Yellowstone River, where other pallid sturgeon populations are concentrated. The high flows during spring and early summer deliver about 80 percent of the total annual amount of suspended sediment in the lower Platte River. The high sediment load and discharge produces in channel fish habitat (i.e. sandbars, backwaters, and pools) in the lower Platte River that is lacking or in extremely short supply in the channelized Missouri River.

The historic floodplain habitat of the Missouri and Mississippi rivers provided important functions for the native large-river fish. Floodplains were the major source of organic matter, sediments and woody debris for the mainstem rivers when flood flows crested the rivers' banks. The transition zone between the vegetated floodplain and the main channel included habitats with varied depths described as chutes, sloughs, or side channels. The chutes or sloughs between the islands and shore were shallower and had less current than the main channel. These areas provided valuable diversity to the fish habitat and probably served as nursery and feeding areas for many aquatic species (Funk and Robinson 1974). The relatively still waters in this transition zone allowed organic matter accumulations, important to macroinvertebrate production. Both shovelnose sturgeon and pallid sturgeon have a high incidence of aquatic invertebrates in their diet (Carlson et al. 1985; Gardner and Stewart 1987). Flood flows connected these important habitats and allowed fish from the main channel to utilize these habitat areas to exploit available food sources.

Carlson et al. (1985) captured pallid and shovelnose sturgeon along sandbars on the inside of river bends, and in deeply scoured pools behind wing dams, indicating overlap of habitat use by the two species. However, 4 of 11 pallids were captured in swifter currents where shovelnose sturgeon were less numerous. Although pallid and shovelnose sturgeon habitat use and movements are similar in certain aspects, Bramblett (1996) noted important differences in his upper Missouri and Yellowstone River studies. Pallid sturgeon showed significant preferences for sandy substrates, particularly sand dunes and avoided gravel and cobble substrate (Bramblett 1996). Snook (2001) found similar results in the lower Platte River. In contrast, shovelnose sturgeon significantly preferred gravel and cobble substrates and avoided sand (Bramblett 1996).

Pallid sturgeon were also more specific and restrictive in use of macrohabitat selection than shovelnose sturgeon (Bramblett 1996). Pallid sturgeon were found most often in sinuous channels with islands or alluvial bars, while straight channels, and channels with irregular patterns or irregular meanders were only rarely used. Seral stage of islands or bars near pallid sturgeon was most often subclimax (Bramblett 1996).

Bramblett (1996) noted that because macrohabitats utilized by pallid sturgeon were more specific and restrictive than shovelnose sturgeon, features in these macrohabitats may be more important to pallid sturgeon than to shovelnose sturgeon. He found that macrohabitats used by pallid sturgeon were diverse and dynamic. For example, pallid sturgeon used river reaches with sinuous channel patterns, and islands and alluvial bars which generally have more diversity in depths, current velocities, and substrates than do relatively straight channels without islands or alluvial bars. The diversity of channel features such as backwaters and side channels was also higher. The subclimax riparian vegetational seres in these areas indicate a dynamic river channel and riparian zone (Johnson 1993).

Snook (2001) found that pallid sturgeon substantially use the downstream edges of alluvial bars. Habitats frequently used were generally characterized by sharp changes in depth. Individual fish used the same length of bar edge repeatedly, and held on this type of habitat for several weeks at a time.

During middle Mississippi River telemetry studies, pallid sturgeon exhibited positive selection for main channel border and downstream islands tips, depositional areas between wingdams, and deep holes off of wingdam tips (Sheehan et al. 1998). This seems to correlate well with findings of Carlson et al. (1985). Sheehan et al. (1998) speculated that between wingdam areas and downstream island tips may be used as velocity refugia and/or feeding stations. Study sturgeon were found most often in main channel habitat; however, they exhibited selection against this habitat type. Their occurrence in such habitat was not surprising considering main channel comprised approximately 65 percent of the available habitat in the study reach (Sheehan et al. 1998).

Constant et al. (1997) reported that sturgeon were most frequently found in associations with low slope features and that such features were used in proportion to their availability. No sturgeon were observed on extremely steep slopes. They found that sand made up over 80 percent of the substrate in low slope areas where over 90 percent of pallid sturgeon were located. Constant et al. (1997) stated that the preference for sand substrates in low slope areas suggests that pallid sturgeon use such areas as current refugia. Sand substrates were found to have lower invertebrate densities than substrates of silt-clay which were generally located on areas of steep slope which were exposed by swift currents. Presumably, it would have been energetically costly for pallid sturgeon to remain near these substrates for extended periods of time. However, telemetry observations showed 55 percent of sturgeon locations occurred within 10 meters of steep slopes, suggesting that pallid sturgeon remained near areas of high food abundance (Constant et al. 1997).

*Micro-Habitat Characteristics* - Microhabitat characteristics of pallid sturgeon have just recently been described. Therefore, much of the microhabitat research to date is located in significantly altered riverine environments, and does not necessarily describe preferred or required habitats. Instead, current microhabitat research studies by Snook (2001), Sheehan et al. (1998), Constant et al. (1997), Hurley (1996), and Bramblett (1996) only describe pallid sturgeon use of habitats currently available. In addition, information from capture locations may reflect seasonal habitat preferences.

*Current/Velocity* - In the Missouri River in South Dakota, pallid sturgeon most frequently occupy river bottoms where velocity ranges from 0 to 0.73 m/s (Erickson 1992). Other studies in Montana found that pallid sturgeon are most frequently associated with water velocities ranging from 0.46 to 0.96 m/s (Clancey 1990). Bramblett (1996) noted pallid sturgeon occupying bottom velocities ranging from 0.0 to 1.37 m/s. In the Platte River, Snook (2001) found pallid sturgeon using bottom velocities ranging from -0.17 to 0.97 m/s. These velocities are commonly found throughout the species' current range.

Pallid sturgeon collected from the Missouri River above Garrison Reservoir in North Dakota during spring and fall seasons of 1988 to 1991 were found in deep pools at the downstream end of chutes and sandbars, and in the slower currents of near-shore areas. These areas may have been providing good habitat for energy conservation and feeding (USFWS 1993). Sheehan et al. (1998) indicated that there were no shifts in habitat selection and avoidance by middle Mississippi River pallid sturgeon under three different velocity regimes (low, medium and high discharge ranges of 0 - 165,000, 165,001 - 270,000 and >270,000 cfs). Data collected by Constant et al. (1997) support observations that shovelnose sturgeon tolerate lower current velocities than pallid sturgeon (Carlson et al. 1985, Ruelle and Keenlyne 1994, Bramblett 1996).

*Turbidity* - Pallid sturgeon historically occupied highly turbid river systems. Turbidity levels where pallid sturgeon have been found in South Dakota range from 31.3 Nephelometric turbidity units (NTU) to 137.6 NTU (Erickson 1992). Bramblett (1996) found the mean Secchi disc transparency was 7.8 inches at 115 pallid sturgeon locations in the upper Missouri and Yellowstone rivers. Pallid sturgeon avoid areas without turbidity and current (Bailey and Cross 1954, Erickson 1992) which may help explain why pallid sturgeon are no longer found in the upper Mississippi River slackwater pools and the Missouri River reservoirs, and why they have not expanded into other rivers in the Mississippi drainage even though access is available (Duffy et al. 1996).

*Water Depth* - The range of water depths where pallid sturgeon were frequently found in Lake Sharpe, in South Dakota, is 2 to 6 meters (Erickson 1992). Erickson surmised that bottom current velocity was more important than water depth because the preferred water depth was more widespread in the lower reaches of the reservoir, but unused by pallid sturgeon presumably because the current velocity was very low or zero. In Montana, pallid sturgeon were captured from depths that ranged from 1.2 to 3.7 meters in the summer, but they were captured in deeper waters during winter (Clancey 1990). Other pallid sturgeon collected in the upper Missouri, Yellowstone and Platte rivers were captured in depths ranging from 1 to 7.6 meters (Watson and Stewart 1991, USFWS 1993). Bramblett (1996) found pallid sturgeon in depths ranging from 0.6 to 14.5 meters. Snook (2001) found pallid sturgeon to use depths from 0.15 to 1.89 meters. These findings contrast with those of Constant et al. (1997) who found pallid sturgeon at mean depths of 15.2 meters in the lower Mississippi and Atchafalaya rivers and observed pallid sturgeon at depths of 7 and 21 meters with greater frequency than such areas were available. They also found almost no pallid sturgeon in areas less than 7 meters in depth.

*Substrate* - Pallid sturgeon are most frequently caught over a sand bottom, which is the predominant substrate within the species' range on the Missouri and Mississippi rivers and spend considerable time associated with sand substrates. Constant et al. (1997) noted that preference for sand substrates in low slope areas suggests that pallid sturgeon use such areas as current refugia (e.g., utilize sand-wave troughs created as bed-material moves along the river bottom). The pallid sturgeon collected on the Yellowstone River in July 1991 was over a bottom of mainly gravel and rock, which is the predominant substrate at that capture site (Watson and Stewart 1991). Pallid sturgeon not engaged in spawning behavior select for sandy substrates, particularly sand dunes, and avoid substrates of gravel and cobble (Snook 2001, Bramblett 1996). Pallid sturgeon have adhesive eggs, and spawning is thought to occur over hard substrates of gravel or cobble with moderate flow (R. Sheehan, SIUC, pers. comm. 2001).

*Temperature* - Pallid sturgeon inhabit areas where the water temperature ranges from 0° C to 33°C, which is the range of water temperature on the Missouri and Mississippi rivers. Sheehan et al. (1998) noted that sturgeon habitat use in the middle Mississippi River did not change with changes in temperature regimes, and stated that temperature would not seem to have an affect on either habitat use or habitat selection by middle Mississippi River pallid sturgeon. However, current research indicates that pallid sturgeon spawning is strongly influenced by water temperature. Temperature influences pallid sturgeon behavior and habitat use. Swimming ability decreased and mortality increased for some river species below 4° C (Sheehan et al. 1998). At temperatures below 4° C, pallid sturgeon were found in association with current-disrupting habitat features such as downstream island tips, areas below wingdams, main channel, and the main channel border (Hurley 1996). When temperatures rose above 4° C, pallid sturgeon were restricted to the main channel border and main channel. As temperatures rose to between 10° C and 20° C, pallid sturgeon were increasingly relocated below wingdams (Hurley 1996).

Movements:

Movements of fifteen radio-tagged pallid sturgeons were monitored in the Missouri River below the Yellowstone River confluence during the period 1992-1994. All fifteen pallid sturgeon moved into the Yellowstone River during April, May, or June of each year. At these times, median discharge in the Yellowstone River tripled, and was significantly higher than in the upper Missouri River. Yellowstone River turbidity values were also more than 20 times greater than those in the Missouri River during these times (Bramblett 1996).

The home range of the individual fish tracked in Hurley's study ranged from 0.97 kilometers to 97.04 kilometers, with a study mean of 34.12 kilometers. The home range of each sturgeon in Bramblett's (1996) study was from 7.7 to 205.3 miles (12.4 to 330.4 kilometers). Studies of diel movement patterns performed by Erickson (1992) in Lake Sharpe, SD, and Hurley (1996) in the middle Mississippi River produced dissimilar results. Across their range, pallid sturgeon appear to exhibit different diel movement patterns (Hurley 1996), but the cause(s) are not understood.

The USGS (DeLonay and Rabeni 1998) has developed and is implementing biotelemetry and habitat assessment methods to document movement and habitat use of large river fishes in the lower Missouri River. Hybrid pallid and shovelnose sturgeon have been tracked using surgically implanted ultrasonic transmitters. Preliminary findings indicate that pallid sturgeon move long distances in relatively short periods of time. Pallid sturgeon moved distances greater than 25 miles downstream and greater than 15 miles upstream per day, with maximum seasonal movements greater than 75 river miles. During all seasons, pallid sturgeon used locations of high current velocity (0.5 - 1.5 m/sec) at the channel margin, near sand islands and off the ends of wing deflectors, usually over a sand substrate. Depth at location ranged from less than 1 to 9 meters.

Food Habits:

Carlson et al. (1985) reported that both shovelnose sturgeon and pallid sturgeon have a high incidence of aquatic invertebrates in their diet, but the pallid sturgeon had a greater proportion of fish (mostly *cyprinids*) than did shovelnose. Other researchers also reported a higher incidence of fish in the diet of the pallid sturgeon than in the diet of shovelnose (Held 1969, USFWS 1993). Although pallid sturgeon are assumed to consume more fish than shovelnose sturgeon, most young and adult piscivorous Missouri River species eat large quantities of aquatic insect larvae (Modde and Schmulbach 1977). Given their adaptations for non-visual feeding, turbidity would appear to play an important role in feeding success. Modde and Schmulbach (1977) found that pallid sturgeon could be expected to forage efficiently for fish and benthic invertebrates in highly turbid areas.

A large pallid sturgeon adult and numerous shovelnose sturgeon were observed on video tape feeding in relatively clear water in the tailrace of Fort Peck Dam on the Missouri River in Montana. The large adult pallid sturgeon "stood on its fins" in a stationary position allowing food organisms to wash with the current beneath it (S. Krentz, USFWS, pers. comm. 1994). During April of 1999, adult pallid sturgeon were collected near the mouth of the Yellowstone River. Several adult pallid sturgeon were observed with larger (greater than 6 inches) food items distending the abdomen. Upon closer examination, one of the pallid sturgeon was observed with a 9-inch long Goldeye (Hiodon alosoides) protruding into the mouth cavity (S. Krentz, USFWS, pers. comm. 1999).

Disease Factors:

In January of 1999, a previously unknown iridovirus was detected in shovelnose sturgeon being held at Gavins Point NFH. Subsequently, the virus was detected in pallid sturgeon being held at Valley City NFH. The virus appears to affect primarily young of the year fish. Very limited mortality was observed, and available evidence indicates that surviving fish may recover completely. The origin of the virus in the hatchery system is as of yet unknown, but it likely occurs naturally in the Missouri River system (H. Bollig, USFWS, pers. comm. 2001).

In July of 2001, the Blind Pony State Fish Hatchery near Columbia, Missouri lost the entire year’s production of pallid sturgeon young to what is believed to be a herpes virus (S. Krentz, USFWS, pers. comm. 2002). No further information is available on the incident at this time.

## D3. Population Dynamics

Population Size:

Since 1988, pallid sturgeon researchers have collaborated on studies to gather information about the species numbers and distribution including estimates of fish numbers (Keenlyne 1995). Population size in the upper Missouri River basin above Gavins Point Dam is estimated to be between 325 and 550 adult fish, with an aging population and no indication of recruitment at that time (Duffy et al. 1996). Subsequently, Kapuscinski (2003) estimated the pallid sturgeon population in RPMA 2 (The Missouri River between Fort Peck Dam and the headwaters of Lake Sakakawea, and the lower Yellowstone River) at 151 adult fish, down from 255 adult fish in 1991.

Obtaining estimates of current abundance in the channelized Missouri River downstream from Sioux City, Iowa, to the mouth of the Missouri River and downstream to the mouth of the Mississippi River is complicated by the difficulties of sampling rapidly flowing river reaches. Abundance estimates for these parts of the range by Duffy et al. (1996) were not considered reliable due to the lack of mark/recapture data.

Glen Constant, at Louisiana State University, estimated the pallid sturgeon population in the Atchafalaya River to range from 2,750 to 4,100 fish (Duffy et al. 1996). This estimate is based on tag returns and telemetry studies. However, a high incidence of hybridization is occurring in the Atchafalaya River and Mississippi Rivers (Keenlyne et al. 1994), making estimation of the number of pure pallid sturgeon in these river systems difficult (Duffy et al. 1996).

Population Variability and Stability:

Occurrence of pallid sturgeon captures in fishery surveys of the upper Missouri River main stem reservoirs has sharply declined since the early 1950s. Range-wide, only three collections of young pallid sturgeon have been documented in recent years, in 1998, South of Cape Girardeau in the middle Mississippi River (Peterson and Herzog 1999), in 1998 and 1999, at Lisbon Chute in the lower Missouri River (J. Milligan, USFWS, pers. comm. 2001), and in 2002, in the upper Missouri River below Fort Peck Dam (Pat Braaten, USGS, pers. comm. 2003). This low rate of capture may be due to low reproductive success or inability of standard sampling gear to capture young pallid sturgeon.

For several reasons, the Platte River may provide reproductive habitat for pallid sturgeon. Timing of captures is concentrated within the period in which pallid sturgeon are believed to spawn, and these captures tend to occur during higher than average flow conditions within that period. Researchers captured a gravid female pallid sturgeon on May 3, 2001, at approximately Platte River mile 13 (E. Peters, University of Nebraska, pers. comm. 2001). *Scaphirhynchus* sturgeon larvae were collected in the Platte River in 1996, 1998 and 1999, but these individuals were too young to positively identify to species (Reade, 2000).

The lower Yellowstone River, in RPMA 2 is also believed to exhibit high potential reproductive habitat for the pallid sturgeon. However, linear regression of population declines indicate that the pallid sturgeon population in RPMA 2 will go extinct in 2018, but extirpation could occur sooner, as individuals reach an old-age threshold (Kapuscinski 2003). In addition, although larvae were collected in RPMA 2 in 2002, their post-hatch drift may carry them into the lentic waters of Lake Sakakewea, which does not provide the necessary habitat for rearing (S. Krentz, USFWS, pers. comm. 2003).

As shown by the one Cape Girardeau and several Lisbon Chute captures, limited recruitment may be occurring downstream of Gavins Point Dam. However, very few larval pallid sturgeon have been captured. The long life span of pallid sturgeon coupled with multiple reproductive periods has the potential to stabilize pallid sturgeon populations. However, the lack of recent documented reproduction coupled with the species apparent low reproductive rate cannot be offset by the long-lived nature of the pallid sturgeon. Sturgeon are K-strategists reproductively, and have a relatively low capacity for population increase (Boreman 1997, Helfman et al. 1997). Keenlyne (1989) concluded that, because of their low reproductive potential, meeting reproductive needs may be a delicate but crucial factor in the success of sturgeon species, including the pallid sturgeon.

In recent years, pallid sturgeon populations have been augmented by release of hatchery-reared fish. In 1994, the MDC released approximately 7,000 fingerlings in the Missouri and Mississippi Rivers and an additional 3,000 fingerlings were stocked in 1997 (Graham 1997, 1999). Since stocking in 1994, approximately 86 pallid sturgeon returns have been reported, mostly in the Mississippi River downstream of St. Louis (Graham 1999). Thirty-five, 12 to 14-inch long fish raised at Natchitoches National Fish Hatchery were stocked in the lower Mississippi River in 1998 (Kilpatrick 1999). Also in 1998, 745 hatchery-reared yearling pallid sturgeon were released at three sites in the Missouri River above Fort Peck Reservoir (Gardner 1999). In 2002, a total of 1,540 juvenile pallid sturgeon, and in 2003, a total of 5,230 yearling pallid sturgeon, respectively, were stocked at various locations in the Missouri River below Gavins Point Dam. Despite stocking efforts, pallid sturgeon remain rare throughout their range, and low tag return rates have made it difficult to assess the success of the stocking program.

## D4. Status and Distribution

The pallid sturgeon was federally listed as an endangered species on September 6, 1990 (USFWS 1990). The type specimens for identification were collected at or near Grafton, Illinois, on the lower Illinois and Mississippi Rivers (Forbes and Richardson 1905).

<u>Reasons for Listing:</u>

*<u>Habitat Loss</u>* - Destroyed and altered habitats are believed to be the primary cause of adverse effects to reproduction, growth, and survival of the pallid sturgeon, as well as other fish species native to the Missouri, Platte, and Mississippi rivers. Six mainstem dams on the Missouri River without fish passage facilities block pallid sturgeon migrations and have inundated spawning and nursery areas. The remaining mainstem riverine habitat between dams and downstream of the dams has been further altered by removal of snags, and hypolimnetic (i.e., year-round cold

water) releases. Recovery of the pallid sturgeon is unlikely to be successful without restoring the critical portions of morphology, hydrology, temperature regimes, and sediment/organic matter transport of the rivers that provide the life requisites for the species (USFWS 1993).

Discharge and sediment are the driving force and raw material, respectively, for habitat development in large floodplain rivers, such as the Missouri, Platte and Mississippi rivers. Elements of the natural hydrograph (e.g., dominant discharge) were essential for the dynamic transport of sediment and the rearrangement of these sediments into natural morphological channel features. High flows also introduced and transported organic material from the floodplain, and maintained turbidity. Invertebrate reproduction and behavioral migration of fish are closely tied to the natural hydrograph (Hesse and Mestl 1993b). Fisher (1999) found that changes to the natural hydrograph have disrupted the sustainable structure and function of most Missouri River habitats, adversely affecting floodplain connectivity and biotic communities.

Historically, erosion introduced organic matter and large woody debris from the floodplain, but also introduced sediment in the form of rock, gravel, sand, silt, and clay. Before the Missouri River was channelized and impounded it annually eroded 3.1 hectares/kilometer of its floodplain (U.S. Army Corps of Engineers 1981). River impoundments have eliminated 80 percent of this material (Slizeski et al. 1982) since the early 1950s. Fremling et al. (1989) reports that the sediment load of the middle Mississippi River has declined 66 percent from pre-1935 levels, mainly due to sediment entrapment in Missouri River impoundments. The lack of sediment upset the natural channel equilibrium and was replaced by a variety of nonequilibrium processes such as hydraulic sorting and bed paving. In the lower Missouri River basin, channel degradation has occurred below Gavins Point Dam, the lowest mainstem dam, downstream to near the mouth of the Platte River. Bed degradation coupled with disruption in the natural hydrograph has resulted in the loss of connection with shallow backwater areas of the floodplain. By the same processes operating in the Missouri River, sediment levels in substantially altered tributaries have similarly declined. Lyons and Randle (1988) found that sand loads in the Platte River at Overton, Nebraska declined to 30 percent of their historic levels in the years following upstream water resource development.

Decreases in turbidity levels in the Missouri River and its tributaries have increased vulnerability of native species adapted to turbid environments to predation. Decreased turbidity levels have affected food availability by changing species composition and may be making it more difficult for pallid sturgeon and other native species to capture prey in the less turbid environment (USFWS 1993). In fact, in the Missouri River, pelagic planktivores and sight-feeding carnivores have increased in abundance, whereas species specialized for life in the turbid, predevelopment river have decreased in abundance (Pflieger and Grace 1987). This decline in turbidity is taking place in Missouri River tributaries affected by water development as well. While the lower Platte River still receives sediment input from the Loup and Elkhorn rivers, contributions from the upper Platte River basin have declined substantially. Yu (1996) measured Platte River total suspended solids (tss) between April and October of 1992 and 1993 and found mean tss levels in the lower Platte River to be more than five times greater than in the central Platte River

Before impoundment in reservoirs, peak runoff in the Missouri River basin generally occurred in March and April, and again in May and June. Comparatively, today's seasonal hydrograph for the lower and middle reaches of the Missouri River is opposite the natural cycle, in that reduced flows occur from April to July and increased flows occur from July to April. In addition to shifts in the seasonal hydrograph, operation of the mainstem dams causes fluctuation between mainstem reservoirs as much as 6 feet. This fluctuation can disrupt the macroinvertebrate community and larval fish rearing in shallow areas by rapidly dewatering habitats (USFWS 1993).

Elements of the natural hydrograph (i.e., current velocity, fluctuations, and timing) are essential for many life requirements of native large-river fish like the pallid sturgeon and paddlefish. Spring and early summer high flows have been shown to stimulate spawning activities of shovelnose sturgeon. Hesse and Mestl (1993b) showed significant negative relationships between indices of river discharges due to flood control actions in the spring and year class development for a number of native fish in the Missouri River. Although the sample size of pallid sturgeon was too small to model, there was a clear relationship between poor year class development and the present artificial hydrograph in most native species studied.

As discussed earlier, spring and early summer high flows have been shown to stimulate spawning activities in shovelnose sturgeon. High flows during the spring are particularly important for pallid sturgeon. Since 1979, 19 of the 23 captures of pallid sturgeon in the Platte River or Missouri rivers near the Platte River confluence occurred during April, May, and June; the remaining occurrences were in July and September of 1999. Twenty of the 23 occurrences correspond with years when flows in the lower Platte River were above normal for the recent period (Louisville gauge, 1970 to 2001).

While the lower Platte River still provides some of the least impacted (in a relative framework), and therefore highest potential remaining spawning habitat in the pallid sturgeon's range, it is the only area in the species range that is directly impacted by hydropower peaking operation on a regular basis. Hydropower peaking operation is the operation of hydropower generating facilities to concentrate power generation into certain timeframes, which in turn results in rapid, large magnitude, sub-daily flow fluctuation in the reach below the generating facility. Median 24-hour changes in flow at Louisville range from 650 to 3,000 cfs per day, or 16 to 46 percent of the median monthly flow rate (USFWS 2002b).

Lake sturgeon (*Acipenser fulvescens*) in the Sturgeon River were significantly better able to utilize available spawning habitat under run-of-the-river conditions than under hydropower peaking operation (Auer 1996). Adverse effects of hydropower peaking operation on reproduction other fish species have been documented through disruption of stable patterns of water temperature, water level, and velocity, thereby disrupting spawning cues and exposing females to physiological stresses, both factors lending to spawning failure (DiStefano et al. 1997). Hydropower peaking operation has been found to adversely effect survival of larval riverine fishes through impairment of nearshore fish habitat and downstream larval displacement due to fluctuating flows, as well as through disruption of larval orientation capability (Scheidegger and Bain 1995). Hydropower peaking operations in the Colorado River were found to increase the rate of bar erosion (Stevens et al. 1995). Sandbar habitats are second only to cattail marsh habitats for utilization as nursery grounds for immature fishes of many species (Schmulbach 1974). Beyond impacts to reproductive success of stream fish, a wide range of adverse impacts to the aquatic community as a whole have been documented in streams and rivers impacted by hydropower peaking operations (Gersich and Brusven 1981, Gore et al. 1989, Blinn et al. 1995, Scheidegger and Bain 1995, Gislason et al. 1996, Cereghino and Lavandier 1998, Zhang et al. 1998). In the Platte River as well, the cumulative adverse effects to the fisheries and aquatic community as a whole from hydropower peaking operations may affect the pallid sturgeon's foodbase. In addition, increased erosion of sandbars may have a direct adverse impact to sandbar complex habitats used by pallid sturgeon.

Both the lower Missouri River from Sioux City, Iowa to its mouth, and the middle Mississippi River from the mouth of the Missouri River to the mouth of the Ohio River have been extensively altered by channel modification. Once a diverse assemblage of braided channels, sandbars, and backwaters, the river is now confined within a narrow channel of rather uniform width and swift current. Morris et al. (1968) found that channelization of the Missouri River reduced the surface area by approximately 67 percent. Funk and Robinson (1974) calculated that the length of the Missouri River between Rulo, Nebraska, and its mouth (~500 river miles) had been reduced by 8 percent and the water surface area had been reduced by 50 percent following channelization. Channel modifications and levee construction on the lower Mississippi River from the Ohio River confluence to near the Gulf of Mexico have also eliminated major natural floodways and reduced the floodplain by 90 percent (Fremling et al. 1989). Levee construction also isolated many floodplain lakes and raised river banks. As a result of levee construction, 15 meander loops were severed between 1933 and 1942 (Fremling et al. 1989).

Several studies from the Missouri River and other midwestern rivers have shown the value of shallow water habitat to all life stages of fishes native to large rivers and other river organisms. In general, the literature reports depths of 0 to 7 feet and velocities less than 2.5 feet-per-second (fps) over sandbars as being preferred main channel and main channel border habitat of big river species such as sauger (*Stizostedion canadense*), channel catfish (*Ictaluras punctatus*), shovelnose sturgeon (*Scaphirhynchus platorynchus*), and blue sucker (*Cycleptus elongatus*), during all or some of their life history (Nelson 1984). Similar depths and velocities are used by pallid sturgeon. These habitats are especially important in the late summer and fall to larval, young-of-the-year, and juvenile life stages of many species. Shallow water habitats with the above characteristics have been largely eliminated from the channelized Missouri River by constriction of the channel and imposition of artificially high flows during the normal late summer/fall low flow period. At sites measured in Missouri, the former high bank to high bank width has been reduced by 72-78 percent.

However, despite efforts to constrict and control the Missouri and Mississippi rivers with reservoirs, stabilized banks, jetties, dikes, levees, and revetments, the flowing reaches of the Missouri River and the Mississippi River from the Missouri River confluence to the Gulf of Mexico still provide remnant habitat believed important for pallid sturgeon. Some of the larger, more concentrated areas of these types occur in the lower portions of major tributaries, including the Platte River in Nebraska. These include divided channels, sandbars, islands, oxbows, and tributary mouths.

*Commercial Harvest* - Sturgeon species, in general, are highly vulnerable to impacts from fishing mortality due to unusual combinations of morphology, habits and life history characteristics (Boreman 1997). Historically, pallid, shovelnose, and lake sturgeon (*Acipenser fulvescens*) were commercially harvested on the Missouri and Mississippi rivers (Helms 1974). The larger lake and pallid sturgeon were sought for their eggs which were sold as caviar. Commercial harvest has declined substantially since record keeping began in the late 1800s. Most commercial catch records for pallid sturgeon did not differentiate between species. Combined harvests as high as 430,889 pounds were recorded in the Mississippi River in the early 1890s, but declined to less than 20,062 pounds by 1950 (USFWS 1993). The lower harvest reflected a decline in shovelnose sturgeon abundance since the early 1900s (Pflieger 1997). Five of the 13 states where pallid sturgeon occur currently allow commercial fishing for shovelnose sturgeon. Difficulty in distinguishing between the two species by commercial fisherman is considered a major threat to the pallid sturgeon. With the recent restrictions placed on the Caspian Sea sturgeon caviar industry in Russia, which could increase the demand for sturgeon caviar from North America, all sturgeon and paddlefish species worldwide were covered under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), effective April 1, 1998.

*Pollution/Contaminants* - Pollution is a likely threat to the pallid sturgeon over much of its range. Various fish-harvest and consumption advisories exist or have existed as a result of manmade pollution from the mouth of the Big Sioux River to the mouth of the Platte River, and from near Kansas City, Missouri, to the mouth of the Mississippi River.

Polychlorinated biphenyls (PCBs), cadmium, mercury, and selenium have been detected at elevated concentrations in tissue of three pallid sturgeon collected from the Missouri River in North Dakota and Nebraska. Detectable concentrations of chlordane, DDT (including its metabolites), and dieldrin were also found. The prolonged egg maturation cycle of the pallid sturgeon, combined with an inclination for certain contaminants to be concentrated in eggs, could make contaminants a likely agent adversely affecting development of eggs and embryos, or survival of fry, thereby reducing reproductive success (Ruelle and Keenlyne 1993).

The exposure and effects of environmental contaminants to pallid sturgeon in the lower Platte River was evaluated by using shovelnose sturgeon as a surrogate species (Schwarz et al., 2006). Gross observations and condition indices seem to indicate that shovelnose sturgeon from the lower Platte River are healthy; however, histological examination of the gonads and reproductive biomarkers revealed potential reproductive impairment as indicated by ovicular atresia, abnormal estrogen to testosterone ratios, and high concentrations of vitellogenin in males. Contaminants detected in shovelnose sturgeon at concentrations of concern included PCBs, selenium, and atrazine. The report concluded that these contaminants may be adversely affecting sturgeon reproduction in the lower Platte River and that pallid sturgeon may be especially at risk to these contaminants because they have a more piscivourus diet, greater maximum life-span, and a longer reproductive cycle than shovelnose sturgeon.

Further investigations are needed to identify sources of contaminants in the Missouri and Mississippi rivers and to assess the role of contaminants in the decline of pallid sturgeon populations.

*Hybridization* - Carlson et al. (1985) first identified that hybridization had occurred between pallid sturgeon and shovelnose sturgeon in the Missouri and middle Mississippi rivers. Suspected hybrids also have been reported in commercial catches from the lower Missouri River (USFWS 1993). As referenced in USFWS (1993), Bailey and Cross (1954) did not report hybrids, which may indicate hybridization is a recent phenomenon resulting from environmental changes caused by man-induced reductions in habitat diversity and measurable changes in environmental variables such as turbidity, flow regimes, and substrate type (Carlson et al. 1985). Campton et al. (2000) collected data that support the hypothesis that pallid and shovelnose sturgeon are reproductively isolated in less-altered habitats, such as the upper Missouri River.

Field surveys of Scaphirhynchus stocks suggest a relatively high incidence of hybridization between shovelnose sturgeon and pallid sturgeon in the middle Mississippi River (Sheehan et al. 1997a, 1997b, 1998). Sheehan et al. (1997b) and Carlson and Pflieger (1981) noted a 3:2 ratio of hybrid sturgeon to pallid sturgeon. If this is representative of the sturgeon population in the middle Mississippi River, hybridization may pose a significant threat to pallid sturgeon as the species continues to introgress with shovelnose sturgeon (Sheehan et al. 1997b).

Hybridization is thought to be related to environmental degradation, because loss of habitat diversity inhibits reproductive isolating mechanisms among fishes, most of which have specific spawning requirements. Also, the loss of total available spawning habitat forces sharing of suitable habitat areas by similar species, resulting in increased hybridization. The two major tributaries of the lower Missouri River in which shovelnose sturgeon have been reported, the Kansas and Platte rivers, have been extensively altered by water development. Thus, the probability of hybridization may increase (USFWS 1993).

Rangewide Trend:

Due to the extreme rarity of pallid sturgeon and the large size of its range, capture information is extremely limited at this time. As a result, rangewide trends have been difficult to identify and monitor. The pallid sturgeon is a long-lived species, but as a consequence of the relative lack of known recruitment, natural mortality would cause a decline in numbers over time. The magnitude of this effect cannot be calculated at this time, and the success of hatchery programs may compensate to an unknown degree.

New Threats:

The previously undescribed iridovirus encountered at hatcheries could present a threat that was not considered when the pallid sturgeon was listed. However, due to the limited mortality observed, the apparent ability of the fish to recover, and the possibility that this virus is naturally occurring throughout the pallid sturgeon’s range, no determination of the severity of the threat can be made.

The spread of the zebra mussel (*Dreissena polymorpha*) has the potential to eventually encroach on substantial parts of the pallid sturgeon range. Zebra mussel establishment has been linked to increased water clarity, a condition that is already believed to impact the pallid sturgeon throughout much of its range. Due to the inability to forecast the rate of spread of zebra mussel infestation, and the actual effects in the possibility of its establishment, it is not possible to determine the severity of the threat posed to the pallid sturgeon at this time.

## *E. Bald Eagle Biological Status*

### E1. Species Description

The bald eagle is a large, long-lived bird of prey, and the only species of sea eagle native to North America. The adults have dark brown bodies with white heads and tails. The young are all brown, and can be distinguished from young golden eagles (*Aquila chrysaetos*) by their bare lower legs (golden eagles have feathered legs all the way to their feet). They do not take on the coloring of the adults or reach sexual maturity until age four (USFWS 1983b). The birds nesting in the northern part of the species range are larger and heavier than birds of the south, with the largest birds nesting in Alaska and Canada and the smallest birds nesting in Arizona or Florida (USFWS 1983b). The female eagle usually weighs 10 to 14 pounds in the northern sections of the continent and is larger than the male, which weighs 8 to 10 pounds. The bald eagle is known to winter in the contiguous 48 states (USFWS 1994h). With the exception of Rhode Island and Vermont, bald eagles are known to breed in 46 of the 48 lower states (Buhler 2000).

The bald eagle was first listed as endangered under the Endangered Species Protection Act of 1966 on March 11, 1967 (32 FR 4001). On February 14, 1978, the species was federally listed under ESA as endangered throughout the lower 48 states, except in Michigan, Minnesota, Wisconsin, and Oregon, where it was designated as threatened (43 FR 6233). On June 12, 1995, the Service published a final rule reclassifying the status of the bald eagle from federally endangered to threatened throughout the lower 48 states (60 FR 36000). Currently, the Service has published a proposed rule to remove the bald eagle in the lower 48 states from the Federal list of endangered and threatened wildlife. If delisting occurs, the bald eagle will continue to be protected under the Bald and Golden Eagle Protection Act of 1962, as amended; the Migratory Bird Treaty Act of 1918, and the Lacey Act of 1900. No critical habitat has been federally designated for the species.

### E2. Life History

Many eagles do not breed for the first time until they are four years of age or older (USFWS 1983b). Pairs of eagles usually raise one to two young per season, originating from one to three eggs. The entire breeding cycle, from initial breeding activity to fledging of the chicks, lasts about six months (USFWS 1983b).

Bald eagles usually nest within 0.5-mile of large bodies of water, but will occasionally nest in upland areas where there is good access to food (USFWS 1983b). Although there are reports of nests on the ground or on cliff faces, eagles typically build their nests in the tallest trees, with large diameters and broad canopies (USFWS 1983b). The nests consist of numerous sticks (USFWS 1983b) and typically are built in live coniferous or dead trees (USFS 1998). Disturbances in close proximity to active nests can cause adult eagles to discontinue nest building or to abandon eggs (USFWS 1983b, Buehler 2000).

Bald eagles winter throughout the nation but are most numerous in the West and Midwest (USFWS 1983b). Trees used for roosting at night have large diameters with dense canopy in areas protected from the wind. Roosts are often located adjacent to foraging areas, but have also been observed up to 17 miles away (USFS 1998). When human disturbance of a night roost occurs, eagles may abandon the location (USFWS 1983b, Buehler 2000).

The availability of prey is the most important characteristic of wintering sites used by bald eagles (USFS 1998). The majority of wintering eagles are found near open water where they feed on fish and waterfowl, usually taking those which are dead, crippled, or otherwise vulnerable (USFWS 1983b; Lingle and Krapu 1986; Stalmaster and Associates 1990). In addition, eagles are known to feed on carrion, small mammals, and gamebirds (Lish 1975, U.S. Bureau of Reclamation 1981, Lingle and Krapu 1986). Lingle and Krapu (1986) found eagles consumed at least 50 species of fish, birds, and mammals along the North Platte and Platte rivers during the winters of 1978-1979 and 1979-1980. Eagles are also known to forage in areas with the least human disturbance (USFWS 1978b and 1983b).

### E3. Population Dynamics

Although bald eagle population studies have shown that both reproduction and survival are important, changes in survival rates seem to have more effect on the population than similar changes in reproduction rates (USFWS1983b). Survival of immature eagles, particularly those in their first year of life, depends heavily on conditions they encounter during the winter. Immature bald eagles suffer significant mortality, and many birds do not reach two years of age (USFWS 1983b). During the winter, adult eagles become physiologically prepared for the next breeding season. Therefore, maintaining and/or improving winter conditions is crucial to eagle recovery (USFWS 1978b and 1983b).

In the Service’s Northern States Recovery Plan for the bald eagle, the population goal for the Northern States recovery region is 1,200 occupied breeding areas in at least 16 of the states by the year 2000 (USFWS 1993b). Colorado and Nebraska should have 10 occupied breeding sites in each state. The population goal also requires occupied breeding site to fledge at least one young to contribute to the recovery unit or state totals.

In the Service’s Pacific States Recovery Plan for the bald eagle, the population goal is 800 occupied breeding areas in at least 16 of the states in that region (USFWS 1993b). The average success rate per occupied site must be 65 percent or more over a five-year period. Additionally, the number of wintering birds in the Pacific states must remain stable or increase each year to reach recovery goals for the region.

## E4. Status and Distribution

Historically, reduced reproduction caused by environmental contaminants affected bald eagle populations. The first population declines were a consequence of pesticide residue from contaminated prey, when ingested contaminants accumulated in the tissue of adults and limited the production of offspring. By the late 1960s, the pesticide Dichloro-diphenyl-trichloroethane (DDT) and its metabolites had caused widespread reproductive failures and resulted in drastic decreases in eagle numbers continent-wide (Sprunt et al. 1973, Wiemeyer et al. 1972). Other contaminants such as polychlorinated biphenyls (PCBs) and heavy metals such as mercury and lead may still contribute to increased eagle mortality in some areas.

Secondary poisoning in eagles from eating lead-poisoned prey, particularly ducks and geese, was a concern in the early 1980s by Pattee and Hennes (1983). They reported that of 650 dead eagles, 7.2 percent probably died from lead poisoning. Their field evaluations in Missouri and Minnesota found 9-11 percent of digested eagle pellets contained lead shot. However, only a small amount of lead shot (0.3 percent in cast pellets) was detected in eagles wintering in Nebraska from 1978 through 1980 (Lingle and Krapu 1988).

Declines in nesting and/or wintering populations have also been attributed to habitat loss and environmental contamination; and individual mortality from electrocution, shooting, poisoning, and trapping (USFWS 1983b). Modification of wintering habitats can severely limit the maintenance and/or growth of bald eagle populations. Loss of eagle habitat due to land development and increasing human populations is a serious problem in some areas (USFWS 1983b). Increased human activity and various kinds of land development can adversely affect the suitability of breeding and wintering habitats (Lish 1975, Grubb and King 1991). Although actions or developments that detrimentally affect separate areas may not appear to be jeopardizing the species, the cumulative effect of many seemingly unimportant actions could be deleterious to eagles (USFWS 1983b).

The population of bald eagles declined to its lowest level in 1963, when only 487 nesting pairs of eagles were estimated for the lower 48 states. In 1998, reductions in threats to the species as a result of recovery efforts by the Service in partnership with other federal agencies, tribes, state and local governments, conservation organizations, universities, corporations, and private landowners, this number has risen to nearly 6,000 nesting pairs in the lower 48 states (USFWS unpublished data).

## *F. Western Prairie Fringed Orchid Biological Status*

Photo credit: Melvin Nenneman/USFWS

### F1. Species Description

The western prairie fringed orchid, *Platanthera praeclara*, (orchid) was listed as a threatened species on September 28, 1989 (57 FR 39863). Critical habitat has not been federally designated for this species. Numerous populations of the western prairie fringed were known to occur along the Platte River. Historic populations from the late 1800s and early 1900s were observed in Cass, Dodge, and Kearney Counties. Recent sightings, from the late 1990s to present, include a population located in a Platte River wet meadow on Mormon Island Crane Meadows in Hall County.

Extant populations of the orchid are known to occur in six states: Iowa, Kansas, Minnesota, Missouri, Nebraska, and North Dakota (USFWS 1996b). Since 1996, there has been a significant population reductions throughout its extant ranges (USFWS Unpublished Data).

### F2. Life History

Although limited information exists, much of the orchid's life history is not known. The orchid is a smooth, erect, 2- to 4-foot tall perennial species of terrestrial and palustrine communities in the North American tallgrass prairie biome. The two to five elongated leaves are hairless and thickish. The open, spikelike inflorescence bears up to two dozen showy, 1-inch wide, white flowers (USFWS 1996b).

The seed stage is an important life stage for the orchid because approximately 99 percent of the reproduction occurs from seed (Armstrong et al. 1997). Production, dispersal, viability, and germination are necessary for species survival. Orchid fruit production is probably pollinator-limited as pollinators are restricted to the hawkmoth family (Sphingidae).

The white flowers lack nectar guides, bear long nectariferous spurs, and are fragrant at night, a suite of features typical of sphingophyllous (sphinx moth-pollinated) plants (Sheviak and Bowles 1986). Sheviak and Bowles (1986) suggest the column of *P. praeclara* is adapted to deposit pollinia on the compound eyes of appropriate pollinators. Recent research has identified eight confirmed pollinator species (Table V-G1).

Adult hawkmoths, may be generalists in their choice of flower visitation, but larval hawkmoths (caterpillars) are often very host specific. At present, pollinator densities are unknown and the ratio of local and in-migrant pollinators at any given site remains unexamined. It is also important to note the dependence of the orchid on hawkmoths is not reciprocal. Although the orchid depends on hawkmoths for pollination, adult hawkmoths can apparently feed from a number of non-orchid nectar sources, thus having the ability to sustain their populations before and after orchid anthesis, or during years of low orchid flowering (Cuthrell, personal communication).

**Table V-F1. Confirmed pollen vectors for *Platanthera praeclara*. All are sphinx moths (Lepidoptera: Sphingidae).**

| Species | Source(s) |
|---|---|
| *Sphinx drupiferarum** | Cuthrell 1994; Westwood and Borkowsky 2004 |
| *Sphinx eremitus* | Harris et al. 2004 |
| *Eumorpha achemon** | Cuthrell 1994; Johnson 2005 |
| *Hyles euphorbiae* | C. Jordan, North Dakota State University, pers. comm. 2003 |
| *H. gallii* | Westwood and Borkowsky 2004 |
| *H. lineate** | G. Fauske, North Dakota State University, pers. comm. 2005 |
| *Paratraea plebeja** | David Ashley, Missouri Western State College, pers. comm. 2004[14] |

* Species records in Nebraska counties that contain the central Platte River (Ferguson et al.1999).

The protocorm/seedling stage is an important stage in the life cycle of the orchid that serves as a link between seedling and vegetative/flowering stages (Armstrong et al. 1997). The ability to observe this below–ground stage makes identification of best management recommendations difficult. Seedling establishment may be linked to edaphic factors controlling soil mycorrhizae, the availability of suitable microhabitats, and competition.

The vegetative stage consists of the majority of above ground population (70-90 percent of total) (Armstrong et al. 1997). Two months of vegetative growth may pass before an inflorescence will fully develop on a flowering plant. Studies suggest it is also common for the orchid to remain vegetative throughout the entire growing season (Sieg and King 1995).

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[14] Dr. Ashley has *P. plebeja* specimen collected from an orchid that “had pollinia on its head” and says that he is “fairly certain” of his identification of the specimen.

The flowering stage is the most visible stage in the plant's life cycle (Armstrong et al. 1997). Plants bloom from mid-June in the south to late July in the north. Sieg and Wolken (1999) found that flowering orchids were more likely to survive flooding than vegetative stems due to the greater height and hollow seed stalks of the flowering orchids. Individual flowering plants that survived flooding were taller and had a greater proportion of their total height above water.

In the dormancy stage, root systems of all Platanthera species are fusiform tubers that regenerate during the growing season by forming a new tuber and a perennating bud (Armstrong et al. 1997). The major mode of perpetuation of established populations occurs when the perennating bud gives rise to vegetative shoots the following season. Vegetative shoots develop from a perennating bud and emerge from the soil in the late spring after a period of soil warming, generally from early May in the south to late May in the north.

Each life stage of the orchid has demonstrated distinct associations with mycorrhizal fungi species (Sharma et al. 2003a, Sharma et al. 2003b). Several authors have theorized the importance of mycorrhizae to orchid ecology, but limited knowledge on mycorrhizae/orchid interactions currently limits the recommendation of any management actions (Sharma 2002, Bowles 1983, Bowles and Duxbury 1986).

### F3. Population Dynamics

Reproductive success, survivorship, and mortality may be limited at several stages in the life cycle of the orchid (Bowles and Duxbury 1986, USFWS 1996b). Identification of limiting factors to population growth is difficult as a result of the limited information on life stage development. Although a small number of orchids on the Sheyenne National Grassland in North Dakota appeared aboveground every year for eight years, a predictable pattern in life states was not apparent. Sieg and King (1995) noted flowering plants can flower the following year, can reappear as vegetative plants, or be absent. Although the orchid is reportedly long-lived (Sheviak and Bowles 1986), more recent published and unpublished data from demographic studies from various parts of the range suggest longevity varies geographically depending on soil moisture and other factors (Sieg and Bjugstad 1994, Pleasants 1995, Sieg and King 1995).

Additionally, recent studies have indicated that seed production, dispersal, viability, and germination are necessary for species survival. Approximately 99 percent of orchid reproduction occurs from seed (Armstrong et al. 1997). On the Sheyenne National Grassland, published demographic data indicate the orchid could have a half life as short as one to three years (Sieg and King 1995). Most plants observed over a seven-year period that included both droughty conditions and flooding in this study area were present aboveground less than three years, and once absent, plants rarely reappeared (Sieg and King 1995).

### F4. Status and Distribution

Published accounts and herbarium records suggest the orchid was widespread and perhaps locally common prior to European settlement (Bowles and Duxbury 1986). Historical (observed only prior to 1981 and/or confirmed destroyed), extant (observed after 1980), and unverified reports exist for approximately 424 sites in 109 counties in eight States and one Canadian Province (USFWS 1996b). Historical observations or collections (last observed prior to 1980 and/or confirmed destroyed) are known from 87 counties in 8 states.

The final listing (USFWS 1989) states that the orchid is known to occur in Iowa, Kansas, Minnesota, Missouri, North Dakota, Nebraska, Oklahoma, and Canada (Manitoba.). Extant populations of the western prairie fringed orchid are known to occur at 304 sites in 48 counties in six States - Iowa (seventeen counties), Kansas (four counties), Minnesota (seven counties), Missouri (three counties), Nebraska (fifteen counties), North Dakota (two counties) - and in the Canadian Province of Manitoba (USFWS 1996b). Figure V-G1 shows orchid distribution as well as recovery units associated with the orchid's recovery plan.

The orchid has declined significantly throughout its historical range, largely because of habitat loss and degradation (Freeman and Brooks 1989). Habitat dewatering and conversion to cropland are primary factors adversely affecting the western prairie fringed orchid throughout its range (USFWS 1996b). Conversion, fragmentation, and dewatering of low grassland and wet meadow habitats may adversely affect the orchid by: a) eliminating habitat; b) reducing its potential range and distribution; c) preventing or retarding expansion, colonization, or recolonization; and d) decreasing the resilience of isolated populations to environmental stochasticity.

Hydrologic alterations that draw down the water table near the root zone are associated with decreased flowering and increased plant mortality (Sieg and King 1995, Currier 1996b). Stream channelization and draining of seasonally wet prairies in eastern Nebraska (Rus et al. 2003) probably adversely impacted the species by altering the hydrologic regime (Wilson and Bray 1991). It is also likely that unregulated groundwater pumping in Nebraska has also exacerbated reduction in groundwater elevations and dewatering of effluent streams (NDNR 2006).

Other agricultural practices, such as overgrazing, intensive haying/mowing, and herbicide use, may have impacted the species (USFWS 1996b). Annual mowing of prairies for hay is a common practice in Kansas, Nebraska, and South Dakota. This practice, which typically occurs prior to the maturation of the western prairie fringed orchid's fruits, may have contributed to the decline of the species. Habitat management, such as mowing, grazing, or burning, could have a positive or negative effect on recruitment and survivorship depending on its frequency, intensity, and timing (Bowles 1983, Bowles and Duxbury 1986).

The absence of habitat management (i.e., haying, grazing, mowing) is detrimental to orchid populations that have co-evolved with the disturbance-based grassland systems (USFWS 1996b). The best management practices for the orchid are those likely to maintain the quality and diversity of the grassland and prairie habitats. Such land management practices will also reduce the presence of invasive cool season grasses such as leafy spurge (*Euphorbia esula*), musk thistle (*Carduus nutans*), and reed canarygrass (*Phalaris arundinacea*), that can invade orchid habitats.

As a result of existing threats to the orchid, the historical and extant ranges show that the species apparently has been lost from South Dakota and Oklahoma, with significant population reductions in Iowa, southeastern Kansas, Missouri, eastern Minnesota, and eastern Nebraska –

the species has evidently been extirpated from 61 of the 109 counties that it originally inhabited and its distribution has been drastically reduced in most of the counties that it still inhabits (USFWS Unpublished Data).

Figure 2. Present and historical distribution of *Plantanthera praeclara*. Data from state Natural Heritage Program databases. Ecoregions follow Bailey 1994.

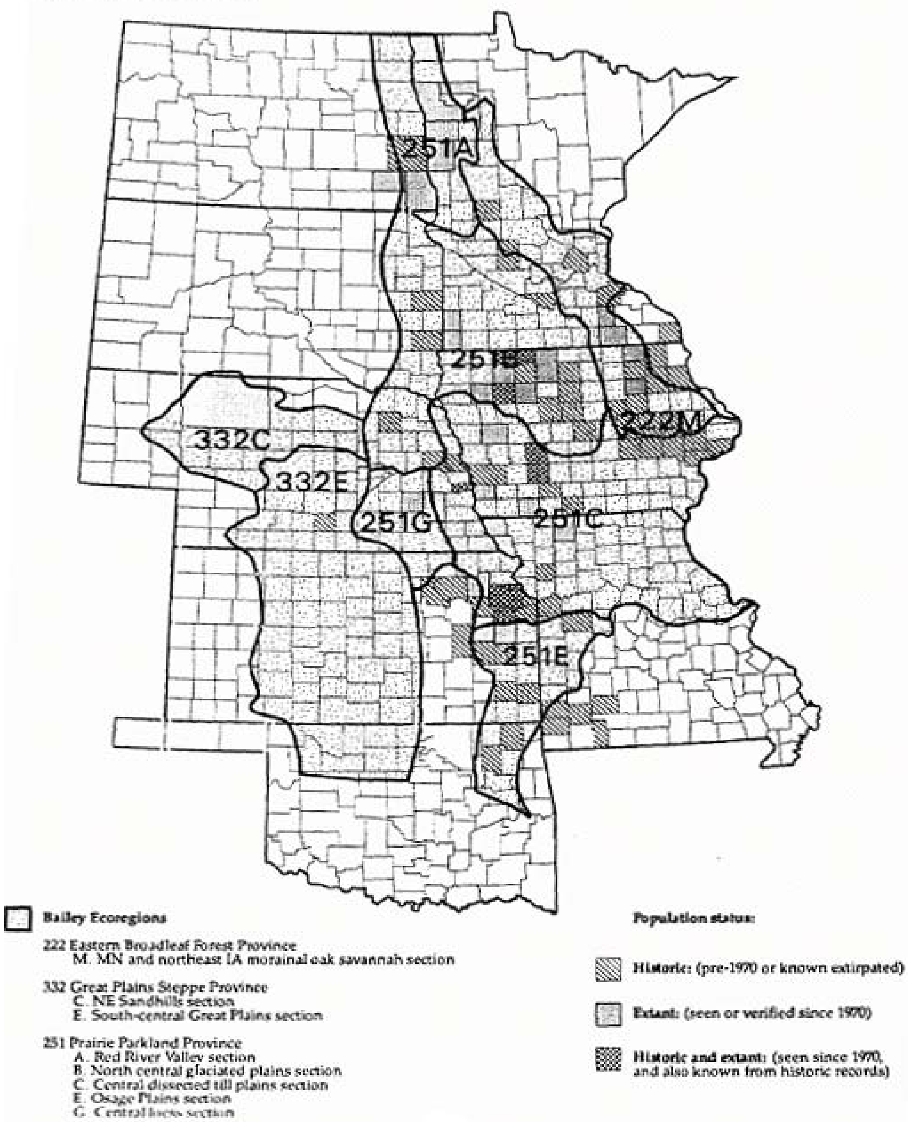



**Figure V-F1. Recovery units of the western prairie fringed orchid. Recovery units that contain the Platte River include the south central Great Plains ecoregion (332E), the central loess ecoregion (251G), north central glaciated plains ecoregion (251B), and the central dissected till plains ecoregion (251C)(USFWS 1996).**

Additional threats identified in the in the final listing or the recovery plan include: a) small, isolated populations with low seed set; b) the collection of plants from small populations; and c) potential threats posed by native and non-native herbivores, including mammals and insects (USFWS 1996b).

A new threat that may further hinder orchid recovery is the recent inter-seeding of non-native species into wet or “sub-irrigated” prairies. Exotic, cool-season grasses are invading and increasing in western prairie fringed orchid habitats in Nebraska. Gerry Steinauer (NGPC, Pers. Comm. 2005) indicated that this has been a long-term trend that is exacerbated by annual mid-summer haying. Although the threat was identified in the initial listing and recovery plan, new species are currently being used for forage production that pose a new threat for the orchid. In Nebraska, creeping foxtail (*Alopecurus arundinaceus* Poir, also called Garrison creeping foxtail), is now promoted to increase livestock forage (Volesky 2003). This may pose a previously unrecognized threat if it is introduced into sites inhabited by the orchid (G. Steinauer, Pers. Comm. 2005).

# VI. Environmental Baseline

This section contains an analysis of the effects of past and ongoing human and natural factors leading to the current status of the target species, their habitats (including federally designated critical habitat), and ecosystem in the action area. The environmental baseline used for these analyses is present condition, and past effects of existing water-related activities.

Using this environmental baseline as a benchmark for comparison, the magnitude of Program benefits to the target species habitats (or adverse impacts thereof) are evaluated within the context of changes to the ecosystem caused by the Program, the continued operation of Reclamation and Service water-related activities as they affect the central and lower reaches of the Platte River, and the interrelated water development activities in the basin. Therefore, the description of the environmental baseline used for analyses of impacts to the target species will include discussions of the factors causing the current deteriorated condition of the Platte River ecosystem, and effects analyses will include discussions of how the proposed Program addresses the causes of jeopardy to the target species and adverse modification of federally designated critical habitat(s) expressed in previous biological opinions.

## *A. Platte River System Environmental Baseline*

### A1. Importance of the Platte River Ecosystem

The central Platte River provides important habitat for fish and wildlife resources of national and international significance. The Platte River is best known for its value as migratory bird habitat in the Central Flyway of North America. Four of the eight federally listed species that regularly occur along the Platte River are migratory birds. This area contains federally designated critical habitat for the whooping crane, essential habitat for the least tern and piping plover, and wintering and nesting habitat for the bald eagle. The lower Platte River contains the least degraded habitat remaining for the pallid sturgeon in the central part of the species range. More information about the importance of the Platte River to the target species is found in the species specific portions of this section.

The central Platte River also provides important spring staging habitat for the majority of the mid-continent sandhill crane (*Grus canadensis*) population. Each spring, about 80 percent of all sandhill cranes (more than 90 percent of the migratory mid-continent population) stop for several weeks to stage in the Platte and North Platte River valleys of Nebraska en route to breeding grounds in Canada, Alaska, and northern Siberia. This concentration of cranes is unparalleled elsewhere in the world. Sandhill cranes, like whooping cranes, roost at night in the shallow water of the Platte River and feed in nearby agricultural fields and wet meadows. Increased efficiency in corn harvest, and use of the Platte River valley by waterfowl in recent decades are reducing the amount of food resources available to the cranes, which generally arrive in the area later than the waterfowl (Krapu and Brandt 2006, Krapu et al, 2004).

Large numbers of waterfowl, estimated in 2002 to number 10 to 14 million, also pass through and stop over in Nebraska (principally in the Rainwater Basin areas, adjacent to the Platte River valley) in preparation for the breeding season. Of these, an estimated one to three million waterfowl use the Platte River (Vrtiska, pers. comm.). These estimates do not include an estimated one million waterfowl which use the Platte River valley upstream of Lexington. The Platte River valley is an important early spring staging area for the mid-continent populations of mallards (*Anas platyrhynchos*), northern pintails (*Anas acuta*), white-fronted geese (*Anser albifrons*), Canada geese (*Branta canadensis*), and lesser snow geese (*Chen caerulescens*) and serves as a major conditioning site for spring staging waterfowl. Additionally, some of these waterfowl (e.g., mallards and Canada geese) also winter along the entire length of the Platte River, and Canada geese now breed in the same area (Vrtiska, pers. comm.).

The Platte River also provides a variety of habitat types for a diverse fish community including the endangered pallid sturgeon. Among numerous other fish species that occur in the Platte River are the western silvery minnow (*Hybognathus argyritus*), plains minnow (*Hybognathus placitus*), flathead chub (*Platygobio gracilius*), and speckled chub (*Macrhybopsis aestivalis*) (Peters et al. 1989). All four of these central plains species are reported to be rapidly declining throughout their range (Cross and Moss 1987, Tabor 1993).

Within the action area, the bald eagle, least tern, and pallid sturgeon all depend on the fish community of the Platte River. Least terns nesting along the Platte River require small fish on the river as their primary source of food. Similarly, pallid sturgeon rely on small fish as forage, and bald eagles rely on larger individuals of several species of fish. In addition, numerous other non-listed piscivorous migratory bird and sport fish species rely on the Platte River fish as an important food source.

Specialized habitats such as backwaters, sloughs, side channels, and shoreline and deep water habitats along the edges of sandbars and river banks are examples of the diverse habitat types that occur along the Platte River. A diverse and abundant assemblage of fish species is needed to maintain the integrity of the central Platte River fish community, and the formation and maintenance of the diverse aquatic habitats necessary for the support of such an assemblage depend on a seasonal hydrographic distribution patterned after the natural hydrographic distribution, as previously recommended by the Service (Bowman and Carlson 1994). Diversity of habitats and food resources is essential to all species covered by this biological opinion.

The Platte River also provides year-round habitat for numerous species of plants, invertebrates, shellfish, amphibians, and reptiles. Although dwindling, the only known population of the threatened western prairie fringed orchid in the South-Central Great Plains Section of the Great Plains Steppe Province Ecoregion (USFWS 1996b) is located in a wet meadow adjacent to the Platte River (i.e., Mormon Island Crane Meadows near Grand Island, Nebraska). The wet meadows along the central Platte host more than 40 species of butterflies. In addition, recent investigations in wet meadows along the central Platte River revealed the presence of a new species of limnephilid caddisfly, (*Ironoquia plattensis*), in an intermittent slough in the wet meadows near Grand Island (Alexander and Whiles 2000, Whiles et al. 1999). This previously undescribed species is known only from a few intermittent sloughs in wet meadows on and near Mormon Island in the central Platte River (Whiles and Goldowitz 2001).

## A2. Platte River Ecosystem Functions

Conservation of the ecosystems upon which federally listed threatened or endangered species depend is a tenet of the ESA and supported inter-Departmental policy (e.g., Interagency Cooperative Policy for the Ecosystem Approach to the Endangered Species Act; 50 CFR 17, FR 59 (126):34274). The rehabilitation of ecosystem integrity through restoration of ecosystem processes and functions is particularly crucial when multiple listed species are present, as is the case along the Platte River. Finally, an independent study conducted by the National Research Council emphasized the importance of an ecosystem approach to restoration of the Platte River and the habitats it provides (NRC 2005).

Numerous authors have described the importance of maintaining the processes that control and define the integrity of riparian ecosystems (Instream Flow Council (IFC) 2002, Richter et al. 1996, 1997; Poff et al. 1997, Bayley 1991, Freeman 2002, Richter and Richter 2000, Sparks et al, 1998, Junk et al. 1989, Hill et al. 1991, Poff and Ward 1989, Resh et al. 1988, Hesse et al. 1989, Dahm et al. 1987, Naiman and Decamps 1997, Bain and Boltz 1989, Crance 1988, Stalnaker et al. 1989, NRC 2005). The primary process driving riparian ecosystems is a normative flow regime that periodically resets physical, chemical and biological functions essential to the ecosystem (i.e., a regime that encompasses predictable variability and extreme flows) (IFC 2002, NRC 2005). Seasonal high flows are critical components of river ecology (IFC 2002, NRC 2005). High flows provide, sort and transport sediments; move bed material; control submerged, emergent and streamside vegetation; influence structural stability of stream banks; and prevent vegetation encroachment into the active channel (IFC 2002, Murphy et al. 2004, NRC 2005). Significant reductions in seasonal high flows adversely affect channel morphology, reduce the diversity of native species present, sever connectivity of the channel to backwaters, sloughs and other portions of the floodplain, and decrease groundwater levels in areas adjacent to the river.

<u>Service Instream Flow Recommendation for Conservation and Recovery:</u>

In 1994, the USGS Mid-Continent Ecological Science Center and the Service convened workshops to identify flows needs for conservation and recovery of Platte River species and habitats. An interdisciplinary panel comprised of USGS and the Service authorities in instream flow policy, fluvial geomorphology, riparian ecology, and met with Platte River investigators to identify specific management of fish and wildlife resources, hydrology, and management applications. Researchers engaged in various disciplines of investigation presented information from their studies and recommendations. All investigators identified spring pulse flows as an important element affecting channel maintenance and other ecological processes of their investigations.

Workshop participants recommended a year-round flow regime that varies by season and hydrologic conditions (dry, normal, or wet, water supply) in the basin. The participants also identified spring pulse flows as the highest priorities for conservation and recovery. Tables VI-A1 and VI-A2 summarize these flows, below. (See also Bowman 1994, and Bowman and Carlson 1994, in Appendix D).

**Table VI-A1. Instream flow targets by seasonal priorities (ranking) for normal (average), wet, and dry years for the central Platte River, Nebraska. Normal (average) year flows will be equaled or exceeded three out of four years. Normal and wet year target flows will be met three out of four years, and in the driest 25 percent of the years, the dry year targets will be met. (From Bowman, 1994)**

| Season | Normal year Ranking & Flow (cfs) | Wet year Ranking & Flow (cfs) | Dry year Ranking & Flow (cfs) |
|---|---|---|---|
| May and June* | * | #1 * | * |
| Feb. and March* | * | #2 * | * |
| May 11-Sept. 15 | #1 @ 1,200 | #3 @ 1,200 | #1 @ 800 |
| March 23-May 10 | #2 @ 2,400 | #4 @ 2,400 | #2 @ 1,700[1] |
| Feb. 1-March 22 | #3 @ 1,800 | #5 @ 1,800 | #3 @ 1,200[2] |
| Sept. 16-30 | #4 @ 1,000 | #6 @ 1,000 | #6(tie) @ 600 |
| Oct. 1-Nov. 15 | #5 @ 1,800 | #7 @ 2,400 | #6(tie) @ 1,300[3] |
| Nov. 16-Dec. 31 | #6 @ 1,000 | #8 @ 1,000 | #5 @ 600 |
| Jan. 1-31 | #7 @ 1,000 | #9 @ 1,000 | #4 @ 600 |

* These specific flow recommendations were not provided in this 1994 document. They were developed in a subsequent workshop as described in Bowman and Carlson, 1994 (Table XX.)

[1] Includes 650 cfs for fish community.

[2] Includes 650 cfs for fish community.

[3] Includes 600 cfs for fish community.

**Table VI-A2. Peak and annual pulse flow recommendations for the central Platte River Valley ecosystem during May and June.**

| Flow | Duration (Period) | (cfs) | (days) | Frequency (yrs) Exceedance (%) |
|---|---|---|---|---|
| **very wet** | May 1 - June 30* | > 16,000 | 5** | 1 in 5 (20%) |
| **wet** | May 1 - June 30* | > 12,000 | 5** | 1 in 2.5 (40%) |
| **normal** | May 20 - June 20 | > 3,000 | 7-30*** | 3 in 4 (75%) |
| **dry** | May 11 - June 30 | none**** | | all remaining (100%) |

* At least 50 percent of these peak flows should occur during May 20 to June 20, with May 1 to June 30 as the timeframe for broadest benefit for channel maintenance, and instream and wet meadow habitats. Occurrence between February 1 and June 30 would accomplish the necessary effects for channel maintenance. The 10-year running average for the mean annual peak flow targets should range from approximately 8,300 cfs to 10,800 cfs.

** The duration of these peak flows should emulate the historic, natural pattern: (a) ascended over approximately 10 days; (b) cresting for approximately 5 days; and (c) descending over approximately 12 days.

*** The target is for a 10-year running average for the 30-day exceedance flow (i.e., 10-year running average of the annual level exceeded for 30 consecutive days) of at least 3,400 cfs. A flow of 3,000 cfs should be exceeded for 7-30 days in at least 75 percent of years. Annual pulse flows should be followed by descending flows approximating a rate of 800 cfs/day.

**** No annual pulse flows during May and June in driest years; target flows identified in the March 1994 workshop (Bowman 1994), apply under dry year conditions.

More recently, the National Research Council (2005) reviewed the Platte River endangered species science at the Governance Committee's request and recommended that recovery efforts focus on a "normative" river regime. A normative regime is one that, taking present development into account, mimics as much as possible the natural relationships in the pre-development structure of the hydrograph (seasonal and interannual peaks, pulses, base flows, and timing). Normative habitat conditions are those established from what is possible in a natural-cultural context, as opposed to striving for pristine conditions. The Service's 1994 instream flow recommendations for spring pulse flows contain a series of rather detailed parameters, and include flow targets for both short-duration (several days) and long-duration (30-day duration) pulse flows. The pulse flow recommendations address the timing, magnitude, duration, and frequency of flows. Though the magnitudes of target pulse flows recommended by the Service are substantially lower than historic levels, the inter-annual magnitude, duration, and to a certain extent the timing of the Service's recommendations vary as would a natural flow regime.

## A3. Status of Platte River Ecosystem

Changes in the condition of the Platte River result primarily from the historic and continuing water resource development in the Platte River basin. The Program is anticipated to provide remedial measures which will, in an incremental fashion, begin to offset the adverse effects of water resource development on the Platte River ecosystem in general, and the habitats of the target species, specifically. Therefore, an understanding of the impact of historic and ongoing water development on the Platte River ecosystem and how those changes in river conditions affect habitat important to the target species is needed.

The status of the Platte River aquatic and terrestrial systems since the period of early settlement is presented and summarized by many sources. Among these are technical studies conducted by Williams (1978), USFWS (1981), USGS (1983), Currier et al. (1985), Lyons and Randle (1988), Sidle et al. (1989), Platte River Management Joint Study (1989 and 1990), Johnson (1994 and 1996), Currier (1995 and 1996a), Simons (2000), Murphy et al. (2004), NRC (2005), Holburn et al. (2006), and the FEIS). Some of these independent and inter-agency studies were initiated to identify instream flows and habitats necessary to maintain desired levels of fish and wildlife habitat conservation and recovery.

In the Platte River ecosystem, the riverine processes most responsible for the form and function of the ecosystem include those related to flow, sediment and topography. The complex interaction of these parameters control channel characteristics (i.e., channel geometry, water width, water depth, and channel vegetation) which collectively determine the health of the riparian ecosystem and the condition of habitats relied on by the target species. The following section examines changes in Platte River conditions associated with historic and ongoing water resource development in the basin, including disruption of the ecosystem processes which most affect the habitats of the target species and other species dependent on the Platte River.

Water Development:

The Hydrology Workgroup of the Platte River Management Joint Study (1989), Simons and Associates (2000), Randle and Samad (2003), Murphy et al. (2004), NRC (2005), and the Platte River FEIS have described the history of water resource development in the Platte River basin. These reports describe the reduction of peak and annual flows due to storage and diversion of flows, changes in sediment transport, and the historical changes in the morphological character of the river (plan form) that correspond with the changes in flow and sediment transport processes.

The Platte River basin is one of the most highly developed river basins in the United States in terms of the amount of water stored and diverted compared to the total annual flow (Platte River FEIS). Total storage in the basin currently equals about 7.5 million acre-feet (MAF), which is about 13 times the average annual flow of the Platte River at Brady, Nebraska, and about 6 times the average annual flow in the central Platte River at Grand Island, Nebraska (USFWS 1997). The net consumptive use (i.e., the consumptive use minus trans-basin imports) approximates 2.4 MAF annually.

The Platte River in Nebraska before the 1880s was a broad and braided river subject to high spring floods, great loads of sediment, and occasional summer droughts. These conditions caused continuous movement of the braided river channels and sandbars, resulting in a very broad, shallow, sandy, and generally unvegetated river channel (Murphy et al. 2004, Platte River FEIS 2006). Between 1900 and 1940, several large dams and reservoirs were built to store the high springtime runoff and increase the available water supply for irrigation, power production, and municipal use (Figure VI-A1). Changes in channel morphology resulting from water resource development on the river and the concurrent loss of habitats for the target species are discussed below.

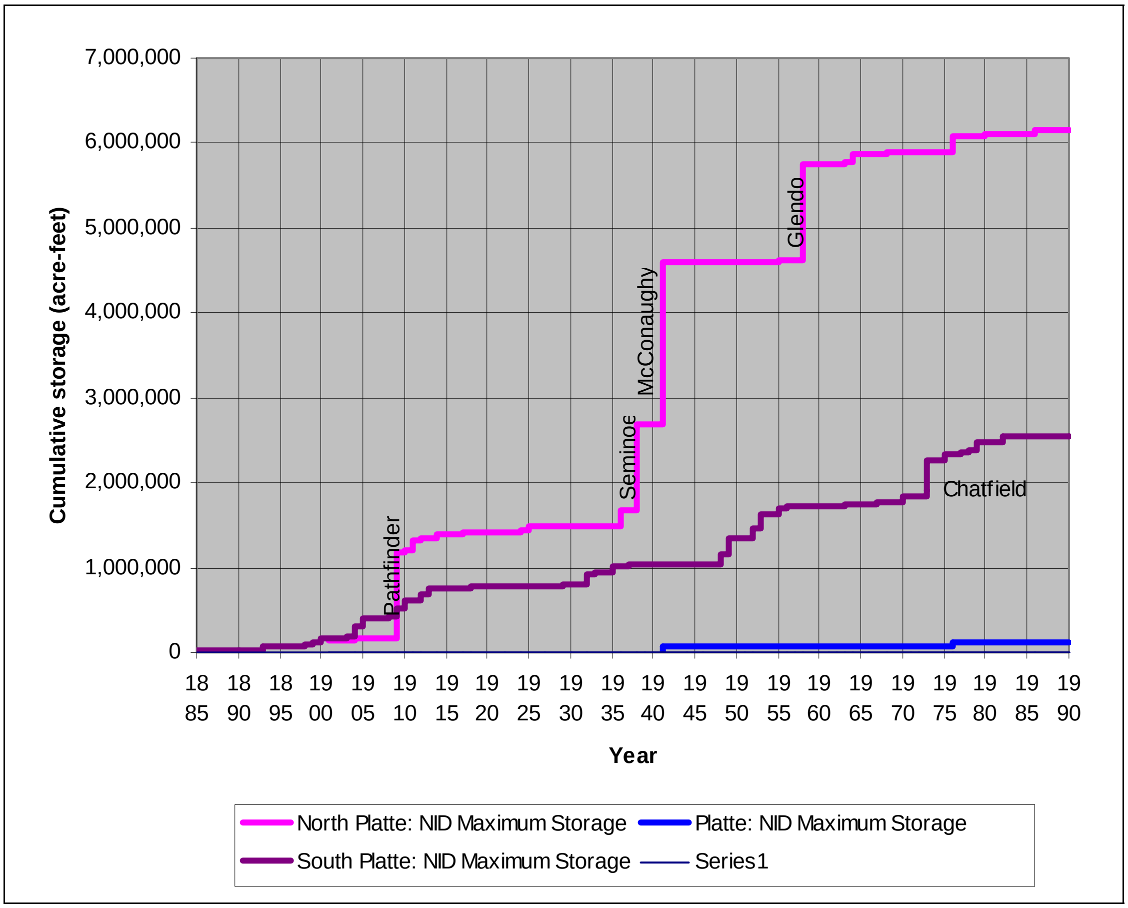



**Figure VI-A1. Timing and capacity of large reservoirs in the Platte River basin (Platte River FEIS 2006).**

<u>Flows:</u>

As presented in the FEIS (2006), the bankfull discharge and the mean annual flow in a river strongly influence the width of the river channel (Leopold 1994). Prior to the construction of the first large storage reservoir, the mean annual flow of the Platte River near Overton, Nebraska, was 2.65 MAF during the period between 1895 and 1909, and 84 percent of this flow came from the North Platte River. During the period 1910 to 1935, the mean annual flow decreased to 2.29

MAF per year. With additional reservoir construction and drought, the mean annual flow decreased to 0.83 MAF per year during the period 1936 to 1969. During the period 1970 to 1998, the mean annual flow of the Platte River near Overton, Nebraska, increased to 1.4 MAF per year, but the proportion of this flow supplied by the North Platte River had decreased to 58 percent (Randle and Samad, 2003). Upstream of Overton, the mean flows are currently about one-fourth of the mean flows at the beginning of the twentieth century (FEIS 2006). Changes in flows over time at various gages are presented in Table VI-A3.

**Table VI-A3. Mean Platte River Flows.**

| | | Mean River Flows (cfs) | | | Percent Change in Mean Flow Relative to the 1910 to 1935 Period | | |
|---|---|---|---|---|---|---|---|
| Gauging Station | 1895 to 1909 | 1910 to 1935 | 1936 to 1969 | 1970 to 1999 | 1895 to 1909 | 1936 to 1969 | 1970 to 1999 |
| North Platte River Basin | | | | | | | |
| North Platte River Near Northgate, Colorado | NA* | 502 | 383 | 432 | NA | -24 percent | -14 percent |
| North Platte River at Saratoga, Wyoming | 1,670** | 1,310 | 1,000 | NA | 27 percent | -24 percent | NA |
| North Platte River at North Platte, Nebraska | 3,190 | 2,750 | 646 | 862 | 16 percent | -77 percent | -69 percent |
| South Platte River Basin | | | | | | | |
| Clear Creek, Colorado | 242 | 231 | 223 | 242 | 5 percent | -4 percent | 5 percent |
| Middle Boulder Creek, Colorado | 61 | 58 | 56 | 59 | 5 percent | -2 percent | 2 percent |
| St. Vrain River at Lyons, Colorado | 153 | 131 | 118 | 126 | 17 percent | -10 percent | -3 percent |
| South Platte River at North Platte, Nebraska | 582 | 492 | 322 | 619 | 18 percent | -35 percent | 26 percent |
| Platte River Stations | | | | | | | |
| Platte River at North Platte, Nebraska | 3,780 | 3,240 | 968 | 1,480 | 17 percent | -70 percent | -54 percent |
| Platte River Near Cozad, Nebraska | 3,550 | 3,040 | 461 | 981 | 17 percent | -85 percent | -68 percent |
| Platte River Near Overton, Nebraska | 3,660 | 3,160 | 1,140 | 2,100 | 16 percent | -64 percent | -34 percent |
| Platte River Near Grand Island, Nebraska | 3,580 | 2,950 | 1,080 | 2,110 | 21 percent | -63 percent | -28 percent |

Source: Randle and Samad (2003).

Note: Shaded rows denote stream gauges that are located upstream of reservoirs and major irrigation.

*NA equals not available.

**Minimum values based on incomplete daily records for this period. Actual values would be somewhat higher if the complete records were available.

At Grand Island, the average annual flow volume has been reduced by approximately 50 percent from pre-development levels to 1.4 MAF (FEIS 2006). Water resource development has altered not only the volume of annual discharge reaching the central Platte River but also the magnitude, duration, frequency and timing of peak flows, and minimum flows during the summer.

Peak Flows - - Seasonally high flows and river stage are essential to maintain physical and biological processes on the Platte River, including: a) hydrological support for subirrigation of low-lying wet meadow and surface flows for wetland functions (Hurr 1983, Wesche et al. 1994, Sanders 2001, Henszey et al. 2004); b) sediment supply and transport (Lyons and Randle 1988, Murphy et al. 2004, Randle and Samad 2003); c) controlling encroachment of woody vegetation on the channel and channel maintenance (Currier 1996a, Johnson 1994); and d) various aspects of aquatic ecology in adjoining wet meadows and wetlands (Goldowitz and Whiles 1999, Whiles and Goldowitz 2005). Depletion of pulse flows causes the long-term, and continued, deterioration of the habitats relied upon by the least tern, piping plover, whooping crane, pallid sturgeon, and the western prairie fringed orchid (NRC 2005, FEIS 2006).

Because the headwaters of the Platte River are in the Rocky Mountains, the natural hydrograph had two annual high flow periods: one in February and March in response to snow melt on the Plains, and the second in May or June caused by snow melt in the mountains. Within each period, the magnitude, duration and timing of pulses varied by year. During the period 1902-1909, the average annual Platte River peak flow (i.e., the average of the annual maximum of mean daily flows) at North Platte was 20,500 cfs and the mean annual flow rate was 2,900 cfs (Stroup et al. 2001). Similarly, annual peak flows of the Platte River near Grand Island, Nebraska, exceeded 17,000 cfs in two out of three years during the period between 1895 and 1909 (Platte River FEIS 2006).

Water resource development projects in the Platte River basin captured the high spring flows and flattened the natural hydrograph (Figures VI-A2 and VI-A3). Peak flows began dropping in 1909 following completion of the Pathfinder Dam on the North Platte River in Wyoming. After 1940 and the completion of several large reservoirs, peak flows at North Platte, Nebraska seldom exceeded 5,000 cfs (Figure VI-A2).

Figure VI-A3 illustrates some of these changes in the hydrograph at Duncan, Nebraska, (downstream of Grand Island). Duncan gauging records are among the earliest available for central Platte River flows and provide some indication of the timing and magnitude of changes. The most prominent aspect of the flow regime change is a profound reduction in the spring pulses which predominated in May and June. Data suggest that substantial flow changes have also occurred in March.

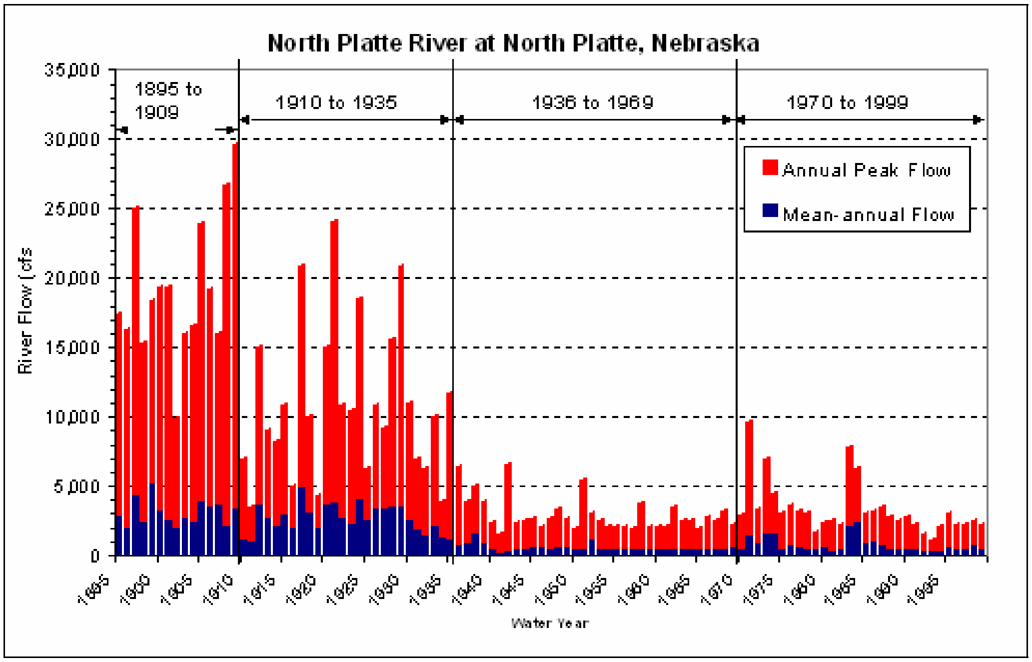



**Figure VI-A2. Annual flow volume and annual peak flow for the North Platte River at the town of North Platte, Nebraska. (Randle and Samad, 2003).**

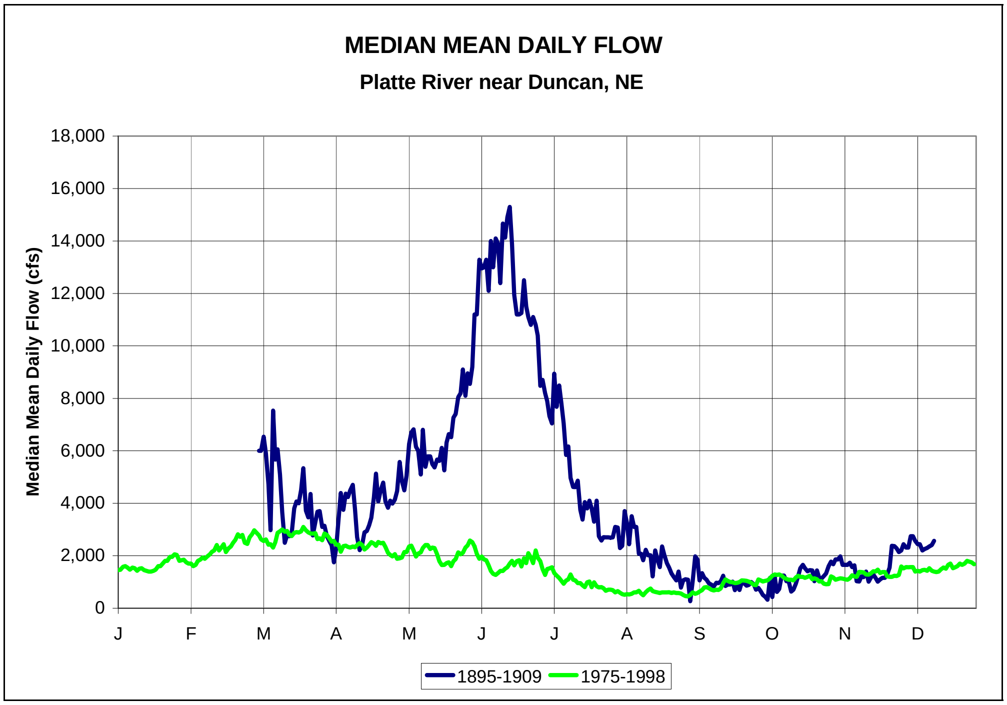



**Figure VI-A3. Median mean daily flow in the Platte River at Duncan, Nebraska, in 1895-1909 vs. 1975-98. (Source: USGS gage data, as presented in Platte River FEIS (2006)).**

Peak flow events have a restraining effect on the colonization of the stream channel by vegetation. The evaluation of Platte River channel-forming processes by Randle and Samad (2003) includes the effects of 1.5-year peak flows, effective discharge, and the mean discharge. They found that all of these indicators of discharge, which affect channel form, have declined over the twentieth century. Changes in the 1.5-year peak flows for four different time periods from 1895 to 1999 at various locations in the basin are presented in Table VI-A4. The effective discharge and the mean discharge values generally follow the same trend as the 1.5-year peak flows.

**Table VI-A4. Platte River 1.5-year peak flows**

| | | 1.5-Year Peak Flows (cfs) | | | Percent Change in 1.5-Year Peak Flows Relative to the 1910 to 1935 Period | | |
|---|---|---|---|---|---|---|---|
| Gauging Station | 1895 to 1909 | 1910 to 1935 | 1936 to 1969 | 1970 to 1999 | 1895 to 1909 | 1936 to 1969 | 1970 to 1999 |
| North Platte River Basin | | | | | | | |
| North Platte River Near Northgate, Colorado | NA* | 2,600 | 2,220 | 2,430 | NA | -15 percent | -7 percent |
| North Platte River at Saratoga, Wyoming | 9,200 | 7,720 | 5,710 | NA | 19 percent | -26 percent | NA |
| North Platte River at North Platte, Nebraska | 16,300 | 8,150 | 2,160 | 2,380 | 100 percent | -73 percent | -71 percent |
| South Platte River Basin | | | | | | | |
| Cache La Poudre River at Canyon Mouth, Colorado | 3,103 | 2,700 | 2,492 | 2,737 | 15 percent | -8 percent | 1 percent |
| St. Vrain River at Lyons, Colorado | 898 | 744 | 962 | 904 | 21 percent | 29 percent | 21 percent |
| South Platte River at North Platte, Nebraska | 2,330 | 1,430 | 712 | 1,420 | 63 percent | -50 percent | -1 percent |
| Platte River Stations | | | | | | | |
| Platte River Near Cozad, Nebraska | 17,600 | 9,140 | 1,980 | 2,590 | 93 percent | -78 percent | -72 percent |
| Platte River Near Overton, Nebraska | 19,400 | 9,000 | 3,490 | 4,750 | 116 percent | -61 percent | -47 percent |
| Platte River Near Grand Island, Nebraska | 17,300 | 10,100 | 4,500 | 6,010 | 71 percent | -55 percent | -40 percent |

Source: Randle and Samad (2003).

Note: Shaded rows denote stream gauges that are located upstream of reservoirs and major irrigation.

*NA equals not available.

*Timing and Relative Magnitude of Flows* - As noted above, the natural annual pattern of flows in the central Platte River was driven primarily by the spring snowmelt. From 1895 to 1909 the annual peak flows at Overton, Nebraska occurred only in May and June and, due to a high sediment load (see below), formed sandbars that protruded above the water surface through much of the year (Murphy et al. 2004). Extensive areas of bare sand in the channel were reported in written narratives from the 1800s (Mattes 1969), and recorded in USGS topographic maps from 1896 to 1902 (FEIS 2006). Summer flows generally were much smaller than the late spring flows and left dry sand bars surrounded by water (which constitutes good nesting habitat for the least tern and piping plover). Because summer thunderstorm flows were small in comparison to the high spring flows, the sandbars were not easily inundated by these events (Murphy et al. 2004). Any least tern or piping plover nests or chicks on the sandbars were relatively secure from inundation.

The height of sandbars depends on the highest stage of flows. Therefore, when high spring flows are reduced, sandbars are lower and more susceptible to inundation by subsequent flows. As the construction of reservoirs in the basin increasingly captured more of the high spring flows, the magnitude of the high spring flows (and potential height of sandbars) was reduced relative to the summer thunderstorm event flows, increasing the incidence of sand bar inundation (Murphy et al. 2004). During the period from 1975 to 1998, annual peak flows occurred in every month of the year except October, November, and January. The reduction in sandbar height due to smaller peak flows has been aggravated by the lack of incoming sediment load in the river and subsequent channel incision.

*Climate and river flows* - Climate is generally defined as the prevailing long-term weather conditions, including long-term averages in rainfall, runoff, and temperature over many decades or centuries. Long-term trends in climate can affect the amount, location, and timing of precipitation and riverflows and, hence, other habitat characteristics (FEIS 2006).

Some have suggested that a drier climate, rather than upstream water use, diversion, and storage, may be the primary reason much of the Central Platte River flows have been reduced so much from presettlement conditions. The available climate record does not support this interpretation (FEIS 2006). Both reconstructed streamflow records and Palmer Drought Severity Indices (PDSI) suggest that the climate history of the Platte River basin is characterized by short periods of wet and dry, with durations of three to ten years, fluctuating around a central average. Climate reconstructions based on tree-ring data for the Great Plains region indicate that while there were significant multi-year droughts in the 20th century these dry periods were exceeded several times previously in the 18th and 19th centuries (Cleaveland and Duvick, 1992; Woodhouse and Overpeck, 1998; and Woodhouse, 2001, as cited in FEIS 2006).

The above information indicates that the conditions of the Platte River, as photographed and described in the mid- to late 1800s, represent a river that had recently been through droughts more severe than those seen in the 20th century. Climate and streamflow records also indicate that the pronounced reduction in flows in the central Platte River during the first part of the 20th century occurred while precipitation was above average, again illustrating how construction of large storage and diversion projects can overwhelm the decadal variation in annual precipitation (FEIS 2006).

The NRC committee concluded that climatic changes create a changing backdrop for the more important human-induced changes in the hydrology of the basin. The committee "is firmly convinced that upstream storage, diversion, and distribution of the river's flow are the most important drivers of change that adversely affect species habitat along the Platte River" (NRC 2005, pg 243).

Sediment Transport:

The quantity and type of sediment carried by a river have a significant effect on the shape and character of the river corridor and, in turn, impact habitat parameters important to the target species (FEIS 2006). The volume of flow and the available supply of sediment determine the volume of sediment that can be transported. A reduction in flow or sediment supply resulting from storage reservoirs and water diversions produces a corresponding reduction in sediment transport capacity (FEIS 2006). Abrupt changes in river flow also impact sediment transport, creating areas of erosion or deposition. The Platte River flow is changed by water diversions and canal returns, causing sediment to be deposited on the channel bed (aggradation) in some reaches and eroded (degradation) from other reaches (FEIS 2006). Channel shape is secondarily influenced by sediment grain size, which has been altered in the Platte River by water resource development (DEIS 2003).

*Sediment Load* - Changes in the volume of sediment transported to and through the central reach of the Platte River are consistent (over time and distance) with changes in flow (Stroup et al. 2001). Table VI-A5 illustrates the average annual sediment load at various locations near and downstream of the confluence of the North Platte and South Platte rivers in Nebraska (FEIS 2006 and Randle and Samad 2003). The highest flow and sediment loads in these areas occur during the first period, from 1895 to 1909. The lowest flow and sediment transported occurred between 1936 and 1969, a period encompassing the severe droughts of the 1930s and 1950s and the construction of Kingsley Dam. Flows and sediment loads increased somewhat between 1970 and 1999, but did not approach those of the earliest two time periods.

**Table VI-A5. Platte River average annual sediment loads.**

| Platte River Stream Gauge Location | Average Annual Sediment Load for Each Time Period (Tons Per Year) | | | |
|---|---|---|---|---|
| | 1895 to 1909 | 1910 to 1935 | 1936 to 1969 | 1970 to 1999 |
| **From Randle and Samad (2003), based on sediment discharge equations by Simons and Associates (2000)** | | | | |
| Platte River at North Platte, Nebraska | 1,530,000 | 1,380,000 | 500,000 | 812,000 |
| Platte River Near Cozad, Nebraska | 1,730,000 | 1,300,000 | 132,000 | 396,000 |
| Platte River Near Overton, Nebraska | 1,810,000 | 1,380,000 | 347,000 | 817,000 |
| Platte River Near Grand Island, Nebraska | 1,670,000 | 1,270,005 | 381,000 | 845,000 |
| **From Randle and Samad (2003), based on sediment discharge equations by Kircher (1983)** | | | | |
| Platte River at North Platte, Nebraska | 2,130,000 | 1,670,000 | 365,000 | 680,000 |
| Platte River Near Cozad, Nebraska | 1,540,000 | 1,190,000 | 126,000 | 361,000 |
| Platte River Near Overton, Nebraska | 1,600,000 | 1,260,000 | 335,000 | 760,000 |
| Platte River Near Grand Island, Nebraska | 1,680,000 | 1,250,000 | 365,000 | 826,000 |

*Distribution of Sediment* - As noted above, abrupt changes in river flow also impact sediment transport, creating areas of erosion or deposition. Downstream of Lake McConaughy in Nebraska, the Sutherland Canal and the Tri-County Canal divert approximately 65 percent and 70 percent of river flows, respectively, for irrigation and hydropower production (Platte River FEIS, NRC 2005). Water from the Sutherland Canal is discharged to the South Platte River upstream of the City of North Platte. Water from the Tri-County Canal is discharged back to the river downstream from Cozad and a few miles upstream of the Overton gauging station (at the J-2 Return).

Where flows in the river are reduced by diversions, the reduced flows transport less sediment. Therefore, due to the Sutherland and Tri-County diversions much of the South Platte River's sediment load is deposited in the reach between the Korty Diversion Dam and Paxton, Nebraska, and much of the load carried by the main river at the City of North Platte is deposited in a reach downstream of the City of North Platte, Nebraska. Although sediment is dredged from both canals and redeposited below the points of diversion, the reduced flows downstream of the diversion points are insufficient to transport the sediment load (DEIS 2003). Consequently, these river reaches have aggraded. Dense vegetation that has invaded much of the original river channel may have exacerbated aggradation. Historically, high and uninterrupted flows carried sediment continuously through these reaches and maintained a broad, active and braided channel. Today, when high flows infrequently occur in narrow channels that are not braided, they spill to the adjacent riparian wooded areas where vegetation impedes the flow, promotes the deposition of sediment, and builds the height of the vegetated islands and banks in these areas (Johnson 1994, Murphy et al. 2004).

*Channel Incision* - For long reaches (tens of miles) of the North Platte and Platte rivers, one-half or more of mean annual flows can be diverted into canals that parallel the river. While reaches of the river downstream of diversion points have aggraded, reaches of the river downstream of points where diverted flows discharge back to the river (such as the J-2 Return) have degraded. The return of clear, sediment-hungry water from the J-2 Return has washed away finer sediments, leaving coarser sediments on the channel bed and incising the channels. Based on recent measurements the channel below the J-2 Return has incised 15 to 18 feet since the 1940s. Incision of the main channel promotes narrowing and a shift in plan form. Vegetation colonizes islands that are no longer part of the active channel.

Both field surveys and sediment modeling (i.e., SEDVEG) indicate that bed degradation downstream of the J-2 Return prevails under the present conditions. Repeated cross-section surveys of the channel have been made by two separate investigations. Cross section surveys of the river were conducted by Reclamation in 1989, and D, J and A Surveyors (Missoula, Montana) in 1998 and 2002. These survey show an incision process of thalweg erosion and channel narrowing extending downstream of the J-2 Return canal. Over the 13-year period between measurements, incision was approximately 6 feet immediately downstream from the Johnson-2 Return Canal, and 2.5 feet of incision 18 miles downstream (Murphy et al. 2004). A technical report by Holburn, et al. (2006) describes trends in aggradation and degradation in different reaches of the central Platte River.

The second investigation of channel changes is also based on repeated cross-section surveys of the channel from 1984-1986 and 1998-2000 (USBR 1987, 1998 and 2002). These consisted of 22 transects nested within three study sites, near Overton (RM 244), near Odessa (RM 228), and at the Audubon Sanctuary (RM 206). These three areas are located on the primary channel within a 40-mile span of the 54-mile-long reach of federally designated critical habitat for the whooping crane (i.e., Lexington to Denman, Nebraska). Like the results reported by Murphy et al. (2004), channel incision was found to be most severe below the J-2 Return and tapered off downstream. The change in the average bed elevation during the 16-year interval was -1.5 feet at the site near Overton, -0.6 feet at the site near Odessa, and -0.2 feet at Audubon's Rowe Sanctuary (Figure VI-A4) (USFWS, unpublished data). These computed changes are conservative when compared to thalweg changes described by Murphy et al. (2004) because the elevation of benches, or the parts of the former channel bed that became elevated relative to the active channel as the bed incised, were included in the computed average elevation.

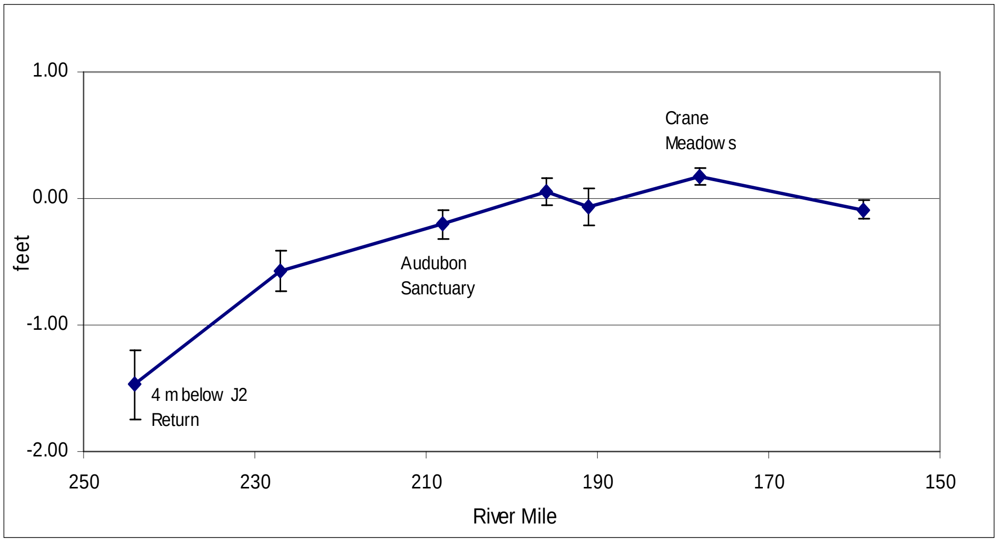



**Figure VI-A4. Change in average channel bed elevation from 1985 to 2000 at seven sites on the Platte River. Surveyed sites were located 4 miles below the J-2 Canal Return; 4 miles above Elm Creek bridge, at Audubon's Rowe Sanctuary near Gibbon, 1 mile above Shelton bridge, midway between the Shelton and Wood River bridges, at Mormon Island Crane Meadows near Grand Island, and 3 miles above the Chapman bridge. Error bars = s.e. of multiple transects**

Similar to the field survey-based empirical data, sediment modeling shows that that bed degradation extends downstream from the J-2 Return past Elm Creek under present conditions. Between Odessa (RM 224) and Wood River, model results are uncertain, showing areas of both aggradation and degradation. Over the long term (48 years), however, if present conditions continue, modeling indicates degradation could develop in currently stable reaches downstream of Wood River (river mile 189). Analyses indicate that under present conditions (and in an average flow year), there is a net erosion of 220,000 tons of sediment from the bed and banks of the river between the J-2 Return (RM 246.5) and near Chapman, Nebraska (RM 160.) Both the modeling and survey data indicate that the primary source of the added load is from the incising channel bed.

*Changes in Sediment Grain Size* - Coarsening of the channel bed material, independent of channel narrowing factors already discussed above, is a secondary factor leading to narrowing of the river channel. Sediment coarsening, (i.e., increase in sediment size) results primarily from erosion of fine bed material by clear-water discharged from diversion canals. As fine grains are removed the grain size increases in the eroding channel bed. In the central reach of the Platte River the median grain size in the riverbed has doubled since the pre-development period (Simons and Associates 2000; Murphy et al. 2004). Historically, median grain sizes at Kearney and Grand Island were similar, 0.35 mm and 0.40 mm, respectively (Murphy et al. 2004). Today, river sediment has coarsened significantly in the western upstream reach of the central Platte River, with median grain size at Overton increasing to 1.0 mm. This bed coarsening, like the channel incision, gradually shifts downstream over time (FEIS 2003). The effect has only partially reached Grand Island where the median grain size has increased to 0.65 mm. (DEIS 2003). The increase in grain size decreases the mobility of that river bed which, in turn, contributes to the evolution of a narrower and deeper channel shape and a shift in river plan form.

A less significant cause of sediment coarsening is the increase in the proportion of sediment reaching the Platte River from the South Platte River relative to the North Platte River. The sediment in the South Platte River is naturally coarser (median grain size 1.0 mm) than that of the North Platte River (median grain size 0.4 mm). During the period 1895 to 1909, more than three to four times as much sediment was supplied by the North Platte than the South Platte River, and bed material size in the central Platte River resembled that in the North Platte River. By the period 1936 to 1969, however, the North Platte contributed only about 1.8 times as much sediment as the South Platte River, resulting in a gradually coarsening bed (DEIS 2003).

## A4. Changes in the River Channel Morphology

The body of information on processes affecting channel morphology and fish and wildlife habitats in the central Platte River has gradually increased:

- Kircher (1983) and Lyons and Randle (1988) found coarsened sediment particle size below hydropower returns.

- O'Brien (1987) and Kinzel et al. (2000) reported coarsening of channel bed material in the Platte River system since the 1930s that extended from Gothenburg downstream to Columbus.

- General information on channel maintenance processes, available information, gaps in information, and potential methods to address technical information needs were identified by an interagency technical committee in 1989 (Platte River Management Joint Study 1989).

- Randle and Woodward (1991) investigated interrelationships among bed material particle size, flow levels, and channel widths. This report indicated that increased flows and coarsened bed material could result in channel narrowing.

- Simons and Associates (2000) modeled the relationships between flow and vegetation growth in the channel.

- Independently, the Service (DOI 1994) and USGS (1999) found long-term river channel bed degradation trends occurring at gauging stations. Because the gauges are at or near bridges the observations are not diagnostic, but are considered to be an indication of channel response to sediment shortage.

● Simons (2002) summarized changes in the hydrologic regime and sediment supply that have a bearing on geomorphic processes. Murphy et al. (2004) describe the processes and model the relationships.

● Randle and Samad (2003) summarize information on sediment transport in the river system.

● Murphy et al. (2004) discusses changes in channel morphology over time. Included are the effects of clear water discharged from the J-2 Return between 1985 and 2000. They found that channel bed degradation is ongoing in the targeted habitat recovery area (Murphy et al. 2004). Within the 15-year interval the bed degradation below the J-2 Return (near Overton, Nebraska) deepened the channel significantly and extended downstream. Degradation extended beyond Audubon's Rowe Sanctuary near Gibbon, Nebraska, a distance approximating 40 to 50 miles within the 54-mile length of river federally designated as whooping crane critical habitat. Channel bed degradation ranged from several feet near Overton to about 0.2-foot at the Audubon Sanctuary (Murphy et al 2004)

● National Research Council (2005) provides a comprehensive review and description of scientific information available regarding the causes of change in the Platte River ecosystem, and the effects of those changes on the target species habitats and the survival and recovery of the those species.

● Reclamation and Service (2006) describe, in the FEIS on the Federal action, changes in the plan form of the river since pre-development; the processes controlling those changes; the relevance of river flow, sediment and topography to those changes; and the effect of those changes on habitat of threatened and endangered species in the central and lower reaches of the Platte River.

● Holburn et al. (2006) discusses trends in channel aggradation and degradation between 1985 and 2005 in various reaches of the central Platte River, based on cross-sectional surveys of the river between North Platte, Nebraska (RM 310) and Chapman, Nebraska (RM 157).

Changes in Plan Form:

Plan form is the form or pattern of the river as seen from the air, as discussed in Schumm's river classification (see FEIS sidebar 2-1, "River Plan Form"). A wide, shallow river with a single channel and multiple mid-channel sandbars is typical of a braided plan form. A narrow, deep, winding river with alternating point bars when bedload is present, are characteristic of a meander plan form. Multiple meander channels in a river section, separated by vegetated islands are representative of an anastomosed channel. Neither a meandering nor anastomosed river plan form provides roosting or nesting habitat for the avian target species.

Desirable riverine habitat for whooping cranes, least terns, and piping plovers includes wide areas of open, shallow water with unobstructed view for roosting and security from predators; and mid-channel, bare sandbars for foraging and nesting. The occurrence of mid-channel sandbars that provide secure nesting habitat is greatly dependent on plan form; a braided plan form characteristically has many more. Based on 1900 USGS maps and 1938 aerial photographs, the plan form of the central Platte River remained predominantly braided, although the width of the river declined significantly through those years (FEIS 2006). In contrast, the current plan form of the central Platte River includes meandering and anastomosed reaches that have small width to depth ratios and do not provide the necessary habitat of wide, shallow water and protruding sandbars (FEIS 2006).

To depict changes in the river over time, the FEIS presents a comparison of plan form, based on USGS topography maps from the period 1896 to 1902, black and white aerial photographs from 1938, and color infra-red aerial photographs from 1998 (Table VI-A6). The FEIS uses several series of photographs to aptly illustrate the changes in plan form over time in various reaches of the central Platte River. An example showing changes in the plan form of the river at RM 218 is presented in Figure VI-A5.

**Table VI-A6. Plan form classification of the central Platte River in 1896 to 1902, 1938, and 1998.**

| River Mile | Location | USGS Topographic Maps, 1896-1902 | Black and White Aerial Photographs, 1938 | Infrared Aerial Photographs, 1998-2001 |
|---|---|---|---|---|
| 277 | Gothenburg, Nebraska | Braided | Braided | Meandering |
| 239 | Overton, Nebraska | Braided | Braided and anastomosed | Anastomosed with some braided |
| 210 | Downstream of Kearney, Nebraska, begin island reach. | Braided | Braided | Braided and anastomosed in main channels |
| 168-159 | Grand Island to Chapman, Nebraska | Braided | Braided | Alternating braided and anastomosed |

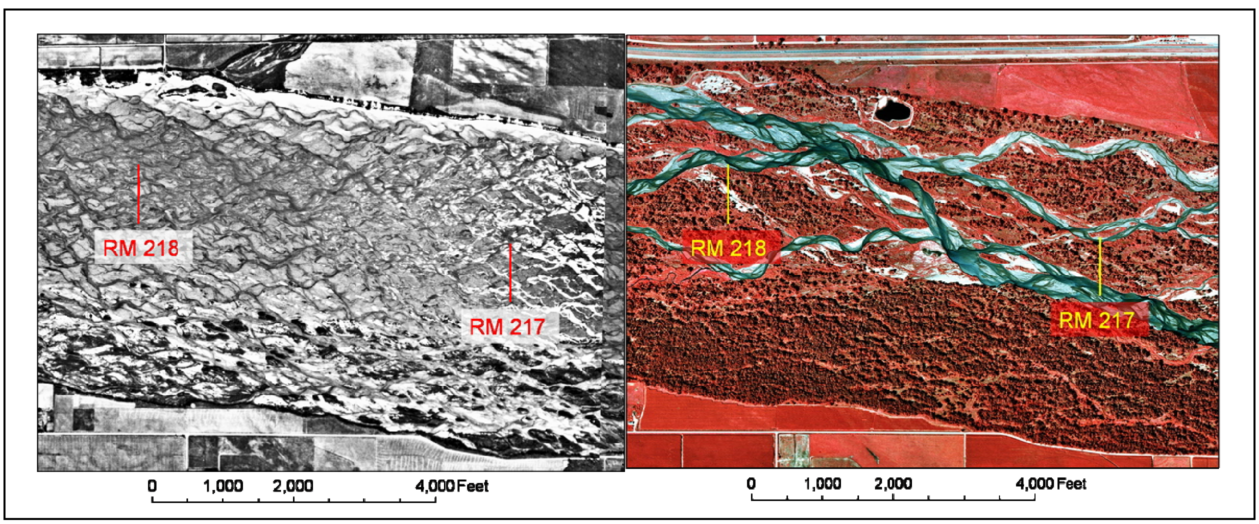



**Figure VI-A5. A single braided channel under 1938 conditions (on left) and anastomosed under the present condition with multiple channels separated by vegetated islands.** [15]

[15] Red or yellow lines depict river mile marker.

In 1900 and 1938, the river was predominantly braided between Gothenburg and Chapman, Nebraska. However, by 1998 the upstream reach meandered; the reach from Overton, Nebraska, to downstream of Kearney, Nebraska, was predominantly anastomosed; and the remaining two reaches downstream to Chapman, Nebraska, were mixed with braided and anastomosed channel (Table 2-10 from FEIS). An understanding of the processes which have produced these changes in plan form aids in determining methods for enhancing the current habitat. The main factors identified as instigating change and controlling plan form in the central Platte River are: flow regime, sediment regime, and the relative influence of topography.

Changes in Channel Width:

Reductions in flow and in the supply of medium-grain sand to the central Platte River has resulted in a shift in plan form from a broad shallow river to a narrow, multi-channeled river. As river flow and sediment load decreased the width of channel that is inundated decreased along with the regular shifting of sand. At lower flows, old braid scars are able to capture the reduced volume of water, and vegetation expands into areas of former active channel. This secondary encroachment of woody vegetation across the formerly wide expanses of the active alluvial river bed are described by Williams (1978), Eschner et al. (1983), Sidle et al. (1989), Peake et al. (1985), Johnson (1990, 1994, and 1996), McDonald and Sidle (1992), and Currier (1995 and 1996a), Simons and Associates (2001), Murphy et al. (2004), and the DEIS (2003). Much of the former river channel is presently dominated by riparian woodland. Channel widths in many areas have been reduced to 10 to 20 percent of their former size (Figure VI-A6) due to reduced sandbar scouring and shifting of alluvial sediments. Habitat conditions within the channels have changed as vegetated areas excluded from the active river channel no longer provide useful habitat for the target bird species (USFWS 1997).

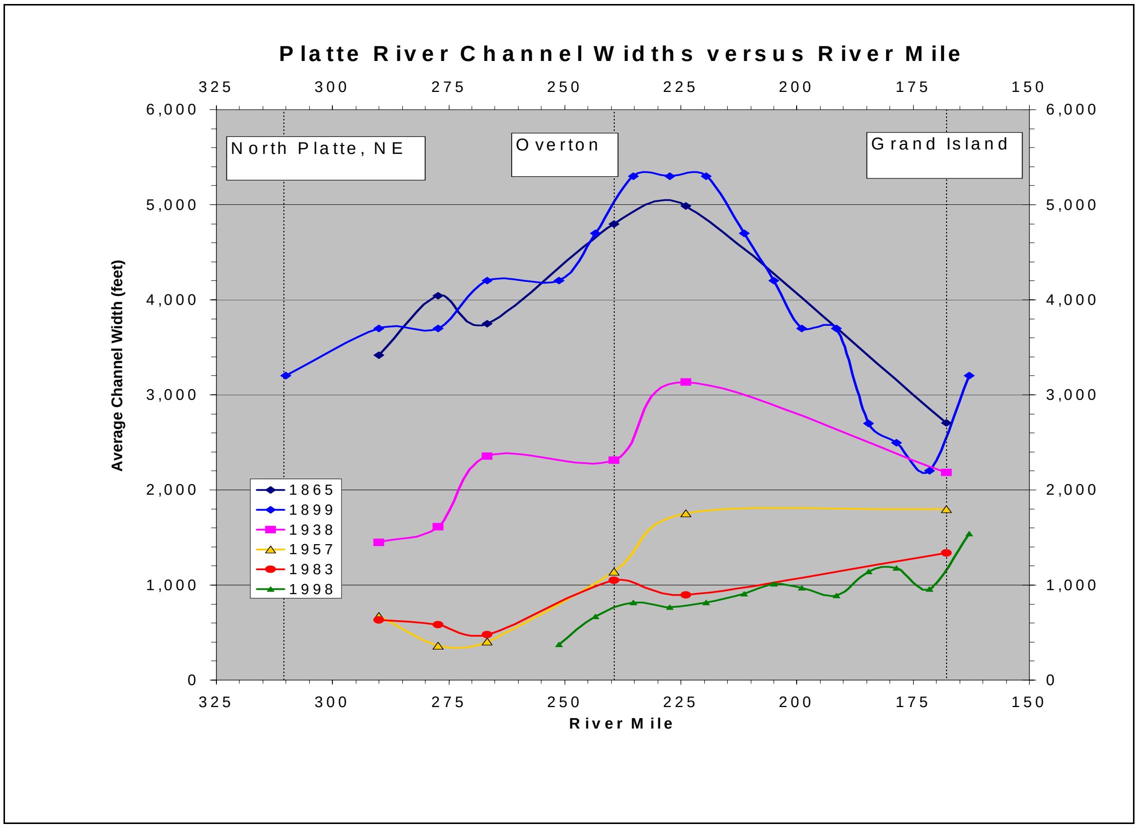



**Figure VI-A6. Platte River channel widths at various times and locations.**

The trend of reduction in channel width mirrors the pattern of coarsening of the riverbed sediments from west to east as described in the previous section. Figure VI-A6 illustrates channel narrowing in the central Platte River near Overton, Nebraska, from 1860 to 1998. Historically, this was one of the widest reaches of the river and it is now one of the narrowest. Murphy et al. (2004) concluded that, while the western part of the habitat reach has fully narrowed and probably reached equilibrium, the section from Kearney to Chapman, Nebraska, could continue to narrow to roughly 800 feet (total width of all channels). Similar narrowing trends have occurred on the North and South Platte rivers, although the effect is not as pronounced (Simons and Associates 2002).

In summary, the primary reason for Platte River channel narrowing, and the resulting loss of habitat, is believed to be a shift in plan form from braided to meandering or anastomosed, resulting from:

a) the substantial reduction in flows (including mean river flow; magnitude, duration, and frequency of peak flows; and natural variability and timing of flows) caused by the construction of large water storage reservoirs commencing in 1909, and by the construction of large flow diversion canals (e.g., Tri-County Supply Canal) which divert and convey flow outside the river channel;

b) sediment reduction resulting from the Tri-County diversion and the resulting channel incision caused by clear-water return flows from the J-2 Return Canal; and

c) topography in the historical flood plain that impacts plan form as a result of the reduction in flows.

Secondary, contributing factors causing narrowing of the Platte River channel include:

a) colonization of the channel by vegetation, especially portions of the channel no longer inundated by river flow;

b) increased bank resistance from vegetation when a braided reach evolves to an anastomosed reach with multiple side channels; and

c) coarsening of the sand supply due to channel bed erosion and reductions in medium sand supply from the North Platte River relative to the coarser sand from the South Platte River.

All of these factors adversely impact ecosystem processes and reduce the value of habitat to the target species that are dependent on the Platte River.

## A5. Wet Meadows

Wet meadows are a vital component of foraging habitat for migratory water birds staging along the Platte River valley. Federally listed species such as the whooping cranes and bald eagles along with sandhill cranes, waterfowl, and many rare species occupy wetland habitat sites adjacent to the river. Many of the food organisms used by migratory water birds depend on aquatic moisture regimes and moist or saturated soils for all or part of their life cycles (USFWS 1997). The variety of plants and microhabitats in the meadows provides habitat for a wide diversity of organisms including birds, mammals, amphibians, reptiles, earthworms, snails, and insects. Sparling and Krapu (1994) and Vercauteren (1998) found that sandhill cranes spend a large amount of time in native grassland areas compared to other available habitats, obtaining food items such as snail shells, earthworms and insects that are not readily available in croplands. Seeds, tubers, insects, ground beetles, spiders, insect larvae, and other organisms found in wet meadows form the bulk of production at the base of the food chain (Currier and Henszey 1998).

Site hydrology and soils help to determine the functional quality of grassland feeding areas, including their biodiversity and productivity. Permeable sands and gravel of the central Platte River valley provide an extensive shallow alluvial aquifer. Groundwater in subirrigated wet meadows is hydrologically linked with river stage. River stage and discharge are the most dominant hydrological influences on groundwater levels of subirrigated wet meadow landscapes (USGS 1964, Henszey and Wesche 1993, Wesche et al. 1994). Groundwater levels respond rapidly to changes in river stage. Hurr (1983) reported groundwater changes up to 0.5-mile away from the river channel within 24 hours of changes in river stage (USFWS 1997).

The combination of subirrigation and the shallow surface relief result in a locally heterogeneous mosaic of biological communities with assemblages of aquatic and semi-aquatic oriented along elevation contours. Subirrigated native grasslands have shallow surface topography and depth to groundwater, generally within 2 feet of the soil surface (Wesche et al. 1994). In the lowest areas, groundwater may seasonally or intermittently intersect surface depressions. Mesic and xeric communities prevail on the higher and drier ridges, aquatic and semi-aquatic wetland communities dominate many sloughs, and transitional species assemblages occur at the intermediate elevations. The degree of biodiversity of Platte River valley meadows is most closely associated with the moisture regime (Siebert 1994).

Periodic saturation near the soil surface is necessary to maintain physical, biological, and chemical characteristics of wetland habitats associated with the river. Seasonal elevated levels of groundwater likely have a controlling influence on the structure and function of biological communities. Groundwater levels during the natural peak runoff period of February and March influence the initiation of biological activity and contribute toward making soil-dwelling fauna available as prey for migratory birds. Groundwater levels during the spring migration period and again during the growing season, especially May and June, are considered to be most important to maintaining the long-term biological functions of wet meadows for federally listed species and for maintenance of biodiversity (USFWS 1997).

Depth to groundwater varies in association with stage and discharge of the Platte River (Hurr 1983, Henszey and Wesche 1993). Groundwater elevations underlying wet meadows and other lowland grasslands are influenced by a combination of river stage, precipitation, and evapotranspiration, but during February to July, river stage is most often the dominant factor influencing groundwater levels (Wesche et al. 1994). These authors describe the pattern of groundwater hydrology as a gradual drawdown during late spring and summer due to evapotranspiration. With dormancy of plants, groundwater levels gradually recover through fall and winter until the levels reach their highest levels in early spring prior to onset of increased use by plants. Rainfall events produce sharp and short-term increases in groundwater levels. An exception to this pattern occurs when high river flow combined with springtime precipitation events retards groundwater drainage resulting in sustained increases in groundwater levels.

Sanders (2002) provides a general description of the direct effect of river stage on groundwater buildup in wet meadows. Precipitation and local site characteristics such as site-specific soils and channeled surface drainages are additional principal factors that determine local effects. However, the effect of stage and stochastic precipitation events may have a combined influence on meadow groundwater levels. May and June have the highest average precipitation totals.

Wet meadows apparently were once common along the Platte River. Maps of the Platte River valley between Fort Kearny and Grand Island produced in 1847 show extensive wetlands, sloughs, and bayous (Willman 1930 as cited in Currier et al. 1985) within that area. Lieutenant Daniel Woodbury (Woodbury 1847), an engineer with the U.S. Army at Fort Kearny, described the valley bottomlands at the Fort site. Portions of this characterization follow:

*The banks of the river are very low – 5 to 7 feet – and still even the low bottom presents no appearance of being overflowed. The reason for this is readily found in the great aggregate width of the channels – nearly two miles -- and in the sandy formation of the western prairies…*

*…The lower bottom bordering the river and sometimes extending back half a mile from it is marked by a heavy growth of tall grass or weeds and is soft in many places, even now when the river is at its lowest stage. It is almost everywhere avoided by the great Pawnee trail and the emigrant roads and is quite moist and soft in the spring….*

*…On the island prairies, which are either lower or of an intermediate elevation between lower and higher bottoms, and on the mainland we found a great abundance of grass….The natural fertility of the lower bottoms is greatly increased by the extraordinary irrigation supplied by the river. In the spring when the snow melts upon the mountains the river is high and the water percolating freely through the sand underlying the adjacent ground renders it soft and moist in many cases to the very surface. The irrigation is gradually withdrawn in summer and fall as the harvest season approaches. In fact that season must depend much upon the irrigation and therefore vary much with the elevation of the bottom. It is therefore not surprising that we should find green grass on the Platte four weeks later than at other places….*

Reductions in Platte River discharge caused by cumulative water storage (especially reduction in river stage during springtime pulse flows) has contributed to substantial loss of wet meadow areas along the central Platte river during the past century and likely substantially diminished the functions of aquatic and semi-aquatic habitats (Currier et al. 1985, Sidle et al. 1989, USDOI 1990b, Whiles and Goldowitz 2005). Further discussion of the magnitude of wet meadow loss and resulting implications to whooping cranes is discussed in the Part B2 of this Environmental Baseline section.

## A6. Hydrocycling

The process of hydrocycling in the central reach of the Platte River may affect the target species and their habitats in the action area. Therefore, the possible effects of hydrocycling in the central Platte River are generally described here, and the potential species-specific impacts of hydrocycling are discussed in the relevant species portions of this *Environmental Baseline* section.

With normal and above-normal water supply conditions, CNPPID has generally released sufficient water from Lake McConaughy during the nonirrigation season to divert at least 1,200 cfs into its canal system at the Tri-County Diversion Dam and produce power through a series of power plants along the canal. Under these conditions, diverted water has been passed through the hydropower turbines and returned back to the Platte River near Lexington out of a canal below the J-2 Return with relatively limited fluctuation and generally in the range of 1,000 to 2,000 cfs.

During dry years when water supplies are low, CNPPID diverts lesser volumes of water into its canal system. Hydroelectric turbines are constructed to have a point of peak efficiency, such that flows above or below this level result in less efficient power generation, and at increasingly lower flows may subject equipment to undesirable stress, cavitation, and vibration. As a result, CNPPID adjusts canal flows in Johnson Reservoir and the canal system until enough volume is available to run a period of flows at higher and more efficient rates, typically operating in an on-and-off manner over repeated cycles of 24 hours or more ("hydrocycling").

The onset of drier conditions in the Platte River basin during the winter of 2001-2002, highlighted the past periodic practice of hydrocycling at that facility. The CNPPID had implemented hydrocycling at the J-2 Return in previous years. The practice of hydrocycling results in a cyclic change in river stage downstream of the J-2 Return. These changes in river stage are most pronounced in the upstream reaches of the central Platte River and attenuate downstream (Table VI-A7). In low water supply conditions, hydrocycling is the predominant mode of operation during the non-irrigation season. Hydrocycling is infrequent during wetter conditions.

**Table VI-A7. Estimated changes in flow and stage from recent hydrocycling operations (USFWS, unpublished data)**

| Habitat Site Location | RM 243-244 | RM 228 | RM 206-207 |
|---|---|---|---|
| Flow Difference (cfs) | 1,000 to 1,600 | 850 to 1250 | 550 to 800 |
| Stage Difference (ft) | 1.6 – 2.1 | 0.5 – 0.8 | 0.25 – 0.33 |
| | (49 – 64 cm) | (15 – 23 cm) | (8 – 10 cm) |

The Service has identified the potential for this pattern of power generation to have adverse effects on the avian target species and their habitats in the central Platte River downstream from the J-2 Return. While the Service has no specific data on past effects of hydrocycling to the species, potential effects of hydrocycling to the species are further discussed in the species-specific portions of this *Environmental Baseline* section.

Negotiations regarding a possible agreement on modifications and monitoring of hydrocycling operations and habitat effects have been ongoing between the Service and CNPPID with the intent to issue an amended ESA document for FERC Project No. 1417 in the summer of 2006. The amended ESA document would identify measures on modified hydrocycling operations to avoid or minimize effects to listed species and Program benefits.

## A7. Invasive Species in the Platte River Basin

Invasive and noxious weeds have become an emerging threat to listed species habitats in the entire Platte River basin. The noxious weeds that are prominent in the basin include purple loosestrife (*Lythrum salicaria*) and saltcedar (*Tamarix ramosissima*). Common reed or phragmites (*Phragmites australis*) is another aggressive invasive species, although it is not currently designated as noxious. With the exception of some non-aggressive types of phragmites, these plants are not native to the Platte River basin, and can form a monocultures in the channels of the Platte River and adjacent meadows. These plants aggressively invade native Platte River vegetation because they: a) are prolific seed producers; b) have highly viable seeds; c) having extensive root systems; and/or, d) have few natural enemies.

Noxious and invasive plants adversely affect target species habitats in two ways: a) by inhibiting the conveyance of water and, b) by reducing habitat available to the avian target species by colonizing sandbars and/or reducing open view in the river channel area. The encroachment of phragmites is one of several reasons for reduced channel capacity along the North Platte River at North Platte (J.F. Sato and Associates, Inc. 2005), thereby restricting the delivery of water to the central Platte River reach (including water provided by the Program for the benefit of the target species).

Although it is the responsibility of each person who owns or controls land to effectively control noxious weeds on that land, the resources needed to effectively control the aforementioned invasive species often fall beyond the means of individual landowners. Currently, no comprehensive plan to control noxious and invasive plants exists in the Platte River basin. Several Weed Management Areas (WMA) in Nebraska have been formed to pool resources to combat invasive weed encroachment in the Platte River basin. The WMAs consist of: a) the Panhandle WMA which manages a the upper reach of the North Platte River; b) the Platte Valley WMA which manages the lower North Platte River reach, the central Platte River, and portions of the lower Platte River; and c) the Lower Platte WMA which manages the remainder of the lower Platte River downstream to the Missouri River confluence. The above efforts are indications that comprehensive planning for noxious or invasive weed control is being developed, but a defined, long-term management plan, and funding for that effort, are not yet in place.

## *B. Whooping Crane Status in the Action Area*

### B1. Status of the Species in the Action Area

The primary migration corridor of the self-sustaining Aransas-Wood Buffalo (AWB) population of the whooping crane overlies a 170-mile reach of the Platte River from the vicinity of Hershey, Nebraska, downstream to just east of Grand Island (USFWS 1981, Austin and Richert 2001) (Figure VI-B1). Whooping crane sightings outside the primary corridor are mostly to the west. The entire river reach within the migration corridor is in the action area of this biological opinion.

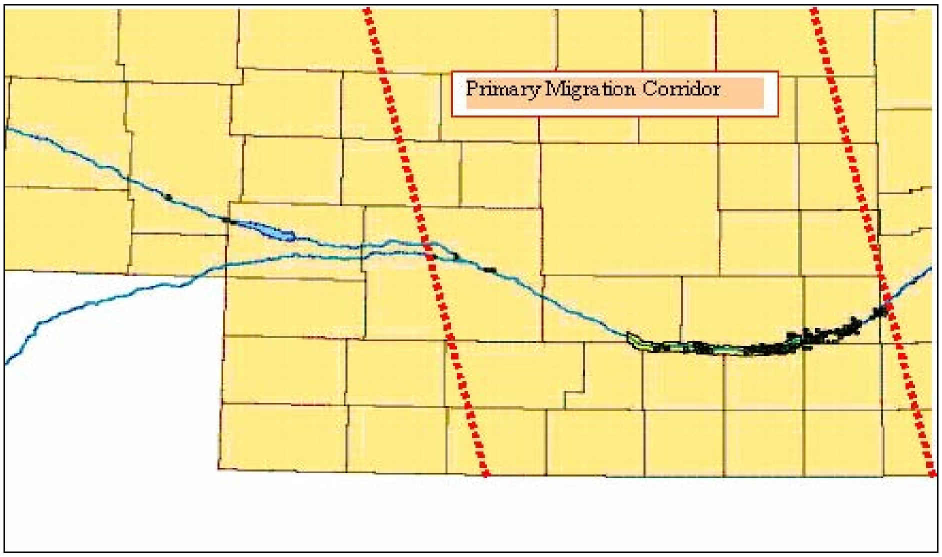



**Figure VI-B1. Whooping Crane primary migrational corridor and sightings along the Platte River from 1978 through 2001.**

The AWB population uses the Platte River during both spring and fall migration. Most confirmed sightings on the Platte River occur during April and October, but sightings outside these months are not uncommon.

More whooping cranes appear to rely on the Platte River during the spring than the fall. Spring sightings on the Platte River occur between February 15 and May 14 (Appendix E). The median period of spring migration sightings in Nebraska is April 12-14.

During fall migration, whooping cranes are seen most frequently from late October to mid-November. Since 1928 the earliest confirmed fall reports of whooping cranes anywhere in Nebraska is October 1. However, some whooping cranes likely migrate through the state in late September based on arrival dates at Aransas NWR.

Whooping cranes use the river channel for nocturnal roosting and for diurnal feeding and loafing. The Service and its cooperators have documented the characteristics of whooping crane use-sites along the Platte River since 1966. Whooping cranes often move between sites during the day and diurnal use sites have not been as closely monitored or thoroughly described as roosting sites.

Five primary records are made of whooping crane stopover Platte River use-sites: a) sighting report forms used by the Cooperative Whooping Crane Migration Monitoring Program; b) field site evaluation forms used by the Cooperative Whooping Crane Migration Monitoring Program; c) a reporting form for channel profile measurements of use sites; d) ground photographs of use sites, and; e) entry of use-locations into a Geographic Information System (GIS) database (in preparation). The data from field site evaluation forms are also entered into a digital database.

Field evaluation and measurements of whooping crane use-sites are obtained as soon as possible following crane departure. Information such as channel width, water width, sandbar width, and water depth characteristics are derived from channel profile measurements. Field observations, aerial photos, and (more recently) GIS are used to identify proximity of other landscape habitat factors (e.g., potential disturbance factors). A summary of the characteristics measured at whooping crane use-sites along the central Platte River is provided in Appendix E.

The Platte River's position within the North America central flyway provides a strategic midpoint for stopovers by migratory waterbirds. It provides whooping cranes and other waterbirds dependable roosting, loafing, and foraging habitats secure from disturbance. The riverine environment provides wide channel roosting areas with nearby wet meadow and cropland feeding areas. Platte River channels used by whooping cranes typically have a wide expanse of water and shallowly submerged sandbars. Wide channel width and expanse of water contribute to the birds' security. Unlike the Rainwater Basin wetland complex, which is also used by large concentrations of migratory waterbirds and lies directly south of the central Platte, the Platte River has thus far been free of contagious disease.

Historical Information on Platte River Use:

Swenk (1933) and Allen (1952) summarized much of the early information known about whooping crane observations and migration, including the observations along the Platte River. Based on a preponderance of sightings along the Platte River in Nebraska during 1820 to 1948, Allen (1952) concluded that the Platte River was a major stopover area. Though several of the individual sightings listed by Allen from throughout the migration corridor are suspect due either to time of year or number of birds, the distribution of sightings represented by Allen's compilation is regarded as generally accurate.

Historically, whooping cranes used the Platte River throughout the North Platte to Grand Island reach (Allen 1952). The greatest number of sightings is in the middle of the migration route near Odessa (Figure VI-B2) (Lingle 1987). Allen (1952), Black (1934), Kennedy (1934), and Swenk (1933) describe historic whooping crane sightings in this reach occurring near Lewellen, Ogallala, and North Platte on the North Platte River, from Gothenburg, "Ranch 96" near Gothenburg, between Cozad and Brady Island, Brady Island in Lincoln County, between Brady and Maxwell, and between Darr and Lexington on the Platte River.

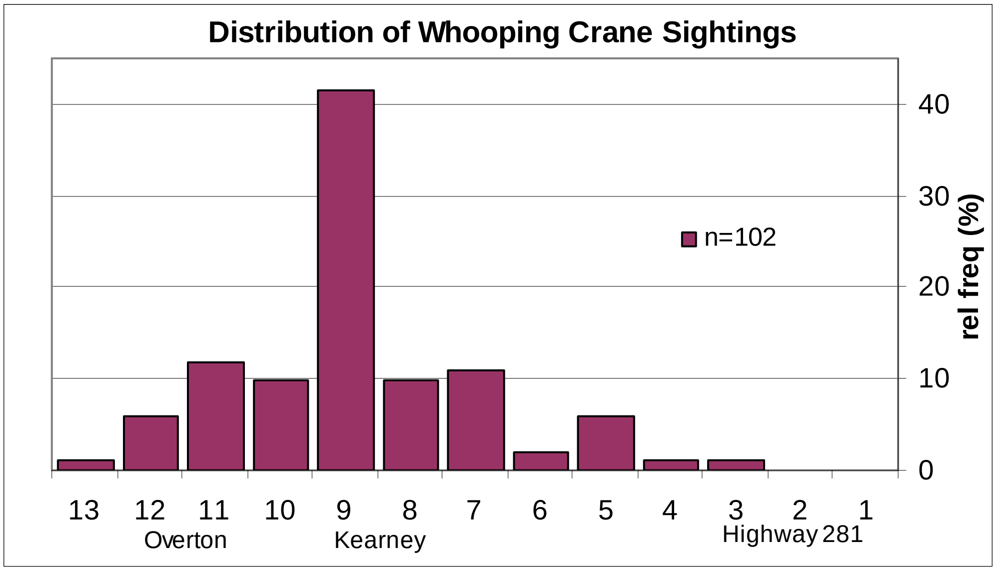



**Figure VI-B2. Relative distribution of whooping crane sightings along the Platte and North Platte Rivers, 1915-1950. The x-axis represents river segments between bridge crossings from Overton (11) to Chapman (1). Segment 12 is the Platte River from North Platte to Overton, and segment 13 is the North Platte River from Hershey to North Platte. (Source: Lingle 1987)**

Johnsgard and Redfield (1977) summarized historic whooping crane sightings reported in the Nebraska Bird Review from 1912 through the spring of 1977. Their findings--that 90 percent of the Nebraska records were within 30 miles of the river--led them to conclude that the Platte River is likely a particularly important habitat to whooping cranes.

Recent Platte River Sightings: Frequency:

The number of confirmed and probable whooping cranes sighted on the Platte River in any single year has ranged between 2 and 33 and averaged 13.5 birds. Confirmed and probable whooping crane sightings in the Platte River valley action area for the recent period are summarized in Table VI-B1 and listed in Appendix E (USFWS unpublished data).

Of the four migrational areas federally designated as critical habitat for the species, the Platte River is second to Quivira National Wildlife Refuge in the number of recorded stopovers (spring and fall). During spring, whooping crane stopovers are more frequent on the Platte River than at any other location in the species' range.

Though comparisons among sites are difficult because efforts to observe whooping cranes along the entire 2,400-mile migration route are uneven, State and Federal migratory bird refuges where knowledgeable observers would readily note whooping crane use are distributed throughout the migrational pathway.

**Table VI-B1. Number of whooping cranes (confirmed and probable, combined) reported each year along the Platte River (Lexington to Chapman, Nebraska) since 1980.**

| Year | Cranes On Ground | Cranes Flying | Total No. Cranes |
|---|---|---|---|
| 1980 | 6 | 7 | 13 |
| 1981 | 0 | 0 | 0 |
| 1982 | 0 | 0 | 0 |
| 1983 | 8 | 0 | 8 |
| 1984 | 2 | 7 | 9 |
| 1985 | 13 | 4 | 17 |
| 1986 | 10 | 3 | 13 |
| 1987 | 5 | 7 | 12 |
| 1988 | 13 | 0 | 13 |
| 1989 | 8 | 0 | 8 |
| 1990 | 14 | 4 | 18 |
| 1991 | 0 | 2 | 2 |
| 1992 | 17 | 16 | 33 |
| 1993 | 10 | 5 | 15 |
| 1994 | 14 | 0 | 14 |
| 1995 | 9 | 16 | 25 |
| 1996 | 15 | 3 | 18 |
| 1997 | 10 | 0 | 10 |
| 1998 | 10 | 1 | 11 |
| 1999 | 5 | 12 | 17 |
| 2000 | 11 | 0 | 11 |
| 2001 | 8 | 4 | 12 |
| 2002 | 17 | 7 | 24 |
| 2003 | 7 | 1 | 8 |
| 2004 | 8 | 0 | 8 |
| 2005 | 4 | 0 | 4 |

The whooping crane numbers reported in Table VI-A1 are a minimum of actual crane use of the Platte River. For reasons described below, the confirmed and probable stopovers are a subset of total whooping crane use of the action area and it is not known how many stopovers actually occur.

Due to their reclusive habits, it is unlikely that all whooping cranes using the Platte River are actually observed. Tree growth on riverbanks and islands visually obscure much of the river channel area from ground observation and thus reduces whooping crane detection by humans. Also, whooping crane movements to and from the river most often occur at dawn and dusk when low light and visibility can make the birds difficult to track.

Other reasons that whooping cranes are not detected are not well understood. Airplane surveys to detect whooping crane stopovers in the Platte River valley have not proven to be efficient at detecting the cranes, even when—through other observational methods—whooping cranes are in the Platte River valley study area (Chavez-Ramirez 2003). Decoys placed in the river and in nearby fields to test airplane survey procedures also frequently fail to be detected.

Not all birds seen are likely reported. The public is the primary source of most initial whooping crane observations as opposed to systematic searches. During 1980 to 2003, about 60 percent of all probable and confirmed reports (combined) were initially received from the general public with the remainder observed by biologists whose primary duties are related to Platte River management activities (Runge, pers. com.).

Observations of whooping cranes may fail to be reported due in part to the public's inability or uncertainty in identifying cranes, because they have no responsibility or obligation to report cranes, may not fully understand the importance of their observations, or due to a reluctance to report cranes (J. Lundgren, K. Schroeder, pers. comm.). Even for confirmed sightings, the initial observers have at times indicating seeing the whooping cranes for several days before they were reported. The frequency with which whooping cranes are seen but not reported is unknown.

Finally, the Service and cooperating agencies cannot always confirm the reports of whooping cranes made by the public. Although the Service or its cooperators attempt to investigate all reports that appear to have accurate whooping crane descriptions, some are not confirmed due to delayed reporting after the birds depart, or an inability to locate birds that have moved, or a lack of personnel available to investigate sighting reports. The relative ability to confirm reports of whooping cranes has not been quantified.

Recent Platte River Sightings: Distribution:

Whooping crane observations have been confirmed along the Platte River as far west as Mitchell, Nebraska, near the Wyoming border on the North Platte River; in rare instances in the South Platte basin of Colorado; and as far east as Chapman, Nebraska on the central Platte River (Table VI-B2). This east-west distance spans about 400 miles.

**Table VI-B2. Spatial distribution of whooping crane sightings (confirmed and probable) along the Platte River and North Platte Rivers, 1966-2005.**

| | **All Sightings in the Platte River Valley*** | | | **Confirmed Sightings on the River** * | |
|---|---|---|---|---|---|
| **River Segment (Bridge Segment)** | No. | Rel. Freq. (%) | | No. | Rel. Freq. (%) |
| Hershey-North Platte | 5 | 3.3 | | 3 | 3.4 |
| North Platte-Lexington (13) | 0 | 0.0 | | 0 | 0.0 |
| Lexington-Overton (12) | 1 | 0.7 | | 0 | 0.0 |
| Overton-Elm Creek (11) | 5 | 3.3 | | 2 | 2.2 |
| Elm Creek-Odessa (10) | 6 | 3.9 | | 4 | 4.5 |
| Odessa-Kearney (9) | 15 | 9.9 | | 3 | 3.4 |
| Kearney-Highway 10 (8) | 14 | 9.2 | | 4 | 4.5 |
| Highway 10-Gibbon (7) | 30 | 19.7 | | 23 | 25.8 |
| Gibbon-Shelton (6) | 12 | 7.9 | | 8 | 9.0 |
| Shelton-Wood River (5) | 18 | 11.8 | | 9 | 10.1 |
| Wood River-Alda (4) | 11 | 7.2 | | 8 | 9.0 |
| Alda-Highway 281 (3) | 22 | 14.5 | | 15 | 16.9 |
| Highway 281-Highway 34 (2) | 8 | 5.3 | | 5 | 5.6 |
| Highway 34-Chapman (1) | 5 | 3.3 | | 5 | 5.6 |

The primary migrational pathway of the AWB population overlies a Platte River reach approximately 140 miles long stretching from near Hershey to near Chapman, Nebraska. As described above in the "Historical information," sighting records from the early 20th century occur throughout this range.

Although the migrational corridor of whooping cranes encompasses the western portions of the Platte River basin (i.e., that portion of the basin generally upstream of Overton, Nebraska) (Austin and Richert 2001), observations of whooping crane in this section of the Platte River are relatively uncommon. During 1975-2005, only 8 of 120 confirmed sightings on or along the Platte River main-stem (including the North and South Platte Rivers) have occurred upstream of Overton, Nebraska (Service sighting database, Grand Island, Nebraska, Field Office, 2005):

a) No use of the river channel or valley has been documented in the 50-mile-long river reach between the Lexington and North Platte;

b) Five sightings (three confirmed uses of the river channel) occurred along the North Platte and South Platte rivers between Ogallala and the confluence of the two rivers downstream of North Platte, Nebraska; and

c) Three sightings occurred along the North Platte River upstream of Kingsley Dam (two at the inflow to Lake McConaughy and another near Oshkosh, Nebraska).

The low frequency of observed sightings in the upper Platte River basin in recent decades is likely due to poor habitat conditions of the narrow channels that presently dominate the North Platte River, South Platte River, and Platte River upstream of Overton.

Under the present condition the widest river channels upstream of Lexington have been reduced to only a few hundred feet wide--much narrower than the river channels whooping cranes are observed to use in the river reach between Fort Kearny to Grand Island. The river channels upstream of Overton are therefore considered to be unsuitable as whooping crane habitat.

Some speculation has been raised that the proportion of whooping cranes using the river west of Kearney is far greater than confirmed reports indicate, but these birds are simply not seen or reported. If this speculation is correct, whooping cranes may be much less selective of migrational stopover habitat characteristics than previously determined by the Service, and the habitat status in the upper river sections is not as seriously degraded as Service biologists believe. However, there is no known data that supports such speculation.

For the reasons explained below the Service believes that the frequency of whooping crane use may be higher than records indicate, but the weight of the best scientific information available indicates the spatial distribution of reported crane observations is a generally accurate representation of the actual distribution of the species' use.
First, due to the diversity of habitats available, information on whooping crane movements and river habitat-use acquired at the local scale is instructive of habitat characteristics that cranes tend to select and those that they tend to avoid. Information presented in the FEIS shows that whooping cranes prefer wide channels and avoid narrow channels (Figure VI-B3).

A preference for wide unobstructed areas is supported by other analyses of then-current data (USFWS 1997, USGS 2000) and opinions of crane authorities for the Platte River and other migrational habitats (USFWS 1987d). Based on this relationship, the narrow channels that predominate upper reaches of the Platte River (i.e., generally, the river reaches above the Fort Kearny Recreation Area at River Mile 210) will tend not to be used by whooping cranes.

Secondly, whooping cranes routinely use off-river fields near roosts for feeding. The birds are more easily observed in these areas and often are the first reported sightings. Off-channel habitats are similar along the upper and lower reaches of the Platte River, yet very few instances of off-river whooping crane use are reported from the western or upstream sections of the river valley west of Kearney.

Finally, most of the mid-continent population of sandhill cranes stages on the Platte River valley in early spring and generally prior to the spring whooping crane migration. The two species use the same general types of habitat, including open channels and fields and grasslands. Sandhill cranes are less reclusive and less wary than whooping cranes and whooping cranes appear to be more selective of wider channels and more remote feeding areas.

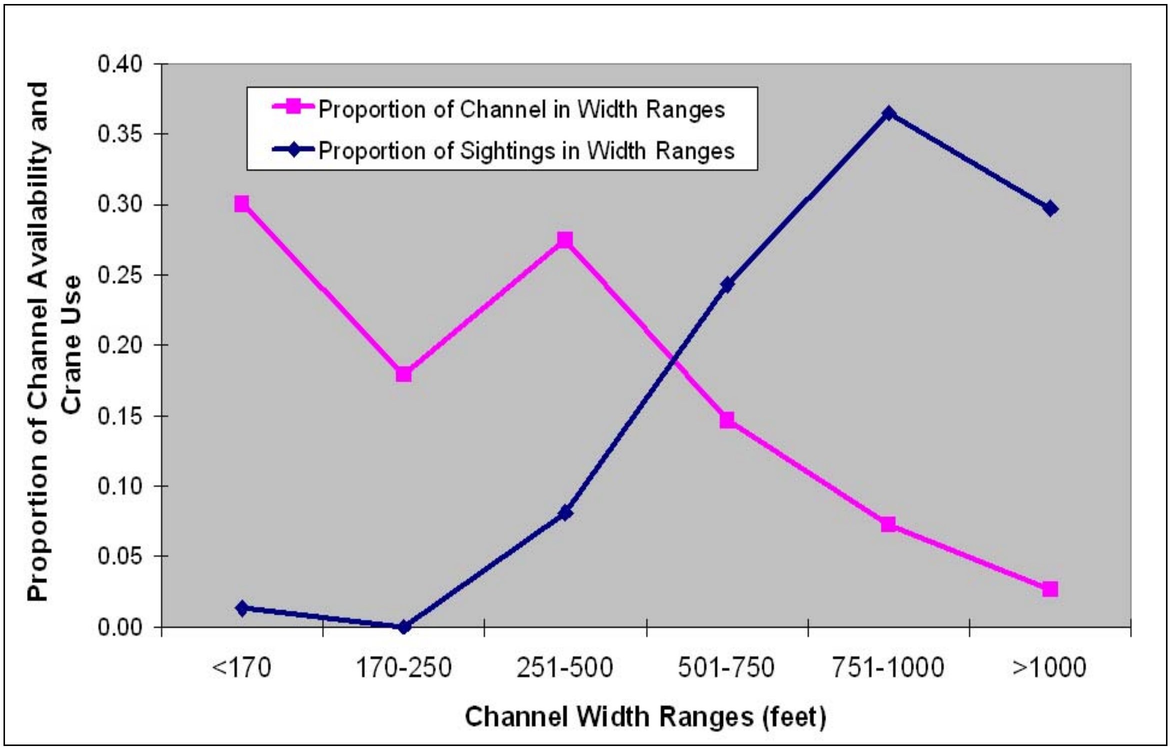



**Figure VI-B3. Whooping crane use of channel areas of various widths compared to the availability of channel areas of varying width (source: Platte River Recovery Implementation Program EIS). The marked difference in the relationships indicates whooping crane preference for the widest channels.**

During the latter half of the 20th century, the distribution of sandhill cranes using the Platte River gradually shifted from west to east, concentrating the population toward the downstream end of their staging area (Figure VI-B4) (Krapu et al. 1982 and 1989, Faanes and LeValley 1993). This shift coincided with channel narrowing and wet meadow loss in the river segments abandoned by the sandhill cranes (Currier et al. 1985, Sidle et al. 1989, Murphy and Randle 2004). Krapu et al. (1984) and Davis (2001) independently concluded that the sandhill crane distribution on the Platte River is positively associated with river channel width. Sidle et al. (1993) concluded that channel width and the proximity to suitable wet meadow feeding areas are the two habitat parameters most important in explaining the distribution of sandhill cranes staging along the Platte River. Researchers attribute the shifts of the sandhill crane distribution to be a response to large-scale habitat changes (i.e., habitat loss) (Krapu 1999, Krapu et al. 1982, Tacha et al. 1994).

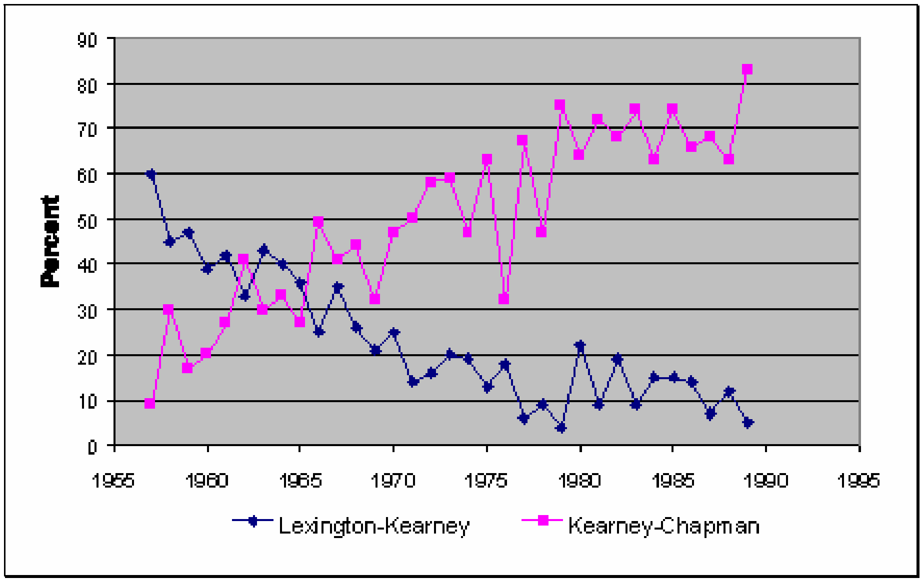



**Figure VI-B4. Change in the distribution of the midcontinental population of sandhill cranes staging on the Platte River (Faanes and LeValley 1993).**

The spatial distribution of the whooping crane observations on the river corresponds with changes in sandhill crane distribution. Though whooping cranes were historically observed in the North Platte to Overton river reach (see "the Historical Information" above) during the past several decades, no whooping crane use has been reported on this section of river and only one off-river observation is known to have occurred. Sightings of whooping cranes are most common in the same river reaches where sandhill crane use is concentrated (Figures VI-B4 and VI-B5).

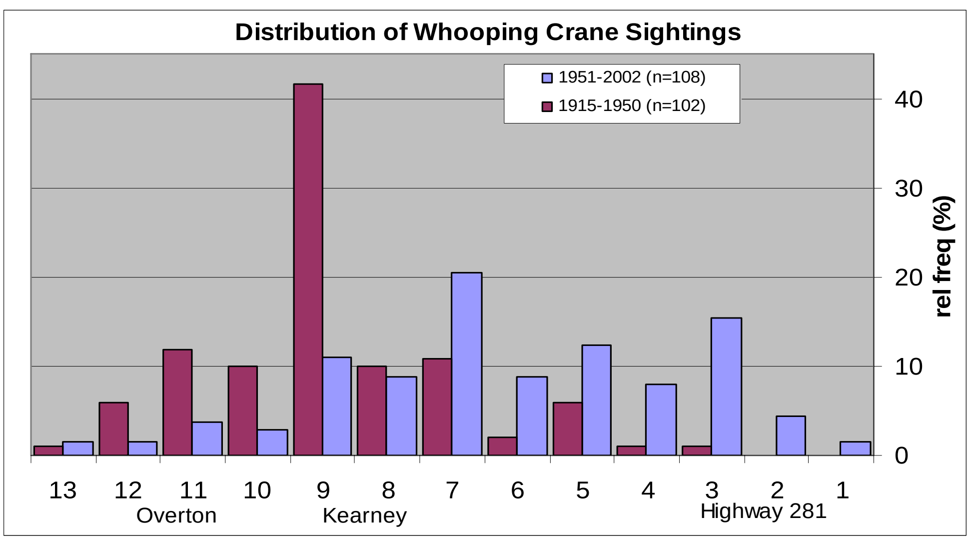



**Figure VI-B5. Relative distribution of whooping crane sightings along the Platte River and North Platte Rivers for two periods: 1915-1950 and 1951-2002. The x-axis represents river segments between bridges from Overton (11) to Chapman (1). Segment 12 is the Platte River from North Platte to Overton, and segment 13 is the North Platte River from Hershey to North Platte. (Source: Lingle 1987 and USFWS whooping crane records)**

As previously mentioned, most sightings of whooping crane stopovers occur through chance observation due to the rarity of the birds and their reclusive habits. Research in whooping crane habitat use is continuing through systematic surveys of the action area.

Surveys by the Service during the 1980s (USFWS 2001), and by an interagency technical committee of the Platte River Cooperative Agreement begun in 2000 (WEST, Inc. 2001), have been designed to apply uniform efforts for crane detection. Objectives of systematic surveys are to help refine our knowledge of the distribution of crane stopovers in the Lexington to Chapman reach and to refine the understanding of habitat use and selection.

### B2. Status of Platte River Habitat and Designated Critical Habitat

In designating whooping crane critical habitat the Service considered the physiological, behavioral, and ecological requirements necessary for whooping crane conservation (FR 43(98):143-148, May 15, 1978). This section describes the status of physical and biological features of whooping crane habitat in and along the Platte River as they pertain to the critical habitat reach.

The spacing of designated critical habitat units within the migrational corridor provide for the protection of stopover opportunities at traditional stopover sites. The Platte River represents a portion of the natural and historic distribution of the Aransas-Wood Buffalo population (Allen 1954), and is of biological importance due to the position at the center of the whooping crane migration corridor (NRC 2005, Austin and Richert 2001).

The Platte River critical habitat unit is important because the Platte River transects the entire migration corridor through which all cranes of the wild population pass twice each year; it may be the predominant habitat available during drought; and it provides an environment at less risk from disease than the surrounding area (Stehn 2003). Whooping cranes have been confirmed using the central Platte River more frequently in spring (use days) than any other habitat in the United States (Stehn 2003). Like other units of designated critical habitat, the Platte River supports rearing of young by providing a site for training and protection as well as feeding and other normal behavior.

The Platte River is a dependable and consistent source of relatively well-watered habitat, and is not subject to drought cycles as severe as those of the northern Great Plains wetlands (NRC 2005). Nevertheless, current degraded habitat conditions along the central Platte River adversely affect the likelihood of survival and recovery of the whooping crane population (NRC 2005). Further, no apparently suitable alternatives can replace the central Platte River in its function as habitat for migrating whooping cranes (NRC 2005).

The rule designating whooping crane critical habitat pre-dates the Service's current guidance of "primary constituent elements" (PCEs) used in designation of critical habitat and in adverse modification of critical habitat determinations. Therefore, physical and biological features of whooping crane critical habitat described in the listing regulation that pertain to the Platte River are addressed here. These include: a) the availability of wide, open, river channel with shallow sand and gravel bars for nightly roosting, b) the availability of bottomland areas, including wet meadows, providing food, water, and other nutritional requirements, and c) isolation and protection from disturbance.

Open Channel Roosting Habitat:

During the past century, channel habitat in the 170-mile long reach that lies within the whooping crane migration corridor has been transformed from a very wide and braided sandy channel to anabranched channels and heavily forested floodplain. Historical accounts of the Platte River place its width between 0.75- and 3 miles. Actual measurements by Bonneville in 1837 was a 1.25-mile width 25 miles downstream from Fort Kearney, and a 1.0-mile width that was measured, by the explorer Fremont in 1845, downstream from the confluence of the North Platte and South Platte rivers (Currier et al. 1985).

Encroachment of woody vegetation into the former wide expanse of the river bed is described by Williams (1978), Eschner et al. (1983), Peake et al. (1985), Johnson (1990, 1994, and 1996), McDonald and Sidle (1992), Currier et al. (1985) and Currier (1995 and 1996a), Simons and Associates (2001), Murphy et al. (2004), and summarized by Sidle et al. (1989) and the EIS (2006). Within the Lexington to Chapman reach alone, Sidle et al. (1989) estimated that by the early 1980s the channel area had been reduced by 73 percent with the greatest reductions in the critical habitat reach from Lexington to Shelton (RM 196 to 250) (Figure VI-A6).

Currier et al. (1985) estimated that 70 percent of the open channel and 90 percent of the habitat value had been lost. Habitat loss and the threat to Platte River whooping crane habitat resources are related to the ongoing deterioration of forming processes (i.e., changes in the magnitude of channel forming flows and sediment transport) as described above. Further information on channel changes and loss of open channel discussed in the *Status of the Platte River Ecosystem* (Chapter VI, Section A) apply to the critical habitat reach.

Downstream of Lexington, the channel degradation described in the Status of the Platte River Ecosystem (*Environmental Baseline* section, part A) of this biological opinion affects both channel roosting habitat and wet meadow feeding habitat. No major tributary inflows or outflows occur below the J-2 Return and river flow patterns at Overton and Grand Island are generally similar, yet channel habitat losses are not uniform within the reach. Sediment-free J-2 Return discharges increase the downstream sediment transport to rates that are about twice the amount supplied to the habitat reach at Lexington (Randle and Samad 2003). Channel surveys indicate that much of the difference in the amount of sediment transported is from erosion of the channel bed.

Channel bed degradation extends downstream from the J-2 Return near Lexington. The length of river reach undergoing degradation is not precisely determinable with existing data, but appears to be least 20 miles and perhaps as much as 40 miles over a recent 15-year interval (Murphy et al. 1998, Holburn et al. 2006).

Channel bed erosion is a factor that adversely affects open channel roost habitat by entrenching the channel and concentrating flow and increasing water depth and velocity. Channel downcutting has left high islands, banks, and benches at higher elevations and provided a surface for vegetation growth. Though the effects of this process on habitat vary somewhat among river reaches, the confining and down-cutting of the river channel between high banks has contributed to substantial decreases in horizontal visibility, open channel, and wetted channel area, and to changes from braided to anabranched river plan form.

The area of open, wide channels is not entirely eliminated in the critical habitat reach, but it is substantially reduced in amount and in quality (Figure VI-B6). Consequently, whooping crane use of the river channel for roosting is substantially limited from Lexington (RM 251) to the vicinity of Fort Kearny State Recreation Area (RM 210) (Fort Kearney lies in bridge segment 8 of Table VI-B2). Portions of the river in bridge segments 7 and 10 are maintained as open channel habitat by private non-government organizations.

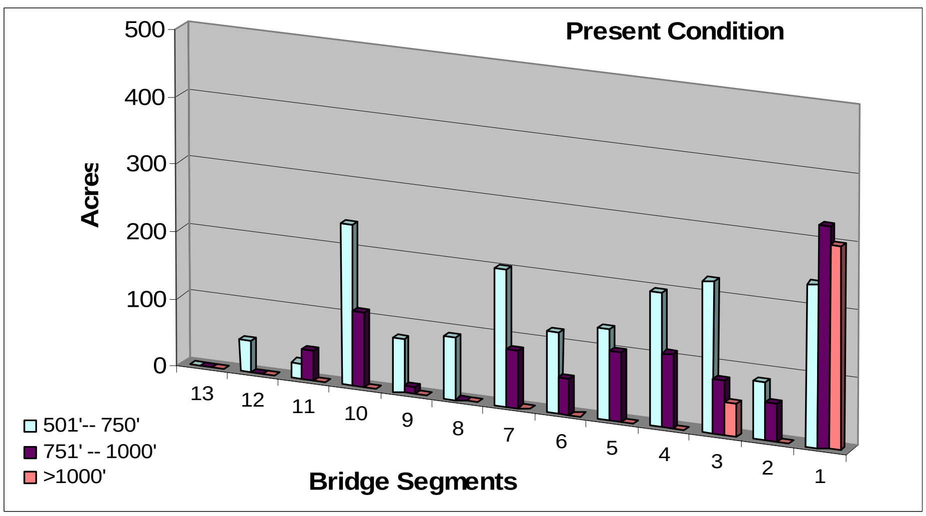



**Figure VI-B6. Distribution of wide channels (>500 ft) in the central Platte River reach targeted by the Federal action for habitat recovery. The horizontal axis represents the river segments between bridges, numbered east to west from Chapman to Lexington. Designated critical habitat lies in bridge segments 6 through 13. (Source: FEIS)**

Quantitatively, loss of whooping crane roost habitat due to channel degradation is greatest in upstream reaches. For example, between 1985 and 2000 near Overton, changes in channel morphology (i.e., channel downcutting and narrowing) virtually eliminated whooping crane roost habitat in a segment of the critical habitat reach near Overton (Figure VI-B7).

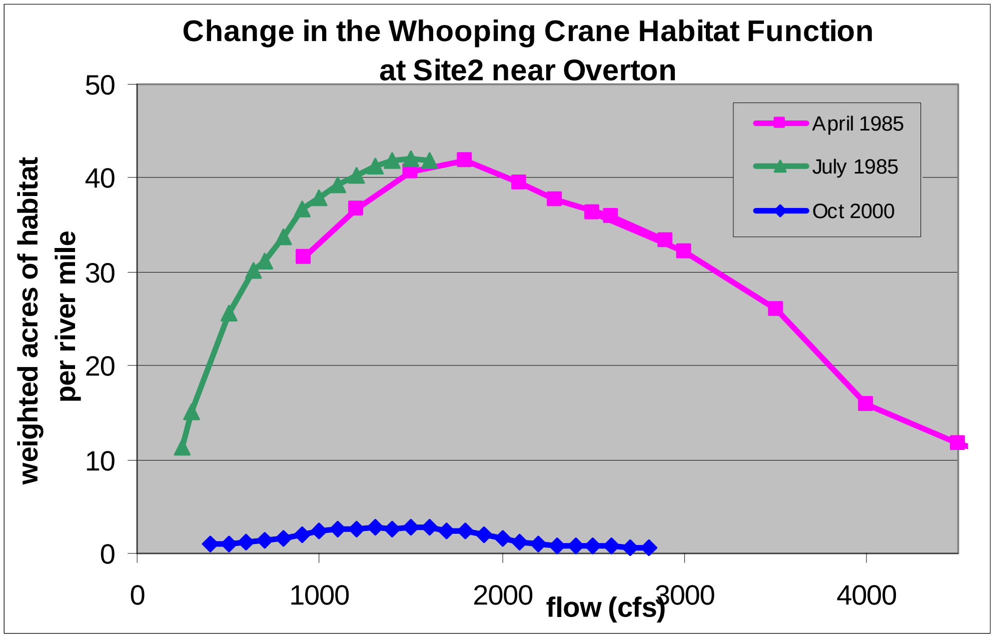



**Figure VI-B7. Changes in modeled whooping crane roost habitat as a function of river flow near Overton, Nebraska, from 1985 to 2000. This change results from channel degradation (deepening and narrowing of the channel).**

Changes in river morphology may have a controlling affect on the hydrologic relationship between the river and subirrigated meadows and wetland components of adjoining bottomland grasslands. Platte River channel morphology must be improved and maintained in order to provide the wide channels suitable as roosting habitat and to restore and maintain wet meadows where cranes feed and rest.

Hydrocycling

Flows of the Platte River during spring and fall whooping crane migration seasons are composed in part of water diverted into CNPPID’s system and returned at the upstream end of the central Platte River habitat area near Lexington. Returns at the J-2 Return and flows remaining in the river depend in part on the releases from Lake McConaughy and inflows from the South Platte River. Releases depend in turn on available water supplies in the basin.

During low water supply conditions, discharges from the J-2 Return are variable. Based on operational descriptions, hydrocycling may occur when flows reaching the Johnson No. 2 power station are less than 1,300 to 1,400 cfs, and must occur when flows are less than 1,050 cfs because of the risk of cavitation damage (CNPPID 2005). During low flow years, hydrocycling may occur during whooping crane spring and fall migration periods.

The magnitude of the change in river stage attenuates downstream. Changes in river stage may range from imperceptible to a few inches (at RM 206 to 207) to more than 2 feet (RM 243-244) during hydrocycling. The potential adverse effects of current hydrocycling operations on whooping cranes may be occurring in a limited portion of the J-2 Return to Kearney reach of the river where wide channels occur, and most specifically in the segments of wide channels maintained as crane habitat.

Though migrating whooping cranes may use the Platte River at various times of day and are observed to retreat from fields to Platte River roosts during severe weather, the primary concern is the potential effects on nocturnal roosts. Whooping cranes stand in shallow (usually < 0.7-foot) slow-moving water to roost. The current hydrocycling operations may affect cranes in several ways, including the potential to flush the birds from their roosts at night, cause restless roosting behavior, and potentially increase exposure to predators (pers. comm., G. Krapu 2006). Collision with utility lines is a principal known cause of direct injury and mortality to migrating whooping cranes (USFWS 1994g, Stehn and Wassenich 2006), and of sandhill crane injury and mortality along the Platte River (USFWS 1994g, Ward and Anderson 1992). Discussions are currently underway with CNPPID to develop an agreement on modified hydrocycling operations to avoid or minimize effects to listed species and Program benefits.

<u>Bottomland Feeding Habitat – Agricultural:</u>

Bottomland feeding habitats comprise another element of the Platte River whooping crane critical habitat designation and serve to help meet the food, water, and other nutritional or physiological requirements of the species.

Cropland in corn production includes about 205,000 acres or nearly one-half-of the land use in the study area. Despite the abundance and broad distribution of corn fields, the availability of waste corn as a food source has dwindled in recent decades in the central Platte River habitat area. Available waste corn in early spring has decreased by roughly 60 percent, and in late spring by as much as 96 percent, from the amounts found available in similar surveys during the 1970s (Krapu and Brandt 2001). Diminished availability of waste grain is apparently due to increased farm harvest efficiency and to competition among large populations of migratory waterbirds.

Loss of open channel habitat has concentrated migratory waterbirds in river segments where wide channels remain. The river segments used by sandhill cranes and geese for roosting and feeding in the nearby fields are the same segments most frequently used by whooping cranes.

In the 1970s, waste corn was sufficiently abundant and no adverse effects on sandhill crane physiological condition were found. Since the 1970s, however, the fat storage of larger sandhill cranes (*Grus canadensis rowani* and *G.c. tabida*) has declined (Krapu 2003), and the distances flown by sandhill cranes from river roosts to feeding areas have increased. These changes are likely due to reduced corn availability and decreased foraging efficiency. Whooping cranes store a higher proportion of fat on the wintering grounds than do sandhill cranes and presumably replenish fat reserves at migration stopovers. Although the species' migration periods overlap, whooping cranes tend to migrate later than the sandhill cranes and geese. Because little waste grain remains late in the migration season, the reduced fitness found in larger sandhill crane subspecies suggests that whooping cranes may also be less able to replenish fat storage during Platte River stopovers.

Bottomland Feeding Habitat - Wet Meadows:

Both springtime discharges and wet meadow acreage have decreased substantially during the past century (Williams 1978, Currier et al. 1985, Sidle et al. 1989). Williams (1978), Eschner et al. (1983), Simons (2001), Murphy et al. (2004) and the USFWS (1993) have described the reduction in spring peak flows that has occurred over the past century. The reduction of river stage, especially springtime pulse flows, caused by cumulative water storage and diversion has facilitated land leveling, groundwater drainage, and conversion of wet meadows to row crop agriculture and other land uses. The result is that few of the former native riparian meadow habitats along the river now exist in the central Platte River reach.

The area of wet meadows along the central Platte River declined by 55 percent from 1938 to 1982 (Sidle et al. 1989). Groundwater levels in the central Platte River valley (Lexington to Chapman, Nebraska) help maintain about 11,330 acres of the remaining wetland meadow habitat (Sidle et al. 1989) or about 4.8 percent of the area within the Platte River valley near the river.

The effective habitat value of wetland meadows remaining in many reaches of the river is further reduced because of the small size and discontinuity (fragmentation) of the parcels and potential threats from adjacent land use practices including housing developments. Larger tracts of wet meadows tend to provide a more diverse mosaic of microhabitats, and also provide whooping cranes with the isolation and security required for feeding, loafing, and socializing activities (USFWS 1997). A variety of other qualitative factors such as proximity to disturbance and management practices also influence the suitability of these areas as feeding habitat for whooping cranes.

As with channel habitat, wet meadow habitats are not uniformly distributed in the Lexington to Chapman reach that is targeted for habitat recovery. A gradation from west to east exists with a greater amount of wet meadows and higher quality meadows located in the eastern end of the study area. Meadows surveyed downstream have shallower depth to groundwater (Wesche et al. 1994).

The Status of the Platte River Ecosystem (*Environmental Baseline* section, part A) discusses ongoing channel bed degradation in terms of the amount, rates, location, and trends surveyed in the critical habitat reach. Degradation has ranged from several feet near Overton to about 0.2 feet at Audubon Sanctuary over a recent 15-year period (Murphy et al. 2006, Holburn et al. 2006). In terms of river stage, a 0.5 foot reduction in river elevation is equivalent to a 1,000 cfs reduction in river flow (USBR 1987).

Channel bed degradation increases the hydrologic gradient between groundwater and the river thereby reducing wet meadow subirrigation. The changes to the groundwater regime have likely resulted in gradually drier meadows, less productive of aquatic and semi-aquatic biota, and reduced diversity of food resources. These changes have in turn reduced the value of these areas as whooping crane feeding habitat. Siebert (1994) reported that biodiversity is associated with soil moisture regime, and Davis and Vohs (1993) found that sandhill crane feeding was most concentrated in lowest wettest meadows. Because whooping cranes are rare, sandhill crane feeding habits are and appropriate surrogate for evaluating whooping crane feeding.

Experimental efforts with limited scale and scope have been undertaken to restore functional riparian meadows (Currier 1995, Currier and Goldowitz 1995, and Central Platte Natural Resources District 2001, FEIS 2006). These attempts include changes in land use, re-contouring leveled lands, improving hydrology, and reseeding native species. Most efforts remain in very early stages of development, and whether restorations result in functional wet meadows is not yet known.

Isolation and Protection from Disturbance:

Whooping cranes do not readily tolerate disturbances. Channel width, expanse of water, and remote feeding areas are site characteristics that contribute to whooping crane security and protection. Most of the Platte River and the critical habitat reach lie in rural and agricultural landscape, but residential, commercial, and industrial developments do limit habitat values in some river sections.

Recreational uses, vehicular traffic on roads and bridges and, to a certain extent, farm machinery and activities are some of the factors that can influence crane habitat use. Lights and noise (e.g., shooting) are other disturbance factors that impinge on crane habitat use. Though detailed spatial models to quantify security from sources of disturbance have not yet been developed, the length of protected river channel habitat is a possible indicator of secured habitat. In Nebraska, ownership of the Platte River channel area is generally determined by ownership of banks and often extends to the midpoint of the main channel.

About 5 miles (9 percent) of the critical habitat reach have both banks of the main channel owned or managed as crane habitat. These are mostly held in fee-title or conservation easement by private non-government organizations. About 7 ½ additional miles (14 percent) of the reach has a single bank in such ownerships (Table VI-B5). These acquisitions insure that adverse effects from land use changes are localized in scope and intensity, and that high quality habitats remain secure.

Downstream of the critical habitat (i.e., from Shelton to Chapman) eight miles have a single bank, and four additional miles of river have both channel banks that are owned or managed as crane habitat. In total, about 10 percent of the bank line in the 170-mile reach in the whooping crane primary migrational path from Hershey to Chapman is protected and managed for crane conservation (North Platte and Platte rivers). Protected lands bordering the primary channel total about 11,400 acres (Table VI-B3).

When both banks of the river channel area are not managed for habitat purposes its biological value may be limited by the following factors:

a) Control of a single bank may interfere with habitat conservation when the river shifts course due to the natural dynamic alluvial processes. Over a period of years, the active river channel--which occupies only a small portion of the floodplain--can migrate from one side of the floodplain to the other, thus disabling the ability to perform channel habitat improvements;

b) Various residential, recreational, industrial, or commercial developments on the opposing bank may result in disturbances that impair habitat value and nullify the investments in habitat improvements; and,

c) Inability to manage the opposing riverbank can prevent access to the channel for research and monitoring on habitat areas. Likewise, a change in ownership or management on the opposing bank may prevent access to established, long-term, monitoring and research sites.

The channel bank length owned and protected is a useful general descriptor, but is not in all cases synonymous with site security for whooping cranes. The length of protected bank does not account for the quality or usability of the channel habitat, or for the width of buffer along the river property. For example, the channel may be too narrow to be attractive to whooping cranes, or the width of land owned might not be sufficient to preclude development that affects channel use. In cases where a single bank is owned or managed, land use changes or disturbance features on the opposing channel bank can occur. Land ownership also does not protect cranes from disturbance by watercraft (e.g. airboats, canoes, etc.).

**Table VI-B3. Approximate length of bank, and acreage, on the primary channel of the Platte and North Platte rivers that is owned or controlled for crane habitat conservation. River segments within designated critical habitat reach are shaded.**

| | **Miles of River Bank** | | | |
|---|---|---|---|---|
| *River Segment* | **Single Bank** | **Both Banks** | **Acres** | **Entity(s)** |
| Platte River | | | | |
| Chapman to Highway 34 | 0 | 0 | 0 | |
| Highway 34 to Highway 281 | 0 | 0 | 0 | |
| Highway 281 to Alda | 4.0 | 1.8 | 4,711 | PRT |
| Alda to Wood River | 3.0 | 1.4 | 2,496 | PRT/TNC |
| Wood River to Shelton | 1.1 | 0.6 | 0 | PRT/TNC/NGPC |
| Shelton to Gibbon | 1.6 | 0 | 0 | PRT |
| Gibbon to Highway 10 | 2.2 | 2.0 | 1,603 | NAS |
| Highway 10 to Kearney | 3.2 | 0.5 | 1,184 | TNC/WWDC |
| Kearney to Odessa | 0 | 0 | 0 | |
| Odessa to Elm Creek | 0.6 | 1.6 | 1,325 | PRT/TNC/NGPC |
| Elm Creek to Overton | 0 | 0 | 0 | |
| Overton to J2 Return | 0 | 0 | 0 | |
| J2-Return to Lexington | 0 | 1.0 | 80 | CNPPID |
| North Platte to Lexington | 0 | 0 | 0 | |

| | | | | |
|---|---|---|---|---|
| North Platte River | | | | |
| North Platte to Hershey | 0 | 1.0 | 0 | NGPC |
| Total | 15.7 | 8.9 | 11,399 | |

PRT = Platte River Whooping Crane Habitat Maintenance Trust; TNC=The Nature Conservancy; NGPC=Nebraska Game and Parks Commission; NAS=National Audubon Society; WWDC=Wyoming Water Development Commission; CNPPID=Central Nebraska Public Power and Irrigation District.

**Summary of Environmental Baseline for the Elements of Critical Habitat**

The ability of the river to provide functional roosting habitat and feeding habitat in riparian meadows is substantially modified under the environmental baseline. Impaired river processes that most contribute to the adverse modifications are: reduced channel maintenance in the form of sediment deprivation and reduced sediment transport; and depletion of high spring pulse flows that support meadow hydrology. Rapid hourly flow oscillations adversely modify the aquatic characteristics of roost habitat. These factors render Platte River critical habitat less able to support physiological, behavioral, and ecological migration requirements for whooping crane conservation. Flow oscillations may interfere with the normal behavior of whooping crane use of the Platte.

## B3. Contagious Disease

The Whooping Crane Status section (*Status of the Species/Critical Habitat* section, part A) discusses the threat presented by contagious disease in some whooping crane migration habitats. Despite high concentrations of migratory waterbirds, no outbreaks of contagious disease have occurred thus far on the Platte River, and no incidences of deaths or disease contracted from direct use of the Platte River are known to have occurred, perhaps due to the lotic (flowing water) environment. Some waterfowl using sand and gravel mine ponds (excavated pits on the valley bottom that fill with groundwater) in the central Platte River valley did die from disease during the 1996 spring migration (Schroeder 1996). However, these birds likely moved to the Platte River valley area from the Rainwater Basins when disease outbreaks were occurring at the time.

Since the mid-1970s (springs of 1975, 1979, and 1984), 15 whooping cranes have been hazed from palustrine wetlands in the Rainwater Basin area where avian cholera outbreaks have occurred. On one of those occasions, seven hazed birds settled on the Platte River before resuming their migration.

## B4. Platte River Recovery Goals

Our recovery plan for the whooping crane calls for several habitat conservation efforts that apply either directly or indirectly to the Platte River. To identify, protect, and manage habitat (explicitly including migratory stopover habitat) is a primary conservation objective of both the *Canadian National Plan for the Recovery of the Whooping Crane* (Edwards et al. 1994) and the *U.S. Whooping Crane Recovery Plan* (USFWS 1994g).

Key sections of the stepped-down U.S. Recovery Plan relevant to Platte River habitat conservation are:

Section 1. Increase the AWBP Aransas-Wood Buffalo Population
- 11. Monitor Movements
- 12. Reduce mortality
- 13. Restrictions on detrimental human activities
- 14. Identify, protect, and create habitat.
  - 141. Identify essential habitat
  - 142. Protect habitat
  - 143. Manage habitat
    - 1432. Manage vegetation
    - 1433. Maintain suitable riverine roosts

In particular, Task 1433 refers to:

> *"…maintaining suitable roosting habitat on the Platte River, Nebraska, or on other rivers used by migrating cranes, by ensuring adequate flows that provide quality roosting habitat and are necessary for scouring invading cottonwoods and willow from the riverbed. Mechanical and chemical control of invading trees may also be required. Purchase or lease of land bordering key roosts may be necessary to protect the sites from human disturbance."*

Lutey (2002) presents detailed recovery objectives for the whooping crane that are pertinent to the Platte River and have been accepted by the Service. These objectives are to provide habitat sufficient to support all cranes in the AWB population.

Habitat conservation areas are specified as contiguous areas sufficient in size to be attractive, and sufficient in size and distribution to be detectable to cranes crossing at any location along the central Platte River. Existing channel habitat, and ecological processes that sustain the structure and function of habitat are also to be maintained. Crane authorities have endorsed the Block/Segment habitat recovery concept described by the Platte River Management Joint Study, Biology Workgroup (1990) for areas of 2,500 to 3,500 contiguous acres of high quality habitat in each of ten bridge segments from Lexington to Chapman (Lutey 2002).

# *C. Interior Least Tern and Piping Plover Status in the Action Area*

## C1. Status of the Species in the Action Area

No nesting records for least tern or piping plover exist in the action area in Wyoming or Colorado. An adult piping plover was, however, collected during the Warren expedition in Laramie County, Cheyenne, Wyoming in 1892.

In the action area in Nebraska, least tern and piping plover nesting has been documented throughout the Platte River basin. Nesting has occurred along the shoreline of Lake McConaughy on the North Platte River, at Lake Minatare on the Interstate Canal system, on the river and at sandpits along the South Platte River, and sandpit and riverine sites along the entire Platte River, and records are included in Appendix F.

Selected recent (1992-2004) piping plover and least tern nesting information is provided in Appendix G. Note that these data are presented for illustration only, to provide examples of relative use of nesting sites in the action area. The data come from several sources and were collected using a variety of methods for a variety of purposes (Lingle 2004, CNPPID and NPPD 2005). Some disparities exist among least tern and piping plover nesting data contained in the databases of various agencies, and these differences need to be reconciled. These data do indicate, however, that channel nest sites in the Platte River between Lexington and Chapman produce fewer fledged plovers and terns than do other sites in the study area.

While population survey efforts were incomplete and sporadic prior to the listing of least tern and piping plover, numerous authors have written about the least tern and piping plover specifically within the action area in Nebraska. These include Atkins (1979), Corn and Armbruster (1993a,b), Currier and Lingle (1993), Dinan (1985), Dinan et al. (1993), Ducey (1981, 1982, 1984, 1985, 1989), E.A. Engineering (1988), Faanes (1983), Fannin and Esmoil (1993), Kirsch (1992, 1993a,b,c, 1996, 2001), Kirsch and Lingle (1993), Lackey (1994, 1997), Lingle (1988; 1993a,b,c, 1999), Lingle and Sidle (1993), McDonald and Sidle (1992), Moser (1940), NRC (2005), Plettner (1993, 1997), Peyton (1997), Plettner and Jenniges (1999), Sidle (1993), Sidle et al. (1989), Sidle et al. (1991), Sidle et al. (1992), Sidle et al. (1993), Sidle and Kirsch (1993), Wilson (1991), Wilson et al. (1991), Wilson et al. (1993a,b), Wingfield (1993), and Wycoff (1950, 1960). In addition, NPPD and CNPPID, collectively referred to as the Districts, submit annual reports of nesting activity on their managed lands.

Kirsch (2001) reviewed past survey efforts between 1987 and 1999 for least terns and piping plovers in Nebraska, and found extremely few terns or plovers on the South Platte River. Virtually no birds occur on sandpits along the South Platte River; and the number of terns and plovers averaged 2.4 and 1.5 respectively, on adjacent riverine sandbars.

When considering the state of Nebraska as a whole, Kirsch (2001) concluded that neither least terns nor piping plovers have reached, or were on track to reach, stated recovery goals. Trends for both species were negative in the important nesting areas of the central and lower Platte River. On a habitat level, least terns were declining significantly on sandpits, and piping plovers were declining significantly on riverine sandbars. Kirsch (2001) noted that although declines are occurring on sandbar habitat statewide, terns and plovers do not appear to be switching to sandpit habitat to compensate.

The NRC (2005) conducted elementary population viability analyses for interior least terns and the NGP population of piping plovers. The models were based on a series of assumptions about population structure and other population parameters, and predicted the probability of persistence of least terns and piping plovers on the Platte and Loup rivers for 200 years (assuming isolation of that subpopulation). Results indicated that, under current conditions, an isolated population of 920 least terns nesting along the Platte and Loup rivers (the combined recovery goals of those areas) would have a poor probability of persisting. Similarly, under present conditions, the models predicted a low probability of the piping plovers persisting along the Platte and Loup rivers, and that the loss of that piping plover subpopulation would have a measurable affect on regional metapopulation persistence. However, because all modeled piping plover populations are declining, the effect is slight. The NRC (2005) noted that the results of the models should be viewed as hypotheses for testing, and that the resolution and predictive power of the models would increase as more data on population parameters becomes available.

The NRC (2005) concluded that baseline habitat conditions on the central and lower reaches of the Platte River affect the likelihood of survival and recovery of the NGP population of piping plovers, and that recovery of the population requires a reversal of present trends by rejuvenation of a more natural regime of river flows, sediment processes, vegetation, and channel morphology. The NRC (2005) also concluded that, for the same reasons, the current habitat conditions on the Platte River are likely to affect the likelihood of survival and recovery of the interior least tern. Until the recovery goals for this area are met, the recovery goals for the entire listed entity will not be met.

Lake McConaughy:

Lake McConaughy is a large irrigation water storage reservoir on the North Platte River, and the amount of nesting habitat along the shoreline varies annually and seasonally with fluctuating lake levels (Ferland and Haig 2002). Kirsch (2001) reported that Lake McConaughy has not been a significant nesting area in Nebraska for least terns, as an average of only 11 least terns nested there annually between 1987 and 1999. In 2005, 18 least tern nests produced 17 fledglings (chicks reaching flight stage) (CNPPID and NPPD 2006).

Shoreline habitat along Lake McConaughy has, however, proven important for piping plovers (Appendix G). Ferland and Haig (2002) noted that the number of piping plovers nesting along the shoreline fluctuate, but remained reasonably stable during the international census years of 1991, 1996 and 2001. In 2001, 73 adult piping plovers were counted along the shoreline, representing 24 percent of the 308 adults counted in Nebraska during the international census (Ferland and Haig 2002). The number of piping plovers nesting at Lake McConaughy increased sharply since 2002, in response to record low lake levels and increased exposed beach habitat (Appendix G). In 2005, 195 plover nests were initiated, and 281 chicks were observed to reach flight stage (down from 371 chicks fledged in 2004)(CNPPID and NPPD 2006, FEIS 2006). As the exposed beach has become more vegetated, available nesting habitat closer to the beach is more accessible to the public, resulting in reduced plover production (Mark Peyton, pers, comm.

2006). In addition, Kirsch (2001) warns that high fledging success rates need to be supported by better documentation of methodology.

Upper and Central Platte River:

NPPD manages six nesting sites for least terns and piping plovers. These six sites include three sandpits and three constructed islands. The CNPPID's relicensing conditions included the continued management of two sandpit sites, and a third constructed site just upstream of its diversion dam near the confluence of the North and South Platte rivers. All of these locations are managed as nesting sites for least terns and piping plovers. Least tern and piping plover nesting at these managed sites is included in Appendix G.

Ferland and Haig (2002) noted that despite such intensive management of some sandpits and artificially created sites in the river, the 1991, 1996, and 2001 International Census' indicate piping plover numbers in the central Platte are declining. In 2001, numbers of piping plovers in Nebraska indicated an 18 percent decline from 1996, and a 23 percent decline from the 1991 census count. Results of the census in the Platte River basin are included in the species status sections of this biological opinion.

Kirsch (2001) reported that between 1987 and 1999, an average of twenty-three least terns and seven piping plovers nested on sandpit habitat in the upper Platte River, as opposed to an average of three terns and two plovers on riverine sandbars. In the upper Platte River, most birds nest on sandpits because the river channel is extremely degraded. The CNPPID manages the sand and gravel dredge pile at its diversion dam near North Platte and Koch's sandpit at Cozad (Peyton and Wilson 2001).

A separate survey effort has been established specifically for the central reach of the Platte River as part of the monitoring and research component of the future Program. Since initiation of the annual surveys in 2001 no least terns and piping plover nesting attempts have been recorded on riverine habitat between Lexington, Nebraska and Chapman, Nebraska. Nesting of least terns and piping plovers on sandpits in this reach of the river is presented in Appendix G.

Lower Platte River:

Although natural sandbar habitat exists along the lower Platte River, least tern and piping plover numbers are declining when both riverine and artificial habitats are considered together (Kirsch 2001). The decline is significant for least terns on sandbars but not on sandpits. The decline for piping plovers, however, is not significant on sandbars, nor is the increase on sandpits significant. From 1987 to 1998, the number of terns averaged 290 on sandbars and 112 on sandpits, while the average number of plovers on sandbars was 72 and 33 on sandpits. Kirsch (2001) calculated that least tern productivity on the lower Platte River between 1987 and 1990 was not high enough to maintain the population long term. Likewise, fledging success estimates for piping plover were far below that needed to sustain a plover population as modeled by Ryan et al. (1993). Kirsch (2001) suggested that the fledging rate for plovers was even too low to maintain the observed negative trend. Sandpits do not provide the full complement of essential elements for tern and plover reproduction, and is not a suitable substitute for riverine nesting habitat (NRC 2005).

## C2. Factors Affecting Species in the Action Area

Decline in Availability of Riverine Nesting Habitat:

As discussed above, water resource development in the Platte River basin has been extensive, resulting in reduced peak and annual flows, reduced sediment load and transport, and resulting changes in river plan form that allow the vegetation of formerly active river channel (Murphy et al. 2004, FEIS 2006). Within the action area, open sandbar habitat along the Platte River between North Platte and Grand Island has largely disappeared as a result of these changes (Eschner et al. 1981, Sidle and Kirsch 1993, Sidle et al. 1989 and 1992, Williams 1978, Currier et al. 1985, Lyons and Randle 1988, Murphy et al.2004, NRC 2005, FEIS 2006).

The current lack of riverine nesting in the central Platte River adversely affects the least tern and piping plover. The NRC (2005) concluded that current conditions in the central Platte River, including the lack of hydrological conditions necessary for development and maintenance of nesting habitat "… appear to be compromising the continued existence – that is, the survival – of the NGP population of the piping plover." (p199). The NRC (2005) further stated that loss of habitat along the river appears to be forcing birds to use alternative sites that are less secure from predators and other sources of disturbance.

Periodically, flooding of sufficient magnitude to scour perennial vegetation off sandbars and form new barren sandbars does occur. However, sandbars that develop under current hydrologic conditions in the central Platte River are typically small and low in elevation. These sandbars are frequently overtopped even by minimal flow changes that occur throughout the nesting season, and are unsuitable for nesting under current conditions (Sidle et al. 1992). An aerial videography study conducted by Ziewitz et al. (1992) documented moderately vegetated sandbars and sandbars that were slightly exposed in the central Platte River. The differences between the central and lower reaches of the Platte River were readily apparent. In the central Platte River, mean nest elevations were lower than the mean sandbar elevation, which was the opposite of the relative elevations observed on the lower reach (Ziewitz et al. 1992). Little suitable nesting habitat was observed in videos taken of the central reach of the Platte River (Ziewitz et al. 1992).

To some degree, flooding of nests is a natural phenomenon to which least terns and piping plovers have adapted through re-nesting and other reproductive strategies (Sidle et al. 1992, Kirsch and Sidle 1999). However, habitat changes along the Platte described by Eschner et al. (1981), Sidle et al. (1989), USFWS (1981), and Williams (1978), have occurred faster than flora or fauna have been able to adapt. Water resource development has taken place at a substantial rate, as has the narrowing and forestation of the Platte River. The effects of groundwater withdrawal have also contributed to degradation of in-channel and floodplain habitat. Releases from the J-2 Return near Lexington exacerbate flooding when coupled with local thunderstorms (Lingle 1993b). Under current channel conditions, many releases from upstream water control structures can result in flooding, and further exacerbate natural flooding events.

Although riverine nesting habitat in the central Platte River is limited, the lower Platte River still functions somewhat naturally. The character of the Platte River changes notably at Columbus, where the Loup River enters the Platte River. The river channel is wider, and larger, higher sandbars are present. The Loup and Elkhorn rivers still provide enough flow to the lower Platte River to support sediment transport, sandbar dynamics, and vegetation scouring (Rodekohr and Engelbrecht 1988, Sidle et al. 1992). As a result, the lower Platte River still offers habitat-forming spring flows which scour vegetation and maintain sandbars, and lower but continuous summer flows to isolate sandbars from mammalian predators and human disturbance and ensure the availability of forage. Sidle et al. (1992 and 1993) documented before and after conditions of such a flood using aerial videography. During the 1990 nesting season, flows in June jumped from 6,215 cfs (176 cms) to 32,182 cfs (911.3 cms) at the North Bend gauging station. At the Louisville gauge (below the mouths of the Loup and Elkhorn rivers), flows increased from 5,368 cfs (152 cms) to 60,505 cfs (1,713.3 cms) between June 13 and June 17. Flows returned to pre-flood levels within a few days, and Sidle et al. (1992 and 1993) reported extensive egg and chick mortality. They also reported woody vegetation being scoured from islands and banks, and an 83 percent increase in barren sandbar area once flows dropped. Periodic scouring flows can result in mortality, but are necessary to maintain sandbar habitat. In addition, the lower Platte River floodplain supports sand and gravel mining as does the central reach, and terns and plovers also nest on these artificial sites.

<u>Riverine Foraging Habitat:</u>

Least terns forage on small fish, including minnows and early life stages of larger fish. Fish surveys conducted in the central Platte River since the late 1930s have documented a fish community dominated by minnows (Johnson, 1942; Morris, 1960; Bliss and Schainost, 1973; and Chadwick et al., 1997), which is typical where available aquatic habitat is primarily shallow, open water (Cross and Collins, 1975 and Pflieger, 1975). Species composition of the minnows in the central Platte River was consistent between 1990 and 1995, and minnows represented between 33.3 and 57.9 percent of the species collected over the 6-year period (Chadwick et al. 1997). However, the species composition of minnows changed between collections in 1939 (prior to Kingsley dam closing) and 1996, and only 18 (64 percent) of the total 28 species collected in 1939 were also collected in 1996 (Goldowitz 1996a).

Periodic low summer flows, coupled with high temperatures, are believed to be a critical factor in determining the abundance and diversity of the central Platte River forage fish community. Between 1974 and 1996, there were 23 reported fish kills occurring between May and September in the central Platte River (Nebraska Game and Parks Commission (NGPC, unpublished data, 1997). Fish kills occurred in 57 percent of the 23 years. Goldowitz (1996b) demonstrated that fish kills were highly likely in other years but not documented. Most of the reported fish kills (92 percent) occurred in the central reach of the Platte River between Cozad and Columbus. High water temperatures (>32 °C) and low flows were observed for many of the kills.

During the summers between 2002 and 2005, inclusive, large segments of the central Platte River dried completely for a month or more. Obviously, the availability of forage fish in dewatered areas of the river is non-existent under those conditions, but the long-term impact on the fish community in the central Platte River from repeated dry channel conditions is not known. During dry conditions, the moist areas of sandbars used for foraging by piping plovers are also absent. However, no studies have been conducted to demonstrate whether, when flows are present in the river, the availability of forage fish and invertebrates in the central Platte River is insufficient to support tern and plover nesting in the river. The Program's IMRP will investigate whether the distribution, abundance, and composition of the aquatic fish community and the invertebrate food base are adequate for the least tern, and piping plover, respectively, and if inadequate, what factors are limiting.

Presence and Management of Artificial Habitat:

The elimination of riverine nesting habitat in the upper and central reaches of the Platte River has forced nearly all of the nesting to occur on sandpits adjacent to the river (Ferland and Haig 2002). While some have suggested that plover numbers could be maintained in central Platte River at the managed sandpits, census results for this reach between 1991 and 2001 indicated a declining piping plover population, despite the intensive management at sandpits and other managed sites (Ferland and Haig 2002). Additionally, the piping plover recovery plan does not consider artificial breeding sites as essential habitats for the piping plover (Haig et al. 1988), and NRC (2005) states that "…artificial habitats cannot provide the full complement of essential habitat requirements for piping plovers over the long term and therefore cannot substitute for riverine habitat." (page 198). Nevertheless, managed sandpits along the central Platte River may serve to maintain species distribution while efforts to improve riverine habitat conditions are implemented.

Nesting success varies greatly between managed and un-managed pits. Nests at un-managed locations are often completely lost as a result of predation and human disturbance, while productivity at sandpit colonies managed by NPPD and CNPPID has been good (Jenniges 2002). Fledge ratios reported by CNPPID and NPPD (2005) between 1992 and 2003 for Koch's managed sandpit have ranged from 0.33 to 2.33, with an average of 0.98 fledged chicks per pair. Of the eight years (1992-1999) of nesting at Kirkpatrick's sandpit, the fledge ratio ranged from 0 to 1.67, with an average of 0.79 fledged chicks per pair. Johnson sandpit, managed by NPPD, supported a fledging ratio of 1.33 fledglings per nest between 1991 and 2002. Also managed by NPPD, the Lexington and Blue Hole sandpits supported a fledge ratio per nest of 1.72 and 2.32, respectively. Measures taken at managed sandpits are often extensive and may include predator fencing around individual nests, fencing around the colony, predator removal, herbicide spraying, discing, burning, signs, and public-relations efforts.

Unmanaged sandpits typically have significantly lower fledge ratios. Nest and chick loss caused by direct and indirect disturbances at sand pits in Nebraska have been reported by many researchers, including Kirsch (1990, 1992), Lackey (1994), and Lingle (1988). Lackey (1994) found that hatching success for protected tern nests was 76 percent compared to 34 percent for unprotected nests. Similarly, fledging at protected sites was 0.76 least tern fledglings per nest, versus 0.30 least tern fledglings per nest at unprotected sites. Piping plover success was also higher at protected locations. Lackey (1994) reported a 67 percent hatching success at protected sites, as compared to a 47 percent at unprotected sites. Likewise, she reported fledging success as 0.71 fledglings per nest when protected by fencing and exclosures, compared to 0.44

fledglings per nest at unprotected nests. Approximately 1526 acres of sand and gravel area occurs along the central Platte River under present conditions (Friesen et al. 2000). Three sandpit sites are managed by NPPD and three are managed by CNPPID.

Data in Appendix G could be interpreted as indicating that other sites (e.g., Lake McConaughy and sandpits) provide adequate nest resources for plovers and terns. While important, nonchannel sites do not produce enough young birds to meet population recruitment needs. For example, piping plovers in the Northern Great Plains declined 15 percent from 1991 to 2001, while Nebraska plovers declined 25 percent during the same period (National Research Council, 2005). The National Research Council reviewed existing information on plover and tern populations in the Northern Great Plains and Nebraska, and commented on the importance of channel nesting in the central reach of the Platte River:

> *"The committee [Committee on Endangered and Threatened Species in the Platte River Basin] also concluded that suitable habitat characteristics along the central Platte River are essential to the survival and recovery of the piping plover and interior least tern. No alternative habitat exists in the central Platte that provides the same values essential to the survival and recovery of piping plovers and least terns. Although both species use artificial habitat (such as shoreline areas of Lake McConaughy and sandpits), the quality and availability of sites are unpredictable from year to year." (National Research Council, 2005, page 203).*

Least terns did not choose either sandpit or riverine nesting habitat over the other; birds may simply use the area of bare sand and proximity to other resources when selecting a colony site (Kirsh 1996). Kirsch (1996) also proposed that terns should not prefer one habitat above another when habitats are equally suitable, if the species has had time to evolve with and respond to new habitats. Under the theory of natural selection, if habitat changes occur rapidly and suitability is severely reduced, animals cannot respond effectively to the change (Kirsch 1996). Therefore, despite colonization of sandpits, it is too early in the process of natural selection for us to make a determination if one habitat is biologically superior to another. Regardless, birds nesting at sandpits continue to visit and use the river channel. Sandpit nesting birds continue to be bound to the river for forage, so sandpits should not be considered as independent habitats until this relationship can be thoroughly investigated.

Hydrocycling:

Current hydrocycling operations may affect ephemeral sandbars suitable for nesting, forage fish for least terns (Auer 1996, Gore et al. 1989, Poff and Ward 1989, Scheidegger and Bain 1995), and the invertebrate food base for the piping plover (Gersich and Brusven 1981, Gislason 1985, Zhang et al. 1998). Some form of hydrocycling is anticipated to continue in the central Platte River. Discussions are currently underway with CNPPID to develop an agreement on modified hydrocycling operations to avoid or minimize effects to listed species and Program benefits. The Program's IMRP will investigate whether the distribution, abundance, and composition of the aquatic fish community and the invertebrate food base are adequate for the least tern, and piping plover, respectively, and if inadequate, what factors are limiting.

Piping Plover Critical Habitat in the Action Area:

Critical habitat was federally designated for the northern Great Plains population of the piping plover on September 11, 2002. The reach of the Platte River from Lexington to the confluence with the Missouri River was included as part of that designation of critical habitat. Only habitat within the river channel was included in the designation, which did not include any adjacent cropland or sandpit areas. When considering the entire United States northern Great Plains/Prairie Canada population, 7.2 percent of the birds were found in the Platte River basin in 2001.

In response to a lawsuit brought by a consortium of water users in Nebraska (i.e., the Nebraska Habitat Conservation Coalition), an October 13, 2005 court ruling vacated the Nebraska portion of the piping plover critical habitat designation, and remanded that portion to the Service for redesignation. If the Service redesignates critical habitat for the piping plover within the action area, reinititation of consultation on the effects of the Federal action to designated piping plover critical habitat will be necessary (50 CFR § 402.16).

## *D. Pallid Sturgeon*

### D1. Species Status in the Action Area

The lower Platte River, downstream from the confluence with the Elkhorn River, provides some of the least degraded pallid sturgeon habitat in the central part of the species' range. At the same time, the pallid sturgeon habitat provided by the Platte River has been greatly altered and reduced by the effects of water resource development and bank stabilization. In other words, the lower Platte River, while clearly less impaired than the Missouri River, is still substantially degraded. It is not currently known if this lower Platte River habitat has reached dynamic equilibrium, or if it continues to degrade as a result of existing human alterations to the system.

The importance of the Platte River to pallid sturgeon recovery is evident within the context of the species range as a whole. The species range consists largely of three divisions: a) the upper range, upstream of Gavins Point Dam (the lowest of the mainstem Missouri River dams); b) the middle range, between Gavins Point Dam and the confluence of the Missouri and Mississippi rivers; and c) the area between the Missouri/Mississippi confluence and the Gulf of Mexico. As discussed in the pallid sturgeon "Status of the Species" section of this biological opinion, the pallid sturgeon population in the upper portion of the species range exhibits little or no recruitment, and the population in the lower portion of the range suffers from a high degree of hybridization with shovelnose sturgeon. The middle portion of the pallid sturgeon's range (which includes the lower Platte River), contains degraded habitat conditions, but there is also evidence of recent reproduction in this portion of the range, and considerably lower rates of hybridization than is exhibited in the lower range. If habitat restoration occurs, the middle section of the species range may show the greatest overall potential for maintaining the continued existence, and eventual recovery of the species.

Within the degraded middle section of the pallid sturgeon range, the Platte River contains the most intact remaining habitat in terms of hydrology and physical habitat, even though those characteristics have declined significantly due to water resource development in the upper and central Platte River basin. The density of capture records in the lower Platte River and Missouri River confluence area supports this value to the species. Of 43 occurrences of pallid sturgeon reported in the lower Missouri River basin (downstream from Gavins Point Dam) in Nebraska from 1979 through 2001, 23 are from the Platte River, Elkhorn River, or the Missouri River near the Platte River confluence (Table V-D1). Thus, 53 percent of the observations in Nebraska are from an area representing about 10 percent of the species range.

The Platte River is the only tributary below Gavins Point Dam that originates in the Rocky Mountains and delivers runoff from mountain snowmelt to the lower basin. As such, while substantial water resource development has significantly altered the hydrograph of the lower Platte River, it continues to retain a semblance of the seasonal flow patterns indicative of Great Plains rivers receiving mountain snowmelt. A review by the National Research Council (2005) found that the lower Platte River remains the habitat with a flow regime most similar to the original, unaltered habitat of pallid sturgeon. In addition, capture records suggest that the Platte

River may be used for reproduction, the critical link to continued species persistence and recovery.

Several factors suggest that the Platte River may, under certain conditions, provide the features necessary for reproductive use by pallid sturgeon. Captures are concentrated during the period when pallid sturgeon are believed to spawn. From 1979 through 2001, 19 of the 23 captures of pallid sturgeon in the Platte or Missouri rivers near the Platte River confluence occurred during April, May, and June; the remaining occurrences were in July and September of 1999. Twenty of the 23 occurrences correspond with years when flows in the lower Platte River were above normal for the recent period (Louisville gauge, 1970 to 2001). Such spring high flow conditions are particularly important for pallid sturgeon, as these conditions are believed to act as a cue to staging and spawning behavior. Further, *Scaphirhynchus* sturgeon larvae have been collected in the lower Platte River in 1996, 1998 and 1999, 2000, 2001, and 2002. However, these larvae have been too young to positively identify to species (Reade 2001, NRC 2005). Finally, researchers captured and implanted a radio-transmitter into a gravid female pallid sturgeon near Louisville, Nebraska in May 2001. This fish remained in the lower Platte River for more than a month before moving back to the Missouri River (NRC 2005). A second pallid sturgeon without evident reproductive products (i.e., possibly post-spawning) was implanted with a transmitter in May 2002. This fish moved consistently downstream, leaving the lower Platte River within six days. The downstream movements of both fish coincided within a week of the time that sturgeon larvae were collected in the lower Platte River (NRC 2005).

## D2. Factors Affecting the Species in the Action Area

Even though the Platte River provides the most intact hydrographic and morphologic habitat in the highly degraded middle section of the species range, it has also been substantially altered. Spring flows in the central Platte have greatly declined since the early 1900s (Williams 1978, Eschner et al. 1983, Murphy et al. 2004, FEIS 2005). The depletion of flows in the upper Platte River basin alone accounts for an approximate 35 percent decrease in May and June flows in the lower Platte River. This reduction in flow results in substantially weaker spawning cues, and a significantly reduced capacity to form and maintain macro-bedforms used by pallid sturgeon. The NRC (2005) found that high water temperatures and loss of habitat connectivity during years of low discharge may be important factors limiting the use of the lower Platte River by pallid sturgeon. The lower overall flows in the river magnify the effect of hydropower peaking operations in other tributary basins to the lower Platte River. This is due to the lower total volume of flow in the river, causing the diurnal variation in flows to account for a greater percentage of the total flows in the river, accentuating their proportionate effect. These types of river operations have been found to have a negative effect on lake sturgeon (*Acipenser fulvescens*) spawning (Auer 1996). Faanes (1992) estimated that other proposed projects in the upper Platte River basin would decrease the remaining flows delivered to the central Platte River by an additional 75 percent.

The exposure and effects of environmental contaminants to pallid sturgeon in the lower Platte River was evaluated by using shovelnose sturgeon as a surrogate species (Schwarz et al., 2006). Gross observations and condition indices seem to indicate that shovelnose sturgeon from the lower Platte River are healthy; however, histological examination of the gonads and reproductive biomarkers revealed potential reproductive impairment as indicated by ovicular atresia, abnormal estrogen to testosterone ratios, and high concentrations of vitellogenin in males. Contaminants detected in shovelnose sturgeon at concentrations of concern included PCBs, selenium, and atrazine. The report concluded that these contaminants may be adversely affecting sturgeon reproduction in the lower Platte River and that pallid sturgeon may be especially at risk to these contaminants because they have a more piscivourus diet, greater maximum life-span, and a longer reproductive cycle than shovelnose sturgeon.

While the lower Platte River still provides some of the least impacted (in a relative framework), and therefore some of the highest potential remaining spawning habitat in the pallid sturgeon's range, it is the only area in the species range that is directly impacted by hydropower peaking operation on a regular basis. Hydropower peaking operation is the operation of hydropower generating facilities to concentrate power generation into certain timeframes, which in turn results in rapid, large magnitude, sub-daily flow fluctuation in the reach below the generating facility (in this case from a project operating with water diverted from the Loup River and returned to the Platte River). Median 24-hour changes in flow at Louisville range from 650 to 3,000 cfs per day, or 16 to 46 percent of the median monthly flow rate (USFWS 2002b). The cumulative effects from hydropower peaking operations to the fisheries and aquatic community as a whole may adversely affect the pallid sturgeon's foodbase. In addition, increased erosion of sandbars may have a direct adverse impact to sandbar complex habitats used by pallid sturgeon. Potential effects of hydropeaking on sturgeon and fish communities in general is discussed in detail in the pallid sturgeon "Status of the Species" section of this biological opinion.

While the NRC (2005) found that current conditions in the lower Platte River do not adversely affect the likelihood of survival or recovery of the pallid sturgeon, it concluded that the loss of lower Platte River habitat would probably result in a catastrophic reduction in the pallid sturgeon population. The NRC further concluded that any recovery effort for the pallid sturgeon will of necessity include the lower Platte River.

In summary, the lower Platte River is highly important pallid sturgeon habitat in a part of the range that the Service believes is crucial to the species continued existence and ability to recover. At the same time, the lower Platte River is degraded in its ability to serve its apparent habitat function due to the effects of water resource development in the basin, the majority of which has occurred in the upper parts of the basin, and further degradation of this habitat would likely be catastrophic to the species.

# *E. Bald Eagle*

## E1. Status of Species in the Action Area

<u>Colorado:</u>

There are 87 bald eagle nest sites in Colorado, 79 of which are considered active (a site is considered active if it has had known occupancy in the last five years). Roughly 75 percent of known active sites are occupied in any given year so the Colorado Division of Wildlife (CDOW) believes that around 60 sites are currently occupied in Colorado. The breeding bald eagle population has increased substantially over the last 30 years, and the increase appears to be continuing. In 1974 there was one known nesting pair in the state. By 1989 the number of nesting pairs had increased to 10, and then 14 by 1994. In the following five years, the known breeding number doubled to 29 in 1999, and has doubled since then. The number of known breeding sites has increased by 16 in the past three years. Roughly one-third of the breeding sites are found east of the Continental Divide within the South Platte River watershed. The recent success rate of monitored nests is near 70 percent with 1.19 young fledged per occupied site (Brent Bibles [CDOW] personal communication 2005).

There are 12 nesting pairs of bald eagles on the upper reach of the South Platte River and its tributaries (all but one of the nests are on the tributaries). On the lower reach of the South Platte River, there are an additional 12 nesting pairs that are within the river corridor. Eagle nests are increasing and expanding eastward along the South Platte River (Kirstie Bay [CDOW] personal communication 2005).

In the South Platte River drainage, annual midwinter bald eagle surveys are conducted from Denver to the Nebraska State line. CDOW has conducted aerial midwinter counts of bald eagles since 1981. The number of wintering eagles increased steadily through the 1980s from the low count of 418 eagles in 1981 to the early 1990s. Since 1992, the number of wintering eagles has varied substantially, but has not shown any apparent trend, averaging 887 eagles, ranging from a high count of 1,235 in 1994 to a low count of 595 in 2001 (Brent Bibles [CDOW] personal communication 2005).

<u>Nebraska:</u>

In 1991, an active bald eagle territory was discovered on the lower Platte River near Valley, Nebraska (Farrar 1991), the first nest recorded in Nebraska in approximately 100 years. Although the lone adult hatched one young, the eaglet did not successfully fledge. In 1992, the first documented successful nesting and fledging of young eagles in Nebraska since the late 1800s occurred in Sherman County. By 2004, the number of active nests in Nebraska had increased to 35, located in 28 counties (Dinan 2005). Of the 35 active nests, monitoring was sufficient to document the outcome of 32 nests which fledged 60 young. Since 2004, 308 young have been fledged in Nebraska (Dinan 2005).

Nesting birds located within the action area on the North Platte River include a nesting pair on Lake Alice in Scottsbluff County (Dinan 2005). Lake Alice and the surrounding uplands are protected as part of the North Platte National Wildlife Refuge (NWR) complex. The lakes of the North Platte NWR are fed by the Interstate Canal, which is managed by Reclamation. Additional eagle nests potentially affected by the Federal action include a nest on the North Platte River near the Bayer Bridge in Morrill County and seven active nests along the lower Platte River in Cass, Dodge, Douglas, Merrick, Platte, and Saunders counties. A once active nest near Odessa in Buffalo County collapsed in 2003 and was destroyed (Dinan 2005).

Studies of wintering bald eagles and their habitat use over the past 20 years have identified the Platte River basin, especially the central Platte River, as a major wintering area for the birds (Vian, 1971; Reclamation, 1981; Lingle and Krapu, 1986; and Stalmaster and Associates, 1990). Three river segments known for high concentrations of wintering bald eagles include: a) the North Platte River, Keystone to Lewellen area including Lake McConaughy and Lake Ogallala, b) the North and South Platte rivers, Maxwell to the Lincoln/Keith county line, including Sutherland Reservoir, and c) the Platte River, Darr to Elm Creek area including Johnson and Elwood reservoirs (NGPC 2005). In 2004, a total of 152, 65, and 202 eagles were observed, respectively, on the North Platte, South Platte, and Platte rivers (NGPC 2005). Table VI-E1 provides annual mid-winter survey for North Platte, South Platte, and Platte rivers since 1990.

In Nebraska, along the Platte River, communal night roosts are within 2 kilometers of the riverbank (USFWS 1978b; U.S. Bureau of Reclamation 1981; Lingle and Krapu 1986). The same roosts are typically used every year and are usually located in areas protected from wind, harsh weather, and human disturbance. A study by the Service (1981) found that the six communal night roosts on the Platte River between Darr and Elm Creek, Nebraska, averaged 60 eagles per night. Currently, there are at least eight communal night roosts on the Platte River between Brady and Grand Island, Nebraska.

Suitable foraging habitat continues to be greatly influenced by the operation of water resource development projects. From mid-October through early December, when the river is generally ice-free, eagles can be found anywhere between Lexington and Grand Island, Nebraska. However, beginning in late December, the weather becomes more severe and the river often freezes between Kearney and Grand Island, Nebraska. Bald eagles then move to a stretch of ice-free river located downstream from the point where J-2 Return flows re-enter the river. Eagles concentrate and forage at this site, and also downstream from Kingsley Dam, where reservoir releases help maintain open water where eagles can easily feed (USFWS unpublished data).

**Table VI-E1. North Platte River, South Platte River, Platte River, and statewide bald eagle totals from the Annual Midwinter Bald Eagle Surveys (NGPC 2005).**

| | North Platte River | | South Platte River | | Platte River | | North, South, and Platte Rivers | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | Total Number | Percent of Statewide Total | Total Number | Percent of Statewide Total | Total Number | Percent of Statewide Total | Total Number | Percent of Statewide Total | Statewide Total |
| 1990 | 160 | 18.7 | 41 | 4.8 | 239 | 27.9 | 440 | 51.3 | 857 |
| 1991 | 125 | 19.5 | 170 | 26.5 | 170 | 26.5 | 465 | 72.4 | 642 |
| 1992 | 49 | 3.8 | 18 | 1.4 | 191 | 14.8 | 258 | 20.0 | 1292 |
| 1993 | 168 | 24.1 | 67 | 9.6 | 106 | 15.2 | 341 | 48.9 | 698 |
| 1994 | 96 | 8.3 | 45 | 3.9 | 249 | 21.4 | 390 | 33.5 | 1163 |
| 1995 | 82 | 10.9 | 41 | 5.5 | 125 | 16.7 | 248 | 33.1 | 749 |
| 1996 | 94 | 13.1 | 25 | 3.5 | 177 | 24.6 | 296 | 41.2 | 719 |
| 1997 | 157 | 15.2 | 40 | 3.9 | 170 | 16.5 | 367 | 35.6 | 1030 |
| 1998 | 145 | 10.1 | 11 | 0.8 | 126 | 8.8 | 282 | 19.7 | 1430 |
| 1999 | 122 | 16.9 | 32 | 4.4 | 112 | 15.5 | 266 | 36.9 | 721 |
| 2000* | | | | | | | | | |
| 2001 | 153 | 13.3 | 14 | 1.2 | 350 | 30.4 | 517 | 44.8 | 1153 |
| 2002 | 212 | 14.6 | 64 | 4.4 | 278 | 19.1 | 554 | 38.1 | 1453 |
| 2003 | 123 | 9.1 | 22 | 1.6 | 189 | 13.9 | 334 | 24.6 | 1358 |
| 2004 | 152 | 13.2 | 65 | 5.7 | 202 | 17.6 | 419 | 36.5 | 1149 |
| 2005 | 98 | 8.8 | 82 | 7.4 | 104 | 9.4 | 284 | 25.5 | 1112 |

* Totals were not provided for 2000 surveys.

Wyoming:

In Wyoming, the bald eagle is found along the North Platte River, most commonly above Seminoe Reservoir for nesting and brood-rearing, with several communal roosts from Seminoe to the Nebraska state line. Surveys conducted by Wyoming Game and Fish Department during April of 2004 found 13 active, occupied nests in the upper North Platte above Seminoe Reservoir (WG&F, 2005, personal communication, Andrea Cerovski, non-game biologist). Active, occupied nests located upstream of Seminoe Reservoir in Carbon County, Wyoming during the 2004 surveys include the following sites identified by WG&F: Seminoe Backwaters, Scout Island, Savage Meadows, Lunt, Rochelle, Baggot Rocks, 1 Bar 11, Monroe, A-A South, Bennett Peak, Rattlesnake Pass, Irving, and Pass Creek at Bryant Slough. Two historical nest sites also exist along the North Platte River downstream from Casper, Wyoming.

A large number of bald eagles winter along the North Platte River from November - March. They concentrate in historically used roosts at night and forage opportunistically over central Wyoming during the day. They make extensive use of the North Platte River and its reservoirs to hunt fish and waterfowl, but also range widely over the sagebrush grasslands in search of winter-killed big game and livestock to scavenge. Foraging on the North Platte River and reservoirs in winter is restricted by availability of open water.

Bald eagles in Wyoming will use Seminoe Reservoir until ice-up and are known to frequent Kortes Reservoir just downstream. The river reach between Kortes Dam and the headwaters of Pathfinder Reservoir is known as the “Miracle Mile” reach of the North Platte River. Bald eagles use this river reach extensively during the winter and commonly are observed perched in cottonwood trees. A major bald eagle winter roost is located in the Pedro Mountain area in close proximity to Pathfinder Reservoir: Pathfinder having the highest concentration of wintering bald eagles of any reservoir managed by Reclamation along the North Platte River (Reclamation, 1981).

The North Platte River from Gray Reef Dam to Glendo Reservoir supports one of the largest wintering concentrations of bald eagles in Wyoming and has been designated by the Service as very high value nationally for wintering and nesting bald eagles (Service, 1988). According to the Midwinter National Wildlife Federation Bald Eagle Survey, the North Platte River supports 50 percent or more of the total wintering bald eagle population in Wyoming. Cottonwood trees along the river are important perch sites and are used as night roosts. Communal bald eagle roosts near the river include Boxelder Creek, Jackson Canyon, Little Red Creek, and Pine Mountain. Roost counts conducted by the U.S. Bureau of Land Management found use of these roosts peaked in the winter of 1984-85, with an average of 43 eagles per count, and a maximum of 70 eagles counted on December 20, 1994 (all roosts combined) (Bureau of Land Management, 1999, personal communication, William Fitzgerald, biologist). Eagles using these roosts hunt for fish and waterfowl along the river and associated reservoirs, hunt in the desert for small game, and scavenge in the desert for winter-killed big game and livestock (Reclamation, 1981). Bald eagles have nested along the river at Edness K. Wilkins State Park and near Caryhurst, although neither of these nests has been active in recent years.

Bald eagles winter in the area of Glendo Reservoir, using the cottonwood trees adjacent to the reservoir for perching and preying on the abundant fish and waterfowl. Bald eagles are common winter residents prior to ice-up in the North Platte River from Glendo Dam to Guernsey Reservoir. The also are common winter residents from Guernsey Dam to the Nebraska State line, feeding on fish and abundant wintering waterfowl in the area (Reclamation, 1981), and the area is recognized for its high resource value by the Service (USFWS 1988c).

## E2. Factors Affecting the Environment in the Action Area

Factors Affecting the Bald Eagle Upstream of Lexington, Nebraska:

The life history of the bald eagle is largely associated with aquatic habitats, as these most often constitute its primary foraging habitat. In Colorado, Nebraska, and Wyoming eagles spend 4 to 5 months on their wintering grounds during a given year (Vian 1971; Lingle and Krapu 1986). Streamflow conditions of the South, North, and Platte rivers are at times inadequate to sustain aquatic habitat necessary for bald eagle prey (i.e., larger individual forage fish and waterfowl). Water depletions could incrementally diminish fish habitat during some periods.

Because of the abundance of wintering eagles along the North Platte, South Platte, and Platte rivers, selected gauges (Table VI-E2) were used to determine effects of the Federal action on flows along these river systems. The months of December through February were identified as the key wintering months for the eagle.

**Table VI- E2. Average monthly flows (cfs) under the present condition (1947-1994).**

| | Dec | Jan | Feb |
|---|---|---|---|
| Above Lake McConaughy | 1,317 | 1,206 | 1,285 |
| North Platte River at Keystone (Below the Sutherland Diversion) | 0 | 5 | 10 |
| North Platte River at North Platte | 371 | 347 | 390 |
| South Platte River at Julesburg | 552 | 734 | 854 |
| South Platte River at Paxton (Below the Korty Diversion) | 209 | 304 | 426 |
| Platte River at Maxwell (Below the Tri-County Diversion) | 201 | 322 | 379 |

Factors Affecting the Bald Eagle in the Central Platte River Habitat Area (i.e., from Lexington to Chapman, Nebraska):

The Service has identified species instream target flows for the months of December through January considered important for wintering eagles and their prey (Bowman 1994). Any new water withdrawals during this period can reduce fishery habitat and affect the species composition, age, and size structure of the Platte River fish community as well as negatively affect waterfowl habitat suitability. In addition, the reduction of high springtime flows has facilitated the gradual loss and fragmentation of wet meadow habitats used by waterfowl on which eagles prey. Conversely, any reduction to target flow shortages, compared to present conditions, would benefit bald eagles.

The availability of large forage fish to bald eagles is dependent upon the frequency of fish kills throughout the year. Low flows and elevated water temperature have frequently resulted in fish kills along the central Platte River. Goldowitz (1996b) reviewed information available regarding Platte River fish kills and examined the relationship between their occurrence and instream flows in the river. Between 1974 and 1995, fish kills in the central Platte River have been reported for 10 of the 22 years, or 45 percent. Goldowitz (1996b) also demonstrated that fish kills were highly likely in other years, but not documented.

The amount of active channel and wet meadow habitats are important to the maintenance of bald eagle prey species, and are used as indices to measure effects of the Federal action on prey availability for the eagles. Under present conditions, there are approximately 9,968 acres of wetted channel in the central Platte River, and approximately 43,035 acres of bottomland grassland, or wet meadows (calculated using 1998 Land Cover GIS [Friesen et al. 2000]).

Factors Affecting the Bald Eagle on the Lower Platte River (i.e., Downstream of Chapman, Nebraska):

Because of the high occurrence of both nesting and wintering bald eagles along the lower Platte River (i.e., below the Loup River confluence), flows associated with food base production in that reach of the river are pertinent to the maintenance of eagle populations in that area. In the lower Platte River during the months of February through July, the mean flows during the wettest third, middle third, and driest third of the period of record were approximately 14,000 cfs, 8,400 cfs, and 5,800 cfs, respectively. The average peak flows during the food base production timeframe (separated by wettest third, middle third, and driest third of the period of record) are approximately 25,800 cfs, 13,800 cfs, and 8,600 cfs, respectively. During the winter (i.e., December and January), the mean flow values for the three driest sixths of the period of record are approximately 3,300 cfs, 4,200 cfs, and 4,700 cfs, respectively, for December and 2,600 cfs, 3,500 cfs, and 4,200 cfs, respectively, for January.

Disturbances to Nesting and Roosting Bald Eagles:

The proximity of adequate night roosts to the other habitats required by wintering bald eagles, such as hunting perches and feeding sites, is important (Steenhof et al. 1980). Freedom from human disturbance is important in communal roost site selection (Steenhof et al. 1980, U.S.

Bureau of Reclamation 1981, Buehler et al. 1991), and continued human disturbance of a nocturnal roost may cause eagles to abandon an area (USFWS 1983b, Buehler 2000).

Bald eagles in the Platte River basin nest from mid-February through mid-August (NGPC, unpublished data). Program activities in close proximity of an active nest could cause adult eagles to discontinue nest building or to abandon eggs (USFWS 1983a, Buehler 2000). Measures adopted by the Program to avoid and minimize Program and non-Program disturbances to known roost and nesting sites will be assessed for effects to roosting and nesting bald eagles.

## *F. Western Prairie Fringed Orchid*

### F1. Status of Species in the Action Area

Published accounts and herbarium records suggest the orchid was widespread and perhaps locally common prior to European settlement (Bowles and Duxbury 1986). Currently, there is no scientific evidence that would exclude Nebraska from the above statement given the continuous, historic habitats available to the orchid (Currier and Davis 2000, Sidle et al. 1989). Historically, the western prairie fringed orchid was reported from 14 counties in Nebraska. Surveys that were conducted since 1994 have identified 80 orchid populations occurring in 15 counties in Nebraska (USFWS Unpublished Data). It is likely that recent discoveries of the orchid populations are probably not the result of expansion of the species range, but of increased interest in the species arising from its listing as a federally-threatened species.

In the Platte River basin, historic populations from the late 1800s and early 1900s were observed in Cass, Dodge, and Kearney Counties (NGPC Unpublished Data). Historical records of the orchid along the Platte River upstream of Kearney County are lacking (Freeman and Brooks 1989). Downstream of Kearney, one distant historical record along the Platte River was documented in June 1891, near Newark, in Kearney County (NGPC Unpublished Data).

The Platte River floodplain was the first large area of Nebraska converted to agriculture. Soon after settlement, irrigation and drainage of fields began changing the moisture regime in the floodplain (Wilson and Bray 1991). The past century has seen drainage, decreased river flows, and development of intensive agriculture in former wet prairies of the river valley. Consequently, little habitat remains that is suitable for the orchid (Sidle et al. 1989). The Interior (1990b) estimated that 112,791 acres of wet meadow had been lost along the North Platte and Platte Rivers in Nebraska from 1938 to 1982.

As a result of basin-wide habitat loss, recent records consist of one orchid population located on Mormon Island Crane Meadows (MICM) in Hall County, Nebraska which was first discovered in 1978. The MICM property is owned and managed by the Platte River Whooping Crane Maintenance Trust, Inc. a non-profit organization. The MICM population occurs on wet meadow habitat adjacent to the Platte River. The initial population survey in 1978 found 50 flowering plants, but the number of plants found in the MICM population during recent surveys has been declining. Recent orchid surveys on the MICM property revealed no flowering or vegetative plants during the 2002, 2003, 2004, and 2005 orchid surveys (USFWS Unpublished Data).

Additional orchid surveys were conducted on 370 grassland sites along the Platte and North Platte rivers during the 1991 flowering season (Wilson and Bray 1991). The surveys discovered 34 sites with potential or marginal habitat, but orchids were only confirmed on the MICM property. Subsequent surveys from 1994 to 1999 have identified three previously undiscovered orchid populations at sites near the Platte River in Sarpy County although sites are not likely to be hydrologically connected to the Platte River (Gerry Steinauer, NGPC, Pers. Comm. 2006). Floodplain habitats along the lower Platte River provide suitable sites for the orchid although no orchids have been observed in recent surveys (Gerry Steinauer, NGPC, Pers. Comm. 2006).

The MICM population is the only extant population within the Great Plains Steppe Province (south-central Great Plains Section) Ecoregion (Figure V-F1). Maintenance of this population is identified in the orchid's recovery plan (USFWS 1996b) as a Priority 2 task. A Priority 2 task is defined as an action that must be taken to prevent significant decline in species population/habitat quality, or some other significant negative input short of extinction). The recovery plan for the species states that the MICM population should be maintained by protective management, including the maintenance of an appropriate hydrologic regime (USFWS 1996e).

The ecoregions that comprised the lower Platte River include the central loess ecoregion, north central glaciated plains ecoregion, and the central dissected till plains ecoregion that are all contained in the larger prairie parkland province (USFWS 1996e). The historic and recent records in Sarpy County occur in the central dissected till plains ecoregion (NGPC Unpublished Data). One historical 1904 record lies in the transition zone between all three ecoregions in Dodge County (NGPC Unpublished Data).

Orchid surveys from 1998 to 2000 have recently documented previously unknown orchid populations in recovery units that contain reaches of the lower Platte River most notably: a) the north central glaciated plains ecoregion; and b) the central dissected till plains ecoregion (Steinauer 1998, 1999, and 2000), but many of the threats at these sites have not abated.

The orchid's recovery plan has set population protection and maintenance objectives for each of the three ecoregions and identified these actions as Priority 2 tasks (USFWS 1996e). One recovery objective for all three ecoregions is the continuation of beneficial land management at existing protected sites. In addition, a second recovery objective was defined for the north central glaciated plains ecoregion and the central dissected till plains ecoregion which is the securing of protective land management at privately owned sites that will protect a minimum of 12 and 245 plants respectively.

### F2. Factors Affecting Environment in the Action Area

The orchid generally occurs in the wetter areas of such prairies or in associated sedge meadows (Sieg and King 1995, USFWS 1996b). Sedge meadows occur in seasonally hydric to wet-mesic conditions and are dominated by perennial cyperaceous taxa, especially sedges (*Carex spp.*) and spikerushes (*Eleocharis spp.*). Wet meadow subirrigation is the dominant factor in plant composition and succession in the central Platte River valley (Henszey et al. 2004), therefore effects of the Federal action on groundwater were evaluated.

Because Platte River discharge and stage are dominant factors influencing groundwater levels in the Platte River valley (USGS, 1964; Hurr, 1983; and Henszey and Wesche, 1993), depletions during the spring contribute to reduced frequency and duration of saturated soil conditions. Depletions contribute cumulatively to flow reductions during the pulse flow season (May and June). This, in turn, influences the frequency and duration of soil saturation. As a result of reduced flows, low-lying prairies and wet meadows near the Platte River have become drier.

Short-term peak flows provide surface water connections to and within riparian meadows that provide for hydrologic conditions required for orchid survival, reproduction, and seed dispersal. Peak flows during late winter, from mid-February to mid-March, occur when plants and animals that inhabit riparian wetlands and backwaters are initiating spring growth and activity including the orchid. The peak flows during early spring elevate groundwater levels and thaw soils and is believed to promote orchid germination and growth. The annual frequency of longer term flows under the present conditions is believed to most directly contribute to maintenance of wet meadows through elevated groundwater levels and soil saturation (see the *Whooping Crane Environmental Baseline* section of this biological opinion for a full description of all wet meadow indicators).

Because of the potential occurrence of orchids in meadows adjacent to lower Platte River reaches, an index of general Platte River hydrology was February through July. Methods used for this analysis reflects methods used to assess food base production for the pallid sturgeon (see the *Pallid Sturgeon Environmental Baseline*). The food base analysis was applied because the February through July period also reflects the general time frame for orchid germination/emergence to flowering. The mean flow values of the wettest third, middle third, and driest third for the period of record are approximately 14,000 cfs, 8,400 cfs, and 5,800 cfs, respectively.

# VII. Effects of the Action

The term "effects of the action" refers to the direct and indirect effects of a proposed action on the listed species and designated critical habitat, together with the effects of other activities that are interrelated or interdependent with that action (50 CFR §402.2). Thus, the effects of the Federal action include the effects of the proposed Program along with the collective future effects of existing and certain future water-related activities, including activities without a federal nexus that are interrelated with the proposed Program (interrelated activities are defined in Chapter III of this document, Scope of the Biological Opinion).

The FEIS provides analyses of the effects of the "GC Alternative" (i.e., the alternative developed to represent one implementation scenario of the proposed Program) on the attributes of the Platte River ecosystem (e.g., hydrology, sediment supply and transport, river channel characteristics, and subirrigation of wet meadows adjacent to the river channel) that function to support federally listed species and other fish and wildlife resources. Analyses presented in this biological opinion rely, in part, on those descriptions and analyses.

For the analyses of the implementation scenario in the FEIS, some assumptions are made about Program activities that may occur but may not be explicitly described in the current Program documents. Assumptions about the Program that were used either in formulating FEIS analyses relied on by this biological opinion, or used directly in the analyses in this biological opinion, are listed in Subsection B2, below.

## *A. Effects of Continued Water-related Activities*

The *Environmental Baseline* section of this biological opinion describes the adverse effects that existing water-related activities in the North Platte River, South Platte River and Platte River basins have had on the natural hydrograph and sediment balance in the Platte River ecosystem, and consequences to channel morphology and the availability of habitat for federally listed species. The proposed Program is to enable existing water-related activities to continue to operate much as they have in the past, and allow new water-related activities in the Platte River Basin consistent with the Program. Therefore, these projects depend on implementation of the Program for compliance with the ESA.

The continued operation of Reclamation and Service water-related activities is also incorporated in the effects of the proposed action. The future adverse effects of these and other existing non-Reclamation and non-Service water-related activities, and new water-related activities that are interrelated with the proposed Program are also incorporated in the effects of the proposed action.

Briefly, the primary effects from existing water-related activities are continued dampening of spring rise of river flows and continued impairment of sediment transport and channel maintenance processes. Water storage and direct diversions will continue to flatten the bi-modal natural hydrograph by capturing the high spring run-off, thereby significantly reducing and retiming annual peak flows reaching habitat in the central and lower segments of the Platte River.

Peak flow reductions resulting from the continuance of existing water-related activities will also perpetually decrease the frequency of inundation of the Platte River floodplain. Reduced floodplain connectivity will adversely impact nutrient cycling and the addition of nutrient-rich detritus to the river system, inundation of backwaters and other floodplain habitats essential for fish spawning, re-distribution, and use as nursery areas. Reduced peak flows will also adversely affect both subirrigation and surface overflows that support the biological functions of wet meadows.

Periods of seasonally high flows, or “pulse” flows, and sediment supply and conveyance are fundamental components of channel maintenance. The combination of reduced spring pulse flows and sediment trapping in the large reservoirs, diversion dams and canal systems will impair the river’s sediment load and transport capacity. Consequently, the river processes that maintain broad and braided river channels, sandbars, and river stage will be impaired. The resulting adverse effects on the listed species and their habitats will continue to worsen with time. These river changes will adversely affect nesting habitat for least terns and piping plovers, roosting habitat and wet meadow feeding habitats for whooping cranes, and spawning cues and in-channel habitat for pallid sturgeon.

Because existing water-related activities would essentially operate as in the past, the effects of water-related activities would result in continued flow diversion from a significantly large segment of the Platte River system, from North Platte to Lexington, Nebraska. Downstream of Lexington, sediment-free discharges from the J-2 Return will contribute to continued erosion of the channel bed. This process increases channel incision and narrowing, and in some river sections, vegetation growth on parts of the channel no longer scoured by the river flows.

As in the past, sediment capture by in-channel structures of water-use facilities on the North Platte River and erosion of the riverbed below the J-2 Return will contribute to increased coarsening of riverbed particle sizes in the central Platte River which will also impair channel maintenance processes.

Overall, May and June flows in the lower Platte River below the Loup River confluence continue to be reduced by approximately 35 percent from their predevelopment levels. Depletions in the upper Platte River basin alone account for about a 25 percent or greater reduction of May and June flows in the lower Platte Basin. The decrease in annual peak flows will result in continued weak spawning cues for the pallid sturgeon, and will continue to impair the formation of macro-bedform habitats used by pallid sturgeon in the lower Platte River. In addition, the reduced flows in the lower river reaches magnify the effects that daily hydro-peaking for power generation in other tributary basins to the lower Platte River have on diminishing these habitat functions.

## *B. Effects of the Action*

### B1. Tools Used in Analysis

System Hydrology:

The OpStudy hydrology model is used to examine the effects of Program water management on aquatic habitats of listed species. This model has been widely used by agencies involved in water supply studies in the Platte River basin over the past two decades, and consists of average monthly flows for a 48-year period of record. Model nodes, or locations on the river where the model generates input and output, extend from Lewellen, Nebraska, on the North Platte River and Julesburg, Colorado, on the South Platte River, downstream to their confluence near the City of North Platte, and then downstream on the Platte River to Duncan, Nebraska (about 30 miles downstream from the City of Grand Island).

For the FEIS analyses, present conditions as modeled by OpStudy (i.e., the starting point for comparing GC Alternative effects) represent the hydrologic conditions that would exist if the river system were to continue being operated as it was in 1997 and future hydrologic and climatologic conditions were similar to the 48-year period from 1947 to 1994, as adjusted for 1997 irrigation demands and return flows. The present condition hydrology is not the same as the historic hydrology from 1947-1994. While the precipitation and runoff are the same, the water storage and diversion facilities, and the level of water demand placed on the river, have all been updated to 1997 levels of development. Thus, the present condition hydrology represents the stream flows, reservoir levels, and diversions that would have occurred from 1947-1994 if current levels of water resources development and use had existed during that period (i.e., historic hydrology, but 1997 system demands). In addition, the Present condition modeling uses average rules of operation for the various reservoirs and diversions. While these rules produce accurate results on average and over the long term, they do not exactly reproduce the actual operations in any given year. The operators of facilities on the Platte River system have significant flexibility to adapt to changing conditions. This short-term operational flexibility is not always captured in the model.

Sub-routines for daily flow output were also developed based on OpStudy monthly output to help assess effects of the proposed action on peak flows, channel maintenance and wet meadow maintenance. The descriptions of the hydrological methods are presented in a technical report available from the Platte River EIS Office (see Attachments to FEIS).

Sediment Supply and Channel Maintenance:

Using an approach to river studies suggested by Simons, Li & Associates (1982), the geomorphic investigations of the Platte River include three levels of analysis: a) qualitative analysis; b) quantitative analysis; and c) numerical modeling. Substantive empirical information on the rate of channel degradation was collected along river channel transects in the 1980s and during 1998-2000. Randle and Samad (2003), Murphy et al. (2004), and Holburn et al. (2006) summarize the sediment balance, channel survey data, state-of-the-art channel morphology modeling, and other information currently available.

The channel morphology model (SedVeg-Gen3) developed by Reclamation's Technical Service Center's Sedimentation and Hydraulics Group uses a series of parameters and explicit hypotheses to advance the understanding of central Platte River channel maintenance. This model contains structured linkages between hydrology, river hydraulics, sediment transport, and vegetation growth. Portions of SedVeg-Gen3 output were used in these analyses. Detailed documentation of the SedVeg-Gen3 model are provided in Murphy et al. (2006).

Land Cover/Land Use Geographic Information System:

The draft Land Plan of the proposed Program contains several habitat criteria to be used to guide land acquisitions and habitat restoration objectives (Attachment 4, Draft Program Document, Table 1). The criteria would be implemented and evaluated during the first 13 years of the proposed Program. Using these criteria, hypothetical scenarios for land management were developed and presented in the FEIS (i.e., the land management actions modeled for the Governance Committee Alternative). The land plans described in the FEIS represent the various conceptual approaches of habitat development and implementation that are evaluated rather than plans for specific land parcels.

The 1998 land cover/land use database was developed by Reclamation's Remote Sensing and Geographic Information Group, in support of the Platte River Cooperative Agreement and development of the FEIS (Friesen et al. 2000, Butler 2001). Land Use/Land Cover is one of several themes developed to describe geographic features of the study area.

## B2. Assumptions Used in the Modeling and Analyses

Several assumptions were used in the analyses of the GC Alternative's effects on the Platte River ecosystem and the listed species and their critical habitats addressed by this biological opinion. As described in the *Description of the Proposed Action* section, the modeled GC Alternative was designed to illustrate probable effects under implementation of the proposed Program. The determination of effects is dependent, in part, on the following assumptions reflected in the FEIS analyses:

a) Water management implemented under the GC Alternative includes the flexibility to convey some Program water, including EA water, at desired times past diversion points; and/or the use of various facilities in the CNPPID and NPPD system (Lake Maloney, Johnson Lake, and any new re-regulatory facilities that may be established under the Program's Water Action Plan) to store and release a short duration pulse from the Jeffrey and J-2 Returns.

b) Water management implemented under the GC Alternative includes the ability to release EA and other operational water up to the full controlled hydropower release capacity of Kingsley Dam. The Service assumes that North Platte River channel capacity near the town of North Platte will be improved as necessary to achieve the increased frequency and magnitude of short-duration near-bankfull total flows passing Overton in the 6,000 cfs to 8,000 cfs range. In the model this was accomplished, in part, by assuming an increased capacity of 3,500 cfs at this location.

c) Land management analyzed in the GC Alternative emphasizes restoration of wide active channels with certain habitat characteristics (Program Documents, Land Plan, Table 1) over simple protection of that habitat. To maximize the benefits of sediment supply and provide the greatest benefit to the target species, most habitat restoration and channel widening occurs upstream of Kearney.

d) This biological opinion is based on the aggregate effects of all Program activities. Therefore, ESA compliance provided for the Federal action during the first stage of the Program is only valid if all Program Signatories and entities that are responsible for actions identified in this biological opinion carry out their obligations agreed to under the Program. In other words, if one Signatory fails to meet its obligations, ESA compliance is not automatically provided to the other participants who accomplish their obligations regarding Program funding and implementation.

Therefore, the modeling used to describe the probable effects of the proposed Program and the assumptions used in the analyses of effects (i.e., GC Alternative) have a direct bearing on the conclusions drawn regarding whether or not the proposed action will likely jeopardize the continued existence of the listed species or adversely modify federally designated critical habitat. The Service recognizes that the actual Program implementation may differ from the specific assumptions in the biological assessment, but this biological opinion is based on the accomplishment of at least the level of benefits described in the biological assessment. Program responses to the effects of Program activities will be addressed using the procedures and resources available under the AMP. The AMP is expected to change and adjust the Program management activities during the first increment as new information is acquired. As stated previously, achieving particular results through implementation of the AMP is not the basis for determining ESA compliance during the first increment. ESA compliance is based upon meeting the first increment milestones. Evaluation of the effectiveness of the Program activities will be assessed at least three years before the end of the first increment.

In addition to the assumptions implicit in the description of the GC Alternative, other assumptions used by the Service in this biological opinion include:

a) The Colorado, Nebraska and Federal depletion plans will be implemented as described and will limit impacts to the peak flows (i.e., those Service instream flow recommendations not encompassed by annual pulse flows and species flows) to the extent indicated in each respective plan.

b) River water re-regulated by Tamarack I will initially be tracked through the central Platte River project area beginning with Project implementation. The Service assumes that water re-regulated by Tamarack I will pass to and through the associated habitats.

c) Program water is conveyed to and through the lower Platte River, minus normal conveyance losses. Program water will be tracked to and through the lower Platte River beginning in the first year of the Program.

d) Hydrocycling at the J-2 Return has not been represented in the OpStudy model, and therefore, any potential effects of that activity have not been accounted for in these analyses. The potential effects of hydrocycling Program water on least tern and piping plover nests, chicks, channel habitat, and food availability are not otherwise analyzed in this biological opinion. In addition, any effects on the pallid sturgeon or its habitat in the lower Platte River resulting from cyclic releases of water from the Loup Public Power District's operations are also not analyzed in this biological opinion.

e) Various activities controlled by either the Program, CNPPID, or NPPD will not interfere with the management of the EA for the benefit of the target species. These various activities include studies of pulse releases, inspections, maintenance, and repair of hydropower facilities. The Service recognizes that maintenance activities and other situations (described in Attachment 5, Section 5 of the Program document) will continue to occur in the future and may result in EA releases being temporarily reduced or suspended.

f) All Program habitat complex sites will approximate, to the extent practicable, the habitat characteristics described in Table 1 of the Land Plan; and agreements with participating land sponsors will enable the Program to undertake efforts to achieve those habitat characteristics.

## *C. Effects of the Action on the Platte River System*

### C1. Effects of the Proposed Action on System Hydrology

<u>General Effect on the Annual Hydrologic Regime:</u>

The proposed Program differs only slightly from present conditions in terms of total average annual flow (Table VII-C1). Average annual river flows of the North Platte River at the town of North Platte decrease by about 2 percent. In the South Platte River, average flows at Julesburg, Colorado, near the Nebraska state line are reduced due to Tamarack reregulation and anticipated water development activities in the first 13 years.

Reduced flow of the South Platte and North Platte rivers at North Platte, and of the Platte River at Cozad below the Tri-County Diversion, are due to a greater volume diverted from the upstream river reaches for hydropower generation and power plant cooling. These reductions will incrementally contribute to the deterioration of flow- and sediment-related riverine processes and aggravate the current trends of channel aggradation in these reaches. Increases in annual flows below the J-2 Return will exacerbate channel bed incision in the upper reaches of the river, but also improve flows for fish resources during the summer.

Sediment supply and channel maintenance in the river reach targeted for habitat recovery between Lexington to Chapman is influenced by the source of flows. The Overton gauge is the most upstream gauging station in the habitat recovery area and is used here as a reference. Presently, about 40 percent of the average annual flow supplied to the reach targeted for habitat recovery at Overton is derived from flows coming down the Platte River past Cozad (Table VII-C1). The remaining 60 percent of river flow is derived from discharge from the J-2 Return, near Lexington, Nebraska and gains from groundwater return flows. The discharge of the J-2 Return and the proportion of river flows derived from the J-2 Return can vary substantially at daily, seasonal, and annual time steps.

**Table VII-C1. Projected changes in the average annual flows in the Platte River system as a result of the proposed action.**

| | Average Annual Flow in 1,000 Acre-Feet (and percent change) | |
|---|---|---|
| | Present Condition | Proposed Action |
| South Platte River at Julesburg | 487 | 480 (-1) |
| Korty Diversion from S. Platte River | 208 | 238 (+14) |
| South Platte River at North Platte | 370 | 364 (-2) |
| North Platte River at North Platte | 479 | 476 (-1) |
| Platte River | | |
| At the N. Platte/S. Platte Rivers Confluence | 1,565 | 1,601 (+2) |
| Tri-County Canal Diversion | 1,153 | 1,190 (+3) |
| Platte River at Brady | 586 | 581 (-1) |
| Platte River at Cozad | 510 | 504 ( -1) |
| J-2 Hydropower Return Canal | 592 | 636 (+7) |
| Platte River at Overton | 1,263 | 1,296 (+3) |
| Platte River at Grand Island | 1,248 | 1,284 (+3) |

Source: FEIS “DailyFlowAnalysis.xls”

The Program changes the existing flow regime by slightly reducing average annual flow at Cozad and by increasing the average annual discharge from the J-2 Return about 7 percent. The impacts likely to result from these flow changes are discussed in greater detail in the *Effects on Sand Transport, Deposition, and Erosion* section, below.

Separate from the change in average annual flow and flow source, most of the flow changes in the central Platte River habitat reach caused by the proposed action are due to flow re-timing. In general, the Program would reduce flows in December and January and would increase flows during spring (especially May) and late summer and fall.

Figure VII-C1 displays median daily flows at Overton for the proposed Program and for the present condition as these two scenarios are modeled in the FEIS. For reference, the Service's target flow recommendations for an average year are also shown (i.e. species and annual pulse flows on a weighted monthly basis, only).


**Figure VII-C1. Median daily flows of the Platte River at Overton, Nebraska, for the present condition and the proposed action. Service average flow targets for a "normal" flow year are also displayed. (Source: FEIS 2006)**

In practice, other than avoiding flooding and other more limited exceptions, the Program contains few specifications or restrictions on the timing of EA releases. Thus, the OpStudy's representation of water facility operations and the Program's EA water releases tends to be somewhat over-simplified. Infrequent events such as peak flows and minimum flows of the present condition are also masked by averaged flow.

Because pulse flows are considered essential to the ecological integrity of the Platte River system, the proposed action's effects on pulse flows are addressed in further detail below.

Effects of the Proposed Action on Pulse Flows:

The largest impact to Platte River flows is the depletion of high spring flows due to the development of dams and water storage projects throughout the basin. The volume of reservoir storage developed in the basin is about five times the present average annual flow volume measured in the habitat recovery area at Grand Island, Nebraska.

The seasonally high flows of natural regimes are frequently cited by river scientists as a critical element necessary to conserve the physical and biological integrity of river systems. These flows, often termed "pulse flows," are characterized by their timing, magnitude, frequency, duration, and rate of change (Poff and Ward 1989 and Poff et al., 1997).

The Service's 1994 flow recommendations contain several detailed parameters for pulse flows and identify both short-duration and long-duration pulse flow events. In total, the flow recommendations address the timing, magnitude, duration, and frequency of flows. Though the magnitudes of pulse flows recommended by the Service are substantially lower than historic levels, the inter-annual magnitude, duration and, to a certain extent, the timing vary as would a natural flow regime.

The effects of the proposed action were evaluated on both the Service's 1994 flow recommendations, and a "normative flow regime" approach recommended by the National Research Council's review of Platte River science (NRC 2005). The Service's 1994 flow recommendations emphasize that results of monitoring and scientific investigations be incorporated in flow protection and management through the process of adaptive management.

*Effect on Short-duration Pulse Flows* - The Service's 1994 flow recommendations for spring pulse flows contain parameters for both short-duration events ranging from one to five days and longer-duration events. The timing of the short-duration peak flow can and usually would overlap with the timeframe of the longer-duration pulse flow event—either in mid-February to mid March, or, more often, during May to June.

O'Brien (1994) identified five potential channel-forming flow parameters for the Platte River. Flow ranges for these parameters were based in part on the historic flow characteristics during 1969-1986 when channel narrowing in the Lexington to Chapman reach slowed and was believed to approach quasi-equilibrium. From an average of these five flow ranges, O'Brien recommended a ten-year running average with five-day spring peak flows averaging 8,300 to 10,800 cfs. Ramp rates for ascending and descending limbs of the pulse flow were also identified. The importance of sediment supply, mobilization, transport, and monitoring of the effects of flow implementation using adaptive management were major emphases of the channel maintenance recommendations.

High magnitude/short duration flows also contribute to the dynamics of wet meadow communities and maintain wetland biodiversity (Henzey and Wesche 1993, Henzey et al. 2004, Whiles and Goldowitz 1998, 2005). Surface water linkages enable (re)introduction and (re)distribution of aquatic and semi-aquatic organisms between the river and riparian wetlands and within the mosaic of wetland biological communities that comprise riparian meadows.

In addition to the ten-year running average of the 8,300 to 10,800 cfs range described by O'Brien, the Service recommends that the occurrence (i.e., frequency and magnitude) of peak flows be retained and increased for events having five-year and more frequent recurrence.

The maximum annual one-day and five-day flow events were computed over 48-year period of variable hydrology to evaluate the proposed action effects on short-duration flow recommendations. The values were sorted by magnitude and plotted as an exceedance curve (Figure VII-C2). For example, the median flow event exceeded in about 50 percent of years is about 5,500 cfs under the present condition, and would be about 6,500 cfs for the proposed action. Similarly, the maximum annual flow that is exceeded in 10 percent of the years (roughly five of 48 years) is 11,700 cfs under present condition and would be 10,400 cfs under the proposed action.

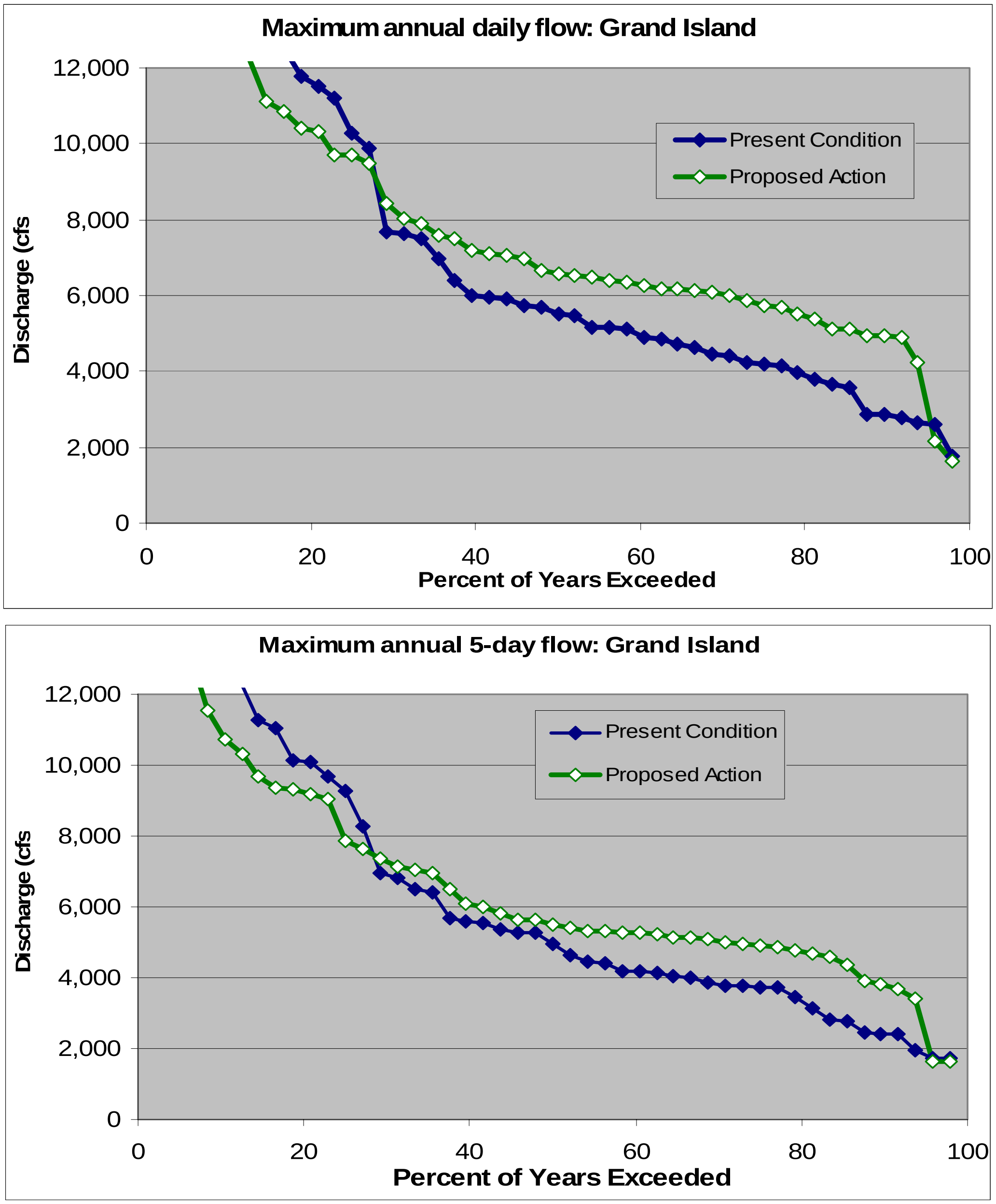



**Figure VII-C2. Comparisons of maximum annual one-day flows (top) and maximum annual five-day flows (bottom) at Grand Island, Nebraska, for present condition and the proposed action over a 48-year period (Source: FEIS 2006)**

In general, maximum annual one-day and five-day flows would be reduced during years with the highest peak flows and increased during the years with "normal" and lower peak flows under the proposed action. The increases would occur in about 70 percent of years (years with peak flows below 8,000 cfs), and are primarily due to water released from the Program's EA storage account.

Essentially, the EA in Lake McConaughy is a re-allocation of water from existing uses. The EA water released for Program purposes on a regular basis results in a lower reservoir level, enabling greater volumes of very high and less frequent inflows to be captured with less reservoir "spill" downstream. One effect of the EA management and other anticipated first-increment development in the basin is that lower peak flows will occur in years with high peak flow events, or in about 30 percent of years.

The frequency that the maximum annual daily flow achieves the flow recommendation of 12,000 cfs would be reduced from nine years under present condition to seven years under the proposed action. This equates to an increase in the recurrence interval from 5.3 years (on average) to 6.8 years.

The frequency that the maximum annual five-consecutive-day flow achieves the 8,300 cfs flow recommendation would be reduced from 14 years under present condition to 12 years under the proposed action. This equates to an increase in the recurrence interval from 3.4 years to 4 years. The frequency that the maximum annual five-consecutive-day peak flow achieves the 10,800 cfs recommendation would be reduced from nine years under present condition to five years under the proposed action, or an increase in the recurrence interval from 5.3 years to 9.6 years.

We also plotted the annual five-day pulse events as a ten-year running average. The 48-years simulation yields a time series of the 39 ten-year running averages (Figure VII-C3). For the present condition, 10 of the 39 ten-year running averages fall within the 8,300 to 10,800 cfs range targeted for habitat recovery. The proposed action reduces this to nine occurrences.

Though 8,300 is not achieved, the proposed action does make some progress toward the 8,300-10,800 cfs range during prolonged periods of generally low and moderate flows. During the periods of low and moderate running averages, the proposed action increases the ten-year running average by roughly 520 cfs overall; roughly an 8 percent increase compared to present conditions. This effect is most prominently shown in years 10 to 25 of the simulation (Figure VII-C3).

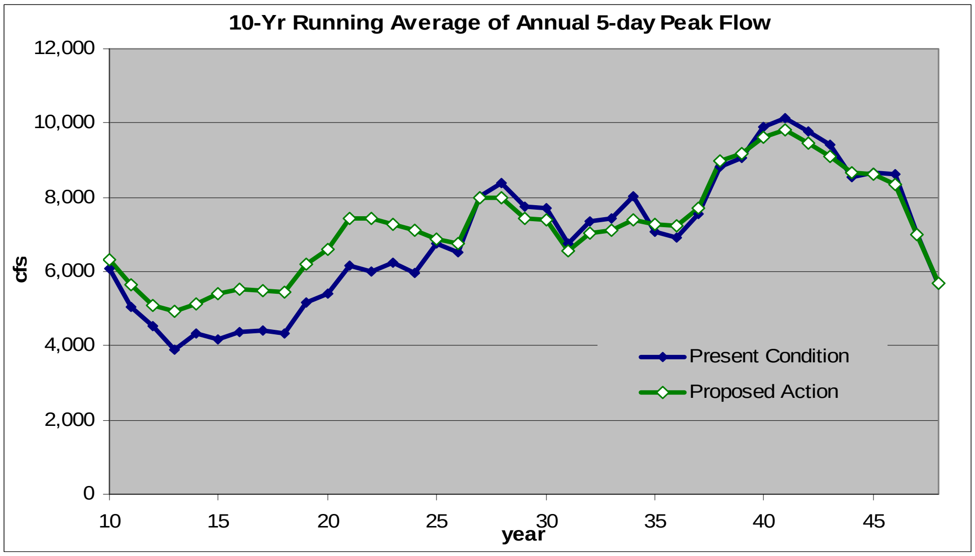


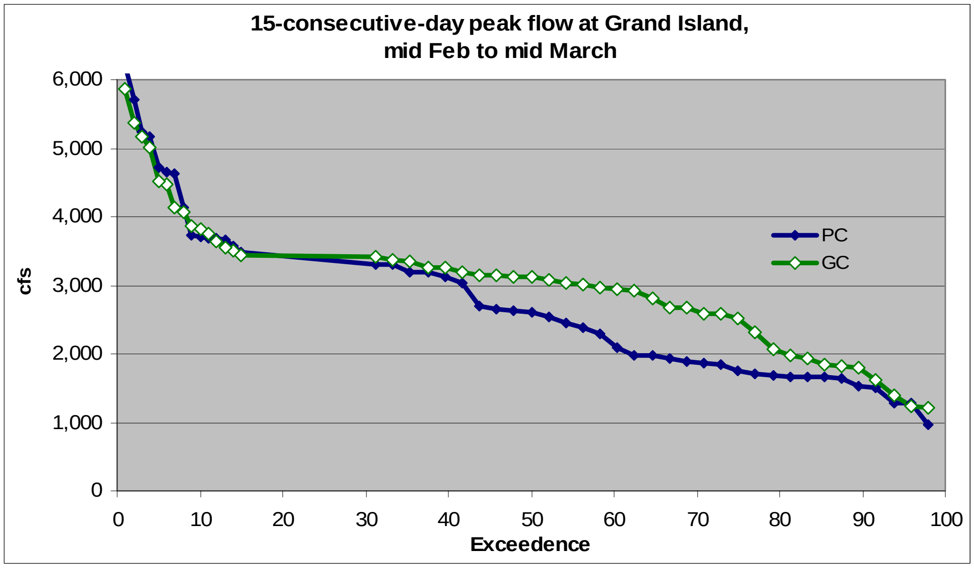

**Figure VII-C3. Comparisons of the ten-year running average of maximum annual 5-day flow events for the Platte River near Grand Island, Nebraska.**

*Effect of the Program on Long-Duration Pulse Flows in Late Winter* - Long-duration pulse flows in late winter help reduce channel vegetation, and elevate groundwater levels in wet meadows adjacent to the river. Johnson (1994) identified winter flows during cake-ice formation and ice breakup as a mechanism significantly affecting seedling removal and mortality. He indicated that these flows maintain channels by eroding sandbars, scouring vegetation from sandbars, and burying young seedlings. Johnson provided no specific flow recommendation for this period, however.

River flows during late winter are also believed to influence the wet meadow hydrology by helping to maintain elevated groundwater levels. Wesche et al. 1994 concluded that river stage is most often the dominant factor influencing groundwater levels. Groundwater saturation supports hydric communities and aquatic and semi-aquatic habitats in meadow swales and sloughs. Soil saturation by groundwater is also believed to help thaw soils, influence the activity and distribution of soil macroinvertebrates, and make soil macro-organisms available as food for migrating birds (Currier and Carlson 1989, Nagel and Harding 1987, Runge1998).

Based on information presented in the workshop and other information available, the Service (Bowman and Carlson 1994) recommended pulse flows during early spring periods of ice-breakup as part of a larger flow management strategy. The Service's instream flow recommendations for habitat recovery seek to improve average late winter flows to levels of 2,000 to 2,500 cfs in low flow years and 3,100 to 3,600 cfs in moderate and high flow years for the period from mid-February to mid-March.

The proposed action would modestly increase the late winter/early spring (mid-February to mid-March) flows at Grand Island by an average of about 250 cfs (11 percent), over all years, and amounts ranging up to about 600 cfs in any single year (Figure VII-C4). The upstream river reaches of the habitat area measured at Overton and Kearney would experience similar flow increases, thereby helping to maintain groundwater levels in the lowest adjacent wet meadows.



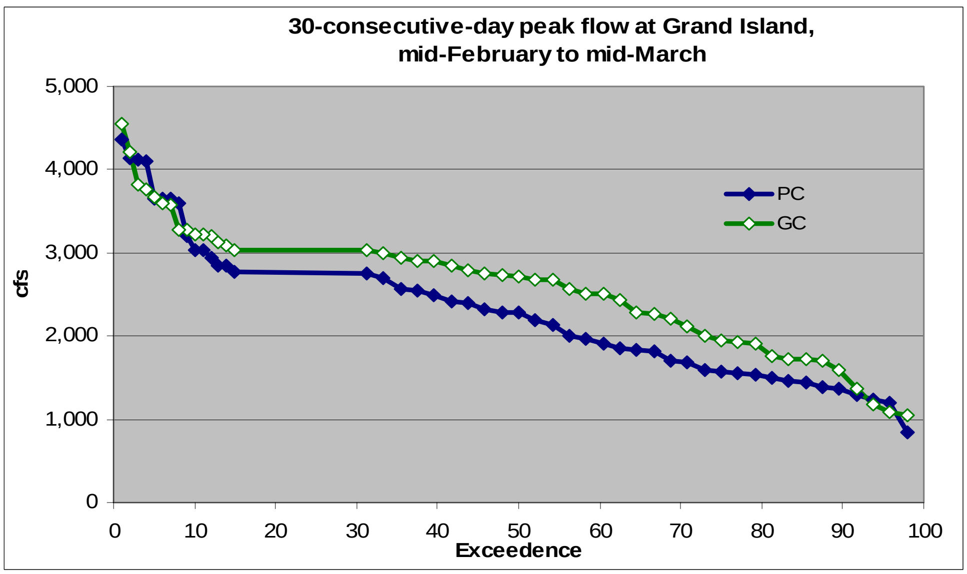




**Figure VII-C4. Exceedance curves of Platte River late winter pulse flow events over a 48-year simulation period. Annual maximum 15-day (top) and 30-day (bottom) flow events are displayed for Grand Island, Nebraska.**

Most flow increases in February and March are due to releases from the EA in Lake McConaughy. In the FEIS scenario these releases for the proposed action average roughly 20 kaf (367 cfs) in February and 15 kaf (233 cfs) in March over the 48-year simulation. At Grand Island, the total flow volume due to EA releases is estimated at about 17 percent in February and 10 percent in March (Table VII-C2).

To achieve the flow levels represented in the FEIS, the EA releases would be expected to occur in about 40 to 50 percent of years for each of the two months, and in general, years with moderate flows would be increased. The flow increases and associated biological benefits in

February and March thus depend on the feasibility of releasing and conveying EA water to the habitat area during this period.

**Table VII-C2. Characteristics of Program EA management in February and March over a 48-year period of simulation.**

| | Frequency of EA Releases (no. years) | Amount Released Averaged Over 48 years | | Program Water as a Percent of Flow at Grand Island (full Program implementation) |
|---|---|---|---|---|
| | | kaf | cfs | |
| February | 24 | 20.5 | 367 | 17 |
| March | 20 | 14.3 | 233 | 10 |

(Source: FEIS OpStudy “Score4794.xls”)

*Effect of the Program on Long-Duration Pulse Flows in Late Spring* - The Service’s 1994 pulse flow recommendations for late spring serve two main purposes: a) mobilizing the channel bed and maintaining channels free of vegetation; and b) supporting a variety of riverine and wetland habitats and biota. This section addresses the likely effect of the proposed action on channel maintenance and the latter sections address wetland and wet meadow hydrology.

A high positive correlation exists between channel width trends and June flow events (Johnson 1994). Mean June flows and peak flow were strongly correlated and were difficult to separate in terms of their proportional effect on woodland expansion into the river channel. Johnson concluded that the magnitude and timing of mean June flows and peak flows “…largely determined both the aerial extent of [cottonwood] seedling populations at the close of the germination period each year and the long-term pattern of woodland expansion.” Johnson recommended mean June flows of 2,600 to 3,000 cfs “averaged over several years” to maintain what he considered “quasi-equilibrium” of the existing channel conditions.

For this analysis, the proposed action was evaluated using a four-year running average of the mean June flow—but with the recognition that many existing channels in the upstream portions of the Lexington to Chapman habitat reach have narrowed to such an extent that they are little used by the listed target species.

In general, the proposed action reduces mean June flows in about one-third of all years, thereby increasing the probability of woodland expansion into the river channel. For the 48-year simulation, the frequency that the four-year running average achieved or exceeded 3,000 cfs was reduced from 13 years for the present condition to ten years for the proposed Program (Figure VII-C5). Similarly, the frequency that the four-year running average achieved 2,600 cfs was reduced from 19 years under present condition to 14 years under the proposed Program.

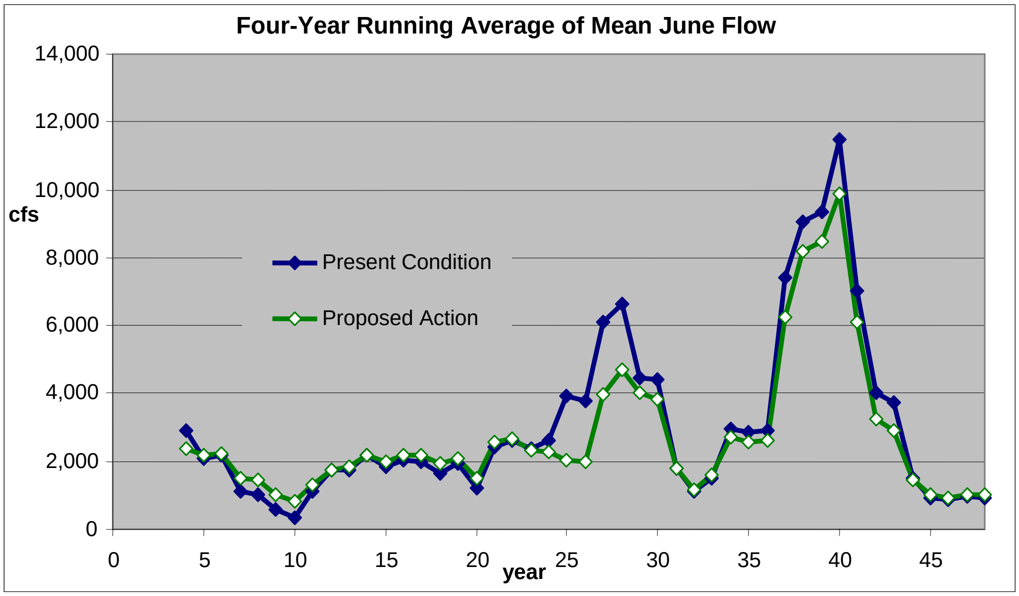



**Figure VII-C5. Time series for a four-year running average for mean June flows at Grand Island under present conditions and with the proposed action for a 48-year simulation period.**

Most June depletions are due to flow reductions in the highest flow years. Figure VII-C6 displays an exceedance curve for the highest flow years indicating flow reductions of 1,000 to 4,000 cfs in those years.

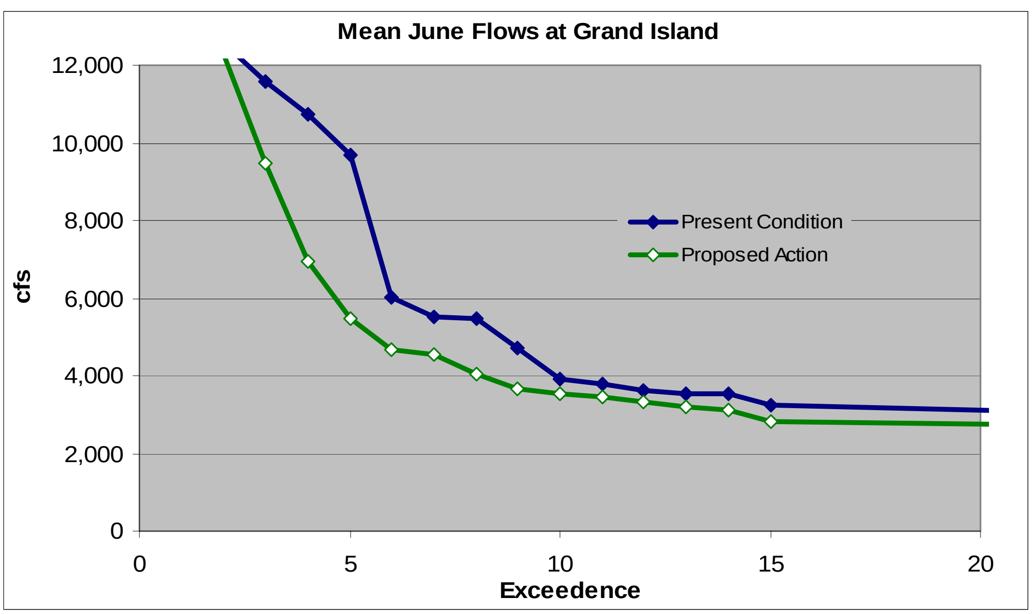



**Figure VII-C6. Exceedance curve of mean June flows at Grand Island under present conditions and with the proposed action for a 48-year simulation period.**

The OpStudy hydrology simulations established the rule for EA releases for producing managed pulse flows in May as a “fixed” parameter. The EA releases in May occur in 85 percent of years and average 44 kaf, whereas June EA releases occur in 31 percent of years and average 6 kaf for the 48-year simulation (Table VII-C3). To evaluate the proposed action, we performed a similar analysis by using the highest monthly flow between May and June of each year, and then selecting the May flow for some years or the higher June flow for other years.

**Table VII-C3. Characteristics of Program EA management in May and June over a 48-year simulation (full Program implementation).**

| | Frequency of EA releases (percent of years) | EA Release Averaged Over 48 Years | | Program Water as a Percent of Flow at Grand Island (Full Program Implementation) |
|---|---|---|---|---|
| | | Kaf | cfs | |
| May | 85 | 44.7 | 730 | 26 |
| June | 31 | 6.2 | 104 | 17 |

Source: FEIS OpStudy “Score4794.xls”

For the analysis of the highest annual monthly flow in May or June, the average over all years (3,374 cfs) was little changed from the same parameter for present conditions (3,434 cfs). The four-year running average achieved 3,000 cfs 18 times under the proposed action versus 17 times for present condition (Figure VII-C7). The proposed action achieved 2,600 cfs 28 times versus 20 times for present condition.

Under the proposed action, the rarer high flows continued to be reduced in about one year in five. The reduction in those years was about the same (average 1,800 cfs) (Figure VII-C8) as the reduction when May flows alone were analyzed.

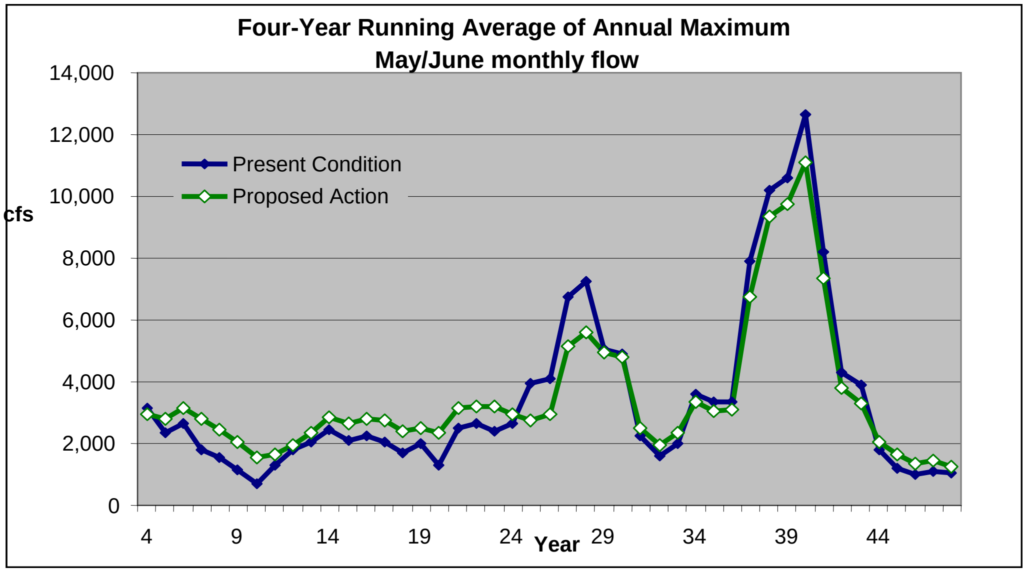



**Figure VII-C7. Time series for a four-year running average of the highest May or June monthly flows at Grand Island under present conditions and with the proposed action for a 48-year simulation.**

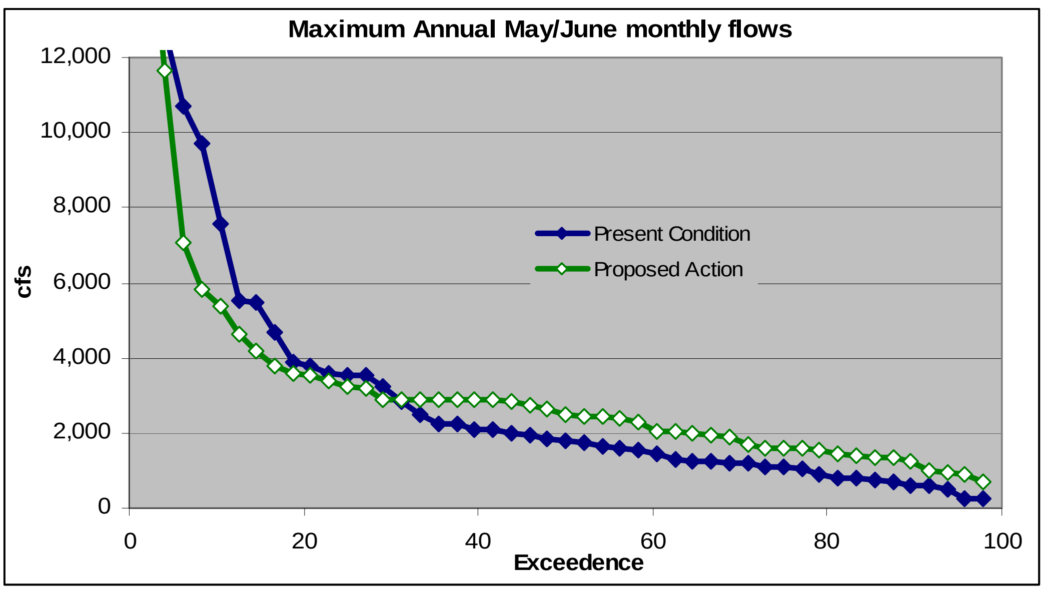



**Figure VII-C8. Exceedance curve for highest May or June monthly flows at Grand Island under present conditions and with the proposed action for a 48-year simulation.**

In practice, the EA releases under the Program would occur at the discretion of the Service and with the flexibility to be timed to optimize the biological benefits in either May or June

*1.5-Year Recurrence Flow* - In the FEIS, the Interior proposes a pulse flow management approach to increase the magnitude of peak flows with a 1.5-year recurrence interval. A 1.5-year to 2.0-year recurrence interval is characterized as a general “rule-of-thumb” of channel forming high-flow events. The 1.5-year recurrence flow is the flow exceeded, on average, in two out of three years (i.e., a 67 percent chance of exceedance in any given year).

Murphy et al. (2006) proposed to increase the annual peak discharges in combination with sediment management activities discussed below. Like the investigators at the 1994 Platte River pulse flow workshop, Murphy et al. (2004) recommended that the effects of implementation be closely monitored and adjusted as needed through adaptive management. The proposed action would test the hypothesis that peak flows on a more frequent basis would more regularly mobilize channel substrate and maintain vegetation scouring capacity of the river and wide channels. This increase in the recurrence of a 1.5 year peak flow in combination with sediment augmentation is intended to maintain the wide channels restored on Program lands and elsewhere within the action area.

Using adaptive management the Program proposes to provide a managed pulse flow for short durations on a regular basis by providing 5,000 cfs of Program water at Overton which would increase the frequency of annual short-duration (e.g., three-day) pulse flows ranging from 6,000 to 8,000 cfs measured at Grand Island. This water re-regulation would be implemented along with channel widening and the sediment augmentation activities of a habitat recovery program through adaptive management.

In the FEIS, hydrologic model runs with annual or near annual recurring pulse flows were simulated. The 1.5-year recurrence values calculated at various river locations downstream of Lake McConaughy and percent change from present condition are summarized in Table VII-C4. The increases are due to water releases from the EA in Lake McConaughy and indicate how peaks would be conveyed through the river system.

**TableVII-C4. 1.5-year recurrence flow (cfs) for present condition and for the proposed action (and percent change).**

| Location | Present Condition | Proposed Action | Change cfs (percent) |
|---|---|---|---|
| North Platte River at the City of North Platte | 2,134 | 2,229 | 95 (+4) |
| South Platte River at the City of North Platte | 1,067 | 1,059 | -12 (-1) |
| Platte River at Cozad | 1,710 | 3,631 | 1,921 (+112) |
| Platte River at Overton | 3,730 | 5,816 | 2,086 (+56) |
| Platte River at Grand Island | 4,693 | 6,157 | 1,463 (+31) |

The largest proportional change in the 1.5-year recurrence flow compared to present condition occurs at Cozad, Nebraska. At Cozad, the 1.5-year flow would increase by about 1,900 cfs or more than double the present condition values. In the habitat area the 1.5-year recurrence flow increases by roughly 2,100 cfs (56 percent) at Overton and 1,500 cfs (31 percent) at Grand Island which may, in conjunction with the sediment augmentation, help maintain channel restoration activities on Program lands in the habitat reach (see below). The flow levels for 1.5-year recurrence of one-day and five-day pulse flow events are represented by the 67 percent exceedance in Figure VII-C2.

## C2. Effects of the Proposed Action on Sand Transport, Deposition, and Erosion:

The understanding of channel maintenance processes of the Platte River is linked with sediment balance (USBR 1989, Simons 2000, Randle and Samad (2003) and Murphy et al. 2006). The SedVeg-Gen3 model (Murphy et al. 2006), empirical data, and concepts of sediment transport and channel geomorphology have been applied to the understanding of sediment transport in the system as explained in the *Environmental Baseline* section of this biological opinion.

The total bed load transported by the South Platte and North Platte rivers near the City of North Platte is not expected to significantly change from present conditions under the proposed action. The limited survey data available indicate that aggradation of the river is occurring within the 63-mile reach of the Platte River from the Tri-County Diversion Dam near the confluence of the North and South Platte rivers to the area of the J-2 Return near Lexington. The SedVeg-Gen3 model projects sediment deposition to continue and increase slightly under the proposed action. This continued deposition would result in a reduction in habitat quality in this stretch of river. This sediment deposition is due to the general dewatering of this river reach.

An estimated 200,000 tons (net) of sediment erode annually from the channel bed and banks downstream of Lexington under the present condition. Under the proposed action the rate would increase somewhat with the larger flows.

The J-2 Return discharge entering the river just downstream of Lexington, Nebraska, contributes to increased erosion by discharging nearly double the average annual river flow (Table VII-C1) at the point of discharge. Because the discharges are nearly sediment-free, they increase net sand transport by the river. Channel surveys and sediment transport modeling of the Platte River indicate a primary source of this additional sand is erosion from the channel bed. Under the proposed action, the J-2 Return discharges would increase by about 7 percent from present conditions, thereby exacerbating the process of erosion, and degrading channel habitats.

The sediment augmentation activities of the proposed Program addresses sediment imbalance. The greatest benefit would occur by adding sand close to the J-2 Return. The river plan form of downstream reaches can then adjust to a consistent transport rate and eliminate downstream river reaches that predominantly degrade or aggrade.

The Program land plan described in the FEIS contains island leveling and sand augmentation in upstream bridge segments to restore and maintain a broad, active channel. Island leveling would have several intended purposes: a) enable water to spread, providing a wide, open channel habitat area; b) decrease flow velocities, which would decrease the rate of removal of bed material in managed areas; c) provide a supply of fine sediment, thereby avoiding erosion downstream; and d) facilitate the mobilization of bed material and creation of ephemeral sandbar habitat in combination with the short-duration pulse flows.

In a geomorphic context, a river channel is considered stable if it does not aggrade or degrade. Under this Program which seeks to begin offsetting substantial channel incision, an aggrading condition is desired in the near-term.

Creating a wide river channel typically reduces the average velocities in the river and reduces the hydraulic capacity of the river to transport sand. The extent of river widening is limited by the volume of flow conveyed in the channel. If too much width is added to the river channel, sediment would begin to deposit in the over-widened reach and vegetation can re-establish on sandbars and divide the width of the river. Consolidating flows helps to increase the channel width that can be maintained by available flows.

For bank and island leveling, vegetation would be cleared from islands and banks within the proposed area of excavation. Sand from bank cutting or island leveling would then be mechanically pushed in stages into the nearby river channel as additional augmentation until the bank or island has been lowered to an elevation near the grade of the active channel. Like the sediment augmentation plan, the upstream reach of a bank or island cutting operation would be monitored to prevent the water surface from rising to levels that cause detrimental effects such as decreased sediment transport or impacts to adjacent landowners. Additionally, downstream locations would be monitored to prevent excessive deposition.

To alleviate net erosion, the Program (as modeled) would add about 150,000 tons of sediment per year to the river channel using earth-moving equipment. This volume of sediment augmentation would be equivalent to approximately 20 acres of islands averaging about 3 feet high leveled to channel grade each year.

Sediment Augmentation Plan Actions:

The Adaptive Management Plan of the proposed Program indicates techniques of flow consolidation, bank cutting, and island leveling would be used to initiate changes in river plan form and promote more reaches of wide, braided river (Table VII-C5). Reduction of an overly-wide river corridor as presented in chapter 4 of the FEIS could be accomplished by consolidating flow. The divergence of flows could be prevented by blocking entrances to side channels at high flows or by redirecting flow in side channels back to the main channel. These actions are an immediate means of converting an anastomosed plan form to a braided plan form. Bank cutting and island leveling accelerate the process of widening the river if there are sufficient flows to sustain the increase in width.

**Table VII-C5. Land management plan for mechanical changes to river channel plan form.**

| Plan | Mechanical Action | Acres Converted to Channel | Locations by GIS Bridge Segment* |
|---|---|---|---|
| Five-Site Plan | Bank and Island Lowering, and Consolidating Flow | 387 acres | 11, 9, 8, 6, 2 |

* As indicated in chapter 3 of the FEIS, the locations of land management activities are displayed for illustrative purposes. Actual sites are not known because this depends on willing sellers.

Initially not all sediment from augmentation would be conveyed downstream past Chapman (FEIS 2006). Deposition, like erosion, is a process that modifies the plan form, profile, and cross section of the river to match new rates of flow and sediment transport. Reaches of high and low sediment transport become less extreme over time under constant loads of sand. The volume of sand needed for augmentation may decrease as less sediment is stored in the riverbed and as sediment transport peaks diminish as a result of the evolving changes in the channel shape.

Augmentation would occur by using heavy equipment to mechanically push sand into the river at steep eroding banks or spread sand on the bed of the river at augmentation sites. Rates of augmentation should be controlled by upstream and downstream monitoring and the transport rate at the site will depend on the riverflow and site geometry. During high flows, the sand may be promptly transported downstream and allow larger volumes of sand to be placed in the river prior to managed pulse flow events. Conversely, the sand may not move noticeably during periods of low flow.

The values in Table VII-C6 indicate the majority of erosion occurs between RM 246.5 and RM 230. The reach between RM 201.1 to RM 189.3 predominantly aggrades and the reach from RM 189.3 to RM 160 is relatively stable, but degrades under the present condition.

**Table VII-C6. Average sediment transport values (in tons/year).**

| | Present Condition | Proposed Action |
|---|---|---|
| **River Mile 246.5 (South Channel of Jeffrey Island)** | | |
| Sediment transport at RM 246.5 | 0 | 0 |
| **River Mile 243.1 (South Channel of Jeffrey Island)** | | |
| Sand augmented | 0 | 0 |
| Tributary inputs | 32,000 | 32,000 |
| Deposition between RM 246.5 and RM 243.1 | -51,000 | -33,000 |
| Sediment transport at RM 243.1 | 83,000 | 65,000 |
| **River Mile 230 (near Elm Creek)** | | |
| Sediment from North Channel of Jeffrey Island | 283,000 | 298,000 |
| Sand augmented | 0 | 150,000 |
| Tributary inputs | 63,000 | 63,000 |
| Deposition between RM 243.1 and RM 230 | -185,000 | -74,000 |
| Sediment transport at RM 230 | 615,000 | 651,000 |
| **River Mile 201.2 (near Gibbon)** | | |
| Sand augmented | 0 | 0 |
| Tributary inputs | 10,000 | 10,000 |
| Deposition between RM 230 and 201.2 | 5,000 | 3,000 |
| Sediment transport at RM 201.2 | 621,000 | 658,000 |
| **River Mile 189.3 (near Wood River)** | | |
| Sand augmented | 0 | 0 |
| Tributary inputs | 0 | 0 |
| Deposition between RM 201.2 and RM 189.3 | 58,000 | 69,000 |
| Sediment transport at RM 189.3 | 563,000 | 589,000 |
| **River Mile 160 (near Chapman)** | | |
| Sand augmented | 0 | 0 |
| Tributary inputs | 0 | 0 |
| Deposition between RM 189.3 and RM 160 | -47,000 | -7,000 |
| Sediment transport at RM 160 | 609,000 | 596,000 |
| **Total** | | |
| Deposition for RM 246.5 to RM 160 | -220,000 | -42,000 |

Values shown for full Program implementation. A 48-year period of variable hydrology was used to estimate average annual values. Transport rates were generated by SEDVEG GEN3 and all values were multiplied by a factor of 1.5 to more closely match sediment transport rates from sediment rating curves at Grand Island (Randle and Samad, 2003). (Source: FEIS)

The FEIS plan reduces but does not eliminate sand imbalance. As shown at the bottom of Table VII-C6, with 150,000 tons of sand augmented near Overton, much lower net erosion could continue.

Sandbar Building Potential:

Sandbars tend to form in relatively low-velocity areas of the river channel. The potential to form river sandbars increases with increases in peak discharge and cumulative sediment transport and decreases as the bed-material grain size becomes larger. Both river water-surface elevation and sediment transport rates tend to increase with river flow, and sand transport rates increase as the bed-material grain size becomes finer.

The median grain size of the bed material was estimated for different reaches of the central Platte River for the near-term and long-term. The average sediment grain size under the proposed action was finer (0.87 mm) than noted under the present condition (1.08 mm). Based on the summaries of the flow, sediment transport and grain size values, the proposed action may provide greater sandbar-building potential due to its larger 1.5-year flow and slightly greater deposition and finer grain sizes over the long-term.

The potential height of new sandbars formed in the channel in any given year is related to the magnitude and duration of peak flows because it is impossible for sandbars to form above the water surface. The process of sandbar formation and maintenance is also driven by the amount of sediment that is available and transported by the river. Moreover, the relationship of flow to the amount of sediment it can transport is not linear because the amount of sediment transported and redistributed by the highest peak flows is exponentially greater than the amount of sediment moved by lower flows. Therefore, the adverse impact of water resource development on the frequency and magnitude of the highest 20 percent of peak flows has a significant negative impact on sediment transport and the impact would not be offset (in terms of sediment re-distribution) by increases of similar magnitude to the lowest 20 percent of flows.

Potential Limitation of Sediment Augmentation:

Mechanical channel widening is necessary for channel habitat restoration to be achieved and the Program has agreed to increase the width of active channels. Island leveling and sediment augmentation as outlined in the FEIS has several practical questions that would need to be worked through regarding the scale and rate at which it can be accomplished and the techniques that would be used to move and redistribute sand into the channel. These activities are to be addressed by an adaptive management approach using the monitoring and research component of the Program.

Activities of this nature and at this scale have not been previously attempted on the Platte River. Logistical uncertainties include channel site access and the feasible scope and scale of channel conversion. Additional factors such as regulatory approval, installation of monitoring systems, and favorable weather and flow conditions create uncertainties about the scope, scale, and timing of island leveling.

## C3. Effect on Wet Meadow Hydrology

Long Duration Pulse Flows and River Water Surface Elevations of Early Spring:

Peak flows during late spring, from mid-February to mid-March, occur when wetland biota in meadows and river backwaters are initiating spring growth and activity. Peak flows and associated increases in river water surface elevation during early spring function along with precipitation to help elevate and sustain groundwater levels, thaw soils, and make soil organisms that birds use as food become active and available.

The proposed action would modestly increase the late winter/early spring by an average of about 250 cfs (11 percent) overall (Figure VII-C4). Amounts estimated from OpStudy range up to 600 cfs in any single year. Channel morphology and bed elevation changes may also contribute to differences in springtime river water surface elevations. River water surface elevations output from the SEDVEG Gen3 model were therefore used in the analysis.
The analysis of river water surface elevations focused on the downstream portion of the central Platte River habitat reach where native wet meadows are most prevalent on large islands or peripheral to the river channel. The analysis assumes that years with the highest river stages would generally have the greatest influence on the long-term maintenance of wet meadow biological communities.

The computations of early spring river water surface elevations in the downstream portion of the central Platte River habitat area (below RM 195) from the SEDVEG Gen3 model incorporate changes due both to altered hydrology and channel morphology. River water surface elevations during the early spring pulse flow period differ only slightly from present conditions. Changes in water surface elevation range between negative 0.12-foot and plus 0.14-foot from the present condition (Table VII-C7).

**Table VII-C7. Change in the 30-consecutive-day maximum water surface elevations (ft) during early spring mid-February to mid-March) from the present condition downstream of RM 195.**

| | Exceedance Level (Percent of Years) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **0** | **10** | **20** | **30** | **40** | **50** | **60** | **70** |
| Proposed Action | +.02 | -.12 | +.02 | +.06 | +.09 | +.09 | +.14 | +.07 |

Note: Values are in feet.
Source: FEIS

Field surveys have not detected significant changes or trends in channel bed elevation in the downstream sections of the habitat reach where most remaining wet meadows occur. Current analyses do not indicate substantial differences in bed elevation in the lower rivers section during the proposed action’s first 13 years. Nevertheless, because available data are limited, monitoring would be a priority early in the proposed action to help refine an understanding of this reach of river, the analytical SEDVEG Gen3 model, and effects from the implementation of sand augmentation and mechanical actions.

Long-Duration Pulse Flows and River Water Surface Elevations of Late Spring:

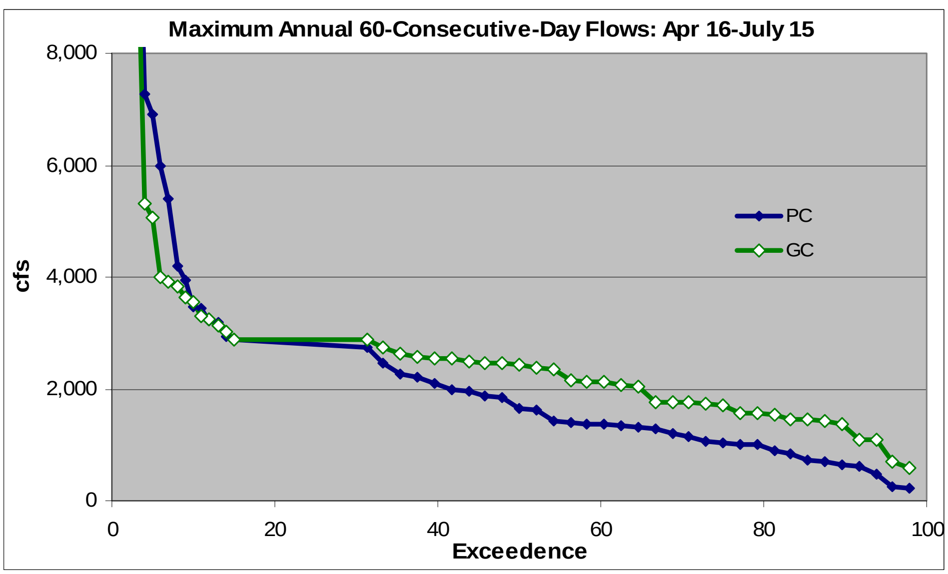
During the late spring period the daily flow output from the FEIS OpStudy model was used to compute the maximum 30-consecutive-day flow from mid-April to mid-July of each year. The 48 values from the 48-year simulation from the present condition and the proposed action were then sorted from high to low and compared using exceedance analysis.

The proposed action would decrease flows in about 30 percent of the years with the highest flows. Reductions in some years could be substantial (e.g., -3,000 cfs). Peak flows would increase in years with moderate and low peak flows (i.e., percent exceedance greater than or equal to 40 percent) (Table VII-C8, Figure VII-C9). While the long-term average is not substantially improved, the proposed action would enable mid-range flows of 3,000 to 4,000 cfs more frequently year to year. Like the early spring flow period, achieving these flow increases depends on the ability and flexibility to make timely EA releases with few constraints.

**Table VII-C8. Maximum 30-consecutive-day mean flows (cfs) during late spring (mid-April to mid-July) at Grand Island, Nebraska.**

| | Exceedance Level (Percent of Years) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **0** | **10** | **20** | **30** | **40** | **50** | **60** | **70** |
| Present Condition | 22,839 | 9,524 | 4,679 | 3,785 | 2,397 | 2,132 | 1,836 | 1,434 |
| Proposed Action | 20,003 | 6,223 | 4,431 | 3,699 | 3,487 | 3,001 | 2,825 | 2,415 |

**Figure VII-C9. Exceedance curves for annual maximum 30- and 60-consecutive-day mean flow in late spring over a 48-year period of simulation measured at Grand Island.**




River water surface elevations (Table VII-C9) in late spring were computed to incorporate the changes due to the altered hydrology and minor changes in channel bed elevation using the SEDVEG Gen3 model. As previously discussed, the analysis of changes in water surface elevation takes into account only the SEDVEG water surface elevations modeled for the river downstream of River Mile 195 near Shelton. Wet meadows adjoining the river channel lie primarily in the downstream portion of the affected area. Qualifications given in the previous subsection (late winter pulse flows) about the limited data and less definitive modeling conclusions for the downstream river reach also apply to these estimates.

**Table VII-C9. Change from the present condition in the maximum 30-day peak water surface elevation for the river reach downstream of RM 195 during late spring (mid-April through June)**

| | Exceedance Level (Percent of Years) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **0** | **10** | **20** | **30** | **40** | **50** | **60** | **70** |
| Proposed Action | -.35 | -.80 | -.19 | -.12 | +.16 | +.17 | +.27 | +.23 |

Note: Values are in feet.
Source: FEIS

The proposed action would reduce river water surface elevations during late spring in the highest flow years. Reductions of the 30-consecutive-day maximum river water surface elevation range from about 0.10-foot lower than the present condition at the 30-percent exceedance level (roughly one in three years on average) to 0.8-foot lower at the 10-percent exceedance level (roughly one in ten years on average). River water elevation in years with normal or moderate spring peaks (≥ 40-percent exceedance) are somewhat improved over (higher than) the present condition. The increases range from 0.16- up to 0.23-foot higher than the present condition.

These data indicate the proposed action would negatively impact wet meadows by negatively impacting river water surface elevations in the wettest years. The proposed action could positively impact river water elevation in normal flow years. Transitional meadows or those areas at higher elevations may be adversely affected by reduction of hydrologic conditions in wettest years for the proposed action compared to the present condition. The lowest and wettest meadows which are capable of being influenced by river stage in normal flow years may be positively impacted. Qualitatively, the reduced pulse flows in high flow years adds to an overall trend toward reduced hydrologic (inter-annual and intra-annual) variation.

<u>Short-Duration Over-Bank Pulse Flows:</u>

As previously mentioned, flow events with high magnitude but relative short duration are observed to create physical connections of surface water for riparian meadows which increase the facilitation, exchange, and redistribution of aquatic and semi-aquatic organisms in low-lying wet meadows. Based on past field observations, the Service believes that a continuum of biological effects likely occur throughout a range of high flows and would be expected. A greater frequency of high flow events and greater magnitude of high flow events each result in greater biological benefits.

Short-duration over-bank pulse flows would generally be reduced by the proposed action. Therefore, the proposed action is expected to have negative impacts on meadows compared to present conditions. The actual magnitude of the impacts varies somewhat based on the duration and flow level selected for comparison.

Over the 48-year simulation, the number of years that 8,000 cfs flow is achieved by one-day flow events increases from 14 under present conditions to 16 under the proposed action (Table VII-C10). However, with the proposed action the frequencies that the maximum annual one-day peak flow achieves 10,000 cfs and 12,000 cfs are reduced from 13 to 11 years, and 9 to 7 years, respectively. Under the proposed action, the frequency that the annual five-day peak flows achieve 8,000 cfs would be reduced from 14 to 12 years. The frequency that five-day peak flows achieve 10,000 and 12,000 cfs would be reduced from 11 to 7 years and 7 to 4 years, respectively.

**Table VII-C10. Relative frequency (percent of years) that annual short-duration peak flow events at Grand Island achieve various levels over a 48-year period of simulation.**

| | **One-Day Peak** | | | **Five-Day Peak** | | |
|---|---|---|---|---|---|---|
| **Flow (cfs)** | **8,000** | **10,000** | **12,000** | **8,000** | **10,000** | **12,000** |
| **Present Condition** | 28 | 26 | 18 | 28 | 22 | 14 |
| **Proposed Action** | 32 | 22 | 14 | 24 | 14 | 8 |

<u>Summary of Wet Meadow Hydrologic Impacts:</u>

The impacts that flow changes would have on wet meadow biology can only be described qualitatively. The Service's greatest interest is the effect of the proposed action on higher flow years that are greater than median. These years are likely to have the greatest long-term influence on meadow ecology. This analysis was also focused on the downstream portion of the affected central Platte River area where most wet meadows occur near the river.

Under the proposed action, the river water surface levels in the downstream portion of the central Platte River action area would slightly decrease in about 10 percent of years and slightly increase in other years during early spring. Overall, the information suggests little change in wet meadow hydrology by the proposed action's effects to late winter pulse flows.

During the late spring pulse flow period, river water surface levels would decrease in about 30 percent of the years. In some years the decrease would be quite substantial (e.g., -3,000 cfs; -0.80-ft). The decreases in higher flow years will likely have an adverse affect on meadows and in particular on transitional communities such as mesic meadows at higher elevations that are infrequently saturated. These changes in flow may have some negative impact on biodiversity and alter the functioning of some semi-aquatic and transitional communities at higher elevations in the wet meadow complexes.

The wet meadow sites mapped by Wesche et al. (1994) indicate that 80 percent of the affected area lies within a 2-foot range of groundwater levels. Despite the shallow relief, wet meadows often support a considerable range of communities from mesic to hydric and aquatic. The variation is mainly associated with elevations due to groundwater subirrigation and highly permeable subsoil and the variation implies that even seemingly small changes in groundwater levels could influence a shift in the composition and functional ecology of the meadow. However, the trade-off of biological effects between reduced frequency of very high flows and increased frequency of moderately high flow is difficult to predict.

Field surveys have not detected significant changes or trends in channel bed elevation in the downstream sections of the Lexington to Chapman reach, the river reach where most wet meadows adjoining the Platte River remain. Using the currently available sand balance modeling procedures, no substantial differences in bed elevations are projected for the proposed action during the proposed action's first 13 years. Nevertheless, because available data are limited, monitoring would be a priority early in the program to help refine an understanding of this reach of river, the analytical SEDVEG Gen3 model, and the effects from the implementation of sand augmentation and mechanical actions.

The proposed action would reduce the frequency of short-duration pulse flow events. Consequently, overland flows into wet meadows and surface water connections within wet meadow communities would likely be reduced. This effect is incremental and cumulative with similar depletive impacts occurring from water impacts over several decades of water resource development.

In general, the loss of rare hydrologic events can have a disproportional large ecological influence for wetland systems by providing strong year-classes that carry the populations through succeeding years when conditions for population growth and maintenance are not as favorable. On the Platte River, short-duration pulse events may play a unique role in rejuvenating wet meadows by providing linkages and enabling redistribution of aquatic and semi-aquatic organisms.

Potential Hydrologic Impacts in the Upstream Areas:

Few riparian wet meadows remain in the upper portion of the Lexington to Chapman river reach. In the upstream portion, field survey data and numerical modeling indicate relatively rapid rates of channel incision are ongoing (Holburn et al. 2006, Murphy et al. 2004). The sand augmentation activities of the Program will help alleviate channel incision and improve the ability to sustain channel elevations.

To the extent that the proposed action attempts to recreate riparian meadow in the upper reach of the Platte River (generally from the J-2 Return to Elm Creek), the sediment augmentation activities of the Program would help maintain the hydrology of riparian meadows near the river. Positive effects of the sediment augmentation activities on channel elevations may persist as far downstream as the general area from Audubon's Rowe Sanctuary to the Shelton bridge.

## C4. Invasive Species in the Platte River Basin

The proposed action will clear established shrub and grass communities from islands to produce least tern and piping plover foraging habitat, but then fails to provide flows to drown annual noxious weeds, the proposed action would result in an increase in noxious and invasive plants. If these plants establish in new areas as a result of the proposed action, the invasive plants could adversely affect target species habitats by: a) inhibiting the conveyance capacity of flows in the river channel, b) by colonizing and overtaking the sandbar substrates the species use and, c) impairing a broad visual expanse that the species require with their tall growth forms. The encroachment of phragmites is one of several reasons for reduced channel capacity along the North Platte River at North Platte (J.F. Sato and Associates, Inc. 2005) and restricts the delivery of water to the central Platte River reach, including water provided by the Program for the benefit of the target species.

Although it is the responsibility of each person who owns or controls land to effectively control noxious weeds on that land, the resources needed to effectively control the above species often fall beyond the means of individual landowners. Currently there is no comprehensive plan to control noxious and invasive plants in the Platte River basin. Several Weed Management Areas (WMA) have been formed in Nebraska to pool resources to combat invasive weed encroachment in the Platte River basin. The areas consist of: a) the Panhandle WMA which manages the upper reach of the North Platte River, b) the Platte Valley Weed Management Area which manages the lower North Platte River reach, the central Platte River, and portions of the lower Platte River, and c) the Lower Platte WMA which manages the remainder of the lower Platte River down to the Missouri River Confluence. The above efforts are indications that comprehensive planning for noxious or invasive weed control is being developed, but a defined, long-term management plan and funding for that effort are not yet in place.

# *D. Effects of the Action on the Whooping Crane*

## D1. Effects of the Action on Whooping Cranes

The Federal action was evaluated for the following effects on whooping cranes: a) land and water management effects on crane stopovers and roosting during spring and fall migration; b) feeding and nutrition; and c) protection of whooping cranes from disturbance and human intrusion.

Channel Roosting:

As modeled in the FEIS, the Program would acquire and restore, where practical, 10,000 acres of habitat lands in approximately five sites between Lexington and Chapman, Nebraska (referred to as habitat complexes). The cleared and widened length of channel habitat represented in the FEIS, totals about 10 miles in length and would be primarily located in the river reach between Lexington and Kearney, Nebraska.

Program increases in roost habitat would benefit whooping cranes by providing them secure and reliable stopover sites during each migration season. Whooping cranes in the remaining wild and self-sustaining Aransas-Wood Buffalo population cross the Platte River twice each year. During the average life span, individual birds cross the Platte River 40 to 60 times and have a high probability of using the Platte River during migration. During the spring and the fall migrations, this increased habitat on the Platte River would benefit crane survival and rearing of young. During spring, the migrational stopovers would also maintain physiological fitness of adult birds for reproduction.

Whooping cranes observed in migration are usually found near suitable wetland roosting sites and the availability of suitable roost sites is a primary attraction at stopover points. Suitable channel roost habitat must be present at or near locations where a crane crosses over the Platte River for whooping cranes to stop. Therefore, the anticipated biological benefits are directly related to the improvements in the distribution, quantity, and quality of the restored habitat sites

The Program distribution of restored wide channels near the center of the migrational pathway has a high potential for providing benefits to migrating whooping cranes. Because whooping cranes migrate as single individuals, as family groups, or as flocks of a few birds, Platte River crossings during any given season occur at various locations within the migrational path, roughly 170 miles wide. Though the 10-mile length of restored channel is a small proportion of the 170-mile migration corridor, it represents a benefit to the whooping crane over the present condition because more high quality locations near the center of the species migrational path would be available to the cranes than presently exist. The spacing of channel restoration illustrated in the FEIS would increase the probability of whooping cranes locating suitable habitat along the Platte River during migration.

Whooping cranes observed roosting on the Platte River use wide channels with shallow, slow moving water, usually stand on shallowly submerged sandbars, and normally occupy a single position within the river channel area throughout the night. Biologists assume that an expanse of water attracts cranes and functions as a barrier that protects cranes from disturbance and predators. The Program land and water management activities increase the quantity and improve the distribution of wide channels that include increased amounts of shallow and slow-moving water (the quantitative effect of specific Program land and water management activities on the availability of suitable habitat is discussed in part D.2 of this section). These improvements benefit the whooping cranes by increasing the probability of locating suitable roost sites in which to stand and rest securely during the night. The availability of suitable roost habitat not only helps protect whooping cranes from predation, but also reduces energy expenditures, thereby helping to maintain the birds' physiological condition.

As with all migratory birds, the physiological fitness of whooping cranes arriving at breeding grounds in spring affects their reproductive potential. Program improvements in the availability of suitable roost sites and potential improvements in food resources in the Platte River Valley help ensure that the whooping cranes arrive at the breeding grounds in good physical condition for breeding.

Feeding and Nutrition:

*Croplands*

Whooping cranes routinely rest and feed in croplands at migration stopover sites to replenish energy and nutritional requirements. The amount of cropland acquired by the Program for feeding or buffers would be a small proportion of the Platte River valley landscape (estimated less than 7 percent of the land within 1 mile of the river). The likelihood that whooping cranes would select or use the particular fields managed by the Program may be relatively small.

A secondary potential benefit from Program improvements in the quantity and distribution of channel roost habitat may be a decrease in interspecific competition for food resources in the Platte River valley. Use of the Platte River valley by the mid-continent population of sandhill cranes and large populations of geese precedes the arrival of whooping cranes and improved farming efficiency has reduced the amount of waste corn available to foraging migratory birds (Krapu 2003). The habitat requirements of these bird populations are much like whooping cranes and the populations often concentrate in parts of the valley with wide river channels. Improvements in the distribution and quantity of wide river channels may disperse the concentrations of sandhill cranes and geese along improved reaches of the Platte River, thereby reducing the competition for limited grain resources in those river reaches that currently have suitable roost habitat. However, the actual behavioral response of populations of other birds and the likelihood that they would become more widely distributed at lower densities along the Platte River is unknown.

*Lowland Grasslands and Wet Meadows*

Whooping cranes, like sandhill cranes, require animal matter to satisfy their nutritional needs, and this material is obtained primarily from grasslands and wetlands. Along the Platte River, grasslands and wet meadows provide animal food items and nutrients that cranes cannot obtain from other food sources.

As illustrated in the FEIS, the Program would increase the amount and improve the distribution of wet meadows along the central Platte River. The amount of bottomland riparian grassland and wet meadow acquired by the Program for feeding or buffers is a relatively small proportion of the Platte River valley landscape (estimated less than 11 percent of the land within 1 mile of the river). However, the potential for whooping cranes to use an area is likely related to the location of grasslands/meadows in the landscape, and most wet meadow areas protected or managed by the Program would be appropriately located near suitable or restored roost sites.

As with all migratory birds, the physiological fitness of whooping cranes arriving at breeding grounds in spring affects their reproductive fitness. During migration, wetlands and wet meadows could provide food sources and nutrients necessary for reproduction that are not obtainable from grain fields. Use of wetlands may also be particularly important for some components of the whooping crane population: Howe (1989) found that whooping crane family groups migrating with young relied more heavily on wetland habitats than other population sectors. Therefore, an increase in wet meadows along the Platte River valley would benefit migrating whooping cranes by increasing the availability of nutrients not supplied by other habitats, and support reproductive fitness of the whooping cranes using these areas.

Protection from Disturbance:

Whooping cranes do not readily tolerate disturbance**.** The Program action to acquire and restore blocks of land would secure these areas from human intrusion at times of whooping crane use. Because much of the action area and potentially acquired lands are in rural settings and the level of crane use in protected areas is unknown, the Program land acquisition may have little effect within the first 13-years. However, the habitat acquisitions would preclude future land use changes (from agricultural to commercial, residential, or industrial purposes). Therefore, Program acquisitions and proper management of buffer and feeding habitats would provide biological benefits for the long-term protection and conservation of whooping cranes. The variety, intensity, frequency, and timing of public use of Program lands would be considered in land management plans under the Program.

## D2. Effects of the Action on Whooping Crane Habitat including Designated Critical Habitat

### D.2.a. Effects on Habitat Upstream of Lexington Nebraska:

Reaches of the South Platte, North Platte, and Platte Rivers from Hershey, Nebraska downstream to Lexington, Nebraska, comprise about 83-miles of the 170-mile wide whooping crane primary migration corridor between Hershey and Chapman, Nebraska. Most of the reach upstream of Lexington has been transformed from a braided channel to gallery riparian forest with anabranched remnant channels generally less than 300 feet wide. Therefore, the Platte River system upstream of Lexington is predominantly unsuitable for whooping crane use.

Under the Program, water development projects affecting this river reach would continue to operate much as they have in the past. Although Program water management would increase or decrease river flows slightly in various reaches of the Platte River system upstream of Lexington;

in the absence of land management activities, the changes would have little effect on the quality of whooping crane habitat upstream of Lexington. Therefore, the present, generally degraded habitat conditions are expected to persist under the Program and little whooping crane use is expected along this reach. Some small areas that provide marginal value as whooping crane habitat will likely persist due to tributary inflows and irrigation/groundwater return flows.

**D.2.b. Effects on Habitat Downstream of Lexington and on Designated Critical Habitat (Lexington to Shelton)**

This biological opinion does not rely on the regulatory definition of “destruction or adverse modification” of critical habitat at 50 C.F.R 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat. The potential for destruction or adverse modification of critical habitat by a Federal action is assessed by determining the effects of the proposed Federal action on primary constituent elements of habitat qualities that are essential to the conservation of the species. These anticipated effects are then analyzed to determine how they will influence the function and conservation role of the affected critical habitat. This analysis provides the basis for determining the significance of anticipated effects of the proposed Federal action on critical habitat. The threshold for destruction or adverse modification is evaluated in the context of whether or not the critical habitat would remain functional to serve the intended conservation role for the species.

The Federal action was evaluated for the direct and indirect effects on the following primary constituent elements[16]: a) open expanse of channel habitat conducive to whooping crane stopovers and that provide secure roosting; b) the quantity and quality of bottomland feeding habitats; and c) the ability to support normal crane behavior and provide protection from disturbances and human intrusion (50 CFR 17.95).

PCE 1: Roosting Habitat

Like other locations throughout the species migrational range, whooping crane use of the Platte River appears to be associated with the availability of suitable roost habitat. Available whooping crane data indicate strong relationships between whooping crane sightings and channel width. Whooping crane use is disproportionately concentrated in the widest channels available in the Platte River study area and the narrow channels tend to be avoided (FEIS Figure 2-2, Page 2-8; Farmer et al. 2000 at Figure 2, page 25; USFWS 1997 Appendix E Figure 4; WEST, Inc., 2005). Across a gradient from narrow to wide channels, whooping crane use increases disproportionate to availability. This relationship is interpreted as a preference for the widest channels.

River channels on Program lands would be managed to achieve certain habitat characteristics as described in Program Document Attachment 4: Land Plan, Table 1. Land accepted into the Program would be managed for wide, active, channels initially approaching 1,150 feet in width and the river channels would be cleared of vegetation and widened using mechanical means. Lands adjoining channel habitat would be managed as buffer areas to protect channel roosts from

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[16] See the Baseline Section of this BO for a discussion of the primary constituent elements of whooping crane critical habitat.

disturbance. The Program may also acquire some lands where little or no restoration activity is needed to achieve the Table 1 characteristics.

The site-characteristics for habitat complexes given in Table 1 of the Land Plan are consistent with the habitat characteristics recommended by the PRMJS Biology Workgroup (Faanes 1993) and are supported by the Service's whooping crane authorities (Lutey 2002). A review of the Land Plan Table 1 guidelines by the Platte River endangered species science panel of the National Research Council (2005) also determined the characteristics to be appropriate. The Program provides for monitoring and research to refine crane roost site criteria (Attachment 3, AMP).

Wider channels would increase the water surface area and provide the expanse of open aquatic habitat that whooping cranes seek for roosting, thereby increasing the availability of roost habitat to migrating cranes (Figure VII-D1). Flow management and sediment augmentation described in the FEIS are designed to maintain the geomorphology of river channels. The Program's emphasis on restoring wide channels and sustaining the geomorphic processes between Lexington and Kearney (which lies entirely within the designated critical habitat area) would improve the availability of roosting habitat for the whooping crane in the Platte River component of the whooping crane designated critical habitat in the Central Flyway, and thereby promote the conservation and recovery of the species.

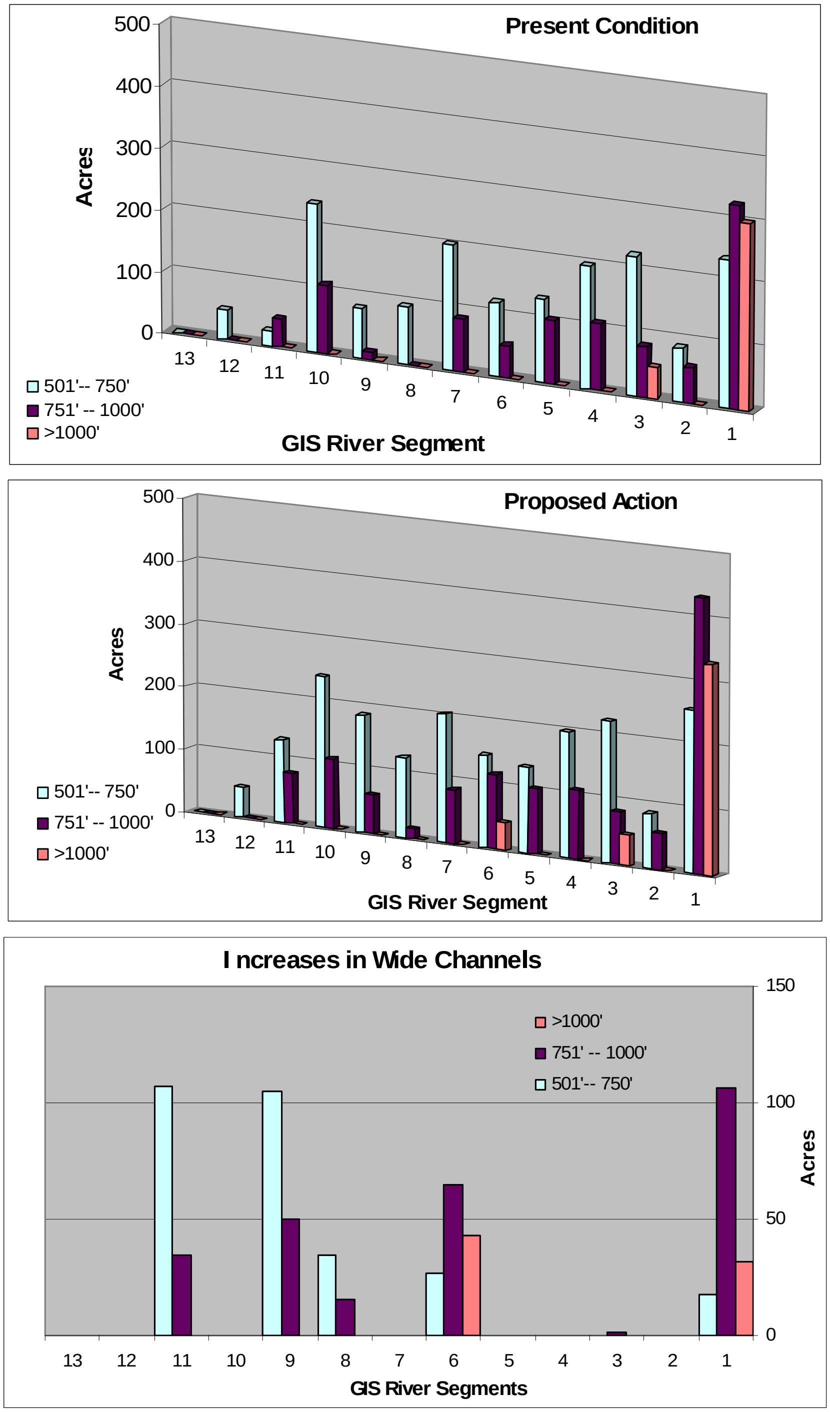



**Figure VII-D1. GIS analysis of changes in wide channels (>500 ft) by bridge/river segments as represented in the FEIS. Actual locations of restoration would depend on willing sellers. River bridge segments are numbered east to west geographically, and from right to left in the figure. US Highway 281 at Grand Island divides bridge segment 2 from 3; State Highway 44 at Kearney divides segment 8 from 9; US Highway 183 at Elm Creek divides segment 9 from 10; and US Highway 283 at Lexington is the upstream extend of segment 13. Whooping crane critical habitat is represented in these graphs by river segments 6 though 13.**

*Aquatic Characteristics of Roost Habitat*

Selection for aquatic areas to roost is innate to the behavior of wild cranes. Whooping cranes observed on the Platte River typically roost in wide expanses of water-filled channel, and stand in shallow slow moving water usually on shallowly submerged sandbars. The river flows that provide these qualities often may have deeper and faster water in braided river subchannels (USFWS 1981). The Program provides for monitoring and research to refine our understanding of aquatic variables that attract crane to use the Platte and that provide suitable roost habitat(Attachment 3, AMP).

Under the Program, channel widening activities would increase the water expanse at potential roost habitats and would maintain or increase river flows compared to present conditions during the whooping crane migration season.. Restored channels are expected to approximate the conditions at sites on the Platte that cranes most frequently use, and are expected to increase the amount of roosting habitat.

Average monthly flows increase during April from 1,793 to about 1,872 cfs, increase during October from 1,437 to 1,555 cfs, and decrease slightly during November from 1,576 to 1,531 cfs (Table VI-D2). Over the 48 years analyzed, the frequency of EA releases, in percent of years, was 21, 27, and 12 in April, October, and November, respectively.

**Table VII-D1. Average flow (cfs) at Grand Island during the primary months of spring and fall whooping crane migration (Source: FEIS OpStudy)**

| | April | Oct | Nov |
|---|---|---|---|
| Present Condition | 1,793 | 1,437 | 1,576 |
| Program | 1,872 | 1,555 | 1,531 |

The FEIS estimated that channel widening and flow management from the Program would increase the wetted area within wide channels (>500 feet) by about 700 acres (27 percent) during spring migration, and by 700 to 800 acres (24 to 32 percent) during the fall migration season (Table VII-D3).

**Table VII-D2. PHABSIM Model: Wetted area (acres) in wide channels (>500 Feet) and percent change from the present condition (FEIS).**

| | **March** | **April** | **May** | **October** | **November** |
|---|---|---|---|---|---|
| Present Condition | 3,091 | 2,758 | 2,601 | 2,516 | 2,786 |
| Program | 3,818 (+23) | 3,493 (+27) | 3,538 (+36) | 3,325 (+32) | 3,453 (+24) |

The area of wide channels that contain a 100-foot minimum shallow width would also improve (i.e., increase). The PHABSIM analysis estimated a 640 acre increase (19 percent) in channel area with shallow water during April, and roughly 700 to 800 acres (21 to 25 percent) increase during the fall migration season (Table VII-D4). Both the distribution of increased water surface area and increased channel with shallow water would correspond with the river locations where channel restoration activities are undertaken by the Program (e.g., Figure VII-D1).

**Table VII-D3. PHABSIM Model: Average area (acres) of wide channels (>500 ft) with 100-foot minimum shallow width (and percent change from the present condition).**

| | March | April | May | | October | November |
|---|---|---|---|---|---|---|
| Present Condition | 3,355 | 3,375 | 3,118 | | 3,265 | 3,464 |
| Program | 3,771 (+12) | 4,014 (+19) | 3,908 (+25) | | 4,070 (+25) | 4,181 (+21) |

All PHABSIM-based channel habitat computations are based on direct changes that immediately result from mechanical reshaping on Program lands. The geometry of channels that are not on Program lands are assumed to remain fixed. This assumption is a significant limitation of PHABSIM when applied to long-term conservation planning of Platte River habitats, as it does not reflect the natural evolution or trends in the channel occurring either on Program lands or throughout the much larger portions of the affected area that are not Program lands as described in the next section

*Roost Habitat Sustainability*

Sustainability of channel roosting habitat is important because deterioration of river channel maintenance processes are the primary cause of past roost habitat losses in the critical habitat reach. The persistence and maintenance of wide and shallow channels for roosting directly affects the ability of the Platte River to function as migration habitat.

Pulse flows and sediment transport are the principal controlling events that maintain the open braided channel habitats used by whooping cranes, although the precise mechanisms by which pulse flows interact to maintain the channel habitat are not entirely understood.

The Program will have these effects on the sustainability of roost habitat:

- Increased discharges from the J-2 Return will increase the net erosion and imbalance of sand transport in the habitat area. Sand transport deficit contributes to downcutting and narrowing with systemic effects on channel maintenance. The sand transport deficit would be offset to some extent by Program sand augmentation activities.

- Late winter pulse flows (i.e., during ice breakup) would increase somewhat, by an average of 233 to 350 cfs (10 to 17 percent). This increase is due in part to releases from the Lake McConaughy EA. Ice-scouring of vegetation during the highest peak flow years may improve slightly.

- The magnitude of annual short-duration pulse flows for channel management would increase in low flow years. This flow increase would occur in about 60 percent of years due to annual or near-annual releases from the Lake McConaughy EA.

- Annual short-duration pulse flows would be used in conjunction with sediment augmentation to restore sediment balance and alleviate channel-bed degradation. The FEIS strategy of increasing the frequency of moderate pulse flows to help maintain channels is a hypothesis to be tested within the Program's adaptive management framework.

- Sand augmentation would substantially reduce the present net erosion and sediment transport deficit; thereby reducing the rate of channel habitat losses. The effect of sand augmentation to sustain roosting habitat as analyzed in this opinion is highly dependent on timing and rate of implementation.

- The Program would reduce the magnitude and frequency of the highest inter-annual, short-duration pulse flows most responsible for channel maintenance. This reduction conflicts with the National Research Council (2005) recommendations and with the Service's 1994 flow recommendations to retain and increase the occurrence of higher inter-annual pulse flows for Platte River habitat conservation and recovery.

The National Research Council (2005) concluded that the first step in management of the Platte River ecosystem is to, "get the water right," and that the Service's 1994 instream flow recommendations appeared "to the committee to be in the correct magnitude and timing to achieve the desired results of using river processes to foster habitat for the threatened and endangered species" (p.142). The Council's report went on to state that, "Specific management questions—such as whether the periods between peak flow are appropriate for maintaining useful habitat system and whether the Federal system of flows is sustainable over a period of years cannot be resolved at this time." The Program includes a monitoring and research component to investigate the river system response to water management and sediment augmentation activities. Information from that monitoring and from other sources will be used in the adaptive management component of the Program to adjust water and land management activities, as appropriate.

<u>PCE 2: Bottomland Feeding Habitat</u>

*Croplands*

The Program would manage some areas to provide food sources for whooping cranes and this action would potentially benefit whooping cranes to a small degree. The amount of cropland acquired by the Program for feeding or buffers would be a small proportion of the Platte River valley landscape (estimated less than 7 percent of the land within 1 mile of the river), and the likelihood that whooping cranes would select or use the particular fields managed by the Program may be relatively small.

*Lowland Grasslands and Wet Meadows*

Along the Platte River, grassland and wet meadow habitats provide animal food items which in turn provide nutrients that whooping cranes cannot obtain from other food sources. The acreage of riparian grassland and wet meadow habitat restored by the Program would modestly increase (4,450 acres; 11 percent) compared to present conditions, thereby improving the function of bottomland feeding habitat in the conservation and recovery of the species. The biological effect of this grassland and meadow restoration is not entirely related to change in acreage, however, because qualitative aspects substantially influence feeding value.

Soil characteristics and hydrologic regime are two primary factors that determine the quality of riparian meadows. The hydrologic regime is a primary determinant of wetland community functioning. The effects of the Program on the hydrological regime are discussed later in this section.

Wetland scientists regard the creation and restoration of functional wetlands as difficult undertakings. The Program's AMP includes funding and objectives that will be directed toward evaluation of meadow restorations. The AMP identifies the need for robust monitoring and research information to be assembled, compiled, analyzed, reviewed, and reported according to rigorous standards. Presently, biological criteria to ensure restored areas are functional and productive for crane food resources will be developed through the Program monitoring and research component, and appropriate adjustments to current wetland restoration methods will be made via adaptive management.

*Effect on Wet Meadow Hydrology*

*Late Winter Pulse Flow* - Late winter river pulse flows would help sustain meadow subirrigation and help support food resources for whooping cranes in wet meadows and in the aerobic zones near the soil surface. The Program would have a small positive effect on river stage during late winter and early spring (February-March). This is due in part to releases made from the Lake McConaughy EA which were made in roughly one-half of the years and averaged 367 cfs in February and 233 cfs in March.

Channel bed degradation is occurring from the J2 Return as far downstream as Audubon Sanctuary and stability of the channel bed is needed to maintain the groundwater hydrology of meadows restored near the river channel. Sand augmentation at the rate portrayed in the FEIS analysis for the Program would reduce the rate of channel degradation and incision. A stable channel bed and minor increases in late winter flows would help maintain river stages at their present levels and in turn, wet meadow groundwater hydrology.

*Late Spring Pulse Flow* - Organisms inhabiting riparian wetlands and backwaters are rapidly growing and reproducing during late spring (mid-April to mid-July). Seasonal hydrologic conditions are needed to sustain the meadow biological communities.

In *Section C, Effects of the Action on the Platte River System,* the Program was found to increase the late spring pulse flows in roughly 65 percent of the years (i.e., those years with the lowest peak flows). As represented in the FEIS, most pulse flow improvements from the Program would occur at average flows below 3,700 cfs for the 30-consecutive-day duration and depend on EA releases in about 85 percent of the years. These flow increases may provide more frequent saturation of the lowest lying wet meadow areas in the downstream portion of the study area.

The FEIS indicates that the magnitude of the highest long-duration pulse flow events would be reduced. The maximum 30-consecutive-day flow would be reduced in years with flows above roughly 3,700 cfs and the frequency of these reductions would be roughly one-in-six years (Figure VII-C9). Also, many of the short-duration inter-annual flow events (e.g., greater than 8,000 cfs) would be reduced. Overbank flows into the low riparian meadows would also be reduced under the Program.

Though overland flows from the river into meadows are uncommon occurrences under present conditions, they likely have a unique and inordinately large biological effect when they occur. These rare, hydrologic events rejuvenate the wet meadow communities by reconnecting low-lying sloughs, enabling the reintroduction and redistribution of aquatic and semi-aquatic organisms such as fish and snails (Currier 1989, Seibert 1994). Therefore, occasional surface overflows are important for maintaining the dynamic structure and functions of wet meadows. Reduced overbank flows would likely have an incremental adverse impact on dynamic processes that are important to wet meadow biodiversity. With reduced occurrence, a shift in the overall composition and structure of wetland communities would occur. Measures to effectively mitigate or offset this type of impact have not been identified and are not currently known to exist.

Historic information on crane feeding in the Platte River valley (Currier et al. 1985) suggests the feeding behavior of whooping cranes has changed as meadow habitats have declined. Further reduction in the hydrologic functions provided by higher flows could incrementally diminish the value of wet meadows on the Platte River for whooping crane feeding.

PCE 3: Protection from Disturbance

The Program would increase the ability of the Platte River to function as disturbance-free habitat for migrational stopovers. Land-use changes under the Program will increase the number and the distribution of large areas suitable for crane use that would be protected from disturbances and intrusion. The initial focus of the Program, which emphasizes establishment of “habitat complexes” where suitable habitat areas are well distributed throughout the central Platte River, is consistent with recommendations of interagency biological teams and reviewers.

The Program would seek to obtain conservation and management of both river banks (Land Plan, Table 1). The Program FEIS projects an increase in protected river bank length from 18 miles to 32 miles in the critical habitat reach between Lexington and Shelton. This is an increase from 16 percent of the bank length for present condition to about 30 percent under the Program. For the whooping crane’s primary migration corridor between Hershey and Chapman, the Program increases protected bank length from 33 to about 54 miles, or from 10 percent to about 16 percent (Table VII-D5).

**Table VII-D4. Approximate length and proportion of bank on the Platte River primary channel that is owned and managed for whooping crane habitat conservation. The Lexington-Shelton river reach is designated as whooping crane critical habitat.**

| | | Lexington – Shelton | Lexington – Chapman | Hershey – Chapman |
|---|---|---|---|---|
| Present Condition | length (miles) | 17.8 | 33.5 | 33.5 |
| | proportion | (0.16) | (0.19) | (0.10) |
| | | | | |
| Federal Action | length (miles) | 32 | 54 | 54 |
| | proportion | (0.30) | (0.30) | (0.16) |

Out-of-Channel Habitat: For off-channel sites, the total area of habitats protected by the Program will comprise roughly 7 percent of the land within the 3-mile wide, 54-mile long area between Lexington and Shelton designated as critical habitat. Therefore, much of the land may remain in agricultural uses. In addition, some human activities will be allowed on Program lands as provided for in land management plans that will be developed for each parcel of Program land.

Restoration of lands in habitat complexes would improve the availability of secure areas protected from disturbance and intrusion during whooping crane migrational periods. Because much of the action area is rural, Program land acquisition may not have a significant immediate or short-term effect. However, Program acquisitions of buffer and feeding habitats for habitat complexes may benefit long-term conservation of whooping crane habitat by precluding future habitat losses from land use changes to commercial, residential, or industrial purposes.

Channel habitat: Protection from predators, disturbances, or intrusions is particularly important to roosting cranes. Protection of channel roosting habitat is therefore important. In Nebraska, ownership of the river channel itself is often determined by ownership of lands abutting the channel. Thus, ownership (or management right) of the riverbank generally affects the ability to control access to the river as well as the ability to directly manage river habitat. Whooping crane use of the river is not restricted to channels maintained specifically as crane habitat, but other lands often do not contain the combination of features considered of high quality for crane use.

This analysis of effects distinguishes between the biological value of managing both banks and the biological value of managing a single bank. When both banks are not managed for habitat purposes, habitat managers have encountered these limitations:

> 1) Control of only a single bank may interfere with habitat conservation when the river shifts course due to natural dynamic natural alluvial processes. Over a period of years, the active river channel which occupies only a small portion of the floodplain can migrate from one side of the floodplain to the other, thus effectively disabling the ability to perform channel habitat improvements;

2) Various residential, recreational, industrial, or commercial developments on the opposing bank may result in disturbances that impair habitat value and nullify the investments in habitat improvements, and;

3) Inability to manage the opposing riverbank can prevent access to the channel for research and monitoring on habitat areas. Likewise, changes in ownership or management on the opposing bank may disallow access to established, long-term, monitoring and research sites.

Protective measures, both on and off the channel, are ultimately dependent on the management of each land parcel. A wide range of human activities, often in the form of recreation or scientific investigation, occur on and along the river. The variety, intensity, frequency, and timing of public use would be considered in land management plans prepared for individual parcels under the Program. The land plans will need to be closely reviewed during advanced planning to ensure public uses are compatible with whooping crane use of the sites, and that protections given the species under the ESA are met.

### D3. Summary of Program Effects to Whooping Cranes and Designated Whooping Crane Critical Habitat

**Summary of Beneficial Effects:**

- increase/improvement in the amount and distribution of wide channels for roosting in deteriorated (i.e., narrowed) sections of river (see qualification for channel improvements in "adverse effects" section below);

- increased ability to sustain restored riverine habitats upstream of Kearney by mechanically adding sediment. Because Program lands comprise a relatively small proportion of the total affected area, sediment augmentation is also needed to maintain channels and wetland habitats in other portions of the river;

- increase in the amount of grasslands and wet meadows available for crane foraging;

- minor increases in early-spring (mid-February to mid-March) water surface elevations which will assist sediment transport and ice-scouring capabilities for river channel maintenance;

- increases in late spring (mid-April to June) peak water surface elevations in normal years could improve groundwater levels and related improvements in wetland maintenance during years with normal river flows. This would generally benefit the lowest and wettest meadows; and

- increase in the length of stream bank and adjacent land area protected to minimize disturbance.

**Summary of Adverse Effects:**

- decrease in late-spring river elevations and peak flows in the wettest years that would negatively affect groundwater elevations that sustain wetland habitats and crane food sources;

- decrease in short-duration peak flows that create overbank flows into meadows and facilitate surface water connections between meadows. Infrequent surface water overflows are a unique driver of the wet meadow and wetland system, loss of which probably cannot be mitigated or offset by other means;

- changes to system hydrology further decrease and adversely affect the river's natural sediment transport processes. J-2 Return discharges are considered a primary factor in channel bed erosion and these discharges would increase. Channel maintenance would be increasingly reliant on artificial sand augmentation (e.g., with heavy equipment).

**Table VII-D5. Summary of the effects of the proposed action on whooping crane and whooping crane critical habitat.**

| Resources, Significant Indicators, and Geographic Area | Proposed Action |
|---|---|
| **Channel Roost Habitat** | |
| Acreage of Channel with channel widths >500 ft | +20 percent |
| Channel aquatic characteristics | The aquatic characteristics of crane roosting habitat improve commensurate with channel widening (15-25 percent improvement). |
| Distribution of Managed Areas | 5 bridge segments (as represented in the FEIS). The actual number may differ, but several areas are expected at a minimum. |
| **Roost Habitat Sustainability** | Improvements to sustainability of Program restoration and other channels ("other" channels would still provide a large majority--80%--of wide channel habitat) will largely depend on the success of the pulse flow component and on the scale, timing, and location of sediment augmentation. The feasibility of each will be tested under the Program's adaptive management framework. |
| **Out-of-Channel Feeding and Loafing Habitat** | |
| Change in acres of grassland feeding area | +10 percent increase overall, but the biological effect could be substantially higher or lower depending on qualitative factors.<br><br>Qualitative factors to define the biological success of grassland restoration efforts are yet to be developed. Biological restoration criteria will need to be developed or applied through ARM. |
| Spring Flows for Wet Meadow Hydrologic Maintenance | Reduced frequency of high flow years and peak flow magnitude in those years. Modest increases in frequency of moderate flow years and peak flow magnitude in those years. Significant negative impacts to highest flow events (short-duration pulse flows) would likely decrease meadow biodiversity. |
| Grain Food Resources | Restored channel segments could potentially alleviate inter-species |

| | | |
|---|---|---|
| | | competition for waste grain, but the behavioral response of the competing migratory species (likelihood and timing of population redistribution) remains uncertain. |
| **Security and Protection** | | |
| Bank length (%) protected | Hershey-Chapman | Increases from 10 percent (present condition) to 19 percent. |
| | Lexington-Chapman | Increases from 16 percent (present condition) to 30 percent |
| Total Out-of-Channel lands reserved (feeding and loafing habitat, and habitat buffers) | | 9,400 acres; about 6 percent of the central Platte Valley area. The Program seeks to achieve biologically effective composition and juxtaposition of habitats |

# E. *Effects of the Action on Least Terns and Piping Plovers*

## E1. Tools Used in the Analyses

Program activities were designed to improve habitat for least terns and piping plovers in the central Platte River (i.e., between Lexington, Nebraska and Chapman, Nebraska). However, Program actions also affect least tern and piping plover habitat in other locations in the action area, and those effects are also evaluated. Other locations include Lake McConaughy, the Platte River between North Platte and Lexington, and the lower reach of the Platte River between Columbus and the Missouri River.

Effects were analyzed using the SEDVEGGen3 model and the central Platte River (CPR) component of the OpStudy hydrology model as described in Volume 3 of the FEIS (2006). Outputs from the CPR model and SEDVEG Gen3 models, various post-processing spread-sheet manipulations of those outputs, and statistical analyses were used to determine effects of the proposed action relative to various parameters of importance to least terns and to present conditions.

## E2. River Resources

Because both nesting and foraging habitats are important to least terns and piping plovers in the Platte River channel, the analysis of the effects of Program water and land management activities focus primarily on these aspects.

Flow Potential to Build Sandbars:

This analysis evaluates the difference in water surface elevation between the mean annual flow and the 1.5-year peak flow measured in four sections of the central Platte River (i.e., from Jeffrey Island to Elm Creek, from Elm Creek to Gibbon, from Gibbon to Wood River, and from Wood River to Chapman). The difference in water surface elevation represents, on average, the potential height a sandbar can protrude above the mean water surface. The analysis focuses on sandbars formed at the 1.5-year recurrence interval because these sandbars are actively reworked by flows at a frequency that prevents the substantial establishment of vegetation.

Compared to present conditions, the proposed action would improve relative water surface elevations for the potential to build sandbars. Projected increases in the difference between average water surface elevations and 1.5 year flood flows range from 54 to 60 percent, with the largest increase occurring between Jeffrey Island and Elm Creek, Nebraska (FEIS 2006). However, absolute differences in water surface elevation between mean flows and 1.5-year flow events are relatively small, and the difference decreases as channels widen downstream (Table VII-E1). Compared to present conditions, the potential height of sandbars in Reaches 2 through 4 (the downstream-most 60 miles of central Platte River) increases about 5 inches from approximately 10 inches to about 15 inches (Table VII-E1). This increase constitutes a benefit to nesting least terns and piping plovers if 15 inches above mean annual flow is sufficient potential sandbar height to provide dry substrate during nesting season.

**Table VII-E1. Effects of Program on potential to build sandbars (i.e. differences in mean and annual water surface elevations compared to present condition).**

| | **Present Condition** | **Governance Committee** | **Program Difference** |
|---|---|---|---|
| **Reach 1: River Mile 243.1 to 230** | | | |
| Mean Flow Average W.S.E. (ft) | 2278.81 | 2280.36 | 1.55 |
| 1.5 yr Flow Average W.S.E. (ft) | 2280.16 | 2282.52 | 2.36 |
| Average Difference in W.S.E between 1.5 yr and mean flows (ft) | 1.34 | 2.16 | 0.81 |
| Potential to build Sandbars (in) | 16.1 | 25.9 | 9.8 |
| | | | |
| **Reach 2: River Mile 230 to 201.2** | | | |
| Mean Flow Average W.S.E. (ft) | 2155.54 | 2154.98 | -0.56 |
| 1.5 yr Flow Average W.S.E. (ft) | 2156.34 | 2156.24 | -0.10 |
| Average Difference in W.S.E between 1.5 yr and mean flows (ft) | 0.80 | 1.26 | 0.47 |
| Potential to build Sandbars (in) | 9.6 | 15.1 | 5.6 |
| | | | |
| **Reach 3: River Mile 201.2 to 189.3** | | | |
| Mean Flow Average W.S.E. (ft) | 2009.96 | 2009.69 | -0.27 |
| 1.5 yr Flow Average W.S.E. (ft) | 2010.74 | 2010.88 | 0.15 |
| Average Difference in W.S.E between 1.5 yr and mean flows (ft) | 0.77 | 1.19 | 0.41 |
| Potential to build Sandbars (in) | 9.2 | 14.3 | 5.0 |
| | | | |
| **Reach 4: River Mile 189.3 to 160.9** | | | |
| Mean Flow Average W.S.E. (ft) | 1884.31 | 1884.23 | -0.08 |
| 1.5 yr Flow Average W.S.E. (ft) | 1885.09 | 1885.46 | 0.37 |
| Average Difference in W.S.E between 1.5 yr and mean flows (ft) | 0.79 | 1.23 | 0.44 |
| Potential to build Sandbars (in) | 9.5 | 14.8 | 5.3 |

On the other hand, the Program's land management activities are expected to provide substantial improvements to the river channel area between Lexington and Chapman. The modeled land management activities result in a 53,100-foot increase in length of braided river channel conditions. A braided river plan form provides wide, open channel conditions with the best probability of sandbars occurring near the middle of the channel. In addition, the width of widest channel improved by 6 percent overall (N=56 transects), and the width to depth ratio at four channel sites through the central Platte River reach improved by 16 percent. The modeled sediment augmentation also reduces the rate of channel degradation in some areas and may stabilize the channel in other areas. Relative to present condition, the modeled sediment augmentation reduces the overall sediment imbalance in the central reach of the Platte River from -220,000 tons to -42,000 tons per year. Although the modeled change in land cover types predicts a 1 percent loss of bare sandbars in the channel, the modeled annual addition of 150,000 tons of sediment to the channel at Overton will likely provide substantial material for creation of new sandbars. It is anticipated that the addition of this sediment in combination with an increase in the difference between 1.5 year flow events and mean annual water surface elevations might improve the availability of least tern and piping plover sandbar nesting habitat in the central Platte River reach.

Fledging Days:

Modeled water surface elevations were used to predict changes in the number of fledging days relative to present conditions. Fledging days represents the number of consecutive days with water surface elevations below the surface elevation recorded at the beginning of the defined nesting period (i.e., the number of days in excess of the number of days required for an average nesting cycle for each species).

The number of fledging days for both piping plovers and interior least terns would increase under the proposed action compared to present condition in all transect categories (Table VII-E2). This increase will benefit piping plovers and least terns by increasing the amount of time available to successfully raise a nest of young and provide increased potential for recruitment of birds into the population. If suitable sandbars are available at the beginning of the nesting period, the proposed action would provide an increase in the number of days (in excess of that required for a complete nesting cycle) when nests would be free from potential inundation. However, both conditions (i.e., the existence of suitable sandbars and adequate inundation-free days) would be required to improve channel nesting conditions for piping plovers and least terns. The planned monitoring of channel conditions (i.e., via the Integrated Monitoring and Research Plan section in the Program's Adaptive Management Plan) during the first 13 years of the proposed action will be crucial to the evaluation of actual effects of Program activities on river channel conditions.

**Table VII-E2. Fledging days under the present condition and proposed action.**

| | **Present Condition** | | **Proposed Program** | |
|---|---|---|---|---|
| **Transect Category** | **Plovers** | **Terns** | **Plovers** | **Terns** |
| All transects | 6.2 | 7.4 | 8.5 | 9.2 |
| Managed transects | 6.4 | 7.7 | 8.8 | 9.5 |
| Unmanaged transects | 6.1 | 7.3 | 8.5 | 9.1 |
| Upstream of Kearney | 5.5 | 6.5 | 7.7 | 8.2 |
| Downstream of Kearney | 6.7 | 8.0 | 9.1 | 9.9 |

Lake McConaughy Spills:

Both the frequency and magnitude of spills from Lake McConaughy would be reduced from present conditions (Figures VII-E1 and VII-E2). Under the proposed action, the number of spills from Lake McConaughy is reduced by 52 percent (i.e., from 29 years to 14 years out of 48 years of record) relative to present condition. The greatest reduction in frequency of spills occurs in the months of March and April, when higher flows are necessary to distribute sediment and build bare sandbars (Figure VII-E1). The average magnitude of spills under the proposed action (95.3 kaf) is significantly lower ($p < 0.10$) than the present condition (169.1 kaf). The loss of high volume spills reduces the dynamic process that would otherwise restructure the channel and create sandbars of various elevations and longevity (nesting habitat) (FEIS 2006).

The significant reduction in frequency and volume of spills from Lake McConaughy, and the absence of management actions in the North Platte to Lexington reach may result in further narrowing of the river channel in this reach, adversely affecting the availability of riverine nesting habitat, including food resources (small invertebrates on moist sandbars and small fish) in the reach of the Platte River above Lexington, Nebraska. Downstream of Lexington, adverse effects of the reduction in frequency and magnitude of Lake McConaughy spills will be partially offset by land management actions to widen river channels on Program lands and add sediment to the river. These actions in combination with water management may improve the availability of nesting and foraging habitat for least terns and piping plovers downstream of Lexington.

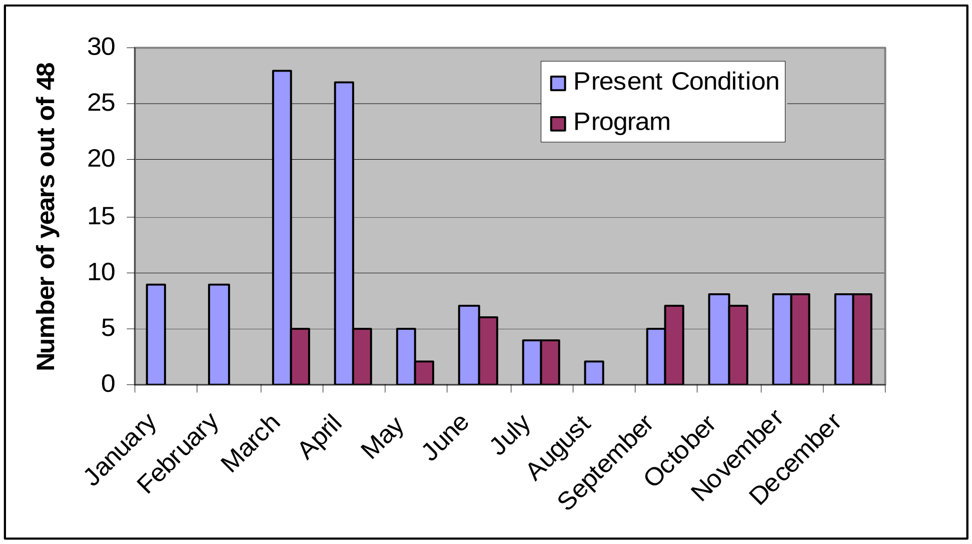



**Figure VII-E1. Frequency of Lake McConaughy spills under the proposed action compared to present condition.**

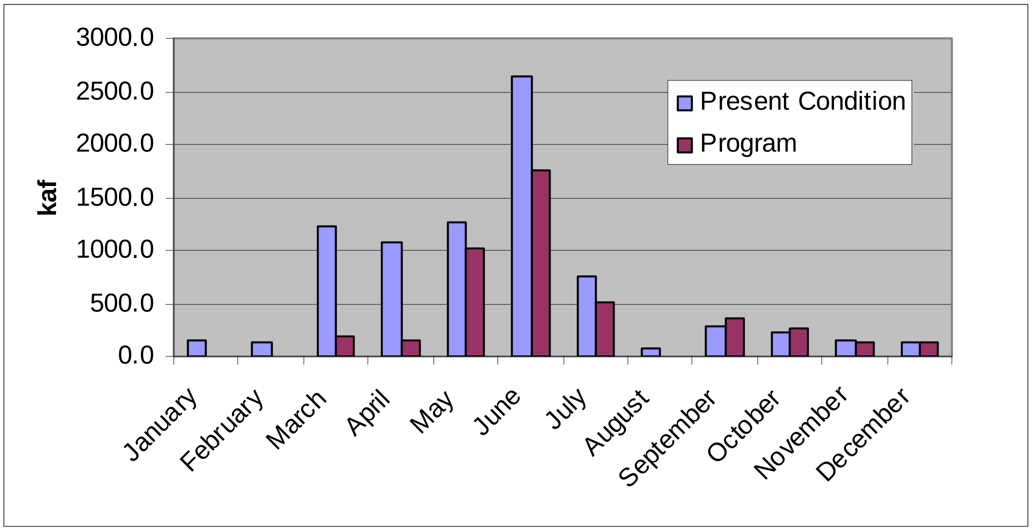



**Figure VII-E2. Estimated total volume (using 48-year period of record) of Lake McConaughy spills (kaf) under the proposed action, compared to present conditions.**

<u>Annual Flow at Cozad:</u>

The median annual flow at Cozad would be numerically higher under the proposed action (323.0 kaf), but not significantly greater than the present condition (287.3 kaf). It is unlikely that this level of increase in annual flow at Cozad would mitigate the effects of reduced Lake McConaughy spills in the reach from North Platte to Lexington and downstream of Lexington because the occasional high volume spills move more sediment and form higher sandbars than lower flows. Given the lack of Program land management activities from North Platte to Lexington, this reach of the river will likely continue to aggrade and narrow under the proposed action, and further narrowing of the channel is likely to adversely affect piping plovers and least terns using this reach as described above.

<u>Water Quality Parameters and Forage Fish:</u>

To evaluate the effects of the proposed action to water quality parameters relevant to least tern food resources the following parameters were examined: a) the probability of exceeding 90ºF water temperature in July at Grand Island; b) turbidity; and, c) concentrations of selenium. These factors determine the health of prey as well as the ability of least terns to find prey.

*<u>Water temperature and turbidity</u>* - High water temperatures in the central Platte River negatively impact the forage fish community. Low flows and water temperatures higher than the Nebraska water quality standard of 90 degrees Farenheit (32 degrees Celsius) are associated with many of the fish kills observed in the central Platte River. By improving July flows at Grand Island relative to present condition, the proposed action would slightly reduce the probability of water temperatures exceeding 90 degrees Farenheit (i.e., from 32.9 percent to 32.5 percent) during a time when the development of least tern chicks is dependent on adequate availability of forage fish. Median turbidity (JTUs) would increase from 25 (the present condition) to 28, while maximum JTUs would decline from 44 (the present condition) to 43. It is unlikely that any of

these changes would elicit a measurable response in the forage fish communities of the central Platte River because the magnitude of changes are so small.

*Selenium* - Selenium is an essential trace nutrient necessary for normal metabolic functions; however, too much selenium can cause problems ranging from feather loss to death, including reproductive impairment (Heinz 1996). While egg viability thresholds for piping plovers or least terns have not been identified, selenium concentrations found in both piping plover and least tern eggs collected on the Platte River between 1991 and 1993 are a concern (FEIS 2006, Volume 3, Water Quality Appendix). Median concentrations of selenium in collected eggs fall within the National Irrigation Water Quality Program level of concern and selenium concentrations in some of the eggs exceed the toxicity threshold level (U.S. Department of the Interior 1998). Selenium may be affecting reproduction of least terns and piping plovers along the Platte River (Fannin and Esmoil 1993).

The Program's Water Action Plan contains an element that has the potential to manage or use the groundwater mound south of the central Platte River, which exhibits high levels of selenium, to increase Platte River flows. If this element is implemented, least terns and piping plovers could be exposed to selenium in amounts that could reduce nesting success.

July Flows at Grand Island:

The proposed action would increase median July flow at Grand Island from 858.6 cfs to 924.7 cfs, but this increase is not statistically significant. An increase in July flows would slightly reduce the probability of water temperatures reaching dangerous levels, but also result in a slight increase in the potential for piping plover and least tern nests to be flooded in the central Platte River and downstream in the Chapman to Missouri River reach of the Platte River. Under Article 412 of its license (i.e., Flow Attenuation Plan), Central is required to use its "best efforts" to attenuate increased flows in the Platte River which might occur because of rejection of irrigation water due to regional or local weather conditions to help protect least terns and piping plovers during the nesting season. Implementation of this plan may adequately address the increased probability of nest inundation in the central reach of the river.

## E3. Non-channel Resources

Median May end-of-month water surface elevations for Lake McConaughy would be lower under the proposed action (3,254.2 feet) than the present condition (3,259.5 feet). Lower May water surface elevations may provide increased beach nesting opportunity for piping plovers and, to a lesser extent, least terns. As demonstrated during 2003, 2004, and 2005, increased nesting at Lake McConaughy occurred in response to drought induced expansion of beach area as lake levels dropped. While the flow levels at Lake McConaughy will not be managed specifically to benefit the nesting piping plovers and least terns, more beach area may be available as a consequence of water management for other purposes under the Program.

The Program proposes to manage an undetermined but additional amount of sandpits as nesting habitat for piping plovers and least terns between Lexington and Chapman. As indicated in the *Environmental Baseline* section, managed sandpits near the river channel provide nest sites for piping plovers and interior least terns when river conditions are poor, and may benefit these species by maintaining the distribution of least tern and piping plover populations along the central reach of the Platte River while efforts to improve riverine conditions are implemented by the Program. However, the NRC (2005) concluded that sandpit habitat is not an appropriate substitute for riverine nesting habitat in the long term because it fails to provide the full complement of habitat requirements for these two species.

Least terns and piping plovers are mobile and may appear in other areas outside the focus area for recovery. When this occurs, the species could be adversely affected by Reclamation operations. For example, three pair of piping plovers and one piping plover nest was detected in 2005 on the dry lake bed of Lake Minatare. No piping plovers had been observed in this area prior to the onset of the drought in 2002. The nest was located in an area that was likely to be inundated by rising lake levels stemming from Reclamation project operations. The eggs from this nest were salvaged but none of the eggs successfully hatched due to a combination of nest predation and nest abandonment. The Service expects that a small number of piping plovers or least terns will occasionally attempt to nest at Lake Minatare and in new areas in the future, and could be adversely affected by Reclamation's covered project operations. However, areas in the North Platte River basin outside main focus area of the Program activities are not considered to be important for the recovery of these species due to the small and temporary (drought-related) incidence of observed nesting. The Service anticipates that the adverse effects and mortality that could occur from Reclamation operations in such cases will be a small proportion of the piping plover and/or least tern populations and would, therefore, not result in a population-level impact to these species.

## E4. Summary of Effects to Least Terns and Piping Plovers

Table VII-E3 summarizes the results of the above analyses. Based on the assumptions inherent in these analyses, the proposed Program is predicted to benefit as well as adversely affect least terns and piping plovers in the action area. As modeled in the FEIS (2006), expected benefits from the Program likely outweigh the adverse affects.

**Summary of Beneficial Effects:**

- The possibility of improvement in the availability of channel nesting habitat downstream of Lexington through water management and sediment augmentation
  - Overall: potentially moderate benefit
  - Biological importance: high

- An increase of 53,100 feet in the length of braided channel in the central Platte River
  - Overall: moderate benefit
  - Biological importance: high

- The probability of increased nesting substrate available at Lake McConaughy and managed sandpits, which may benefit least terns and piping plovers in the short-term
  - Overall: short term moderate benefit
  - Biological importance: low

- A slight increase in July flows at Grand Island, resulting in decreased probability of water temperatures dangerous to fish (i.e., a slight benefit to least tern food resources).
    - Overall: small benefit
    - Biological importance: low

**Summary of Adverse Effects:**

- A substantial reduction in the frequency and significant reduction in magnitude of spills from Lake McConaughy, which exacerbate the decline of ecosystem processes maintained by a normative hydrologic regime and sediment transport through the system
    - Overall: moderate adverse effect
    - Biological importance: high

- An increased probability of continued channel narrowing and habitat degradation from North Platte to Lexington that may negatively affect the availability of resources to piping plovers and interior least terns currently using this reach of the Platte River;
    - Overall: moderate adverse effect
    - Biological importance: high

- A slight increase in the possibility of inundation of least tern or piping plover nests downstream of Chapman through slightly elevated July flows at Grand Island.
    - Overall: small adverse effect
    - Biological importance: low

**Table VII-E3. Summary of proposed action impacts to parameters pertinent to least tern and piping plover use of the Platte River relative to present condition.**

| Program Activity | Present Condition | Proposed Program (% Change) | Reach(es) Affected |
|---|---|---|---|
| | | | |
| **Water Management** | | | |
| Lake McConaughy | | | |
| Frequency of spills (out of 48 years) | 29 | 14 (-44.7 percent) | U,C,L* |
| Magnitude of spills | 169.1 | 95.3 kaf (-52 percent) | U,C,L |
| May End-of-Month Elevation (ft) | 3259.5 | 3254.2 | Lk. Mac |
| | | | |
| Annual flow at Cozad (kaf) | 287.3 | 323.0 (12 percent) | U,C |
| Median July flow at Grand Island (cfs) | 858.6 | 924.7 (7.7 percent | L |
| | | | |
| Flow potential to build sandbars | | | |
| 1.5-year peak flow | | (57 percent) | C, L |
| Fledging Days | | | |
| All transects | | (PP: 37; LT: 24) | C |
| Managed transects | | (PP: 38; LT:23) | C |
| Non-managed | | (PP: 39; LT: 25) | C |
| Above Kearney | | (PP: 40; LT: 26) | C |
| Below Kearney | | (PP: 36; LT: 24) | C |
| | | | |
| Water Quality | | | |
| Prob of >90 degrees at GI in July (percent) | 32.9 | 32.5 | C |
| Turbidity (JTU) | 25 | 28 | C |
| | | | |
| **Land Management** | | | |
| Acres of bare sand in channel | | (-1 percent) | C |
| Acres of managed sandpits | | increased | C |
| | | | |
| **Channel Changes water and land management** | | | |
| Length of braided channel (feet) | | + 53,100 | C |
| Width to depth ratio at 4 sites | | (16 percent) | C |
| Widest channel width over 56 transects | | (6 percent) | C |
| Overall sediment balance (tons) | -220,000 | -42,000 | C |

* U= North Platte to Lexington, C= Lexington to Chapman, L= Chapman to the Missouri River.

# *F. Effects of the Action on Pallid Sturgeon*

## F1. Methods of Analyses

Hydrology:

The effects of the water components of the Program on the pallid sturgeon are determined by analyzing changes in river flows at the Louisville gage, located at approximately the midpoint of the pallid sturgeon habitat area in the lower Platte River. Monthly flows for present conditions and the GC Alternative are calculated for Louisville, Nebraska by the CPR OpStudy hydrology model, adjusted for transmission loss as determined by the "testing the assumption" (testing) analysis described in the FEIS.

The data are divided into distinct periods important to life history requirements of the pallid sturgeon within the year. Within these periods, the data are examined by exceedance intervals, which is a specified percent range of flows for the period of record (e.g., the highest 33.3 percent of flows). Generally, for the purpose of this analysis, the 48-year period of record was examined by thirds (wettest third of years in the period of record, middle third, driest third of years) or sixths (following the same pattern, but in sixths) to determine the effects of the GC Alternative on river flows important to the different life requirements of the pallid sturgeon.

*Pallid Sturgeon Spawning Period* - Based on capture records, runoff patterns and water temperature patterns, opportunity for pallid sturgeon to spawn in the Platte River would typically occur between April and June. Initiation of pallid sturgeon spawning migrations has been associated with seasonal spring flow differences in rivers (Peterman 1977, Zakharyan 1972, both cited in Gilbraith et al. 1988). From 1979 through 2001, 19 of the 23 captures of pallid sturgeon in the Platte River or Missouri River near the Platte confluence occurred between April and June (captures after 2001 are not included for the reasons discussed in the pallid sturgeon species status section). The remaining four captures were in July and September of 1999. Twenty of the 23 captures correspond with years when May through June flows in the lower Platte River were above normal for the recent period (USFWS 1997). Pallid sturgeon do not spawn every year (Keenlyne and Jenkins 1993), and intervals between spawning for females are estimated to be three to seven years or more (H. Bollig, USFWS, personal communication). Environmental conditions are believed to play a part in intervals between spawning intervals (USFWS 1993). For these reasons, the wettest three sixths of the April through June period of record are considered to be the most critical.

The critical spawning period for pallid sturgeon is from April to June. The exceedance intervals examined within this period are the years in the wettest sixth of the dataset, second wettest sixth, and third wettest (0 percent through 16.7 percent, 16.7 percent through 33.3 percent, and 33.3 percent through 50 percent).

*Pallid Sturgeon Habitat Creation and Maintenance Period, and Pallid Sturgeon Food Base Production Period* - Studies in the Platte River and elsewhere have found significant pallid sturgeon use of in-channel structure, principally the downstream edges of sand and gravel bars, and submerged dunes (Snook 2000, Bramblett 1996, Hurley 1996). Formation of these in-channel structures occurs primarily at the elevated flow levels most often seen in the February to

July period in the lower Platte River. The wetter years would be expected to play a greater role in maintenance and formation of in-channel structure, therefore, we looked at data pertaining to the wettest half of the record for this factor. The diet of the pallid sturgeon consists of small fish and aquatic invertebrates (Carlson et al. 1985, Held 1969). Multiple studies have stressed the role of floodplain connectivity in fish and aquatic invertebrate production (Crance 1988, Schlosser 1990, Killgore and Baker 1996, Fisher 1999). This connectivity occurs most often in the February to July period in the lower Platte River, and the degree of connectivity is directly related to flow conditions. The greatest potential for formation and maintenance of the species in-channel habitat occurs at higher flows, and as a result, the analysis focuses on the wettest half of the record for this factor. The exceedance intervals we examined in the food base analysis encompass the full range of flow conditions. While the greatest production of small fish and aquatic invertebrates could be expected with higher flows, increases in flow rates during the driest years could be expected to increase the more limited production occurring in those years.

Habitat forming and maintenance flows most frequently occur during February to July, as does the primary production period for the prey base for the pallid sturgeon. The exceedance intervals examined within this period are the years in the wettest sixth of the dataset, second wettest sixth, and third wettest for pallid sturgeon habitat formation and maintenance (0 percent through 16.7 percent, 16.7 percent through 33.3 percent, and 33.3 percent through 50 percent), and the wettest third, the middle third, and the driest third for the pallid sturgeon food base (0 percent through 33.3 percent, 33.3 percent through 66.7 percent, and 66.7 percent through 100 percent).

*Summer Period* - High water temperature events, coupled with frequent fluctuations in flows can be moderated to some degree by the presence of greater summer base flows. Temperature effects on pallid sturgeon have not been investigated, but adult pallid sturgeon have been located in water with temperatures of up to 33.7°C (Snook 2001), and are quite capable of moving to avoid dewatering under normal circumstances. As a result, direct effects of these fluctuations on adult pallid sturgeon would be expected to be minimal. Effects of these fluctuations on the larval and young of the year pallid sturgeon and foodbase for the pallid sturgeon could be more substantial. Years with the lowest summer flows would be considered the most impacted by high water temperatures and the effects of flow fluctuations, and therefore the driest three sixths are considered to be the most important exceedance intervals. It should be noted that the fluctuating flows in the lower Platte River are a result of hydroelectric project operation in the Loup River that is not related to this Federal action. As a result, while some small moderation of those fluctuations resulting from GC Alternative water management slightly reduces the adverse impacts of those fluctuations, any such interaction is incidental, and not an element of Program design.

The June, July, and August period is identified as the period most likely to be impacted by low water and high temperature events. It is important for pallid sturgeon prey base survival, and may be of significant importance in pallid sturgeon young of the year survival. The exceedance intervals specifically examined for this period are the driest sixth, second driest sixth, and third driest sixth (50 percent through 66.7 percent, 66.7 percent through 83.3 percent, and 83.3 percent through 100 percent).

*Fall and Winter Periods* - Daily fluctuations in flow are still a consideration in the fall months, and opportunity for improvement in baseline habitat flows is available in both fall and winter.

As a result, the months in the fall period are analyzed, but would not be emphasized as highly as the previously discussed periods at this time.

The importance of the period from September through January for pallid sturgeon in the Platte River is not well understood. As a result, at this time the September through January period is examined by month, but lower emphasis is placed on the period until such information is available that would warrant otherwise. The intervals specifically examined for the months in this period are each of the driest three sixths, as in the June to August period.

Sediment Transport:

The SedVeg-Gen3 model developed by Reclamation calculates the rate of sediment transport at a number of transects in the central Platte River. At this point in time, the model does not extend to the lower Platte River. As a result, it cannot model the process of sediment movement from the central Platte River to the pallid sturgeon habitat area in the lower reach of the river. It can predict only the amount and timing of sediment transport through the last central Platte transect (river mile 162.2). This limitation does not mean that the SedVeg-Gen3 model is not useful as an indicator of changes in sediment contributions to the lower Platte River habitat area resulting from Program implementation. Basic geomorphological principles dictate that the river will move that sediment from the central Platte River through its lower reaches. However as a result of the variation in channel configuration and flow pattern in the intervening 125 miles of river, it is not possible to accurately predict the timing and distribution of that movement with the information provided by the action agencies. As a result, the percent changes in the rate of sediment transport leaving the central Platte River are indicative of changes in sediment transport in the lower Platte River habitat area, but may not be very precise. This model is described in the “Application of the Sediment and Vegetation Model to EIS Alternatives” technical appendix to the DEIS.

The SedVeg-Gen3 model provides mass of sediment transported per day using hydrologic records from January 1, 1947, to December 31, 1994. The analysis of these data calculated cumulative sediment transport for the period of record, average daily sediment transport for the period of record and median daily sediment transport for the period of record for each alternative.

Sediment transport coupled with flow rate directly affects habitat formation and maintenance in the lower Platte River. Simply put, both sufficient sediment and flows sufficient to move and arrange that sediment are necessary to build and maintain the macro-bedforms used as habitat by pallid sturgeon in the lower Platte River.

A disproportionately large fraction of sediment transport occurs during high flow events. As a result, the mean daily transport rate is largely influenced by, and therefore reflective of, these high flow events. Given the nature of the seasonal flow patterns in the Platte River, it is difficult to define “typical” river conditions. The median daily sediment transport rate is used by this analysis to represent somewhat more “typical” river conditions. This statistic is less influenced by high flow events than is the mean sediment transport rate, and is therefore less reflective of those high flow events. As both episodic (high flow) and base (typical flow) sediment transport are important to habitat formation and maintenance, mean and median transport rates must be viewed together to gain an adequate view of sediment movement from the central Platte River reach.

## F2. Results

Hydrology:

| Pallid Sturgeon Spawning Period | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| April-June | percent change from present conditions | | | | absolute (cfs) change from present conditions | | | |
| | average flow | | highest flow month | | average flow | | highest flow month | |
| | high end | low end | high end | low end | high end | low end | high end | low end |
| wettest sixth | -2 | -1 | -3 | -2 | -373 | -292 | -820 | -626 |
| 2nd wettest sixth | 0 | 0 | -4 | -4 | 43 | 9 | -666 | -623 |
| 3rd wettest sixth | 2 | 2 | 2 | 2 | 144 | 160 | 212 | 286 |
| Average | 0 | 0 | -2 | -1 | -62 | -41 | -424 | -321 |

| Habitat Formation and Maintenance Period | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| February-July | percent change from present conditions | | | | absolute (cfs) change from present conditions | | | |
| | average flow | | highest flow month | | average flow | | highest flow month | |
| | high end | low end | high end | low end | high end | low end | high end | low end |
| wettest sixth | -2 | -1 | -2 | -2 | -304 | -227 | -767 | -582 |
| 2nd wettest sixth | 1 | 1 | -1 | -1 | 101 | 87 | -159 | -157 |
| 3rd wettest sixth | 1 | 1 | -1 | -1 | 138 | 101 | -143 | -237 |
| Average | 0 | 0 | -1 | -1 | -22 | -13 | -356 | -325 |

| Food Base Production Period | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| February-July | percent change from present cond. | | | | absolute (cfs) change from present cond. | | | |
| | average flow | | highest flow month | | average flow | | highest flow month | |
| | high end | low end | high end | Low end | high end | low end | high end | low end |
| wettest third | 1 | 1 | -1 | -1 | 101 | 87 | -159 | -157 |
| middle third | 3 | 2 | 2 | 1 | 237 | 185 | 213 | 161 |
| driest third | 6 | 5 | 4 | 3 | 286 | 218 | 230 | 163 |
| Average | 3 | 3 | 2 | 1 | 208 | 163 | 94 | 55 |

| Summer Period | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| June-August | percent change from present cond. | | | | absolute (cfs) change from present cond. | | | |
| | average flow | | lowest flow month | | average flow | | lowest flow month | |
| | high end | low end | high end | low end | high end | low end | high end | low end |
| 3rd driest sixth | 0 | 0 | 2 | 1 | 5 | 1 | 51 | 30 |
| 2nd driest sixth | 4 | 3 | 5 | 4 | 162 | 115 | 111 | 79 |
| driest sixth | 3 | 2 | 9 | 6 | 80 | 57 | 114 | 73 |

| Other Periods | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | percent change from present conditions | | | | | | | | | |
| | January | | September | | October | | November | | December | |
| | high end | low end | high end | low end | high end | low end | high end | low end | high end | low end |
| 3rd driest sixth | -6 | -3 | 2 | 1 | 6 | 5 | 2 | 2 | -6 | -4 |
| 2nd driest sixth | -2 | -1 | 2 | 1 | 3 | 2 | 2 | 1 | -3 | -2 |
| driest sixth | -1 | 0 | 2 | 2 | 14 | 11 | 4 | 3 | -2 | -1 |
| | | | | | | | | | | |
| | absolute (cfs) change from present conditions | | | | | | | | | |
| | January | | September | | October | | November | | December | |
| | high end | low end | high end | low end | high end | low end | high end | low end | high end | low end |
| | | | | | | | | | | |
| 3rd driest sixth | -225 | -132 | 62 | 35 | 221 | 168 | 81 | 72 | -239 | -159 |
| 2nd driest sixth | -77 | -46 | 34 | 16 | 107 | 69 | 63 | 51 | -120 | -83 |
| driest sixth | -23 | -12 | 38 | 25 | 337 | 268 | 119 | 96 | -45 | -31 |

Sediment Transport:

The SedVeg-Gen3 model provides sediment transport rates on a daily time-step for a number of cross sections in the central Platte River. The closest of these to the pallid sturgeon habitat area (i.e., <RM 38) is at river mile 162.2, near Chapman, Nebraska. Factors affecting the transport of this sediment in the lower basin such as channel morphology, sediment contributions of other tributaries, and hydrologic contributions of other tributaries have not been modeled at this time. As a result, as discussed above, the values presented can identify trends in upper basin sediment contribution but may not directly translate to the realized timing and distribution of this sediment

reaching the pallid sturgeon habitat area, or its importance relative to the contributions of other lower basin sources.

The mean and median daily sediment transport rates at river mile 162.2 modeled for the Federal action are presented in Table VII-F1.

**Table VII-F1. Daily sediment transport rates from the upper basin.**

| | Modeled Daily Sediment Transport Rate (in tons) | | Percent Change from Present Conditions | |
|---|---|---|---|---|
| | Mean | Median | Mean | Median |
| Present Conditions | 1121 | 405 | - | - |
| GC Alternative | 1179 | 506 | 5% | 25% |

## F3. Biological Effects Discussion

Water Components:

*Spawning Period* - The pallid sturgeon currently has extremely low rates of recruitment. As such, hydrologic effects during the spawning period are crucial to a recovery program for the species. The proposed action would result in relatively small changes from present conditions for the wettest of conditions, a calculated adverse impact of -1 to -4 percent. This impact is likely the effect of the storage component of the Program. Increases in storage capacity in the system increase the ability of the system to capture the higher flows rather than transmit them downstream. In addition, the EA established in Lake McConaughy creates another demand on that reservoir, thereby, maintaining it at a lower average level. This similarly increases the ability of the reservoir to capture higher flows rather than transmit them, also affecting the highest flow interval.

In the comparative pallid sturgeon analysis, adverse impacts relative to present conditions on the order of up to a 4 percent decline in the wettest intervals may initially appear very small. However, when viewed in the larger context of pallid sturgeon biology, they may be quite significant. The spawning cue is likely driven by a number of factors, most of which are tied to the spring rise. Among these likely factors are increases in temperature, turbidity, depth, velocity, and changes in water chemistry. While depth and velocity are controlled fairly directly by river stage, on which the 1-4 percent flow reduction has a minor impact, temperature, turbidity, and water chemistry are more directly tied to floodplain connectivity on which there would be expected to be a more substantial impact relative to the absolute change in flow rate.

The lower Platte River morphology consists of relatively wide channels with low, but relatively steep banks, and a very wide, low gradient floodplain (Figure VII-F1).

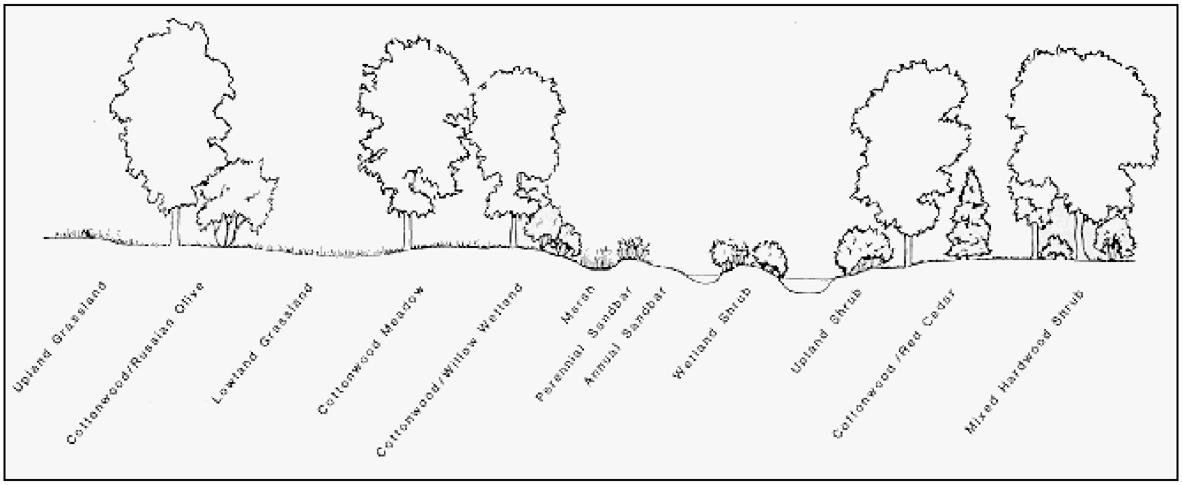



**Figure VII-F1. Typical Platte River channel cross section.**

As a result, the relationship between river stage and wetted area in the Platte River is not linear (Fig. VII-F2). As river flow increases from zero, the channel bottom is covered relatively quickly. Further increases in flow largely increase depth and inundate in-channel structure until the river connects to its floodplain. When river flows are very high, minor increases in stage result in significant increases in wetted area as the river connects to the low-gradient floodplain.

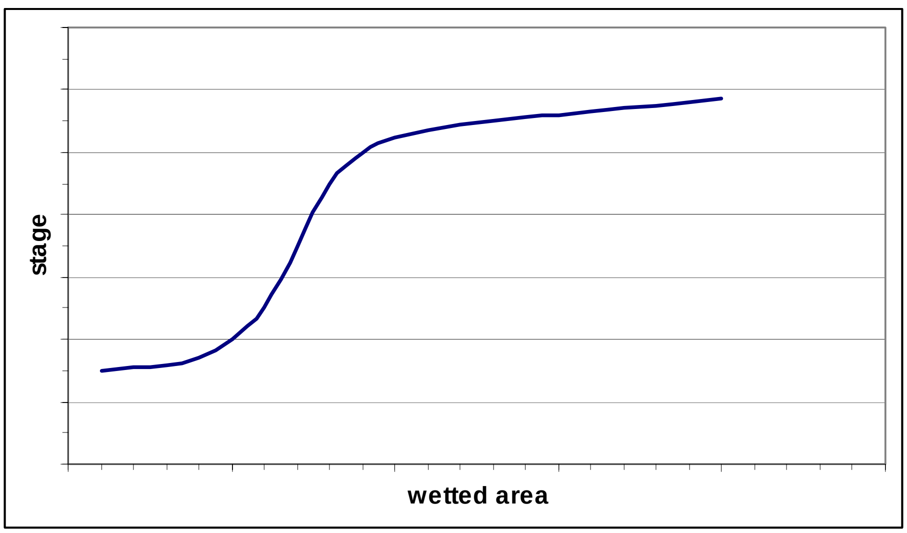



**Figure VII-F2. Conceptual illustration of the relationship between river stage and wetted area.**

The increase in floodplain connectivity that occurs during high flow events results in: a) more rapid increases in temperature as water surface area increases relative to its volume; b) increases in turbidity as fine sediment and organic matter are contributed by the floodplain; and c) increases in nutrient cycling through similar mechanisms. All of these effects appear to be components of the pallid sturgeon spawning cue.

Under the drier of the examined intervals, some positive change is realized (+2 percent). This would likely be a product of the emphasis on enhancing mid-range peak flows under the GC Alternative. The effect of these small increases in flow in this interval would most likely be a corresponding small increase in the moderate spawning cue provided by flows in this range, and may, therefore, increase the limited spawning potential in this flow range.

The small relative positive impacts to the moderate flows during the spawning period may partially offset some of the negative effects to the high spawning period flows, as they occur in the same broad hydrographic framework (i.e., they both occur in the wetter intervals). However, for the reasons discussed above, the very wettest conditions would logically be expected to provide the strongest spawning cues, and therefore impacts to these conditions would still outweigh the similar magnitude benefits to moderate flow conditions. In light of this, the net sum effect during the spawning period would be that of a very small adverse impact.

*Habitat Formation and Maintenance Period* - After provision of reproductive cues, the ability to provide habitat is the next most important hydrologic component of a recovery program for the pallid sturgeon. The results of the habitat formation and maintenance period are somewhat similar to those under the spawning period analysis. The wettest period is still adversely impacted (-1 percent to -2 percent), and results are mixed for other periods.

In addition to the effects on pallid sturgeon spawning cues, the effects of the highest flows on the formation and maintenance of habitat are of particular importance. The highest flows have the greatest potential to build and maintain extensive macro-bedform complexes of the type used by pallid sturgeon throughout their range. This increase in potential is due to the fact that a non-linear relationship exists between sediment transport and rate of flow. Figure VII-F3 depicts the role of flow rate in suspended sediment transport. As the graph indicates, high flow events move a disproportionately high percentage of sediment transported in a given year relative to their frequency. A similar relationship holds true for bedload sediment transport responsible for habitat creation and maintenance. However, this relationship can be as pronounced or more pronounced for bedload sediment than for suspended sediment at very high flows such as those in question. The consequence of this is that very high flow events such as those analyzed, move a disproportionately large percentage of the sediment transported in a year, and are responsible for the construction and maintenance of a disproportionate share of pallid sturgeon habitat features in the lower Platte River.

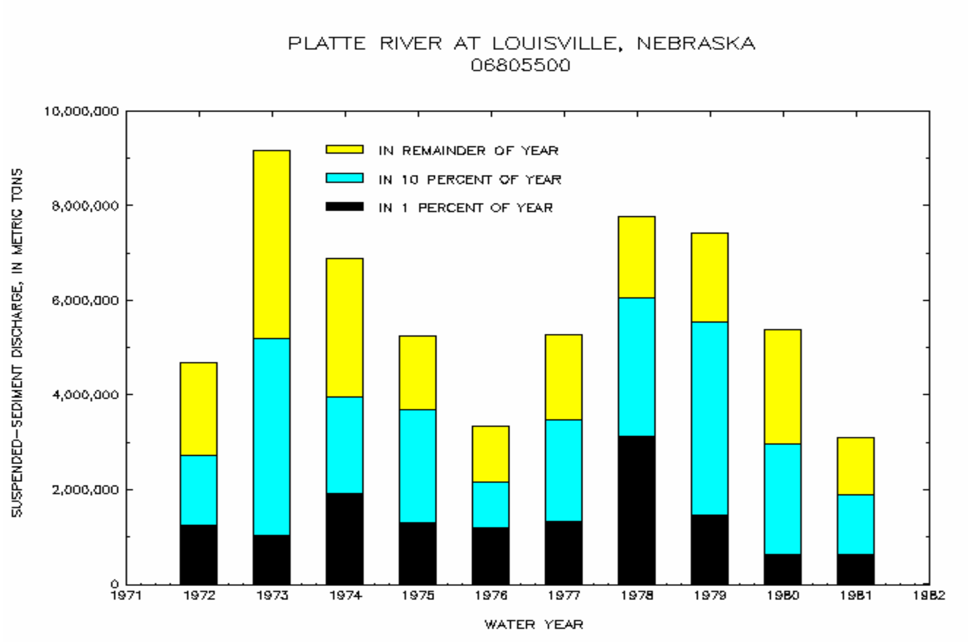



**Figure VII-F3. Suspended sediment transport by proportion of annual flow in the Platte River.**

The very small overall magnitude of the change in flow rate during the highest flow conditions shown in the habitat formation and maintenance analysis, coupled with the relatively high importance of these flows suggests the potential for relatively small, but not necessarily insignificant overall adverse effects to pallid sturgeon. The result may be of particular concern, as the National Research Council found that loss of lower Platte River habitat would probably result in a catastrophic reduction in the pallid sturgeon population (National Research Council 2005)

*Food Base Production Period* - Impairment of the quality and quantity of the pallid sturgeon food base in the lower Platte River has never been specifically identified. However, given the general hydrologic impairment of the river, the effects of bank stabilization on reducing floodplain connectivity, and the effects of existing levees on reducing floodplain connectivity, it is very likely that some impairment of the lower Platte fishery resources exists. What is not certain is the degree to which this affects pallid sturgeon in the Platte River. For this reason, the effects of the GC Alternative on the pallid sturgeon foodbase are examined, but would be considered of secondary importance to the spawning and habitat formation and maintenance periods. The food base production period is changed only slightly from present conditions. Wettest intervals again exhibit a slight negative change (-1 to +1 percent), while driest intervals exhibit a mixed, but somewhat positive change (+3 percent to +6 percent). Overall, the trend is slightly positive for the full range of flows (+1 to +3 percent). The wettest flows stand the greatest chance of connecting the river to its floodplain and inundating backwaters, both very important elements in nutrient cycling and river productivity. At the same time, the driest periods currently have the lowest ability to provide successful spawning habitat to the range of species that comprise the lower Platte River fishery, and the pallid sturgeon food base, and would represent the years in which the pallid sturgeon food base would be under the greatest stress. As a result, the overall biological effect of the GC Alternative would likely be neutral, with potentially some very slight reduction in total productivity over time, but some very slight increase in the potential to maintain species diversity, and provide consistency of foodbase availability.

*Summer Period* - Similar to the condition of the food base, availability of summer habitat and prevalence of high water temperatures have not been previously identified as impairing use of the lower Platte River by pallid sturgeon. However, as with the condition of the food base, the effects of flow reductions combined with daily flow fluctuations have most likely had some adverse effect during the summer. Given the lack of information, the effects of the GC Alternative on this period are analyzed, but are given still less weight than the aforementioned hydrologic analyses. Unlike the previously discussed analyses, the range of summer flows most likely experiencing impairment (the driest half of the flow range in the period of record) does exhibit some discernable improvement under the GC Alternative. Under the very driest of conditions, the greatest improvement is exhibited (+2 percent to +9 percent). Depending on the degree of actual impairment during this period, this increased flow would most likely be considered a significant improvement. It is unlikely that improvement in this characteristic of the river alone could significantly enhance the potential for recovery of the pallid sturgeon in the lower Platte River, but it is likely that through reducing stress on the lower Platte River aquatic ecosystem, a degree of benefit may be achieved.

*Other Periods* - The importance of other periods (i.e. the fall and winter timeframes) to pallid sturgeon in the lower Platte River is also unknown at this time. For this reason, it is not possible to determine the biological significance of flow changes caused by the GC Alternative to pallid sturgeon.

<u>Land Components:</u>

The mean daily sediment transport rate leaving the central Platte River is strongly influenced by high flow events, which transport a disproportionately large quantity of sediment. As such, the statistic acts as an indicator for the ability of the upper basin to contribute large quantities of sediment in an episodic fashion, which has an effect on the ability of the system to create large macro-bedforms. The median daily sediment transport rate is more indicative of typical conditions on the river, and as such acts as an indicator of the base contribution of sediment. This median transport has an effect on the ability of the system to retain these bedforms, as well as create and maintain smaller bedforms, such as submerged “dune” formations. Both of these types of formations are used by pallid sturgeon in the lower Platte River. The overall effect of changes in mean and median transport rate (+5 percent and +25 percent respectively) at RM 162.2 is that there may be some increase in the ability of the system to create large macro-bedforms in the habitat area farther downstream, and possibly a more significant increase in the ability of the system to build and maintain smaller bedforms. As discussed above, because the pallid sturgeon habitat area is a significant distance (approximately 125 river miles) downstream from RM 162.2, the timing and distribution of effects cannot be quantified at the habitat area itself. Further, given that the upper basins currently contribute only about 25% of the annual flow in the lower Platte River, it is not known at this time what the relative contribution this increase in sediment transport from the central Platte River will make to the total sediment budget of the lower Platte River.

Research Plan:

Program design includes funding for an intensive pallid sturgeon monitoring and research plan. The primary objective of the plan is to gain information through research on species biology and habitat use, and the form, functions, and processes of the Platte River that define, form, and maintain Platte River pallid sturgeon habitat. The monitoring and research plan is designed to determine specific actions to be taken in order to provide defined benefits to the species. The specific details of the plan are described in the Program's Adaptive Management Plan (Program document Attachment 3).

The research plan is anticipated to advance the state of knowledge about the pallid sturgeon in the lower Platte River. If fully implemented as described, it is anticipated to provide a level of completeness of information sufficient to design and implement individual actions, or a suite of actions that would provide defined benefits to the pallid sturgeon in the Platte River in the future. Implementation of the research plan will provide important information that can be used to design offsetting measures, but does not provide by itself, direct benefit to the species.

Offsetting Measures:

The Program document and attachments identify that the Program will undertake an effort to assess Program related impacts to the pallid sturgeon's lower Platte River habitat within the first three years following Program implementation. If this study identifies adverse impacts, the Program has committed to develop and implement activities to negate or offset those adverse impacts during the first 13 years of the Program increment.

## F4. Summary of Effects

Hydrologic

Spawning period (April through June)

- Highest flows (most important) decreased 2-3% (very small adverse effect)
- Second highest flows (very important) decreased 4% (small adverse effect)
- Third highest flows (important) increased 2% (very small beneficial effect)
    - Overall: very small adverse hydrologic effects during spawning period
    - Biological Importance: very high
        - Note: Program commitment made to negate or offset any adverse effects to pallid sturgeon due to reduction in spring peak flows following stage change study.

Habitat formation and maintenance period (February through July)

- Highest flows (most important) decreased 2% (very small adverse effect)
- Second highest flows (very important) decreased 2% (very small adverse effect)
- Third highest flows (important) decreased 1% (very small adverse effect)
    - Overall: very small adverse hydrologic effects during habitat formation period

  - Biological Importance: high
    - Note: Program commitment made to negate or offset any adverse effects due to reduction in spring peak flows following stage change study.

Food base production period (February through July)
- Lower flows (important) increased 3-4% (small beneficial effect)
- Middle flows (important) increased 1-2% (very small beneficial effect)
- Higher flows (important) decreased 1% (very small adverse effect)
  - Overall: very small beneficial hydrologic effects during food base production period
  - Biological Importance: moderate

Summer low flow period (June through August)
- Lowest flows (most important) increased 6-9% (moderate beneficial effect)
- Second lowest flows (important) increased 4-5% (small beneficial effect)
- Third lowest flows (less important) increased 1-2% (very small beneficial effect)
  - Overall: small beneficial hydrologic effects during summer low flow period
  - Biological Importance: moderate

Fall timeframe (September through November)
- Small to moderate increases in flow, importance unknown
- Winter timeframe (December through January)
- Small to moderate decreases in flow, importance unknown

Sediment

Notes:

Changes in sediment transport rate, below, are expressed as change from previous contribution *of the upper basins* to the habitat area. These contributions are already quite small compared to the contributions of other sub-basins (Loup, Elkhorn) to the lower Platte pallid sturgeon habitat area.

Changes are determined near Chapman (approx. 125 river miles above uppermost extent of known habitat area), leading to some uncertainty on how the actual effects are realized in the habitat area.

Mean sediment transport rate
- Illustrates high flow transport – influences habitat formation
- Increased approximately 5% (moderate beneficial effect)
  - Biological Importance: very high

Median sediment transport rate
- Illustrates daily transport – influences habitat maintenance
- Increased approximately 25% (considerable beneficial effect)
  - Biological Importance: moderate

## G. *Effects of the Action on Bald Eagle*

### G1. Factors to be Considered

Because of the hydrologic continuum associated with riverine systems, Program water components have the potential to affect the bald eagle throughout the mainstem of the North Platte, South Platte, and Platte river systems, with the exception of the South Platte River mainstem above Greeley, Colorado (i.e., Greeley is the upstream limit for Program water management components). Any Program water management components affecting tributaries to the North Platte, South Platte, and Platte rivers could also potentially affect the bald eagle.

The primary proposed action effects to bald eagles would result from Program water management components as they affect wintering eagles, and associated prey populations located in wintering habitats. The Environmental Baseline section in this biological opinion has identified the occurrence of wintering bald eagles throughout the Platte River basin as well as known communal roosts in the basin.

A secondary effect would be to nesting bald eagles in the lower Platte River reach where there is a large concentration of nesting bald eagles. Eagle nests are infrequent and scattered in the Platte, North Platte, and South Platte river mainstems above the lower Platte River; therefore, Program effects in these reached were not analyzed. Any alterations to lower Platte River hydrology compared to the present condition would be persistent through the first 13 years.

Program land management activities could affect both nesting and wintering bald eagles. These activities include habitat management and restoration on Program lands. Program land management activities would also include those associated with improving flow conveyance through the North Platte River chokepoint, or activities associated with the development of WAP infrastructure. Impacts from land management activities have a localized affect. Because timing and location of such activities have not been specified, both nesting and wintering eagles are potentially vulnerable to disturbances associated with such activities. The duration and frequency of these activities are expected to vary considerably.

### G2. Analysis of the Effects of the Proposed Action

<u>Flow in the South Platte River:</u>

During the bald eagle wintering period, South Platte River flows at Julesburg for the months of December and January had a 6 and 7 percent decrease respectively from the monthly average under the GC Alternative. The month of February showed a 6 percent increase in the monthly average when compared to the present condition.

<u>Flows in North Platte Above Lake McConaughy:</u>

The average seasonal flows above Lake McConaughy during October through March show no change under the GC Alternative when compared to the present condition.

Flows in North Platte River Below Keystone Diversion Dam:

The flow in the North Platte River immediately below the Keystone Diversion Dam does not change significantly from present conditions for the GC Alternative during the bald eagle wintering period from December to February. A marginal increase is present in February under the GC Alternative. Flows at North Platte, Nebraska would follow a similar pattern under the GC Alternative (see *Water Resources, Impacts Analysis, North Platte Basin, Flows* in the FEIS for detailed effects to North Platte River flows).

Flows in the Platte River Below the Tri-County Diversion Dam:

In the reach just below the Tri-County Diversion Dam winter flows would be low, averaging less than 200 cfs during some winter months, with occasional periods of zero flow. The GC Alternative is expected to provide improved flow in February (see *Water Resources, Impacts Analysis, North Platte Basin, Flows* in the FEIS for detailed effects to Platte River flows).

Reduction to Instream Flow Shortages at Grand Island:

Based on OPSTUDY modeling results, the GC Alternative is anticipated to marginally increase instream flow shortages January (0.05 percent decrease in mean monthly flows compared to the present condition). The greatest reduction to instream flow shortages occurs in February (a 16.08 percent). There is no change in mean monthly flows in December under the GC Alternative.

Flows in the Lower Platte River at Louisville:

In the food base production analysis, the GC Alternative provides slightly greater benefits, primarily in drier years (see the *Pallid Sturgeon Effects of the Action* section of this biological opinion for a full description of food base production effects). It is anticipated that the slightly greater benefits would provide some buffer for food base production for nesting bald eagles in drier years when production might otherwise be impaired.

Habitat for Waterfowl:

The GC Alternative is anticipated to increase wetted channel bottomland grassland habitat in the central Platte River by 4 and 10 percent, respectively, from present conditions.

Land Management Impacts:

The amount of active channel and wet meadow habitats, through Program land restoration and maintenance, would benefit eagle prey species. Wetted channel is the selected index for channel habitat which represents 9,968 acres for the present conditions in the central Platte River. The *River System Effects of the Action* section describes how Program land and water actions will increase active channel by 387 acres (4 percent). Bottomland grassland is the selected index for wet meadow habitat which represents 43,035 acres for the present conditions in the central Platte. Anticipated Program land activities will increase bottomland grassland by 4,314 acres (11 percent).

Freedom from human disturbance is important in communal roost site selection (Steenhof et al. 1980, U.S. Bureau of Reclamation 1981, Buehler et al. 1991), and continued human disturbance of a nocturnal roost may cause eagles to abandon an area (USFWS 1983b, Buehler 2000).

Eagles in the Platte River basin nest from mid-February through mid-August (NGPC, unpublished data). Program activities in close proximity of an active nest could cause adult eagles to discontinue nest building or to abandon eggs (USFWS 1983a, Buehler 2000). Measures adopted by the Program to avoid and minimize Program and non-Program disturbances to known roost and nesting sites will be assessed for roosting and nesting bald eagle impacts. The Program will, where practical, select restoration, maintenance, and other management measures that do not harm or may benefit the bald eagle including any disturbance-related impacts resulting from Program actions.

In addition as Program lands are acquired, a review of habitat restoration plans for specific tracts will be required, pursuant to section 7 of ESA, to insure that protective measures similar to those employed on NPPD's Cottonwood Ranch property (i.e., buffer zones around bald eagle night roost sites and the protection of feeding perch trees), are established on Program lands to protect bald eagle roosting, loafing, feeding, and nesting habitats.

## G3. Species Response to the Action

The localized impacts to flows may cumulatively, with other hydrology-modifying actions, influence wintering food sources South Platte, and Platte rivers. These reductions in flow may affect foraging efficiency and the condition of wintering bald eagles. Consequently, eagles could select food sources that are more scarce, less desirable, or more difficult to obtain than traditional sources.

Implementation of the proposed Program goals would have the following beneficial effects on the bald eagle in Nebraska: a) increase wet meadow/low-lying prairie grassland habitat in portions of the central Platte River; b) provide for river island clearing and leveling in portions of the central Platte River; c) offset channel incision in portions of the central Platte River; and d) reregulate water to reduce February target flow shortages. In addition, the protective measures in the Program's Land Plan will reduce any disturbance-related impacts.

The anticipated improvements in central Platte River habitats would likely outweigh the localized impacts to South Platte and central Platte River flows. Despite localized impacts to flow, eagle nesting activity in the Northern States and Pacific Recovery regions has followed an improved national trend. In 1998, the estimated number of occupied breeding areas in the Northern States and Pacific Recovery regions had increased to 2,200 and 1,480, respectively (USFWS 1999). Nebraska and Colorado have exceeded state-wide recovery plan goals in just the Platte Basin. Given the state-wide and region-wide trends of bald eagle populations and nesting activity, known adverse Program actions will have little affect on regional or state recovery goals.

The following bulleted section summarizes the GC Alternative’s beneficial and adverse effects to bald eagle habitats in the Platte River basin:

**Summary of Beneficial Effects:**

- increase in wet meadow and low-lying prairie grassland habitat along portions of the central Platte River;
- reregulation of water to reduce shortages to February target flows in the central Platte River;
- channel restoration activities in the central Platte River; and
- protective measures in the Program's Land Plan to reduce disturbance-related impacts.

**Summary of Adverse Effects:**

- periodic reduction in winter flows in the South Platte River and in the central Platte River reach.

# *H. Effects of the Action on Western Prairie Fringed Orchid*

## H1. Factors to be Considered

Program water components have the potential to affect the western prairie fringed orchid (orchid) in the Platte River floodplain as a result of the hydrologic continuum associated with riverine systems. Orchid habitats affected by Program water components are composed primarily of wet meadows that are hydrologically connected to the central or lower Platte River.

The orchid's wet meadow habitat depends on both subirrigation and overland flows for maintenance of unique habitat characteristics. Platte River discharge and stage are dominant factors influencing groundwater levels in the Platte River Valley (USGS, 1964; Hurr, 1983; and Henszey and Wesche, 1993), and as a result, flow depletions during the late winter and spring contribute to reduced frequency and duration of saturated soil conditions in adjacent subirrigated wet meadows. Similarly, decreases in river stage during late spring pulse flows reduce the frequency and magnitude of overland flooding, and the frequency and duration of soil saturation due to this overland flooding. As a result of reductions in river flow, low-lying prairies and wet meadows near the Platte River have become drier over time.

The hydrology in the Platte River typically follows a bi-modal peak flow distribution, with a late winter peak resulting from plains snowmelt runoff, and a higher late spring peak resulting from melt of mountain snowpack. The late winter peak flows elevate groundwater levels and thaw soils and are believed to promote orchid germination and growth. Late spring peak flows provide surface water connections to and within riparian meadows that provide for hydrologic conditions required for orchid survival, reproduction, and seed dispersal.

## H2. Analysis of the Action

Peak River Water Surface Elevations of Late Winter (mid-February to mid-March):

Late winter river flows help sustain meadow subirrigation, which in turn helps support nutrient resources in wetlands and in the aerobic zones near the soil surface. The proposed action would have little effect on river stage during this time. This is due in part to modeled releases made from the Lake McConaughy EA in roughly one-half of the years, which averaged 367 cfs in February and 233 cfs in March (see *Whooping Crane Effects of the Action* section for a full description of the late winter peak flows).

Wet Meadow Hydrology—Peak River Water Surface Elevations of Late Spring:

The GC Alternative was found to increase the magnitude of late spring pulse flows in roughly 65 percent of the years (i.e., those years with the lowest peak flows). As represented in the FEIS, most pulse flow improvements from the Program would occur at average flows below 3,700 cfs for the 30-consecutive-day duration and depend on EA releases in about 85 percent of the years. These flow increases may provide more frequent saturation of the lowest lying wet meadow areas in the downstream portion of the study area.

The FEIS indicates that the highest of the long-duration pulse flow events in late spring would be reduced in magnitude. The maximum 30-consecutive-day flow magnitude is reduced in years with flows above roughly 3,700 cfs and the frequency of these reductions was roughly one-in-six years. Also, many of the short-duration inter-annual flow events (i.e., greater than 8,000 cfs) will be reduced in magnitude. Overbank flows into the low riparian meadows would also be reduced under the proposed action. Water surface elevations (see *Whooping Crane Effects of the Action* section for a full description of the late spring peak flows).

Wet Meadow Hydrology—Lower Platte River Peak Flows:

Because of the potential occurrence of orchids in meadows adjacent to the lower Platte River, an index of general Platte River hydrology was used, encompassing February through July. Methods used for this analysis reflects methods used to assess food base production for the pallid sturgeon (see the *Pallid Sturgeon Effects of the Action* section for a full description for effects lower Platte River peak flows). The food base analysis was applied because the February through July period also reflects the general time period for orchid germination/emergence to flowering. The mean flow values of the wettest third, middle third, and driest third for the period of record are approximately 14,000 cfs, 8,400 cfs, and 5,800 cfs, respectively.

There is a ±1-2 percent change in lower Platte River peak flows resulting from Program actions when compared to the present condition (see *Pallid Sturgeon Effects of the Action* section for a full description of lower Platte River forage fish production analysis). Changes of this magnitude would minimally affect groundwater hydrology of adjacent orchid wet meadow habitats.

## H3. Species Response to the Action

Given the very marginal changes in lower Platte River peak flows, the absence of records within the lower Platte River floodplain, and the current records throughout many of the orchid's recovery units that contain the lower Platte River, the Service has determined that the proposed action will minimally affect orchid recovery efforts in the lower Platte River.

A reduction the wettest of late-spring peak flows as well as reduction in overland flows, will adversely affect the Mormon Island-Crane Meadows (MICM) population. Occasional surface overflows are a driver that maintains the dynamic structure of wet meadows and facilitates wet meadow community succession. Reduced overbank flows would likely have an incremental adverse impact on dynamic processes that are important to wet meadow biodiversity. These high magnitude events facilitate orchid survival, reproduction, and seed dispersal (Sieg and King 1995, USFWS 1996e). Reduction in the occurrence of peak flows will reduce wetland plant community succession limiting orchid seedling establishment. Measures to effectively mitigate or offset this type of impact have not been identified and are not known to exist.

As a result of historic and ongoing reductions in river flow, the MICM population of the western prairie fringed orchid has shown a steady decline in numbers and may be extirpated. Impacts of the proposed action on wet meadow hydrology in the central Platte River is anticipated to adversely affect orchid production, dispersal, viability, and germination necessary for population survival.

Protection of the MICM population, including the maintenance of appropriate hydrologic regime is identified as a Priority 2 task in the species' recovery plan (USFWS 1996b). A Priority 2 task is defined as an action that must be taken to prevent significant decline in species population/habitat quality, (or some other significant negative effect short of extinction). The potential loss of the MICM population, as a result of the effects of water-related projects in the basin will not threaten the continued existence of the orchid, although Program actions may adversely affect the recovery of the species.

**Summary of Beneficial and Neutral Effects**

- minor increases in early-spring (mid-February to mid-March) water surface elevations which will facilitate growth and activity of wet meadow communities including the orchid;

- increases in late spring (mid-April to June) peak water surface elevations in normal years could improve groundwater levels and related improvements in wetland maintenance during years with normal river flows. This would generally benefit the lowest and wettest meadows;

- neutral effects to wet meadow hydrology associated with lower Platte River peak flows.

**Summary of Adverse Effects**

- decreases in late-spring river elevations and peak flows in the wettest years that would adversely affect groundwater elevations that sustain wetland habitats.

- decreases in short-duration peak flows that create overbank flows into meadows and facilitate surface water connections between meadows. Surface water overflows are a unique driver of the wet meadow and wetland system that probably cannot be mitigated or offset by other means

# VIII. Cumulative Effects

Cumulative effects include the effects of future State, local, or private (non-federal) actions that are reasonably certain to occur in the action area considered in this biological opinion. A non-federal action is "reasonably certain" to occur if the action requires the approval of a State or local resource or land-control agency, such agencies have approved the action, and the project is ready to proceed. Other indicators which may also support such a “reasonably certain to occur” determination include whether: a) the project sponsors provide assurance that the action will proceed; b) contracting has been initiated; c) State or local planning agencies indicate that grant of authority for the action is imminent; or d) where historic data have demonstrated an established trend, that trend may be forecast into the future as reasonably certain to occur. These indicators must show more than the possibility that the non-federal project will occur; they must demonstrate with reasonable certainty that it will occur. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act and would be consulted on at a later time.

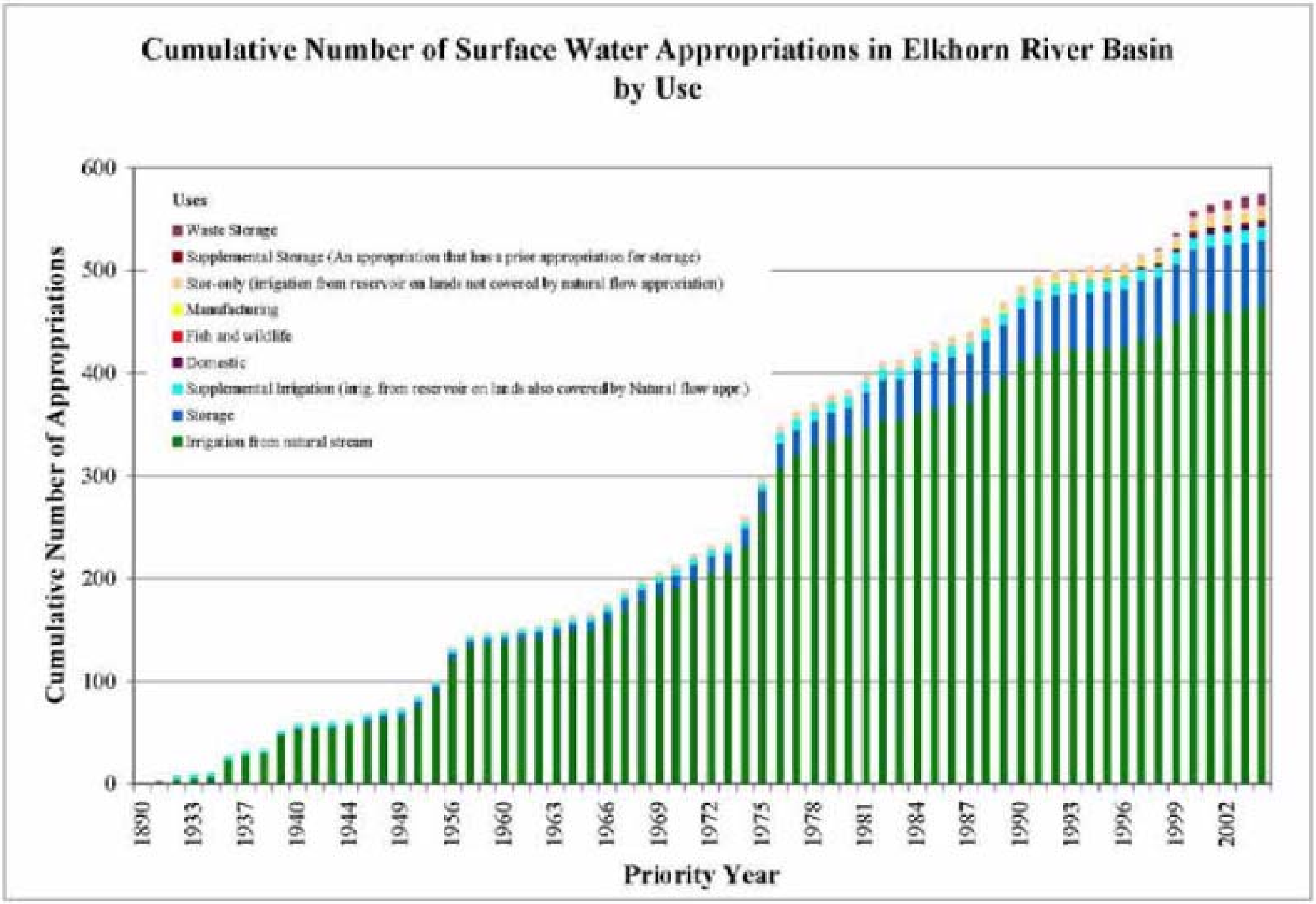
The Program is intended to provide ESA compliance for all water-related activities that affect flows above the Loup River confluence (see *Scope* section of this biological opinion). Any non-federal actions, as a result of continued ground and surface water development since July 31, 1997, resulting in impacts to Platte River flows below the Loup River confluence, will likely have a cumulative adverse effect upon the federally listed species and their habitats.

Lower Platte River cumulative effects were derived using a report titled, *2006 Annual Evaluation of Availability of Hydrologically Connected Water Supplies* (hereby referred to as the Annual Report) (NDNR 2005). The Annual Report was written to comply with Nebraska Revised Statutes § 46-713(1)(a)(Reissue 2004). The Annual Report is an evaluation of the expected long-term availability of hydrologically connected water supplies for both existing and new surface water uses and existing and new ground water uses in each of the State’s river basins. The Annual Report projects consumptive uses 25 years into the future using a 2005 hydrologic baseline. The Annual Report is divided by major river basins of which the Elkhorn River Basin, Loup River Basin, and Lower Platte River Basin pertain to lower Platte River cumulative effects. The Lower Platte River in the Annual Report is defined as the portion of the Platte River from its confluence with the Loup River to its confluence with the Missouri River.

## *A. Cumulative Surface Water Depletions to the Lower Platte River*

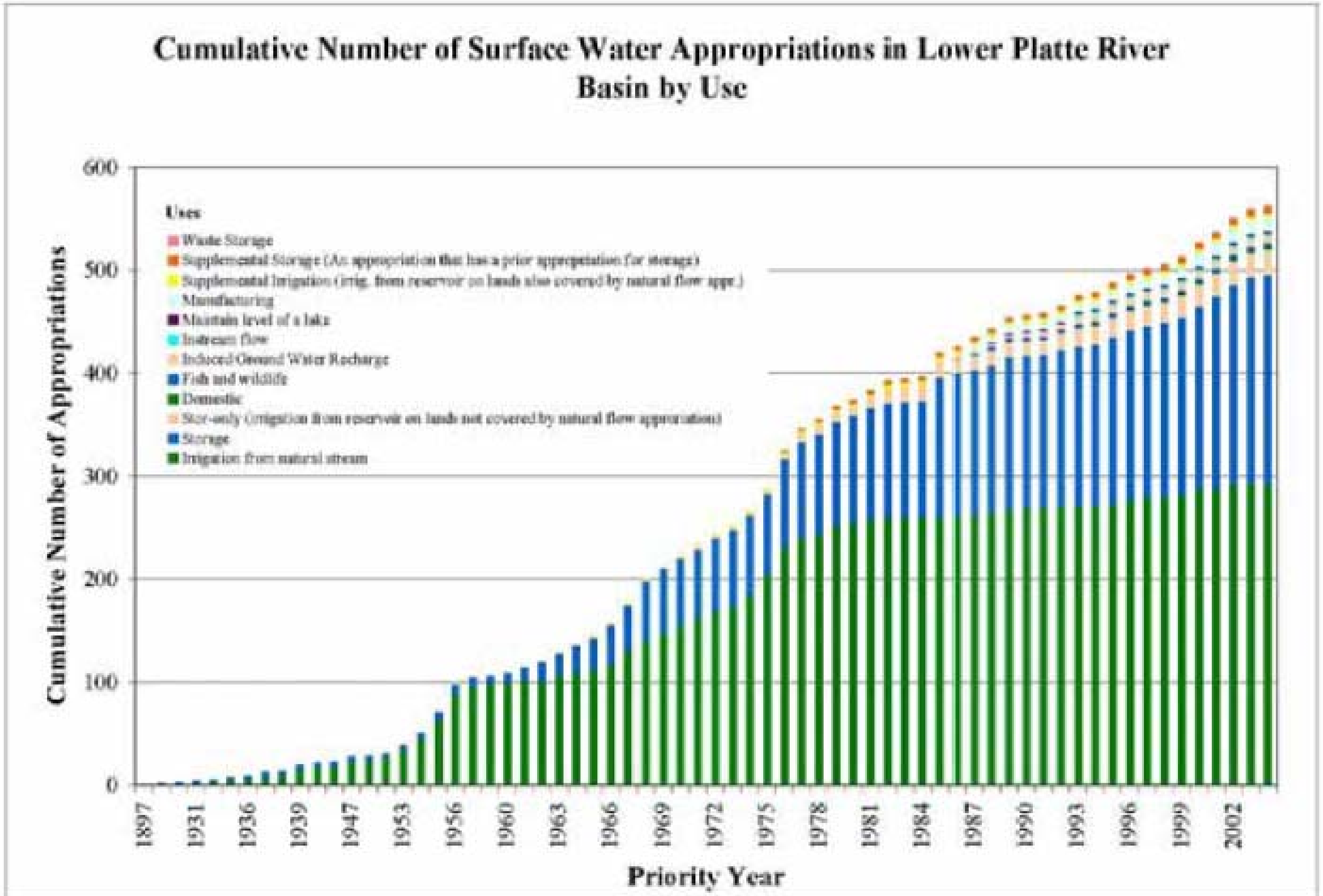
Figures VIII-1, VIII-2, and VIII-3 illustrate the yearly cumulative total number of permitted surface water rights for the Loup, Elkhorn, and lower Platte river basins. The total number of permitted surface water diversions for all river basins have increased from 1997 to 2004 (Figures VIII-1, VIII-2, and VIII-3). The Service also recognizes that an increasing trend is likely to represent an increase in lower Platte River depletions although this trend may not necessarily be linear.

**Figure VIII-1. Cumulative number of surface water appropriations in the Elkhorn River Basiu by use (NDNR 2005).**




Source: DNR Surface Water Rights Database
Figure E-49

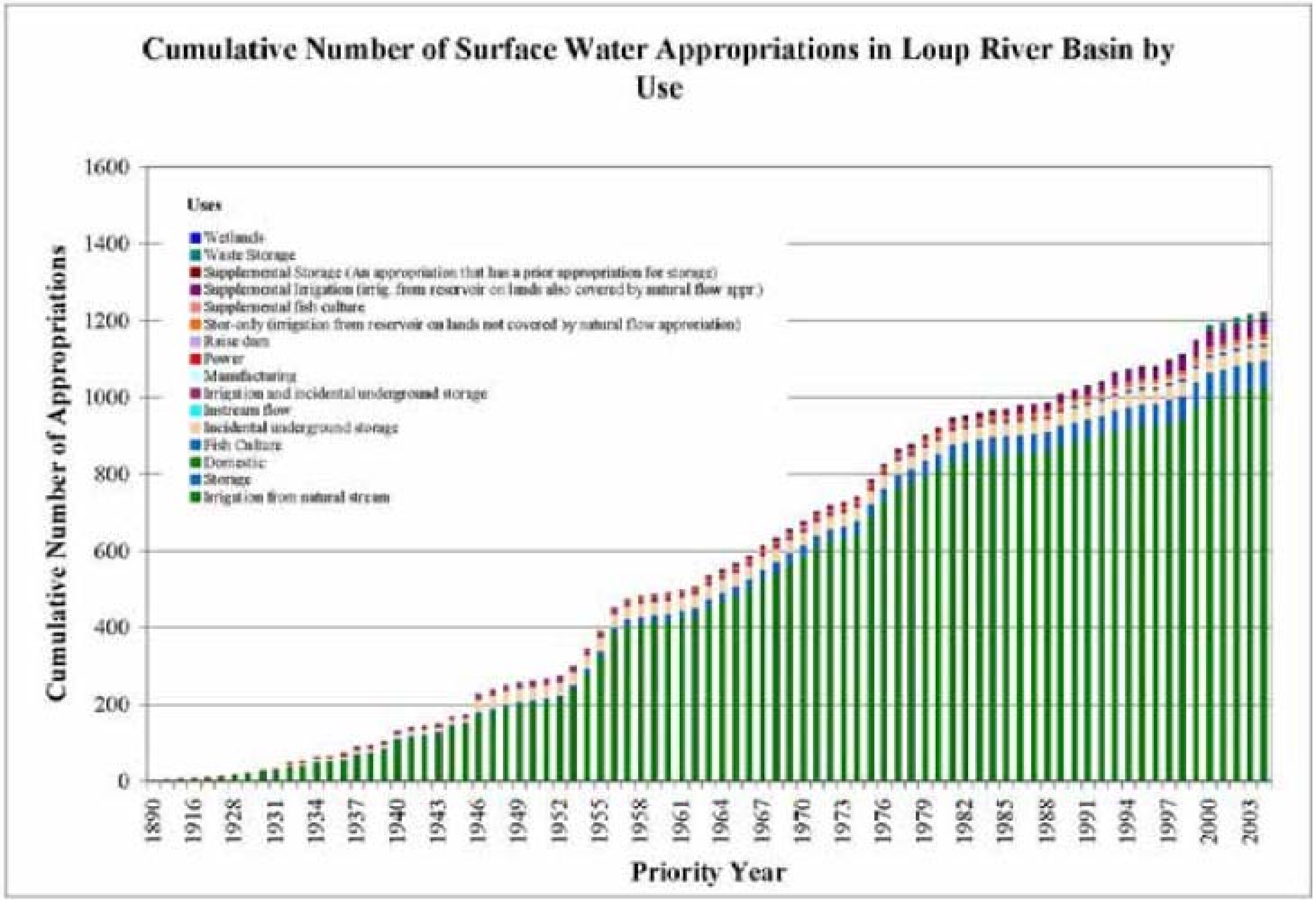
11/23/2005 by Shuhai Zheng




Source: DNR Surface Water Rights Database
Figure LP-44

11/23/2005 by Shuhai Zheng

**Figure VIII-2. Cumulative number of surface water appropriations in the Lower Platte River Basin by use (NDNR 2005).**




Source: DNR Surface Water Rights Database
Figure L-57

11/23/2005 by Shuhai Zheng

**Figure VIII-3. Cumulative number of surface water appropriations in the Loup River Basin by use (NDNR 2005).**

For future permitted surface water diversions occurring after the 2005 Annual Report baseline, the report states that for all three basins, the "number of surface water appropriations in the Basin has grown steadily over the past 30 years and it appears reasonable to project that the trend will continue into the future." Also cited in the Annual Report is that any future surface water right application would require permit review under the Nebraska Nongame and Endangered Species Conservation Act (NESCA). Any surface water diversions with a state nexus (i.e., involved state funding or requires a state permit) would be subject for review under NESCA whose review authority is delegated to the NGPC. Surface water diversions that would be reviewed under NESCA would include natural flow diversions, storage, and groundwater recharge (Frank Albrecht, NGPC, Pers. Comm., 2006). NGPC has expressed concerns that depletions to the lower Platte River may affect the pallid sturgeon, least tern, and piping plover as well as affecting the state-listed sturgeon chub (*Macrhybopsis gelida*) and the lake sturgeon (*Acipenser fulvescens*) (NGPC 2006).

An interlocal agreement, signed in 2000, was developed between NGPC and several state resource agencies that allowed for 5,000 acre-feet of new depletions to the Platte River below Chapman in return for funding of pallid sturgeon and sturgeon chub habitat studies. The interlocal agreement did not apply to projects whose requested diversions exceeded 5.0 cfs or whose requested storage exceeded 200 acre-feet. From the original signing of the interlocal agreement in 2000 to the end of 2005, approximately 3,043 acre-feet from the original allocated 5,000 acre-foot limit has been granted to individual project proponents (NDNR 2006). NGPC may require any future surface water diversions, with a state nexus, to avoid or offset any lower Platte River depletions that are not covered by the interlocal agreement, potentially influencing future numbers of surface water diversions permitted.

## *B. Cumulative Groundwater Depletions to the Lower Platte River*

The Annual Report used high capacity wells to define groundwater wells of a depletive nature. High capacity wells are groundwater wells capable of pumping more than 50 gallons per minute. Using 20 years of data prior to the 2005 hydrologic baseline, the annual rate of increase for high capacity wells in the Elkhorn, Loup, and lower Platte river basins were 129, 114, and 43 wells, respectively. The Annual Report stated that the 20-year trendline for all three basins was linear. Given the 8.5-year time span between the Program's hydrologic baseline (July 31, 1997) and the Annual Report's hydrologic baseline (December 31, 2005), the Service concludes that approximately 2,431 high capacity wells were constructed within the stated time frame.

The Annual Report also considers lag impacts resulting from groundwater wells that were installed before the hydrologic baseline in which the fullest extent of depletions would not be realized until after the hydrologic baseline (i.e., it may take several years before the fullest extent of groundwater well depletions are realized). These lag impacts affect the Program's July 31, 1997, hydrologic baseline and would be considered new depletions to the lower Platte River.

The Service recognizes that the groundwater well totals provide a qualitative tool for assessing lower Platte River depletions knowing that there are several factors and analysis necessary to quantify depletions (Appendix D of the Annual Report). Therefore, lower Platte River depletions occurring after the Program's hydrologic baseline (July 31, 1997) and before the Annual Report's hydrologic baseline (December 31, 2005), can only be addressed qualitatively in this biological opinion. It is reasonable to assume that some level of depletions have occurred within this timeframe based on the data in the Annual Report.

Although lower Platte River groundwater depletions within the July 31, 1997, and December 31, 2005 time frame can not be quantified, the Nebraska Department of Natural Resources was able to quantify anticipated future groundwater depletions to year 2030 (Table VIII-1). These new depletions (post 2005) were calculated using Jenkins Stream Depletion Factor methodology defined in Appendix D of the Annual Report. The Annual Report calculated total future depletions for the North Bend hydrologic gage (which includes the future depletion from the Loup River Basin, and the Platte River Basin) and for the Louisville hydrologic gage (which includes the future depletions from the Loup River Basin, Elkhorn River Basin, and the lower Platte River Basin). Total depletions at both hydrologic gages include new depletions from existing groundwater wells (installed on or before 2005) and from new groundwater wells.

**Table VIII–1. New Platte River depletions assessed at the North Bend and Louisville hydrologic gages (depletions are average daily reductions to flow in cfs).**

| | | North Bend Gage | Louisville Gage |
|---|---|---|---|
| **Lower Platte River Basin** | Existing Projects | 15 | 15 |
| | New Projects | 50 | 55 |
| **Loup River Basin** | Existing Projects | 95 | 95 |
| | New Projects | 220 | 220 |
| **Elkhorn River Basin** | Existing Projects | NA | 40 |
| | New Projects | NA | 95 |
| | **Total Depletions** | **380** | **520** |

The Annual Report stated that there were no anticipated legal constraints that would limit the construction of new wells within the next 25 years. Groundwater wells with a state nexus would be subject to review under the NESCA, but these cases represent a small proportion of total wells permitted (Frank Albrecht, pers comm., 2006). Wells subject to NESCA review would include wells located within 50 feet of a stream, or wells receiving financial support from the State.

## *C. Summary of Depletion Related Impacts to the Lower Platte River*

Both surface water diversions and ground water extraction contribute to reductions in lower Platte River flows. The Annual Report developed by the Nebraska Department of Natural Resources used a 2005 hydrologic baseline to quantify Platte River depletions caused by high capacity groundwater wells, but their calculations project consumption after 25 years of continued development. Therefore, it is difficult to interpolate estimated 2030 lower Platte River depletions with depletions at the end of the Program’s first 13 years. Additionally, lower Platte River groundwater depletions can only be assessed qualitatively from July 31, 1997 to December 31, 2005. The Annual Report stated that there were no anticipated legal constraints that would limit the construction of new groundwater wells within the next 25 years.

Total Platte River depletions at the North Bend and Louisville hydrologic gages (Table VIII–1) do not reflect totals identified in the Annual Report. The exclusion of estimated depletions from the Metropolitan Utilities District (MUD) wellfield accounts for the differences between both sources. The MUD wellfield had fully offset Platte River depletions under section 7 of ESA (Service 1999 and 2001); therefore, depletions associated with the wellfield are a component of the environmental baseline (Chapter VI) as opposed to a cumulative effect. Similar projects resulting in depletions to the lower Platte River that would affect the Program's hydrologic baseline (July 31, 1997) and whose depletions also contribute to Table VIII–1 totals are identified in the Consultation History section (Chapter II). Although these projects are components of the environmental baseline because of offsetting impacts resulting from section 7 of ESA, lower Platte River depletions associated with these projects could not be segregated from Table VIII–1 totals as with the MUD project; therefore, it should be identified that Table VIII–1 totals are not entirely cumulative effects.

Lower Platte River depletions resulting from surface water diversions can only be assessed qualitatively from July 31, 1997 to the end of the Program's first 13 years. The Annual Report expected the historic trend of surface water diversions to continue to 2030, but acknowledged future diversions would be subject to review under NESCA.

# IX. Conclusions

To insure the continued survival and recovery of the whooping crane (*Grus americana*), interior least tern (*Sterna antillarum*), northern Great Plains population of the piping plover (*Charadrius melodus)*, and pallid sturgeon (*Scaphirynchus albus*), collectively referred to as the target species, it is necessary to arrest habitat loss and increase habitat through restoration, in the existing, severely degraded Platte River ecosystem The severity and extent of habitat degradation in the Platte River ecosystem has resulted principally from extensive development of Platte River basin water resources.

For more than two decades, discussions regarding the need for a comprehensive, basin-wide recovery and research program have taken place among the numerous and diverse parties involved with water use and management in the Platte River basin. While there has not been agreement among the parties regarding the need for remedial measures to conserve federally listed species that use the Platte River, there has been general agreement that the objectives of the various parties can best be met through the implementation of a basin-wide, cooperative recovery and research program. The Program addressed by this biological opinion is to help recover the four target species associated with the central and lower reaches of the Platte River in Nebraska by implementing certain aspects of the recovery plans. By providing habitat related benefits to the target species through restoration of the structure and function of the Platte River ecosystem, the Program is to help offset the adverse impacts to the Platte River ecosystem from the continuation of existing and new water-related projects in the basin upstream of Columbus, Nebraska, and thereby, obtain ESA compliance for such projects during the first 13-years of the Program. The Program is also intended to protect designated critical habitat for the whooping crane, and help prevent the need to list additional Platte River basin associated species pursuant to ESA.

The purpose of this biological opinion is to evaluate the effects of the Federal action to determine whether that action, as described earlier, is likely to jeopardize the continued existence of federally listed endangered and threatened species, or adversely modify or destroy designated critical habitat in the action area. Section 7(2)(a) of the ESA requires, when making such a determination, that the Service consider the effects of the action relative to the environmental baseline, and within the context of the rangewide status of the species and cumulative effects. Previous sections include extensive information on the status of the species and their habitats, the effects of the Federal action, and cumulative effects considered in these determinations. The existing trends and conditions of Platte River habitat and ecosystem processes, and the status of the populations of the four target species lead the Service to conclude that the survival and future recovery of these species cannot be ensured without significant changes made to improve current environmental conditions.

<u>Environmental Baseline Factors in the Service's Determinations</u>:

The environmental baseline chapter of this biological opinion describes the condition of the river ecosystem and factors affecting the target species and their habitats. The practice of hydrocycling to enable generation of hydropower when river flows are low is one such factor currently affecting the central Platte River and potential effects of this practice on least terns, piping plovers, whooping cranes and pallid sturgeon and their habitats are discussed in the

*Environmental Baseline* section. The Service does not consider the impacts of hydrocycling in the central Platte River to significantly affect the bald eagle, western prairie fringed orchid or the pallid sturgeon or to significantly modify Program effects to those species. Discussions are currently underway with CNPPID to develop an agreement on modified hydrocycling operations to avoid or minimize potential hydrocycling effects on the avian target species and on Program benefits.

Monitoring, Research, and Adaptive Management:

A fundamental component of the Program is a functional, scientific adaptive management process supported by an extensive and peer-reviewed monitoring and research program. The initial activities and commitments described in the Program documents are negotiated starting points to be tested during the first stage of the Program. In addition, the GC Alternative analyzed in the FEIS and evaluated in this biological opinion represents a reasonable assumption of an implementation scenario within the framework of the Program. The Service recognizes that the actual results from implementation of the Program elements and activities may differ from those described in the biological assessment. Activities conducted by the Program must be monitored carefully to determine if effects on the target species and their habitats are consistent with those anticipated and predicted by this analysis. The Service's conclusions in this biological opinion are dependent on the efficient and complete implementation of Program activities, and scientifically rigorous studies to determine effects of those activities, to support the appropriate application of the adaptive resource management process within and between stages of a long-term Program.

**Whooping Crane**

Environmental Baseline:

The *Environmental Baseline* section describes the status of the whooping crane and its habitat in the action area. The present habitat conditions in the central Platte River, including designated critical habitat from Lexington downstream to Denman, Nebraska, reflect deteriorated habitat conditions resulting from water resource development in the Platte River basin. In upstream segments of the central Platte reach, in particular, the current condition includes the transformation of the river channel from a broad braided plan form to an anastomosed plan form, which reduces the availability of whooping crane roost habitat in the channel.

Effect of the Action:

Based on the analyses presented in the FEIS, the Federal action is predicted to benefit the whooping crane and its habitat in the central reach of the Platte River. These benefits, discussed and summarized in the Effects of the Action Section, include: a) improvements in the quality and distribution of wide, wet channels used for roosting whooping cranes; b) an increase in sediment input to the river system essential to sustain restored habitats on Program lands upstream of Kearney, and to maintain channels and wetland habitats in other portions of the river; c) an objective for increasing the amount of grasslands and wet meadows available for crane foraging; d) minor increases in early-spring (mid-February to mid-March) water surface elevations which will assist sediment transport and ice-scouring capabilities for river channel maintenance, e) increases in late spring (mid-April to June) peak water surface elevations in normal years which could improve groundwater levels and related improvements in wetland maintenance during years with normal river flows; and f) an increase in the length of stream bank and adjacent land area protected to minimize disturbance.

The FEIS analyses also predict that implementation of the GC Alternative will adversely affect the whooping crane and its habitats through changes in system hydrology, primarily reductions in the magnitude and frequency of peak flows, such as: a) reductions in the peak flows in the wettest years which would reduce groundwater elevations that sustain wetland habitats and crane food sources; b) a decrease in short-duration peak flows that create overbank flows into wet meadows and facilitate surface water connections between meadows; c) increased diversion of river flows which adversely affect the river's natural sediment transport processes. Increases in J-2 Return flows, which exacerbate erosion of the channel bed, would be partially offset by providing sufficient sediment to the river through the sediment augmentation activities.

<u>Cumulative Effects:</u>

Expansion of residential and commercial development along the river in the central Platte River valley may increase sources of disturbance to whooping cranes roost or feeding in the river channel, but buffers to habitat provided on Program lands will reduce disturbance to areas protected or restored by the Program.

**Whooping Crane Critical Habitat**

Based on the assumptions inherent in the analysis as presented in the FEIS, the Federal action is expected to both benefit and adversely affect elements of critical habitat designated for the whooping crane between Lexington and Denman, Nebraska. These elements in the central reach of the Platte River valley include wide, open river channels with wide wetted widths for nightly roosting, bottomland feeding areas (including wet meadows), and the element of isolation from disturbance. The beneficial and adverse effects of the Federal action (described above) would both positively and negatively affect the ability of the channel to provide suitable roost habitat for migrating whooping cranes. Similarly, the Federal action contains a goal of increasing wet meadow habitats in the central Platte River, but adverse impacts from water management activities may adversely affect groundwater levels that subirrigate the wet meadows. The increased protection from disturbance provided by buffers on protected and restored Program lands would increase isolation of whooping cranes from disturbance. Taken together, the Federal action would likely improve the function of the designated critical habitat to conserve and recover the whooping crane.

**Least Tern and Piping Plover**

Environmental Baseline:

See discussion of river condition under whooping crane, above. The transformation of a wide, braided river plan form to narrow channels, the current sediment imbalance, and reduced peak flows constrain the development of suitable channel nesting habitat for least terns and piping plovers.

Effects of the Action:

Based on the assumptions inherent in the analyses presented in the FEIS, Federal action is predicted to benefit, as well as adversely affect, least terns and piping plovers in the action area, with a potential net effect of benefiting both species. Expected benefits from the management scenario modeled in the FEIS (2006) include: a) the possibility of slight improvement in the availability of channel nesting habitat in the channel through water management and sediment augmentation, as reflected by improvement in both the potential for flows to build sandbars, and the number of days in excess of those required to fledge young, b) an increase of 53,100 feet in the length of braided channel in the central Platte River, which is the plan form exhibiting the greatest possibility of sandbars near the center of the channel, c) an increase in both the width of widest channels and in the width to depth ratio in the central Platte River reach, and d) the probability of increased nesting substrate provided at Lake McConaughy and managed sandpits, which may benefit least terns and piping plovers in the short-term; e) sediment augmentation which reduces the rate of channel degradation in some areas and may stabilize the channel in other areas. Although erosion is still occurring in the areas downstream of the J-2 Return, the modeled sediment augmentation reduces the overall sediment imbalance in the central reach of the Platte River from -220,000 tons (present condition) to -42,000 tons per year (as modeled under the GC Alternative).

Predicted adverse impacts of the Federal action include: a) a significant reduction in the frequency and magnitude of spills from Lake McConaughy, which exacerbates the decline of ecosystem processes maintained by a normative hydrologic regime and sediment transport through the system; b) an increased probability of continued channel narrowing and habitat degradation from North Platte to Lexington that may negatively affect the availability of resources to piping plovers and interior least terns currently using this reach of the Platte River, and c) a slight increase in the possibility of inundation of least tern or piping plover nests downstream of Chapman through slightly elevated July flows at Grand Island.

Cumulative Effects:

The Nebraska New Depletions Plan only offsets depletions above Chapman. New groundwater withdrawals that only affect Platte River flows below Chapman, Nebraska, are not offset by the Federal Action. These unmitigated new groundwater withdrawals that affect peak flows will reduce the potential for the formation of sandbar nesting habitats below Chapman, and the withdrawals that affect summer flows will, under normal conditions, reduce the potential for nest inundation in the lower Platte River. During dry years, unmitigated new withdrawals will contribute to drying of the channel between Chapman and Columbus, Nebraska.

**Pallid Sturgeon**

Environmental Baseline:

As discussed in the environmental baseline section, the lower Platte River has been highly altered, but still appears to provide some of the best remaining pallid sturgeon reproductive habitat in the middle of the species range. As such, this habitat is pivotal in the continued existence of the species. Likewise, while the habitat is still at least somewhat functional, it has been highly altered. This alteration is primarily due to alterations of the seasonal hydrograph, daily hydrograph, bank stabilization, and disconnection from the floodplain (which is directly related to the seasonal hydrograph). Secondary forms of alteration that may or may not be as impaired are foodbase quality and quantity, summer water temperature, and bedload sediment availability.

Effect of Action:

Under the Federal action, the hydrologic analyses show: a) small adverse effects to flows during the critical pallid sturgeon spawning period; b) small adverse effects to flows during the important habitat formation and maintenance period; c) a small tendency toward normalization of abundance and maintenance of diversity of the potentially impaired food base production period; and d) small to moderate positive effects on the summer period which has a relatively unknown level of current impairment. The sediment analyses show the potential for positive effects under the Federal action, but as discussed above, modeling constraints result in uncertainty as to the relative effect in the overall lower Platte River sediment budget.

Given these results, the Federal action relies heavily on offsetting measures to be designed and implemented during the first 13 years of the Program. The pallid sturgeon research plan is designed to provide prescriptions for offsetting measures based on the research results. It is anticipated that the Program effects analysis will be designed to further define the type and extent of necessary measures to negate or offset Program impacts to the species, and that such measures will be implemented, thereby, offsetting any adverse effects of hydrologic modifications to the pallid sturgeon's lower Platte River habitat.

Cumulative Effects:

As discussed in the cumulative effects section of this opinion, it is anticipated that the rate of new well establishment below Chapman, Nebraska, and in the lower Platte River drainage area not covered by the new depletions plans, would be consistent with that experienced during the recent past. This is supported by current long range forecasts of groundwater development prepared annually by the State of Nebraska (NDNR 2006a). As the majority of these new wells are developed for the purposes of irrigation, their withdrawals would take place primarily during the summer months. The result would be that the effective depletion to lower Platte River flow would be most likely realized in the summer, fall, and possibly into the winter. Although it is not possible to quantify the total effect of this new well establishment due to the many variables involved, it is anticipated that the net effect would be some level of depletion to lower Platte

River flows. Therefore, the flow rates analyzed for the summer, fall, and possibly winter would be smaller by some presently unquantifiable degree. As a result, the benefits produced by the Federal Action to summer flow levels in the lower Platte River would be somewhat less than those predicted by this analysis. Increases in fall flow rates in the lower Platte River would be similarly reduced to some extent. Effects during the winter cannot be determined at this time.

**Bald eagle**

Environmental Baseline:

The environmental baseline for the bald eagle reflects expanding populations of eagles in the entire Platte River basin. Water management activities that reduce channel flows can adversely affect forage resources, but water releases below storage facilities that maintain open water areas in the winter increase opportunities for foraging.

Effects of the Action:

Based on the assumptions inherent in the analysis as presented in the FEIS, the Federal action would produce both beneficial and adverse effects, but would likely result in a net benefit to the bald eagle. Implementation of the Program goals would have the following beneficial effects on the bald eagle in Nebraska: a) increase wet meadow/low-lying prairie grassland habitat in portions of the central Platte River; b) provide for river island clearing and leveling in portions of the central Platte River; c) offset channel incision in portions of the central Platte River; and d) reregulate water to help meet Service recommended target and pulse flows in the central Platte River. In addition, the Program's Land Plan notes that the Program would, where practical, select restoration, maintenance, and other management measures for the target species that do not harm or may benefit bald eagles and other “species of concern.”

The adverse effects of depletions may cumulatively, with other hydrology-modifying actions, influence local South Platte, North Platte, and Platte River wintering food sources, which may affect foraging efficiency and the condition of wintering bald eagles, and would likely require that alternative types of prey be more frequently used. The cumulative loss of fishery habitat likely has an adverse effect on the foraging efficiency of the bald eagle. Consequently, eagles would more frequently need to rely on forage sources that are either scarcer, less desirable, or more difficult to obtain than traditional sources.

Cumulative Effects:

The Service is unaware at this time of specific State or private actions that might affect bald eagles in the upper reaches of the basin. In the central and lower reaches of the Platte River, unmitigated new groundwater withdrawals that affect channel flows below Chapman will adversely affect, to an unknown degree, forage resources in that area. During dry years, unmitigated new withdrawals will contribute to drying of the channel between Chapman and Columbus, Nebraska.

**Western Prairie Fringed Orchid**

Environmental Baseline:

As a result of historic and ongoing reductions in river flow, the Mormon Island population of the western prairie fringed orchid has shown a steady decline in numbers and may be extirpated, although drought conditions during the last several years have complicated detectability of the species.

Effects of the Action:

Based on the assumptions inherent in the analysis as presented in the FEIS, the Federal action would produce both beneficial and adverse effects, but would likely adversely affect the western prairie fringed orchid, over all. Because wet meadows are the habitat of the western prairie fringed orchids in the central reach of the Platte River, effects to the species are the same as those described in the section on impacts to wet meadows in the whooping crane effects analysis. Wet meadows may be benefited by the Federal Action in the following ways: a) in early-spring (mid-February to mid-March) increases in water surface elevations will facilitate growth and activity of wet meadow communities including the orchid, b) during years with normal river flows, increases in late spring (mid-April to June) peak water surface elevations in normal years could improve groundwater levels and related improvements in wetland maintenance in the lowest and wettest meadows.

Habitats of the western prairie fringed orchid may be adversely affected by: a) a decrease in late-spring river elevations and peak flows in the wettest years that would negatively affect groundwater elevations that sustain wetland habitats, b) a decrease in short-duration peak flows that create overbank flows into meadows and facilitate surface water connections between meadows.

Cumulative Effects:

The Service is unaware at this time of specific State or private actions that would significantly affect western prairie fringed orchids in the central and lower reaches of the Platte River.

## Conclusions

As is inherent in large programmatic consultations in which there is a range of possible effects, there remains some uncertainty regarding the ultimate effects of the Federal Action on the federally listed species and their habitats in the central and lower reaches of the Platte River basin. For this reason and others, the effects of Program activities will be carefully monitored, and the activities adjusted via the process of scientific adaptive resource management described in the Program's Adaptive Management Plan to achieve benefits for the target species. Based on that understanding; and after reviewing the current status of the species, the environmental baseline for the action area, the effects of the Federal Action, and the cumulative effects; it is the Service's biological opinion that the Federal Action, as described, is not likely to jeopardize the continued existence of the federally endangered whooping crane, interior least tern, and pallid sturgeon, or the federally threatened Great Plains population of the piping plover, bald eagle, or western prairie fringed orchid. The Federal Action is also not likely to destroy or adversely modify designated critical habitat for the whooping crane.

# X. Incidental Take Statement

Section 9 of ESA and federal regulations pursuant to section 4(d) of ESA prohibit the take of endangered and threatened species without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct, and applies to individual members of a listed species. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under ESA provided that such taking is in compliance with the terms and conditions of this incidental take statement.

Sections 7(b)(4) and 7(o)(2) of ESA do not apply to the incidental take of federally listed plant species (e.g., Colorado butterfly plant, Ute ladies' tresses orchid, and western prairie fringed orchid). However, limited protection of listed plants from take is provided to the extent that ESA prohibits the removal and reduction to possession of federally listed endangered plants or the malicious damage of such plants on non-federal areas in violation of state law or regulation or in the course of any violation of a state criminal trespass law. Such laws vary from state to state.

The Service has developed the following incidental take statement based on the premise that the Governance Committee Alternative as analyzed in this biological opinion will be implemented. As such, this incidental take statement addresses incidental take associated with implementation of the Governance Committee Alternative and operation of existing and new water-related activities in the Platte River basin covered by the Program, as described in Section IV (description of the action) of this opinion and hereafter referred to as the "Federal Action." Even upon successful implementation of the Governance Committee Alternative, a minimum amount of incidental take of listed species may indirectly result from existing and new water-related activities[17] covered by the Program, habitat alteration or surveys conducted by the Program. The resulting take is further described below for each species. The Service acknowledges that there are "Acts of God" or "Acts of Nature" that are beyond the operational control of the Program participants; and that type of take is not incidental take and is not addressed as such.

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[17] The term "water-related activities" means activities and aspects of activities that (1) occur in the Basin upstream of the Loup River confluence; and (2) may affect Platte River flow quantity or timing, including but not limited to water diversion, storage, and use activities and land-use activities. Changes in temperature and sediment transport will be considered impacts of a "water-related activity" to the extent that such changes are caused by activities affecting flow quantity or timing. Impacts of "water-related activities" do not include those components of land use activities or discharges of pollutants that do not affect flow quantity or timing. "Existing water-related activities" include surface water or hydrologically-connected groundwater activities implemented on or before July 1, 1997. "New water-related activities" include surface water or hydrologically-connected groundwater activities including both new projects and expansion of existing projects, both those subject to and not subject to section 7(a)(2) of the ESA, that may affect the quantity or timing of water reaching the associated habitats and that were implemented after July 1, 1997.

Estimating the number of least terns, piping plovers, whooping cranes, and pallid sturgeon taken in the manner described below is difficult to quantify for the following reasons: a) determining whether an individual foregoes breeding as a result of Program activities versus natural causes would be extremely difficult to determine; b) the species are sensitive to human activities, thus take is difficult to monitor and detect; c) finding dead or injured individuals would be difficult, due to the expanse of the project area and because carcasses are subject to scavenging; d) low sample size and natural fluctuations in abundance may mask project-caused effects; and e) effects that reduce productivity are difficult to quantify. According to Service policy, as stated in the Endangered Species Consultation Handbook (March 1998) (Handbook), some detectable measure of effect should be provided, such as the relative occurrence of the species or a surrogate species in the local community, or amount of habitat used by the species, to serve as a measure for take. Take also may be expressed as a change in habitat characteristics affecting the species, such as water quality or flow (Handbook, p 4-47 to 4-48). Therefore, for each of the species described below, a surrogate measure has been developed to estimate the amount of anticipated take. Given the programmatic nature of the action and the consultation, should an individual measure of allowable take be exceeded, consultation should be reinitiated on the aspect of the Federal Action resulting in that take, rather than the Federal Action as a whole. Assuming the Program is being implemented in accordance with the requirements in the Milestones Document, ESA compliance for individual water-related activities covered by the Federal Action will continue during the process of such reconsultation.

No take resulting from unauthorized human activity is exempt under this biological opinion.

The Service will not refer the incidental take of any migratory bird covered by this incidental take statement or bald eagle for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. Sec. 703-712), or the Bald and Golden Eagle Protection Act of 1940, as amended (16 U.S.C. Sec. 668-668d), if such take is in compliance with the terms and conditions specified herein.

The Service also wishes to make clear that any Terms and Conditions, or Reasonable and Prudent Measures (RPMs) in this Incidental Take Statement, do not supersede or change the Incidental Take Statement in the biological opinion for FERC Project Nos. 1417 and 1835 (USFWS 1997). The two Incidental Take Statements are intended to complement one another.

## *A. Least Tern and Piping Plover*

### A1. Amount or Extent of Incidental Take Anticipated

Incidental take of least terns and piping plovers may directly or indirectly result from water-related activities outlined in the Federal Action and monitoring of habitats and populations. Such take includes killing, harming, and harassing which could include the loss of habitat, individuals (adults, eggs and/or chicks), and recruitment.

In the event of lethal take, the specimen should be collected and stored in a dry, frozen condition, if possible, and delivered to the Service’s Field Office in Grand Island, Nebraska, as soon as possible after the incident is reported. Individuals affiliated with the Program who discover such take must notify the Service's Field Office in Grand Island within 24 hours of discovering such take. Upon notification that such take was the result of research or monitoring activities, additional protective measures may be added to the section 10(a)(1)(A) permits held by involved researchers.

The following types of losses are reasonably foreseeable to occur as a result of implementation of the Federal Action:

1. While known nesting of either species has not occurred on riverine habitats in the central Platte since 1996, it is anticipated that nesting will likely occur during the first 13-years of the Program. Precautions are in place to reduce the likelihood of take of least tern and piping plover eggs and unfledged chicks by high flows due to EA releases or other Program water management activities or releases from other Water-related activities covered under the Federal Action. However, it remains reasonably foreseeable that such instances, while rare, may occur during the nesting season and could result in unintended flooding of riverine nests and mortality of eggs and chicks. The Service realizes that the Platte River system is highly variable, that some of the variability is natural and not possible to control, that it is difficult to predict incidental take levels for any given year, and that it is unlikely to avoid all incidental take;

2. While sandpits are anticipated to offer benefits to the species, use of such habitats may pose some specific risks to individuals of both species that could result in take. Least terns and piping plovers utilizing these areas may be subject to increased susceptibility to predation compared with riverine habitat, and depending on the amount of habitat protected at a site and other factors inherent to the site, may be subject to increased human disturbance (Table 2 of the Program Land Plan outlines measures included in Program design to avoid human disturbance). In addition, if such habitats are developed in areas that do not provide sufficient forage, adult birds nesting on these habitats and juveniles reared from these habitats could incur an energetic disadvantage resulting from their use of such habitat. As a result, these individuals may be subject to increased mortality during the nesting season and subsequent migration. Table 2 of the Program Land Plan also specifies that Program acquisition of sandpit habitat will be limited to lands within two miles of the river to reduce the travel distance to the river for foraging.

3. Least terns and piping plovers using Program lands could be subject to take during monitoring, research, surveys or other Program activities. At these sites, incidental take of least terns and piping plovers may occur during the course of monitoring or research. Researchers will be required to apply for and obtain section 10(a)(1)(A) permits that will contain measures to minimize the effects of research on federally listed species. No take resulting from monitoring and research activities, beyond those authorized in the individual 10(a)(1)(A) permits, is authorized;

4. Least terns and piping plovers using Program lands could be subject to take during Program habitat restoration and land management activities. At these sites, incidental take of least terns and piping plovers may occur during the course of habitat restoration or other land management activities. Site specific habitat restoration and land

management plans are to be developed by the Program and approved by the Governance Committee. These habitat restoration and land management plans will contain site specific measures to minimize the effects of land management on federally listed species.

5. Least terns and piping plovers nesting on lands off of the river and outside of the central Platte River reach may be subject to take. This may include nests or chicks flooded or displaced on the shorelines of the Inland Lakes (e.g., Lake Minatare, Lake Alice, Lake Winters Creek, and Little Lake Alice) of Reclamation's North Platte Project in Nebraska.

The following estimates of take are possible as a result of those causes outlined above:

1. As a result of the large area of habitat, and the logistical challenges inherent in adequately surveying this area, all birds nesting on the central Platte River may not be accounted for at a given time. Because of the difficulty in estimating the number of least terns and piping plovers taken by the activities of the Federal Action, the Service has identified the incidence of "inundating flows" caused entirely or aggravated by the Federal Action, as a surrogate measure for take of least terns and piping plovers during the first 13 years of the Program. Except as described below, "inundating flows" are defined as instantaneous flows caused entirely or aggravated by the Federal Action occurring at Overton between June 1 and August 15 that exceed a benchmark flow rate established by the Service on June 1. That benchmark will be the same as the benchmark established under the flow attenuation plan established by CNPPID pursuant to the Incidental Take Statement in the biological opinion for FERC Project Nos. 1417 and 1835 (USFWS 1997). The benchmark will be based on the maximum flow recorded at the Overton gage between May 1 and May 31 earlier in that calendar year, on data regarding nesting locations or desired nesting locations and flows that are believed not to inundate known nests, and on operational factors that limit flow attenuation. The Service will revise the benchmark flow rate consistent with the flow attenuation plan. The defined "inundating flows" would not include flows that would otherwise meet the "inundating flow" criteria, but that are due entirely to natural causes, to natural flows increased by the Federal Action that would have been of a magnitude to constitute "inundating flow" even without such addition, or to flow releases as specifically defined in 2., below. Because it is not possible to accurately quantify take of nests or birds, defined "inundating flows" will serve as a surrogate measure for unidentifiable take due to flooding of nests on the Platte River.

   Several conditions may occur under which comparable flows to these defined "inundating flows" would be unlikely to result in take. Under such conditions, irrespective of the cause for flows of this magnitude, it would be inappropriate to quantify such inundating flows against the take allowed under this incidental take statement.

   a. Documented riverine nesting by either species has not taken place on riverine habitat in the central Platte River reach since 1996. As this is likely due to habitat conditions on the river, and restoration of such habitat is not anticipated to occur immediately upon Federal Action implementation, quantification of the measure will not begin under the Program until such nesting on riverine habitat in the central Platte Reach occurs and has been verified.

b. If flows above the benchmark occur (naturally or otherwise), subsequent instances of "inundating flows" will be quantified based on a revised benchmark flow, if applicable.

c. If flows above the benchmark occur (naturally or otherwise) late enough in the nesting season that successful re-nesting will be highly unlikely, additional instances of "inundating flows" would not be anticipated to result in additional injury in that year. In such an instance, defined as after July 15 in a given year, flows above the benchmark flow will not be quantified as inundating flows.

d. As a result of survey data, the EA Manager may conclude that no nesting on the river appears to be occurring, and may authorize suspension of "inundating flow" control measures by Program water projects and Program participants. Under such circumstances, flows above the benchmark flow will not be quantified as inundating flows.

This surrogate measure will be evaluated on a continuing basis by the Service, and in the unlikely event that the measure is found to be ineffective in determining the actual incidence of nest loss due to defined inundating flows, the measure may be altered or discontinued by the Service through reinitiation of consultation on this surrogate measure and/or the specific Program activity involved if the level of anticipated take is exceeded. The amount of take exempted under this measure is the occurrence of defined "inundating flows" in up to seven years during the first Program stage. Consistent with the introductory section, should this amount of take be exceeded, reinitiation of consultation will be limited to the Program releases that cause the exceedance.

2. The Program may make restoration flow releases specifically designed to modify habitat parameters in the central Platte River reach. These flows may include spring "pulse" flows, releases to mobilize liberated sediment, or other such flows intended to bring about physical changes in the habitat lasting beyond the duration of the release itself. These types of releases are anticipated to be a substantial element of Program habitat restoration activities, and are anticipated by the Service to bring about significant overall improvements in the status of the species in the central Platte River reach. As such, while it is expected that the EA Manager will exercise caution in planning such releases, and that such releases would generally take place early in the nesting season, so as to allow for re-nesting, it is reasonably foreseeable that such releases could be made during the nesting season in up to four out of five years, with quantification beginning in year five of the first 13 years of the Program. Measured on a rolling basis, this frequency of take due to release of restoration flows is the amount exempted under this Incidental Take Statement.

3. Some level of predation of least terns, piping plovers, and their eggs and young is anticipated to occur in natural, created, managed, or unmanaged systems. The margin

between predation at sandbar habitat on the central Platte River and sandpits is unknown, as nesting has only occurred on sandpits in this reach since 1996, but only this margin is construed to be incidental take. Sandpit habitat will be managed, and among the measures for consideration in developing management plans will be predator exclusion measures. Estimates of take associated with least tern and piping plover use of sandpit habitat are difficult to calculate. Therefore, the Service will quantify take due to predation on Program managed sandpits by using only the surrogate below. The Districts have considerable experience managing and monitoring non-complex sandpit habitat for least terns and piping plovers, and have maintained a database of losses due to predation which shows considerable variability in rate of loss between pits and between years. In some instances, predation can have catastrophic effects on individual nesting colonies. Based on the variability of past predation and natural component to predation, the Service believes that incidental take may be occurring if there is repeated catastrophic loss. Loss to predation on any individual sandpit managed by the Program (averaging five or more least tern nests or three or more piping plover nests) up to 70 percent of the nests or 80 percent of the hatched chicks in three of five consecutive years is exempted. Loss to predation on sandpits managed by the Program averaging less than five least tern nests or three piping plover nests up to 100 percent of nests or hatched chicks in four of five consecutive years is exempt. Should either of these measures be exceeded, reinitiation will be limited to management of nesting habitat at the individual sandpit at which the exceeding take occurred.

4. Quantification of allowable take will be identified in the individual section 10(a)(1)(A) permits issued to researchers.

5. Least terns and piping plovers using Program lands could be subject to take during Program habitat restoration and land management activities. At these sites, incidental take of least terns and piping plovers may occur during the course of habitat restoration or other land management activities. Site specific habitat restoration and land management plans will be developed by the Program and approved by the Governance Committee. These plans will contain site specific measures to minimize the effects of habitat restoration and land management activities on listed species. As a result, the majority of instances where there would be potential for take can be avoided. Nonetheless, given the extent of land holdings to be acquired, restored, and managed during the first 13 years of the Program, and the potential for the birds to arrive and initiate nesting after surveys have been conducted, there still exists the likelihood that there may be some occurrence of take as a result of habitat restoration and land management activities. Recognizing this, one instance of take in the form of harassment[18] of least terns and piping plovers is exempt per site per year. The amount of take in the form of harm[19] exempted due to site specific habitat restoration and land management activities is three least tern nests (including eggs and young) and three piping plover nests (including eggs and young) during the first 13 years of the Program.

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[18] Harass means an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to breeding, feeding, or sheltering.

[19] Harm means an act which actually kills or injures wildlife.

6. Levels of take of least terns and piping plovers on the shorelines of the Inland Lakes are expected to be quite low, however some level of take is reasonably foreseeable to occur. Known attempts at nesting by piping plovers on Lake Minatare, Nebraska occurred in 2004 and 2005. As these birds do show some level of site fidelity, it is reasonably likely that attempts to nest on the shoreline of this reservoir will occur in the future, and may also occur at the other Inland Lakes. As a result, the amount of nesting that could be expected to occur at the Inland Lakes during the term of the first 13 years of the Program would be up to two nests each year. While attempts were made to move nests and relocate eggs from the nests at Lake Minatare in 2005, those efforts were not successful. Therefore the amount of take exempted is 26 total nests during the first 13-year Program stage.

Despite the recognition that take may be unavoidable during implementation of the Federal Action, efforts to avoid and minimize take are warranted. The following RPMs will minimize incidental take.

## A2. Reasonable and Prudent Measures to Minimize Take

These RPMs are determined to be necessary to minimize take from the actions based on the Service's current understanding of the species status.

The measures described below are non-discretionary, and must be undertaken by DOI so that they become binding conditions of any grant or permit issued to an applicant, as appropriate, for the exemption in section 7(o)(2) to apply. DOI has a continuing duty to regulate the activity covered by this incidental take statement. If the Program a) fails to assume and implement the terms and conditions, or b) fails to require an applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the Program must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR §402.14(i)(3)].

The Service believes the following RPMs with their implementing terms and conditions are necessary and appropriate to minimize take of the least tern and piping plover on the central Platte River.

**RPM 1:** All least tern and piping plover nesting sites on the central Platte River and adjacent sandpits will be surveyed and monitored by the Program subject to permitted access by any private landowners. Population surveys will be conducted and information collected annually from May through August and will include parameters described in the Terms and Conditions below. Maps of nest site locations are also required and must be provided, along with other annual population survey data for the central Platte River, to the Service's Field Office in Grand Island, Nebraska.

**RPM 2:** The Program shall continue to monitor and evaluate Program water operations, and to implement water management measures to avoid take in accordance with Program documents. The EA Manager's decision to use Program water to create or enhance short duration high flows for the benefit of ecosystem restoration when there is a known potential for take shall represent Service concurrence with that Program action.

**RPM 3:** Program habitat restoration and land management activities shall be scheduled and conducted such that the possibility of take is reduced or eliminated on areas managed by the Program. Service concurrence is required for the use of habitat restoration and land management activities not included in "Habitat Management Methods for Least Terns, Piping Plovers, and Whooping Cranes," referenced in the Program's Draft Land Plan (page 12).

**RPM 4:** The Program will implement or participate in an existing public outreach and education program to minimize loss of reproductive success on the central Platte River.

**RPM 5:** Reclamation will take specific steps to attempt to reduce mortality of least terns and/or piping plovers attempting to nest at the Inland Lakes.

## A3. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of ESA, the Program must comply with the following terms and conditions which implement the RPMs described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

**Terms and Conditions (RPM 1):**

1) Population survey information shall include: a) the total number of colonies; b) the total number of least tern and piping plover adults and chicks; and c) mapping of locations used by least terns and piping plovers (i.e., general location map of colony sites and acreage determination). It is anticipated that this will be consistent with the Program IMRP that is currently under development.

2) Productivity (i.e., nesting and fledge success) estimates may be conducted on all areas, but shall be based at least on subsamples of the nesting population in each bridge segment of the central Platte River between Lexington and Chapman, Nebraska. Monitoring information shall include: a) the total number of nests; b) the total number of fledged birds per nesting pair and causes and numbers of nest and chick loss; and c) elevation of nests above mean sea level.

**Terms and Conditions (RPM 2):**

1) All incidences of take due to inundation of nests observed by Program affiliated personnel on the central Platte River between Lexington and Chapman shall be documented and reported within 24 hours of discovery to the Service's Field Office in Grand Island, Nebraska. Specific releases (due to EA water management operations or other significant Program-related releases of water) resulting in take will be identified and documented so that measures can be considered in the EA Annual Operating Plan and elsewhere to avoid future take. Program flows which have the potential to result in take will be avoided during the nesting season, unless the Service determines flows to restore riverine sandbar habitat to be a greater overall benefit to the ecosystem and the long-term viability of least tern and piping plover populations. Such Program

flows include any flow, or combination of flows, originating from the EA, Tamarack, or other water plan projects or activities, excluding high flows resulting from discharges made for reasons of human safety.

2) All incidences of egg, chick, and adult mortalities observed by Program affiliated personnel on Program-managed and controlled sand pits, between Lexington and Chapman shall be documented and reported within 24 hours of discovery to the Service's Field Office in Grand Island, Nebraska. In addition, the Service will monitor the incidence of "inundating flows" in the river.

3) Where practical, an attempt shall be made to salvage specimens of dead least terns or piping plovers when found by Program affiliated personnel. Data including date, species, location, condition, likely cause of death, and name and contact information for the collector must accompany the specimen. The Service's Field Office in Grand Island, Nebraska, must be notified within 24 hours following the discovery, and the specimen stored in a frozen state until such time it can be transferred to the Service. If human disturbance is suspected to have played a role in the death of the bird, photographic evidence should be taken, if possible, and the Service's Special Agent in either Lincoln or North Platte, Nebraska, immediately notified.

**Terms and Conditions (RPM 3):**

1) Habitat restoration and land management activities occurring on river channel habitat or sandpit habitat between April 15 and August 15 shall be undertaken only in the absence of nesting least terns and piping plovers. To confirm absence of nesting least terns and piping plovers, surveys for these species should be conducted in the area to be manipulated by the Program within three days prior to the initiation of the habitat restoration and land management activities.

2) If least terns or piping plovers nest on Program-managed sandpits, any appropriate measures determined during the development of the site specific management plan shall be taken to control predation at those sites to improve nesting success and recruitment. Modification of such site specific plans may be warranted based on experience managing individual sites. Service concurrence must be obtained on these aspects of management plans and any modifications thereof.

**Terms and Condition (RPM 4):**

1) The Program shall develop and implement or participate in existing public education programs in an effort to avoid or minimize human disturbance of nesting least terns and piping plovers within the central Platte River area. This education program should include, but not be limited to, public education (e.g., in local schools or libraries), continued use of informational brochures, and posting of signs at sandpit and riverine nesting areas, where appropriate. Management of human activities at, and adjacent to, least tern and/or piping plover nest sites on Program lands is part of the overall effort to educate the public regarding human disturbance.

**Terms and Conditions (RPM 5):**

1) Reclamation shall investigate potential flexibility in the operation of the Inland Lakes. If investigations identify operational flexibility that reduces the potential for incidental take that is mutually agreeable to Reclamation and the Service, and constitutes only a minor change, then Reclamation shall implement such measures in a manner that is practicable and consistent with its legal responsibilities and contractual obligations.

2) Should nesting of least terns and/or piping plovers be identified at the Inland Lakes in such locations that would be threatened by anticipated rising water due to project operations, Reclamation shall take measures to move those eggs and or nests "out of harms way," as follows. All appropriate permits to handle eggs should be obtained prior to such handling.

a. Nests should be relocated farther up the shoreline of the water body as per existing Service protocols, unless this proves impracticable due to the anticipated rates and levels of rise exceeding the amount or rate of move allowed under the protocol.

b. Should such measure prove impracticable as described, eggs should be relocated to active, suitable nests located at Lake McConaughy, Nebraska as per existing Service protocols, unless this also proves impracticable due to lack of suitable nests or similarly unsafe rising water conditions.

c. Should this measure also prove impracticable as described, eggs should be relocated to active, suitable nests located on other Program-controlled lands as per existing Service protocols, unless this also proves impracticable due to lack of suitable nests or similarly unsafe rising water conditions.

d. Should the measures outlined above in a, b, and c, all prove impracticable as described, information on the fate of those nests that would otherwise be moved shall be collected, including the number of eggs lost, the date of inundation, approximate rate and duration of rise in water level associated with such inundation, and any operational measures taken to reduce the risk of take due to project operation. This information shall be reported within one week of discovery to the Service's Field Office in Grand Island, Nebraska

## *B. Whooping Crane*

### B1. Amount or Extent of Incidental Take Anticipated

Incidental take of whooping cranes may result from surveys conducted under the Program. Such take includes harm caused by harassment of individuals, and effects to fitness of adults resulting in loss of productivity. The following forms of incidental take of whooping cranes may occur from implementation of the Federal Action:

1. Reduction in whooping crane productivity caused by unintentional take by Program personnel or aircraft monitoring whooping crane activity in the valley. Researchers will be required to apply for and obtain section 10(a)(1)(A) permits that will contain measures to minimize the effects of research on listed species. Due to the especially precarious nature of this species, and the potential catastrophic effects of loss of individuals in the population, the total allowable take of whooping cranes that would remove an individual from the migrating population (i.e., lethal or crippling) due to Program monitoring and research activities is one individual during the first 13 years of the Program.

2. Whooping cranes using Program lands could be subject to take during Program habitat restoration and land management activities. At these sites, incidental take of whooping cranes may occur during the course of habitat restoration or other land management activities. Site specific habitat restoration and land management plans will be developed by the Program and approved by the Governance Committee. These plans will contain site specific measures to minimize the effects of land management on federally listed species. Nonetheless, given the extent of land holdings to be acquired, restored, and managed during the first 13 years of the Program, there still exists the likelihood that there may be some occurrence of take as a result of habitat restoration and land management activities. Recognizing this, six instances of take in the form of harassment of whooping cranes is exempted during the first 13 years of the Program. Similarly, the amount of lethal take exempted due to site specific habitat restoration and land management activities is one whooping crane during the first 13 years of the Program.

Despite the recognition that some take may be unavoidable during implementation of the Federal Action, efforts to avoid and minimize take are warranted. The following RPMs will minimize incidental take.

## B2. Reasonable and Prudent Measures to Minimize Take

These RPMs are determined to be necessary to minimize take from the actions based on the Service's current understanding of the species status.

The measures described below are non-discretionary, and must be undertaken by DOI so that they become binding conditions of any grant or permit issued to an applicant, as appropriate, for the exemption in section 7(o)(2) to apply. DOI has a continuing duty to regulate the activity covered by this incidental take statement. If the Program a) fails to assume and implement the terms and conditions, or b) fails to require an applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the Program must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR §402.14(i)(3)].

**RPM 1:** Surveys to document whooping crane use of the central Platte River study area shall be conducted during spring and fall migrations according to the IMRP protocols developed by the Program with concurrence of the Service.

**RPM 2:** Program habitat restoration and land management activities shall be scheduled and conducted such that the possibility of take caused by disturbance/harassment due to such activities is reduced or eliminated on areas managed by the Program.

## B3. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of ESA, the Program must comply with the following terms and conditions, which implement the RPMs described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

**Terms and Conditions (RPM 1):**

1) Program personnel engaged in monitoring and research of whooping crane habitat use in the central Platte River valley will maintain a safe distance from whooping cranes, as identified in the whooping crane monitoring protocol (in the IMRP) or as identified in the section 10(a)(1)(A) permit(s) issued by the Service, whichever distance is greater.

2) Human encounters with whooping crane(s) resulting in the bird(s) taking flight will be documented and reported to the Service's Nebraska Field Office in Grand Island, Nebraska, at the end of each migration season. In the report, information on the weather, date, location, observers, number of whooping cranes involved, distance from the whooping cranes at the time the crane(s) take flight, other species involved (if applicable), and any other pertinent information, shall be included for each encounter.

**Terms and Conditions (RPM 2):**

1) If habitat restoration and land management activities within the channel of the Platte River occur between April 1 and May 10, or October 1 and November 15, construction shall only be permitted between the hours of 10:00 a.m. and 3:00 p.m. daily. The construction should be completed as quickly as possible.

2) Aerial surveys for whooping cranes will be conducted under the Program during the spring and fall migration surveys. The aerial survey crew or ground survey crew shall contact the construction crew whenever (and as soon as) whooping cranes are discovered in the Platte River study area, and report the results of each survey to the construction crew as long as the whooping cranes are in the area.

3) Earth moving equipment should be moved from the river channel to an upland site located behind a tree line at the end of each work day (by 3:00 p.m.) if such features are available on the property. In the instance that such features are unavailable, equipment should be moved to the farthest extent feasible, or to a position of cover at least 0.25 miles away from the channel, whichever is closer.

## *C. Pallid Sturgeon*

### C1. Amount or Extent of Incidental Take Anticipated

The Service anticipates incidental take of pallid sturgeon may occur as a result of implementation of the Federal Action. Even if the elements of the Federal Action are successfully implemented, a minimum amount of incidental take of pallid sturgeon may indirectly result from surveys conducted by the Program.

Based on the strong seasonal use trends apparent in the pallid sturgeon capture record in the lower Platte River, the prevalent hydrologic conditions under which the captures have occurred, and collection of *Scaphirhynchus* sturgeon larvae in the lower Platte River, it is likely that pallid sturgeon spawn or attempt to spawn in the lower Platte River in some years. High spring flows provide a critical aspect of the pallid sturgeon spawning cue and to floodplain connectivity important to both the spawning cue and the larval and adult forage base. As a result, incidental take in the form of “harm” to pallid sturgeon may result from future significant alterations in the natural hydrograph during spawning periods as altered seasonal flows and changes in water constituents (e.g., reduction in turbidity caused by flow reduction) may preclude spawning and/or cause mortalities to early life stages and/or significantly disrupt normal behavioral patterns which include but are not limited to breeding, feeding, or sheltering within an important portion of the species’ range. As it is difficult to estimate the level or amount of take that could occur from this effect, the Program includes a measure to investigate effects caused by future diminishment of high flows, and to negate or offset any such adverse impacts if identified. As such, while the analyses of effects on pallid sturgeon presented in the biological opinion identified the potential for such reductions in peak flows as a result of the Federal Action, identification of the existence of any such impacts is anticipated within the first three years of Program implementation, and implementation of any negating or offsetting measures necessary is anticipated to occur within the following two to three years. The effects of additional water development are not anticipated to be realized until near the end of the first 13 years of the Program, any negating or offsetting measures necessary should be in place before the effects occur. Similarly, the potential exists for use and management of the EA to result in similar reductions in peak flows through a reduction in magnitude and frequency of spills and reservoir evacuation at near spill conditions. Given current reservoir conditions in the North Platte River basin however, reservoir spills or evacuation at near spill conditions is unlikely to occur before negating or offsetting measures, if found necessary, would be in place. For these reasons, no incidental take of pallid sturgeon due to habitat modification resulting from this additional water development covered by the Program, or EA management, is anticipated.

The following describes the types of “harm” to pallid sturgeon that could occur from implementation of the Federal Action, and the extent anticipated in Federal Action implementation, which is exempt under section 7(o)(2):

- Individuals of all life stages of pallid sturgeon could be killed or injured from stress of capture and handling for monitoring and research activities. Researchers will be required to apply for and obtain section 10(a)(1)(A) permits that will contain measures to minimize the effects of research on listed species. No take resulting from monitoring and research activities, beyond those authorized in the individual 10(a)(1)(A) permits, is authorized.

Despite the recognition that some take may be unavoidable during implementation of the Federal Action, efforts to avoid and minimize take are warranted. The following RPMs will minimize incidental take.

## C2. Reasonable and Prudent Measures to Minimize Take

These RPMs are determined to be necessary to minimize take from the actions based on the Service’s current understanding of the species status.

The measures described below are non-discretionary, and must be undertaken by DOI so that they become binding conditions of any grant or permit issued to an applicant, as appropriate, for the exemption in section 7(o)(2) to apply. DOI has a continuing duty to regulate the activity covered by this incidental take statement. If the Program a) fails to assume and implement the terms and conditions, or b) fails to require an applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the Program must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR §402.14(i)(3)].

**RPM 1:** Monitoring and research of pallid sturgeon performed under the authority of the Program will be conducted according to the protocols developed by the Program with concurrence of the Service.

### C3. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of ESA, the Federal Action must comply with the following terms and conditions, which implement the RPMs described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

**Terms and Conditions (RPM1):**

1) Each capture of a pallid sturgeon under the Program monitoring protocols will be documented and reported to the Service's Nebraska Field Office in Grand Island, Nebraska, at the end of each field season. In the report, information on the date, time, location, river flow (at nearest gage) at time of capture, water temperature, observers, number of pallid sturgeon captured, method of capture, condition of individuals captured upon capture and upon release, other species captured in association (if applicable), and any other pertinent information, shall be included for each encounter.

## *D. Bald Eagle*

### D1. Amount or Extent of Incidental Take Anticipated

Significant numbers of bald eagles use nesting habitat available in the central Platte River reach. Construction of a nest constitutes a substantial investment of energy, often over several years. Unlike winter roosting, which is more opportunistic and can be displaced without rising to the level of harm to individuals, loss of existing nests or nests under construction may preclude successful nesting by pairs of bald eagles in breeding condition. A major component of habitat restoration under the Program involves removing existing trees and widening channels on Program lands throughout this reach. Therefore, while every attempt will be made under the Program to avoid the need to remove trees used for nesting by bald eagles, there remains a likelihood that at some point during the first 13 years of the Program, it will be necessary to remove individual trees that have such historical use. The Program incorporates a focus on attaining complex habitat in large blocks for the target species, and has committed to acquiring lands only on a willing seller – willing lessor basis. Availability of lands that meet both these criteria may to some degree dictate areas in which habitat can be restored for the target species, and as a result, trees that need to be removed. As a result, it would not be a reasonable expectation that removal of all such historically used trees could be avoided.

Three of the eight known bald eagle nest sites within three miles of the central Platte River area in the central Platte River reach are located on lands already under some form of protection. It is possible that one or more of the other five known nest sites, or other nests that may be identified later may occur on lands acquired by the Program. While it is recognized that it may be necessary at some point to remove a nest tree in order to enable pivotal habitat restoration activities, it is likewise anticipated that appropriate protection of nest trees will be possible in most circumstances. As a result, the amount of take of bald eagle nest trees exempt under this incidental take statement is one nest tree.

## D2. Reasonable and Prudent Measures to Minimize Take

These RPMs are determined to be necessary to minimize take from the actions based on the Service's current understanding of the species status.

The measures described below are non-discretionary, and must be undertaken by DOI so that they become binding conditions of any grant or permit issued to an applicant, as appropriate, for the exemption in section 7(o)(2) to apply. DOI has a continuing duty to regulate the activity covered by this incidental take statement. If the Program a) fails to assume and implement the terms and conditions, or b) fails to require an applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the Program must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR §402.14(i)(3)].

**RPM 1:** Surveys to document bald eagle use of Program lands shall be conducted during the nesting season according to the IMRP protocols developed by the Program with concurrence of the Service.

**RPM 2:** Program habitat restoration and land management activities shall be scheduled and conducted such that the possibility of take caused by disturbance/harassment due to such activities is reduced or eliminated on areas managed by the Program.

**RPM 3:** Service concurrence must be obtained when Program management actions will be implemented and when there is a potential for take of bald eagles or their nests.

## D3. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of ESA, the Federal Action must comply with the following terms and conditions, which implement the RPMs described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

**Terms and Conditions (RPM 1):**

1) Population survey information shall include: a) the total number of nests; b) the total number of observed adults and chicks; and c) mapping of locations used by bald eagles on Program lands. It is anticipated that this will be consistent with the Program IMRP currently under development.

2) Program personnel engaged in monitoring and research of bald eagle habitat use will maintain a safe distance from nests, as identified in the bald eagle monitoring protocol (in the IMRP) or as identified in the section 10(a)(1)(A) permit(s) issued by the Service, whichever distance is greater.

**Terms and Conditions (RPM 2):**

1) Program habitat restoration and land management activities involving personnel or equipment on site may not occur within one-half mile of any active bald eagle nest.

2) Surveys for bald eagles will be conducted under the Program during the nesting season. The survey crew shall contact the executive director whenever (and as soon as) active bald eagle nests are discovered in the Platte River study area.

3) If work is conducted during the nesting season on sites with existing but unoccupied nests, earth moving equipment should be moved from the river channel to an upland site located behind a tree line at the end of each work day if such features are available on the property. In the instance that such features are unavailable, equipment should be moved to the farthest extent feasible, or to a position of cover at least one quarter mile away from the channel, whichever is closer.

**Terms and Conditions (RPM 3):**

1) Service concurrence will be obtained for Program habitat restoration and land management activities that have the potential for bald eagle take, including removal of a nest site.

## *E. Reporting Requirements*

Reports and written notifications required by the above Terms and Conditions will be submitted to the Service at the following address:

Field Supervisor
Nebraska Ecological Services Field Office
U.S. Fish and Wildlife Service
Federal Building, Second Floor
203 West 2$^{nd}$ Street
Grand Island, NE 68801

Report frequency and deadlines will be as follows:

a) Least tern and piping plover population surveys: annual reports, including information referenced in section A3.RPM 1, above, are due by December 1 of each year of the Program.

b) Whooping crane migration surveys: annual spring migration report due by September 1; annual fall migration report are due by January 1 of each year of the Program. These reports shall include information referenced in section B3.RPM 1.

c) Reports documenting Program personnel and whooping crane encounters resulting in flight by whooping cranes, as in section B3.RPM 2: annual spring migration report are due by June 1 of each year of the Program; annual fall migration report are due by December 1 of each year of the Program.

d) Bald eagle surveys: annual survey report due by October 1. This report shall include information referenced in section D3.RPM 1.

e) Reports documenting discernable take, as in A3.RPM 2 and 5, B3.RPM 1, and C3.RPM 1 (i.e., observations or salvage of dead listed species, or observed take): submitted within 24 hours days of observation or collection.

## XI.  Closing Statement

This concludes formal consultation on the actions outlined in the July 6, 2004, request and the December 27, 2005 and February 15, 2006 amendments from Interior.  As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if:  1) the amount or extent of incidental take is exceeded; 2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; 3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or 4) a new species is listed or critical habitat designated that may be affected by the action.  In instances where the amount or extent of incidental take is exceeded, the specific action(s) causing such take shall be subject to reinitiation expeditiously.

# XII. Conservation Recommendations

Section 7(a)(1) of ESA directs Federal agencies to utilize their authorities to further the purposes of ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of an action on listed species or critical habitat, to help implement recovery plans, or to develop information. The following conservation recommendations are offered for possible accomplishment by the Program:

1. As the Program's AMP is being completed prior to Program start, incorporate into the plan the concepts and recommendations described in the Program's Adaptive Management Advisors' review of the draft AMP, Review of Draft Platte River Adaptive Management Plan (Aumen et al. 2005).

2. When possible, emphasize water action plan elements that focus on water leasing. The water leasing components, as identified in the FEIS, provide additional benefits to target and non-target species in the entire Platte River basin.

3. Encourage county governments to use their authorities (e.g., zoning ordinances) to promote the conservation and protection of floodplain and habitat areas along the Platte River corridor.

4. Prioritize accomplishment of research to better understand the relationship between least tern and piping plover use of sand/gravel pits and riverine habitat sites along the central Platte River. The research should investigate the availability and quality of nesting, foraging, and loafing habitats between the various sites, including energetic demands upon the species to meet part of their life requirements while in the central Platte River valley area. The results of this research will assist the Program in making future decisions about the adaptive management of these two avian target species on Program lands.

5. Establish a partnership with the Platte Valley Weed Management Area, the Lower Platte Weed Management Area, private landowners, and various other stakeholders to cost-share in the development and implementation of a program for the control of invasive species (e.g., phragmites, purple loosestrife, etc.) along the central Platte River that will benefit the targeted avian species and their associated riverine habitats along with other fish and wildlife resources.

6. Fund or otherwise accomplish research to better understand the biology of the western prairie fringed orchid and its habitat requirements (e.g. limiting factors, fire, grazing, mowing, etc.) along the central Platte River.

7. Promote the establishment of new western prairie fringed orchid populations essential for the recovery and eventual delisting species. Work toward developing suitable sites on Program properties for the orchid with the intent of establishing new orchid populations. In a cooperative effort with the Service, work toward establishing orchid populations on private grounds in the central or lower Platte River reaches.

8. Promote species diversity on Program properties through direct seeding and proper land management including host species to western prairie fringed orchid pollinators (Table V-F1). Larval hawkmoths (i.e., caterpillars) are known to be host specific. Host species for caterpillars include: wild cherry and plum species (*Prunus spp.*), grape (*Vitis spp.*), evening primrose (*Oenothera biennis*), lambsquarters (*Chenopodium album*), fringed willowherb (*Epilobium ciliatum*), Woods' rose (*Rosa woodsii*), smartweed (*Polygonum spp.*), and dock (*Rumex spp.*).

9. Consistent with Program purpose 3, “helping prevent the need to list more basin associated species pursuant to the ESA,” fund or otherwise accomplish investigations to identify and develop means to reduce threats to the river otter (*Lutra canadensis*), Platte River caddisfly (*Ironoquia plattensis*), plains topminnow (*Fundulus sciadicus*), northern redbelly dace (*Phoxinus eos*), and finescale dace (*Phoxinus neogaeus*). Based on those investigations, review program land and water management activities to avoid adversely impacts to those species, and improve habitat conditions for them through land and water management where feasible and consistent with other Program purposes.

10. During Program land restoration, promote the planting of low shrubby vegetation associated with brushy fields or early successional riparian vegetation for vegetative screens (e.g., wild cherry and plum species, *Prunus spp.*) to improve early successional habitats for species of concern identified in the baseline document (e.g., yellow-billed cuckoo and Bell’s vireo) (Brown 1993, Hughes 1999).

11. Investigate and pursue opportunities with electrical utility companies to accomplish the marking, relocation, or burial of power transmission lines along the central Platte River to minimize or avoid possible take of the targeted avian species and other migratory bird species. Emphasis should be placed on modifying the power transmissions lines that may either cross or be in close proximity to Program lands.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting federally listed species or their designated critical habitats, the Service requests notification regarding the implementation of any conservation recommendations described above.

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