U.S. Department
of Transportation

Federal Aviation
Administration

Port of Seattle

FINAL
ENVIRONMENTAL IMPACT STATEMENT

for

PROPOSED MASTER PLAN UPDATE DEVELOPMENT ACTIONS

at

SEATTLE-TACOMA INTERNATIONAL AIRPORT

VOLUME 4 OF 7

APPENDICIES Q-A - S

This statement is submitted for review pursuant to the requirements of Section 102(2)(C) of the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq); E.O. 11990, Protection of Wetlands; E.O. 11998, Floodplain Management; the 49 USC Subtitle VII; 42 U.S.C. 7401 et seq; 49 U.S.C. 47101 et seq; Washington State Environmental Policy Act (RCW 43.21C); and other applicable laws. The proposed action will impact the 100-year floodplain as indicated on the Federal Emergency Management Agency's Flood Insurance Rate Map. This Environmental Impact Statement (EIS) is a combined National Environmental Policy Act and Washington State Environmental Policy Act (SEPA) document. With regard to SEPA requirements, this EIS represents the second step of a phased environmental review which began with publication of the 1992 Flight Plan Final EIS, which assessed alternatives for addressing regional aviation needs. This Final EIS also contains the draft conformity statement, as required by the Clean Air Act amendments.

The Port of Seattle, operator of Seattle-Tacoma International Airport, has prepared a Master Plan Update for the Airport. The Plan shows the need to address the poor weather operating capability of the Airport through the development of a third parallel runway (Runway 16X/34X) with a length of up to 8,500 feet, separated by 2,500 feet from existing Runway 16L/34R, with associated taxiways and navigational aids. Other development needs include: extension of Runway 34R by 600 feet; establishment of standard Runway Safety Areas for Runways 16R/34L and 16L/34R; development of a new air traffic control tower; development of a new north unit terminal, Main Terminal improvements and terminal expansion; parking and access improvements and expansion; development of the South Aviation Support Area for cargo and/or maintenance facilities, and relocation, redevelopment, and expansion of support facilities. This Environmental Impact Statement assesses the impact of alternative airport improvements, including installation of navigational aids, airspace use, and approach and departure procedures. The proposed improvements would be completed during the 1996-2020 period, with initial 5-year development focused on the proposed new parallel runway, and existing passenger terminal, parking and access improvements. The proposed improvements and its alternatives would result in wetland impacts, floodplain encroachment, stream relocation, social, noise, water, and air quality impacts.

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APPENDIX Q

WATER STUDIES

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AGI
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APPENDIX Q-A
BASELINE GROUNDWATER STUDY
FINAL ENVIRONMENTAL IMPACT STATEMENT
PROPOSED MASTER PLAN UPDATE
SEA-TAC INTERNATIONAL AIRPORT
SEATAC, WASHINGTON

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EXECUTIVE SUMMARY

This report characterizes the baseline hydrogeology of the Sea-Tac International Airport and vicinity, and evaluates potential groundwater quality and quantity impacts from proposed improvements associated with the updated Sea-Tac Airport Master Plan. The proposed improvements are discussed in the draft Environmental Impact Statement (EIS), which was issued in April 1995. Most of the improvements involve the development of a third runway and additional terminal facilities. These improvements will require extensive importation and placement of fill that will be excavated from a number of borrow areas within the study area. The purpose of this report is to respond to comments on the draft EIS. As such, this report addresses impacts to the aquifers below the EIS study area resulting from the development of impervious areas associated with airport facility development and utilization of Port-owned borrow source areas.

HYDROGEOLOGY

The sediments in the study area have been divided into 10 stratigraphically distinct nonglacial and glacial deposits including (from youngest to oldest): Fill (Qaf), Alluvium (Qal), Vashon Recessional Outwash (Qvr), Vashon Till (Qvt), Vashon Drift, Vashon Advance Outwash (Qva), Lawton Clay (Qvl), Third Coarse Grained Deposit (Qc[3]), Third Fine Grained Deposit (Qf[3]), Fourth Coarse Grained Deposit (Qc[4]), Fourth Fine Grained Deposit (Qf[4]), and Tertiary Bedrock (Tbr).

The uppermost groundwater is perched within Alluvium, Recessional Outwash, and discontinuous porous zones of till. The primary aquifers in the study area occur as the Shallow (Qva), Intermediate (Qc[3]), and Deep (Qc[4]) Aquifers. Groundwater in the study area generally flows downward through each of the aquifers, and outward towards Puget Sound and the Green River Valley.

POTENTIAL IMPACTS

In areas where fill will be placed and compacted, recharge to the Shallow (Qva) Aquifer will be reduced by an estimated 0.18 million gallons per day (mgd). In borrow areas where the till will be removed to expose the Esperance Sand, Shallow (Qva) Aquifer recharge will be increased an estimated 0.32 mgd. The proposed improvements may therefore result in a net increase in recharge to the Shallow (Qva) Aquifer of an estimated 0.14 mgd.

Regional groundwater flow directions are not likely to change as a result of the improvements. Small changes in local groundwater flow, however, could occur in the borrow areas as a result of the possible elevation of the water table in these areas. These changes are likely to occur primarily in the Shallow (Qva) Aquifer.

Elevation changes of the Shallow (Qva) Aquifer water table in the borrow areas associated with increased recharge may result in temporarily increased discharge to nearby streams, and to upstream expansion of zones of perennial flow in Des Moines or Miller Creeks, where they intersect the Shallow (Qva) Aquifer.

Groundwater quality in the Shallow (Qva) Aquifer could potentially be impacted by the proposed improvements through either infiltration of contaminated surface water associated with construction activities or with future airport operations or borrow area development.

Potential construction-related impacts to water quality include a range of pollutants used during construction. The potential for construction impacts is considered low due to the relatively short period of construction and the likely requirement for implementation of best management practices.

Potential operational impacts to groundwater quality in the proposed runway and ancillary improvement areas are related to new impervious surface area and associated stormwater runoff. This potential is also considered low because of plans to convey new surface water runoff to Des Moines Creek and Miller Creek, thereby eliminating infiltration. Potential groundwater quality impacts due to future airport operations are primarily those resulting from the use or leakage of hazardous materials. The potential for these contaminants to infiltrate is considered low if best management practices are implemented.

Because of the potential for direct recharge to the Shallow (Qva) Aquifer within borrow areas, future development in the areas could potentially present significant water quality impacts to the groundwater system. Application of proper management techniques can reduce or eliminate the potential for groundwater contamination.

MITIGATION MEASURES - AQUIFER RECHARGE AND DISCHARGE

The results of our study indicate a net increase in recharge to the study area groundwater system may result from the proposed improvements. Little or no mitigation will likely be needed under these circumstances. However, Shallow (Qva) Aquifer discharge from borrow areas may result if seasonal water table elevations rise above the base of borrow area excavations. Containment of this potential discharge could be constructed such that this water is detained within the borrow area, or the base of the borrow pit could be kept above the seasonally highest water table.

MITIGATION MEASURES - GROUNDWATER QUALITY

Most potential impacts to groundwater quality associated with the airport improvements will likely be prevented by continued implementation of existing management plans and techniques, and those that will be adopted for the improvements.

For construction of airport improvements and the borrow areas, potential contamination spills can be mitigated by implementation of best management practices, phasing of construction activities, and conducting activities during the dry season.

As indicated in the draft EIS, various mitigation requirements stipulated by applicable laws, policies, and design standards will be implemented during construction and operation of the proposed airport developments. It is assumed that construction and operational impacts on water quality will be mitigated through implementation of National Pollutant Discharge Elimination System (NPDES) permit requirements, and other guidelines.

In the event of future development of the borrow areas, mitigation against potential groundwater quality impacts to the Shallow (Qva) and Intermediate (Qc[3]) Aquifers will be necessary. This mitigation could include preventing surface water run-on into the borrow areas from outside areas, reserving the borrow areas for activities with little or no potential for groundwater contamination, or developing the borrow areas with appropriate engineering controls.

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1.0 INTRODUCTION

1.1 GENERAL

This report characterizes the baseline hydrogeology of the Sea-Tac International Airport and vicinity and evaluates potential groundwater quality and quantity impacts from proposed improvements associated with the Sea-Tac Airport Master Plan Update. AGI was retained by the Port of Seattle (Port) under a subconsultant agreement with Shapiro Associates to perform this study in response to comments on the Draft Environmental Impact Statement (EIS) for the Master Plan update. The Draft EIS was prepared by the Port and the Federal Aviation Administration (FAA) and was issued in April 1995. Information in this report will be incorporated into a Final EIS.

The airport is located in SeaTac, Washington, approximately 12 miles south of downtown Seattle. The area considered by this hydrogeologic characterization is a subarea of the Draft EIS study area and is shown on **Figure 1**. The study area encompasses the Master Plan improvements.

1.2 BACKGROUND

Sea-Tac Airport was first developed in 1943 and began operating commercially by 1948. When opened, the airport consisted of four runways, with the main runway approximately 6,100 feet in length. By 1956, the main runway was lengthened to 11,900 feet, and during the 1960s and 1970s, extensive additions and improvements were made to the passenger terminal. From 1967 to 1973, a second parallel runway, the north and south satellite terminals, and the passenger terminal were constructed. Airport physical features have not significantly changed since that time.

Most of the development alternatives proposed by the Master Plan Update are associated with a proposed third runway and additional terminal facilities. These improvements will require extensive importation and placement of fill that will be excavated from a number of sites within the study area. Details of the improvements are described in the Draft EIS.

This report is intended to be a companion report of the EIS. The Draft EIS is therefore referenced extensively in discussions of the proposed improvements. Information in this study was also derived from a number of investigations focused on the airport vicinity. The reference section at the end of this report lists selected documents available from these investigations.

1.3 PURPOSE AND SCOPE OF SERVICES

The purpose of the baseline hydrogeologic characterization is to identify the general hydrogeologic conditions of the EIS study area, based on existing hydrogeologic data, as a basis for evaluating effects of the proposed construction activities on groundwater recharge, quality, and flow. In particular, this study addresses impacts to the aquifers below the study area from increased impervious areas associated with airport facility development and from utilization of Port-owned borrow source areas. The specific objectives of the baseline hydrogeologic characterization are to:

- Characterize three-dimensional subsurface geology.
- Identify aquifers and aquitards.
- Characterize existing groundwater occurrence and movement, including recharge and discharge relationships.
- Qualitatively evaluate the impact of the proposed airport development on groundwater conditions.
- Identify mitigation measures, as appropriate.

To accomplish these objectives, we reviewed information obtained through meetings with the Port, Seattle Water Department, and Highline Water District (HWD). We also compiled and reviewed data from the following sources:

- Regional geologic literature
- Hydrogeologic studies of the Des Moines Upland
- Hydrogeologic studies of the Sea-Tac Airport vicinity
- Department of Ecology records
- Seattle Water Department records
- HWD records

The specific references we reviewed in preparing this report are listed in Section 5.0.

2.0 EXISTING CONDITIONS

2.1 REGIONAL PHYSIOGRAPHY

The study area is located on the Des Moines Upland within the Puget Lowland, a north-south trending structural and topographic depression bordered on the west by the Olympic Mountains and on the east by the Cascade Mountains. Sea-Tac Airport occupies approximately 2,500 acres of gently south- and west-sloping land near the crest of the Upland. Physiographic details of the study area are described in the Draft EIS (Port of Seattle, 1995). Topography of the study area is shown on **Figure 1**. Elevations at the airport range from approximately 350 to 420 feet above Mean Sea Level (elevations in this report refer to Mean Sea Level datum). Outside the study area, land surface elevations drop off steeply east and west to the Green River Valley and Puget Sound, respectively.

The study area includes watersheds of two streams: 1) Miller Creek, north and west of the airport, and 2) Des Moines Creek, south and southwest of the airport (**Figure 1**). The Des Moines and Miller Creek watersheds are discussed in the Draft EIS (Port of Seattle, 1995). The study area is primarily lightly to moderately forested land of mixed commercial, light industrial, and residential use. An undeveloped noise buffer area exists on the north, south, and west sides of the airport.

2.2 HYDROGEOLOGY

2.2.1 *Regional Geologic History*

The Des Moines Upland occurs as an elevated drift plain underlain by Quaternary glacial and non-glacial sediments and by Tertiary volcanic and sedimentary bedrock. Deposits of at least six glaciations have been identified in the Puget Lowland (Crandell, 1958; Easterbrook, 1967). The last of these major glaciations was named the Vashon. Armstrong, et al. (1965) renamed the youngest glaciation the Fraser, and modified it to include two glacial advances or stades, separated by one interstade. The youngest stade of the Fraser Glaciation is the Sumas and the oldest is the Vashon. Only deposits of the Vashon Stade are present in the study area.

The majority of surficial deposits and landforms in the study area can be attributed to fluvial, lacustrine, and direct ice contact processes associated with the advance and recession of the Vashon Glacier (Waldron, 1961, 1962). Glacial drifts from two older glaciations--Salmon Springs Glaciation and the older Stuck Glaciation--have also been mapped near the study area (Waldron, 1961, 1962), although more recent work by Easterbrook (1994) suggests that the widespread correlation of pre-Vashon deposits with Salmon Springs Drift may be invalid. Each of these glaciations had erosional and depositional processes similar to the Fraser Glaciation; consequently, deposits of the older glaciations often appear physically and hydraulically similar to those of Vashon age. Interglacial deposits commonly occur between glacial drift sequences and are often represented by volcanic ash, mudflow, and stream delta deposits.

2.2.2 *Study Area Geology*

Waldron (1962) completed the first surficial geologic map of the Des Moines 7.5 minute quadrangle, which includes the study area. His map shows deposits of the Vashon and Salmon Springs Glaciation and the Puyallup nonglacial sequence overlying Tertiary bedrock; no other pre-Vashon glacial or nonglacial deposits are recognized. However, a considerable number of geologic studies completed since 1962 in the Puget Lowland have suggested that additional glacial and nonglacial deposits occur between those of Vashon and Salmon Spring age (Easterbrook, et al., 1967; Luzier, 1969; Noble, 1990). In particular, geologic studies in the study area conducted for the South King County Groundwater Management Plan (SKCGMP) (South King County Advisory Committee, 1989) identified a number of previously unrecognized glacial and nonglacial sequences beneath the Des Moines drift plain. These include a nonglacial deposit between the Vashon and Salmon Springs drift, and a possible older glacial and nonglacial sequence beneath the Salmon Springs drift. Because the SKCGMP recognizes these additional deposits and presents the most comprehensive stratigraphic framework developed to date for the study area, this report generally follows the stratigraphic nomenclature used in the SKCGMP.

Sediments in the study area have been divided into 10 stratigraphically distinct deposits based on the SKCGMP nomenclature. Correlation of these deposits is based on common nomenclature in which upper Vashon and post-Vashon deposits are named based on their genesis, and deeper deposits are identified by their stratigraphic location and general particle size distribution. Study area deposits and their corresponding geologic map symbols are, from youngest to oldest:

- Fill (Qaf)
- Alluvium (Qal)
- Vashon Recessional Outwash (Qvr) ⎫
- Vashon Till (Qvt) ⎬ Vashon Drift
- Vashon Advance Outwash (Qva) ⎪
- Lawton Clay (Qvl) ⎭
- Third Coarse Grained Deposit (Qc[3])
- Third Fine Grained Deposit (Qf[3])
- Fourth Coarse Grained Deposit (Qc[4])
- Fourth Fine Grained Deposit (Qf[4])
- Tertiary Bedrock (Tbr)

These deposits are presented in order of increasing depth and age on the Generalized Stratigraphic Column shown on **Figure 2**. Surficial geology of the study area is shown on **Figure 3**. Generalized geology beneath the study area is depicted by Cross Sections A-A', B-B', and C-C', which intersect the study area as shown on **Figure 4**. Cross Sections A-A', B-B', and C-C' are shown on **Figures 5, 6, and 7**. Geology shown on these figures is based on well log information compiled from the references listed at the end of this report and is simplified to show general, large-scale subsurface relationships. Specific boring logs used to construct the cross sections are included in **Appendix A**. Actual geologic conditions are much more complex than depicted on the cross sections.

The following paragraphs describe the deposits in the study area in order of increasing depth and age.

Fill : Fill placed during construction of airport facilities is present over an extensive area as shown on Figure 3. Although fill is only shown on Figure 3 as underlying the airport, fills also occur scattered throughout the study area supporting roads, buildings, and other structures. Fill deposits consist of a variety of earth materials, but typically comprise silty sand and gravel. Fill density ranges from loose in landscaped areas to dense where compacted below runways, roadways, and buildings. Fills in the study area may range up to approximately 30 feet in thickness.

Quaternary Alluvium (Qal) : Alluvium in the study area typically consists of loose fine-grained sand, silt, clay, and peat deposits, located in low-lying areas. These deposits are primarily associated with post-glacial fluvial and low energy depositional processes.

Vashon Recessional Outwash (Qvr) : Thin scattered deposits of Recessional Outwash occur below fill or at land surface across the study area. This deposit occurs in a variety of grain sizes, but is typically loose, coarse-grained sand and gravel. Recessional Outwash was primarily deposited by glacial meltwater streams near the front of the receding Vashon glacier.

Vashon Till (Qvt) : Vashon till underlies Recessional Outwash or fill where present, or is exposed at land surface in the study area. The till is typically very dense, and consists of a non-stratified, poorly sorted mixture of gray clay, silt, sand, and gravel, with occasional cobbles and boulders. The Vashon till is interpreted to have been deposited at the base of overriding Vashon glacial ice (lodgement till), causing its highly dense and compact character. The till typically averages approximately 10 to 50 feet in total thickness across most areas of the study area.

Vashon Advance Outwash (Qva) : Advance Outwash, also commonly named the Esperance Sand in the northern Puget Lowland, generally underlies Vashon Till, but also crops out at land surface in some parts of the study area. This deposit comprises beds of fluvial fine to medium-grained sand with minor gravel likely deposited in streams and lakes in front of the advancing Vashon ice. In comparison with the Recessional Outwash, the Advance Outwash is typically denser due to compaction beneath the overriding Vashon glacier. This deposit ranges from 50 to 150 feet thick in the study area.

Lawton Clay (Qvl) : This deposit is composed of beds of finely laminated to massive gray, brown, and blue-gray silt and clay, occurring beneath the Esperance Sand. This clay is absent in several locations beneath and north of Sea-Tac Airport, as shown on Cross Sections A-A' and B-B' (Figures 5 and 6). Regionally, the clay appears to pinch out southward. Lawton Clay was likely deposited in lacustrine environments. This deposit typically ranges from 50 to 100 feet thick where present in the study area.

Third Coarse-Grained Deposit (Qc[3]) : This deposit is ubiquitous throughout the study area, occurring below the Lawton Clay in most areas, and beneath the Esperance Sand where the Lawton Clay is absent. This deposit typically consists of a complex mixture of gravel, sandy gravel, and gravelly sand with varying proportions of silt and cobbles. Some drilled borings in the airport area have encountered wood debris and volcanic ash within this deposit. Qc(3) is interpreted by the SKCGMP and the Seattle Water Department (1990) to be outwash associated with the Salmon Springs Glaciation, and typically ranges from 50 to 250 feet thick in the study area.

Third Fine-Grained Deposit (Qf[3]) : This fine-grained deposit occurs immediately beneath the Salmon Springs. Qf(3) sediments are more heterogeneous than overlying deposits, but are characterized by fine to medium sand, silty sand, and silt fluvial deposits ranging in thickness up to several hundred feet. These sediments are thought to have been deposited during an interglacial period and to be correlative with the Puyallup Formation of Crandell, et al. (1958).

Fourth Coarse-Grained Deposit (Qc[4]) : This deposit typically consists of gravel and sandy gravel, and is likely associated with an older, pre-Salmon Springs Glaciation; however, its origin is uncertain.

Fourth Fine-Grained Deposit (Qf[4]) : This unit comprises predominantly silty clay which appears to occur uniformly below Qc(4) in the study area. The age and origin of the Fourth Fine-Grained Deposit is uncertain.

Tertiary Bedrock (Tbr) : The bedrock below the Des Moines Drift Plain is primarily arkosic, micaceous sandstone with interbedded shale and coal. The sandstone is reported to occasionally contain volcanic conglomerate, tuffaceous siltstone, tuff-breccia, and lava flows (South King County Groundwater Advisory Committee, 1989).

2.2.3 Aquifers and Aquitards

Groundwater in the study area occurs at least occasionally in each geologic deposit below ground surface. The uppermost groundwater occurs perched within Alluvium, Recessional Outwash, and discontinuous porous zones of the till. The primary aquifers in the study area, however, occur within the deeper glacial deposits, and are hydraulically delineated by the interposing deposits of glacial till or low permeability fine-grained sediments. Hydrostratigraphy of the study area is shown on the stratigraphic column (Figure 2).

Three deposits, Qva, Qc(3), and Qc(4), are considered the principal aquifers of the study area based on permeability and development as groundwater sources for water supply. These aquifers are identified as Shallow (Qva), Intermediate (Qc[3]), and Deep (Qc[4]). Cross sections A-A', B-B', and C-C' (Figures 5, 6, and 7) show these aquifers.

For this report we have generally adopted the aquifer names defined in Final Report; Highline Well Field Aquifer Storage and Recovery Project (Seattle Water Department, 1990). Study area stratigraphic deposits are defined hydrostratigraphically as follows:

• Fill (Qaf)	¦	
• Alluvium (Qal)	¦	Perched Zone
• Vashon Recessional Outwash (Qvr)	¦	
• Vashon Till (Qvt)	-	Aquitard
• Vashon Advance Outwash (Qva)	-	*Shallow (Qva) Aquifer*
• Lawton Clay (Qvl)	-	Aquitard
• Third Coarse Grained Deposit (Qc[3])	-	*Intermediate (Qc[3]) Aquifer*
• Puyallup Formation (Qf[3])	-	Aquitard
• Fourth Coarse Grained Deposit (Qc[4])	-	*Deep (Q[4]) Aquifer*
• Fourth Fine Grained Deposit (Qf[4])	-	Aquitard
• Tertiary Bedrock (Tbr)		

Hydrostratigraphy is shown on the Generalized Stratigraphic Column on **Figure 2**. Hydrostratigraphic units are described in the following paragraphs.

Perched Zone : Most of the perched groundwater in the study area occurs in Quaternary Alluvium and Recessional Outwash where they overlie the till. Groundwater is also occasionally perched within fill on top of till, or may be perched in discontinuous permeable zones within the till. These zones are generally seasonally present within a few tens of feet of land surface and have limited thickness and lateral extent.

First Aquitard : Where present in the study area, compact fill (Qaf) forms the uppermost aquitard restricting downward movement of water to underlying deposits. Over most of the study area, however, the Vashon Till (Qvt) forms the first significant aquitard. The fine-grained, compact nature of these deposits retards surface water infiltration and promotes runoff. Previous AGI studies indicate the vertical hydraulic conductivity of till in the study area is typically in the range of 10^{5} to 10^{-7} cm/sec, which is several orders of magnitude less than that of the underlying Shallow (Qva) Aquifer (AGI, 1988).

Shallow (Qva) Aquifer : Groundwater in the Vashon Advance Outwash (Esperance Sand) comprises this uppermost aquifer. Groundwater in the Shallow (Qva) Aquifer generally occurs under unconfined (water table) conditions, and is typically protected from direct surface water infiltration by overlying fill or till. However, in some areas those upper deposits are absent, as shown on Cross Sections A-A', B-B', and C-C' (Figures 5, 6, and 7). The base of the Shallow Aquifer is between approximate Elevation 200 and 250, and its saturated thickness varies seasonally, typically ranging from approximately 50 to 75 feet. Water table elevations in the study area typically range from approximately 250 to 310 feet, or approximately 10 to 50 feet below ground surface.

The Shallow (Qva) Aquifer is considered to be of moderate permeability. Pumping test information reported by the South King County Groundwater Advisory Committee (1989) indicates a transmissivity of approximately 48,000 gallons per day per ft (gpd/ft). Water supply wells completed in the Shallow Aquifer may yield up to 500 gallons per minute (gpm) (South King County Groundwater Advisory Committee, 1989).

Qvl Aquitard : In most of the study area, the Shallow (Qva) Aquifer is separated from underlying aquifers by the Lawton Clay, which forms the Qvl Aquitard. Hydraulic conductivity of clays representative of the Lawton Clay are typically 10^{-7} to 10^{-10} cm/sec (Freeze and Cherry, 1979). The low permeability of the clay significantly retards flow between the overlying Qva and underlying Qc(3) Aquifer.

A window or gap in the Lawton Clay exists in the north portion of the study area as shown on Cross Section A-A' (**Figures 5**), and also in the middle and south portions of the study area where the Lawton Clay appears to pinch out to the south, as shown on Cross Section B-B' (**Figure 6**). In these areas, the Esperance Sand appears to directly overlie the Salmon Springs Drift, resulting in direct hydraulic connection between the Shallow and Intermediate Aquifers. These conditions may exist beneath portions of Sea-Tac Airport (see **Figure 6**), but existing data are inadequate to define this relationship.

Intermediate (Qc[3]) Aquifer : The Salmon Springs Drift has been studied as an important aquifer in the Des Moines Upland, and is extensively used for water supply. The City of Seattle Highline well field is completed in this aquifer. The aquifer exists under confined conditions where overlain by Lawton Clay. Unconfined conditions may occur south of the study area near Midway Landfill, where the Salmon Springs Drift is reported to occur at land surface (AGI, 1988).

The Intermediate Aquifer typically occurs between sea level and Elevation 200, with a saturated thickness ranging from approximately 50 to 250 feet. Water levels in wells screened in the Intermediate Aquifer are typically above the top of the deposit, but below water levels in the Shallow Aquifer.

Permeability of the Intermediate Aquifer is generally high. Aquifer test results for City of Seattle Highline wells indicate transmissivity of the Intermediate Aquifer in the study area ranges from 20,000 to 460,000 gpd/ft (Seattle Water Department, 1990; Hart Crowser, 1985b), and well yields of 1,500 to 3,000 gpm have been reported for Intermediate Aquifer production wells (South King County Groundwater Advisory Committee, 1989).

Qf(3) Aquitard : Fine-grained sand and silty sand below the Intermediate Aquifer form this aquitard. Significantly lower in permeability than the overlying Intermediate Aquifer, these fine-grained sediments retard downward movement from the Intermediate Aquifer; however, permeable zones within the aquitard may transmit appreciable volumes of water. The Qf(3) Aquitard typically occurs above approximately Elevation -100 and appears to range from approximately 50 to 100 feet thick beneath most of the study area.

Deep (Qc[4]) Aquifer : The Fourth Coarse-Grained Deposit forms the Deep Aquifer. The areal extent of this aquifer in the study area is not known; however, its depth is generally below Elevation -100. The Deep Aquifer is likely highly confined. Where the Deep Aquifer has been encountered, saturated thickness ranges up to 150 feet. Water levels in Deep Aquifer wells are typically above the top of the aquifer, but below water levels in Intermediate Aquifer wells.

Permeability of this aquifer is considered low to moderate, with reported transmissivities of approximately 2,000 to 30,000 gpd/ft (South King County Groundwater Advisory Committee, 1989; Hart Crowser, 1985b). Well yields for the more permeable portions of the Deep (Qc[4]) Aquifer range between 200 and 1,500 gpm (South King County Groundwater Advisory Committee, 1989).

Qf(4) Aquitard : The areal extent of the Qc(4) Aquitard in the study area is also not known. Silty clay comprises this deposit, and typically occurs below Elevation -150. The fine-grained nature of this deposit indicates it likely retards downward flow of groundwater from the Deep (Qc[4]) Aquifer.

2.2.4 Groundwater Flow

Upon entering the study area aquifers, groundwater generally flows outward toward the edges of the upland and downward from the Shallow (Qva) Aquifer to the Intermediate (Qc[3]) and Deep (Qc[4]) Aquifers (Luzier, 1969; South King County Groundwater Advisory Committee, 1989). It appears most groundwater eventually reaches Puget Sound to the west, or the Green River Valley to the east.

Local groundwater flow in the study area is complex, reflecting small-scale interlayering of glacial and nonglacial deposits within the subsurface deposits identified in **Section 2.2**. Local flow is also influenced by the distribution and magnitude of recharge and discharge, topography, water levels, and aquifer hydraulic properties. **Figures 8** and **9** show flow directions for the Shallow (Qva) and Intermediate (Qc[3]) Aquifers based on generalized aquifer potentiometric surface contours. Points shown on **Figures 8** and **9** are primarily compiled from the SKCGMP and Hart Crowser Technical Memorandum No. 1 - Summary of Data Review for Highline Well Field Study (1984a), respectively. Water level dates and well designations are not certain.

Groundwater flow in the Shallow (Qva) Aquifer generally appears to radiate outward from the highest portion of the upland toward the edges. A groundwater divide appears to be located east of the airport (**Figure 8**). The primary directions of flow are to the east toward the Green River Valley and to the west toward Puget Sound. In some areas, groundwater in the Shallow (Qva) Aquifer intersects ground surface and discharges to streams. Groundwater discharge is discussed in **Section 2.3**. Downward vertical flow also occurs from the Shallow (Qva) Aquifer, through the underlying Lawton Clay to the Intermediate (Qc[3]) Aquifer. Flow through the Lawton Clay is very slow due to its low permeability. However, in areas where the Lawton Clay Aquitard is absent, downward vertical flow from the Shallow (Qva) Aquifer to the underlying Intermediate Aquifer can occur more quickly.

Groundwater in the Intermediate (Qc[3]) Aquifer also generally flows outward from the crest of the Drift Plain (**Figure 9**). Like the Shallow (Qva) Aquifer, primary directions of flow within the Intermediate Aquifer appear to be east and west, and where the aquifer intersects ground surface, groundwater discharges to streams. Downward vertical flow also occurs in this aquifer, following the regional flow pattern described above. Some water in the Intermediate Aquifer likely eventually reaches the Deep (Qc[4]) Aquifer.

Groundwater flow in the Deep (Qc[4]) Aquifer is not known due to lack of wells completed in this aquifer.

2.3 GROUNDWATER RECHARGE AND DISCHARGE

2.3.1 *Groundwater Recharge and Discharge Areas*

Groundwater in the study area aquifers is recharged by infiltrating precipitation. Recharge occurs everywhere across the study area where impervious surfaces such as roadways, buildings, and airport runways do not exist and where groundwater does not discharge at ground surface. Recharge magnitude is largely governed by the permeability of the surface sediments and topography.

In relatively flat areas underlain by fine-grained, low permeability materials, such as till, peat, and compact fill, precipitation does infiltrate, but at very slow rates. These areas often contain bodies of water, including Angle Lake and Bow Lake (Figure 1). Sloped areas underlain by these same fine-grained deposits typically shed water at a much faster rate and allow less infiltration. In areas where till is overlain by alluvium or Recessional Outwash, infiltrating water may be temporarily detained in the Perched Zone. In contrast, areas underlain by coarse-grained sands or gravels allow considerable direct infiltration regardless of slope. These areas are typically considered recharge areas, and are represented in the study areas by exposures of Vashon Advance Outwash.

Figure 10 depicts our interpretation of existing recharge, discharge, and nonrecharge areas. Areas underlain by fill, till, or peat, and existing developed areas of the airport are considered nonrecharge zones despite the fact that some recharge does occur in these areas. Similarly, small-scale recharge/discharge features associated with local sloped and low-lying areas are not mapped. Areas with alluvium, Recessional Outwash, or Advance Outwash at the surface are considered to be recharge areas, except where the alluvium is predominantly peat or where discharge likely occurs. Most of the recharge areas shown on **Figure 10** are based on assumed direct surface exposure of Advance Outwash or absence of the till below the Recessional Outwash. Because boring log data indicate Advance Outwash likely reaches land surface in several locations across the study area (see **Figures 5, 6, and 7**), we assume areas mapped as Recessional Outwash on **Figure 2** (Luzier, 1969) are either areas where till is absent below the Recessional Outwash or where the outwash is actually Advance. In both cases we assume these areas represent direct recharge areas.

Infiltrating water passing through one of the identified recharge zones reaches the Shallow (Qva) Aquifer and provides direct recharge.

The Intermediate (Qc[3]) and Deep (Qc[4]) Aquifers are recharged by groundwater percolating downward from the Shallow (Qva) Aquifer. Most of the recharge from the Shallow to the Intermediate Aquifer probably occurs in areas where the Lawton Clay is absent, as shown on Cross Sections A-A' and B-B' (**Figures 5 and 6**).

Discharge from the study area aquifers primarily occurs as:

- Flow into perennial streams or springs discharging to Puget Sound or the Green River Valley, including Des Moines, Miller, and Walker Creeks, and other smaller, unnamed drainages.
- Underflow to the Green River Valley and Puget Sound.
- Pumping from municipal water supply wells in the Des Moines and Highline areas.

Figure 10 shows discharge areas within the study area. Des Moines and Miller Creek are the primary stream discharge and both generally sustain flow at their mouths throughout the year. While some of this water may come from seasonal water in the Perched Zone, the sustainable flow in these streams is largely attributable to baseflow discharging from aquifers identified in the study area. Below approximately Elevation 300, Des Moines Creek flows through exposures of the Shallow (Qva) and Intermediate (Qc[3]) Aquifers. Baseflow in this stream is therefore attributable to discharge from these aquifers. Miller Creek flows toward Puget Sound through exposures of the Shallow Aquifer west of the airport at elevations close to the water table in that area; some of Miller Creek's baseflow is therefore also likely due to discharge from the Shallow Aquifer.

Puget Sound and the Green River Valley are the other discharge areas for groundwater flowing downward and outward from the study area flow system. Discharge along the sea cliffs or walls of the Green River Valley forms springs. This discharge also likely occurs at depth as groundwater underflow to the Green River Valley and Puget Sound.

Groundwater possibly enters other aquifers not shown on Cross Sections A-A', B-B', and C-C'. However, previous studies indicate the Qf(4) Aquitard overlies, or is near Tertiary Bedrock (Tbr), which is thought to contain little groundwater.

Water supply accounts for a relatively small percentage of discharge from the study area groundwater system. Groundwater use from the Intermediate (Qc[3]) and Deep (Qc[4]) Aquifers is discussed in **Section 2.4**.

2.3.2 *Existing Water Balance*

Recharge and discharge relationships in the study area groundwater system are represented by the water balance schematic for the study area shown on **Figure 11**. The water balance indicates relative volumetric rates for recharge to and discharge from study area aquifers based on a simplified mass balance of the study area groundwater flow system. Generally, inflow enters the groundwater system as precipitation minus direct runoff, evaporation, and plant transpiration; water discharges from the groundwater system as baseflow to streams, as springs or underflow to the Green River Valley or Puget Sound, or as withdrawal from wells.

Inflow and outflow parameters used to develop the water balance are based on those used in previous investigations for the Des Moines Upland (Hart Crowser, 1985; South King County Groundwater Advisory Committee, 1989; Seattle Water Department, 1990). Averages of these parameters for the Des Moines Upland are listed below with volumetric rates based on the approximately 38,800-acre study area.

- Precipitation of approximately 39 inches per year (112.5 million gallons per day [mgd]).
- Evapotranspiration of approximately 17 inches per year, or 44 percent of precipitation (49 mgd).
- Runoff of approximately 8 inches per year, or 20 percent of precipitation (28 mgd).

Infiltration to the Shallow (Qva) Aquifer is the balance of water not lost to evapotranspiration or direct surface runoff as shown on **Figure 11**. The water balance assumes water entering the Shallow Aquifer either flows downward to the Intermediate (Qc[3]) Aquifer, or discharges to streams. Groundwater entering the Intermediate Aquifer either moves downward to the Deep (Qc[4]) Aquifer, out to streams, to Puget Sound or the Green River Valley, or to water supply wells. Similarly, Deep Aquifer groundwater flows to Puget Sound, the Green River Valley, or to water supply wells. Relative volumes of these flows are estimated as shown on **Figure 11**.

Total existing inflow to the Shallow (Qva) Aquifer in the study area is estimated to be approximately 35.5 mgd. Discharge from the study area aquifers that occurs as baseflow to streams is assumed to total approximately 5 mgd, based on data reported for Des Moines and Miller Creeks in SKCGMP and Seattle Water Department, 1990. Groundwater volumes discharged by wells are based on supply well production information discussed in the following section; these total approximately 4.5 mgd for the Shallow (Qva), Intermediate (Qc[3]), and Deep (Qc[4]) Aquifers. The balance of water in the groundwater system, approximately 26 mgd, is assumed to enter the Green or Duwamish River Valley or Puget Sound.

2.4 CURRENT GROUNDWATER USE

2.4.1 *Water Supply*

Each of the study area aquifers has been utilized historically as a source of groundwater for water supply. The Draft EIS states there is currently no known use of the Shallow (Qva) Aquifer water for drinking water supply in the study area; however, water rights information (discussed in Section 2.4.2) suggests there may be wells completed in this aquifer which may still be used for domestic, irrigation, commercial, or other uses. The Intermediate (Qc[3]) and Deep (Qc[4]) Aquifers are used by two major water purveyors for municipal water supply. The City of Seattle currently pumps from the Intermediate Aquifer via their Riverton Heights and Boulevard Park production wells located in the city's Highline Well Field located northeast of the airport. The HWD draws water from the Deep Aquifer via the Angle Lake and Des Moines production wells located south of the airport. Well locations are shown on **Figure 4**.

According to their respective records, the city's supply from the Intermediate (Qc[3]) Aquifer averages a total of approximately 1.5 mgd, and HWD's yield from the Deep (Qc[4]) Aquifer currently averages approximately 2.5 mgd. Total groundwater withdrawal by unknown or incidental wells throughout the area is not certain, but for purposes of the water balance we assume these do not exceed 0.5 mgd.

2.4.2 *Water Rights*

Current water rights issued by the Washington Department of Ecology for the study area are included in Appendix B. Rights to water supply in the study area provide for the following uses:

- Domestic
- Irrigation
- Commercial/Industrial
- Stock Watering
- Recreation and Beautification
- Fish Propagation
- Fire Protection

Approximately 40 percent of the listed water rights are for municipal and non-municipal wells. The remainder are designated for streams, springs, rivers, and lakes. The water rights information does not indicate which aquifers are screened by these wells; however, based on age and yield, it appears most non-municipal wells are likely completed in the Shallow (Qva) or Intermediate (Qc[3]) Aquifers. This study did not determine which water rights are being exercised; however, total yield from non-municipal wells is expected to be small compared with municipal withdrawals.

2.5 GROUNDWATER QUALITY

2.5.1 *General Groundwater Quality of Study Area Aquifers*

Representative general water quality data for the three study area aquifers are included in **Table 1**. Man's impact on Shallow (Qva) Aquifer groundwater quality is documented near the airport due to the many investigations of airport facility impacts in that area; these studies, however, do not typically identify general water quality parameters representative of background (non-impacted) conditions. Elsewhere, background water quality in the Shallow Aquifer is uncertain. **Table 1** shows data for several Shallow Aquifer wells as reported by Economic and Engineering Services, Inc. (1985). Shallow Aquifer groundwater is generally assumed to be of good quality (Port of Seattle, 1995).

Intermediate (Qc[3]) Aquifer water quality shown on **Table 1** is based largely on City of Seattle Highline Wellfield Studies (Seattle Water Department, 1990). Intermediate (Qc[3]) Aquifer water quality is generally considered to be excellent throughout most of the study area.

Deep (Qc[4]) Aquifer water quality is based on HWD records of recent testing. Based on these data and information in the Draft EIS, general water quality in the Deep (Qc[4]) Aquifer is excellent. The HWD data indicate manganese is occasionally elevated. However, naturally occurring manganese in the Deep (Qc[4]) Aquifer sediments are likely the source of these concentrations.

2.5.2 *Existing Contamination Sources*

Existing sources of contamination in the airport area are presented in the Draft EIS (Port of Seattle, 1995) and are documented in various airport area investigations (see Section 5.0). Several areas of known jet fuel hydrocarbon contamination exist in the Shallow (Qva) Aquifer near the airport. The Draft EIS reports this contamination has not migrated nor has it been identified at significant distances from its sources. Characterization and cleanup of these sources are reportedly underway (Port of Seattle, 1995).

There are also numerous sources of known and potential contamination throughout the study area outside of the airport. Commercial development along major transportation corridors and the overall increasing level of development in the area all pose potential long-term risk to groundwater quality in the Shallow (Qva) Aquifer and underlying aquifers. This risk cannot be quantified with the data available for the study.

Puget Sound is a potential source of high salinity to the Deep (Qc[4]) Aquifer, whereby high pumping rates in Deep Aquifer wells could reduce the hydrostatic pressure in this aquifer sufficiently to cause intrusion of Puget Sound water. Under these conditions, Deep Aquifer groundwater quality could deteriorate significantly.

2.5.3 *Contamination Receptors*

The contamination receptors of interest in the study area are currently operating water supply wells in the Intermediate (Qc[3]) and Deep (Qc[4]) Aquifers and Des Moines and Miller Creeks. Specific wells are the City of Seattle's Boulevard Park and Riverton Heights wells, which are completed in the Intermediate Aquifer, and HWD's Angle Lake and Des Moines wells, which are completed in the Deep Aquifer. Based on the groundwater system described in **Section 2.2.4**, contamination introduced at the ground surface may enter the Shallow (Qva) Aquifer, particularly in identified recharge areas. **Figure 10** shows areas where recharge conditions exist. Upon entry of contaminants to the Shallow Aquifer, direct or indirect downward flow routes could result in impacts to the underlying Intermediate, and possibly the Deep Aquifer. Although the Qvl and Qf(3) Aquitards significantly inhibit downward flow, areas where the Lawton Clay is absent provide a direct flow pathway from the Shallow to the Intermediate Aquifer.

3.0 POTENTIAL IMPACTS

3.1 PROPOSED IMPROVEMENTS

Improvements associated with the Master Plan Update are detailed in Section II of the Draft EIS. The EIS considers four alternatives; Alternative 1 is "Do Nothing" and is not considered further in this report. Alternatives 2, 3, and 4 consist of a new runway and associated taxiways or roads, and terminal facility improvements. The following basic elements are common to Alternatives 2, 3, and 4.

- A 7,000- or 8,500-foot-long by 150-foot-wide runway. The proposed runway will parallel the existing primary runway on the west. Runway grades will likely range between about Elevation 400 at the north end and about Elevation 350 at the south end.

- Other ancillary improvements, including: a safety area extending 250 feet west from the new runway centerline; a 75-foot-wide parallel taxiway situated 600 feet east of the proposed runway; and a 40-foot-wide perimeter access road with its centerline 285 feet west of the proposed runway centerline.

The three alternatives also include the following terminal improvements:

- Alternative 2: Centralized Terminal
- Alternative 3: North Unit Terminal
- Alternative 4: South Unit Terminal

Figure 12 shows existing airport facilities together with proposed improvements and borrow areas associated with Alternatives 2, 3, and 4.

Construction of the new runway and ancillary improvements associated with Alternatives 2, 3, and 4 will require importation and placement of substantial quantities of fill. Anticipated fill volumes and design thickness are referenced in Chapter 4, Section 24 of the EIS. Potential borrow areas for the new fill are located within Port-owned properties north and south of the airport. The borrow areas are shown as Areas 1 through 5 on **Figure 12**. The runway and ancillary facilities will be permanent. Long-term plans for the borrow areas are not currently defined.

Alternatives 2, 3, and 4 would each disturb surficial geology of the study area to some degree. Construction of the runway and other airport facilities will largely be completed by placing fill over native soil or other fill to reach design grades and foundations. Specifically, the 8,500-foot runway and other proposed improvements would result in approximately 193 acres of new impervious surfaced fill and 544 acres of unsurfaced fill area. The impervious area would be approximately 18 percent and less for the 7,000-foot runway than for the 8,500-foot runway (Port of Seattle, 1995). In the borrow areas, native soils will be removed for construction of the proposed airport facilities. **Table 2** summarizes the area and maximum volume of soil available from each borrow area

3.2 POTENTIAL IMPACTS ON GROUNDWATER RECHARGE AND DISCHARGE

Construction and excavation associated with Alternatives 2, 3, and 4 will alter existing areas of recharge areas shown on **Figure 10**. In areas where fill will be placed and compacted, including the runway and airport facility improvements, direct surface water runoff will be increased and recharge reduced. According to the EIS, this water will be directed to Des Moines and Miller Creeks via stormwater management facilities. In borrow areas, recharge should increase since excavation will remove till and expose permeable Advance Outwash.

Alteration of recharge or discharge in the study area will change existing inflow to the groundwater balance depicted on **Figure 11**, and therefore will affect flow and volume in the Shallow (Qva), Intermediate (Qc[3]), and Deep (Qc[4]) Aquifers. Effects on groundwater recharge and discharge are discussed in more detail in the following sections.

3.2.1 Aquifer Recharge Volume

The new runway and airport facilities associated with Alternatives 2, 3, and 4 will generally be surfaced with impervious material, or be filled and compacted, significantly reducing surface permeability. With the 8,500-foot runway, approximately 97 acres of new impervious surface area and 262 acres of unsurfaced fill area would drain to Miller Creek, and approximately 95 acres of new impervious surface area and 283 acres of unsurfaced fill would drain to Des Moines Creek (Port of Seattle, 1995). For purposes of this study, we have assumed that all new fill areas will be nonrecharge areas (recognizing that some recharge does occur in these areas). **Figure 13** shows existing recharge areas defined by this study that would be filled by the proposed improvements, and thus be converted to non-recharge areas. The total reduction in recharge area based on **Figure 13** is approximately 77.5 acres (3,376,000 square feet).

Evapotranspiration and runoff in areas of direct recharge are less than the regionwide values used in **Section 2.3.2** due to more direct percolation of precipitation. For such areas, evapotranspiration and direct surface water runoff may each be estimated as approximately 10 percent of precipitation (Viessman, et al., 1989). Assuming these values, up to 31 inches of annual precipitation may infiltrate the recharge areas in **Figure 13** (39 inches minus 3.9 inches minus 3.9 inches). The reduction of 77.5 acres in recharge area would thereby reduce recharge to the Shallow (Qva) Aquifer approximately 0.18 mgd.

The Shallow (Qva) Aquifer is overlain by low-permeability till in portions of Borrow Areas 1, 2, 4, and 5. In these areas the till inhibits surface water infiltration to the Shallow Aquifer. In areas where the till will be removed sufficiently to expose the advance outwash, Shallow Aquifer recharge will be increased. Borrow Areas 1 and 5 appear to overlie zones in which the Lawton Clay is absent (see Cross Sections A-A', B-B', and C-C'); recharge from these borrow areas may also directly recharge the Intermediate (Qc[3]) Aquifer.

Current excavation plans suggest existing till will be completely removed from the borrow areas. **Table 2** provides estimates of the area of till that will likely be removed from each borrow area; **Figure 13** depicts these as recharge areas created by till removal. (Note that recent borrow studies indicate the till is not present in Area 3 despite its being mapped there on the surficial geology map (**Figure 3**). The total recharge area created by borrow area till excavation is approximately 158.3 acres (6,896,400 square feet). Assuming evapotranspiration and direct runoff total approximately 20 percent, as above, approximately 31 inches of precipitation would be available as direct recharge in the borrow areas as long as the excavations are unsurfaced and undeveloped. Total additional recharge to the Shallow (Qva) Aquifer associated with these new recharge areas would thereby total approximately 0.32 mgd. The estimated value of additional recharge per borrow area is included in Table 2.

In summary, our study indicates the Alternative 2, 3, and 4 improvements would reduce recharge approximately 0.18 mgd and borrow area development would increase recharge approximately 0.32 mgd. The balance of these effects indicates a net increase in recharge to the Shallow (Qva) Aquifer of approximately 0.14 mgd is likely as long as the borrow areas are undeveloped or unsurfaced.

3.2.2 *Aquifer Discharge Volume*

Discharge volumes from study area aquifers will increase in direct proportion to the increase in net recharge discussed above in Section 3.2.1. This increase will be expressed partly as greater discharge to Miller and Des Moines Creeks, and partly as greater underflow to Puget Sound and the Green River Valley. Greater discharge to the creeks would occur shortly after development; greater underflow would likely not be detectable for many years, perhaps centuries.

Greater discharge to area streams would be observable primarily near the proposed borrow areas, where increased recharge would cause the water table (Shallow [Qva] Aquifer) to rise. The rising water table would extend the area of perennial flow upstream and increase the volume of seepage into the stream.

The decrease in recharge associated with fill placement for the airport improvements might also have a localized effect on aquifer discharge. In the new fill areas the reduction in recharge could cause the water table to drop slightly, thus reducing seepage into either Des Moines or Miller Creeks. These effects should be offset by the greater discharge discussed above.

One other possible impact of increased recharge in the borrow areas is increased discharge if the water table rises to land surface and then flows out of the borrow area. This could only occur if the borrow area was excavated to below the seasonal high water table and an outlet was created for overflows.

3.2.3 *Groundwater Flow*

Regional groundwater flow directions are not likely to change as a result of the increased recharge associated with the Master Plan Update improvements. Small changes in local groundwater flow, however, could occur in the borrow areas through increased recharge. Elevation of the water table in these areas could result in higher hydraulic gradients than existing conditions, and therefore increase local groundwater velocities. Similarly, changes in groundwater discharge, particularly along segments of Des Moines and Miller Creeks, may temporarily change local flow directions toward the creeks. These effects are likely to occur primarily in the Shallow (Qva) Aquifer. Hydraulic gradients and groundwater velocity may also be reduced slightly below the proposed construction fill areas due to reductions in recharge.

3.3 GROUNDWATER QUALITY

Groundwater quality in the Shallow (Qva) Aquifer could be impacted by the proposed Alternative 2, 3, and 4 improvements through either infiltration of contaminated surface water associated with construction activities or with later airport operations or borrow area development. However, all of the potential impacts can be mitigated through proper planning and management.

Construction-Related Impacts : Potential construction-related impacts to groundwater quality associated with the airport runway and ancillary improvements would depend on local construction area size, the amount of exposed soil, topography, proximity to water bodies, and the effectiveness of erosion and sediment controls implemented. In the borrow areas, groundwater quality may be impacted by construction-related contaminants introduced by infiltrating surface water. In both the borrow and the airport improvement areas, the potential for construction impacts should be low based on the relatively short construction period and the restrictions likely to be applied by the permitting agencies.

Potential construction impacts on water quality include a range of substances used during construction, including fuels, lubricants, and other petroleum products, and construction waste such as concrete wash water. The Draft EIS identifies the potential for pollution resulting from accidental spills of these substances, from leaking storage containers, from refueling, and from construction equipment maintenance activities. The potential for these impacts should be minimized in areas of new impervious surfaces associated with the Alternative 2, 3, and 4 improvements.

Operations-Related Impacts : Operational impacts on groundwater quality in the proposed runway and ancillary improvement areas are related to new impervious surface area and associated stormwater runoff. The EIS reports that drainage from the new runway and taxiways would be detained on site and then conveyed to Des Moines Creek and Miller Creek. Potential impacts to surface water quality are discussed in Chapter IV of the Draft EIS. Essentially all of the new surface water runoff will leave the airport and not be available for infiltration. Thus, the potential for groundwater contamination from this source is low.

Potential groundwater quality impacts due to future airport operations in the improvement areas include those resulting from the use or leakage of hazardous materials (e.g., fuels and other petroleum products) stored at the airport. These contaminants could create conditions similar to those discussed in Section 2.5.2. However, the airport is currently undertaking studies aimed at reducing the potential for future groundwater quality impacts from this source.

In the borrow areas, operational impacts will depend on future development. The EIS reports the borrow areas may be cleared, graded, or surfaced; however, plans for the areas are currently undetermined. Because of the direct recharge to the Shallow (Qva) Aquifer from the borrow areas, future development in unsurfaced borrow areas could present significant water quality impacts to the groundwater system.

3.4 SUMMARY OF POTENTIAL IMPACTS

Potential impacts associated with Alternative 2, 3, and 4 improvements are summarized as follows:

Groundwater Recharge and Discharge Volumes

- In areas where fill will be placed and compacted, including the runway and airport facility improvements, direct surface water runoff will be increased and recharge reduced. This reduction in recharge to the Shallow (Qva) Aquifer is estimated to be approximately 0.18 mgd.

- In borrow areas where the till will be removed to expose the Esperance Sand, Shallow (Qva) Aquifer recharge will be increased. Total additional recharge to the Shallow Aquifer associated with these new recharge areas is estimated to total approximately 0.32 mgd.

- Alternative 2, 3, and 4 improvements may result in a net increase in recharge to the Shallow (Qva) Aquifer of approximately 0.14 mgd.

- Elevation of the Shallow (Qva) Aquifer water table in the borrow areas due to increased recharge may result in temporarily increased discharge to nearby streams, and to upstream expansion of zones of perennial flow in Des Moines or Miller Creeks, where they intersect the Shallow (Qva) Aquifer.

- A possibility exists for groundwater discharge directly out of the borrow areas if they are excavated below the seasonal high water table and an outlet is created for overflow.

- Borrow Areas 1 and 5 are in areas where the Lawton Clay is absent. Recharge in these areas may therefore directly affect the Intermediate (Qc[3]) Aquifer.

Groundwater Flow and Quality

- Regional groundwater flow directions are not likely to change as a result of the Master Plan Update improvements. Small changes in local groundwater flow, however, could occur in the borrow areas as a result of the possible elevation of the water table in these areas. These changes are likely to occur primarily in the Shallow (Qva) Aquifer.

- Groundwater quality in the Shallow (Qva) Aquifer could potentially be impacted by the proposed Alternative 2, 3, and 4 improvements through either infiltration of contaminated surface water associated with construction activities or with later airport operations or borrow area development.

- Potential construction impacts on water quality include a range of pollutants used during construction, including fuels, lubricants, and other petroleum products, and construction waste such as concrete wash water. The Draft EIS states pollution could result from accidental spills of these substances, from leaking storage containers, from refueling, and from construction equipment maintenance activities. The potential for construction impacts is considered low due to the short period of construction and implementation of best management practices.

- Operational impacts on groundwater quality in the proposed runway and ancillary improvement areas are related to new impervious surface area and associated stormwater runoff. This potential is also considered low because most stormwater will be transported off the airport and not be available for infiltration.

- Potential groundwater quality impacts due to future airport operations in the improvement areas are primarily those resulting from the use or leakage of hazardous materials (e.g., fuels and other petroleum products) stored at the airport. These contaminants could infiltrate similar to the existing contaminants discussed in Section 2.5.2. The potential for this to occur is considered low as described above.

- Because of the direct recharge to the Shallow (Qva) Aquifer from the borrow areas, future development in unsurfaced borrow areas could potentially present significant water quality impacts to the groundwater system.

- Application of proper management techniques can reduce or eliminate all the potential impacts listed above as sources of groundwater contamination.

4.0 MITIGATION MEASURES

Mitigation measures for impacts from construction and operation-related activities are discussed in the EIS, except where they relate to groundwater recharge or discharge. Mitigation measures identified by our study for potential impacts to groundwater are presented below.

4.1 AQUIFER RECHARGE AND DISCHARGE

Our study indicates a net increase in recharge to the study area groundwater system may result from the proposed Alternative 2, 3, and 4 improvements. Little or no mitigation will likely be needed under these circumstances. However, where Shallow (Qva) Aquifer discharge may result from seasonal water table elevations rising above the base of borrow area excavations, containment could be constructed such that this water is detained within the borrow area, or the base of the borrow pit could be kept above the seasonally highest water table.

4.2 GROUNDWATER QUALITY

Most potential impacts to groundwater quality associated with the airport improvements will likely be prevented by continued implementation of existing management plans and techniques, and those that will be adopted for the improvements.

For construction of the airport improvements and the borrow areas, potential contamination spills can be mitigated by implementation of best management practices such as construction waste handling plans and fueling and vehicle maintenance plans, and strict contractual requirements of contractors. Use of best management practices such as spill containment areas, phasing of construction activities (to minimize the amount of disturbed and exposed areas), and conducting activities during the dry season (April through September) also should prevent or reduce potential impacts on surface water and groundwater quality (Port of Seattle, 1995).

As indicated in the EIS, various mitigation requirements stipulated by federal, state, and applicable local laws, policies, and design standards, will be applicable to construction and operation of the new parallel runway development at the airport. It is assumed that construction and operational impacts on water quality will be mitigated through implementation of National Pollutant Discharge Elimination System (NPDES) permit requirements, detention requirements, and compliance with state waste and materials management requirements, water quality standards, and stormwater management guidelines (Port of Seattle, 1995).

Specific plans required as part of compliance with the Port's NPDES permit will need to be implemented to identify and control pollutants coming from the airport, and to prevent and control potential operational impacts on groundwater from industrial wastewater system (IWS) and storm drainage system (SDS) discharges.

In the event of future development of the borrow areas, mitigation against potential groundwater quality impacts to the Shallow (Qva) and Intermediate (Qc[3]) Aquifers will be necessary. This mitigation could include preventing surface water run-on into the borrow areas from outside areas, reserving the borrow areas for activities with little or no potential for groundwater contamination, or developing the borrow areas with appropriate controls.

AGI
TECHNOLOGIES

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AGI
TECHNOLOGIES

DISTRIBUTION

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Quality Assurance/Technical Review by:

for Mackey Smith, C.E.G.
Executive Vice President

AGI TECHNOLOGIES

Table 1
General Groundwater Chemistry
Shapiro/Sea-Tac EIS
SeaTac , Washington

Aquifer	Specific Conductance (µmhos/cm)	TDS	Alakalinity (mg/L)	Color	Iron (mg/L)	Manganese (mg/L)	Hardness (mg/L)	Sodium (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	Nitrate as N (mg/L)
Shallow Aquifer											
Hellums, Ellaston, Washington Memorial Park, Brittenbach, & Gingrich Wells (E.E.S., 1985)	244 - 358	N/A	79.2 - 142	N/A	0.01 - 0.3	0.0 - 0.23	21.7 - 156	5.9 - 10.8	N/A	N/A	0.3 - 4.2
Intermediate Aquifer											
Boulevard Park and Riverton Heights Wells *(Seattle Water Department, 1990)*	153 -289	160 -195	N/A	3 - 5	0.04 - 0.6	0.012 - 0.065	N/A	4.78 - 8.12	4.7 - 35	3.0 - 7.55	0.02 - 3.3
Expected water quality based on historical analysis of inorganic parameters (E.E.S., 1984)	150	N/A	80	N/A	0.1 - 1.0	0.03 - 0.10	70	6	8	5	0.1
Deep Aquifer											
Angle Lake & Des Moines Wells (7-26-95) (Personal Communication - *Highline Water District*)	154 - 259	N/A	N/A	<5	<0.03	0.067 - 0.093	61 - 91	9 - 10	N/A	2 - 7	<0.02

Notes:

mg/L - Milligrams per liter.
N/A - Not available.
µmhos/cm - Micromhos per centimeter.

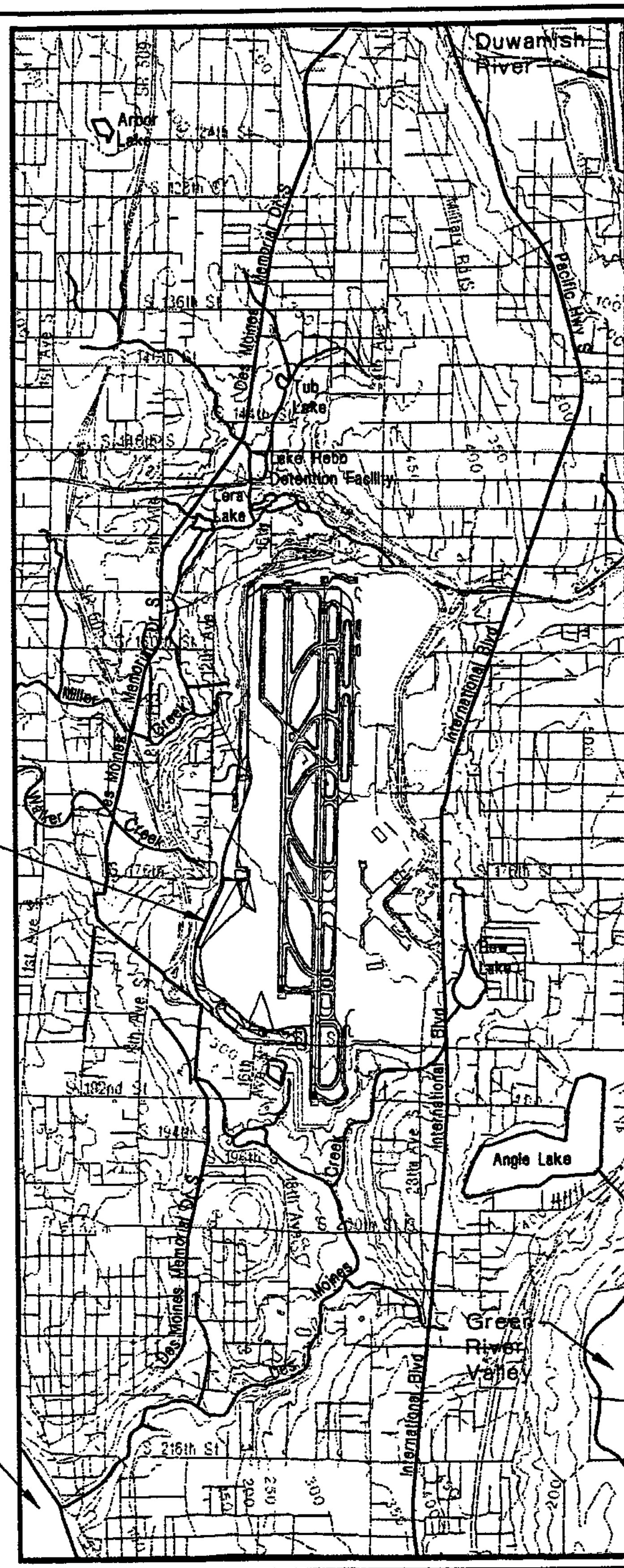
AGI TECHNOLOGIES

Table 2
Summary of Borrow Area Acreage, Fill Volume, and Estimated Recharge
Shapiro/Sea-Tac EIS
SeaTac, Washington

Area	Approximate Ground Surface Elevation Range [a] (feet)	Approximate Acreage	Maximum Volume of Soil Available for Excavation [b] (million cubic yards)	Approximate Area of Till (Qvt) to be Removed (square feet)	Additional Recharge to Groundwater Due to Removal of Till [c] (gallons/day)
1	250 to 350	110	0.5	3,537,215	188,471
2	175 to 275	20	0.65	450,552	24,006
3	250 to 350	60	2.90	0	0
4	290 to 395	40	2.20	447,595	23,849
5	275 to 475	60	1.75	1,523,534	81,177
TOTAL		290	8.0	5,958,896	317,503

Notes:

a) NGVD 1929 Datum.
b) From Shapiro, 1995.
c) Based on 39 inches precipitation, minus 10% evaporation and 10% runoff.



Reference:
Basemap: Port of Seattle, 1995

N

0 2000 4000
Scale in Feet

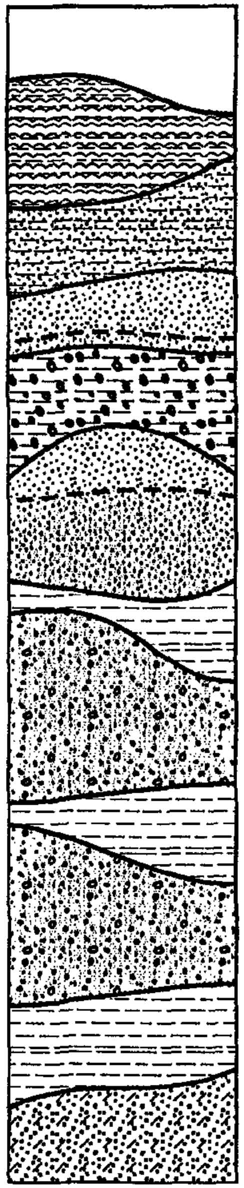
AGI TECHNOLOGIES

Study Area

Shapiro/Sea-Tac EIS
Seatac, Washington

FIGURE **1**

studyar.dwg	PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
	14,887.003	BJA	Nov 95			



Symbol	Stratigraphic Unit As Identified in SKCGMP	Geologic Description and Regional Correlation	Hydrostratigraphic Unit Modified from HWFASR
Qaf	Fill	Miscellaneous surficial fills	**Perched Zone** Seasonally perched groundwater occurs at base of fills on top of till.
Qal	Recent Alluvium	Primarily fine grained sand, [illegible] and peat deposited along stream channels and [illegible]toms.	Seasonally perched groundwater occurs at base of alluvium at top of till.
Qvr	Vashon Recessional Outwash	Scattered deposits of well sorted sand and gravel. Typically include outwash deposits.	Seasonally perched groundwater occurs at base of Recessional Outwash on top of till.
Qvt	Vashon Till	Compact mixture of gravel in a gray clayey, silty sand matrix, with occasional boulders and lenses of sand and gravel. Typically mantles older Vashon glacial and nonglacial deposits in study area.	**Aquitard** Primarily of low permeability except for isolated lenses of sand which may contain water seasonally. Typically averages 10 to 50 feet thick.
Qva	Vashon Advance Outwash	Predominantly sand in study area. Locally may include very fine sand and silt (Esperance Sand of Mullineaux, 1965; Colvos Sand of Molenaar, 1963).	**Shallow [Qva] Aquifer** Moderately permeable aquifer with typically abundant water; primarily unconfined. Typically 50 to 150 feet thick.
Qvl	Lawton Clay	Glacio-lacustrine deposit primarily composed of laminated clayey silt, silty clay, silt, and fine sand (Mullineaux, 1965).	**Aquitard** Low permeability deposit which impedes downward flow to Qc(3) Aquifer. Typically 50 to 100 feet thick.
Qc(3)	Third Coarse-Grained Deposit	Typically oxidized glacial outwash sand and gravel (Salmon Springs Drift of Crandell, et al.,1958).	**Intermediate [Qc(3)] Aquifer** Typically saturated, high permeability aquifer, primarily confined. Regionally important for water supply. Supplies Seattle Water Department Highline Well Field.
Qf(3)	Third Fine-Grained Deposit	Composed primarily of fine to medium silty sand. Contains andesite grains imparting characteristic lavender hue (Puyallup Formation of Crandell, et al., 1958).	**Aquitard** Typically low permeability relative to overlying and underlying aquifers. Impedes vertical flow between Qc(3) and Qc(4) Aquifers. Thickness typically 50 to 250 feet.
Qc(4)	Fourth Coarse-Grained Deposit	Coarse grained deposits (formation uncertain).	**Deep [Qc(4)] Aquifer** High permeability, confined aquifer. Thickness uncertain. Regionally used for water supply. Supplies Highline Water District wells.
Qf(4)	Fourth Fine-Grained Deposit	Primarily silty clay (formation uncertain).	**Aquitard** Low permeability deposit which impedes downward flow. Thickness uncertain.
Tbr	Tertiary Bedrock	Principally arkosic, micaceous sandstone and interbedded shale and coal. Locally includes thick sequence of volcanic sandstone and conglomerate, tuffaceous siltstone, tuff-breccia, and lava flows (Puget Group of Waldron, et al., 1962).	**Bedrock** Hydraulic characteristics uncertain.

Notes:

SKCGMP - South King County Groundwater Management Plan (South King County Groundwater Advisory Committee, 1989)

HWFASR - Highline Well Field Aquifer Storage and Recovery Project (Seattle Water Department, 1994)

☐ Water Bearing Deposits

AGI TECHNOLOGIES

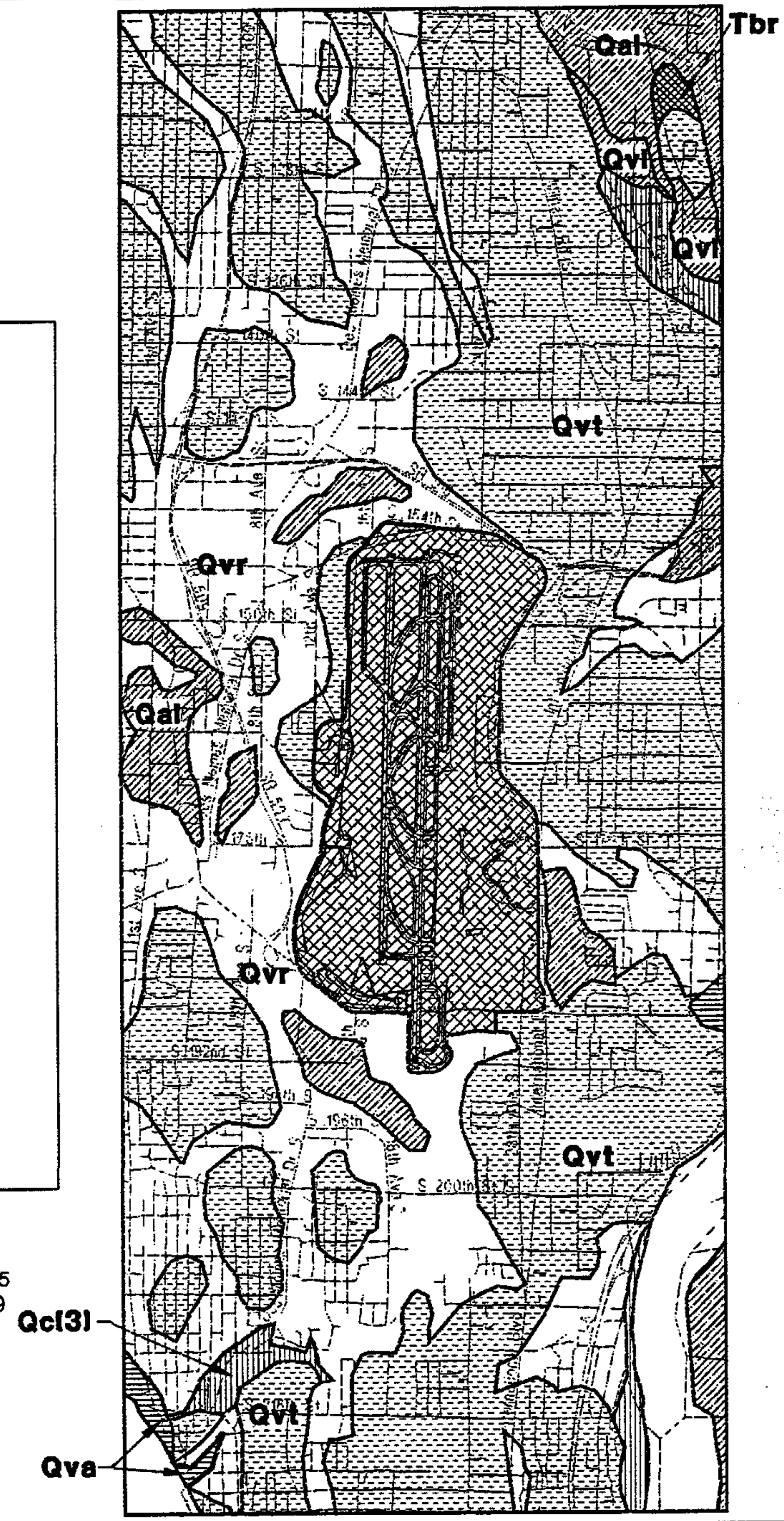
Generalized Stratigraphic Column

Shapiro/Sea-Tac EIS

Seatac, Washington

FIGURE **2**

	PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
stratcol.cdr	14,887.003	BJA	Nov 95	TWW		



Legend:

- **Qaf** Construction Fill
- **Qal** Quaternary Alluvium
- **Qvr** Vashon Reccessional Outwash
- **Qvt** Vashon Till
- **Qva** Vashon Advance Outwash
- **Qvl** Lawton Clay
- **Qc[3]** Salmon Springs Drift
- **Tbr** Tertiary Bedrock

Reference:
Basemap: Port of Seattle, 1995
Geology based on Luzier, 1969

N

0 2000 4000
Scale in Feet

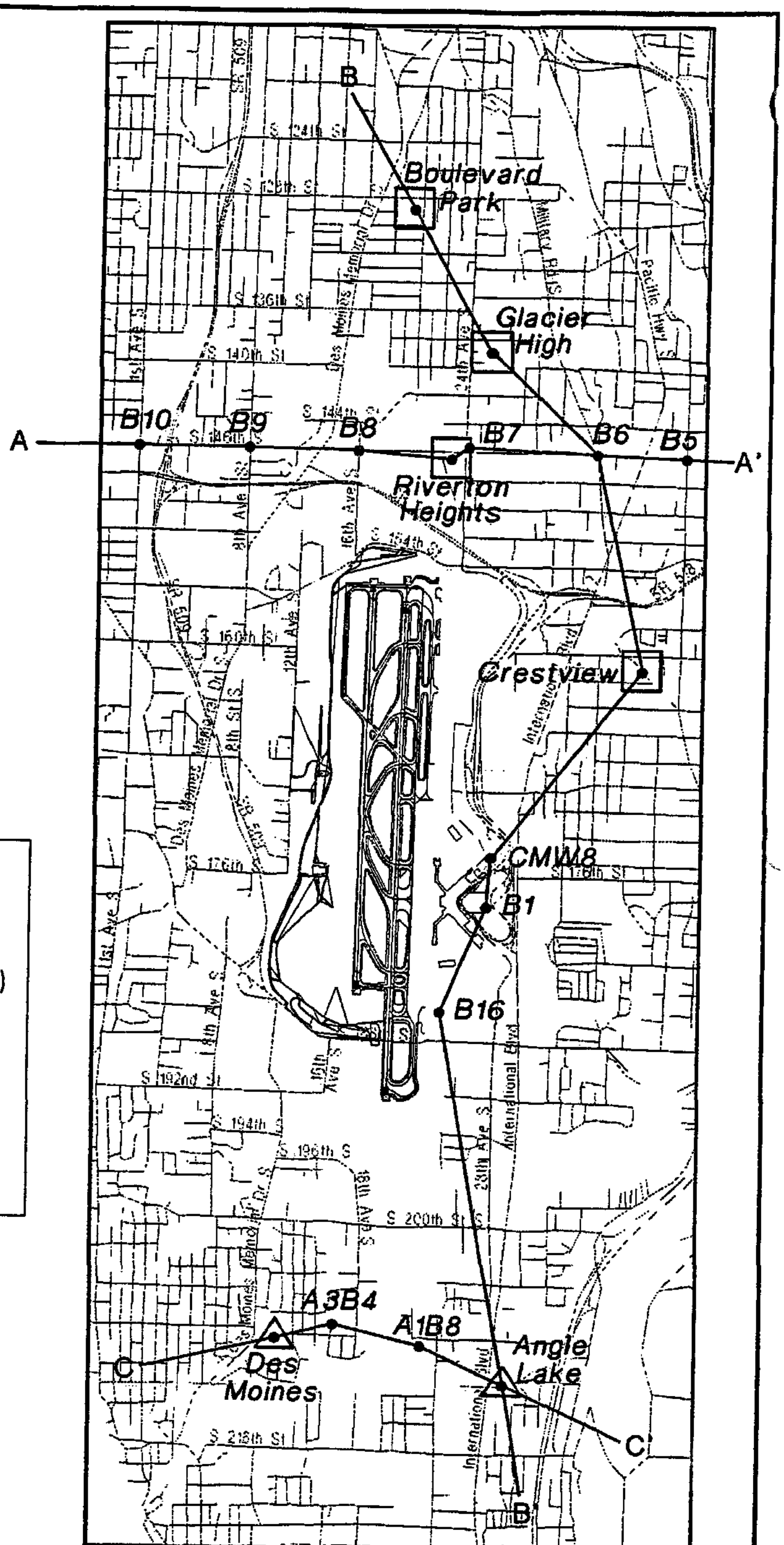
AGI TECHNOLOGIES

Surficial Geology

Shapiro/Sea-Tac EIS
Seatac, Washington

FIGURE **3**

	PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
geology.dwg	14,887.003	BJA	Nov 95	[illegible]		



Legend:

Seattle Water Department Water Supply or Test Well (Highline Well Field)

Highline Water District Water Supply Well

Boring/Well from Previous Investigations

Reference:
Basemap: Port of Seattle, 1995

N

0 2000 4000
Scale in Feet

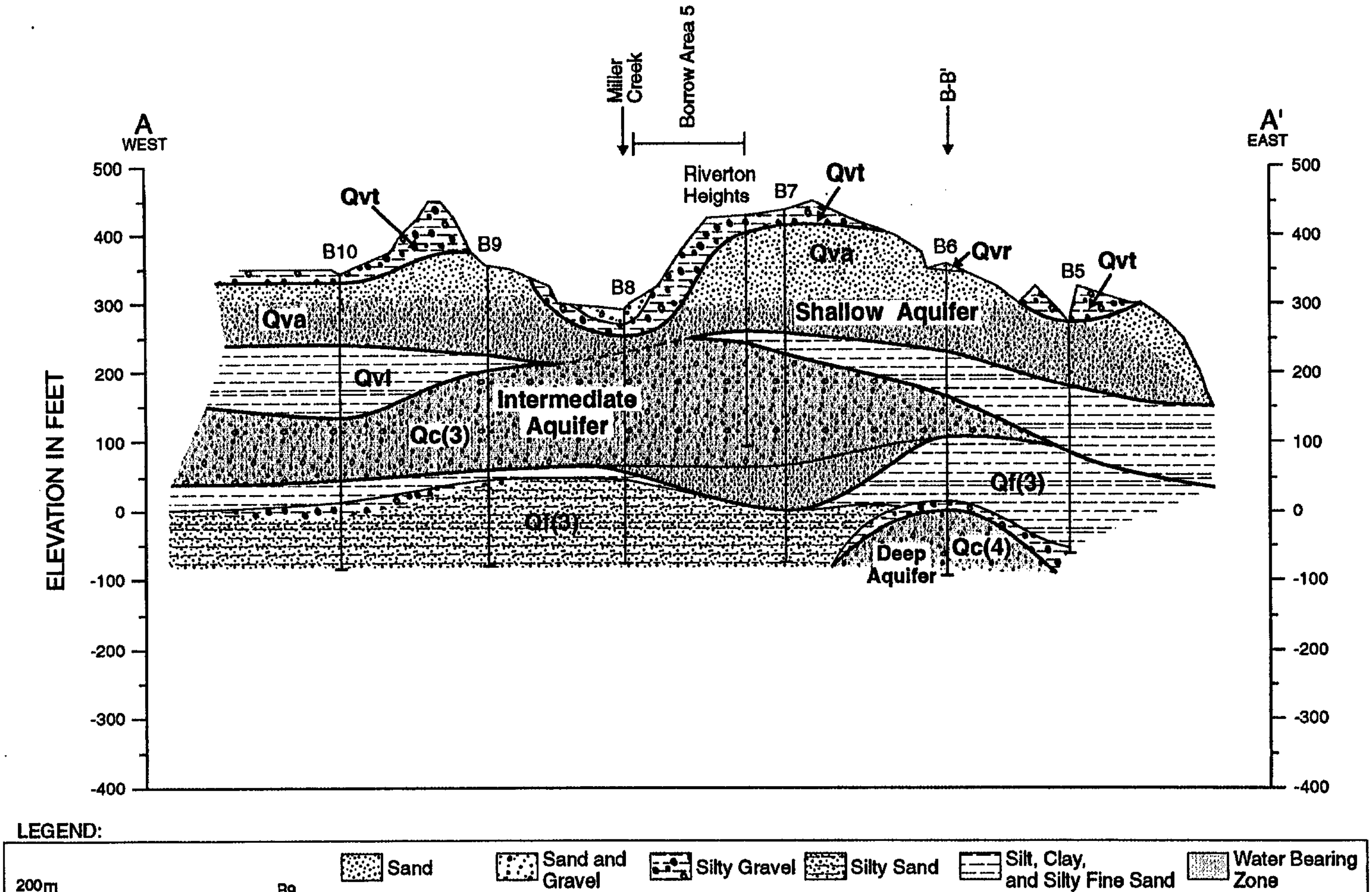
AGI TECHNOLOGIES

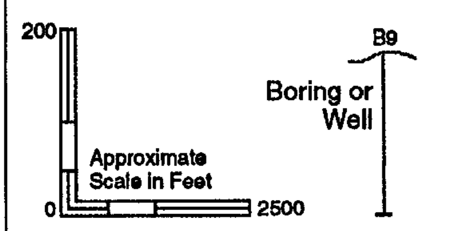
Well Locations and Cross Section Location Map

Shapiro/Sea-Tac EIS
Seatac, Washington

FIGURE 4

	PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
crosssec.dwg	14,887.003	BJA	Nov 95			



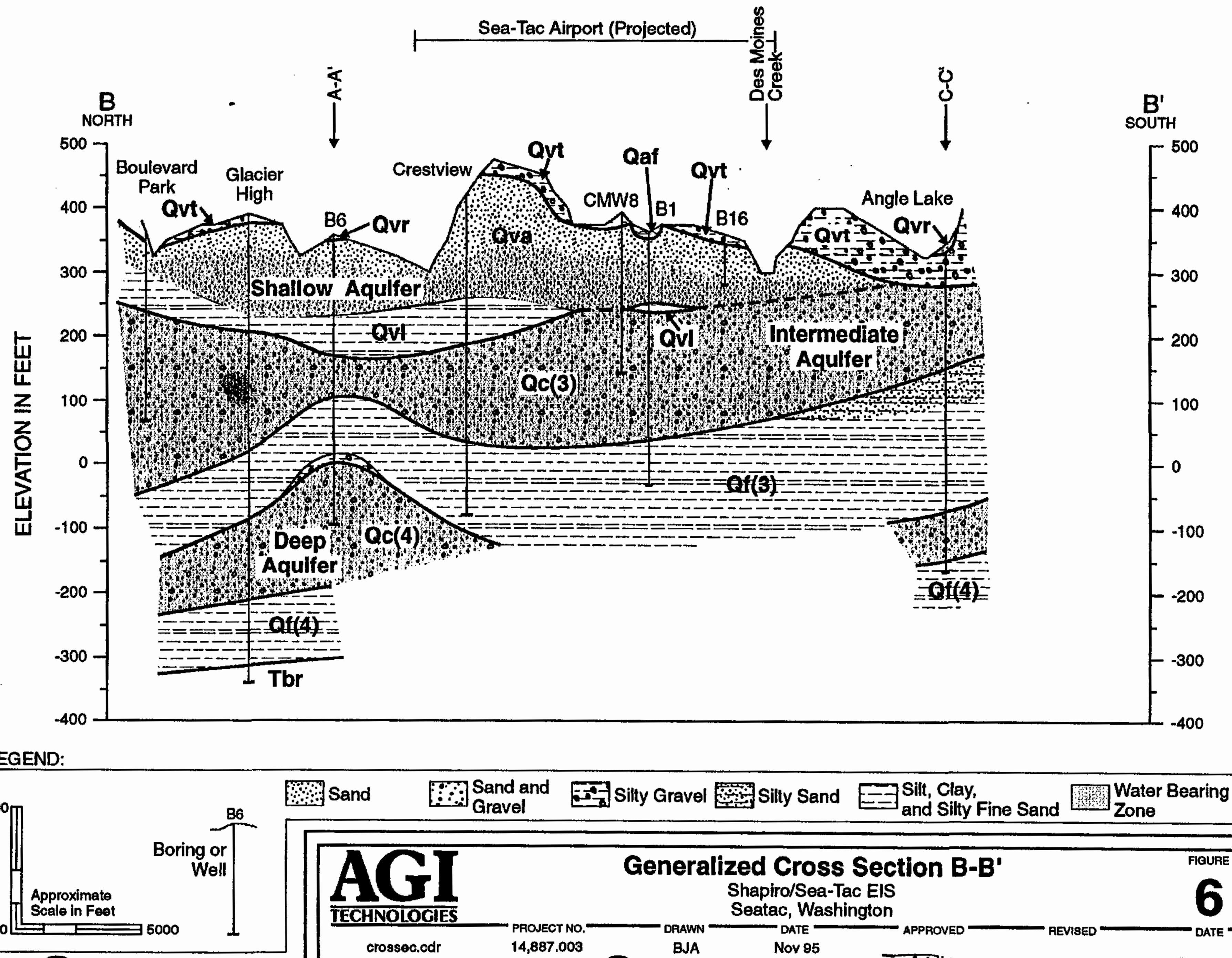


AGI TECHNOLOGIES

Generalized Cross Section A-A'
Shapiro/Sea-Tac EIS
Seatac, Washington

FIGURE **5**

	PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
crossec.cdr	14,887.003	BJA	Nov 95			

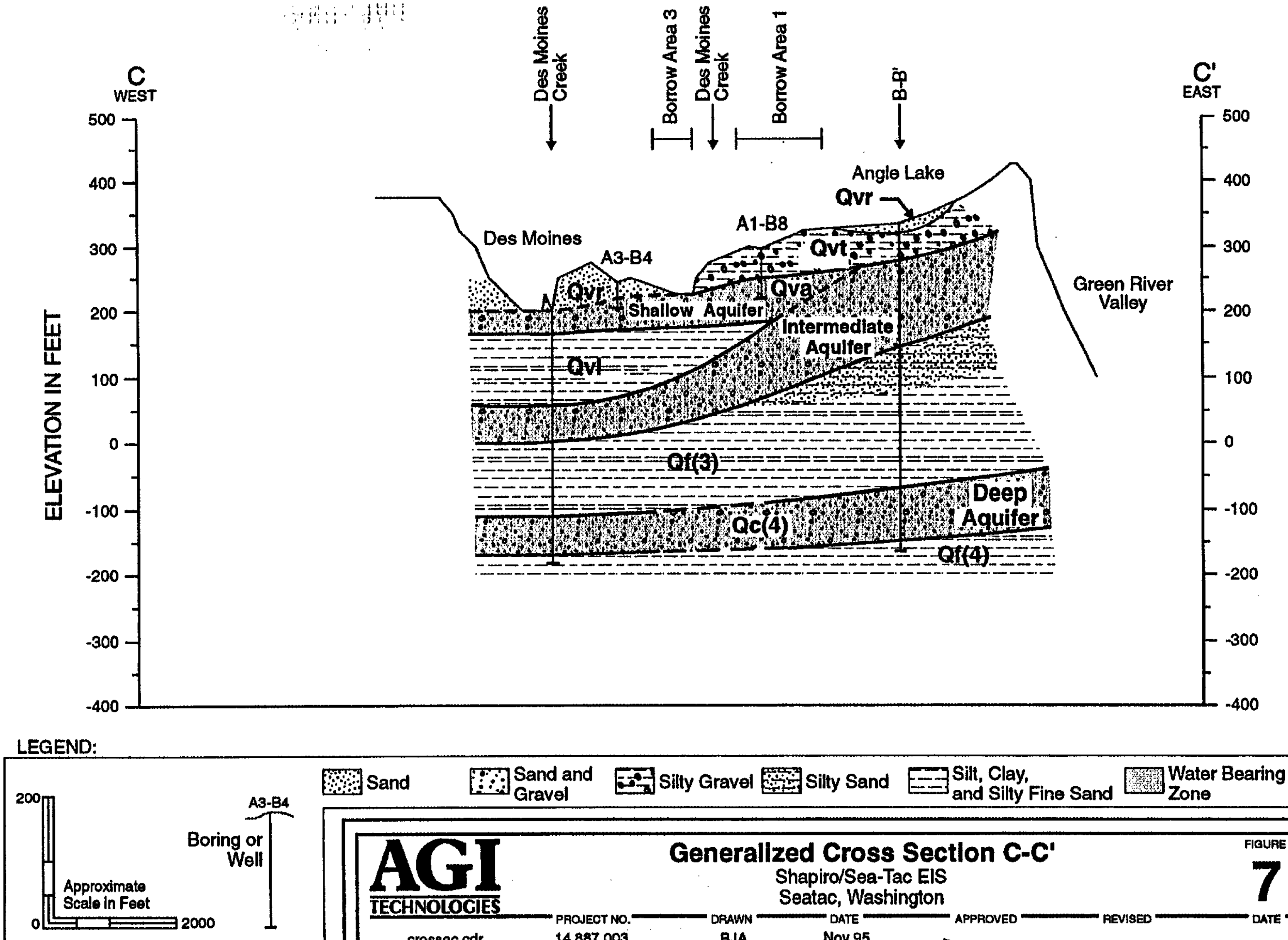


AGI TECHNOLOGIES

Generalized Cross Section B-B'
Shapiro/Sea-Tac EIS
Seatac, Washington

FIGURE 6

	PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
crossec.cdr	14,887.003	BJA	Nov 95			



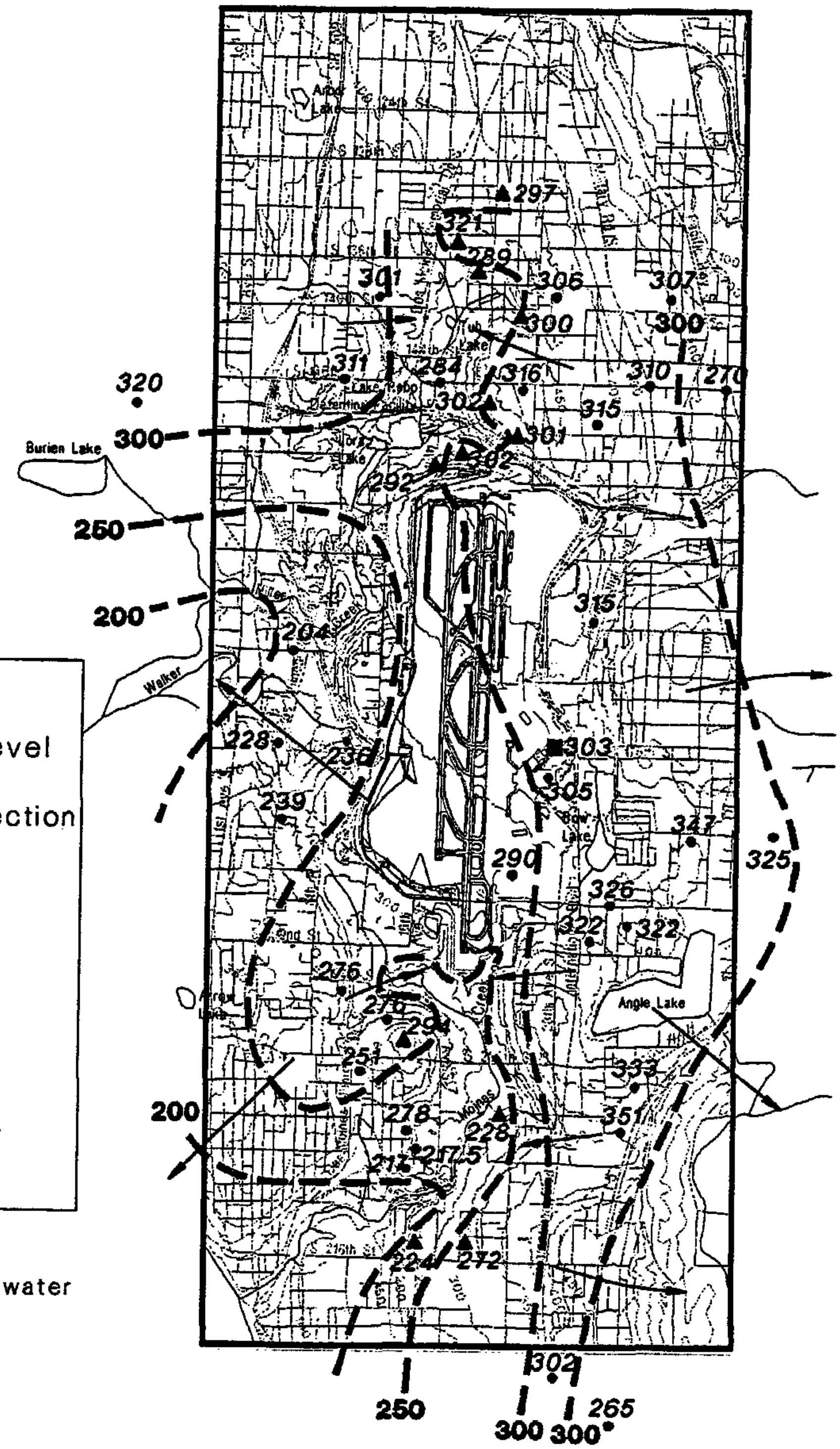
AGI TECHNOLOGIES

Generalized Cross Section C-C'

Shapiro/Sea-Tac EIS
Seatac, Washington

FIGURE **7**

	PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
crossec.cdr	14,887.003	BJA	Nov 95			



Legend:

Generalized Water Level Contour and Inferred Groundwater Flow Direction

▲ AGI Piezometers (January 1995)

• Wells from Previous Investigations (Miscellaneous Dates)

Converse Well CMW8 (March 1994)

Reference:
Modified from King Co. Groundwater Advisory Committee, 1989.

N

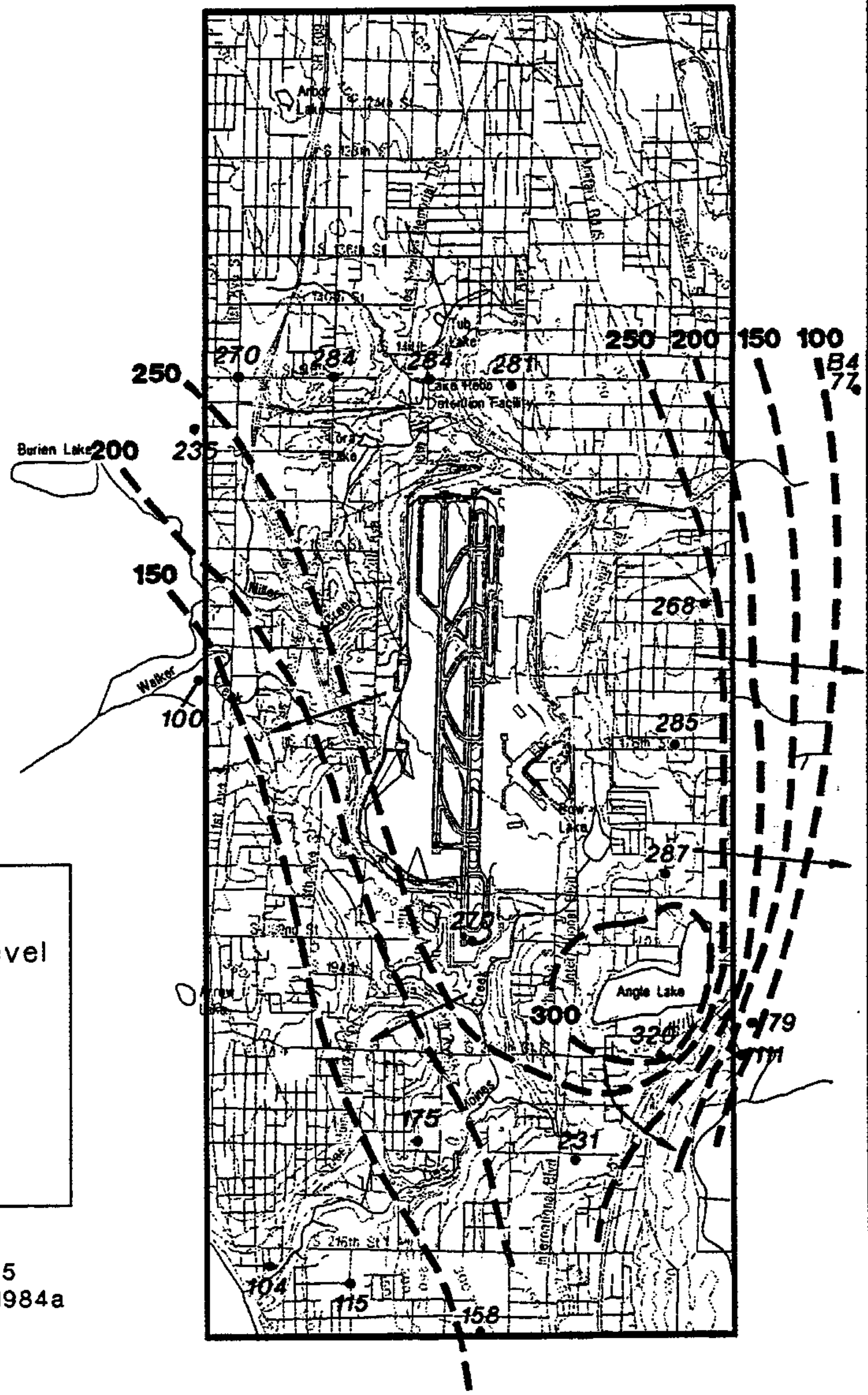
0 2500 5000
Scale in Feet

AGI TECHNOLOGIES **Generalized Groundwater Elevations-Shallow (Qva) Aquifer**

Shapiro/Sea-Tac EIS
Seatac, Washington

FIGURE 8

	PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
wells2.dwg	14,887.003	BJA	Nov 95			



Legend:

Generalized Water Level Contour and Inferred Flow Direction

• Wells from Previous Investigations (Miscellaneous Dates)

Reference:
Basemap: Port of Seattle, 1995
Modified from Hart Crowser, 1984a

N

0 2500 5000
Scale in Feet

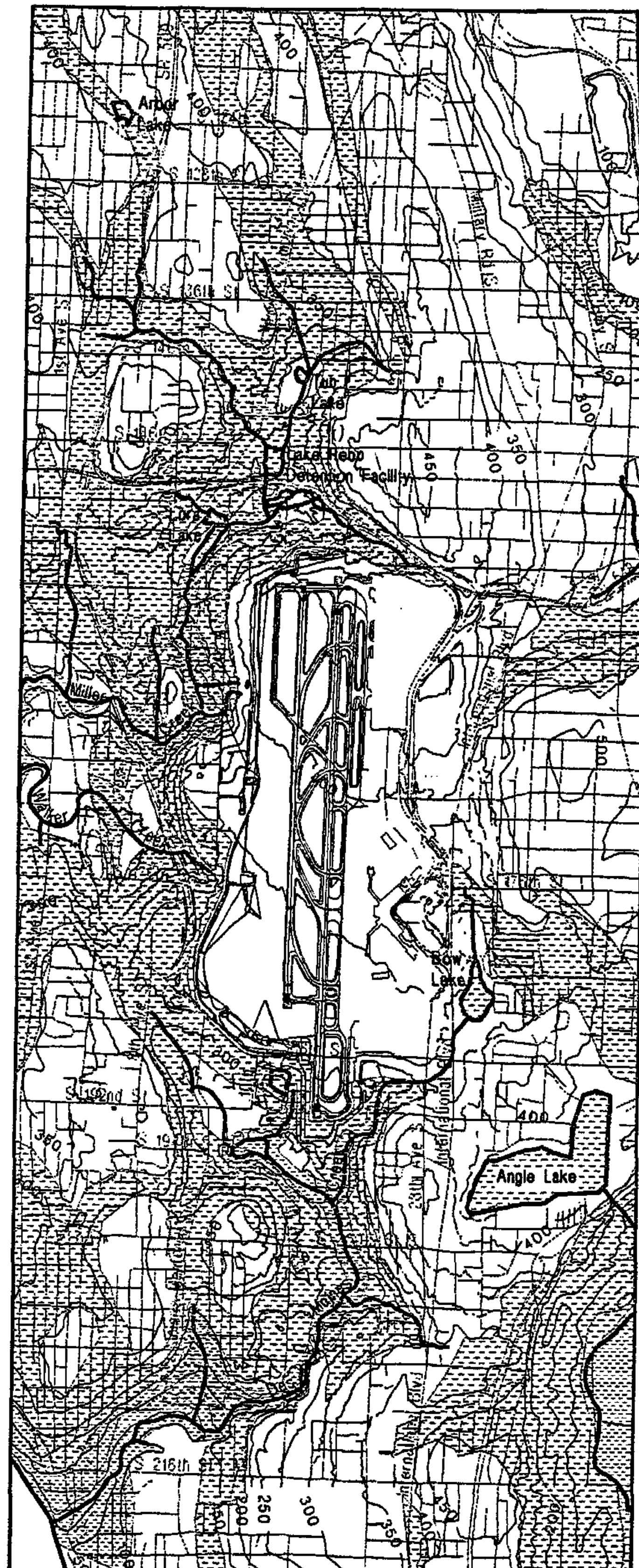
AGI TECHNOLOGIES

Generalized Groundwater Elevations-Intermediate Aquifer

Shapiro/Sea-Tac EIS
Seatac, Washington

FIGURE 9

points.dwg	PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
	14,887.003	BJA	Nov 95			



Legend:

Recharge Area

Discharge Area

Reference:
Basemap: Port of Seattle, 1995

N

0 2000 4000
Scale in Feet

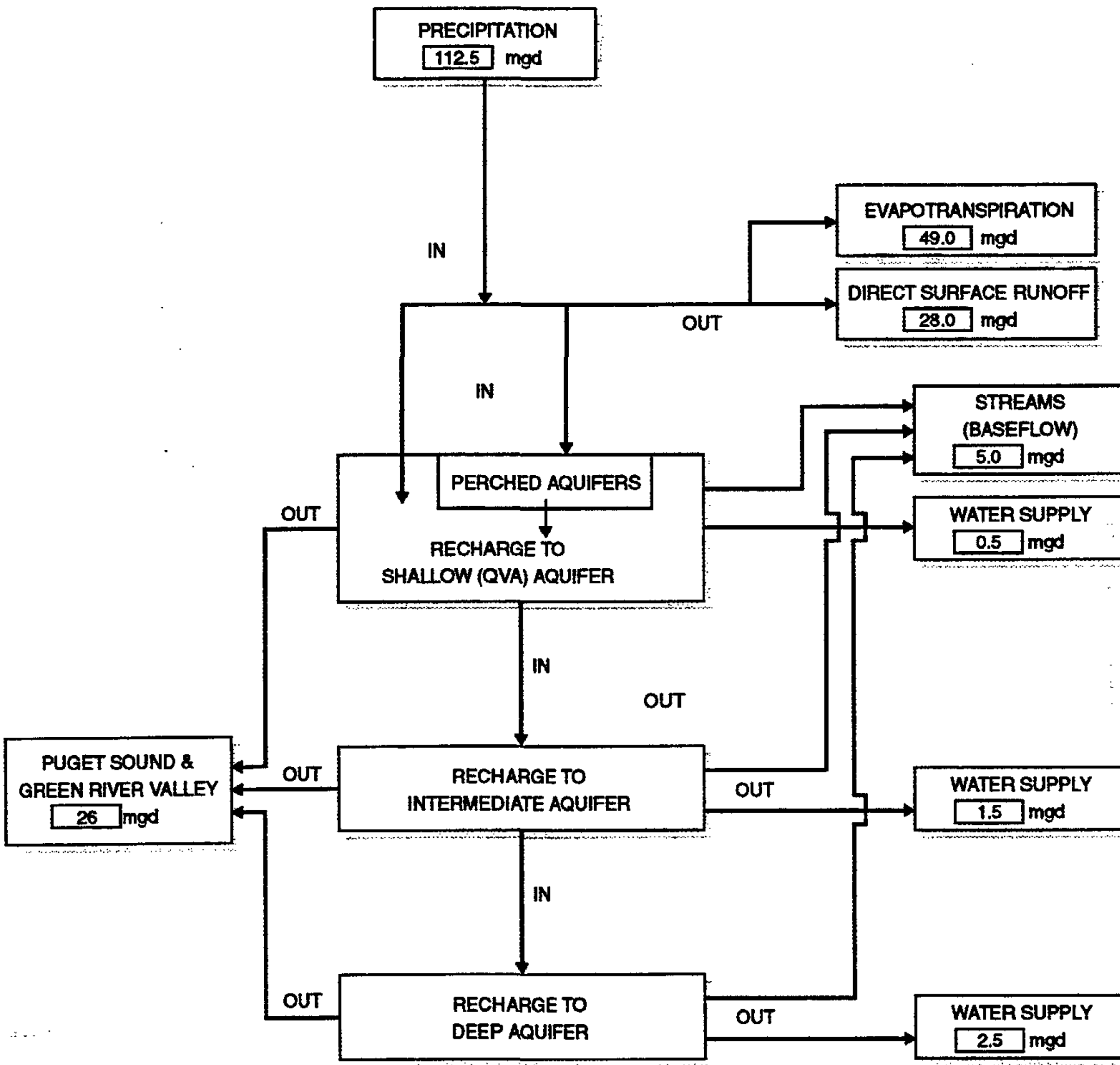
AGI TECHNOLOGIES

Aquifer Recharge/Discharge - Existing Conditions

FIGURE **10**

Shapiro/Sea-Tac EIS
Seatac, Washington

	PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
redis.dwg	14,887.003	BJA	Nov 95			



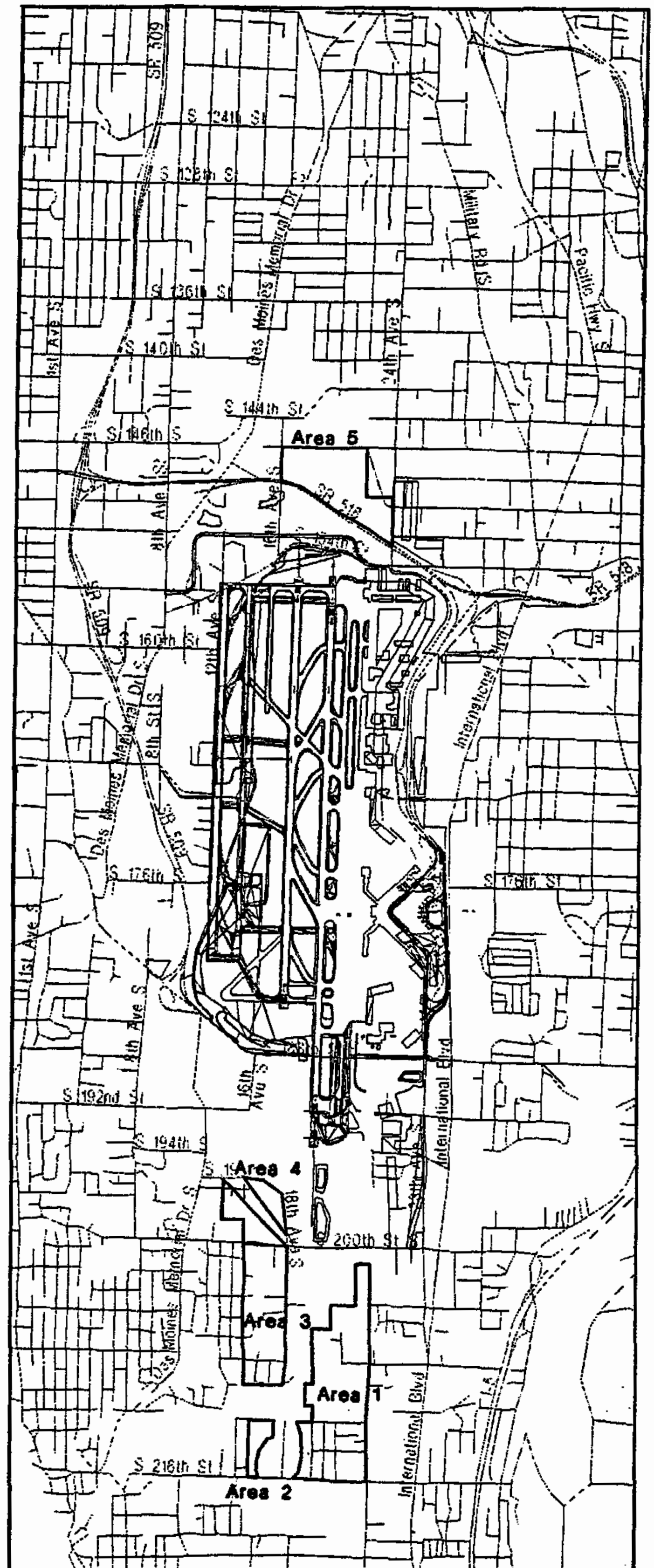
AGI TECHNOLOGIES

Groundwater Balance - Existing Conditions

Shapiro/Sea-Tac EIS
Seatac, Washington

FIGURE 11

	PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
waterbal.cdr	14,887.003	BJA	Nov 95			



Legend:

Proposed Future Facilities (Existing Facilities with Proposed Improvements)

Borrow Area

Reference:
Basemap: Port of Seattle, 1995

N

0 2000 4000
Scale in Feet

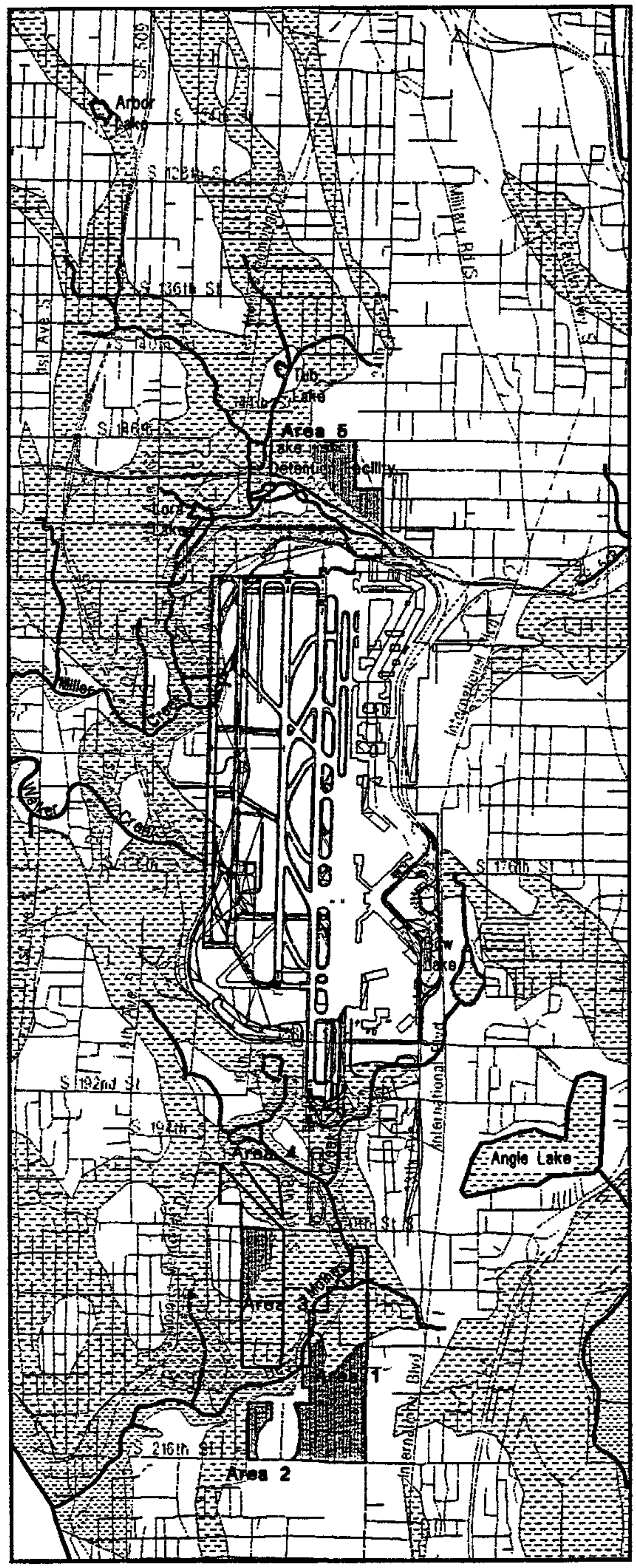
AGI TECHNOLOGIES

Existing Facilities with Improvements

Shapiro/Sea-Tac EIS
Seatac, Washington

FIGURE **12**

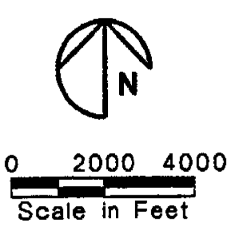
	PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
Improv.dwg	14,887.003	BJA	Nov 95			



Legend:

- Proposed Future Facilities (Existing Facilities with Proposed Improvements)
- Borrow Area
- Filled Recharge Area
- Recharge Area Created by Till Removal
- Recharge Area
- Discharge Area

Reference:
Basemap: Port of Seattle, 1995



AGI TECHNOLOGIES

Aquifer Recharge/Discharge with Improvements

Shapiro/Sea-Tac EIS
Seatac, Washington

FIGURE **13**

	PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
redisimp.dwg	14,887.003	BJA	Nov 95			

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AGI
TECHNOLOGIES

APPENDIX A

Boring/Well Logs

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SITEID	472919122182501	LOCAL NUMBER	23N/04E-16D02
LATITUDE	47d29m19s	LONGITUDE	122d18m25s
ALTITUDE	365.00	CONST. DATE	03/25/1985
WELL DEPTH	75.00	HOLE DEPTH	75.00
WATER LEVEL	61.00	W.L. DATE	11/13/1986
SCREEN INT.	65.00 - 75.00		
DRILLER	HOKKAIDO		
WELL OWNER	SEATTLE WATER DEPT.		

INT NO.	INTVL(FT)	DESCRIPTION
1 :	0- 20	GLACIAL TILL
2 :	20- 75	DENSE, DAMP TO WET, BR, F-MED SAND
3 :	75-	DENSE, DAMP, GRAY SILT

SITEID	472919122182502	LOCAL NUMBER	23N/04E-16D3
LATITUDE	47d29m19s	LONGITUDE	122d18m25s
ALTITUDE	365.00	CONST. DATE	06/27/1985
WELL DEPTH	297.00	HOLE DEPTH	297.00
WATER LEVEL	7871.00	W.L. DATE	07/18/1985
SCREEN INT.	212.00 - 297.00		
DRILLER	HOKKAIDO		
WELL OWNER	SEATTLE WATER DEPT.		

INT NO.	INTVL(FT)	DESCRIPTION
1 :	0- 17	BR TO GRAY SILTY,GRAV,SAND(TILL)
2 :	17- 61	BR SAND WITH OCC. GRAVEL
3 :	61- 128	BLUE-GRY SILT AND CL. SILT
4 :	128- 140	BR SL. GRAV, SILTY SAND
5 :	140- 169	BROWN SL SILTY FN-MED SAND WITH GR
6 :	169- 274	BR SANDY GRAVEL WITH COBBLES,WEATHE
7 :	274- 275	BR SILTY SANDY GRAVEL
8 :	275- 297	GRAY SD & GR, CL SILT AT BOTTOM

SITEID	472842122175801	LOCAL NUMBER	23N/04E-16K01
LATITUDE	47d28m42s	LONGITUDE	122d17m58s
ALTITUDE	390.00	CONST. DATE	04/09/1985
WELL DEPTH	109.00	HOLE DEPTH	109.00
WATER LEVEL	84.00	W.L. DATE	11/13/1986
SCREEN INT.	98.00 - 108.00		
DRILLER	HOKKAIDO		
WELL OWNER	SEATTLE WATER DEPT.		

INT NO.	INTVL(FT)	DESCRIPTION
1 :	0- 20	GLACIAL TILL
2 :	20- 109	DENSE, DAMP TO WET, BR, F-MED SD

SITEID	472842122175701	LOCAL NUMBER	23N/04E-16K02
LATITUDE	47d28m42s	LONGITUDE	122d17m57s
ALTITUDE	390.00	CONST. DATE	04/09/1985
WELL DEPTH	320.00	HOLE DEPTH	729.00
WATER LEVEL	120.00	W.L. DATE	11/13/1986
SCREEN INT.	220.00 - 320.00		
DRILLER	HOKKAIDO		
WELL OWNER	SEATTLE WATER DEPT.		

INT NO.	INTVL(FT)	DESCRIPTION
1 :	0- 13	DAMP, GRY&BR, SLIGHTLY GR, SDY SLT
2 :	13- 152	DAMP, BR, F-MED SD W/SOME GR ZONES
3 :	152- 165	WET, BLUE-GRY, VERY FINE SANDY SLT
4 :	165- 185	MOIST, BLUE-GRY, SLIGHTLY F SDY SLT
5 :	185- 199	DAMP,GRY,YELL,VERY SLTY, GR SAND
6 :	199- 330	WET, GRY, SLIGHTLY SLTY TO CLEAN
7 :	330- 363	WET, GRY, GRAVELLY SAND
8 :	363- 438	DAMP, GRAY, SANDY AND FINE SDY SILT
9 :	438- 477	MOIST TO WET, GRAY, SILTY TO CLEAN
10 :	477- 580	WET, GRAY, SANDY GRAVEL W/COBBLE
11 :	580- 602	WET, GRAY, SANDY, COBBLY GR
12 :	602- 619	DAMP, GRAY, SILTY CLY AND CLYEY SLT
13 :	619- 623	SET, GRAY, SLIGHTLY GRAVELLY SAND
14 :	623- 704	DAMP, GRAY, SILTY CLY AND CLYEY SLT
15 :	704- 729	DAMP, WHITE TO LIGHT GRAY SANDSTONE

SITEID	472834122183101	LOCAL NUMBER	23N/04E-16N01
LATITUDE	47d28m34s	LONGITUDE	122d18m31s
ALTITUDE	335.00	CONST. DATE	12/10/1987
WELL DEPTH	47.00	HOLE DEPTH	54.50
WATER LEVEL	292.00	W.L. DATE	12/07/1987
SCREEN INT.	42.00 - 47.00		
DRILLER	GEOBORING		
WELL OWNER	SEATTLE WATER DEPARTMENT		

INT NO.	INTVL(FT)	DESCRIPTION
1 :	0- 7	DAMP, GRAY TO BR, SLTLY SLTY, GR SD
2 :	7- 12	DAMP, GRAY, CLEAN, M-F SAND
3 :	12- 16	GRAVELLY SAND
4 :	16- 35	BROWN SAND
5 :	35- 47	GRAVELLY SAND
6 :	47- 55	VERY DENSE, DAMP, GRAY TO BLUE, CLY

SITEID	472843122190901	LOCAL NUMBER	23N/04E-17K01
LATITUDE	47d28m43s	LONGITUDE	122d19m09s
ALTITUDE	320.00	CONST. DATE	08/21/1973
WELL DEPTH	99.00	HOLE DEPTH	110.00
WATER LEVEL	19.00	W.L. DATE	11/21/1984
SCREEN INT.	89.00 - 94.00		
DRILLER	STATEWIDE DR		
WELL OWNER	HELLUMS JAMES		

INT NO.	INTVL(FT)	DESCRIPTION
1 :	0- 20	SILT, PEAT, BROWN
2 :	20- 25	HARD PAN
3 :	25- 89	SANDY SILT (BROWN)
4 :	89- 99	SAND, BROWN WATER
5 :	99- 110	SILT, PEAT, BROWN GRAY

B10

SITEID	472820122200001	LOCAL NUMBER	23N/04E-19A01
LATITUDE	47d28m20s	LONGITUDE	122d20m00s
ALTITUDE	343.60	CONST. DATE	04/23/1982
WELL DEPTH	110.00	HOLE DEPTH	427.50
WATER LEVEL	175.00	W.L. DATE	08/24/1982
SCREEN INT.	80.00 - 100.00		
DRILLER	PITCHER		

INT NO.	INTVL(FT)	DESCRIPTION
1 :	0- 13	GLACIAL TILL
2 :	13- 25	GRNSH-GRY, VERY HARD, CLAYEY SILT
3 :	25- 37	GRAY, VERY DENSE, SILTY SAND
4 :	37- 101	GRAY, VERY DENSE, F-MED SAND
5 :	101- 123	GRAY, VERY DENSE, SILT
6 :	123- 134	GRAY, VERY DENSE FINE SAND
7 :	134- 144	GRAY, VERY DENSE, SILTY SAND
8 :	144- 164	GRAY, VERY DENSE FINE SAND
9 :	164- 189	GRAY, VERY HARD, CLAYEY SILT
10 :	189- 194	GRAY, VERY DENSE, FINE SAND AND SLT
11 :	194- 210	GRAY VERY DENSE CLAYEY SILT
12 :	210- 218	GRAY, VERY DENSE, GRAVELLY SAND
13 :	218- 224	GLACIAL TILL
14 :	224- 244	GRN-GRY, VERY DENSE, F-CRSE SAND
15 :	244- 250	GRAY, V DENSE, HARD, SD & CLY SILT
16 :	250- 298	GRY-BR, VERY DENSE SANDY GRAVEL
17 :	298- 308	GRAY, VERY DENSE FINE SAND
18 :	308- 330	GRAY, VERY HARD, SILTY CLAY
19 :	330- 352	GLACIAL TILL
20 :	352- 359	GRY-BR, VERY DENSE, SAND
21 :	359- 371	GRY, VERY HARD, SILTY CLAY
22 :	371- 374	GRAY, VERY DENSE, FINE SILT AND SD
23 :	374- 428	GRAY, VERY HARD, SILTY CLAY

SITEID	472820122200002	LOCAL NUMBER	23N/04E-19A02
LATITUDE	47d28m20s	LONGITUDE	122d20m00s
ALTITUDE	343.60	CONST. DATE	04/23/1982
WELL DEPTH	320.00	HOLE DEPTH	427.00
WATER LEVEL	72.00	W.L. DATE	07/19/1982
SCREEN INT.	260.00 - 290.00		
DRILLER	PITCHER		

INT NO.	INTVL(FT)	DESCRIPTION
1 :	0- 13	GLACIAL TILL
2 :	13- 25	GRNSH-GRY, VERY HARD, CLAYEY SILT
3 :	25- 37	GRAY, VERY DENSE, SILTY SAND
4 :	37- 101	GRAY, VERY DENSE, F-MED SAND
5 :	101- 123	GRAY, VERY DENSE, SILT
6 :	123- 134	GRAY, VERY DENSE FINE SAND
7 :	134- 144	GRAY, VERY DENSE, SILTY SAND
8 :	144- 164	GRAY, VERY DENSE FINE SAND
9 :	164- 189	GRAY, VERY HARD, CLAYEY SILT
10 :	189- 194	GRAY, VERY DENSE, FINE SAND & SILT
11 :	194- 210	GRAY VERY DENSE CLAYEY SILT
12 :	210- 218	GRAY, VERY DENSE, GRAVELLY SAND
13 :	218- 224	GLACIAL TILL
14 :	224- 244	GRN-GRY, VERY DENSE, F-CRSE SAND
15 :	244- 250	GRAY, V DENSE, HARD, SD & CLY SILT
16 :	250- 298	GRY-BR, VERY DENSE SANDY GRAVEL
17 :	298- 308	GRAY, VERY DENSE FINE SAND
18 :	308- 330	GRAY, VERY HARD, SILTY CLAY
19 :	330- 352	GLACIAL TILL
20 :	352- 359	GRY-BR, VERY DENSE, SAND
21 :	359- 371	GRAY, VERY HARD, SILTY CLAY
22 :	371- 374	GRAY, VERY DENSE, FINE SILT AND SD
23 :	374- 428	GRAY, VERY HARD, SILTY CLAY

SITEID	472822122201901	LOCAL NUMBER	23N/04E-19B01
LATITUDE	47d28m22s	LONGITUDE	122d20m19s
ALTITUDE	375.00	CONST. DATE	03/18/1985
WELL DEPTH	350.00	HOLE DEPTH	362.00
WATER LEVEL	119.00	W.L. DATE	05/20/1985
SCREEN INT.	265.00 - 342.00		
DRILLER	RICHARDSON		
WELL OWNER	KCWD 49		

INT NO.	INTVL(FT)	DESCRIPTION
1 :	0- 26	BROWN SANDY TILL
2 :	26- 48	BROWN SAND W/SOME SILT AND GRAVEL
3 :	48- 56	BROWN GRAVEL WITH SOME SAND
4 :	56- 72	BROWN SAND WITH SOME GRAVEL
5 :	72- 97	BROWN COMPACTED SILT AND FINE SAND
6 :	97- 106	BROWN COMPACTED SILT, SAND & GRAVEL
7 :	106- 109	BROWN SAND WITH SILT AND SAND
8 :	109- 126	BROWN MODERATLY COMPACTED SLT,SD&GR
9 :	126- 145	GRY SILT AND F-SAND W/PEAT & WOOD
10 :	145- 159	GRAY SILTY CLAY
11 :	159- 168	GRAY SILTY CLAY W/GR & SD
12 :	168- 208	GRY TILL COMPACTED SD GR SLT & CLY
13 :	208- 246	GRAY SILT CLAY AND FINE SD W/WOOD
14 :	246- 257	GRY TO BLK SD & GR W/SOME FINE
15 :	257- 263	SAND AND SILT MATRIX
16 :	263- 276	GRY TO BLK SAND AND GR W/GRY CLAY
17 :	276- 278	GRAY SILT
18 :	278- 287	GRAY TO BLK GRAVEL AND SAND
19 :	287- 302	GRY POORLY SORTED SD & GR W/ SLT
20 :	302- 343	GRY GRN AND BLK GR AND MED-CRS SD
21 :	343- 345	GREEN CLAY
22 :	345- 359	GR AND SD W/GRN CLAY & GRY SAND
23 :	359- 362	FINE GRY SD AND CLAY

SITEID	472822122201902	LOCAL NUMBER	23N/04E-19B02
LATITUDE	47d28m22s	LONGITUDE	122d20m19s
ALTITUDE	375.00	CONST. DATE	02/04/1986
WELL DEPTH	354.00	HOLE DEPTH	620.00
WATER LEVEL	120.00	W.L. DATE	07/16/1986
SCREEN INT.	284.00 - 304.00		
DRILLER	RICHARDSON		
WELL OWNER	KCWD 49		

INT NO.	INTVL(FT)	DESCRIPTION
1 :	0- 55	GRAY GLACIAL TILL, SOMEWHAT SANDY
2 :	55- 61	SAND AND GRAVEL WITH CLAY
3 :	61- 65	LOOSE COARSE GRAVEL, DRY
4 :	65- 90	BROWN SILTY SAND
5 :	90- 94	GRAY LOOSE SAND AND GRAVEL
6 :	94- 105	GRAY SAND MUD CLAY WITH SOME GRAVEL
7 :	105- 118	GRAY BROWN SAND AND GR W/CLAY
8 :	118- 120	BROWN SILTY CLAY AND SAND
9 :	120- 135	BROWN SILTY CLAY AND SAND
10 :	135- 162	COMPACTED GRAY SILT
11 :	162- 200	GRAY CLAY AND GRAVEL
12 :	200- 212	COMPACTED GRAY CLAY COBBLES AND SD
13 :	212- 362	GRY SILT AND F-MED SD SOME WOOD
14 :	362- 370	GRAY SANDY SILT W/SOME GRAVEL
15 :	370- 399	GRAY SILTY SAND WITH SOME GRAVEL
16 :	399- 419	DARK GRAY SILT AND CLAY
17 :	419- 426	DK GRAY GRN, SLT WITH PEAT

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SITEID	472820122184601	LOCAL NUMBER	23N/04E-20A01
LATITUDE	47d28m20s	LONGITUDE	122d18m46s
ALTITUDE	290.40	CONST. DATE	05/06/1982
WELL DEPTH	15.00	HOLE DEPTH	367.00
WATER LEVEL	7.50	W.L. DATE	05/10/1982
SCREEN INT.	10.00 - 15.00		
DRILLER	PITCHER		

INT NO.	INTVL(FT)	DESCRIPTION
1 :	0- 20	YELLWSH-BR, VERY DENSE, SANDY GR
2 :	20- 38	GLACIAL TILL
3 :	38- 44	GRAY, VERY DENSE, F-CRS SAND
4 :	44- 65	GRAY, VERY DENSE F-CRS SILTY SAND
5 :	65- 110	GRAY VERY DENSE, F-CRS SAND
6 :	110- 117	GRNSH-BLK, VERY DENSE GRVL & COBBLE
7 :	117- 123	GRAY, VERY DENSE, SANDY GRAVEL
8 :	123- 128	GRAY, VERY DENSE, SLTY SDY GRAVEL
9 :	128- 133	GRAY, VERY HARD SILT
10 :	133- 140	BROWSH-BLK, VERY DENSE, SILTY SAND
11 :	140- 197	GRAY, VERY DENSE, GRAVEL AND SAND
12 :	197- 224	GRAY, VERY DENSE, SANDY GRAVEL
13 :	224- 244	GRAY, VERY DENSE, SAND
14 :	244- 254	GRAY, VERY DENSE SAND AND SILT
15 :	254- 343	GRAY VERY HARD CLAYEY SILT
16 :	343- 347	GRAY, VERY DENSE SAND
17 :	347- 356	GRAY, VERY HARD, CLAYEY SILT
18 :	356- 367	GRAY VERY DENSE SANDY SILT

SITEID	472820122184602	LOCAL NUMBER	23N/04E-20A02
LATITUDE	47d28m20s	LONGITUDE	122d18m46s
ALTITUDE	290.40	CONST. DATE	05/06/1982
WELL DEPTH	195.50	HOLE DEPTH	367.00
WATER LEVEL	6.50	W.L. DATE	05/10/1982
SCREEN INT.	150.00 - 180.00		
DRILLER	PITCHER		

INT NO.	INTVL(FT)	DESCRIPTION
1 :	0- 20	YELLWSH-BR, VERY DENSE, SANDY GRVL
2 :	20- 38	GLACIAL TILL
3 :	38- 44	GRAY, VERY DENSE, F-COARSE SAND
4 :	44- 65	GRAY, VERY DENSE F-COARSE SLTY SD
5 :	65- 110	GRAY VERY DENSE, F-COARSE SAND
6 :	110- 117	GREENISH BLACK, VERY DENSE GR & CBL
7 :	117- 123	GRAY, VERY DENSE, SANDY GRAVEL
8 :	123- 128	GRAY, VERY DENSE, SLTY SDY GRAVEL
9 :	128- 133	GRAY, VERY HARD SILT
10 :	133- 140	BRWNSH BLK, VERY DENSE, SILTY SAND
11 :	140- 197	GRAY, VERY DENSE, GRAVEL AND SAND
12 :	197- 224	GRAY, VERY DENSE, SANDY GRAVEL
13 :	224- 244	GRAY, VERY DENSE, SAND
14 :	244- 254	GRAY, VERY DENSE SAND AND SILT
15 :	254- 343	GRAY VERY HARD, CLAYEY SILT
16 :	343- 347	GRAY, VERY DENSE SAND
17 :	347- 356	GRAY, VERY HARD, CLAYEY SILT
18 :	356- 367	GRAY VERY DENSE SANDY SILT

SITEID	472820122184603	LOCAL NUMBER	23N/04E-20A03
LATITUDE	47d28m20s	LONGITUDE	122d18m46s
ALTITUDE	290.40	CONST. DATE	05/06/1982
WELL DEPTH	365.00	HOLE DEPTH	367.00
WATER LEVEL	40.30	W.L. DATE	07/16/1982
SCREEN INT.	340.00 - 350.00		
DRILLER	PITCHER		

INT NO.	INTVL(FT)	DESCRIPTION
1 :	0- 20	YELLWSH-BRW, VERY DENSE, SANDY GRV
2 :	20- 38	GLACIAL TILL
3 :	38- 44	GRAY, V DENSE, F-COARSE SAND
4 :	44- 65	GRAY, VERY DENSE F-COARSE SLTY SD
5 :	65- 110	GRAY VERY DENSE, F-COARSE SAND
6 :	110- 117	GRNSH BLK, VERY DENSE GR & COBBLES
7 :	117- 123	GRAY, VERY DENSE, SANDY GRAVEL
8 :	123- 128	GRAY, VERY DENSE, SILTY SDY GRAVEL
9 :	128- 133	GRAY, VERY HARD SILTY
10 :	133- 140	BROWSH BLK, VERY DENSE, SILTY SAND
11 :	140- 197	GRAY, VERY DENSE, GRAVEL & SAND
12 :	197- 224	GRAY, VERY DENSE, SANDY GRAVEL
13 :	224- 244	GRAY, VERY DENSE, SAND
14 :	244- 254	GRAY, VERY DENSE SAND AND SILT
15 :	254- 343	GRAY VERY HARD, CLAYEY SILT
16 :	343- 347	GRAY, VERY DENSE SAND
17 :	347- 356	GRAY, VERY HARD, CLAYEY SILT
18 :	356- 367	GRAY VERY DENSE SANDY SILT

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SITEID	472821122192101	LOCAL NUMBER	23N/04E-20C01
LATITUDE	47d28m21s	LONGITUDE	122d19m21s
ALTITUDE	354.80	CONST. DATE	06/07/1982
WELL DEPTH	70.00	HOLE DEPTH	435.00
WATER LEVEL	44.20	W.L. DATE	06/15/1982
SCREEN INT.	35.00 - 50.00		
DRILLER	PITCHER		

INT NO.	INTVL(FT)	DESCRIPTION
1 :	0- 13	YELLWSH-BRW, DENSE, SILTY SANDY GR
2 :	13- 89	YELLWSH-BR, DENSE, F-MED SAND
3 :	89- 130	GRAY, VERY DENSE, SILTY SAND
4 :	130- 149	GRAY, VERY HARD, SILTY CLAY
5 :	149- 153	GRAY, VERY HARD CLAYEY SILT
6 :	153- 165	GRAY, VERY DENSE, GRAVEL AND SAND
7 :	165- 176	GRAY, VERY DENSE, SILTY SAND
8 :	176- 194	GRAY, VERY DENSE GRAVEL AND SAND
9 :	194- 204	GRAY, VERY HARD, CLAYEY SILT
10 :	204- 214	GRAY, VERY DENSE, SAND
11 :	214- 294	GRAY, VERY DENSE GRAVEL AND SAND
12 :	294- 309	GRAY, VERY HARD, CLAYEY SILT
13 :	309- 318	GLACIAL TILL
14 :	318- 323	GRAY, VERY HARD, CLAYEY SILT
15 :	323- 333	GRAY, VERY DENSE, SANDY SILT
16 :	333- 367	GRAY, VERY HARD SILT
17 :	367- 373	GRAY, VERY HARD SILTY CLAY
18 :	373- 393	GRAY, VERY HARD, CLAYEY SILT
19 :	393- 414	GRAY, VERY HARD, SILTY CLAY
20 :	414- 435	GRAY, VERY HARD CLAYEY SILT

SITEID	472821122192102	LOCAL NUMBER	23N/04E-20C02
LATITUDE	47d28m21s	LONGITUDE	122d19m21s
ALTITUDE	354.80	CONST. DATE	06/07/1982
WELL DEPTH	289.50	HOLE DEPTH	435.00
WATER LEVEL	73.10	W.L. DATE	06/18/1982
SCREEN INT.	234.00 - 274.00		
DRILLER	PITCHER		

INT NO.	INTVL(FT)	DESCRIPTION
1 :	0- 13	YELLWSH-BR, DENSE, SILTY SANDY GR
2 :	13- 89	YELLWSH-BR, DENSE, F-MED SAND
3 :	89- 130	GRAY, VERY DENSE, SILTY SAND
4 :	130- 149	GRAY, VERY HARD, SILTY CLAY
5 :	149- 153	GRAY, VERY HARD CLAYEY SILT
6 :	153- 165	GRAY, VERY DENSE, GRAVEL AND SAND
7 :	165- 176	GRAY, VERY DENSE, SILTY SAND
8 :	176- 194	GRAY, VERY DENSE GRAVEL AND SAND
9 :	194- 204	GRAY, VERY HARD, CLAYEY SILT
10 :	204- 214	GRAY, VERY DENSE, SAND
11 :	214- 294	GRAY, VERY DENSE GRAVEL AND SAND
12 :	294- 309	GRAY, VERY HARD, CLAYEY SILT
13 :	309- 318	GLACIAL TILL
14 :	318- 323	GRAY, VERY HARD, CLAYEY SILT
15 :	323- 333	GRAY, VERY DENSE, SANDY SILT
16 :	333- 367	GRAY, VERY HARD SILT
17 :	367- 373	GRAY, VERY HARD SILTY CLAY
18 :	373- 393	GRAY, VERY HARD, CLAYEY SILT
19 :	393- 414	GRAY, VERY HARD, SILTY CLAY
20 :	414- 435	GRAY, VERY HARD CLAYEY SILT

SITEID	472821122192103	LOCAL NUMBER	23N/04E-20C03
LATITUDE	47d28m21s	LONGITUDE	122d19m21s
ALTITUDE	354.80	CONST. DATE	06/07/1982
WELL DEPTH	341.00	HOLE DEPTH	435.00
WATER LEVEL	83.00	W.L. DATE	05/20/1982
SCREEN INT.	316.00 - 326.00		
DRILLER	PITCHER		

INT NO.	INTVL(FT)	DESCRIPTION
1 :	0- 13	YELLWSH-BR, DENSE, SLTY SDY GRAVEL
2 :	13- 89	YELLWSH-BR, DENSE, F-MED SAND
3 :	89- 130	GRAY, VERY DENSE, SILTY SAND
4 :	130- 149	GRAY, VERY HARD, SILTY CLAY
5 :	149- 153	GRAY, VERY HARD CLAYEY SILT
6 :	153- 165	GRAY, VERY DENSE, GRAVEL AND SAND
7 :	165- 176	GRAY, VERY DENSE, SILTY SAND
8 :	176- 194	GRAY, VERY DENSE GRAVEL AND SAND
9 :	194- 204	GRAY, VERY HARD, CLAYEY SILT
10 :	204- 214	GRAY, VERY DENSE, SAND
11 :	214- 294	GRAY, VERY DENSE GRAVEL AND SAND
12 :	294- 309	GRAY, VERY HARD, CLAYEY SILT
13 :	309- 318	GLACIAL TILL
14 :	318- 323	GRAY, VERY HARD, CLAYEY SILT
15 :	323- 333	GRAY, VERY DENSE, SANDY SILT
16 :	333- 367	GRAY, VERY HARD SILT
17 :	367- 373	GRAY, VERY HARD SILTY CLAY
18 :	373- 393	GRAY, VERY HARD, CLAYEY SILT
19 :	393- 414	GRAY, VERY HARD, SILTY CLAY
20 :	414- 435	GRAY, VERY HARD CLAYEY SILT

SITEID	472821122192104	LOCAL NUMBER	23N/04E-20C04
LATITUDE	47d28m21s	LONGITUDE	122d19m21s
ALTITUDE	354.80	CONST. DATE	06/07/1982
WELL DEPTH	435.00	HOLE DEPTH	435.00
WATER LEVEL	84.40	W.L. DATE	05/03/1982
SCREEN INT.	410.00 - 415.00		
DRILLER	PITCHER		

INT NO.	INTVL(FT)	DESCRIPTION
1 :	0- 13	YELLWSH-BR, DENSE, SILTY SNDY GRVL
2 :	13- 89	YELLWSH-BR, DENSE, F-MED SAND
3 :	89- 130	GRAY, VERY DENSE, SILTY SAND
4 :	130- 149	GRAY, VERY HARD, SILTY CLAY
5 :	149- 153	GRAY, VERY HARD CLAYEY SILT
6 :	153- 165	GRAY, VERY DENSE, GRAVEL AND SAND
7 :	165- 176	GRAY, VERY DENSE, SILTY SAND
8 :	176- 194	GRAY, VERY DENSE GRAVEL AND SAND
9 :	194- 204	GRAY, VERY HARD, CLAYEY SILT
10 :	204- 214	GRAY, VERY DENSE, SAND
11 :	214- 294	GRAY, VERY DENSE GRAVEL AND SAND
12 :	294- 309	GRAY, VERY HARD, CLAYEY SILT
13 :	309- 318	GLACIAL TILL
14 :	318- 323	GRAY, VERY HARD, CLAYEY SILT
15 :	323- 333	GRAY, VERY DENSE, SANDY SILT
16 :	333- 367	GRAY, VERY HARD SILT
17 :	367- 373	GRAY, VERY HARD SILTY CLAY
18 :	373- 393	GRAY, VERY HARD, CLAYEY SILT
19 :	393- 414	GRAY, VERY HARD, SILTY CLAY
20 :	414- 435	GRAY, VERY HARD CLAYEY SILT

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SITEID	472823122180501	LOCAL NUMBER	23N/04E-21B01
LATITUDE	47d28m23s	LONGITUDE	122d18m05s
ALTITUDE	436.80	CONST. DATE	05/25/1982
WELL DEPTH	167.00	HOLE DEPTH	512.00
WATER LEVEL	122.30	W.L. DATE	07/16/1982
SCREEN INT.	137.00 - 147.00		
DRILLER			

INT NO.	INTVL(FT)	DESCRIPTION
1 :	0- 6	WEATHERED GLACIAL TILL
2 :	6- 22	GLACIAL TILL
3 :	22- 118	GRAY, V DENSE, F-COARSE SAND
4 :	118- 134	GRAY, VERY DENSE GRAVELLY SAND
5 :	134- 141	GRAY, VERY DENSE SAND
6 :	141- 164	GRAY, VERY DENSE SILTY SAND
7 :	164- 179	GRAY, VERY DENSE, SAND AND GRAVEL
8 :	179- 182	GRAY, VERY DENSE SAND
9 :	182- 217	GRAY, VERY DENSE SAND AND SILT
10 :	217- 230	GRAY, VERY DENSE SAND
11 :	230- 286	GRAY VERY DENSE, SILTY GRVL & SAND
12 :	286- 370	GRAY, GRAVEL AND SAND
13 :	370- 400	GRAY, VERY DENSE SAND
14 :	400- 403	GRAY, VERY DENSE SILTY SAND
15 :	403- 413	GRAY, VERY DENSE SAND
16 :	413- 418	GRAY, VERY DENSE SILTY SAND
17 :	418- 437	GRAY, VERY DENSE SAND
18 :	437- 448	GRAY, VERY DENSE SILTY SAND
19 :	448- 453	GRAY, VERY HARD, CLAYEY SILT
20 :	453- 458	GRAY, VERY DENSE, SAND
21 :	458- 473	GRAY, VERY DENSE, SAND AND SILT
22 :	473- 483	GRAY, VERY HARD, SILTY CLAY

SITEID	472820122181401	LOCAL NUMBER	23N/04E-21C03
LATITUDE	47d28m20s	LONGITUDE	122d18m14s
ALTITUDE	429.00	CONST. DATE	07/29/1982
WELL DEPTH	337.00	HOLE DEPTH	337.00
WATER LEVEL	149.00	W.L. DATE	08/24/1928
SCREEN INT.	285.00 - 325.00		
DRILLER	HOKKAIDO		
WELL OWNER	PORT OF SEATTLE		

INT NO.	INTVL(FT)	DESCRIPTION
1 :	0- 28	GLACIAL TILL
2 :	28- 36	GRYBRWN, V DENSE, F-CRS SLTY SAND
3 :	36- 111	GRY BROWN, V DENSE, F-MED SAND
4 :	111- 151	GRY BROWN, V DENSE GRAVELLY SAND
5 :	151- 170	GRY BROWN, VERY DENSE F-CRS SAND
6 :	170- 185	GRAY, VERY HARD, SILT
7 :	185- 226	GRY, V DENSE, SDY GRAVEL W/OCC. ORG
8 :	226- 240	GRY, V DENSE, GRAVELLY SD W/OC.ORG
9 :	240- 244	GRAY, V DENSE SANDY SILT
10 :	244- 274	GRAY, VERY DENSE SANDY GRAVEL
11 :	274- 337	GRAY, VERY DENSE SANDY GRAVEL

SITEID	472810122173701	LOCAL NUMBER	23N/04E-21H07
LATITUDE	47d28m10s	LONGITUDE	122d17m37s
ALTITUDE	410.00	CONST. DATE	06/01/1985
WELL DEPTH	107.50	HOLE DEPTH	107.50
WATER LEVEL	95.00	W.L. DATE	07/18/1985
SCREEN INT.	95.00 - 105.00		
DRILLER	HOKKAIDO		
WELL OWNER	SEATTLE WATER DEPT.		

INT NO.	INTVL(FT)	DESCRIPTION
1 :	0- 9	DAMP, BR, GRAVELLY, SLTY SAND
2 :	9- 62	DAMP, GRAY, GRAVELLY, SILTY SAND
3 :	62- 108	DAMP, BROWN, F-MED. SAND W/GR ZONES

SITEID	472826122162601	LOCAL NUMBER	23N/04E-22A01
LATITUDE	47d28m26s	LONGITUDE	122d16m26s
ALTITUDE	285.00	CONST. DATE	05/30/1981
WELL DEPTH	70.00	HOLE DEPTH	71.00
WATER LEVEL	16.00	W.L. DATE	06/04/1981
SCREEN INT.	62.00 - 67.00		
DRILLER	B&J DRLG		
WELL OWNER	ELLAFSON, LARRY		

INT NO.	INTVL(FT)	DESCRIPTION
1 :	28- 70	WHITE SAND, WATER
2 :	70- 71	BLUE CLAY
3 :	71-	BLUE SILT

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SITEID	472822122164901	LOCAL NUMBER	23N/04E-22C01
LATITUDE	47d28m22s	LONGITUDE	122d16m49s
ALTITUDE	272.40	CONST. DATE	05/19/1982
WELL DEPTH	58.00	HOLE DEPTH	335.20
WATER LEVEL	2.20	W.L. DATE	05/30/1982
SCREEN INT.	48.00 - 53.00		
DRILLER	PITCHER		

INT NO.	INTVL(FT)	DESCRIPTION
1 :	0- 9	YELLWSH-BRW, V DENSE SLTY GR & SD
2 :	9- 32	GLACIAL TILL
3 :	32- 65	GRAY, VERY DENSE, FINE SAND
4 :	65- 94	GRAY, VERY DENSE, SAND AND SILT
5 :	94- 104	GRAY, VERY HARD SILTY CLAY
6 :	104- 117	GRAY, VERY HARD, SILT
7 :	117- 123	GRAY, VERY HARD SILTY CLAY
8 :	123- 128	GRAY, VERY DENSE, SILT AND SAND
9 :	128- 167	GRAY VERY HARD SANDY, CLAYEY SILT
10 :	167- 175	GRAY, VERY DENSE SANDY SILT
11 :	175- 189	GRAY VERY DENSE SILT AND SAND
12 :	189- 204	GLACIAL TILL
13 :	204- 257	GRAY VERY HARD SILTY CLAY
14 :	257- 295	GRAY, VERY HARD, SILT
15 :	295- 301	GRAY, VERY DENSE SAND AND SILT
16 :	301- 322	GRAY, VERY DENSE, SAND
17 :	322- 327	GRAY, VERY DENSE SAND AND SILT
18 :	327- 335	GLACIAL TILL

SITEID	472822122164902	LOCAL NUMBER	23N/04E-22C02
LATITUDE	47d28m22s	LONGITUDE	122d16m49s
ALTITUDE	272.40	CONST. DATE	05/19/1982
WELL DEPTH	200.00	HOLE DEPTH	335.20
WATER LEVEL	17.20	W.L. DATE	05/23/1982
SCREEN INT.	170.00 - 190.00		
DRILLER	PITCHER		

INT NO.	INTVL(FT)	DESCRIPTION
1 :	0- 9	YELLSH-BRW, V-DENSE SLTY GR & SAND
2 :	9- 32	GLACIAL TILL
3 :	32- 65	GRAY, VERY DENSE, FINE SAND
4 :	65- 94	GRAY, VERY DENSE, SAND AND SILT
5 :	94- 104	GRAY, VERY HARD SILTY CLAY
6 :	104- 117	GRAY, VERY HARD, SILT
7 :	117- 123	GRAY, VERY HARD SILTY CLAY
8 :	123- 128	GRAY, VERY DENSE, SILT AND SAND
9 :	128- 167	GRAY VERY HARD SANDY CLAYEY SILT
10 :	167- 175	GRAY, VERY DENSE SANDY SILT
11 :	175- 189	GRAY VERY DENSE SILT AND SAND
12 :	189- 204	GLACIAL TILL
13 :	204- 257	GRAY VERY HARD SILTY CLAY
14 :	257- 295	GRAY, VERY HARD, SILT
15 :	295- 301	GRAY, VERY DENSE SAND AND SILT
16 :	301- 322	GRAY, VERY DENSE, SAND
17 :	322- 327	GRAY, VERY DENSE SAND AND SILT
18 :	327- 335	GLACIAL TILL

SITEID	472822122164903	LOCAL NUMBER	23N/04E-22C03
LATITUDE	47d28m22s	LONGITUDE	122d16m49s
ALTITUDE	272.40	CONST. DATE	05/19/1982
WELL DEPTH	335.00	HOLE DEPTH	335.20
WATER LEVEL	99.30	W.L. DATE	07/19/1982
SCREEN INT.	305.00 - 325.00		
DRILLER	PITCHER		

INT NO.	INTVL(FT)	DESCRIPTION
1 :	0- 9	YELLWSH-BR, VERY DENSE SLTY GR & SD
2 :	9- 32	GLACIAL TILL
3 :	32- 65	GRAY, VERY DENSE, FINE SAND
4 :	65- 94	GRAY, VERY DENSE, SAND AND SILT
5 :	94- 104	GRAY, VERY HARD SILTY CLAY
6 :	104- 117	GRAY, VERY HARD, SILT
7 :	117- 123	GRAY, VERY HARD SILTY CLAY
8 :	123- 128	GRAY, VERY DENSE, SILT AND SAND
9 :	128- 167	GRAY VERY HARD SANDY, CLAYEY SILT
10 :	167- 175	GRAY, VERY DENSE SANDY SILT
11 :	175- 189	GRAY VERY DENSE SILT AND SAND
12 :	189- 204	GLACIAL TILL
13 :	204- 257	GRAY VERY HARD SILTY CLAY
14 :	257- 295	GRAY, VERY HARD, SILT
15 :	295- 301	GRAY, VERY DENSE SAND AND SILT
16 :	301- 322	GRAY, VERY DENSE, SAND
17 :	322- 327	GRAY, VERY DENSE SAND AND SILT
18 :	327- 335	GLACIAL TILL

SITEID	472823122172201	LOCAL NUMBER	23N/04E-22D01
LATITUDE	47d28m23s	LONGITUDE	122d17m22s
ALTITUDE	358.20	CONST. DATE	06/02/1982
WELL DEPTH	106.00	HOLE DEPTH	452.50
WATER LEVEL	46.40	W.L. DATE	06/10/1982
DRILLER			

B6

INT NO.	INTVL(FT)	DESCRIPTION
1 :	0- 11	YELLWSH-BRW, DENSE SANDY GRAVEL
2 :	11- 42	YELLWSH-BRW, DENSE SLTY GRVLLY SAND
3 :	42- 75	YELLWSH-BRW, V DENSE, F-MED SAND
4 :	75- 127	BROWNSH GRY V DENSE, F-MED SAND
5 :	127- 141	GRAY; VERY HARD, SILT (LACUSTRINE)
6 :	141- 189	GRAY, VERY HARD, CLAYEY SILT
7 :	189- 254	GRAY, VERY DENSE GRAVEL AND SAND
8 :	254- 262	GRAY, VERY DENSE, SILTY SAND
9 :	262- 269	GRAY, VERY HARD, SILT
10 :	269- 280	GRAY, VERY DENSE, SAND AND SILT
11 :	280- 304	GRAY, VERY DENSE, SAND
12 :	304- 314	GRAY, VERY DENSE SAND AND SILT
13 :	[illegible]- 321	GRAY, VERY HARD, CLAYEY SILT
[illegible]	334	GRAY, VERY DENSE, GRAVEL AND SAND
[illegible]	339	GRAY, VERY DENSE SILT AND SAND
16 .	344	GRAY, VERY DENSE SAND
17 :	358	GLACIAL TILL
18 :	362	GRAY, VERY HARD SILTY CLAY
19 :	374	GRAY, VERY DENSE GRAVEL AND SAND
20 :	389	GRAY, VERY DENSE GRAVELLY SAND
21 :	[illegible]- 431	GRAY, VERY DENSE SANDY GRAVEL
22 :	431- 442	GRAY, VERY DENSE, SAND
23	442- 453	GRAY, VERY DENSE SANDY GRAVEL

LATITUDE	47d28m21s	LONGITUDE	122d15m35s
ALTITUDE	192.60	CONST. DATE	06/14/1982
WELL DEPTH	245.00	HOLE DEPTH	253.00
WATER LEVEL	94.70	W.L. DATE	06/24/1982
SCREEN INT.	205.00 - 225.00		
DRILLER	PICTURE		

INT NO.	INTVL(FT)	DESCRIPTION
1 :	0- 12	YELWSH ORNGE, HRD SILTY CLY AND GR
2 :	12- 32	BLUE, HARD, SANDY CLAYEY SILT
3 :	32- 45	BEDROCK (SANDSTONE)
4 :	45- 147	BEDROCK (BASALT)
5 :	147- 253	BEDROCK (SANDSTONE)

SITEID	472821122160101	LOCAL NUMBER	23N/04E-23D01
LATITUDE	47d28m21s	LONGITUDE	122d16m01s
ALTITUDE	163.10	CONST. DATE	06/02/1982
WELL DEPTH	150.00	HOLE DEPTH	220.00
WATER LEVEL	84.90	W.L. DATE	07/19/1982
SCREEN INT.	110.00 - 130.00		
DRILLER	PITCHER		

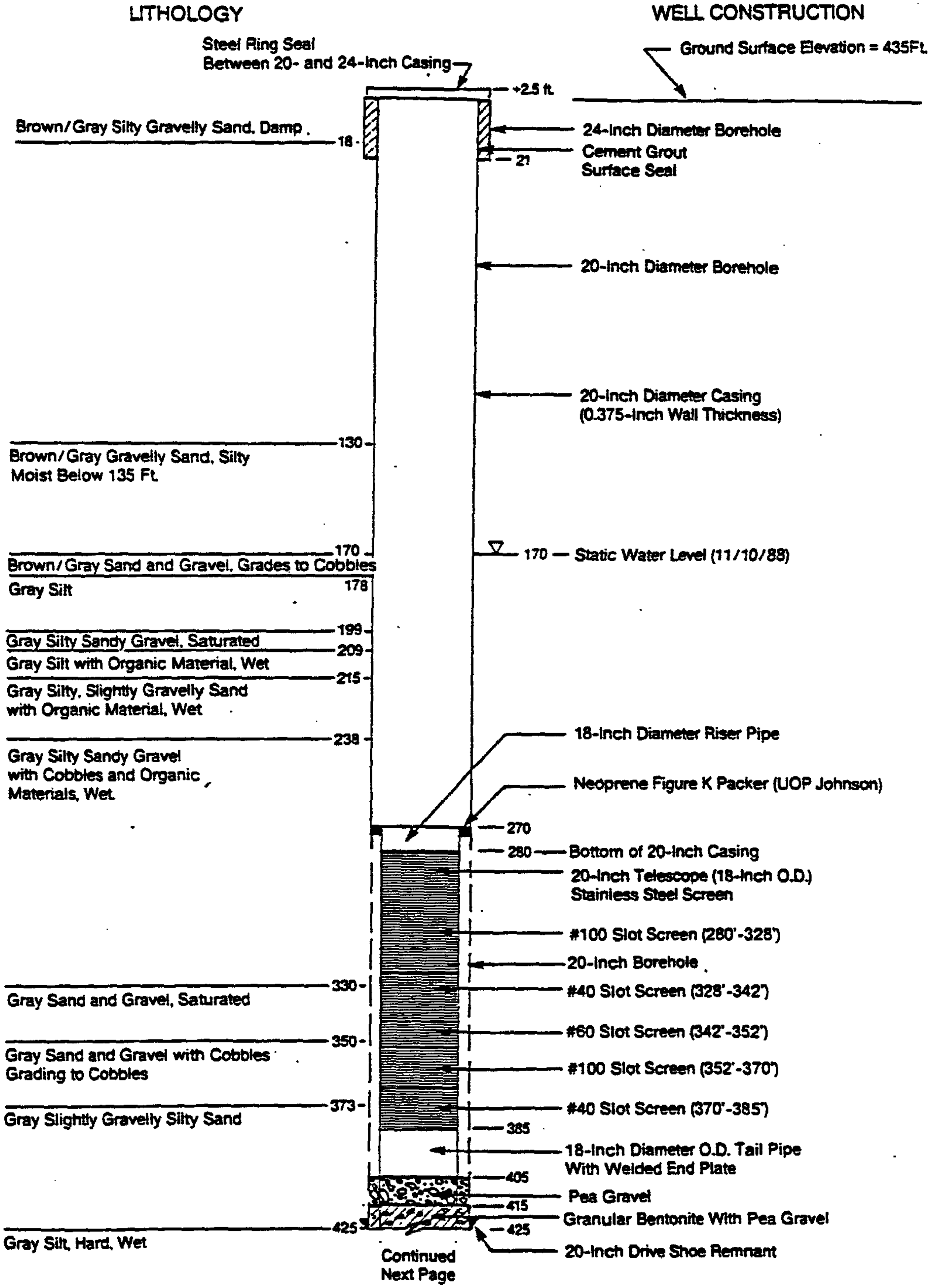
INT NO.	INTVL(FT)	DESCRIPTION
1 :	0- 14	YELLOWISH OR, DENSE SAND AND SILT
2 :	14- 18	GRAY, VERY DENSE, GR SAND AND SILT
3 :	18- 23	GRAY, VERY DENSE, SILT AND SAND
4 :	23- 49	GLACIAL TILL
5 :	49- 106	GRAY, VERY HARD CLAYEY SILT
6 :	106- 112	GRAY, VERY DENSE FINE SAND
7 :	112- 117	GRAY, VERY DENSE SILT
8 :	117- 181	GRAY, VERY DENSE FINE-MED SAND
9 :	181- 197	GRAY, VERY DENSE GRAVEL AND SAND
10 :	197- 204	GRAY, VERY DENSE LAMINATED SD & SLT
11 :	204- 237	WEATHERED BEDROCK

SITEID	472821122160102	LOCAL NUMBER	23N/04E-23D02
LATITUDE	47d28m21s	LONGITUDE	122d16m01s
ALTITUDE	163.10	CONST. DATE	06/02/1982
WELL DEPTH	220.00	HOLE DEPTH	220.00
WATER LEVEL	75.20	W.L. DATE	06/24/1982
SCREEN INT.	180.00 - 200.00		
DRILLER	PITCHER		

INT NO.	INTVL(FT)	DESCRIPTION
1 :	0- 14	YELLOWISH OR, DENSE SAND AND SILT
2 :	14- 18	GRAY, VERY DENSE, GRAVELLY SD & SLT
3 :	18- 23	GRAY, VERY DENSE, SILT AND SAND
4 :	23- 49	GLACIAL TILL
5 :	49- 106	GRAY, VERY HARD CLAYEY SILT
6 :	106- 112	GRAY, VERY DENSE FINE SAND
7 :	112- 117	GRAY, VERY DENSE SILT
8 :	117- 181	GRAY, VERY DENSE FINE-MED SAND
9 :	181- 197	GRAY, VERY DENSE GRAVEL AND SAND
10 :	197- 204	GRAY, VERY DENSE LAMINATED SD & SLT
11 :	204- 237	WEATHERED BEDROCK

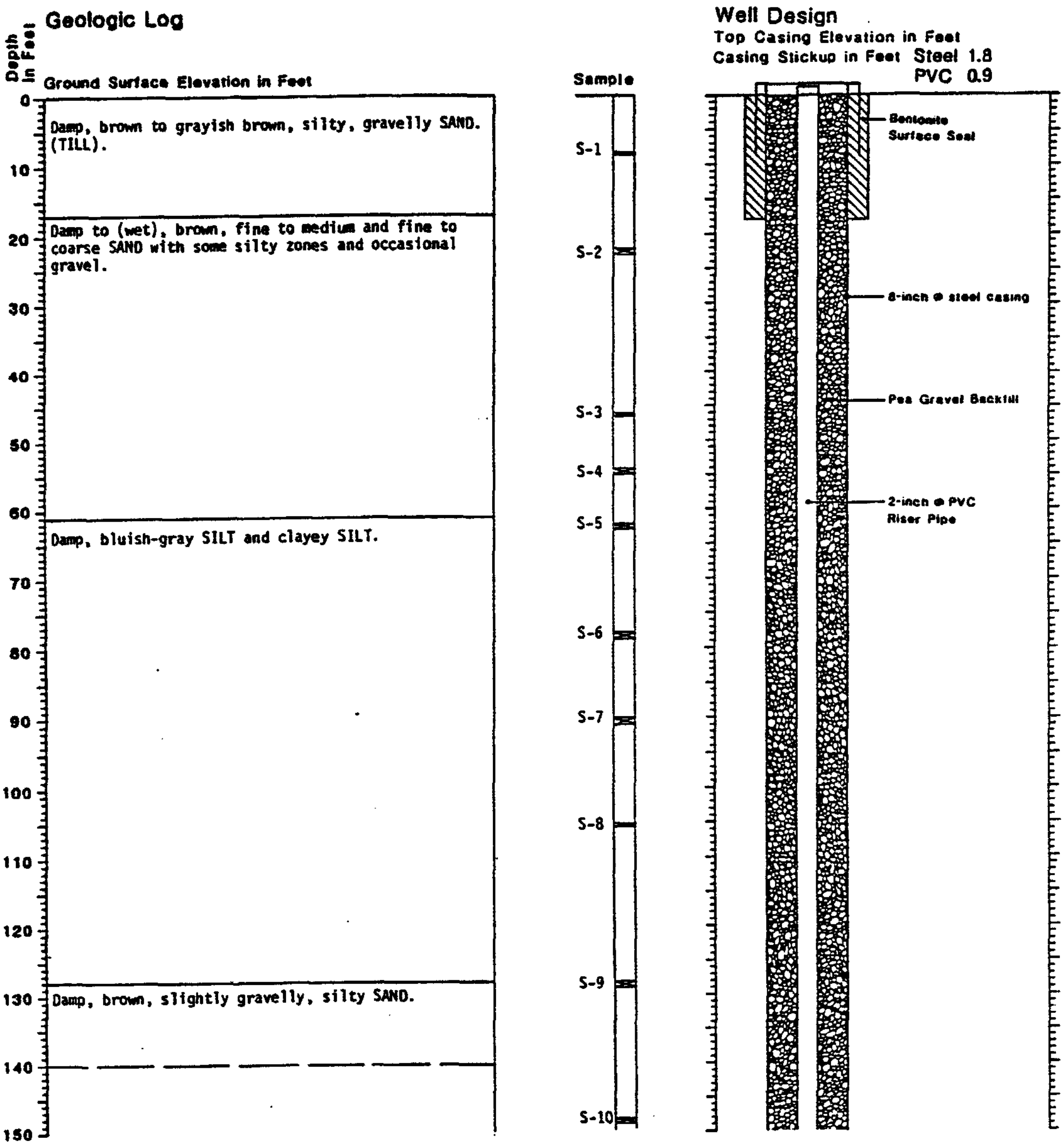
SITEID	472734122150601	LOCAL NUMBER	23N/04E-23R01
LATITUDE	47d27m34s	LONGITUDE	122d15m06s
ALTITUDE	23.00	CONST. DATE	01/01/1961
WELL DEPTH	168.00	HOLE DEPTH	0.00
WATER LEVEL	9.17	W.L. DATE	/ /
DRILLER	DAMES & MOOR		
WELL OWNER	VESTEN INC		

Riverton Heights Well No. 2 (RH-2)



- BOULEVARD PARK -

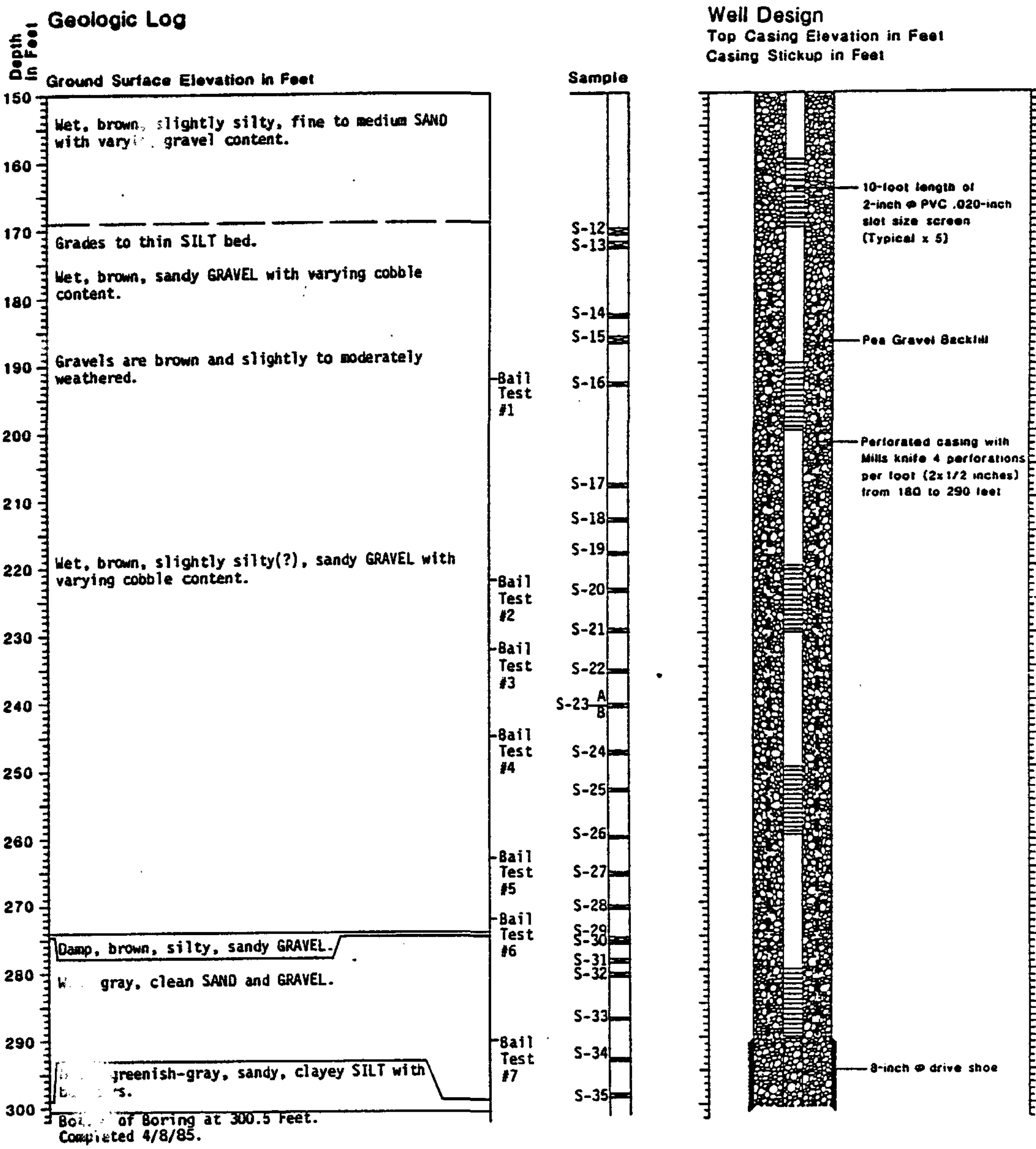
Boring Log and Construction Data for Well OW-2



NOTES: 1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level ▽ is for date indicated and may vary with time of year.
ATD: At Time of Drilling

J-1441 April 1985
HART-CROWSER & associates, inc.
Sheet 1 of 2 Figure A-2

Boring Log and Construction Data for Well OW-2

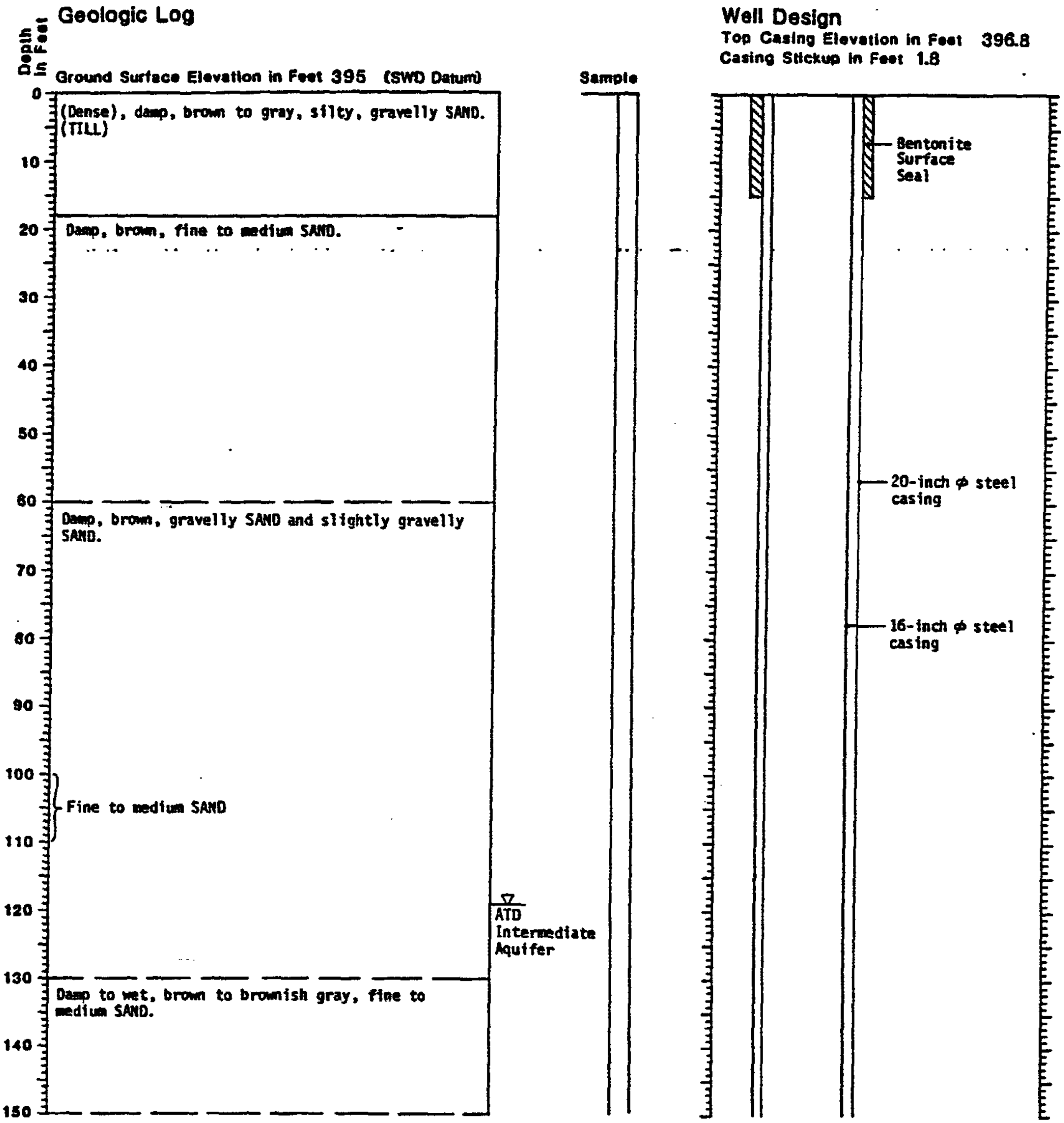


NOTES: 1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level ▽ is for date indicated and may vary with time of year.
ATD: At Time of Drilling

J-1441 April 1985
HART-CROWSER & associates, inc.
Sheet 2 of 2 Figure A-2

- GLACIER HIGH -

Boring Log and Construction Data for Well GHPW-1



NOTES: 1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level ▽ is for date indicated and may vary with time of year.
ATD: At Time of Drilling

J-1441-01 April 1986
HART-CROWSER & associates, inc.
Sheet 1 of 4 Figure 2

Boring Log and Construction Data for Well GHPW-1

Geologic Log

Depth in Feet

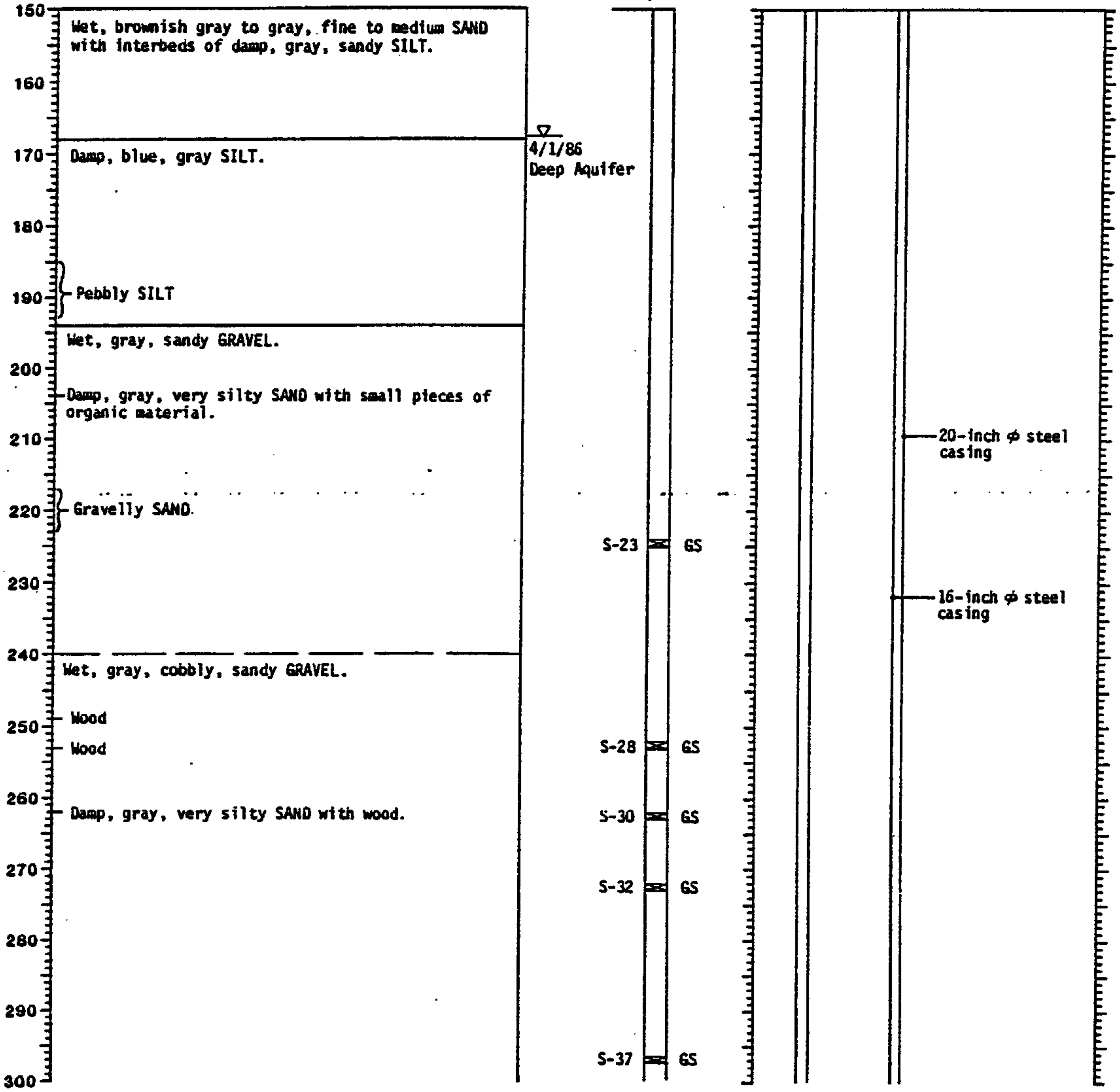
Ground Surface Elevation in Feet 395 (SWD Datum)

Sample

Well Design

Top Casing Elevation in Feet 396.8

Casing Stickup in Feet 1.8



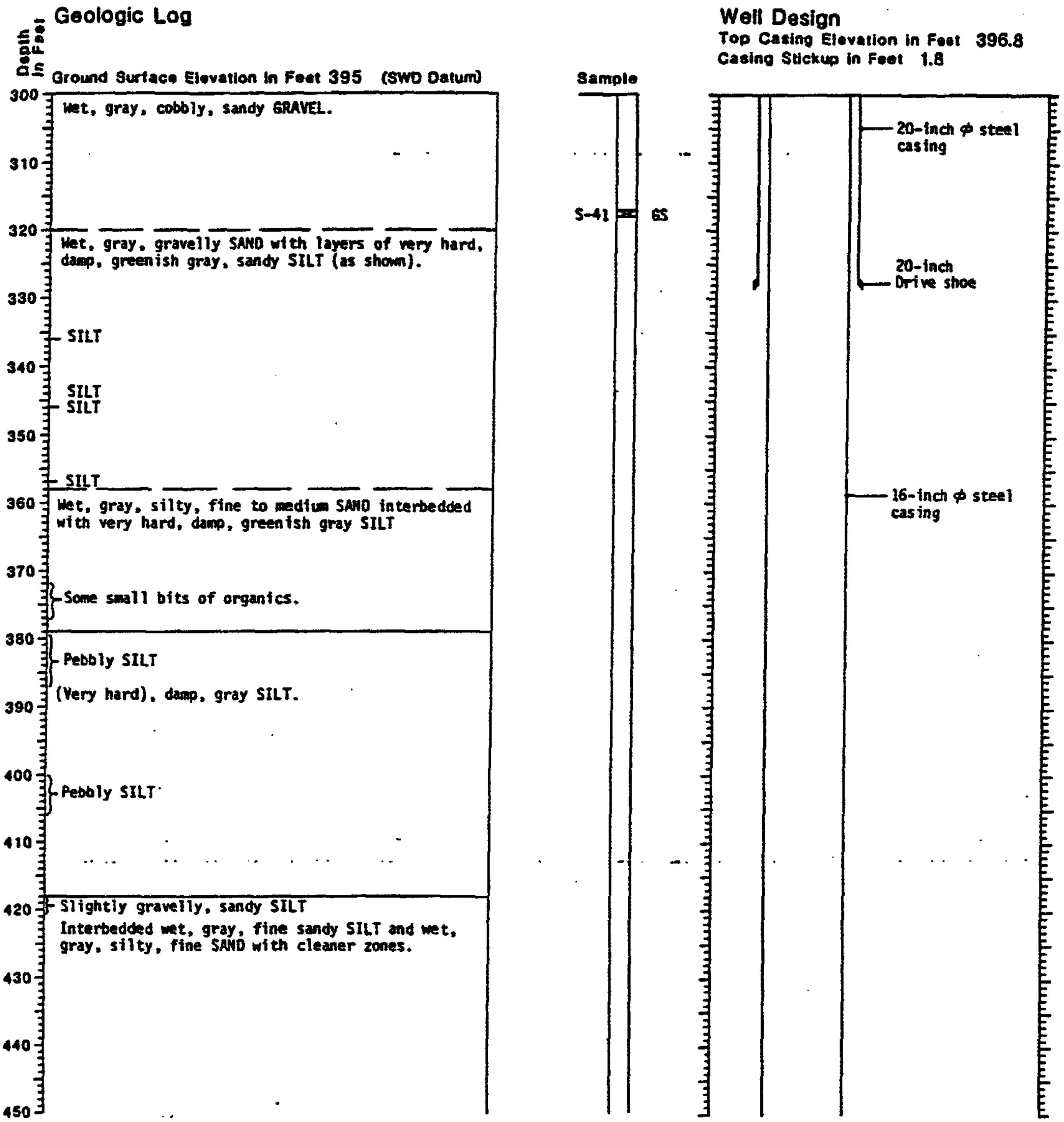
NOTES: 1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level ▽ is for date indicated and may vary with time of year.
ATD: At Time of Drilling

J-1441-01 April 1986

HART-CROWSER & associates, inc.

Sheet 2 of 4 Figure 2

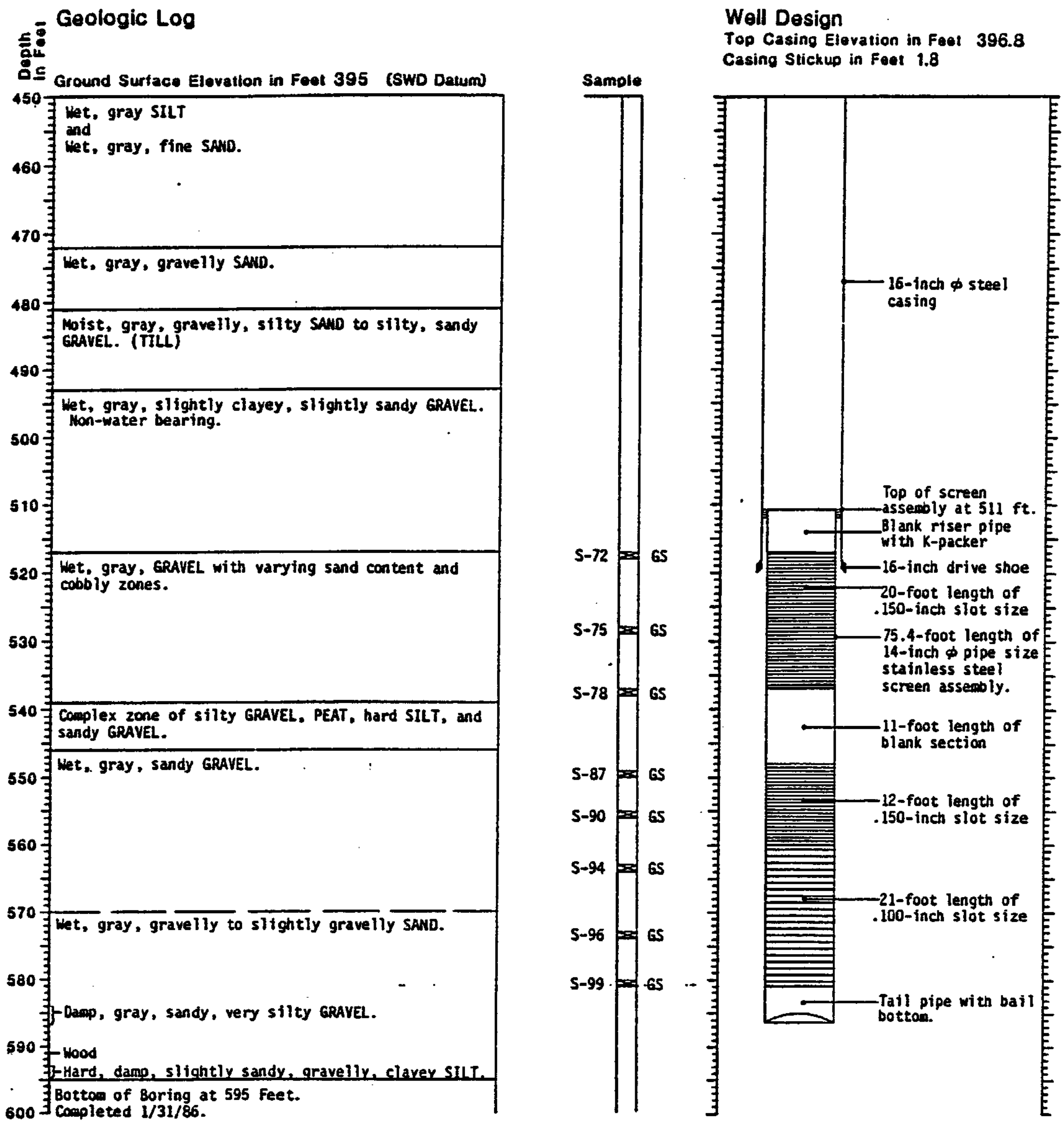
Boring Log and Construction Data for Well GHPW-1



NOTES: 1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level ∇ is for date indicated and may vary with time of year.
ATD: At Time of Drilling

J-1441-01 April 1986
HART-CROWSER & associates, Inc.
Sheet 3 of 4 Figure 2

Boring Log and Construction Data for Well GHPW-1

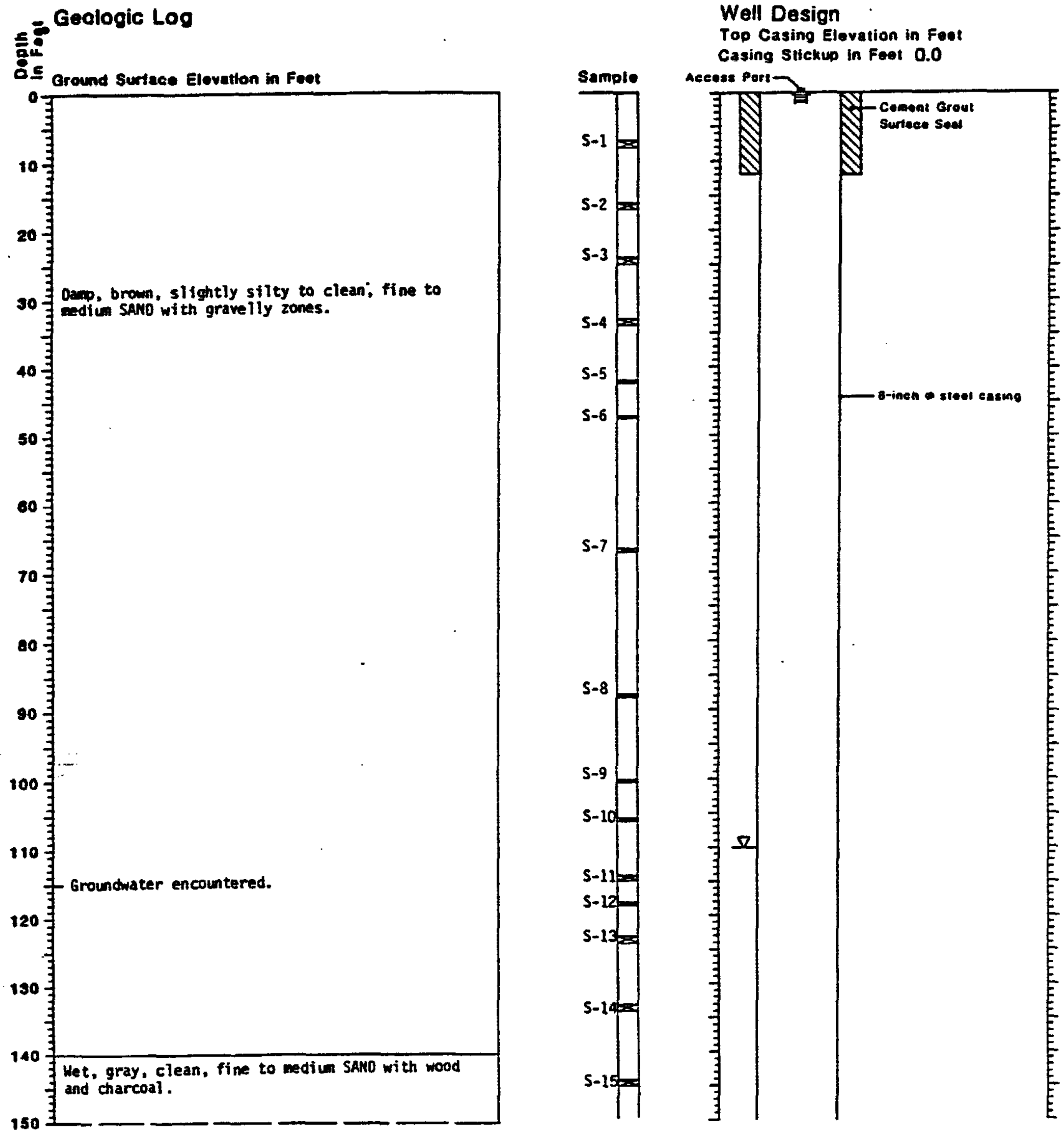


NOTES: 1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level ∇ is for date indicated and may vary with time of year.
ATD: At Time of Drilling

J-1441-01 April 1986
HART-CROWSER & associates, inc.
Sheet 4 of 4 Figure 2

- CRESTVIEW -

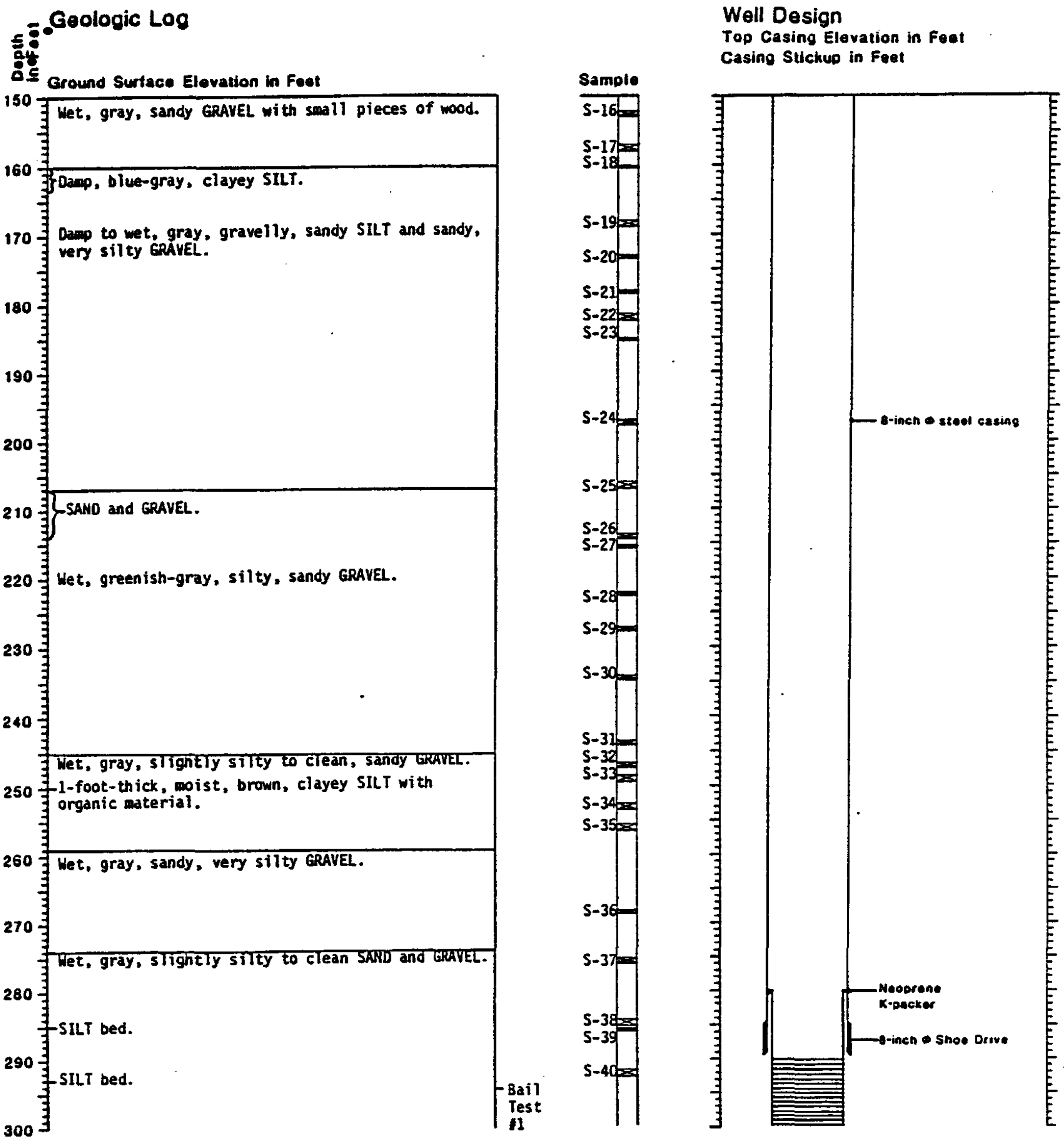
Boring Log and Construction Data for Well OW-1



NOTES: 1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level ▽ is for date indicated and may vary with time of year.
ATD: At Time of Drilling

J-1441 February 1985
HART-CROWSER & associates, inc.
Sheet 1 of 4 Figure A-1

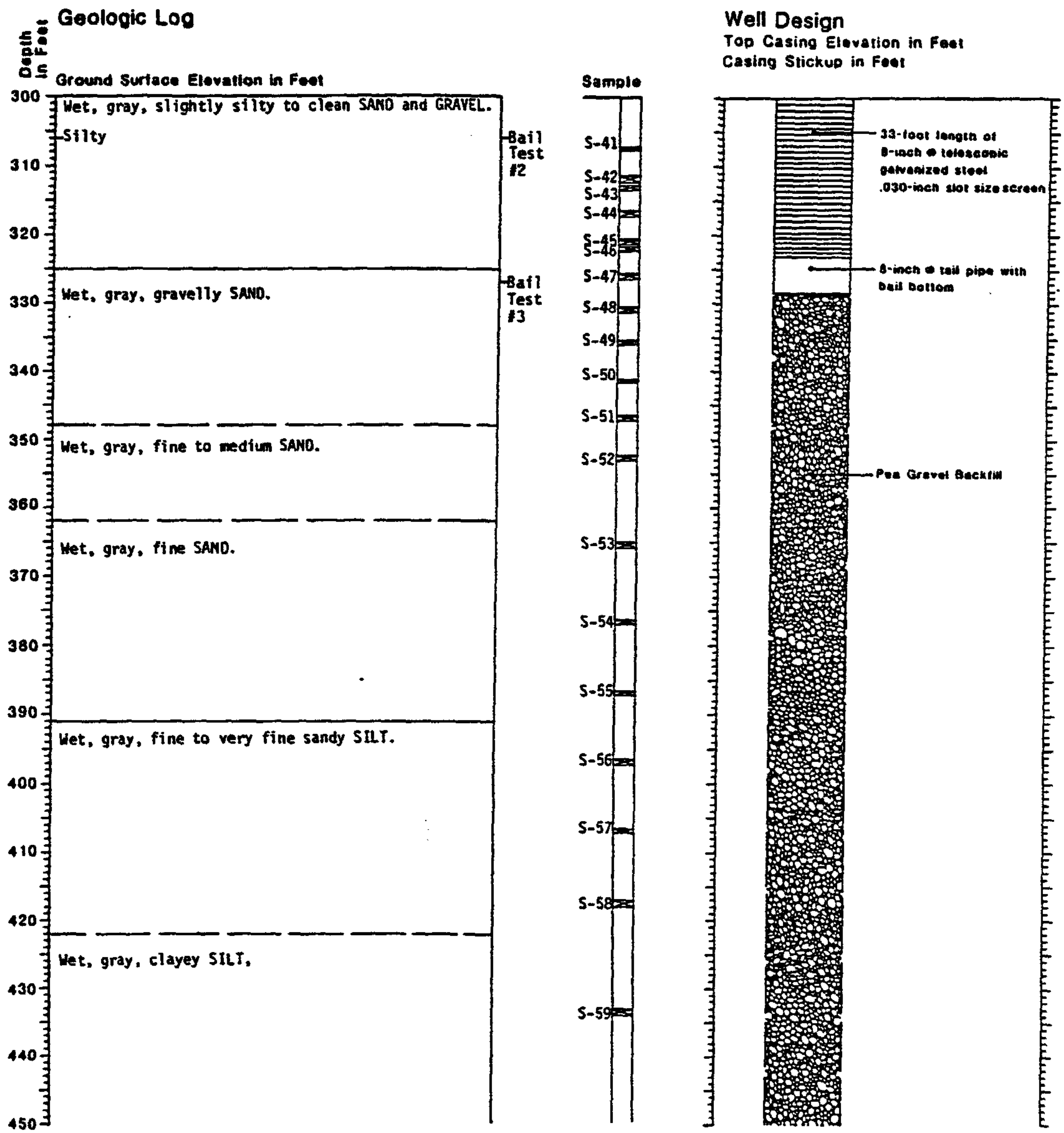
Boring Log and Construction Data for Well OW-1



NOTES: 1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level ∇ is for date indicated and may vary with time of year.
ATD: At Time of Drilling

J-1441 February 1985
HART-CROWSER & associates, inc.
Sheet 2 of 4 Figure A-1

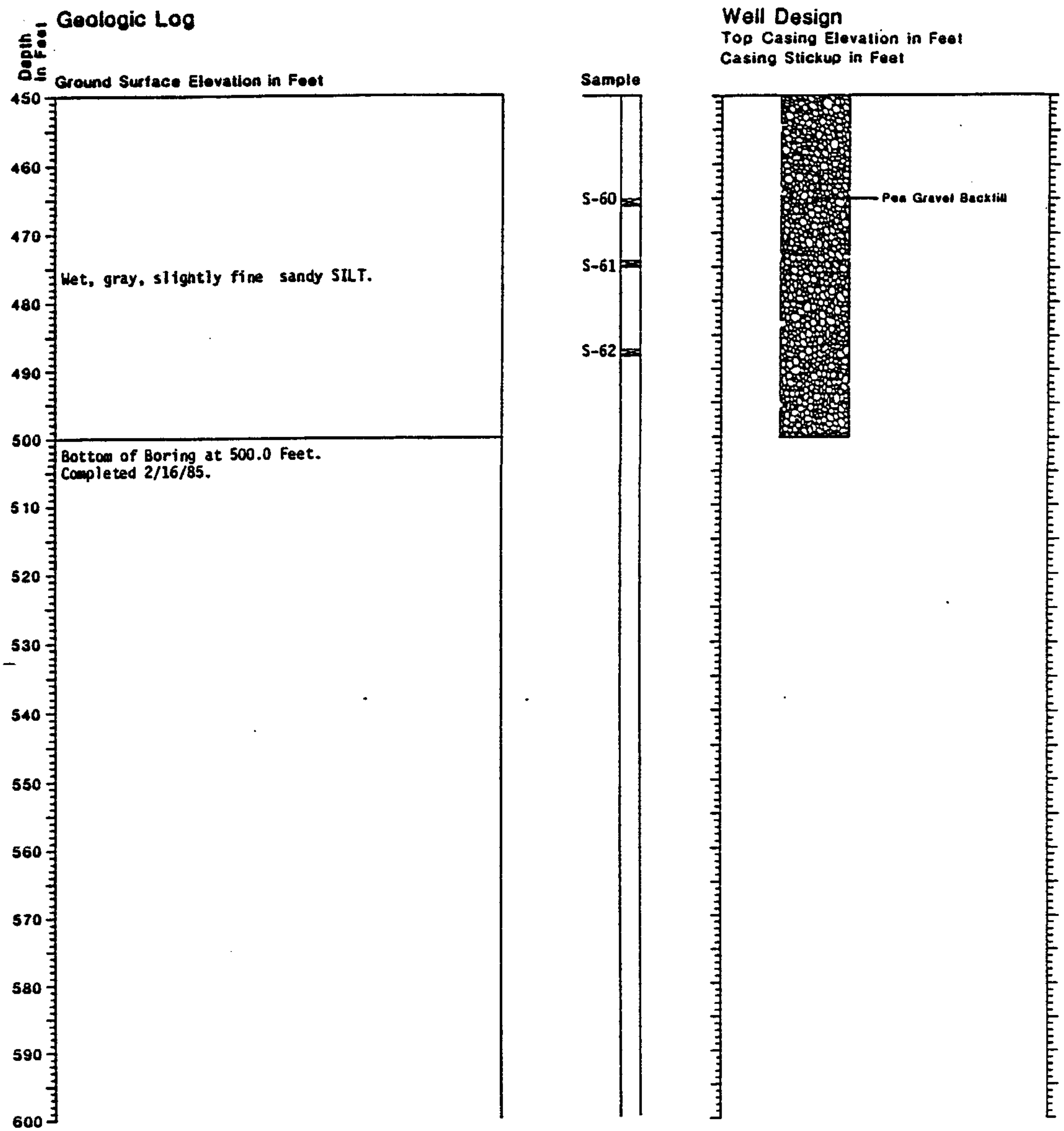
Boring Log and Construction Data for Well OW-1



NOTES: 1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level ∇ is for date indicated and may vary with time of year.
ATD: At Time of Drilling

J-1441 February 1985
HART-CROWSER & associates, inc.
Sheet 3 of 4 Figure A-1

Boring Log and Construction Data for Well OW-1



NOTES: 1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level ∇ is for date indicated and may vary with time of year.
ATD: At Time of Drilling

J-1441 February 1985
HART-CROWSER & associates, inc.
Sheet 4 of 4 Figure A-1

Converse NW

Geologic & Monitoring Well Construction Log

Project Number	Well Number	Sheet
91-35364-06	CMW-8	1 of 7

Project: SeaTac International Airport, Concourse D
Location: Seatac, Washington
Elevation (Top of Well Casing): 392.22
Surface Elevation: 392.78
Water Level Elev.: 303.61
Start Date: April 5, 1993
Drilling Method: Soil Sampling
Finish Date: April 13, 1993
Sampler/Driving Weight: Air Rotary

Depth feet	Well Construction	Other Tests	Blows/6"	OVA (ppm)	Description
	flush mount steel monument QED Well Wizard 4" Cap concrete annular seal				12" Asphalt Pavement FILL
5					
			9 7 13	0	SANDY GRAVELLY SILT; brown, slightly mottled, fine-grained, gravel rounded 1" diameter, medium dense, moist
10	bentonite chip seal				
15					
					GLACIAL TILL
	casing blank, 4" ID Johnson 304 stainless steel		11 40 50/6"	2.6	SANDY SILT WITH GRAVEL; gray, fine to coarse sand, medium to coarse gravel up to 2"; dense, very moist
20					
			25 50/3"	2	SILTY SAND WITH GRAVEL; gray-brown, fine to medium, medium to coarse gravel; dense, moist
25					
		Ch	20 38 50/5"	2.4	SANDY SILT WITH GRAVEL; gray-brown, slightly mottled rust, fine-grained, fine to coarse gravel; dense, moist
30					
					(Transitional till to outwash)
			11 20 33	0	SILTY SAND WITH GRAVEL; gray-brown, fine to medium sand, fine to medium gravel; dense, moist
35					
					ADVANCE GLACIAL OUTWASH SILTY SAND WITH GRAVEL; gray-brown, fine to medium sand, fine to medium gravel; dense, moist
		Ch	32 50/4"	6	

ST - Sampler Type:
- 2" OD Split Spoon Sampler (SPT)
- Grab Sample
- 3.25" OD Ring Sampler

Lab Tests:
Ch - Chemical Properties
(Sample I.D. Number)
Water Level (Date of Measurement)

Logged by: JJS
Approved by: JJS

Figure No. A-5

Converse NW

Geologic & Monitoring Well Construction Log

Project Number	Well Number	Sheet
91-35364-06	CMW-8	2 of 7

Project: SeaTac International Airport, Concourse D
Elevation (Top of Well Casing): 392.22
Water Level Elev.: 303.61
Drilling Method: Soil Sampling
Sampler/Driving Weight: Air Rotary

Location: Seatac, Washington
Surface Elevation: 392.78
Start Date: April 5, 1993
Finish Date: April 13, 1993

Depth feet	Well Construction	Other Tests	Blows/6"	OVA (ppm)	Description
			7 22 36	0.6	SILTY SAND; brown, fine to medium, little medium to coarse gravel; dense, moist
45					
			7 25 38	0.9	grade no gravel
50	bentonite chip seal				
			10 50/6"	7	grade slightly less silt
55					
		Ch	23 50/6"	12	
60					
			14 50/6"	3	SILTY SAND; brown, fine-grained; dense, moist
65					
	high solids bentonite grout seal		10 25 50/6"	0	grade finer-grained, increasing silt
70					
			5 6 28	0	
75					
			6 27 38	0.2	SAND; brown, fine to medium, little silt; dense, moist

ST - Sampler Type:
- 2" OD Split Spoon Sampler (SPT)
- Grab Sample
- 3.25" OD Ring Sampler

Lab Tests:
Ch - Chemical Properties
(Sample I.D. Number)
Water Level (Date of Measurement)

Logged by: JJS
Approved by: JJS

Figure No. A-5

Converse NW

Geologic & Monitoring Well Construction Log

Project Number	Well Number	Sheet
91-35364-06	CMW-8	3 of 7

Project: SeaTac International Airport, Concourse D
Elevation (Top of Well Casing): 392.22
Water Level Elev.: 303.61
Drilling Method: Soil Sampling
Sampler/Driving Weight: Air Rotary

Location: Seatac, Washington
Surface Elevation: 392.78
Start Date: April 5, 1993
Finish Date: April 13, 1993

Depth feet	Well Construction	Other Tests	Blows/ 6"	OVA (ppm)	Description
			13, 33, 50/4"	0	SAND; brown, fine to coarse, trace silt, trace fine gravel; dense, very moist
85					
			30, 50/4"	0	SANDY SILT; brown, fine-grained; dense, very moist
90	ATD 4/16/93 5/18/93				
			13, 25, 50/6"	0.6	SAND; brown, fine to medium, little silt; dense, wet
95					
			32, 50/5"	0	grade coarser sand
100	high solids bentonite grout seal				
					driller reports heaving sand conditions beginning at depth 103 feet
105			35, 50/6"		SAND; brown, fine to coarse, little silt, trace gravel; dense, wet
			40, 120/3"	0.2	SAND; brown, medium to coarse, little silt; dense, wet
			14, 75/4"	0	grade slightly coarser-grained, trace fine gravel
110			43, 75/3"	0	poorly graded, no gravel
			13, 16, 35	0	
115			50/3", 8, 10	0	grade coarser sand, trace fine gravel
			8, 9, 6	0.2	
			10, 13	0.3	GRAVELLY SAND; brown, medium to coarse sand, fine gravel;

ST - Sampler Type:
- 2" OD Split Spoon Sampler (SPT)
- Grab Sample
- 3.25" OD Ring Sampler

Lab Tests:
Ch - Chemical Properties
(Sample I.D. Number)
Water Level (Date of Measurement)

Logged by: JJS
Approved by: JJS

Figure No. A-5

Converse NW

Geologic & Monitoring Well Construction Log

Project Number	Well Number	Sheet
91-35364-06	CMW-8	4 of 7

Project	SeaTac International Airport, Concourse D	Location	Seatac, Washington
Elevation (Top of Well Casing)	392.22	Surface Elevation	392.78
Water Level Elev.	303.61	Start Date	April 5, 1993
Drilling Method	Soil Sampling	Finish Date	April 13, 1993
Sampler/Driving Weight	Air Rotary		

Depth feet	Well Construction	Other Tests	Blows/6"	OVA	Description
			12	(ppm)	medium dense, wet
			4		increasing gravel, well-rounded, 1/4" diameter
			9	0.2	GRAVELLY SAND; brown, medium to coarse sand, fine gravel,
			13		6" thick clean gravel layer; loose, wet
			22		
			22	0.4	less distinct gravel layers
			12		cobble-size gravel stuck in discharge line at depth 124 feet
			8		
125			4	0.7	
			11		
			50/6"		
			50/0"		no sample collected at depth 127-129 feet due to extreme sand heave conditions, 10' of heave inside drill rods
			20		
			25		
			23	0	cobble clogging discharge line at depth 129 feet
			50/3"		SAND; brown, medium to coarse, trace fine gravel; loose, wet
130			1		
			3		
			8	0.6	SILTY SAND WITH GRAVEL; brown, fine to coarse, fine gravel; dense, wet
			12		
			14		change bit to downhole hammer- gravel clogging tricone bit
			40		coarse to cobble-size gravel exiting discharge at 133 feet
			50/3"		Drill through gravel zone- clean gravel observed exiting discharge between depths 133 and 135 feet
135				0.1	SAND; gray, little gravel, trace silt; wet
	high solids bentonite grout seal				PRE-VASHON INTERGLACIAL
					GRAVELLY SAND; greenish gray, coarse sand, medium well-rounded gravel; wet
140				0.2	
					wood fragments observed in cuttings, gravel abundant, discharge color change to dark brown, organic-rich zone
145				0	SAND; green-gray, fine to coarse, little gravel, trace silt, wood debris; wet
					abundant gravel 1"-2" diameter exiting discharge
150				0	SAND WITH GRAVEL; green-gray, medium to coarse, medium gravel; wet
	QED Well Wizard Purge Pump Intake				
155				0	

ST - Sampler Type:
- 2" OD Split Spoon Sampler (SPT)
- Grab Sample
- 3.25" OD Ring Sampler

Lab Tests:
- Ch - Chemical Properties
- (Sample I.D. Number)
- Water Level (Date of Measurement)

Logged by: JJS
Approved by: JJS

Figure No. A-5

Converse NW

Geologic & Monitoring Well Construction Log

Project Number	Well Number	Sheet
91-35364-06	CMW-8	5 of 7

Project SeaTac International Airport, Concourse D
Location Seatac, Washington
Elevation (Top of Well Casing) 392.22
Surface Elevation 392.78
Water Level Elev. 303.61
Start Date April 5, 1993
Drilling Method Soil Sampling
Finish Date April 13, 1993
Sampler/Driving Weight Air Rotary

Depth feet	Well Construction	Other Tests	ST	Blows/6"	OVA (ppm)	Description
						SAND; green-gray, medium to coarse; wet
						driller reports gravel zone, coarse gravel exiting discharge between 162-165 feet
165					0	SANDY GRAVEL; green-gray, medium, medium to coarse sand, well-rounded; wet CLAYEY GRAVEL; gray, stringer of clay grade back into clean sandy gravel, wood debris driller estimates 20-30 gpm of water out of discharge
170					0	SANDY GRAVEL; very clean, no fines, productive water bearing zone
175					0	
	high solids bentonite grout seal					grade to SILTY SAND WITH GRAVEL; gray, fine to coarse
180					0	SANDY GRAVEL; green-gray, fine to coarse, medium to coarse sand, trace silt; wet decrease in discharge
					0.3	gray silty sand out of discharge line, very fine-grained
185					0	SILTY SAND; gray, fine-grained, white volcanic ash fragments observed in cuttings; wet decrease in water yield < 5 gpm
190					0	
195					0	

ST - Sampler Type:
- 2" OD Split Spoon Sampler (SPT)
- Grab Sample
- 3.25" OD Ring Sampler

Lab Tests:
Ch - Chemical Properties
(Sample I.D. Number)
Water Level (Date of Measurement)

Logged by: JJS
Approved by: JJS

Figure No. A-5

Converse NW

Geologic & Monitoring Well Construction Log

Project Number	Well Number	Sheet
91-35364-06	CMW-8	6 of 7

Project: SeaTac International Airport, Concourse D
Location: Seatac, Washington
Elevation (Top of Well Casing): 392.22
Surface Elevation: 392.78
Water Level Elev.: 303.61
Start Date: April 5, 1993
Drilling Method: Soil Sampling
Finish Date: April 13, 1993
Sampler/Driving Weight: Air Rotary

Depth feet	Well Construction	Other Tests	ST	Blows/6"	OVA (ppm)	Description
205					0	SILTY SAND; gray, fine-grained, wet heavy sand heave conditions encountered
210	high solids bentonite grout seal				0.1	
215					0	
220	8/12 Colorado silica sand pack				0	grade slightly coarser sand
						little coarse gravel observed exiting discharge
225					0.2	SILTY SAND; gray, fine-grained, few coarse gravel, white volcanic ash observed in sample; wet
	stainless steel centralizer					increasing sand grain size, grade less silt
230	well screen, 4" ID Johnson 304 stainless steel, 0.020" slot size				0	SILTY SAND; gray, fine to coarse, wet
						increasing gravel
235					0	SILTY GRAVELLY SAND; gray, fine to coarse sand, fine to medium gravel; wet increase in water discharge, approximately 10 gpm
						color change to green-gray, harder drilling

ST - Sampler Type:
- 2" OD Split Spoon Sampler (SPT)
- Grab Sample
- 3.25" OD Ring Sampler

Lab Tests:
- Ch - Chemical Properties
- (Sample I.D. Number)
- Water Level (Date of Measurement)

Logged by: JJS
Approved by: JJS
Figure No. A-5

Converse NW

Geologic & Monitoring Well Construction Log

Project Number	Well Number	Sheet
91-35364-06	CMW-8	7 of 7

Project: SeaTac International Airport, Concourse D
Elevation (Top of Well Casing): 392.22
Water Level Elev.: 303.61
Drilling Method: Soil Sampling
Sampler/Driving Weight: Air Rotary

Location: Seatac, Washington
Surface Elevation: 392.78
Start Date: April 5, 1993
Finish Date: April 13, 1993

Depth feet	Well Construction	Other Tests	ST	Blows/6"	OVA	Description
					0.1	green-gray, clayey silt clods in sample driller reports harder drilling
245					0	SILTY SAND WITH GRAVEL; green-gray, fine to coarse sand, medium gravel, some clayey silt clods; wet discharge of water approximately 10 gpm
	stainless steel centralizer					
	QED Well Wizard Sample Pump Intake				0	CLAYEY SILT; olive green, fine-grained, little gravel and fine sand out of discharge
	sediment sump, 4" ID			17 28	0	CLAYEY SILT; green-gray, very fine-grained; hard, moist
250	Johnson 304 stainless steel			48		Bottom of boring at depth 248.5 feet Monitoring well installed to depth 249.52 feet Soil sampler driven using 300-pound hammer falling 30-inches
255						
260						
265						
270						
275						

ST - Sampler Type:
- 2" OD Split Spoon Sampler (SPT)
- Grab Sample
- 3.25" OD Ring Sampler

Lab Tests:
Ch - Chemical Properties
(Sample I.D. Number)
Water Level (Date of Measurement)

Logged by: JJS
Approved by: JJS

Figure No. A-5

INT NO.	INTVL(FT)	DESCRIPTION
1 :	0- 58	DIRTY SAND AND SMALL GRAVEL, DRY
2 :	58- 104	DIRTY SAND AND GRAVEL
3 :	104- 113	CLAY, BLUE
4 :	113- 126	GRAVEL & SAND, DIRTY
5 :	126- 197	SANDY BLUE CLAY
6 :	197- 220	HARDPAN, BLUE
7 :	220- 250	GRAVEL WITH CLAY AND SAND
8 :	250- 260	GRAVEL AND BOULDERS
9 :	260- 308	BOULDERS, GRAVEL & SOME CLAY
10 :	308- 350	CLAY, BLUE AND GRAVEL
11 :	350- 380	CLAY, SANDY, BLUE
12 :	380- 401	GRAVEL SAND AND SOME CLAY
13 :	401- 490	SANDY CLAY, BLUE
14 :	490- 537	SANDY CLAY
15 :	537- 569	CLAY SANDY GRAY
16 :	569- 645	CLAY, GREEN & BLUE
17 :	645- 652	SAND, HARD CLAY, CEMENT

SITEID	472539122174701	LOCAL NUMBER	23N/04E-33B01
LATITUDE	47d26m38s	LONGITUDE	122d17m54s
ALTITUDE	364.00	CONST. DATE	10/ /1943
WELL DEPTH	324.00	HOLE DEPTH	396.00
WATER LEVEL	60.00	W.L. DATE	01/01/1943
SCREEN INT.	85.00 - 321.00		
DRILLER	N C JANNSEN		
WELL OWNER	PORT OF SEATTLE		

B1

INT NO.	INTVL(FT)	DESCRIPTION
1 :	0- 32	GRAVEL AND BOULDERS
2 :	32- 45	SAND
3 :	45- 59	SAND AND GRAVEL
4 :	59- 64	SAND
5 :	64- 105	SAND AND GRAVEL, W.B.
6 :	105- 111	BOULDERS
7 :	111- 113	HARDPAN
8 :	113- 137	CLAY
9 :	137- 143	CLAY AND GRAVEL
10 :	143- 224	GRAVEL, SAND, AND CLAY
11 :	224- 247	BLUE CLAY
12 :	247- 290	CLAY WITH GRAVEL
13 :	290- 321	GRAVEL, W.B.
14 :	321- 396	CLAY, BLUE

SITEID	472608122174401	LOCAL NUMBER	23N/04E-33J01
LATITUDE	47d26m05s	LONGITUDE	122d17m28s
ALTITUDE	375.00	CONST. DATE	10/17/1974
WELL DEPTH	61.00	HOLE DEPTH	61.00
WATER LEVEL	44.00	W.L. DATE	10/18/1974
DRILLER	NW PUMP		
WELL OWNER	SMITH, ROBERT		

INT NO.	INTVL(FT)	DESCRIPTION
1 :	0- 3	TOPSOIL
2 :	3- 54	BROWN GLACIAL TILL
3 :	54- 58	BROWN SAND
4 :	58- 61	WATER BEARING SAND AND GRAVEL

SITEID	472633122172401	LOCAL NUMBER	23N/04E-34C02
LATITUDE	47d26m39s	LONGITUDE	122d17m08s
ALTITUDE	395.00	CONST. DATE	12/15/1960
WELL DEPTH	388.00	HOLE DEPTH	388.00
WATER LEVEL	112.00	W.L. DATE	11/01/1961
SCREEN INT.	152.00 - 189.00		
DRILLER			
WELL OWNER	KCWD 75		

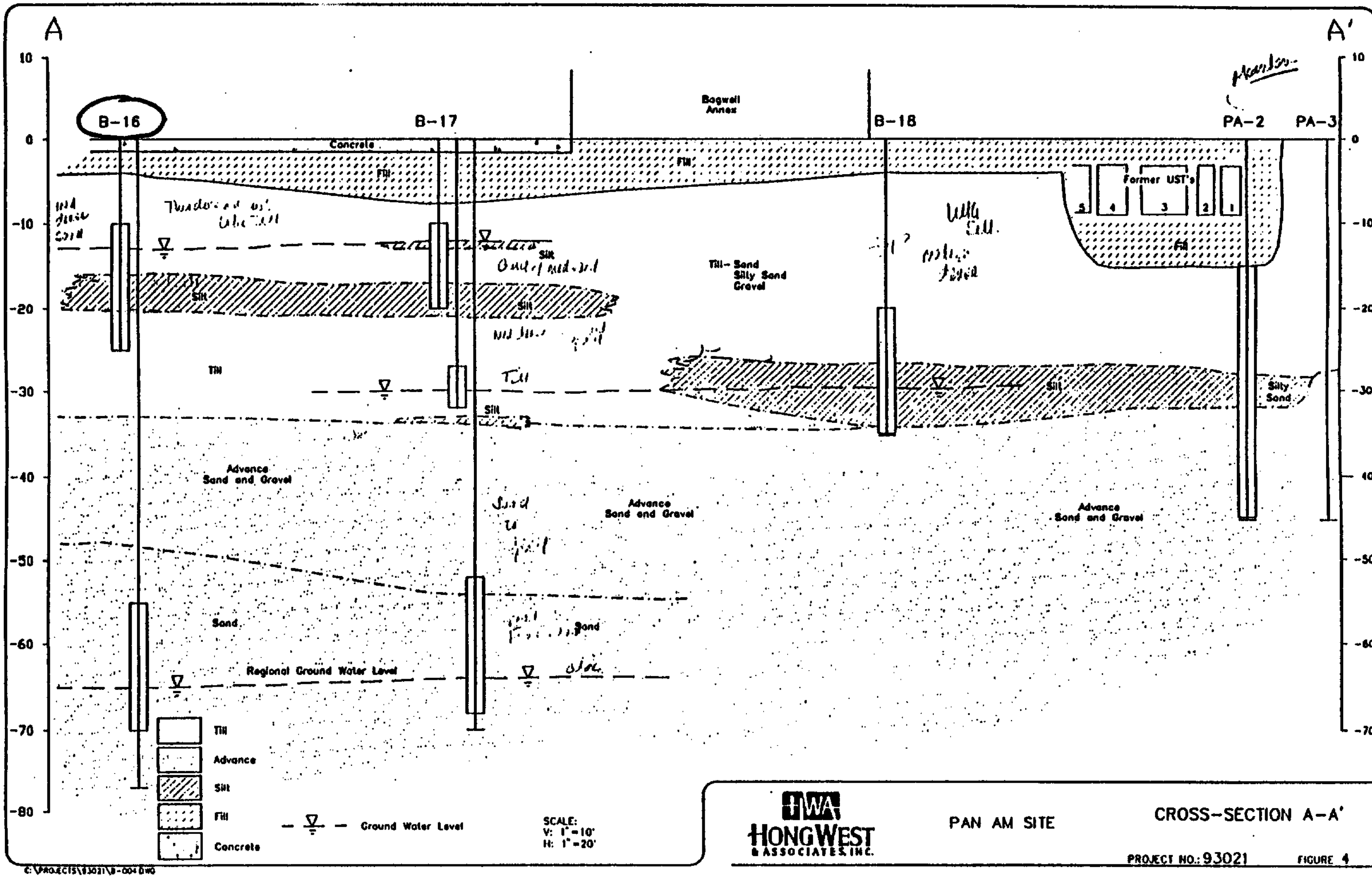
INT NO.	INTVL(FT)	DESCRIPTION
1 :	0- 3	TOPSOIL
2 :	3- 15	CLAY AND GRAVEL
3 :	15- 63	HARDPAN
4 :	63- 67	SAND, GRAVEL AND WATER
5 :	67- 133	CLAY, SAND AND GRAVEL
6 :	133- 139	CLAY, MULTI-COLORED AND PEAT
7 :	139- 151	CLAY, GREEN, SOME SAND AND GRAVEL
8 :	151- 190	WATER, SAND, GRAVEL SPECKS AND CLAY
9 :	190- 238	SAND AND GRAVEL, CEMENTED
10 :	238- 247	CLAY, SAND AND GRAVEL
11 :	247- 388	CLAY, BLUE; SOME SHALE

SITEID	472641122171801	LOCAL NUMBER	23N/04E-34D02
LATITUDE	47d26m41s	LONGITUDE	122d17m18s
ALTITUDE	450.00	CONST. DATE	01/16/1961
WELL DEPTH	189.00	HOLE DEPTH	388.00
WATER LEVEL	112.00	W.L. DATE	01/16/1961
SCREEN INT.	152.00 - 189.00		
DRILLER			

INT NO.	INTVL(FT)	DESCRIPTION
1 :	0- 3	TOP SOIL
2 :	3- 15	CLAY AND GRAVEL
3 :	15- 63	HARDPAN-CEMENTED SAND AND GRAVEL
4 :	63- 67	SAND, GRAVEL AND WATER
5 :	67- 133	CLAY, SAND AND GRAVEL
6 :	133- 139	MULTI-COLORED CLAY AND PEAT
7 :	139- 151	GREEN CLAY, SOME SAND AND GRAVEL
8 :	151- 190	WATER, SAND, GR SPECKS AND CLAY
9 :	190- 238	CEMENTED SAND AND GRAVEL
10 :	238- 247	CLAY, SAND AND GRAVEL
11 :	247- 388	BLUE CLAY, SOME SHALE

SITEID	472625122165401	LOCAL NUMBER	23N/04E-34F02
LATITUDE	47d26m25s	LONGITUDE	122d16m54s
ALTITUDE	397.00	CONST. DATE	00/00/1958
WELL DEPTH	245.00	HOLE DEPTH	247.00
WATER LEVEL	109.00	W.L. DATE	08/06/1958
SCREEN INT.	197.00 - 205.00		
DRILLER	GAUDIO		
WELL OWNER	KCWD 75		

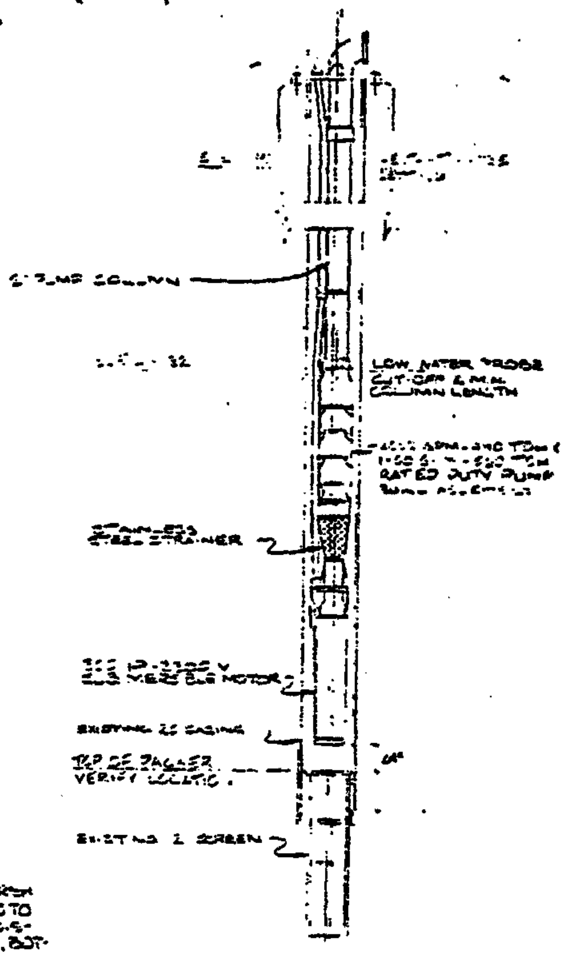
INT NO.	INTVL(FT)	DESCRIPTION
1 :	0- 12	TOP SOIL AND CLAY
2 :	12- 32	CLAY, SANDY
3 :	32- 53	HARDPAN
4 :	53- 68	SAND, BROWN, TIGHT



PAN AM SITE

CROSS-SECTION A-A'

PROJECT NO.: 93021 FIGURE 4



SUBMERSIBLE PUMP (2/4)
NO SCALE

...GE GUAGE-MARSH
...UAGE #245, 0 TO
...PSI PUMP 3-5"
...DIA. DIAL, BOT-
...NECTION

...GE COCK

PIGTAIL

...SS TEE W/PLUG

TAP W/¾"-125# BRONZE COCK, NO. 2... OR EQUAL

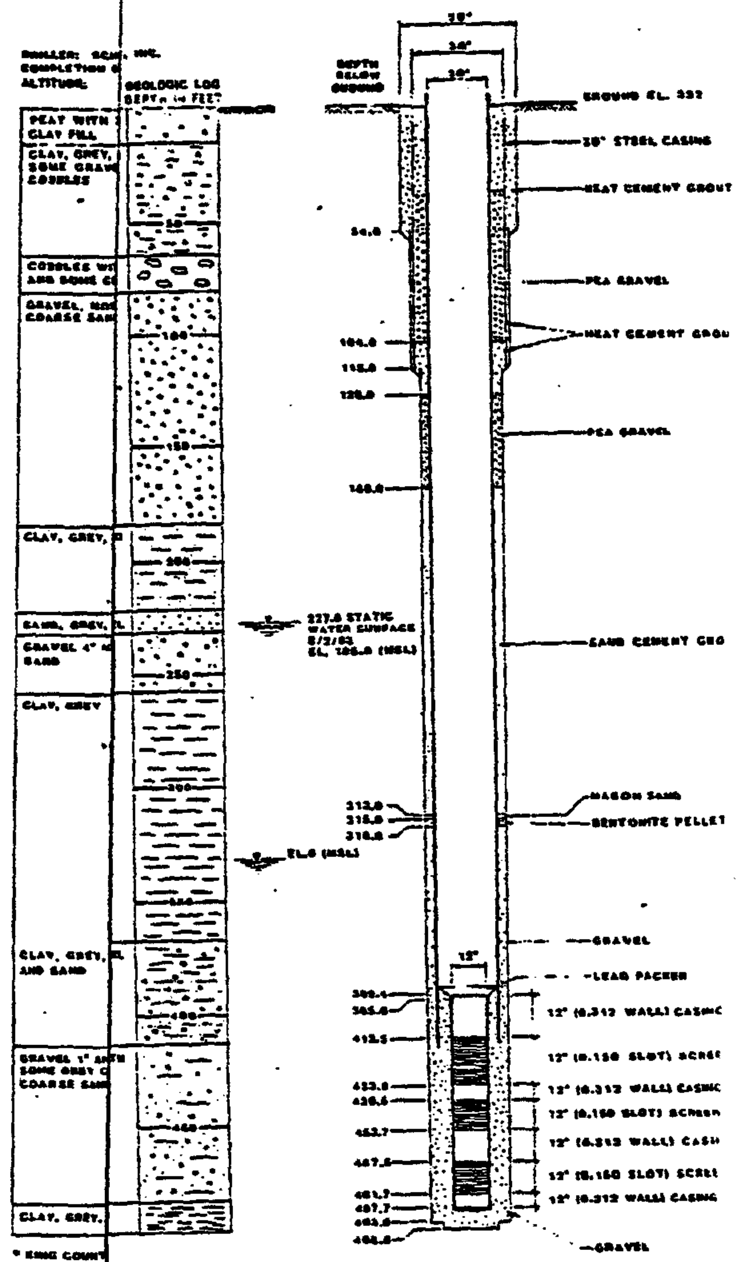
PRESSURE GUAGE (5/4)

...EASE VALVE APCO NO. 55 OR EQUAL

...SSURE VACUUM BREAKER & HOSE BIBB

... W/ ¾"-125# BRONZE COCK, ... OR EQUAL

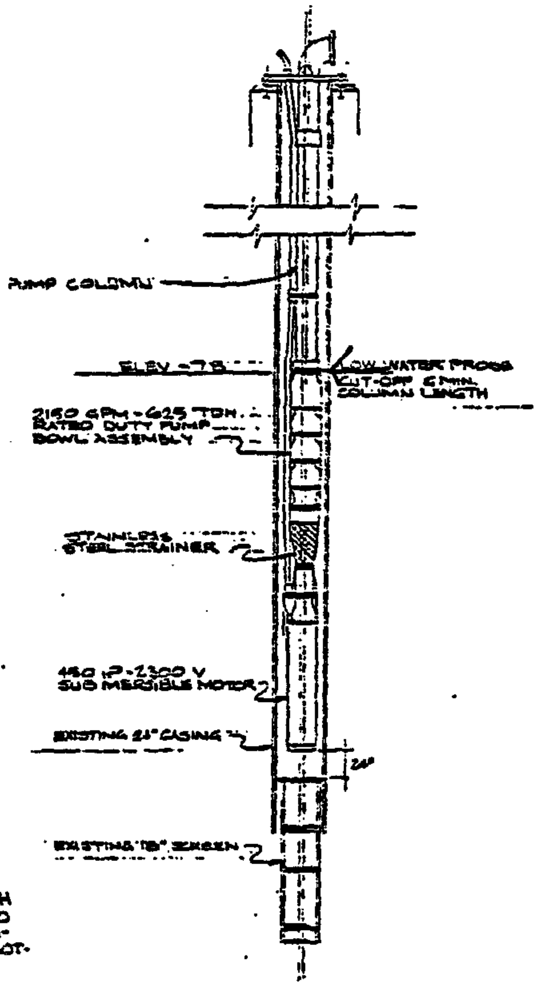
...SE VALVE (5/4)



ANGLE LAKE WELL
AS BUILT DIAGRAM AND LOG
GROUND WATER SUPPLY
SE 1/4, SEC 9, T22N, R45E

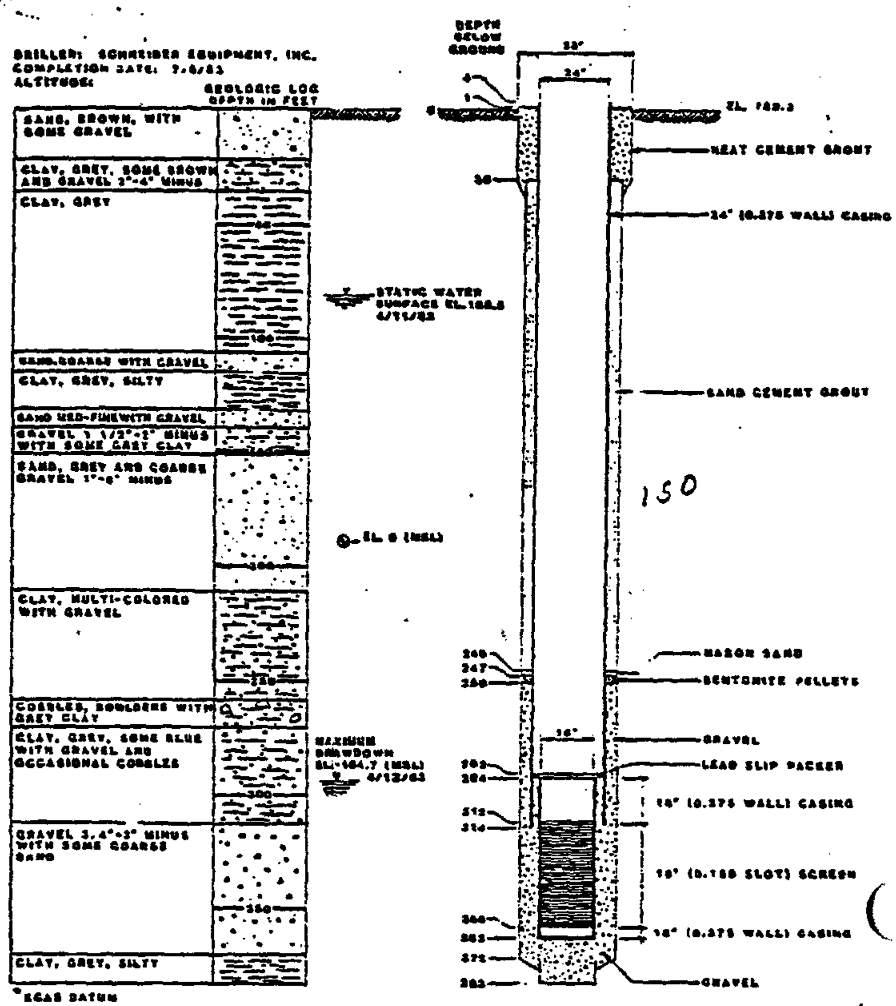
...ND, COLLIER & WADE-LIVINGSTONE ASSOCIATES, INC.
CONSULTING ENGINEERS
... STONE WAY N. SEATTLE WASHINGTON ...
(206) ...

Water District No. 75, King County
ANGLE LAKE WELL & PUMP STATION
PHASE 2
MECHANICAL DETAILS



SUBMERSIBLE PUMP (2/4)

NO SCALE



*EGAS DATUM

...RONZE COCK, ...UAL

... GUAGE (3/4)

APCO NO. 55 OR EQUAL

...UUM BREAKER & HOSE BIBB

... BRONZE COCK, ...UAL

...E (5/4)

DES MOINES WELL
AS BUILT DIAGRAM AND LOG
GROUND WATER SUPPLY
NE 1/4, SEC 8, T22N, R4E

...LLIER & WADE-LIVINGSTONE
...SSOCIATES, INC.
... ENGINEERS

Water District No. 75, King County

DES MOINES WELL & PUMP STATION

MECHANICAL DETAILS

DRAWN HCW
KCW
CON
SHEET

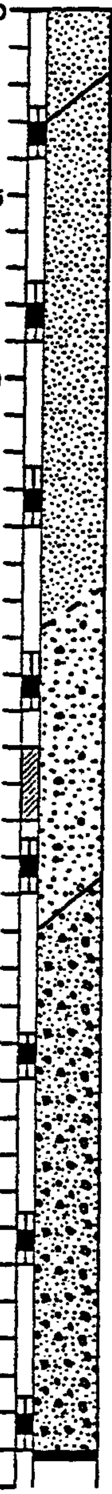
P.O.S. Coordinates: N 3480 E 12,710

Equipment: Mobile B-61

Land Surface Elevation: 243 feet Date: 12/2/94

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot
MD	2.5	104	21
MD	13.4	96	16
MD	4.6	99	24
MD,SA	2.9	132	29
COMP			
MD	5.7	144	90
			60
MD,SA	6.8	142	80
MD	4.4	132	81

Depth (feet): 0, 5, 10, 15, 20, 25, 30, 35, 40



BROWN SAND (SP) loose, wet; fine to medium grained, with organic material (Recessional Outwash - Unit 1).

GRAY BROWN SAND (SP) medium dense, moist; fine to coarse grained, with a trace of gravel (Recessional Outwash - Unit 1).

Becomes red brown.

GRAY SAND (SW) dense, moist; fine to coarse grained, with gravel and a trace of silt (Recessional Outwash - Unit 2).

Becomes very dense, wet; with fine to medium gravel.

GRAY GRAVEL (GW) very dense, saturated; fine to coarse grained, with sand and a trace of silt (Recessional Outwash - Unit 2).

Becomes brown.

Groundwater encountered at 25.5 feet during drilling. Boring backfilled with bentonite and cuttings on 12/2/94.

AGI TECHNOLOGIES

Log of Area 3 Boring 4

HNTB/Runway Borrow Source Study
SeaTac, Washington

PLATE **A19**

	PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
H3mw.cdr	14,190.208	ECR	6 December 94			

P.O.S. Coordinates: N 3365 E 14.840

Equipment Mobile B-61

Land Surface Elevation 297 feet Date 12/23/94

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot
MD	15.1	119	18
			50/5"
MD	7.7	124	50/3"
			50/4"
			50/1"
M	6.6		50/3"
			50/3"
MD	11.3	122	50/5"

Depth (feet): 0, 5, 10, 15, 20, 25, 30, 35, 40

BROWN-GRAY SILTY SAND (SM) medium dense, wet; fine to medium grained, with gravel (Fill).

GRAY SILTY SAND (SM) very dense, moist; fine to coarse grained, with fine gravel (Till - Unit 1).

With some wet interbedded sand zones.

AGI TECHNOLOGIES

Log of Area 1 Boring 8 (0-40')

HNTB/Runway Borrow Source Study

SeaTac, Washington

PLATE A10a

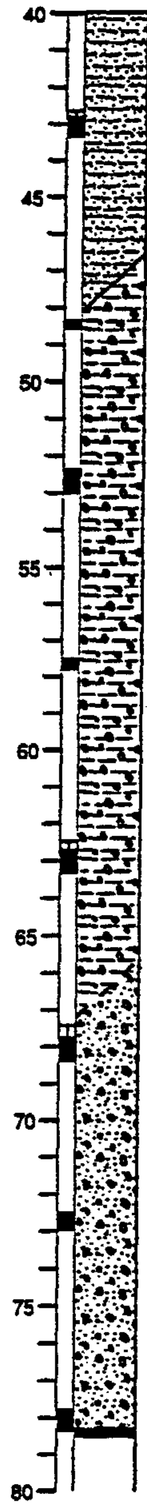
	PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
H1Bmw.cdr	14,190.208	ECR	6 December 94			

P.O.S. Coordinates: N 3365 E 14,840

Equipment Mobile B-61

Land Surface Elevation 297 feet Date 12/23/94

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample
			50/4"		
			50/2"		
MD	12.3	115	50/5"		
			50/3"		
			50/2"		
MD	10.5	129	50/3"		
			50/4"		
			50/5"		



BROWN SILTY GRAVEL (GM) very dense, wet; fine grained, with sand (Advance Outwash - Unit 3).

GRAY GRAVEL (GP-GM) very dense, wet; fine grained, with silt and sand (Advance Outwash - Unit 3).

Groundwater encountered at 71.5 feet during drilling. Boring backfilled with bentonite and cuttings on 12/23/94.

AGI TECHNOLOGIES

Log of Area 1 Boring 8 (40-78.4')

HNTB/Runway Borrow Source Study
SeaTac, Washington

PLATE **A10b**

	PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
H1-40.cdr	14,190.208	ECR	6 December 94			

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AGI TECHNOLOGIES

APPENDIX B

Study Area Water Rights
Washington Department of Ecology

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CONTROL # SEC OLD APPL # OLD PERM OLD CERT DATE OF PRIORITY S T C A M CNTY PERMIT DATE NAME SOURCE OF APPROPRIATION TRIBUTARY OF
#OF R PTS P LOC. OF POD/POW (CHG C#) PURPOSE OF USE USE TYPE INST QI C R S M U U ANNUAL QA C R S M U U IRR AC C S M U PRO- VISOS TIME OF USE R R R I A C

WATER RESOURCE INVENTORY AREA- 09

TOWNSHIP - 23 RANGE - 04 E

1 SW4SW4SE4 IRRIGATION C .7 C 68.5 IS

S1-21397C 08 04/02/974 KING 05/15/975 RAINIER GOLF & C C UNN STR & POND
1 NE4NE4 IRRIGATION C 1.1 C 140.0 70.0 IS

G1-22821P 09 03/23/977 C KING 10/14/977 CAPERCI JAMES ETUX WELL
1 SE4SW4 IRRIGATION C 10.0 G 3.0 1.2 IS

G1-24822A 09 04/14/986 R KING / / SEATTLE CITY OF WELL
1 ENTIRE SECTION DOMESTIC MUNICIPAL C 4000.0 G

S1*02849C 09 02849 01476 00414 02/19/930 KING 06/05/930 SEATTLE DAHLIA GDN MILL CR * DUWAMISH R
1 L3 IRRIGATION C .1 C 2.5 IS

S1*04133A 09 04133 07/15/935 R KING / / RORVIK JACK UNN SPR DUWAMISH R
1 L-1 DOMESTIC SINGLE C .02 C 2
IRRIGATION C .02 C 2 1.0 IS

S1*05610C 09 05610 03458 01879 11/13/941 KING 01/08/942 ROSATTO JOE ET UX UNN STR DUWAMISH R
1 L1 IRRIGATION C .01 C .5 IS

S1*02063P 10 02063 00998 04/25/927 C KING 10/07/927 ROBERTS DANA GREEN R DUWAMISH R
1 N/A DOMESTIC SINGLE C 40.0 C 2
COMMERCIAL/INDUSTRIAL C 40.0 C 2

S1*02213P 10 02213 01058 12/14/927 C KING 02/14/928 ENGLE ALLEN B DUWAMISH R DUWAMISH WTRWAY
1 NW4 COMMERCIAL/INDUSTRIAL C 16.0 C

S1*02483CAL 10 02483A 01255A 00390A 12/23/928 KING 03/29/929 BIGELOW W H UNN SPRS DUWAMISH R
1 2SW4SW4 DOMESTIC SINGLE C .05 C 2 2 0 0
IRRIGATION C .05 C 2 1.75 05011001 2 0 2

S1*02704P 10 02704 01490 09/13/929 C KING 07/12/930 LITTLE RICHARD B J MILL CR DUWAMISH R
1 BL-6 REPLAT RIVERSIDE TRS POWER N .04 C 2
IRRIGATION C .04 C 2 3.0 04011001

S1*03117P 10 03117 01671 08/29/930 C KING 04/03/931 BRENNER GEORGE W MILL CR DUWAMISH R
1 GL-14 DOMESTIC SINGLE C .04 C 2
IRRIGATION C .04 C 2 2.0 05011001

S1*04135C 10 04135 02313 05406 07/20/935 KING 10/28/936 WILSON J H UNN STR DUWAMISH R
1 L-18 BL-9 RIVERTON DOMESTIC SINGLE C .0025C

S1*04742A 10 04742 02/16/939 R KING / / POHL ED MILL CR DUWAMISH R
1 S2 TR-40 RIVERSIDE INT TRS DOMESTIC SINGLE C .1 C 3
FISH PROPAGATION N .1 C 3
IRRIGATION C .1 C 3 2.0 IS

S1*12332P 10 12332 09310 05/11/953 C KING 12/10/953 CODIGA A DUWAMISH R DUWAMISH WTRWAY
1 C C LEWIS DLC IRRIGATION C .49 C 50.0 S 04151001
DOMESTIC SINGLE C .01 C S

G1-21930C 12 06/12/974 KING 11/28/975 KING CO WTR D #14 WELL
1 B 14 P KELSEY CRAIG 5 AC TRSDOMESTIC MUNICIPAL C 300.0 G 480.0 RM

G1-21931C 12 06/12/974 KING 11/28/975 KING CO WTR D #14 WELL
1 B 14 P KELSEY CRAIG 5 ACRE TDOMESTIC MUNICIPAL C 100.0 G 160.0 RM

S1*05220C 13 05220 03140 01772 08/03/940 KING 10/26/940 MATTHIESEN O S UNN STR BLACK R SL
1 L4 BL20 EARLINGTON ACRE TR DOMESTIC SINGLE C .02 C 2
IRRIGATION C .02 C 2 1.5 IS

S1*19954CAL 13 19954A 14671A 09943A 10/31/966 KING 04/06/967 BLACK RIVER QUARRY BLACK R DUWAMISH R
1 L-26 JUNCTION ADD COMMERCIAL/INDUSTRIAL C 1.0 C SMD 2 0 0

G1-24891A 14 08/18/986 R KING / / TUKWILA CITY OF PK WELL
1 NE4SW4 IRRIGATION C 1000.0 G

S1*19954CBL 14 19954B 14671B 09943B 10/31/966 KING 04/06/967 BLACK RIVER QUARRY BLACK R DUWAMISH R
1 L-26 JUNCTION ADD COMMERCIAL/INDUSTRIAL C 1.0 C SMD 2 0 0

S1-20620A 14 05/15/973 R KING / / FREIDMAN/TWEET DUWAMISH R DUWAMISH WTRWAY
1 TR 44 45 46 PL E RV 2 IN NW4IRRIGATION C .02 C 2 1.0 IS
STOCK WATERING C .02 C 2

S1-23433C 14 07/11/979 KING 08/31/981 TUKWILA CITY OF DUWAMISH R DUWAMISH WTRWAY

R: Rejected application
C: Cancelled Permit.

CONTROL # / #OF PTS R P LOC. OF POD/POW	SEC #	OLD APPL	PERM (CHG C#)	OLD CERT	DATE OF PRIORITY / PURPOSE OF USE	S C A T C M	CNTY / USE TYPE	PERMIT DATE / INST QI	C R S M U U	NAME / ANNUAL QA	SOURCE OF APPROPRIATION	IRR AC	C S M U PRO-VISOS	TRIBUTARY OF / TIME OF USE	R R R I A C
WATER RESOURCE INVENTORY AREA- 09															
TOWNSHIP - 23 RANGE - 04 E															
1 NW4SE4					IRRIGATION		C	1.78	C	104.0			SM	IS	
G1-00013C	15	06604	06230		02/04/963		KING	05/27/963		RIVERTON CREST CEM	WELL				
1 GL-4					IRRIGATION		C	150.0	G	30.0		15.0		05010930	
S1*02483CBL	15	02483B	01255B	00390B	12/23/928		KING	03/29/929		BIGELOW W H	UNN SPRS			DUWAMISH R	
1 2NW4NW4					DOMESTIC SINGLE		C	.05	C 2						2 0 0
					IRRIGATION		C	.05	C 2			1.75		05011001	2 0 2
S1*03164C	15	03164	01641	00636	09/23/930		KING	03/06/931		DESIMONE G	MILL CR M			DUWAMISH R	
1 BL-12 RIVERTON PL					IRRIGATION		C	.4	C			40.0		IS	
S1*04332C	15	04332	02369	01197	12/29/936		KING	03/30/937		TORBERT E S	UNN STR			DUWAMISH R	
1 L1 BL2 ROBBINS SPR BROOK ADD					POWER		N	.04	C						
					IRRIGATION		C	.01	C			1.1		IS	
S1*04776C	15	04776	02763	01333	04/08/939		KING	07/27/939		ABBEY E D	UNN SPR			DUWAMISH R	
1 L6					DOMESTIC SINGLE		C	.01	C						
S1*05283C	15	05283	03203	01681	10/15/940		KING	01/16/941		LOVEGREN F J	UNN STR			DUWAMISH R	
1 NE4 NW4					DOMESTIC SINGLE		C	.01	C 2						
					IRRIGATION		C	.01	C 2			.5			
S1*06036C	15	06036	03848	02043	05/23/944		KING	07/14/944		HINTERBERGER E	UNN STR			DUWAMISH R	
1 W2 NW4 NW4					DOMESTIC MULTIPLE		C	.02	C 2						
					IRRIGATION		C	.02	C 2			1.8		IS	
S1*06087C	15	06087	04029	02178	07/29/944		KING	03/23/945		MCRAE W	UNN STR			DUWAMISH R	
1 NW4NW4					IRRIGATION		C	.01	C			.5		IS	
S1*06610C	15	06610	04354	02415	08/21/945		KING	01/30/946		CLOGSTON T L	UNN STR			DUWAMISH R	
1 GL6					FISH PROPAGATION		N	.03	C				S[illegible]		
S1*07600C	15	07600	05079	03401	01/18/947		KING	06/12/947		MADDEN G	UNN STR			DUWAMISH R	
1 NE4					IRRIGATION		C	.05	C			5.0	S	IS	
S1*16714C	15	16714	12412	08555	06/08/961		KING	09/01/961		ROSS R E	UNN STR			DUWAMISH R	
1 L12 BL8 ROBBINS SPR BRK ADD					IRRIGATION		C	.01	C	1.0		.5	SD	IS	
S1-00403C	15	23185	16821		06/21/971		KING	01/19/972		WHITTINGTON ETHEL	UNN STR				
1 L 19 20 BL 2 PL MORTIMER PL					DOMESTIC SINGLE		C	.01	C	1.0			SM		
G1-24619A	16				03/07/985		KING	/ /		SEATTLE CITY OF	WELL				
1 NW4					DOMESTIC MUNICIPAL		C	4000.0	G						
G1-24620A	16				03/07/985		KING	/ /		SEATTLE CITY OF	WELL				
1 NW4SE4					DOMESTIC MUNICIPAL		C	4000.0	G						
G1-24824A	16				04/14/986		KING	/ /		SEATTLE CITY OF	WELL				
1 NW4SE4					DOMESTIC MUNICIPAL		C	4000.0	G						
G1-24825A	16				04/14/986		KING	/ /		SEATTLE CITY OF	WELL				
1 NW4					DOMESTIC MUNICIPAL		C	4000.0	G						
S1*19083A	17	19083			06/16/965	R	KING	/ /		MCLEOD THOMAS T	UNN STR			PUGET SOUND	
1 LOT-7 PLAT MCKAY'S ADDITION					DOMESTIC SINGLE		C	.01	C						
S1*00158A	18	00158			07/16/918	R	KING	/ /		WORTH HENRY	UNN STR			PUGET SOUND	
1 NW4					DOMESTIC SINGLE		C	.2	C 2						
					IRRIGATION		C	.2	C 2			10.0		IS	
G1*00533S	19	00533		00488	05/15/940	Q	KING	/ /		KING CO WTR DIST #	WELL				
1 NW4SE4NE4					DOMESTIC MULTIPLE		C	400.0	G	132.0					
G1*00534S	19	00534		00489	05/00/944	Q	KING	/ /		KING CO WTR DIST #	WELL				
1 W2NW4SE4NE4					DOMESTIC MULTIPLE		C	400.0	G	132.0					
G1*00673C	19	00673	00653	00333	12/19/947	Q	KING	04/01/948		KING CO WTR DIST #	WELL				
1 W2NW4SE4NE4					DOMESTIC MULTIPLE		C	1000.0	G	840.0					
G1-24532A	19				08/06/984	R	KING	/ /		KCWD #49	WELL				
1 NW4NE4					DOMESTIC MUNICIPAL		C	3000.0	G						
S1-22016C	19				07/23/974		KING	10/31/975		GWINN HOWARD J	BURIEN LK				
1 L-7 PL LAKEWOOD TERRACE					IRRIGATION		C	.01	C	1.0		.5	S	IS	

WATER RESOURCE INVENTORY AREA- 09

TOWNSHIP - 23 RANGE - 04 E

CONTROL # / #OF PTS R P LOC. OF POD/POW	SEC #	OLD APPL	OLD PERM	OLD CERT / PURPOSE OF USE (CHG C#)	DATE OF PRIORITY	S C A T C M	CNTY / USE TYPE	PERMIT DATE / INST QI	C R S M U U	NAME / ANNUAL QA	C R S M U U	SOURCE OF APPROPRIATION	IRR AC	C S M U	PRO-VISOS	TRIBUTARY OF / TIME OF USE	R R R I A C
S1-22081C	19				09/09/974		KING	09/15/975		PERRY ROBERT L		BURIEN LK					
1 NE4SW4				IRRIGATION			C	.02	C	1.0			.5	S		IS	
S1-22099C	19				09/23/974		KING	08/31/975		CASSIDY THOMAS G		BURIEN LK					
1 NE4SW4				IRRIGATION			C	.02	C	1.0			.5	S		IS	
S1-23411C	19				06/20/979		KING	03/31/981		DILLON CARL L		BURIEN LK					
1 NW4SW4				IRRIGATION			C	.01	C	.5			.33	S		IS	
S1*02060C	20	02060	00989	00625	04/23/927		KING	09/24/927		BALZARINI L		UNN STR				MILLER CR *	
1 SW4SW4SW4				IRRIGATION			C	.2	C				4.75			IS	
S1*03699P	20	03699	01941		08/06/932	C	KING	11/23/932		HALL BARRY B		UNN CR					
1 E2SW4SW4SW4				DOMESTIC SINGLE			C	.1	C 2								
				IRRIGATION			C	.1	C 2				5.0			04011101	
S1*03763C	20	03763	01972	01051	12/09/932	E	KING	02/06/933		BURNS E		UNN CR					
1 SW4 SW4				DOMESTIC SINGLE			C	.02	C					M			
G1*01850C	21	01850	02428	02417	03/03/951		KING	10/27/952		KING CO WTR DIST #		WELL					
1 L3 BL2 KNOXS 5 AC GDN TRS				DOMESTIC MULTIPLE			C	350.0	G	560.0				A			
G1*04227C	21	04227	04089	02726	02/23/956		KING	10/05/956		KING CO WTR DIST #		WELLS					
2 L3 BL2 KNOX 5 AC GDN TR				DOMESTIC MULTIPLE			C	1425.0	G	448.0		S		AE			
G1-24621A	21				03/07/985		KING	/ /		SEATTLE CITY OF		WELL					
1 NE4NW4				DOMESTIC MUNICIPAL			C	4000.0	G								
G1*00230P	22	00230	00361		05/07/946	C	KING	02/06/947		FINCH DAVID R ET U		WELL					
1 SW4SW4				DOMESTIC MULTIPLE			C	150.0	G	67.0							
S1*01029A	22	01029			12/15/923	R	KING	/ /		GREENE E F		UNN SPR				WHITE R	
1 E2SE4				DOMESTIC MUNICIPAL			C	.5	C								
S1*03119C	22	03119	01635	00635	08/29/930		KING	02/26/931		LEE I W		UNN SPR					
1 NE4SW4				IRRIGATION			C	.02	C				2.0			IS	
S1*04367C	22	04367	02397	01016	03/25/937		KING	06/15/937		RASMUSSEN H E		UNN SPRS				UNN STR	
1 SUNNYDALE GARDENS ADD DIV 1				DOMESTIC SINGLE			C	.05	C 2								
				IRRIGATION			C	.05	C 2				2.12			IS	
S1*04455C	22	04455	02500	02679	08/21/937		KING	12/21/937		ANDROS J		UNN SPRS				DUWAMISH R	
1 E2N2NW4SE4				DOMESTIC SINGLE			C	.03	C 2								
				IRRIGATION			C	.03	C 2				2.5			IS	
S1*04862C	22	04862	02802	01728	06/02/939		KING	09/15/939		SHARP M E		UNN STR				GILLAM CR *	
1 SW4 NW4 SE4				DOMESTIC SINGLE			C	.02	C 2								
				IRRIGATION			C	.02	C 2				1.5			IS	
S1*10073C	22	10073	07209	05264	01/09/951		KING	05/07/951		MAXWELL J C		UNN STR				GREEN R	
1 L7 BL4 3RD ADDN ADAMS HM TRS				DOMESTIC SINGLE			C	.2	C 2					SD			
				FISH PROPAGATION			N	.2	C 2					SD			
S1*13085C	22	13085	09799	06337	08/18/954	E	KING	01/07/955		LILLEHEI O		UNN STR				GREEN R	
1 S2 L6 BL4 3 ADD ADAMS HM TR				DOMESTIC SINGLE			C	.01	C 3					S			
				FISH PROPAGATION			N	.01	C 3					S			
				IRRIGATION			C	.01	C 3				1.0	S		IS	
S1*14752C	22	14752	11056	07641	04/14/958		KING	07/14/958		BENNETT V R		UNN SPRS					
1 TR28 SUNNYDALE GARDENS DIV 1				DOMESTIC SINGLE			C	.01	C 2					SO			
				STOCK WATERING			C	.01	C 2					SO			
S1*17629PAL	22	17629A	12995A		11/23/962	C	KING	03/18/963		ALBERTI F ET AL		UNN SPR				GILLIAM CR	
1 SE4 SE4				IRRIGATION			C	.12	C	24.0			12.0	S		IS	2 2 2
S1*07645C	23	07645	05182	03365	02/22/947		KING	08/25/947		SMITH E G		GILLAM CR *				GREEN R	
2 TR24 BROOKVALE GARDEN TRS				FIRE PROTECTION			C	.02	C 2					S			
				IRRIGATION			C	.02	C 2				2.0	S		IS	
S1*07960C	23	07960	05353	03826	07/30/947		KING	11/18/947		EPPS R		GILLIAN CR *				GREEN R	
1 L14 CEDAR LODGE				IRRIGATION			C	.015	C				1.5	S		IS	
S1*11370C	23	11370	08296	05742	05/19/952		KING	09/05/952		JORGENSEN G		GREEN R				DUWAMISH R	
1 GL-1,2				IRRIGATION			C	.5	C				53.0	S		IS	

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WATER RESOURCE INVENTORY AREA- 09																
TOWNSHIP - 23 RANGE - 04 E																
S1*12487CAW	23	12487A	09305A	06736A	08/05/953		KING	12/07/953		WATKINS A D		UNN SPRS			DUWAMISH R	
1 BROOKVALE GARDEN TR-13				DOMESTIC SINGLE			C	.01	C					M		2 0 0
				FISH PROPAGATION			P	.04	C					M		2 0 0
S1*12487CBW	23	12487B	09305B	06736B	08/05/953		KING	12/07/953		WATKINS A D		UNN STR			DUWAMISH R	
1 BROOKVALE GARDEN TR-13				DOMESTIC SINGLE			C	.01	C					M		2 0 0
				FISH PROPAGATION			P	.04	C					M		2 0 0
S1*15025P	23	15025	13004		08/27/958	C	KING	12/08/958		WATANABE S & M		UNN SPR			DUWAMISH R	
1 TR6 BROOKVALE GARDEN TRS				DOMESTIC SINGLE			C	.01	C							
				IRRIGATION			C	.02	C	4.0			2.0	S	04151001	
S1*17629PBL	23	17629B	12995B		11/23/962	C	KING	03/18/963		ALBERTI F ET AL		UNN SPR			GILLIAM CR	
1 TR8 BROOKVALE GARDEN TRS				IRRIGATION			C	.12	C	24.0			12.0	S	IS	2 2 2
G1-27288A	24				08/12/993		KING	/ /		BOEING CO		WELL				
1 NE4SW4				ENVIRONMENTAL QUALITY			C	100.0	G							
S1*04795C	24	04795	02768	01240	04/25/939		KING	08/02/939		ANDERSON M C		GREEN R			DUWAMISH R	
1 SW4SW4				IRRIGATION			C	.75	C				70.0	S#	IS	
S1*11368C	24	11368	08294	05764	05/19/952		KING	09/05/952		NELSEN F		UNN DRN DIT			BLACK R	
1 SW4NE4				IRRIGATION			C	.4	C				40.0	SD	IS	
S1*11369C	24	11369	08295	05741	05/19/952		KING	09/05/952		NIELSEN J		UNN DRN DIT			BLACK R	
1 SW4NE4				IRRIGATION			C	.35	C				35.0	SD	IS	
S1-23815C	24				03/24/981		KING	04/15/982		ALLEMAN KEN K		GREEN R				
1 GL-10 W/N SW4				IRRIGATION			C	.02	C	4.0			1.0	S-	IS	
S1*02381C	25	02381	01252	00809	08/10/928		KING	03/14/929		HILL F G		GREEN R			DUWAMISH R	
1 SW4NW4				IRRIGATION			C	1.0	C				71.0		IS	
S1*05951P	25	05951	03786		01/29/944	C	KING	03/24/944		MARTIN ELIZABETH B		GREEN R			DUWAMISH R	
1 GL-4				IRRIGATION			C	.4	C				30.0	M	04151001	
S1*07753C	25	07753	05091	03611	04/12/947		KING	06/20/947		STREULI O		GREEN R			DUWAMISH R	
1 GL5				IRRIGATION			C	.6	C				60.0	S	IS	
S1*04560P	26	04560	02657		07/18/938	C	KING	02/21/939		CLOUGH RUSSELL A		UNN SPRS			DUWAMISH R	
2 NW4NW4				DOMESTIC SINGLE			C	.02	C 2							
				IRRIGATION			C	.02	C 2				6.4			
S1*04561P	26	04561	02658		07/18/938	C	KING	02/21/939		CLOUGH RUSSELL A		UNN SPRS				
2 NW4NW4				DOMESTIC SINGLE			C	.005	C 2							
				IRRIGATION			C	.005	C 2				6.4			
S1*04562P	26	04562	02659		07/18/938	C	KING	02/21/939		CLOUGH RUSSELL A		UNN SPRS				
2 NW4NW4				DOMESTIC SINGLE			C	.05	C 2							
				IRRIGATION			C	.05	C 2				6.4			
S1*10657C	26	10657	07698	04489	08/27/951		KING	12/10/951		GREENHEAD GUN CLUB		UNN SPR			GREEN R	
1 L11 BL3 MCMICKEN HT				DOMESTIC SINGLE			C	.01	C							
S1*12852C	26	12852	09665	07301	04/05/954		KING	10/01/954		ROBINSON S A		UNN SPRS				
2 NW4NW4				DOMESTIC SINGLE			C	.01	C					M		
				FISH PROPAGATION			N	.03	C					M		
G1*00109S	27	00109		00069	01/00/927		KING	/ /		SOUTH SEATTLE LAND		WELL				
1 NW4				DOMESTIC MULTIPLE			C	150.0	G	244.0						
G1*00110S	27	00110		00070	02/07/944		KING	/ /		SOUTH SEATTLE LAND		WELL				
1 NW4				DOMESTIC MULTIPLE			C	350.0	G	566.0						
G1*00291C	27	00291	00294	00153	06/20/946	W	KING	11/07/946		SOUTH SEATTLE LAND		WELL				
1 SW4				DOMESTIC MULTIPLE			C	400.0	G	250.0						
G1*00292A	27	00292			06/20/946	R	KING	/ /		S SEATTLE LAND CO		WELL				
1 SW4NW4				DOMESTIC MUNICIPAL			C	400.0	G							
G1*03450C	27	03450	03228	02181	12/04/953		KING	03/05/954		SOUTH SEATTLE WTR		WELL				
1 L10 BL27 MCMICKEN HTS DIV 2				DOMESTIC MULTIPLE			C	500.0	G 2	740.0	S			A		
				DOMESTIC MULTIPLE			C	500.0	G 2	60.0				A		
G1*06179P	27	06179	05816		02/14/962	C	KING	04/27/962		SOUTH SEATTLE WTR		WELL				
1 L19 BL11 MCMICKEN HTS DIV 2				DOMESTIC MULTIPLE			C	800.0	G	1280.0				A		

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WATER RESOURCE INVENTORY AREA- 09																
TOWNSHIP - 23	RANGE - 04 E															
G1-26913A	27				02/01/993		KING	/ /		TUKWILLA CITY OF	WELLS 7					
7	NW4NE4			DOMESTIC MUNICIPAL			C	9750.0 G					0			0 0 0
S1*07180P	27	07180	04779		05/27/946	C	KING	12/19/946		DELANEY JOSEPH J	UNN SPR				WHITE R	
1	NE4NE4			FISH PROPAGATION			N	.005	C					N		
				IRRIGATION			C	.005	C			2.13		M	04151001	
G1*05706C	28	05706	05364	03929	08/17/960		KING	10/28/960		WASHINGTON CEMETER	WELL					
1	SEC OF WASH MEMORIAL DIV 2			IRRIGATION			C	500.0 G		130.0		65.0		AE	IS	
G1*06154A	29	06154			01/16/962	R	KING	/ /		KING CO WATER DIS	WELL					
1	SW4SW4			DOMESTIC MUNICIPAL			C	300.0 G								
S1*00849C	29	00849	00304	00694	11/09/922		KING	03/28/923		ROSAIA P F / G P	MILLER CR *				PUGET SOUND	
1	NW4SE4NW4			IRRIGATION			C	.3	C			23.5			IS	
S1*00854P	29	00854	00333		11/13/922	C	KING	06/28/923		KESSLER MAUD	MILLER CR					
1	SE4NW4			DOMESTIC SINGLE			C	.2	C 3							
				REC & BEAUTIFICATION			N	.2	C 3							
				IRRIGATION			C	.2	C 3			10.0			04151001	
S1*00907C	29	00907	00332	01300	04/06/923		KING	06/13/923		KINCAID J	MILLER CR *				PUGET SOUND	
1	N2 NE4 SW4 NW4			REC & BEAUTIFICATION			N	.15	C 2							
				IRRIGATION			C	.15	C 2			4.0			IS	
S1*01205C	29	01205	00505	00070	11/18/924		KING	04/14/925		ODONNELL ADA	UNN STR				MILLER CR *	
1	S2 NW4 NW4			DOMESTIC SINGLE			C	.25	C 2							
				IRRIGATION			C	.25	C 2			3.0			IS	
S1*02138C	29	02138	01000	00280	08/16/927		KING	10/18/927		BURTON HENRY ET UX	UNN STR				MILLER CR *	
1	SW4SE4			IRRIGATION			C	.1	C			4.0			IS	
S1*02890C	29	02890	01497	01106	03/24/930		KING	07/25/930		WINTER C M	UNN STR				MILLER CR *	
1	W2NW4NW4 NW4			IRRIGATION			C	.02	C			1.0			IS	
S1*03594C	29	03594	01872	01239	01/28/932		KING	04/20/932		EMMANUEL S	MILLER CR *				PUGET SOUND	
1	NW4NW4			IRRIGATION			C	.06	C			3.0			IS	
S1*03623P	29	03623	01901		04/19/932	C	KING	07/02/932		BAKER FREDERIC A	MILLER CR				PUGET SOUND	
1	NW4NW4			DOMESTIC SINGLE			C	.1	C 2							
				IRRIGATION			C	.1	C 2			6.0				
S1*03773C	29	03773	01994	00844	01/03/933		KING	04/10/933		ORCHARD T K	UNN STR				MILLER CR *	
1	SW4NE4NE4			DOMESTIC SINGLE			C	.06	C 2					M		
				IRRIGATION			C	.06	C 2			3.0		M	IS	
S1*04369C	29	04369	02436	04740	04/03/937		KING	07/31/937		GORDON W G	MAYBROOK CR *				MILLER CR *	
1	N2 E2 S2 SW4 NW4 SW4			DOMESTIC SINGLE			C	.02	C 2							
				IRRIGATION			C	.02	C 2			1.87			IS	
S1*04421C	29	04421	02449	02660	06/08/937		KING	08/17/937		MAY M M	MAYBROOK CR *				MILLER CR *	
1	NW4 SW4			DOMESTIC SINGLE			C	.1	C 4							
				FISH PROPAGATION			N	.1	C 4							
				REC & BEAUTIFICATION			C	.1	C 4							
				IRRIGATION			C	.1	C 4			2.5			IS	
S1*04551CAM	29	04551A	02626A	01811A	06/29/938	M	KING	01/05/939		THOMPSON R E	MAYBROOK CR *				MILLER CR *	
1	2SW4 NE4 NW4 SW4			DOMESTIC SINGLE			C	.02	C 2							0 0 0
				IRRIGATION			C	.02	C 2			2.5				0 0 2
S1*04551CBM	29	04551B	02626B	01811B	06/29/938	A	KING	01/05/939		FISHER E	MAYBROOK CR *				MILLER CR *	
1	2E2E2NW4SW4			DOMESTIC SINGLE			C	.01	C 2							0 0 0
				IRRIGATION			C	.01	C 2			2.5				0 0 2
S1*04903C	29	04903	02814	01577	07/17/939		KING	09/29/939		ROULLARD W R	MILLER CR *				PUGET SOUND	
1	SW4NE4			IRRIGATION			C	.01	C			.25			IS	
S1*04904C	29	04904	02824	01633	07/17/939		KING	10/09/939		RANDALL D	MILLER CR *				PUGET SOUND	
1	SE4NW4			IRRIGATION			C	.01	C			.5			IS	
S1*05145P	29	05145	03207		05/23/940	C	KING	01/17/941		WALLACE W A	MILLER CR				PUGET SOUND	
1	N2N2S2NW4NE4			IRRIGATION			C	.01	C			.5		M	04151001	
S1*05219P	29	05219	03139		08/01/940	C	KING	10/26/940		KERR WILLIAM	MILLER CR				PUGET SOUND	
1	S2N2S2NW4NE4			IRRIGATION			C	.03	C			2.5		M	04151001	
S1*05783P	29	05783	03661		01/14/943	C	KING	04/28/943		PHELPS ARCHIE E	MILLER CR				PUGET SOUND	

CONTROL # / #OF R PTS P LOC. OF POD/POW	SEC	OLD # APPL	OLD PERM (CHG C#)	OLD CERT / PURPOSE OF	DATE PRIOR	C A / C S M	CNTY / USE TYPE	PERM DATE / QI		ANNUAL QA	SOURCE OF APPROPRIATION / C R S M U U	IRR AC	C S M U PRO-VISOS	TRIBUTARY OF / TIME OF USE / R R R I A C
WATER RESOURCE INVENTORY AREA- 09														
TOWNSHIP - 23 RANGE - 04 E														
1 SW4NW4				DOMESTIC SINGLE			C	.03 C 2					M	
				FISH PROPAGATION			N	.03 C 2					M	
S1*05799A	29	05799			03/06/963	R	KING	/ /	PADDOCK CHARLES R		MILLER CR			PUGET SOUND
1 SE4NW4				DOMESTIC SINGLE			C	.05 C 2						
				IRRIGATION			C	.05 C 2				2.0		IS
S1*05991C	29	05991	03812	02212	03/31/944		KING	05/18/944	LLOYD R		MILLER CR *			PUGET SOUND
1 SW4 NE4				DOMESTIC SINGLE			C	.01 C 2						
				IRRIGATION			C	.01 C 2				1.7		IS
S1*06355C	29	06355	04091	04438	03/16/945		KING	05/22/945	HUTH A J		UNN SPR			MILLER CR *
1 SW4 NE4				DOMESTIC SINGLE			C	.01 C						
S1*12460C	29	12460	09278	05958	07/21/953		KING	11/18/953	FISHER ELMER ET UX		MAYBROOK CR *			MILLER CR *
1 E2NW4SW4				DOMESTIC SINGLE			C	.01 C					SD#	
S1*12791C	29	12791	09495	06259	03/03/954		KING	05/12/954	MCKINNON J A		MAYBROOK CR *			MILLER CR *
1 SW4NW4SW4				DOMESTIC SINGLE			C	.01 C					SD	
S1*16768C	29	16768	12438	08435	07/07/961		KING	10/09/961	PETERSEN K E		MAYBROOK CR *			MILLER CR *
1 E2SE4NW4 SW4				FISH PROPAGATION			N	.01 C					SD	
S1-20949C	29				10/02/973		KING	02/28/975	BUTTS BERTHA W		UNN STR			MILLER CR *
1 SW4NE4				DOMESTIC SINGLE			C	.01 C		1.0			S	
S1-22238A	29				06/03/974	R	KING	/ /	MERCY JOHN A		UNN STR (MAY CR)			PUGET SD
1 NW4SW4				STOCK WATERING			C	.01 C						
G1*02695C	30	02695	02585	01790	09/02/952		KING	02/06/953	NORMANDY PARK WTR		WELL			
1 NE4SE4				DOMESTIC MULTIPLE			C	250.0 G		400.0			AE	
G1*03057C	30	03057	02876	01639	03/10/953	Q	KING	07/06/953	KING CO WTR DIST #		WELL			
1 SW4NW4				DOMESTIC MULTIPLE			C	1000.0 G 2		1104.0	S		A	
				DOMESTIC MULTIPLE			C	1000.0 G 2		509.0			A	
G1-20523C	30				04/03/973		KING	03/15/974	SOUTHWEST SUB SEW		WELL			
1 E2 SW4				COMMERCIAL/INDUSTRIAL			C	100.0 G		160.0			TMPR	
G1-24687G	30				08/06/985		KING	08/15/986	HOOVER MAHLON R		INFILTRATION SYSTEM			
6 NE4SE4				HEAT EXCHANGE			C	15.0 G 2		1.0				
				IRRIGATION			C	15.0 G 2				.75		IS
G1-24754C	30				10/30/985		KING	01/16/990	SW SUB SEWER DIST		WELL			
1 E2SW4				COMMERCIAL/INDUSTRIAL			C	33.0 G		17.4			RM	
G1-24755A	30				10/30/985	R	KING	/ /	SOUTHWEST SUB SEWE		WELL			
1 E2SW4				COMMERCIAL/INDUSTRIAL			C	250.0 G						
G1-25411C	30				03/17/989		KING	11/15/989	SW SUB SEWER DIST		WELL			
1 E2SW4				COMMERCIAL/INDUSTRIAL			C	150.0 G		240.0			#RM	
S1*03658C	30	03658	01975	01502	06/20/932		KING	02/15/933	DRACHENBERG F		UNN STR			MILLER CR *
1 NE4NE4NE4				FISH PROPAGATION			N	.1 C 3					M	
				REC & BEAUTIFICATION			N	.1 C 3					M	
				IRRIGATION			C	.1 C 3				4.0	M	IS
S1*04479C	30	04479	02529	01103	11/29/937		KING	03/16/938	LOVGREN E		UNN SPRS			MILLER CR *
1 SW4 SW4 NE4				DOMESTIC SINGLE			C	.02 C 3						
				FIRE PROTECTION			C	.02 C 3						
				IRRIGATION			C	.02 C 3				2.0		IS
S1*04612C	30	04612	02640	01295	08/30/938		KING	01/23/939	CHESBRO C E		UNN SPR			MILLER CR *
1 W2 NE4 NE4				IRRIGATION			C	.02 C				1.0	S	IS
S1*05059C	30	05059	02978	01354	01/26/940	E	KING	03/22/940	RUTOWSKI J J		UNN STR			MILLER CR *
1 SW4 NE4				DOMESTIC SINGLE			C	.02 C 2						
				IRRIGATION			C	.02 C 2				2.0		IS
S1*05399C	30	05399	03303	02061	03/29/941		KING	06/02/941	MEAD W L		UNN STR			MILLER CR *
1 S2NE4NW4NE4				FISH PROPAGATION			N	.01 C 2					M	
				IRRIGATION			C	.01 C 2				.75	M	
S1*06210C	30	06210	04108	02781	10/20/944		KING	06/12/945	KUEHNOEL O A		WALKER CR *			MILLER CR *
1 NE4SE4				FISH PROPAGATION			N	.25 C					#SF	

CONTROL # / #OF PTS P LOC. OF POD/POW	SEC #	OLD APPL	OLD PERM (CHG C#)	OLD CERT / PURPOSE OF USE	DATE OF PRIORITY	S C A T C M	CNTY / USE TYPE	PERMIT DATE / INST QI	C R S M U U	NAME	ANNUAL QA	C R S M U U	SOURCE OF APPROPRIATION	IRR AC	C S M U	PRO-VISOS	TRIBUTARY OF / TIME OF USE	R R R I A C
WATER RESOURCE INVENTORY AREA- 09																		
TOWNSHIP - 23 RANGE - 04 E																		
S1*06647C	30	06647	04541	03264	09/05/945		KING	07/08/946		HERRING C J ET UX			UNN SPRS				MILLER CR *	
1 SE4SW4				DOMESTIC SINGLE			C	.01	C									
S1*06828C	30	06828	04478	02492	12/31/945		KING	05/13/946		HUBBERT F A			MILLER CR *				PUGET SOUND	
1 SW4SW4, L-7 SHORBROOK ADD				IRRIGATION			C	.01	C					1.0		S	IS	
S1*10542C	30	10542	07558	04634	07/20/951		KING	10/12/951		THOMAS D			MAYBROOK CR *				MILLER CR *	
1 SE4NE4SE4				IRRIGATION			C	.01	C					1.0		SD	IS	
S1*11384P	30	11384	08268		05/22/952	C	KING	08/25/952		ANNIBAL ALFRED G			UNN STR					
1 NE4SE4				DOMESTIC SINGLE			C	.01	C							SH		
S1*11385C	30	11385	08264	05898	05/22/952		KING	09/25/952		ANNIBAL R J			UNN STR					
1 NE4NE4SE4				DOMESTIC SINGLE			C	.01	C							S		
S1*11583CAW	30	11583A	08459A	06012A	08/12/952		KING	11/25/952		PARKER A			MAYBROOK CR *				MILLER CR *	
1 SE4SE4				REC & BEAUTIFICATION			N	.11	C							SND		2 0 0
S1*11583CBW	30	11583B	08459B	06012B	08/12/952		KING	11/25/952		PARKER A			SEEPAGE WTR				PUGET SOUND	
1 SE4SE4				REC & BEAUTIFICATION			N	.11	C							SND		2 0 0
S1-20116C	30				05/09/972		KING	02/12/973		WILSON T A			UNN STR					
1 SE4NE4SE4				IRRIGATION			C	.01	C		2.0			1.0		SM	04010830	
S1-21479C	30				04/11/974		KING	05/30/975		DAMMANN GILBERT H			UNN SPR					
1 SE4SE4				IRRIGATION			C	.02	C		1.0			.75		S	IS	
S1*04609C	31	04609	02615	01970	08/27/938		KING	12/21/938		REITZE C N			UNN STR				PUGET SOUND	
1 GL4				FISH PROPAGATION			N	.1	C 2									
				IRRIGATION			C	.1	C 2					3.0			IS	
S1*05398P	31	05398	03305		03/29/941	C	KING	06/02/941		BROWER / MIHALISIN			UNN STR				PUGET SOUND	
1 L-2 BL-6 NORMANDY PK RIVIERA				DOMESTIC SINGLE			C	.01	C							M		
				IRRIGATION			C	.01	C					1.75		M	04151001	
S1*06947P	31	06947	04709		03/06/946	C	KING	11/13/946		GARBE FRANK A			UNN STR				PUGET SOUND	
1 GL-4				DOMESTIC SINGLE			C	.01	C							SLM#		
				FISH PROPAGATION			N	.01	C							SLM#		
				IRRIGATION			C	.02	C					3.0		SLM#	04151001	
S1*07314C	31	07314	04714	02640	07/12/946		KING	11/13/946		MOORE R B			UNN STR				PUGET SOUND	
1 GL3				IRRIGATION			C	.01	C					1.25		S	IS	
S1*07336C	31	07336	04926	03092	07/25/946		KING	03/29/947		DIAMOND E L			UNN STR					
1 GL-4				REC & BEAUTIFICATION			P	.005	C							S		
S1*08459C	31	08459	06303	03581	06/10/948		KING	03/17/950		ANDERSON A F			UNN DRN DIT				PUGET SOUND	
1 NORMANDY PK RIVIERA SEC				FISH PROPAGATION			N	.01	C							SD		
S1*09078C	31	09078	06233	04811	09/12/949		KING	02/17/950		CUNNINGHAM M B ET			UNN STR				PUGET SOUND	
1 L4 BL5 RIVIERA, NORMANDY PK				IRRIGATION			C	.02	C					2.0			IS	
S1*12200A	31	12200			03/27/953	R	KING	/ /		REDDEN EARL			UNN STR				PUGET SOUND	
1 L-F PLAT OF NORMANDY PARK				FISH PROPAGATION			N	.01	C									
S1*17145C	31	17145	12676	10199	02/23/962		KING	05/17/962		NORMANDY PK COM CL			MAYBROOK CR *				MILLER CR	
1 L A RIVIERA SEC NORMANDY PK				REC & BEAUTIFICATION			N	.2	C							SD		
S1*01101C	32	01101	00528	01178	05/23/924		KING	06/19/925		GOULD E			UNN SPR					
1 N2 NW4 NW4				DOMESTIC SINGLE			C	.1	C 2									
				IRRIGATION			C	.1	C 2					11.0			IS	
S1*04203C	32	04203	02308	01922	02/27/936		KING	10/21/936		LENHARD E G			UNN SPR				PUGET SOUND	
1 S2NW4NW4				DOMESTIC MULTIPLE			C	.07	C									
S1*12981P	32	12981	09738		06/11/954	C	KING	11/19/954		MALONE DONALD M			MAYBROOK CR				MILLERS CR	
1 S2NE4NW4				DOMESTIC SINGLE			C	.005	C 2							SD		
				FISH PROPAGATION			N	.005	C 2							SD		
S1*13018C	32	13018	09699	05960	07/13/954		KING	10/20/954		MALONE W R			MAYBROOK CR *				MILLER CR *	
1 NW4NE4NW4				DOMESTIC SINGLE			C	.01	C							SD		
S1*19845C	32	19845	14528	10142	08/24/966		KING	12/08/966		ALEXANDER K M			UNN SPR/STR					
2 NW4SE4				FISH PROPAGATION			N	.03	C									
				IRRIGATION			C	.02	C		4.0			2.0			IS	
S1*07994P	33	07994	05340		08/20/947	C	KING	11/18/947		SMITH ROBERT G			BOW LK					

CONTROL # / #OF PTS	SEC # / R P LOC. OF POD/POW	OLD APPL	OLD PERM / (CHG C#)	OLD CERT / PURPOSE OF USE	DATE OF PRIORITY	S C A T C M	CNTY / USE TYPE	PERMIT DATE / INST QI	C R S M U U	NAME / ANNUAL QA	C R S M U U	SOURCE OF APPROPRIATION / IRR AC	C S M U	PRO-VISOS	TRIBUTARY OF / TIME OF USE	R R R I A C
WATER RESOURCE INVENTORY AREA- 09																
TOWNSHIP - 23	RANGE - 04 E															
1	NE4SE4			DOMESTIC SINGLE			C	.01	C					SM		
				IRRIGATION			C	.09	C			10.0		SM	04151001	
S1*07996P	33	07996	05343		08/20/947	C	KING	11/18/947		BOYSEN CHRIS		BOW LK				
1	SE4NE4			IRRIGATION			C	.1	C			10.0		SLM	04151001	
G1*00082C	34	00082	00412	00060	01/11/946		KING	04/23/947		KING CO WTR DIST #		WELL				
1	E2E2SW4SW4			DOMESTIC MULTIPLE			C	400.0	G	320.0						
G1*02736C	34	02736	02513	01445	09/30/952		KING	12/19/952		SCHADER R M		WELL				
1	SE4NE4			DOMESTIC SINGLE			C	50.0	G 2	26.0	2					
				IRRIGATION			C	50.0	G 2	26.0	2	13.0			IS	
G1*04961C	34	04961	04636	03545	08/14/958		KING	11/21/958		KING CO WTR DIST #		WELL				
1	NE4SW4			DOMESTIC MULTIPLE			C	400.0	G	640.0				A		
G1*05781C	34	05781	05474	04190	11/29/960		KING	03/17/961		KING CO WTR DIST #		WELL				
1	SW4 SW4 NW4 NE4 NW4			DOMESTIC MULTIPLE			C	310.0	G	496.0				A		
S1*03536A	34	03536			10/21/931	R	KING	/ /		DESIMONE L		BOW LK				
1	NW4SW4			IRRIGATION			C	.33	C			160.0			IS	
S1*14823C	34	14823	11091	07406	05/26/958		KING	08/26/958		UNITED SERV & UTIL		UNN STR				
1	SE4 SE4			DOMESTIC SINGLE			C	.01	C					S		
				POWER			N	.04	C					S		
S1*20030C	34	20030	14718	10389	12/28/966		KING	05/24/967		MATELICH G J		ANGLE LK			GREEN R	
1	S2, GL-2			IRRIGATION			C	.02	C	3.0		1.5		S	04010930	
S1-20322C	34				10/18/972		KING	06/01/973		BAYNE EDWARD C		ANGLE LK			GREEN R	
1	GL-1			IRRIGATION			C	.005	C	.5		.5		SLM	05150915	
S1-20848C	34				08/20/973		KING	12/16/974		STEVENS C HARLOW		ANGLE LK			GREEN R	
1	GL-2			IRRIGATION			C	.01	C	1.0		.5		S	IS	
S1-21162C	34				01/08/974		KING	03/28/975		BAHL LORETTA E		ANGLE LK			GREEN R	
1	GOVT LOT 2			DOMESTIC SINGLE			C	.02	C	1.0				S		
S1-21600C	34				05/06/974		KING	08/29/975		COSGRAVE RONALD ET		ANGLE LK			GREEN R	
2	GL-1			IRRIGATION			C	.04	C	4.0		2.0		S	IS	
S1-22009C	34				07/12/974		KING	08/31/975		TONSETH ASTRID		ANGLE LK			GREEN R	
1	GL 2			IRRIGATION			C	.02	C	1.0		.5		S	IS	
S1*03687C	35	03687	01963	00714	07/29/932		KING	01/16/933		LISTON M E		UNN SPR				
1	NW4NE4NW4			DOMESTIC SINGLE			C	1.0	C 3 P					M		
				STOCK WATERING			C	1.0	C 3 P					M		
				IRRIGATION			C	1.0	C 3 P			122.0		M	IS	
S1*03744C	35	03744	01978	00756	11/04/932		KING	02/17/933		MESS F J / W		GREEN R			DUWAMISH R	
1	GL-2			IRRIGATION			C	2.15	C			67.0		M	IS	
S1*03750C	35	03750	01979	00757	11/04/932		KING	02/17/933		MESS F J / W		GREEN R			DUWAMISH R	
1	GL-5			IRRIGATION			C	2.15	C			70.0		M	IS	
S1*05990C	35	05990	03930	02103	03/30/944		KING	11/15/944		SCHOENBACHLER A		GREEN R			DUWAMISH R	
1	GL2			IRRIGATION			C	.8	C			80.0		S	IS	
S1*05994C	35	05994	03931	03252	04/04/944		KING	11/15/944		SCHOENBACHLER A		UNN STR				
1	SE4 NW4			DOMESTIC SINGLE			C	.025	C 2							
				STOCK WATERING			C	.025	C 2							
S1*08662C	35	08662	05994	04340	12/14/948		KING	08/05/949		BRISCOE MEMORIAL S		GREEN R			DUWAMISH R	
1	HENRY ADAMS DLC #43			IRRIGATION			C	.75	C			100.0		S	IS	
S1*10468C	35	10468	07509	04451	07/06/951		KING	09/21/951		DESIMONE R		GREEN R			DUWAMISH R	
1	HENRY ADAMS DLC			IRRIGATION			C	1.0	C			100.0		S	IS	
G1*03859C	36	03859	03595	02812	02/01/955		KING	04/18/955		LOVE W G		WELL				
1	ADAMS DLC W2SW4			IRRIGATION			C	200.0	G	120.0	P	60.0		A	IS	
S1*06428C	36	06428	04159	02423	05/14/945		KING	07/30/945		PILLIE A		SPRING BROOK CR			BLACK R	
1	SW4NE4			IRRIGATION			C	.5	C			80.0		S	04151001	

CONTROL # / WOF R PTS P LOC. OF POD/POW	SEC #	OLD APPL	OLD PERM (CHG CB)	OLD CERT / PURPOSE OF USE	DATE OF PRIORITY	S C A T C M	CNTY / USE TYPE	PERMIT DATE / INST QI	C R S M U U	NAME / ANNUAL QA	C R S M U U	SOURCE OF APPROPRIATION	IRR AC	C B M U	PRO-VISOS	TRIBUTARY OF / TIME OF USE R R R I A C

WATER RESOURCE INVENTORY AREA- 09

TOWNSHIP - 22 RANGE - 04 E

S1*07193C	01	07193	04600	02605	05/28/946		KING	08/22/946		STANDAERT W		MILL CR *				SPRING BROOK CR
1 SW4SW4				IRRIGATION			C	.1	C				10.0		S	IS
S1*08924C	01	08924	06077	03721	07/22/949		KING	10/20/949		COSTELLO W F		UNN DRN DIT				SPRING BROOK CR
1 NW4SW4				IRRIGATION			C	.3	C				30.0		S	IS
S1*11388A	01	11388			05/23/952	R	KING	/ /		WARREN J B		MILL CR				GREEN R
1 SW4SW4				DOMESTIC SINGLE			C	.2	C 2							
				IRRIGATION			C	.2	C 2				20.0			IS
S1*12054C	01	12054	08942	06839	02/10/953		KING	06/03/953		MIZOGUCHI H		MILL CR *				SPRING BROOK CR
1 L3 HIWAY HOME GARDEN TRS				IRRIGATION			C	.18	C	36.0			18.0		S	IS
G1-25978A	02				11/16/990	R	KING	/ /		MINH CHESHENH		WELL				
1 GL-7				IRRIGATION			C	90.0	G				10.0			
S1*02084P	02	02084	00984		05/17/927	C	KING	09/20/927		MALMO & CO		O'BRIEN CR *				GREEN R
1 SE4SE4				IRRIGATION			C	1.0	C				73.93			04011001
S1*03751C	02	03751	01980	00758	11/04/932		KING	02/17/933		MESS F J / W		GREEN R				DUWAMISH R
1 GL-11				IRRIGATION			C	2.15	C				70.0		M	IS
S1*06010C	02	06010	03875	02350	04/25/944		KING	09/08/944		BRAND V		UNN DRN DIT				GREEN R
1 SE4SE4				IRRIGATION			C	.34	C				62.0		S	IS
S1*08307C	02	08307	05611	03190	04/01/948		KING	06/04/948		AHERN D		GREEN R				DUWAMISH R
1 GL4				IRRIGATION			C	1.0	C				104.0		S	IS
S1*11157C	02	11157	08083	04758	03/17/952		KING	06/03/952		O'CONNELL R		GREEN R				DUWAMISH R
1 GL7				IRRIGATION			C	.25	C				25.0		S	IS
S1*12300C	02	12300	09301	06078	04/28/953		KING	12/01/953		STROOMER N		GREEN R				DUWAMISH R
1 GL8				IRRIGATION			C	.27	C				35.0		LSD	IS
G1*05610C	03	05610	05275	03705	05/17/960	E	KING	08/11/960		TOMBS B A		WELL				
1 SE4NW4SW4				DOMESTIC MULTIPLE			C	20.0	G	13.2					AN	
G1-21700C	03				05/23/974		KING	09/15/975		PITTENGER FRED WM		WELL				
1 NW4 SE4				DOMESTIC SINGLE			C	15.0	G 2	2.0						
				IRRIGATION			C	15.0	G 2	2.0			1.0			IS
S1*03865P	03	03865	02346		07/28/933	C	KING	01/13/937		BIRKELAND C F		UNN SPR				WHITE R
1 L-6				DOMESTIC SINGLE			C	.2	C 2							
				IRRIGATION			C	.2	C 2				10.0			05011001
S1*06666C	03	06666	04364	02441	09/13/945		KING	02/09/946		SUNSKI E		UNN STR				
1 NW4 SE4				DOMESTIC SINGLE			C	.02	C 2							
				STOCK WATERING			C	.02	C 2							
S1*08589C	03	08589	05812	03583	09/17/948		KING	01/18/949		BIRKELAND T O		UNN SPR				GREEN R
1 L6				DOMESTIC SINGLE			C	.01	C						S	
S1*10514P	03	10514	07805		07/19/951	C	KING	01/23/952		ANDERSON CHAS N		UNN STR				
1 NW4SE4				DOMESTIC SINGLE			C	.01	C						MS	
S1*11862C	03	11862	08775	06424	11/19/952		KING	03/30/953		ZGRAGGEN A		UNN SPR/STR				GREEN R
1 SW4SE4				STOCK WATERING			C	.01	C							
				IRRIGATION			C	.14	C				15.0			IS
S1*12645C	03	12645	09428	05673	11/04/953		KING	03/01/954		ZGRAGGEN A		UNN SPR				GREEN R
1 E2NE4SW4				DOMESTIC SINGLE			C	.01	C						U	
S1*17927C	03	17927	13153	08890	05/22/963		KING	09/05/963		VINCENZI A J		ANGLE LK				GREEN R
1 SW4NW4				IRRIGATION			C	.01	C	1.5			.75		S	IS
S1*20683C	03	20683	15170	10321	12/26/967		KING	04/22/968		STEVENS J D		UNN STR				GREEN R
1 NW4 NE4 SE4				DOMESTIC SINGLE			C	.005	C 2	1.0	2				S	
				STOCK WATERING			C	.005	C 2	1.0	2				S	
S1-00480C	03	23268			07/30/971		KING	01/25/974		THOMAS J C & S H		ANGLE LK				GREEN R
1 GL-4				IRRIGATION			C	.02	C	1.0			.5		SL	04151001
S1-20001C	03	AND SHORELANDS			03/01/972		KING	08/18/972		LAYNE BRUCE L		ANGLE LK				GREEN R
1 GL-1				IRRIGATION			C	.02	C	1.0			.5		SM	05010930
S1-20015C	03				03/14/972		KING	12/04/972		CARPENTER J W & C		ANGLE LK				GREEN R

WATER RESOURCE INVENTORY AREA- 09

TOWNSHIP - 22 RANGE - 04 E

CONTROL # / #OF PTS R P LOC. OF POD/POW	SEC #	OLD APPL (CHG C#)	OLD PERM	OLD CERT / PURPOSE OF USE	DATE OF PRIORITY	S T / C C / A M	CNTY / USE TYPE	PERMIT DATE / INST QI C R S M U U	NAME / ANNUAL QA C R S M U U	SOURCE OF APPROPRIATION	IRR AC	C S M U / PRO-VISOS	TRIBUTARY OF / TYPE OF R R R I A C
1 GL-4				IRRIGATION				.02 C	1.0		.5	SM	05011031
S1-20147C	03				05/30/972		KING	01/31/973	VINCENZI ALMO J	ANGLE LK			GREEN R
1 GL-4				IRRIGATION			C	.01 C	.5		.5	SM	05010930
S1-20290C	03				09/20/972		KING	05/02/973	MOOREHEAD A F & M	ANGLE LK			GREEN R
1 GL-6				IRRIGATION			C	.01 C	2.0		1.0	SM	05011001
S1-20513C	03				03/30/973		KING	03/29/974	BLAKE AMOS E	ANGLE LK			GREEN R
1 L 31 B 4 P SNIVELYS AN LK TR				IRRIGATION			C	.01 C	.5		.2		04151001
S1-20546C	03				04/11/973		KING	05/15/974	STIRRAT GEORGE R	ANGLE LK			GREEN R
1 GL-1				IRRIGATION			C	.02 C	3.5		1.4	SL	04151001
S1-20741C	03				07/06/973		KING	04/30/974	WARBERG FRED C R	ANGEL LK			GREEN R
1 GL-1				IRRIGATION			C	.02 C	1.0		1.0		IS
S1-21103C	03				12/12/973		KING	03/28/975	WILBERT REYNOLD E	ANGLE LK			GREEN R
1 GL-5				IRRIGATION			C	.01 C	1.0		.5	S	IS
S1-21161C	03				01/08/974		KING	03/28/975	CAIN GUY E	ANGLE LK			GREEN R
1 GL-5				IRRIGATION			C	.01 C	1.0		.5	S	IS
S1-21186C	03				01/14/974		KING	03/28/975	HAMILTON WILLIAM L	ANGLE LK			GREEN R
1 GL-5				IRRIGATION			C	.01 C	1.0		.7	S	IS
S1-21565C	03				05/02/974		KING	06/30/975	TONNEMAKER G E & H	ANGLE LK			GREEN R
1 GL-6				IRRIGATION			C	.01 C	1.0		.5	S	IS
S1-21767C	03				06/05/974		KING	06/30/975	JARNIG ANDREW E	ANGLE LK			GREEN R
1 L6 B 4 SNIVELYS ANGLE LK TR				DOMESTIC SINGLE			C	.01 C	1.0			S	
S1-21895C	03				06/26/974		KING	08/29/975	HAYNES STANLEY W	ANGLE LK			GREEN R
1 GL 1				IRRIGATION			C	.01 C	1.0		.5	S	IS
S1-21986C	03				07/02/974		KING	10/31/975	LOUVIER JAMES I	ANGLE LK			GREEN R
1 GL 1				IRRIGATION			C	.03 C	3.0		4.0	S	IS
S1-22321C	03				06/27/974		KING	11/14/975	DEPUE WILLIAM E	ANGLE LK			GREEN R
1 L 24 B 4 SNIVELYS ANGLE L TR				DOMESTIC SINGLE			C	.02 C	1.0			S	
S1-22529C	03				06/18/975		KING	04/30/976	SAURWEIN ALBERT C	ANGLE LK			GREEN R
1 GL 5				IRRIGATION			C	.01 C	.5		.4	S	IS
S1-22562C	03				08/04/975		KING	07/15/977	ANDERSON C N ET AL	UNN SPR			GREEN R
1 NE4 SW4				DOMESTIC MULTIPLE			C	.17 C	7.0			U	
S1-22869C	03				05/12/977		KING	11/15/977	KENNEDY KEITH J	ANGLE LK			GREEN R
1 L-2 B-4 SNIVELY'S ANGLE LK T				IRRIGATION			C	.01 C	.5		.15	S	IS
S1-23560P	03				02/20/980	C	KING	08/16/982	GRIFFIN GARY L	ANGLE LK			GREEN R
1 L-19 BLK-4 SNIVELYS ANGLE TR				HEAT EXCHANGE			N	.056 C					
S1-25118C	03				11/06/987		KING	02/15/989	ESTES VICTOR G	ANGLE LK			
1 L-1				IRRIGATION			C	.02 C	.25		.13		IS
S1-26104P	03				03/13/991		KING	12/15/992	YOROZU D S & P J	ANGLE LAKE			
1 SW4NW4				IRRIGATION			C	.05 C	.8		.4	S	IS
S1-26793A	03				11/18/992		KING	/ /	GALVIN J GERALD	ANGLE LK			
1 NW4				IRRIGATION			C	.05 C					IS
G1*00010C	04	00010	00147	00296	08/25/945		KING	05/28/946	HIGHLINE SCH DIST	WELL			
1 NE4NW4NE4				DOMESTIC MULTIPLE			C	20.0 G	25.0				
G1*01065C	04	01065	01006	02369	02/09/949		KING	07/05/949	KING CO WTR DIST #	WELL			
1 SW4SE4NW4				DOMESTIC MULTIPLE			C	400.0 G	560.0				
G1*03218C	04	03218	03075	02191	05/14/953		KING	10/23/953	KING CO WTR DIST #	WELL			
1 SE4NW4				DOMESTIC MULTIPLE			C	750.0 G	600.0				
G1*03843C	04	03843	03757	02376	01/19/955		KING	08/26/955	KING CO WTR DIST #	WELL			
1 NE4NW4				DOMESTIC MULTIPLE			C	350.0 G	560.0			A	
G1*04120C	04	04120	03910	02735	09/23/955		KING	04/05/956	KING CO WTR DIST #	WELL			

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                RECORDED WATER RIGHTS OF THE DEPARTMENT OF ECOLOGY  REGION  1          PAGE  624      REPORT DATE  5/ 4/95
CONTROL #     SEC  OLD      OLD      OLD      DATE OF     S C A   CNTY   PERMIT     NAME                   SOURCE OF APPROPRIATION TRIBUTARY OF
               #   APPL     PERM     CERT     PRIORITY    T C M          DATE
#OF R                                                             USE       INST   C R S        ANNUAL C R S       IRR   C S PRO-   TIME OF   R R R
PTS P LOC. OF POD/POW  (CHG C#)  PURPOSE OF USE                   TYPE      QI     M U U        QA     M U U       AC    M U VISOS  USE       I A C

WATER RESOURCE INVENTORY AREA-  09

TOWNSHIP - 22    RANGE - 04 E
 1   TR20/21 HOMESTEAD PARK SAC  DOMESTIC MULTIPLE                C      1000.0 G            1600.0      S                  A
G1*04999C   04 04999   04717   03584   08/29/958                 KING 02/04/959 KING CO WTR D #75  WELL
 1   SW4 SW4 SW4                DOMESTIC MUNICIPAL               C        450.0 G                        S            0     A                    0 0 0
G1*06124P   04 06124   05818           12/08/961  C              KING 04/27/962 KING CO WTR DIST 7 WELL
 1   NE4 NE4 NW4 SW4            DOMESTIC MULTIPLE                C       1000.0 G            1600.0      B                  A
S1*03053P   04 03053   02292           07/23/930  C              KING 08/07/936 HALL WM            UNN STR                           BOW LK
 1   SW4SW4                     DOMESTIC SINGLE                  C          .05  C 2                                        M
                                IRRIGATION                       C          .05  C 2                            5.0         M     04011001
S1*03054P   04 03054   02293           07/23/930  C              KING 08/07/936 HALL HELEN MRS     UNN STR                           BOW LK
 1   SW4SW4                     DOMESTIC SINGLE                  C          .05  C 2                                        M
                                IRRIGATION                       C          .05  C 2                            5.0         M     04011001
S1*03163C   04 03163   01592   00773   09/22/930                 KING 12/30/930 BEVILACQUA A       UNN STR                           PUGET SOUND
 1   NE4SW4SW4                  DOMESTIC SINGLE                  C          .1   C 2
                                IRRIGATION                       C          .1   C 2                            5.0               IS
S1*05986C   04 05986   03857   04375   03/24/944                 KING 08/10/944 AUER N             UNN STR                           PUGET SOUND
 1   SW4 SE4 NW4                DOMESTIC SINGLE                  C          .01  C

S1*07700C   04 07700   05148   02811   03/19/947                 KING 07/31/947 HOLCOMB A V        DESMOINES CR *                    PUGET SOUND
 1   NE4NW4                     IRRIGATION                       C          .02  C                              1.5         S     IS
S1*08291A   04 08291                   03/23/948  R              KING  /  /     ECKMAN G L         DESMOINES CR                      PUGET SOUND
 1   SE4NW4                     IRRIGATION                       C          .2   C                             20.0               IS
S1*11477A   04 11477                   06/24/952  R              KING  /  /     LLOYD MORTON F     DESMOINES CR                      PUGET SOUND
 1   NE4SW4                     IRRIGATION                       C          .1   C                             10.0               IS
S1-20715C   04                         06/21/973                 KING 04/30/974 WOOD WAYNE W       ANGLE LK                          GREEN R
 1   GOVT LOT 2                 DOMESTIC SINGLE                  C          .02  C 2          1.0    2                      S
                                FIRE PROTECTION                  C          .02  C 2          1.0    2                      S
G1*00763S   06 00763           00600   05/22/944                 KING  /  /     FREDRICKSON A P    WELL
 1   NE4NE4                     DOMESTIC SINGLE                  C         50.0  G 4         19.5    4
                                STOCK WATERING                   C         50.0  G 4         19.5    4
                                FIRE PROTECTION                  C         50.0  G 4         19.5    4
                                IRRIGATION                       C         50.0  G 4         19.5    4             13.0               IS
G1*00944C   06 00944   00795   00762   07/02/948                 KING 08/26/948 FREDRICKSON A P    WELL
 1   NE4NE4                     DOMESTIC SINGLE                  C         50.0  G 4         16.5    4
                                STOCK WATERING                   C         50.0  G 4         16.5    4
                                FIRE PROTECTION                  C         50.0  G 4         16.5    4
                                IRRIGATION                       C         50.0  G 4         16.5    4             11.0               IS
S1*04767C   06 04767   02976   03233   03/31/939                 KING 03/18/940 FOSS C A           UNN SPR
 1   NW4SE4                     DOMESTIC SINGLE                  C          .01  C
S1*04812C   06 04812   02904   01888   05/05/939                 KING 12/26/939 FOSS C A           UNN STR
 1   GL3                        DOMESTIC MULTIPLE                C          .01  C 2
                                STOCK WATERING                   C          .01  C 2
S1*03860C C 07 03860   02074   01934A  07/19/933                 KING 10/05/933 BENSON H V         UNN STR                           PUGET SOUND
 1  2L2                         DOMESTIC MULTIPLE                C          .12  C
S1*04640C   07 04640   02631   02181   09/29/938                 KING 01/06/939 BENSON H V         UNN SPR                           PUGET SOUND
 1   GL2                        DOMESTIC SINGLE                  C          .1   C 2
                                IRRIGATION                       C          .1   C 2                            3.0               IS
S1*04934C   07 04934   02856   01377   08/03/939  E              KING 11/08/939 STONEMAN/BAKER     UNN STR                           PUGET SOUND
 1   L2                         DOMESTIC SINGLE                  C          .08  C 2
                                POWER                            N          .08  C 2

S1*04953C C 07 04953   02877   01934B  08/28/939                 KING 12/01/939 BENSON H V         UNN STR                           PUGET SOUND
 1  2L2                         POWER                            N          .15  C
S1*05660P   07 05660   03644           03/10/942  C              KING 03/17/943 HADLEY HOMER M     UNN STR                           PUGET SOUND
 1   GL-1                       DOMESTIC SINGLE                  C          .01  C                                          M
                                IRRIGATION                       C          .02  C                              4.0         M     04151001
S1*23091A   07 23091                   05/17/971  R              KING  /  /     TAYLOR LOUIS G     UNN SPR                           PUGET SOUND
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CONTROL # / # OF PTS	SEC # / R P LOC. OF POD/POW	OLD APPL	OLD PERM (CHG C#)	OLD CERT	DATE OF PRIORITY	PURPOSE OF USE	S C A T C M	CNTY / USE TYPE	PERMIT DATE / INST QI	C R S M U U	NAME	ANNUAL QA	C R S M U U	SOURCE OF APPROPRIATION	IRR AC	C S M U	PRO-VISOS	TIME OF USE	TRIBUTARY OF	R R R I A C

WATER RESOURCE INVENTORY AREA- 09

TOWNSHIP - 22 RANGE - 04 E

1	GOVT LOT 2					DOMESTIC SINGLE		C	.01	C 2										
						FISH PROPAGATION		C	.01	C 2										
S1-20755C	07				07/16/973			KING	05/15/974		COOK DON W			UNN STR					PUGET SOUND	
1	GL-3					DOMESTIC SINGLE		C	.02	C		1.0								
S1-21285C	07				02/25/974			KING	03/28/975		CIEREBIEJ ALBERT			UNN STR					PUGET SOUND	
1	GL-2					FISH PROPAGATION		N	.02	C							S			
G1*00078S	08	00078		00045	05/00/938			KING	/ /		KING CO WTR D #54			WELL						
1	NW4SE4					DOMESTIC MUNICIPAL		C	150.0	G		244.0								
G1*00089C	08	00089	00060	00036	01/17/946			KING	03/21/946		KING CO WTR D #54			WELL						
1	NW4SE4					DOMESTIC MUNICIPAL		C	300.0	G						0				0 0 0
G1*00751S	08	00751		00597	00/00/905			KING	/ /		WESLEY GARDENS			WELL						
1	NW4SE4					DOMESTIC GENERAL		C	75.0	G 2		15.0	2							
						IRRIGATION		C	75.0	G 2		15.0	2		10.0			IS		
G1*02001C	08	02001	01797	01677	06/08/951			KING	08/10/951		WESLEY GARDENS			WELL						
1	NW4 SE4					DOMESTIC MULTIPLE		C	100.0	G 2		28.0					A			
						IRRIGATION		C	100.0	G 2		20.0			10.0		AE	IS		
G1*03600C	08	03600	03387	02765	05/03/954			KING	08/20/954		KING CO WTR D #54			WELL						
1	SE4 NW4 SE4					DOMESTIC MUNICIPAL		C	250.0	G			S			0	A			0 0 0
G1*05425C	08	05425	05132	03627	10/26/959			KING	03/18/960		KING CO WTR D #75			WELL						
1	NW4NE4NE4					DOMESTIC MUNICIPAL		C	1750.0	G						0	A			0 0 0
G1*05426C	08	05426	05124	03626	10/26/959			KING	03/07/960		KING CO WTR D #75			WELL						
1	NE4NE4SE4					DOMESTIC MUNICIPAL		C	500.0	G						0	AN			0 0 0
G1*06282A	08	06282			05/04/962		R	KING	/ /		KING CO WATER DIS#			WELL						
1	SE4SE4					DOMESTIC MULTIPLE		C	1000.0	G										
G1*08089C	08	08089	07559	06076	05/12/966			KING	08/04/966		KING CO WTR D #54			WELL						
1	E2 SE4 NW4 SE4					DOMESTIC MULTIPLE		C	2250.0	G 2		162.0					RHM			
						DOMESTIC MULTIPLE		C	2250.0	G 2		734.0	S				RHM			
G1-20219C	08				07/17/972			KING	01/31/973		DES MOINES SEWER D			WELL						
1	S2NE4					COMMERCIAL/INDUSTRIAL		C	100.0	G		161.0					R			
G1-21135A	08				12/18/973		R	KING	/ /		KING CO WTR DIST 5			WELL						
1	NW4SE4					DOMESTIC MUNICIPAL		C	250.0	G										
G1-21136A	08				12/18/973		R	KING	/ /		KING CO WTR DIST 5			WELL						
1	NW4SE4					DOMESTIC MUNICIPAL		C	700.0	G										
G1-23253A	08				10/27/978		R	KING	/ /		DES MOINES SEWER D			WELLS						
35	SE4NE4					DOMESTIC MULTIPLE		C	1250.0	G 2										
						IRRIGATION		C	1250.0	G 2					7.0			IS		
G1-23881C	08				07/24/981			KING	05/14/982		KING CO WTR D #54			WELL (#5)						
1	NW4SE4					DOMESTIC SINGLE		C	500.0	G		360.0					RM			
G1-24214C	08				01/17/983			KING	09/14/984		KING CO WTR D #75			WELL						
1	NE4NE4					DOMESTIC MUNICIPAL		C	2500.0	G		1760.0					M#			
G1-26306A	08				08/29/991			KING	/ /		KING CO WTR D #54			WELL						
1	SE4NW4SE4					DOMESTIC MUNICIPAL		C	350.0	G										
S1-20232A	08				07/31/972		R	KING	/ /		DES MOINES SEWER D			UNN STR					PUGET SOUND	
1	N2 S2 NE4					COMMERCIAL/INDUSTRIAL		C	.222	C		161.3								
G1*05423C	09	05423	05122	03624	10/26/959			KING	03/07/960		KING CO WTR D #75			WELL						
1	SW4SE4SW4					DOMESTIC MUNICIPAL		C	750.0	G						0	A			0 0 0
G1*05424C	09	05424	05123	03625	10/26/959			KING	03/07/960		KING CO WTR D #75			WELL						
1	NW4NE4NE4					DOMESTIC MUNICIPAL		C	750.0	G						0	A			0 0 0
G1-24212C	09				01/17/983			KING	09/14/984		KING CO WTR D #75			WELL						
1	NE4NE4					DOMESTIC MUNICIPAL		C	2200.0	G		1600.0					M#			
S1*04543P	09	04543	02637		06/16/938		C	KING	01/17/939		BADCON EBER W			UNN STR					PUGET SOUND	
1	N2NW4NW4					DOMESTIC SINGLE		C	.1	C 2										
						IRRIGATION		C	.1	C 2					20.0			04151001		

CONTROL # / #OF PTS P LOC. OF POD/POW	SEC #	OLD APPL	OLD PERM (CHG C#)	OLD CERT / PURPOSE OF USE	DATE OF PRIORITY	S C A T C M	CNTY / USE TYPE	PERMIT DATE / INST QI	C R S M U U	NAME	ANNUAL QA	C R S M U U	SOURCE OF APPROPRIATION	IRR AC	C S M U	PRO-VISOS	TRIBUTARY OF / TIME OF USE	R R R I A C
WATER RESOURCE INVENTORY AREA- 09																		
TOWNSHIP - 22 RANGE - 04 E																		
S1*05394C	09	05394	03299	01754	03/25/941		KING	05/20/941		STEVICK FRANK ET U			UNN SPR					
1 SW4 NW4 NW4				DOMESTIC SINGLE			C	.01	C 2									
				FIRE PROTECTION			C	.01	C 2									
S1*14236C	09	14236	10632	07199	02/20/957		KING	05/24/957		OSTERHOUDT D			UNN SPRS					
1 W2 SE4 SW4				DOMESTIC SINGLE			C	.01	C									
				FISH PROPAGATION			N	.09	C							S		
G1*01748C	10	01748	01569	00673	12/07/950		KING	03/09/951		LOGAN K			WELL					
1 TR3 VANDEVANTERS 10 AC TR				IRRIGATION			C	30.0	G		15.0			7.5		EA	IS	
G1-00213C	10	12286			11/12/971		KING	10/12/972		KENT HIGHLANDS INC			WELL					
1 SW4SW4SE4				DOMESTIC SINGLE			C	15.0	G		1.0							
G1-23730BAL	10				01/06/981	C	KING	07/31/981		LDS CHURCH			WELL					
1 NE4NE4				IRRIGATION			C	250.0	G		24.0			48.0			IS	2 2 2
G1-25163C	10				01/13/988		KING	10/14/988		GREEN JOHN B			WELL					
1 LOT 3				DOMESTIC MULTIPLE			C	33.0	G		3.5						00000000	
S1*06536C	10	06536	04246	02564	07/17/945		KING	11/08/945		ADELL F E			GREEN R				DUWAMISH R	
1 GL2				IRRIGATION			C	.69	C					68.9		S	IS	
S1*07249C	10	07249	04706	03487	06/14/946	E	KING	11/06/946		GOOD W			GREEN R				DUWAMISH R	
1 D A NEELY DLC 37				DOMESTIC SINGLE			C	.3	C 3							S		
				STOCK WATERING			C	.3	C 3							S		
				IRRIGATION			C	.3	C 3					30.0		S	IS	
S1*07309PAL	10	07309A	04704A		07/08/946	C	KING	11/06/946		FARM EQUIPM'T& SAL			WHITE R				DUWAMISH R	
1 DAVID A NEELY DLC #37				COMMERCIAL/INDUSTRIAL			C	.05	C							SM		4 0 0
S1*07562C	10	07562	05072	02846	12/04/946		KING	06/12/947		WRIGHT C I			GREEN R				DUWAMISH R	
1 GL-3				IRRIGATION			C	.34	C					34.0		S	IS	
S1*12308C	10	12308	09319	05587	04/29/953		KING	12/18/953		DELACRUZ C			GREEN R				DUWAMISH R	
1 GL-4				IRRIGATION			C	.15	C					15.0		SDL	IS	
S1*12420C	10	12420	09280	05565	06/18/953		KING	11/18/953		SHUMATE L E			GREEN R				DUWAMISH R	
1 GL-3				IRRIGATION			C	.1	C					10.0		LS	IS	
S1*16706C	10	16706	12404	08481	06/02/961		KING	08/30/961		KOWING J E			GREEN R				DUWAMISH R	
1 DAVID A NEELY DLC				DOMESTIC SINGLE			C	.01	C							SD		
G1-23730BBL	11				01/06/981	C	KING	07/31/981		LDS CHURCH			WELL					
1 NW4NW4				IRRIGATION			C	250.0	G		24.0			48.0			IS	2 2 2
S1*02050P	11	02050	00983		04/16/927	C	KING	09/20/927		MALMO & CO			WHITE R				DUWAMISH R	
1 SW4NE4NW4				IRRIGATION			C	1.5	C					73.93			04011001	
S1*07309PBL	11	07309B	04704B		07/08/946	C	KING	11/06/946		FARM EQUIPM'T& SAL			WHITE R				DUWAMISH R	
1 DAVID A NEELY DLC #37				COMMERCIAL/INDUSTRIAL			C	.05	C							SM		4 0 0
S1*13126P	11	13126	09815		09/15/954	C	KING	01/17/955		BARNETT ALTA M			GREEN R				DUWAMISH R	
1 GL-5				IRRIGATION			C	.1	C					10.0		SDL	04151001	
S1-24083G	11				05/12/982		KING	01/14/983		KENT VLY FMS (LDS)			GREEN R				DUWAMISH R	
1 NE4NW4				IRRIGATION			C	1.1	C		48.0			48.0		S-	IS	
G1*04259C	12	04259	03995	02887	03/21/956		KING	06/08/956		KOMOTO J T / G			WELL					
1 SE4NE4				IRRIGATION			C	72.0	G		30.0			15.0		AEK	IS	
S1*04623CBL	12	04623B	02626B	01214B	09/07/938		KING	01/05/939		OLSON A			MILL CR *				SPRING BROOK CR	
1 NE4NW4				IRRIGATION			C	.51	C					34.0			04151001	2 0 2
S1*05578C	12	05578	03478	02557	09/09/941		KING	01/27/942		EARHART W J			MILL CR				SPRING BROOK CR	
1 SE4SW4				IRRIGATION			C	.22	C					20.0		S	IS	
S1*07341C	12	07341	04774	02747	07/26/946		KING	12/19/946		EARHART W J			MILL CR				SPRING BROOK CR	
1 SE4SW4				IRRIGATION			C	.05	C					13.0		S	IS	
S1*10497C	12	10497	07574	04879	07/16/951		KING	10/18/951		OLSON D A			MILL CR				SPRING BROOK CR	
1 NE4SW4				IRRIGATION			C	.21	C					21.0		S	IS	
G1*04953C	13	04953	04644	03522	08/07/958		KING	12/01/958		HORATH G			WELL					
1 NW4 NW4				DOMESTIC SINGLE			C	5.0	G 2		5.6	2				AE		

CONTROL # / #OF PTS P LOC. OF POD/POW	SEC #	OLD APPL	OLD PERM (CHG C#)	OLD CERT / PURPOSE OF USE	DATE OF PRIORITY	S C A / T C H	CNTY / USE TYPE	PERMIT DATE / INST QI	C R S / M U U	NAME / ANNUAL QA C R S M U U	SOURCE OF APPROPRIATION	IRR AC	C S M U / PRO-VISOS	TRIBUTARY OF / TIME OF USE	R R R / I A C
WATER RESOURCE INVENTORY AREA- 0\															
TOWNSHIP - 22 RANGE - 04 E															
				STOCK WATERING			C	5.0	G 2	5.6 2			AE		
S1*09231C	13	09231	06382	03834	11/29/949		KING	04/13/950		LAZZARINI G ET AL	MILL CR			SPRING BROOK CR	
1 NW4NE4				IRRIGATION			C	.3	C			34.0	S	IS	
S1*09289C	13	09289	06480	04164	12/30/949		KING	05/31/950		BERNASCONI T	UNN DRN DIT			GREEN R	
1 NE4NE4				IRRIGATION			C	.38	C			38.0	SD	IS	
S1*10216C	13	10216	07349	05305	03/28/951		KING	07/16/951		SHAFF W E	UNN DRN DIT			GREEN R	
1 SE4NE4				IRRIGATION			C	.08	C			8.0	SD	IS	
S1*11056P	13	11056	08046		02/13/952	C	KING	05/20/952		RADKE RYNHOLD J	MILL CR			GREEN R	
1 NE4SE4				IRRIGATION			C	.025	C			2.5	SMLD	04151001	
S1*12504A	13	12504			06/25/953	R	KING	/ /		REAND J	MILL CR			GREEN R	
1 N2SE4NE4				DOMESTIC SINGLE			C	.16	C 2						
				IRRIGATION			C	.16	C 2			16.0		IS	
G1-25102C	14				09/22/987		KING	12/14/990		KENT COMM LAKES	WELLS 3				
3 SW4SE4				REC & BEAUTIFICATION			C	450.0	G	45.0			$RM	06011031	
S1*07309PCL	14	07309C	04704C		07/08/946	C	KING	11/06/946		FARM EQUIPM'T& SAL	WHITE R			DUWAMISH R	
1 DAVID A NEELY DLC #37				COMMERCIAL/INDUSTRIAL			C	.05	C				SM		4 0 0
S1*08308C	14	08308	05619	03191	04/01/948		KING	06/09/948		SOAMES H L	GREEN R			DUWAMISH R	
2 D A NEELY DLC 37 / GL1				IRRIGATION			C	1.0	C			102.0	S	IS	
G1-00212C	15	12285			11/12/971		KING	10/12/972		KENT HIGHLANDS INC	WELL				
1 NW4NW4NE4				DOMESTIC SINGLE			C	15.0	G	1.0					
S1*06911A	15	06911			02/18/946	R	KING	/ /		BLECKER W H	UNN SPR			GREEN R	
1 NW4				DOMESTIC SINGLE			C	.015	C 3						
				STOCK WATERING			C	.015	C 3						
				IRRIGATION			C	.015	C 3			1.0		IS	
S1*06912A	15	06912			02/18/946	R	KING	/ /		SMITH CLARENCE ET	UNN SPR			GREEN R	
1 ENOS COOPER DLC NO 38				DOMESTIC SINGLE			C	.015	C 4						
				HEAT EXCHANGE			C	.015	C 4						
				STOCK WATERING			C	.015	C 4						
				IRRIGATION			C	.015	C 4			1.0		IS	
S1*06971C	15	06971	04601	02771	03/14/946		KING	08/22/946		HASHAGEN L G	GREEN R			DUWAMISH R	
1 D A NEELY DLC 37				IRRIGATION			C	.42	C			42.0	S	IS	
S1*07063C	15	07063	04594	02657	04/20/946		KING	08/22/946		TAYLOR A P	GREEN R			DUWAMISH R	
1 D A NEELY DLC 37				IRRIGATION			C	1.0	C			100.0	S	IS	
S1*07247C	15	07247	04705	04440	06/14/946		KING	11/06/946		CARVER I D	GREEN R			PUYALLUP R	
1 DAVID A NEELY DLC 37				DOMESTIC SINGLE			C	.1	C 3				S		
				STOCK WATERING			C	.1	C 3				S		
				IRRIGATION			C	.1	C 3			10.0	S	IS	
S1*07248C	15	07248	04703	03587	06/14/946		KING	11/06/946		DOLAN M E	GREEN R			DUWAMISH R	
99 DAVID NEELY DLC 37				DOMESTIC SINGLE			C	1.14	C 3				S		
				STOCK WATERING			C	1.14	C 3				S		
				IRRIGATION			C	1.14	C 3			114.0	S	IS	
S1*07309PDL	15	07309D	04704D		07/08/946	C	KING	11/06/946		FARM EQUIPM'T& SAL	WHITE R			DUWAMISH R	
1 DAVID A NEELY DLC #37				COMMERCIAL/INDUSTRIAL			C	.05	C				SM		4 0 0
S1*07342C	15	07342	04791	03354	07/26/946		KING	01/07/947		SMITH C A / C B	UNN SPRS			GREEN R	
1 ENOS COOPER DLC 38				STOCK WATERING			C	.1	C 3				S		
				FIRE PROTECTION			C	.1	C 3				S		
				IRRIGATION			C	.1	C 3			10.0	S	IS	
S1*07707C	15	07707	05186	03918	03/22/947		KING	08/25/947		BLECKER W H	UNN STR			GREEN R	
1 E COOPER DLC 38				IRRIGATION			C	.15	C			15.0	S	IS	
S1*16699C	15	16699	12405	09203	05/23/961		KING	08/30/961		KENT HIGHLANDS INC	GREEN R			DUWAMISH R	
1 NW4SE4NE4				COMMERCIAL/INDUSTRIAL			C	2.2	C				SDP		
S1*17594P	15	17594	13030		10/23/962	C	KING	04/17/963		KENT HIGHLANDS INC	UNN STR			GREEN R	
1 ENOS COOPER DLC 38				COMMERCIAL/INDUSTRIAL			P	1.0	C				PS		
S1-00151C	15	23517			11/12/971		KING	08/28/972		KENT HIGHLANDS INC	MORGAN SPR H			GREEN R	
1 SW4NW4NE4				DOMESTIC SINGLE			C	.02	C	1.0			M		

WATER RESOURCE INVENTORY AREA- 09

TOWNSHIP - 22 RANGE - 04 E

CONTROL # / #OF PTS, P, LOC. OF POD/POW	SEC #	OLD APPL	OLD PERM	OLD CERT	PURPOSE OF USE	DATE OF PRIORITY	S C A T C M	CNTY	USE TYPE	PERMIT DATE	INST QI	C R S M U U	NAME	ANNUAL QA	C R S M U U	SOURCE OF APPROPRIATION	IRR AC	C S M U	PRO-VISOS	TRIBUTARY OF / TIME OF USE
G1*04579C	16	04579	04336	03073		04/19/957		KING		08/21/957			KING CO WTR DIST #			WELL				
1 SW4SW4SW4					DOMESTIC MULTIPLE				C		400.0	G		215.0					A	
G1-25093C	16					10/02/987		KING		02/15/989			BEALL ERIC A			WELL				
1 LOT 3					DOMESTIC SINGLE				C		10.0	G		.5						
S1*03148P	16	03148	01595			09/16/930	C	KING		12/31/930			DALLMAN FRANK E			UNN STR				PUGET SOUND
1 NE4SW4					DOMESTIC SINGLE				C		.05	C 2								
					IRRIGATION				C		.05	C 2					7.5			04011001
S1*03490C	16	03490	01856	01073		08/24/931		KING		03/12/932			DEAN I H			UNN STR				PUGET SOUND
1 SW4 SW4					DOMESTIC SINGLE				C		.2	C 2								
					IRRIGATION				C		.2	C 2					12.0			IS
S1*03688A	16	03688				07/29/932	R	KING		/ /			ANDERSON FRED			UNN SPR				
1 NE4NW4					DOMESTIC SINGLE				C		.5	C 2								
					IRRIGATION				C		.5	C 2					40.0			IS
S1*14650C	16	14650	10979	07211		01/31/958		KING		05/15/958			WILLITZ V M			UNN STR				PUGET SOUND
1 SE4 NW4					DOMESTIC SINGLE				C		.01	C 2							SD	
					STOCK WATERING				C		.01	C 2							SD	
					IRRIGATION				C		.01	C		2.0			1.0		SD	IS
G1*00218S	17	00218		00202		00/00/924		KING		/ /			GRAND LODGE F/AM			WELL				
1 SW4SE4					DOMESTIC GENERAL				C		30.0	G 2		5.0	2					
					IRRIGATION				C		30.0	G 2		5.0	2		15.0		%	IS
G1*00219S	17	00219		00203		00/00/924	G	KING		/ /			GRAND LODGE F/AM			WELL				
1 SW4SE4					DOMESTIC GENERAL				C		30.0	G 2		5.0	2					
					IRRIGATION				C		30.0	G 2		5.0	2		25.0		%	IS
G1*00220S	17	00220		00204		00/00/926		KING		/ /			GRAND LODGE F/AM			WELL				
1 SW4SE4					DOMESTIC GENERAL				C		75.0	G 2		28.0						
					IRRIGATION				C		75.0	G 2		30.0			15.0		%	IS
G1*01712C	17	01712	01591	01199		10/27/950		KING		03/23/951			MOST W GRAND LODGE			WELL				
1 SE4SW4SE4					DOMESTIC MULTIPLE				C		100.0	G 2 2		81.0					A	
S1*01297P	17	01297	00597			04/08/925	C	KING		11/19/925			RINK EMIL C			UNN CR				PUGET SOUND
1 L-54 DES MOINES TWO-ACER TRS					REC & BEAUTIFICATION				N		.2	C								
S1*02094P	17	02094	01017			06/08/927	C	KING		11/15/927			OLSEN OLAF			UNN STR				PUGET SOUND
1 SW4SW4NE4					DOMESTIC SINGLE				C		.05	C 2								
					IRRIGATION				C		.05	C 2					2.0			05011001
S1*03555C	17	03555	01859	00827		11/13/931		KING		03/12/932			ELLINGTON A C			UNN STR				PUGET SOUND
1 DES MOINES 2 ACRE TRS					IRRIGATION				C		.03	C					2.0			IS
S1*04125C	17	04125	02253	01114		06/14/935		KING		02/27/936			HOFFMAN A A			UNN STR				PUGET SOUND
1 TR43 DES MOINES TWO ACRE TR					DOMESTIC SINGLE				C		.02	C 2							M	
					POWER				N		.21	C							M	
					IRRIGATION				C		.02	C 2					2.0		M	IS
S1*04909A	17	04909				07/20/939	R	KING		/ /			WILHELM JOHN H			UNN STR				PUGET SOUND
1 GL-2					IRRIGATION				C		.03	C					2.0			IS
S1*09992C	17	09992	07205	05348		11/18/950		KING		05/07/951			MOSER ALBERT ET UX			UNN STR				PUGET SOUND
1 LII DESMOINES 2 AC TRS					REC & BEAUTIFICATION				N		.1	C							SD	
S1-21875P	17					06/25/974	C	KING		08/16/976			MICKELSON FORREST			UNN STR				PUGET SOUND
1 T 50 P DES MOINES 2 ACRE TRS					IRRIGATION				C		.03	C 2		2.0			1.0		S	IS
					FISH PROPAGATION				N		.03	C 2							S	
S1*03501A	20	03501				09/02/931	R	KING		/ /			HATCH O C			MCSORLEY CR N				PUGET SOUND
1 SE4SE4					DOMESTIC SINGLE				C		2.0	C								
R1*14620C C	21	14620	00218	08314A		12/26/957		KING		08/15/958			MARTINDALE R B			UNN STR				PUGET SOUND
1 E2NW4NW4SW4					REC & BEAUTIFICATION				F			C		7.0					-$	
S1*08432C	21	08432	05810	03245		05/20/948		KING		01/18/949			GUFFEY C D ET UX			UNN SPR				
1 SW4 SW4					DOMESTIC SINGLE				C		.02	C 2								
					STOCK WATERING				C		.02	C 2								
S1*14583C C	21	14583	11080	08314B		11/18/957		KING		08/15/958			MARTINDALE R B			UNN STR				UNN STR
1 E2NW4NW4SW4					REC & BEAUTIFICATION				N		.5	C							$$	

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APPENDIX Q-B
SEA-TAC AIRPORT MASTER PLAN UPDATE FINAL EIS

Sea-Tac International Airport
Preliminary Water Conservation Plan

Prepared for

Port of Seattle

Prepared by

SHAPIRO AND ASSOCIATES, INC.
1201 Third Avenue, Suite 1700
Seattle, WA 98101

January 1996

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Introduction

WATER CONSERVATION - PLANNING FOR THE FUTURE

Throughout the Puget Sound area, water is regarded as a finite and increasingly valuable natural resource. Growth in the region places new demands on public water systems. Water utilities, such as Seattle Water, are planning for development of new water supplies, evaluating agreements for interbasin water transfer with other utilities, and evaluating storage projects to meet future demands. Conservation however, can help provide the additional water the Port needs in the 1990s. Conservation is less expensive than developing new water supplies and provides environmental benefits such as habitat conservation (Seattle Water, July 1992; City of Denver, December 1992). In addition, conservation is effective in addressing the region's biggest water supply problem, which is summer water demand (Dietemann, November 1995).

Operating an international airport requires planning, commitment, and availability of various resources, including water. As passenger activity increases, Sea-Tac International Airport will have greater demands for water. For this reason, The Port of Seattle has included a water conservation plan in their future.

WHY CONSERVE?

The Port of Seattle believes that an efficient airport operation includes efficient use of resources. On a regional scale, the Airport is a significant water user. Everything the Airport does to use water more efficiently benefits not only those at the Airport, but the communities around the Airport. It also helps reduce or delay incurring the expenses of developing new sources of water.

By using water more efficiently, the Port of Seattle saves money. Every year the Port's water costs increase. Seattle Water anticipates that the cost of potable water will quadruple by the year 2000 (Seattle Water, August 1995). The costs to dispose of water, whether through the Airport's onsite industrial wastewater treatment plant or a publicly owned treatment works, is more expensive per unit of water than the original purchase. Using less water also reduces the water system operating pumping costs. Like supply costs, wastewater treatment costs increase every year. The Port of Seattle won't have to pay for water they don't use—when they conserve.

The natural environment also benefits when the Port conserves (Washington State Department of Ecology and Washington State Department of Health, November 1991). By conserving water in the Lower Puget Sound Basin, the Port is actually helping to conserve salmon and trout habitat in the upper Cedar and Tolt River watersheds, the sources of the Airport's water.

CONSERVATION GOALS

This water conservation plan was designed with four goals in mind to address immediate and future concerns:

- Increase the efficiency of water use at the airport;
- Reduce water use, especially during seasons with peak demands;
- Develop long-range conservation plans to meet future demand; and
- Ensure that water conservation is integrated into airport expansion activities.

WHAT'S IN THIS WATER CONSERVATION PLAN?

The Airport gets its water from Seattle Water, the Puget Sound area's largest water utility. The Airport's water system is a public system; owned, operated, and maintained by the Port of Seattle. The Port acts as its own water utility, providing water to tenants and Airport facility operations.

The Washington State Department of Ecology and Department of Health have published a document, *Conservation Planning Requirements* (March 1994), that provides guidelines and requirements for public water system conservation plans. This water conservation plan contains required elements outlined in the state's guidelines. These elements include defining objectives of the conservation plan, forecasting water demand, describing procedures to collect water use data, and identifying conservation activities.

This plan supplements and augments water conservation measures already in place at the Airport. This plan, which is preliminary in nature, will be revised and updated as the Port of Seattle gathers new information and data.

Chapter 1: Water Use Demands

HOW IS WATER AT SEATTLE-TACOMA INTERNATIONAL AIRPORT USED?

The water the Port of Seattle supplies to its customers accounts for about 80 percent of the demand at the Airport. Most of this water is metered and billed on a monthly basis. Customers at the Airport fall into four classes: food services, air cargo facilities, aircraft hangars/maintenance, and car rental agencies (Figure 1). The remaining 20 percent of the water demand at the Airport supports terminal operations including domestic, maintenance, 20 acres of landscape irrigation, and building cooling systems (Figure 2).

CURRENT DEMAND

Water demand at the Airport for 1994 was 172 million gallons. The average daily water use in 1994 was 470,000 gallons with a summer peak demand of about 740,000 gallons per day (Figure 3). This high seasonal demand—June through September—is caused by increased passenger traffic (Figure 4), irrigation, and building cooling. The monthly irrigation amounts shown in Figure 3 are an estimate based on predicted irrigation demands for the Puget Sound area. Water supply costs currently range from $5,000 to $20,000 per month.

FUTURE DEMAND

Water demand at the Airport is expected to increase with forecasted increases in passenger traffic. To estimate future demands, the trend forecasting method developed in the Airport's *Comprehensive Water System Plan* (Horton Dennis and Associates, Inc., August 1991) using recent passenger traffic and water consumption data was applied. The forecast is based on water use per passenger. Prior to 1990, water use per passenger averaged about 15 gallons per visit (Horton Dennis and Associates, Inc., August 1991). Since 1990, this water use trend has declined, most likely due to new plumbing codes requiring water-saving plumbing fixtures in new installations (Table 1). In forecasting water demand—without any additional conservation—a consumption of 8.2 gallons per passenger was assumed. This has been the average consumption for the past two years. In forecasting water demand with the recommended conservation activities outlined in Chapter 3, a water use of 7.0 gallons per passenger was assumed. This reduced consumption assumes that water conservation will decrease overall water demands by 15%. An overall savings of 15% seems reasonable based on audits of several industries that showed that implementing various water conservation activities resulted in savings of 10 to 25% (American Water Works Association, 1989).

Annual traffic volume at the Airport, used in the demand forecast, is based on projections from the Airport's *Master Plan Update* (Federal Aviation Administration and Port of Seattle, April 1995), which includes traffic associated with the runway expansion (Table 2). High passenger growth projections used in Horton Dennis and Associates, Inc. (1991) are shown for comparison. Based on the FAA and Port of Seattle (1995) traffic volumes, annual water consumption, with additional conservation, is forecasted to be 166 million gallons by 2000, 213 million gallons by 2010, and 266 million gallons by 2020 (Table 2, Figure 5). Without additional conservation, annual water consumption is forecasted to be 195 million gallons by 2000, 251 million gallons by 2010, and 313 million gallons by 2020 (Figure 5). By implementing the recommended conservation activities, annual water consumption could potentially be reduced from the 1994 rate of 172 million gallons to 166 million gallons by 2000—even with a 14 percent increase in passenger traffic.

Water demand for the high growth traffic projections presented in Horton Dennis and Associates, Inc. (1991) was also forecasted. Based on this traffic projection, annual water consumption—

with additional conservation—is forecasted to be 178 million gallons by 2000, 238 million gallons by 2010, and 315 million gallons by 2020 (Table 2, Figure 6).

Table 1: WATER CONSUMPTION PER PASSENGER VISIT AT SEA-TAC INTERNATIONAL AIRPORT

Year	Number of Passengers (Millions)	Annual Water Use (Millions of Gallons)	Average Use Per Passenger (Gallons)
1991	16.31	226.3	13.9
1992	17.96	224.9	12.5
1993	18.80	177.7	9.5
1994	20.99	171.9	8.2
1995	17.31*	141.2*	8.2*

* Through September 1995

Source: Port of Seattle, 1995.

Table 2: PROJECTED PASSENGER TRAFFIC AND WATER DEMAND AT SEA-TAC INTERNATIONAL AIRPORT

Year	*Master Plan Update* Traffic Projections (1995)		*Comprehensive Water System Plan* High Growth Traffic Projections (1991)	
	Number of Passengers (Millions)	Water Demand (Millions of Gallons)	Number of Passengers (Millions)	Water Demand (Millions of Gallons)
2000	23.8	166	25.4	178
2010	30.6	213	34.0	238
2020	38.2	266	45.0	315

Note: Projected water demands assume conservation activities will reduce existing rates of water consumption by 15%.

Source: Port of Seattle, 1995.

Chapter 2: Collecting Water Use Data

Collecting accurate water use information would identify use patterns, improve demand forecasting, define additional water conservation activities, and help to evaluate implemented conservation activities.

To more effectively evaluate water use, the Port of Seattle has developed two categories of water use to track; terminal water use and customer classes. Water uses associated with operating the terminal include domestic, cooling, landscape irrigation, fire protection, construction, and maintenance. Customer classes include food services, car rental agencies, aircraft hangars, and air cargo.

The Port of Seattle currently meters several of their water customers and have monthly water use data. To date, these data have been used to bill customers for their water consumption. The Port reads most of the meters once each month. It is important for the Port to continue with monthly readings so they can identify trends in seasonal water use. In upcoming technical studies, described in Chapter 3, the Port will use existing and future water meter data to identify trends in water use among customer classes.

Collecting more data through metering, customer audits, and customer surveys will help the Port understand the amount and patterns of water use for each terminal water use and customer class. As conservation activities are implemented, the data collected will assist in evaluating the effectiveness of the activities.

In summary, water use data collection will include:

- Monthly meter readings of customers and terminal water use classes;
- Voluntary customer water audits; and
- Customer surveys.

Chapter 3: Water Conservation Activities

CURRENT ACTIVITIES

Over the past four years the Port of Seattle has made progress in more efficiently using water. The Port has installed water conserving wash basins in all of the public rest rooms at the Airport. When the Port installs new plumbing fixtures or replaces old fixtures, they use water conserving fixtures. The Port's car rental agency customers have installed onsite water reuse systems for washing cars. In addition, the Port has initiated a metering program and implemented mechanisms (such as monthly billings) to educate water customers.

PLANNED ACTIVITIES

In general, as the Port considers new water conservation activities, they will attempt to identify obstacles that could potentially prevent these activities from being implemented. These obstacles include health codes, fire safety, customer attitudes, water system infrastructure, and economic limitations over the next 3 years.

Based upon a current understanding of water use patterns, the Port is evaluating the feasibility of implementing the following water conservation activities:

- **Install additional meters.** The airport currently has 71 metered connections to 32 separate tenants (Paradee, November 1995; Horton Dennis and Associates, Inc., August 1991). These meters are read monthly and customers are billed for their water consumption. Additional meters are needed to further understand water use patterns. The Port would select specific meter locations to sample representative terminal water uses.

- **Conduct an irrigation audit.** The Port is currently using a phased approach to improve the efficiency of the airport landscape irrigation system. The Port recently established irrigation zones to allow more effective control of the system. An irrigation audit would help refine the rates and amounts of irrigation for each zone. In addition, the audit would give an indication of the current application efficiency and identify fixtures that may need to be replaced. Implementing an irrigation scheduling system based on real time demand would be included in the next phase of the system upgrade.

- **Establish guidelines for new irrigation systems.** These guidelines would include a suggested list of landscape plants that consume less water, recommendations for water efficient irrigation technologies such as drip irrigation, irrigation scheduling methods, mulching recommendations, and considerations for irrigating with reclaimed water.

- **Conduct customer water use audits.** The Port would conduct voluntary on-site water audits for a subset of representative water customers. The audits would allow the Port to recommend appropriate conservation activities for customers. Where possible, the audits would be done in conjunction with the Port's ongoing cross-connection prevention and control program.

- **Conduct customer water use surveys.** To better understand how the Port's metered customers use their water, the Port would ask customers to complete a water use survey. The Port would then summarize the results to determine trends.

- **Eliminate single-pass cooling.** The compressors used in the Airport terminal air conditioning would be re-plumbed to eliminate single-pass cooling. The Port would convert to a closed-loop system, allowing reuse of the cooling water.

- **Find and repair leaks.** A detailed evaluation of 8,000 feet of water system pipeline is planned for 1996. The Port will determine the condition of the pipeline and detect existing leaks. Recommendations for upgrading the pipeline will be based on the outcome of the study. The Port also has a system of detector check meters incorporated into the fire water system. These meters are read regularly to detect leaks.

- **Retrofit plumbing fixtures.** The Port would continue to install water conserving fixtures as new plumbing fixtures are added and old fixtures are replaced.

- **Restructure customer water rates.** The water rate schedules for water customers are established by the Port of Seattle Commissioners. In anticipation of rate schedule changes from Seattle Water, the Port would restructure the water rates to their customers. Higher charges of water will most likely be scheduled during peak demand season, from mid-May through mid-September. To encourage wise water use and manage water demand, the Port would establish excessive-use fees, especially during peak demand season. On the other hand, the Port would recognize water-efficient customers through an annual award or rebate program.

- **Use monthly billings to inform customers.** The Port would use monthly water billings to keep customers aware of conservation issues and their water use patterns. A summary chart on each billing would show the customer's water consumption for the past twelve months.

- **Develop a water shortage contingency plan.** A water shortage could have a tremendous impact on Airport operations. To allow quick response to a seasonal water shortage, the Port would develop a water use contingency plan. The plan would address trigger conditions, contingency measures, and information to distribute to water users during a water shortage.

TECHNICAL STUDIES AND CUSTOMER EDUCATION

Over the next 3 years, the Port would conduct technical studies to learn more about water use patterns at the Airport. With this information at hand, the Port would be better equipped to evaluate other conservation activities and inform customers of the methods and benefits of water conservation. Technical studies and customer education tentatively include:

- **Evaluating opportunities for water reuse and reclamation.** The Airport would continue to evaluate the economics of using reclaimed water for non-potable uses such as toilets, irrigation, and cooling. Potential sources of reclaimed water include the Airport's onsite industrial wastewater treatment plant (Kennedy/Jenks Consultants, July 1995), King County's effluent transfer system (Seattle Water, July 1995), and small-scale onsite wastewater treatment systems.

- **Designing a database to track water use.** The database would include currently metered customers and new meters as they are added. The database would graph monthly consumption, which would be incorporated into monthly customer billings. In addition, the database would show seasonal trends in water use and detect unusually low or high water use for a given meter location. This database feature would help identify meters that may be out of calibration or leaks in the pipeline.

- **Establishing a technology transfer program.** The Airport would investigate the potential of sharing water conservation information among other airports or similar water users. In addition, the airport would benchmark their progress in water conservation against other Airports and other industries that have implemented successful water conservation programs.

- **Developing educational materials about water conservation.** Based on findings from audits and water use evaluations, the Port would determine the most effective methods to educate their customers about water conservation. The Port may find that circulating water conservation literature that is customized to the specific needs of their customers, as done by the City of Phoenix, may be an effective outreach program (American Water Works Association, 1989).

Chapter 4: Implementing and Evaluating the Plan

COSTS, SAVINGS, AND SCHEDULE

Estimated costs, savings, and the schedule of implementing each of the activities described in Chapter 3 are listed below in Table 3. Targeted annual water savings are based on the Port's current understanding of the Airport's water consumption patterns. The Port anticipates that most of the conservation activities listed in Table 3 would have a payback period of less than 2 years, based on savings in water supply costs and wastewater treatment charges.

Table 3: COSTS, SAVINGS, AND SCHEDULE FOR CONSERVATION ACTIVITIES (1996-1998)

Conservation Activity	Invested Cost ($)	Annual Water Savings (Millions of Gallons)	Schedule
Install additional meters	14,500	3.1	1996-1998
Conduct irrigation audit	9,500	1.2	1996-1998
Establish guidelines for new irrigation systems	4,500	0.1[a]	1996
Conduct customer water use audits	10,500	6.0	1996
Conduct customer water use surveys	5,500	2.0	1996-1997
Eliminate single-pass cooling	4,000	0.1	1996
Find and repair leaks along an 8000-foot pipeline	8,000	0.7	1996
Retrofit plumbing fixtures	20,000	8.0[b]	1996-1998
Restructure water rates	2,500	2.0	1997-1998
Use monthly billings to inform customers	6,500	2.0	1997
Develop water shortage contingency plan	6,500	c	1996

[a]Water savings are per acre of new landscape irrigated.

[b]Water savings include terminal and customer plumbing retrofits.

[c]The goal of the water shortage contingency plan will be to reduce peak daily demands.

EVALUATING THE CONSERVATION ACTIVITIES

The overall conservation plan is best evaluated by assessing the success of the individual activities that make up the plan. Water use data from meters would be used to evaluate the effectiveness of most conservation activities. In some cases, meters may need to be installed prior to the conservation activity to collect baseline data. Comparing two similar water uses—one with a selected conservation activity and one without—may also be useful in evaluating the effectiveness of the conservation activity. As conservation activities are evaluated, the Port of Seattle would document the performance of the activities in supplementary reports.

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Washington State Department of Ecology and Washington State Department of Health, November 1991. *Water Conservation Planning Handbook for Public Water Systems.* Publication 91-39. Olympia, Wash.

Figure 1. Water use by customer billing class at Sea-Tac International Airport (80% of total water usage).

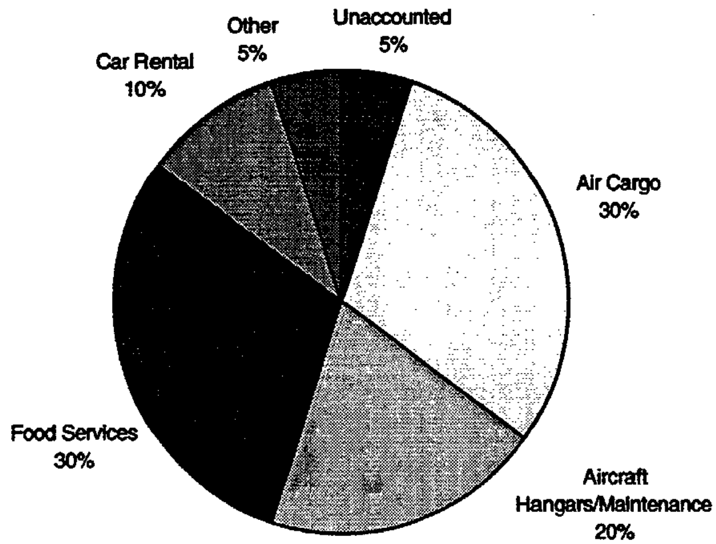


Figure 2. Port of Seattle water uses supporting terminal operations at Sea-Tac International Airport (20% of total water usage).

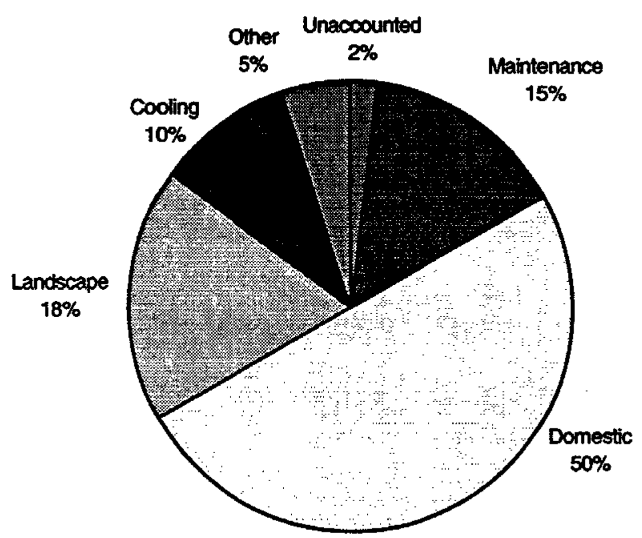


Figure 3. Monthly water demands at Sea-Tac International Airport for 1994.

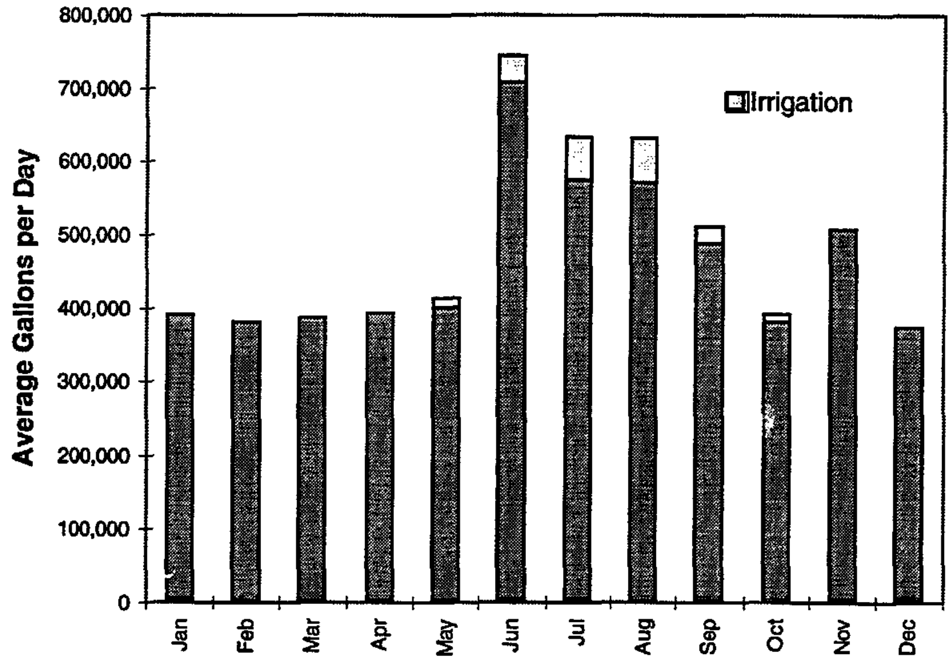


Figure 4. Monthly passenger traffic at Sea-Tac International Airport for 1994.

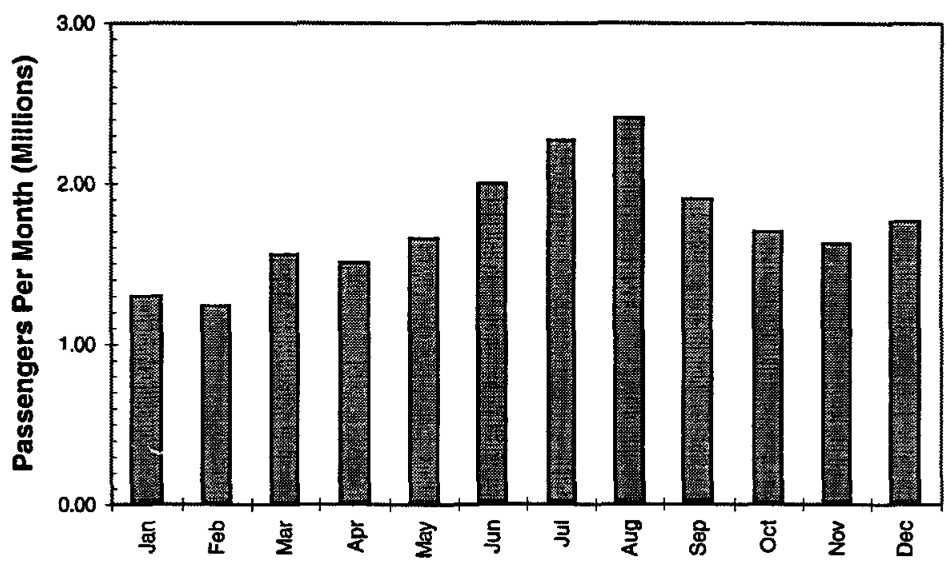


Figure 5. Forecasted water demand at Sea-Tac International Airport with and without additional conservation.

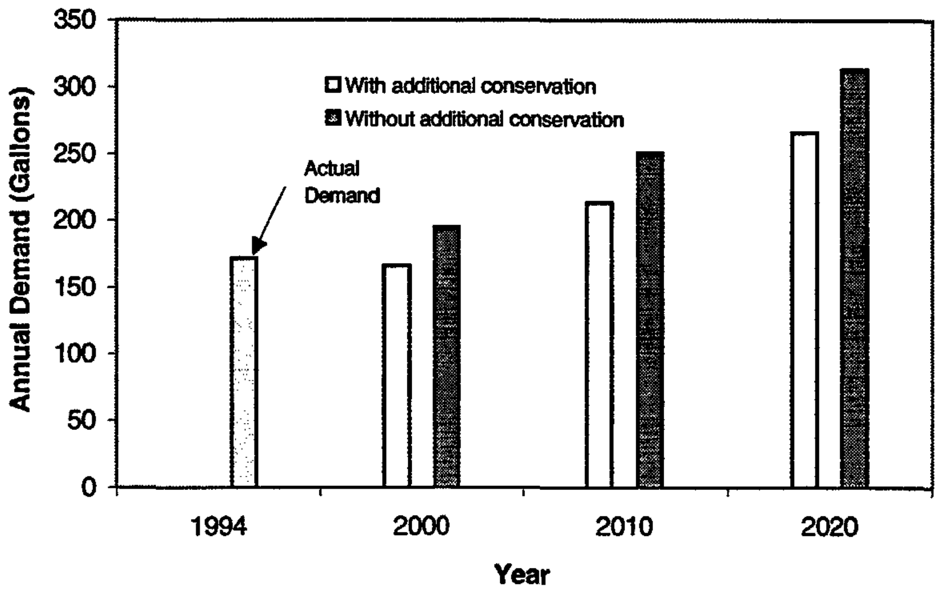
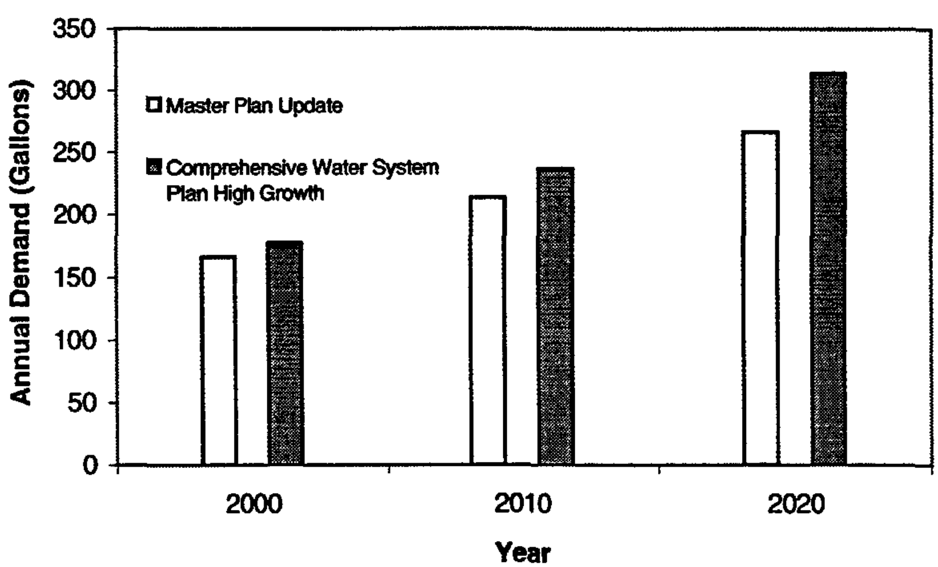


Figure 6. Forecasted water demand at Sea-Tac International Airport for alternative growth projections.



APPENDIX Q-C

SEA-TAC AIRPORT MASTER PLAN UPDATE FINAL EIS

CONCEPTS FOR USING A CONSTRUCTED AQUIFER TO MANAGE AIRPORT STORMWATER

Prepared for

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January 1996

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BACKGROUND INFORMATION

In terms of the 8,500-foot runway option, constructing the proposed new parallel runway would add 550 acres of fill surface area and 193 acres of impervious surface area in the Miller Creek and Des Moines Creek watersheds. In compliance with jurisdictional stormwater requirements, stormwater from the runway expansion area would be collected and managed to improve water quality and attenuate peak flow rates. Preliminary hydrologic modeling indicates that 4 million cubic feet of storage (Federal Aviation Administration and Port of Seattle, 1995; Montgomery Water Group, Inc., 1995) would be required to meet Washington state stormwater flow rate control standards (Washington State Department of Ecology, 1992).

Increasing the acreage of existing fill and impervious area would reduce the amount of naturally occurring infiltration. Downstream resources from the runway expansion area include Des Moines Creek, Miller Creek, and associated wetlands that benefit from the natural processes of shallow groundwater infiltration, groundwater movement, and seepage. Water entering the soil profile attenuates peak storm flows and sustains baseflows to streams and wetlands. Furthermore, water quality is improved by its flow through soil.

Open, above-ground water storage (and other wildlife attractants) in the vicinity of airport operation is restricted by Federal Aviation Administration (FAA) codes in order to prevent aircraft collision hazards with waterfowl. Considering this design constraint, previous engineering studies (Anne Symonds and Associates, Inc., 1992) have recommended that underground vaults be used for managing stormwater. Based on per unit cost estimates for stormwater detention from the HNTB (1994) engineering study, construction of underground vaults to provide the required stormwater storage would cost 38 million dollars.

Construction of the new parallel runway would require extremely large volumes and heights of fill under and adjacent to the proposed new parallel runway. The large quantities of fill and earthwork required to construct the runway expansion present a unique opportunity for stormwater management. Preliminary evaluations suggest that by constructing an aquifer within the proposed fill, stormwater could be better managed when compared to conventional stormwater management systems. A constructed aquifer would simulate the natural infiltration process, thereby benefiting downstream resources. Managing stormwater with a constructed aquifer, as described in this report, would reduce the land area required for stormwater management, improve water quality, attenuate peak flow rates, and extend flow durations to a far greater extent than conventional stormwater management systems. In addition, compared to conventional underground vaults, a constructed aquifer system could save as much as 17 million dollars in construction costs. The concept of creating an aquifer to manage stormwater has not been used before. Further design and analysis would be required to confirm the suitability of the concept to the intended application of managing stormwater.

OBJECTIVES OF THE CONSTRUCTED AQUIFER

Concepts for using a constructed aquifer to manage stormwater from the Airport runway expansion area were developed with intent to:

- Simulate the natural process of shallow groundwater infiltration, storage, movement, and discharge;
- Attenuate peak stormwater flow rates from developed areas by orders of magnitude;
- Extend flow duration of a storm to several days or weeks;
- Disperse ground surface flow at non-erosive rates before entering streams and wetlands;

- Eliminate above-ground storage of stormwater in open ponds, thereby reducing waterfowl hazards in the runway operation area and reducing land area required for managing stormwater;

- Reduce the construction cost of underground stormwater storage by eliminating or reducing the need for (costly) conventional underground concrete vaults; and

- Allow design flexibility such that the constructed aquifer could be sized to manage stormwater from one or all of the subbasins in the runway expansion.

DESCRIPTION OF THE SYSTEM

Referring to the figures, and in particular to Figure 1, the constructed aquifer would be located at an elevation above the existing ground surface within the proposed fill area. The storage and conveyance components of the constructed aquifer would be located in the lower portions of the fill, 50 to 100 feet below the surface of the proposed new parallel runway (Figure 2). The constructed aquifer would gently slope toward the toe of the fill slope on the downgradient side of the security road.

Stormwater runoff from the runway and taxiway would travel by sheet flow to a swale along the east side of the perimeter road, away from the top of fill slope (Figures 3 and 4). Berms would be graded at intervals in the swale to create 400-foot wide subbasins that drain to the pretreatment sand filter. The perimeter road, having a cross-slope to the east, would also drain to the swale. A pretreatment sand filter would be embedded within the swale to screen out floating debris from the stormwater at the surface of the sand filter and provide additional stormwater treatment as it percolates through the sand filter media. An underdrain would collect water passing through the sand filter media and convey water to an inlet catch basin. The inlet catch basin, adjacent to the sand filter, would provide an overflow outlet for the swale and sand filter (Figure 5). A connector pipe would convey treated stormwater to a drop catch basin. During maintenance of the sand filter, or subsequent to an accidental spill in the subbasin, flow from the inlet catch basin could be shut off with a gate valve located between the inlet catch basin and the drop catch basin. From the drop catch basin, the treated stormwater would flow down a drop pipe through 50 to 100 feet of fill, and then into an introduction aquifer. Baffles in the drop pipe, spaced at regular intervals, would dissipate energy and aerate the water before it infiltrates the introduction aquifer.

The introduction aquifer would be located at a depth varying from approximately 50 to 100 feet below the perimeter road. The introduction aquifer would be comprised of clean, washed gravel (Figure 6) and it would store inflowing stormwater while transmitting the stormwater into the underlying storage and conveyance aquifer. The storage and conveyance aquifer, comprised of select fill material, would provide storage, conveyance, and additional treatment of the water. The storage and conveyance aquifer would be 180 feet long. A geotextile fabric would enclose the introduction aquifer and the storage and conveyance aquifer to prevent fine sediments from entering (from the overlying fill).

For the subbasin shown in Figure 4, the outlet of the constructed aquifer would be on the downward side of the security road at the toe of the fill. Water would flow through the storage and conveyance aquifer and discharge along a 400-foot wide seepage face. Water leaving the aquifer would be either collected by a swale at the toe of the seepage face or flow overland to nearby streams and wetlands. The flow rate from the aquifer would be controlled by the configuration and hydraulic conductivity of the storage and conveyance aquifer.

An alternative or additional method of regulating discharge from the aquifer could be accomplished by installing perforated drain pipe along the length of the aquifer and placing a valve at the downstream end of the pipe. The valve would normally be closed, but could be opened or regulated to vary the discharge rate from the aquifer. Other considerations in designing the constructed aquifer could include collecting runoff from the fill slope terraces and directing the stormwater to the constructed aquifer through drop pipes as occurs with runoff from the top of slope. In addition, runoff from the security road ditch could be infiltrated into the lower end of the aquifer.

PERFORMANCE OF THE SYSTEM

To demonstrate the performance of the constructed aquifer in managing stormwater, a simulation of the system was conducted for a subbasin comprised of a 400-foot wide section of the runway expansion in Basin B (Figures 1 and 3). The subbasin contributing to the simulated aquifer extends from the east side of the runway to the west edge of the perimeter road. The total drainage area of the subbasin is 8.0 acres, including the runway, taxiway, perimeter road, and grass areas.

Flow was simulated into, through, and out of the constructed aquifer for both the 6-month/24-hour and 100-year/24-hour storms. Applying Darcy's equation (Freeze and Cherry, 1979; Clark et al., 1971) and developing a sectional flow net through the length of the aquifer (Monahan, 1994), we calculated the rate of discharge from a 3-foot deep section of the aquifer to be approximately 0.04 cubic feet per second. For the aquifer material specified, a coefficient of permeability of 0.000185 feet per second (5.6×10^{-3} centimeters per second) was used in calculating flow rates through the constructed aquifer. This value of permeability is generally considered to be within the lower range of permeability for clean sands and gravels (Terzaghi and Peck, 1967). For the 6-month storm, it is predicted that about 15% of the storage capacity of the constructed aquifer would be used to manage the runoff. For the 100-year storm, about 75% of the storage capacity of the constructed aquifer would be used. The hydrograph entering the sand filter has a relatively high peak rate (Table 1). After passing through the sand filter and the introduction aquifer, the hydrograph entering the storage and conveyance aquifer is noticeably attenuated. After passing through the storage and conveyance aquifer, the hydrograph leaving the system is greatly attenuated. The time required to dispense the stormwater stored in the constructed aquifer would be roughly 4 days for the 6-month storm (Figure 7) and 24 days for the 100-year storm (Figure 8).

Based on the calculated hydraulic gradient, porewater pressure at the outlet of the constructed aquifer does not appear to be a significant concern, indicating that slope stability at the outlet should not be a problem. An approximate hydraulic gradient ratio of 0.2 was calculated for the proposed aquifer configuration and discharge rate. The critical value for the hydraulic gradient ratio, where pore pressure is a concern, is generally considered to be about 1.0 and greater (Terzaghi and Peck, 1967; Monahan, 1994). The rip-rap blanket located at the seepage face (Figure 4) would dissipate energy of water discharge through the low point drain pipe and the pore pressure relief pipe. The rip-rap would also help resist any potential heave that may be associated with the seepage from the aquifer outlet.

Table 1: PEAK FLOW RATES AT DIFFERENT LOCATIONS IN THE CONSTRUCTED AQUIFER

Location in Aquifer	Peak Flow Rate 6-month/24-hour (cubic feet per second)	Peak Flow Rate 100-year/24-hour (cubic feet per second)
Inlet to sand filter	1.23	6.27
Outlet of introduction aquifer	1.04	1.85
Outlet of constructed aquifer	0.04	0.04

COMPARING THE COST TO A CONVENTIONAL SYSTEM

The extensive fill areas that will be needed to create the proposed new parallel runway present unique opportunities for managing stormwater with a constructed aquifer. A conservative cost estimate for constructing the aquifer system has been created and compared to estimates for construction of a conventional underground vault system (HNTB, 1994). To account for performance uncertainty that may be associated with operation of the constructed aquifer, we increased the amount of storage volume provided by 2 million cubic feet over the requirements (Table 2). To account for uncertainty in construction costs of the aquifer system, we increased the contingency from 30% to 50%. The construction cost of the aquifer system is $3.50 per cubic foot (compared to $9.50 per cubic foot for the vault system [HNTB, 1994]). The total storage cost for the constructed aquifer is 21 million dollars versus 38 million dollars for the vault—a savings of 17 million dollars. Operation and maintenance costs for the conventional system and the aquifer system are anticipated to be comparable.

Table 2: COMPARISON OF CONSTRUCTION COSTS TO A CONVENTIONAL SYSTEM

	Conventional Underground Vaults	Constructed Aquifer
Storage Volume Required (cubic feet)	4,000,000	4,000,000
Storage Volume Provided (cubic feet)	4,000,000	6,000,000
Construction Cost Contingency (% of Cost)	30	50
Per Unit Cost of Construction with Contingency ($/cubic foot)	9.50	3.50
Total Storage Cost ($)	38,000,000	21,000,000

CONCLUSIONS

To address land area constraints and waterfowl hazards, it would be ideal to use an underground stormwater system in managing stormwater from the proposed runway expansion area. Conventional underground concrete vaults are expensive to construct, especially considering the large stormwater storage volumes required for the proposed new parallel runway. The configuration of the proposed new parallel runway would require large quantities of fill. An aquifer, constructed within the fill, could be designed to manage stormwater. Because the technology is not tested, there are risks associated with this novel concept. However, preliminary evaluations indicate that there would be several benefits to managing stormwater with a constructed aquifer. By simulating natural processes of infiltration and groundwater movement, the constructed aquifer would attenuate peak flow rates, extend flow durations, and improve water quality beyond the expected performance of a conventional stormwater system. The discharge from the constructed aquifer could be incorporated into wetland and stream mitigation designs. The seepage discharging from the aquifer outlet would enhance summer base flows in Miller Creek and Des Moines Creek. In addition, there would be enormous potential savings in construction costs associated with a constructed aquifer as opposed to a conventional underground vault system. A pre-design study should be conducted to further evaluate the suitability of using a constructed aquifer to manage stormwater from the runway expansion area.

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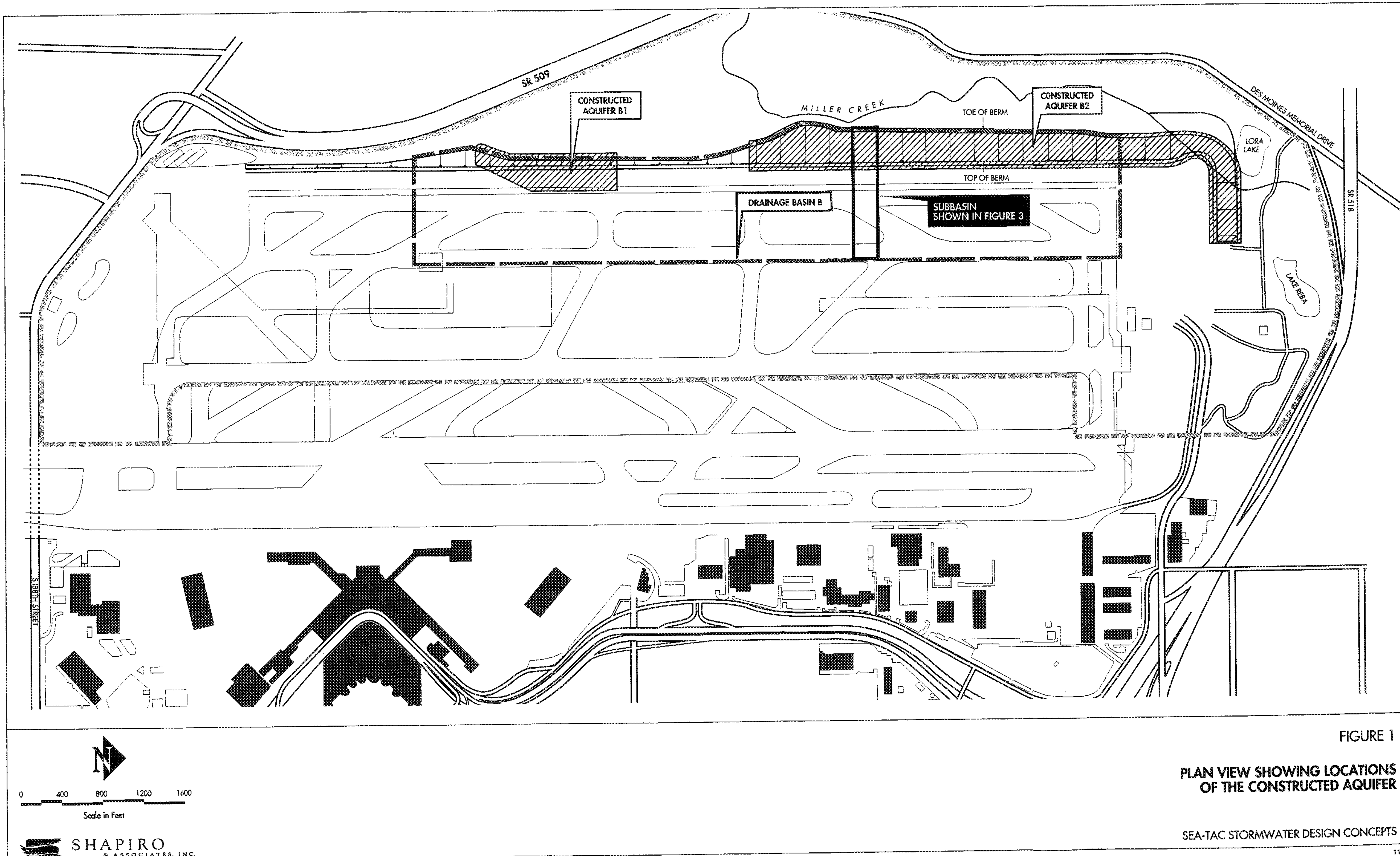

FIGURE 1

PLAN VIEW SHOWING LOCATIONS OF THE CONSTRUCTED AQUIFER

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SEA-TAC STORMWATER DESIGN CONCEPTS

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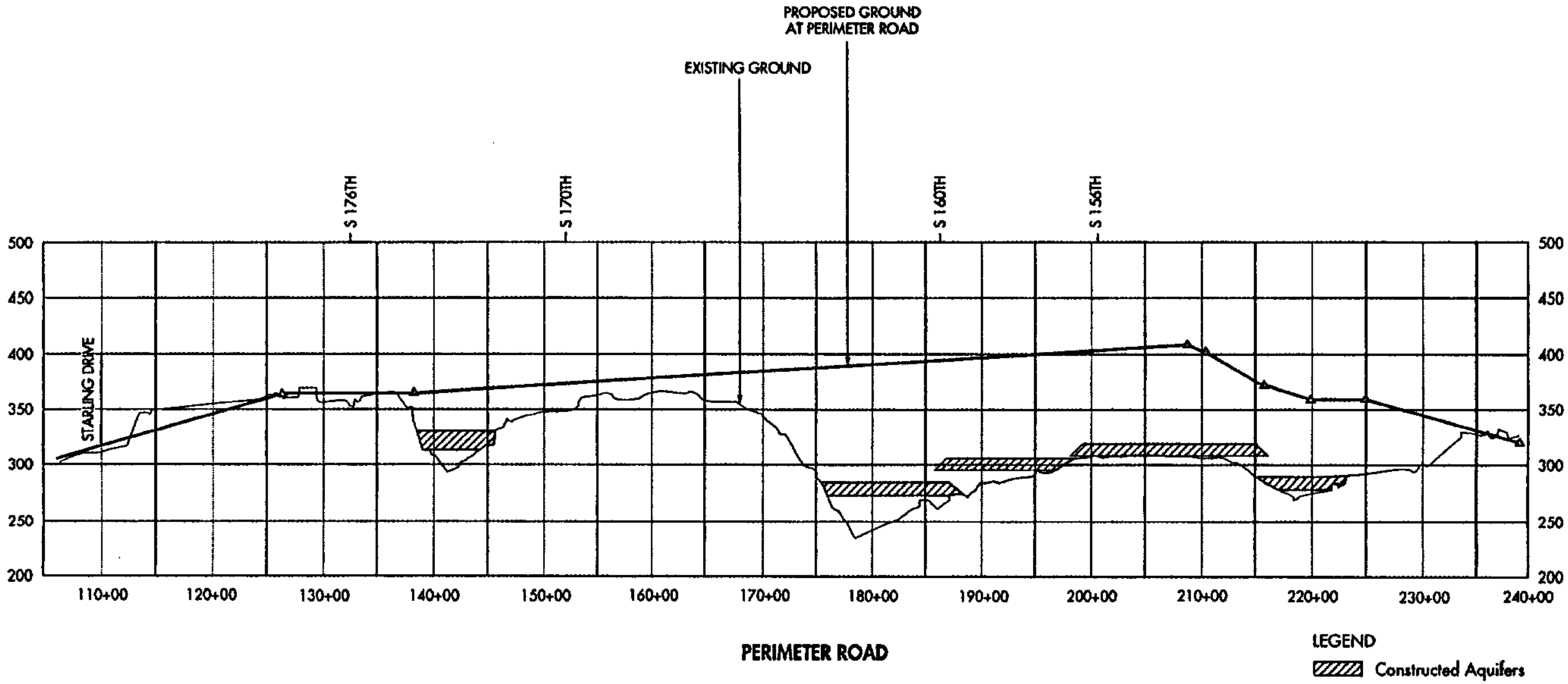

FIGURE 2

CROSS SECTION OF THE RUNWAY FILL SHOWING LOCATIONS OF THE CONSTRUCTED AQUIFER WITHIN THE FILL

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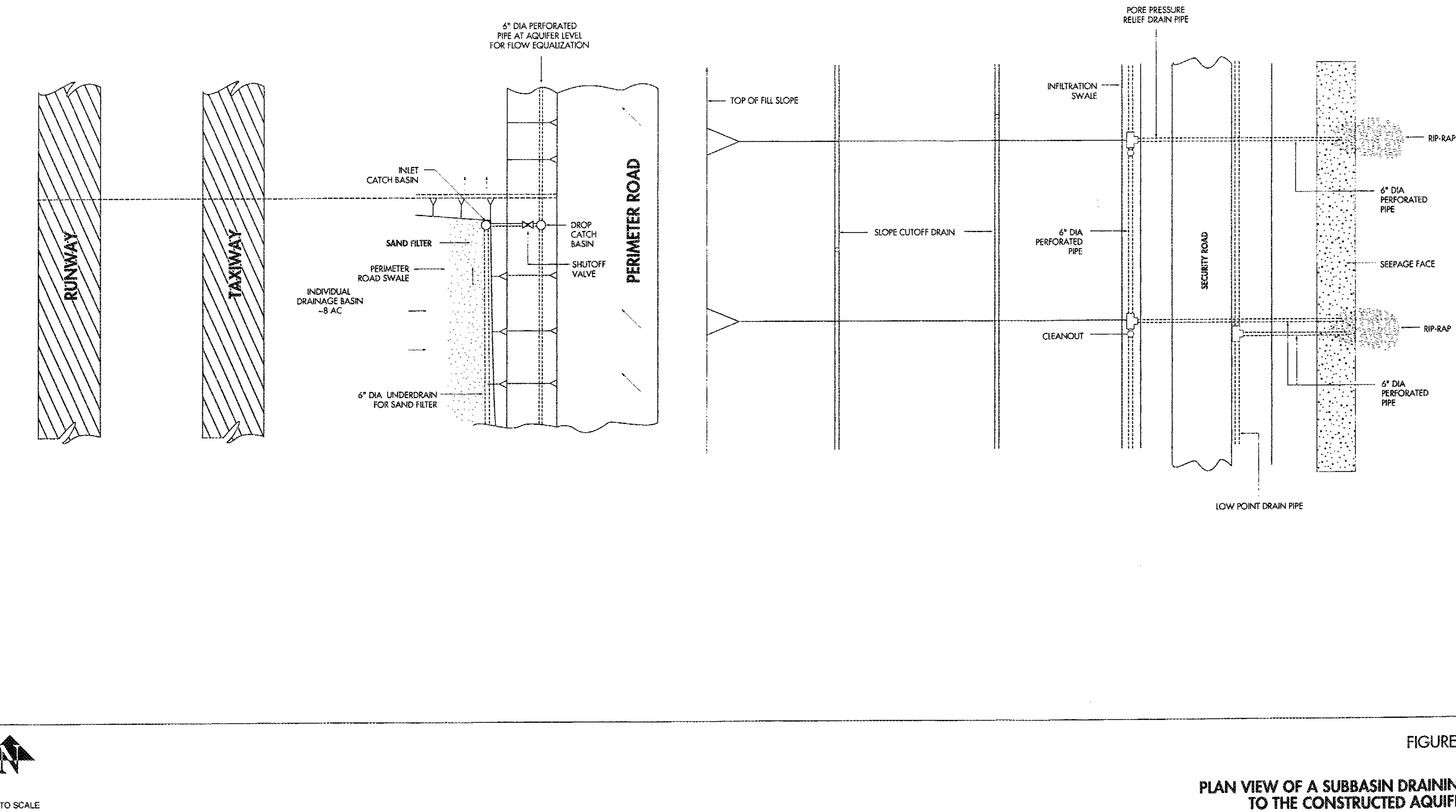

FIGURE 3

PLAN VIEW OF A SUBBASIN DRAINING TO THE CONSTRUCTED AQUIFER

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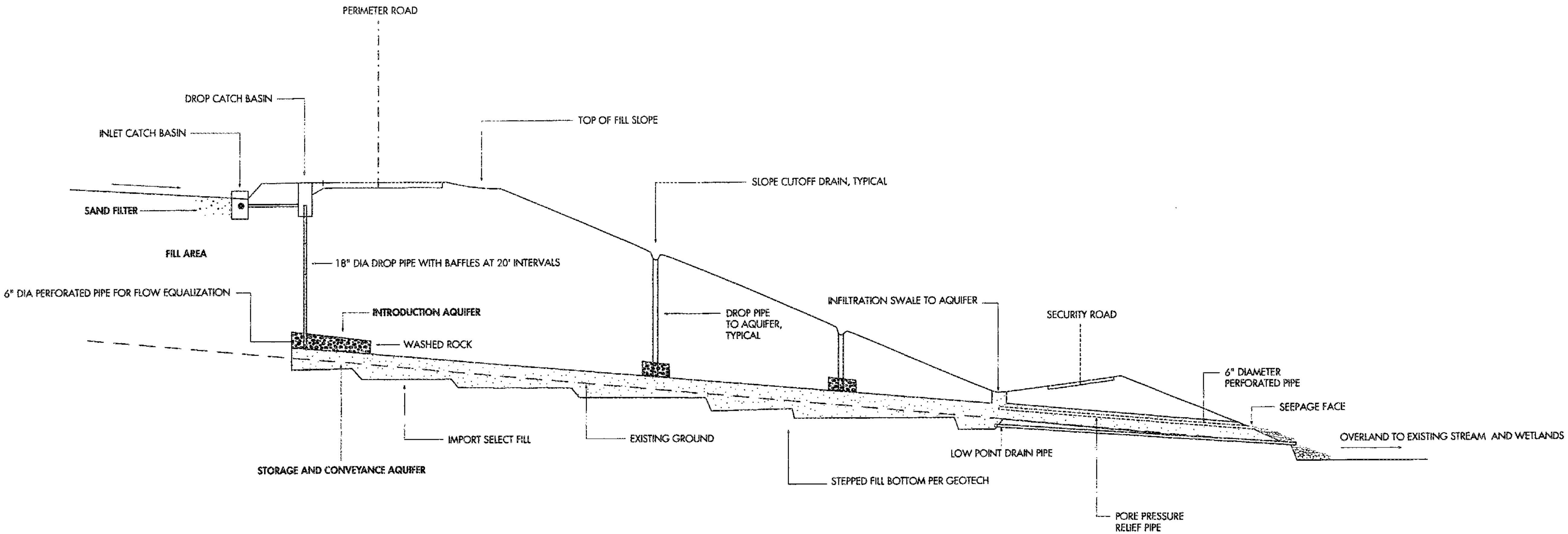

NOT TO SCALE

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FIGURE 4

SECTIONAL ELEVATION OF THE CONSTRUCTED AQUIFER

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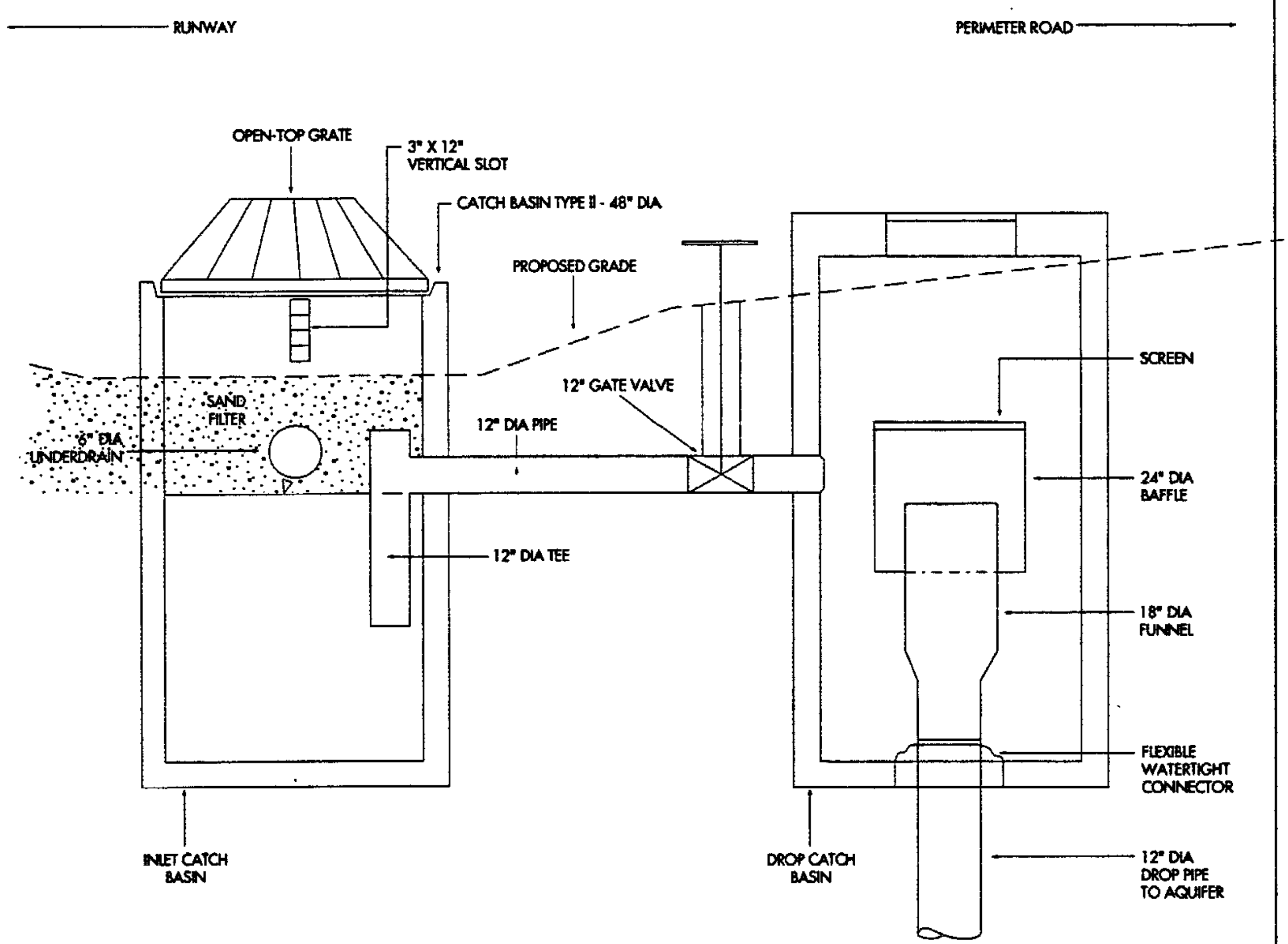

Not to Scale

FIGURE 5

ENLARGED SECTIONAL ELEVATION OF THE PRETREATMENT SAND FILTER INLET

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SEA-TAC STORMWATER DESIGN CONCEPTS

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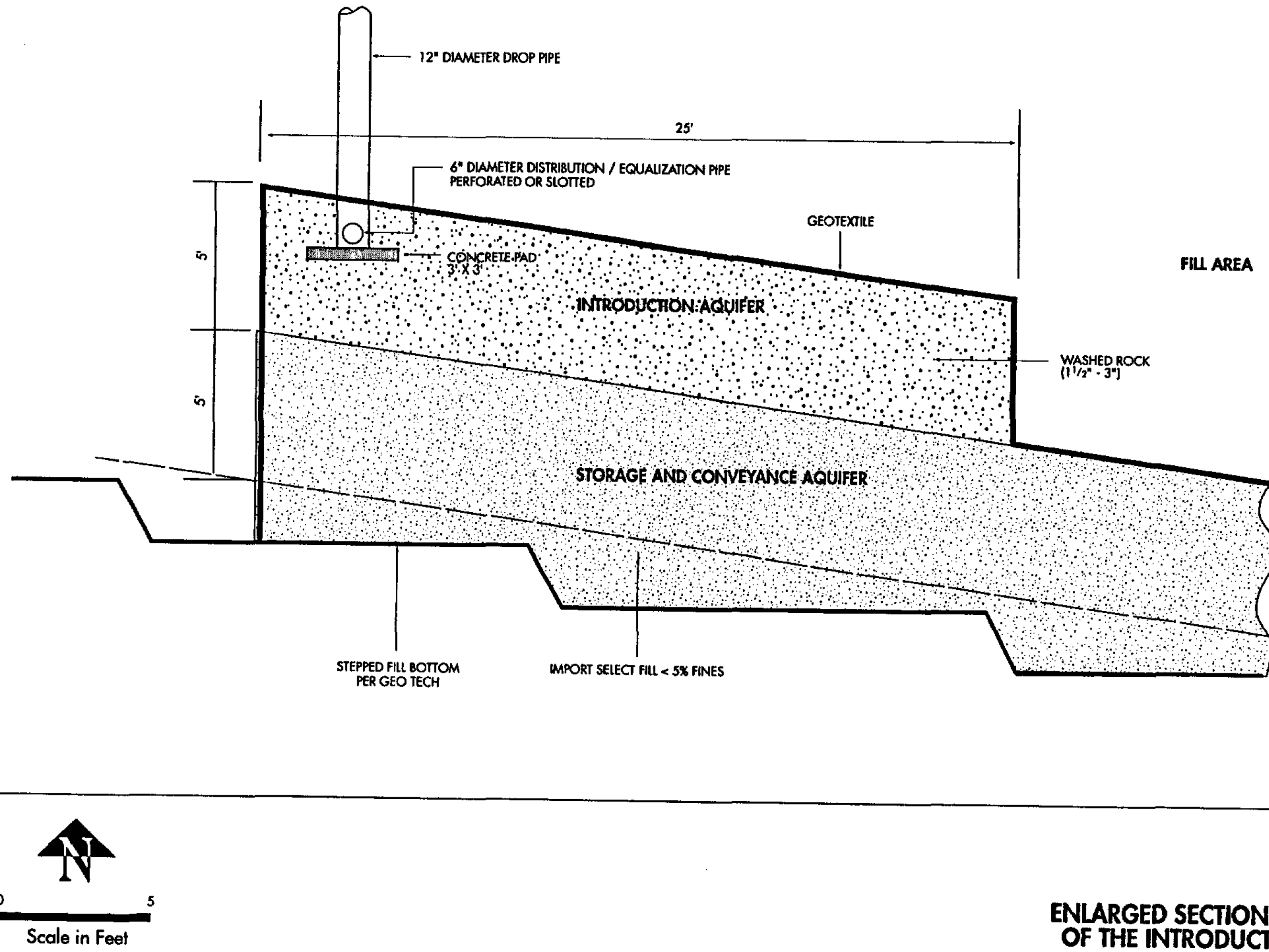

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FIGURE 6

ENLARGED SECTIONAL ELEVATION OF THE INTRODUCTION AQUIFER

SEA-TAC STORMWATER DESIGN CONCEPTS

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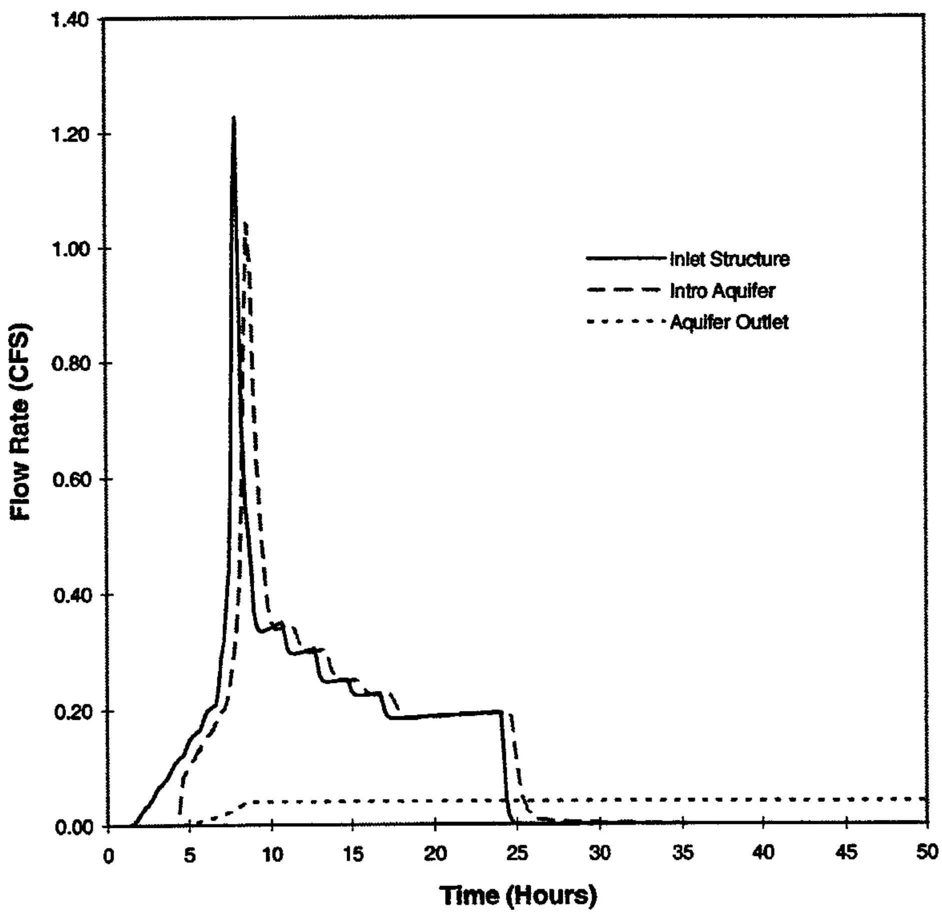

Figure 7. Hydrographs of a 6-month/24-hour storm at various locations in the aquifer.

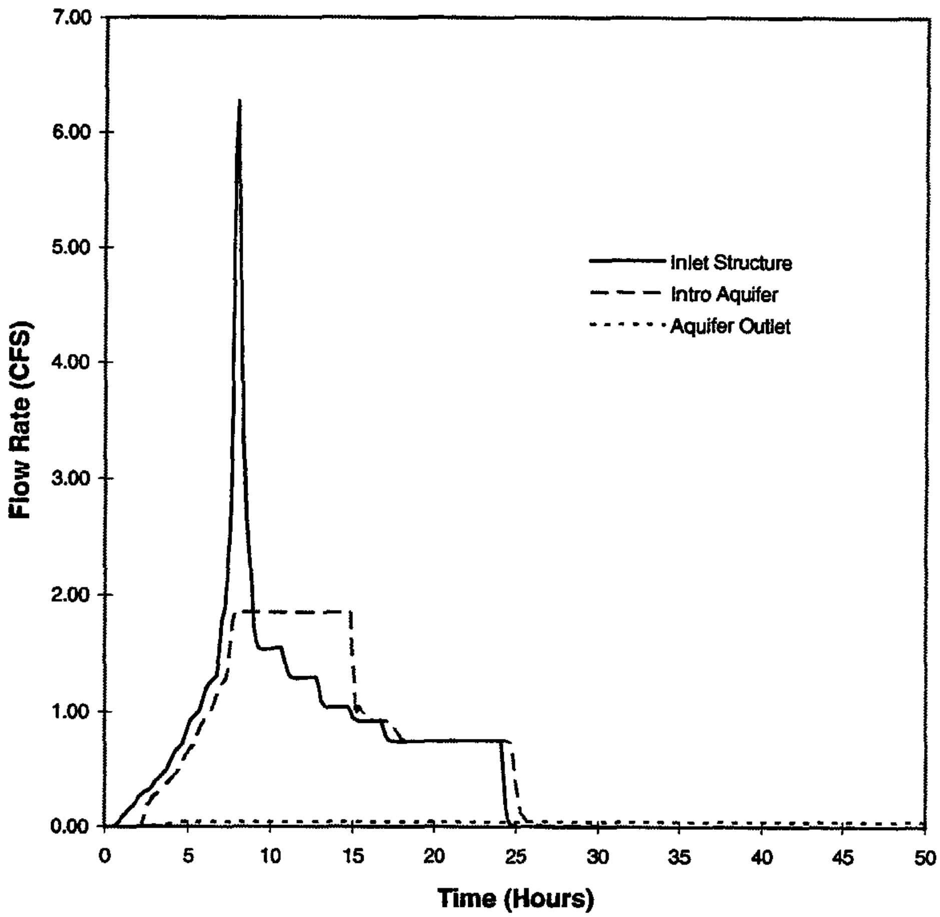

Figure 8. Hydrographs of a 100-year/24-hour storm at various locations in the aquifer.

APPENDIX R

RESPONSE TO PUBLIC COMMENTS

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TABLE R-1

INDEX OF COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT SEATTLE-TACOMA INTERNATIONAL AIRPORT

HT = Indicates that comment is located in the Hearing Transcript, # indicates the order of the individual's comment in either the transcript or receipt of letters (#s' market at top of first page of all letters received).

Document #	Name	Organization
164		
30		Communities Against Noise (Beacon Hill)
38	7 Signatures	Glen Acres Homeowners Assoc.
47	5 Signatures	Glen Acres Homeowners Assoc.
147	A Concerned Citizen	
181	Aircraft Noise Abatement Committee-3 Signatures	
214	Airport Communities Coalition	ACC
27	Airport Communities Coalition (Bob Olander	ACC
31	Airport Communities Coalition (Bob Olander)	ACC
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57	Amero, Lynol	Mayor, City of Pacific
45	Anderson, Alvin	
90	Anderson, Joseph	
48	Anonymous	
67	Anonymous	
100	Ashunal, W.	Glen Acres
95	Austria, Almario	
HT 77	Ayres, Marilyn	
115	Bader, Jorgen	
4	Bader, Jorgen	Revenna-Bryant Community Assoc.
HT 20	Bakst, Jay	Kent Chamber of Commerce
159	Balach, J.R	
39	Bannon Residence	
149	Bartlemay, James	
150	Bartlemay, James	
HT 11	Bartlemay, James	
188	Bass, Erika	
206	Batayola, Teresita	Seattle Water
81	Bedayan, K.	Glen Acres
237	Benedum, Mark	Highline Community Hospital
133	Benjaminson, Michael	Customs Brokers & International Freight Forwarders
HT 118	Berg, Avill	
44	Berg, Avill	
HT 25	Berger, Dorian	Mt. Rainier High Student Body
96	Berho, Felipe	
230	Bittenc, Linda	
177	Bittermann, Toby	
HT 112	Bolles, R.C.	
136	Bolles, Bob	Southwest King County Community Group
HT 55	Bonney, Ann	
136	Bonney, Ann	Southwest King County Community Group
163	Booth, Charles	City of Auburn
223	Borgmann , Craig	
HT 35	Brasher, Minnie	
136	Brasher, Minnie	Southwest King County Community Group
HT 28	Brazil, Terry	
169	Brockey, Jerry	South Seattle Community College
205	Brown, A.	
HT 101	Brown ,Arlene	
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247	Browne, Harriet	
246	Browne, James	
196	Buckingham, Mark	
63	Bullard, Don	Queen Ann Community Council
56	Buller, John	Bon Marche
207	Burke, Herbert	
HT 49	Burrage, Janett	Des Moines City Council
153	Byington, Terry	American Electronics Association
82	Byrd, Barbara &Miller, Nelva	Glen Acres
HT 14	Caldwell, Dan	
136	Caldwell, Dan	Southwest King County Community Group
251	Cannon, Robert	Kent Chamber of Commerce
184	Carlson, Walter & Mary	
HT 72	Carpenter, James	
120	Cauble, Gloria	
229	Cegon, Robert & Grumm, Stephen	Prince of Peace Luthern Church
HT 113	Chapin, Ed	
HT 22	Christy, Stephanie	
HT 114	Clark, Margaret	
HT 67	Clark, Rose	
136	Clark, Rose	Southwest King County Community Group
HT 60	Clifford, Chris	
37	Clymer, William J. & West, Ruth Catherine	
224	Clymer, William J. & West, Ruth Catherine	
80	Conner, Opal	Glen Acres
18	Cooper, John	
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254	Corps of Engineers (Mueller, Thomas)	
111	Coyote, Beth	
74	Creech, Greg	Glen Acres
213	Creighton, Stuart	RCAA
46	Creighton, Stuart	Regional Commission on Airport Affairs
HT 73	Creighton, Stuart	
HT 23	Cunningham, Guy	Pacific Northwest Lab/Batelle
HT 99	Cunningham, Guy	Pacific Northwest Lab/Battelle
3	Dalbec, Fred	
70	Depner, Joe	
233	Derrick, Robert	King County Depart. of Development & Env. Ser
HT 89	DesMarais, Debbie	
HT 13	DesMarias, Debbie	
136	DesMarias, D.L.	Southwest King Co. Community Group
83	Dettman, Alan	
204	Dinndorf, Jerry	PSRC
HT 62	Docherty, Don	
HT 58	Dodge, Clark	Normandy Park City Council
HT 81	Dolvey, Jack	Federal Way Council
176	Driscoll, Clarence	
148	Dulaney, Nancy	
76	Eaton, William	Glen Acres
72	Edwards, Gene	
HT 82	Elder, Hope	Federal Way Council
33	Ellison, R.A.	
HT 54	Ellison, Robert	
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208	Ferullo, E.J.	
HT 90	Feuerstein, Joe	
232	Ford, Angela	
HT 8	Fornar, Elmira	
190	Forrey, Arden	
7	Forrey, Arden	Hawthornwe Hills Community Club
195	Frause, Henry	
HT 110	Frause, Henry	
HT 12	Frause, Sophie	
22	Frutu, David	
HT 75	Furney, Al	
HT 4	Gates, Mary	Federal Way
HT 100	Gates, Mary & Priest, Skip	
78	Gendo, Gladys	Glen Acres
85	Gibbons, Laura & Keyes, David	
50	Gilbreath, Janis L.	
HT 17	Giles, Robert	Perkins & Coie
HT 32	Gilespie, Bob	
68	Givens, John	Washington Public Ports Association
116	Glen Acres = 25 Signatures	Glen Acres Homeowners Association
HT 69	Gould, Trina	Air Washington
HT 87	Graham, Jerry	
203	Green, Bob	Greater Federal Way Chamber of Commerce
17	Greene, James K.	
8	Griffith, Gregory	Office of Archaeology and Historic Preservation
36	Grubb, Ria	
229	Grumm, Stephen & Cegon, Robert	Prince of Peace Lutheran Church
104	Gwinn, David	H. J. Gwinn & Company
99	Hablin, Arthur	Glen Acres
HT 59	Hagstrom, Claes	Seattle RCA
222	Hales, George	Glen Acres
2	Hall, Heidi	Department of Natural Resources
25	Hansen, Ingrid	
51	Hansen, Rodney	King County Solid Waste
84	Hansen, Rodney	King County Waste Division
197	Harding, Beverly	
218	Harris, Keith	Highline Water District
102	Hatfield, M.E.	Glen Acres
215	Hayden, John	Boeing
HT 45	Heavey, Mike	State Representative
139	Heavy, Mike	State Senator
98	Helland, David	
86	Heslop, Serena	
134	Hess, James Dean	
HT 56	Hetzel, Carol	ANAC
26	Hickman, James	
162	Hill, Jennifer	
121	Hitt, Ray	
138	Hoge, Michael	Seattle Public Schools
HT 39	Hoglund, Eugene	Citizen
200	Hopkins, Henry	
89	Horne-Webster, Martha	
146	Horsley, Levi William	
HT 5	Hoult, Linda	Snohomish County Community Group
53	Houser, Richard	Glen Acres Homeowners Assoc.
113	Hubbard, Minnie	
202	Hughes, Nada	Southwest King County Chamber of Commerce

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251	Ivanov, Barbara & Cannon, Robert	Kent Chamber of Commerce
19	Ivenson, Susan	
122	Jackson, Julie	
HT 41	Jhaveri, Arun	Mayor, Burien
HT 97	Jhaveri, Arun	
HT 33	Jones, Bill	Sea-Tac Firefighters
178	Jones, Len	
93	Jones, Richard	
143	Judd, Adeline	
226	Karlinsey, Joyce	
199	Kellogg, Kristine	
97	Kemron, Carol	
250	Kennedy, Elizabeth	
HT 27	Kennedy, Richard	Mayor Des Moines
HT 105	Kennedy, Richard	Talking Points
85	Keyes, David & Gibbons, Laura	
168	Kircher, David	PSAPCA
174	Kishida, Yone	
173	Kishida-Haley, Darlene	
179	Kittilsby, Lisa	
136	Kludt, Helen	Southwest King County Community Group
12	Klug, Bob	North East District Council
29	Klug, Bob	North East District Council
164	Ku, Peter	North Seattle Community College
108	Kumar, Ramendra	
68	Kuntz, Jim	WPPA Aviation Committee
HT 34	LaFramboise, Bob	Heath Techna Aerospace
193	Lang, Elizabeth	
182	Lawder, William	Hertz Corp
137	Le Compte, Howard	
220	Lepley, Jean	
54	Lewis, Randall	City of Tacoma
HT 16	Lindsay, John N.	Tri City Industrial Dev. Council
1	Lund, Erik S.	
117	Luther, Rick	City of Black Diamond
150	MacPherson-Krutsky, Susan	
92	Maedche, Don	
158	Maes, Elaine	
191	Magnolia Community Club	Magnolia Community Club
9	Mandel, Eric	Leschi's Community Council
227	Marshall, Viola	
234	Mason, Dawn	State Representative
HT 43	Matthews, Pierre	
HT 94	Matthews, Peter	
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249	Matthews, Vivian & Pierre	
14	Maurice, John	
151	McCollier, Elizabeth	
209	McDougall, CoCo	
HT 51	McGeehan, Dr.Joseph	Highline School District
HT 102	McGeehan, Dr.Joseph	
180	McGrath, Jeff	
59	McGwire, Elizabeth	
66	McKinney, Maureen & Buck	
HT 64	Mealy, Carl	
243	Means, Beth & Talbot, Chas.	Seattle Community Council
118	Mehlhoff, Mike	

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171	Miles, Frank	
238	Miller, Alan	Trout Unlimited
HT 2	Miller, David	Normandy Park
82	Miller, Nelva & Byrd, Barbara	Glen Acres
192	Miller, Raymond	The Church Council of Greater Seattle
HT 83	Millsaps, Joe	John Graham Assoc.
HT 42	Milne, Kitty	Burien City Council
HT 63	Moeller, Jeanne	
217	Montgelas, Renee	Washington State Department of Transportation
198	Moore, Barbara	
231	Moriyason, Saya	
132	Motel, Cameo	
254	Mueller, Thomas	Corps of Engineers
40	Mulder, Jan	Seattle City Light
61	Murphy, James	Fleet Glass Repair, Inc.
23	Murphy, Sherri	
129	Nelson, Katia	
HT 38	Nelson, Robert	
5	Neuzil, Dennis	
HT 44	Newby, Don	
155	O'Brien, Yvonne	
170	O'Keefe, Elise	
35	Okamoto, Dennis	U. S. West Comm.
107	Okamoto, Jean	
27	Olander, Bob	Airport Communities Coalition (ACC)
31	Olander, Bob	Airport Communities Coalition (ACC)
60	Osaki, Carl	King County Heath Department
161	Osborne, Jennifer	
245	Osterman, Doug, Julie & Mitchell	
212	Osterman, Doug, Julie & Mitchell	
HT 116	Ott, Frank	
HT 115	Overholt, Mark	
HT 76	Parker, Kathy	
219	Parkin, Richard	US Environmental Protection Agency (EPA)
HT 46	Patterson, Julia	State Representative
165	Peterson, Bruce	
110	Peyton, Brian	Ravenna- Bryant Community Association
252	Pichereau, Susan	
52	Platt, Tom & Marilyn	
20	Plowman, Linda	
HT 31	Pomeroy, Vernon	
HT 9	Pompeo, Pat	
136	Ponpeo, Pat	Southwest King County Community Group
106	Powell, Mark	Unocal
64	Price, Mary	Glen Acres
HT 15	Prichart, Janet	Tacoma Pierce County Chamber
HT 3	Priest, Skip	Federal Way
HT 100	Priest, Skip & Gates, Mary	
130	Ramirez, L. Dan	Greater Readmond Chamber of Commerce
96	Rannig, Majorie & Leslie	
HT 57	Rants, John	Mayor Tukwila
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126	Reardon, Ken	
28	Redlin, Victoria	Spokane Area Chamber of Comm.
HT 19	Rees, Mike	Magnolia Community Club

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175	Richardson, Earl	South East Effective Development Inc (SEED)
HT 7	Richter, Audrey	
136	Richter, Audrey	Southwest King County Community Group
240	Riggs, Don	
210	Rohlfs, D. Scott	City of SeaTac
119	Rondaz, Seine	
HT 68	Rosenberg, Matt	Regional Comm. on Airport Affairs
65	Rosenblatt, Roger	
140	Ross, Cheryl	
HT 65	Rozdilsky, John	
225	Saladis, John & Rose	
154	Sauer, Raymond	
43	Scarvie, Stanley	
216	Schneider, S.G.	
152	Schreier, Eda	
145	Schuster, Andrew	Wedgewood Community Council
211	Schuster, John	John F. Kenndy High School
112	Scott, Nadine	
109	Scott, Ora	
21	Shawman, P.	
244	Shinyeda, Amy	
87	Sican, Linda	
94	Sican, Lisa	
135	Simons, Richard	
HT 10	Smith, Adam	State Senator
141	Smith, Audrey	
142	Smith-Buehler, Robyn	
194	Sobers, Frances	
15	Soltis, Jerry	
77	Sonislo, Barbara	Glen Acres
202	Southwest King County Chamber of Commerce	
136	Southwest/King County Community Group	Southwest/King County Community Group
236	Spears, Patricia	
HT 36	Springer, Elizabeth	
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79	St. Laurent, Cornelia	Glen Acres
101	Stankey, Warren & Janice	Glen Acres
HT 74	Stark, Ben	
13	Sternberg, Maxine	
88	Stonehocker, Patricia	
16	Stuhring, Barbara	
32	Stuhring, Barbara	
136	Stuhring, Barbara	Southwest King Co. Community Group
167	Suther, Suzanne	Issaquah Chamber of Commerce
156	Swhela, Tilesa	
243	Talbot, Chas. & Means, Beth	Seattle Community Council
185	Talley, Karen Waddell	
183	Tang, David K.Y.	Washington Council on International Trade
166	Tate, Randy	Congressman
HT 48	Tate, Randy	U. S. Congressman
HT 103	Tate, Randy	
235	Taylor, Laurie	
58	Taylor, Marie	
HT 111	Taylor, Ralph	
55	Taylor, Willie	Department of Interior
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HT 71	Thompson, John	
HT 70	Thompson, Lewis	
HT 50	Thomson, Leslie	
HT 26	Thornton,Dean	
6	Tilley, Steve	Puget Sound Water Quality Auth.
HT 78	Tinker, Carey	
HT 79	Tinker, Jane	
71	Toepelt, Rovert	
HT 85	Towe, Gary	DesMoines City Council
HT 93	Townsend, Peter	
HT 104	Tri Cities Industrial Development Council	
157	Uriyu, Hideko Sue	
41	Vaa, Robert	
HT 117	Vaa, Robert	
HT 84	Vance, Chris	King County Council
HT 66	Vermeier, Kathleen	Normandy Park City Council
HT 1	Vigilante, Mary	Landrum & Brown
HT 80	Vigilante, Mary	Landrum & Brown
239	Voeller, Ray & Judy	
HT 91	Vonesh, Bob	
189	Wagner, David	
HT 18	Walker, George	
11	Watanabe, Stanley	
34	Watanabe, Stanley	
HT 29	Watanabe, Stanley	
HT 109	Watanabe, Stanley	
241	Webb, Kris	
HT 92	Webb, Kris	
91	Webster, Lonnie	
105	West, Carla & Robert	
37	West, Ruth Catherine & Clymer, William J.	
224	West, Ruth Catherine & Clymer, William J.	
62	Whitled, Vernon & Lori	
49	Whitlock, John	
HT 86	Wiberg, Roy	
HT 61	Wichert, Erhard	
10	Wieting, Donna	DOC, NOAA
128	Williams, Kari	
242	Woodward, Bethany	
HT 40	Woosley, T.J.	Greater Kirkland Chamber
HT 21	Wordian, Laurie	
186	Wozniak, Joseph	
131	Yada, Joe	
HT 30	Yamamoto, Amy	
172	Yanez, Tony	
253	Yoshikawa, Troy	
42	Zembruski, Victor	
HT 119	Zembruski, Victor	

HT = Indicates that comment is located in the Hearing Transcript, # indicates the order of the individual's comment in either the transcript or receipt of letters.

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APPENDIX R

RESPONSE TO COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT

To facilitate the receipt of comments, two public hearings were held concerning the Master Plan Update Draft Environmental Impact Statement (Draft EIS):

- June 1, 1995: at the SeaTac Red Lion Hotel from 1 p.m. until 10 p.m. Simultaneous with the conduct of the hearing, a workshop was conducted to assist the public with understanding the contents of the Draft EIS. Testimony was provided by 77 individuals and the workshop/hearing was attended by about 150 people.
- June 14, 1995: at the Calvary Lutheran Church in Federal Way from 6 p.m. until 10 p.m. Testimony was received from 15 individuals. This hearing was attended by about 40 people.

The hearing record remained open until August 3, 1995, representing a public and agency comment period of 90 days.

All of the comments submitted during the 90-day comment period were reviewed and responses have been prepared to address all applicable comments. In many instances, the comments resulted in additional analysis that has been included in the Final Environmental Impact Statement (Final EIS). To aid in the review of comments and the preparation of responses, the comments were grouped by issue and/or chapter of the Draft EIS. A code was then given to each unique comment to facilitate the review of the individual comment and the identification of the corresponding response. Each code corresponds to a comment in the hearing transcript or correspondence (provided in **Appendix T**), which have been annotated with brackets in the right margin. The codes represent *R-A-B*, where R indicates a response, *A is the issue group*, and *B is a sequential number within the issue group, representing a unique comment.* The following issue groups were identified:

Table R-1 provides an index to the individuals and organizations that either testified at the Public Hearing (listed as HT) or submitted written comments during the comment period. The transcripts from the hearings as well as the written comments are included in **Appendix** T "Public Comments on the Draft EIS".

A number of significant comments were received concerning two key topics:

- Aviation demand forecast relative to the Do-Nothing and "With Project" alternatives
- The assessment of air pollutant conditions

The following section presents an elaboration on these issues, while the final section of this appendix contains the individual responses to comments.

I. AIRPORT ACTIVITY LEVELS WILL BE THE SAME REGARDLESS OF THE IMPROVEMENTS AT SEA-TAC DUE TO THE REGIONAL DEMAND FOR AIR TRAVEL AND THE CAPACITY OF THE EXISTING AIRFIELD.

A number of commentors on the Draft EIS requested clarification of why the development of the proposed new parallel runway (and overall Master Plan Update improvements) would not result in a greater level of passengers and/or aircraft operations being served in the future in comparison to the Do-Nothing. In preparing the Draft EIS, three initial questions were examined:

- What is the forecast demand for air travel through the year 2020?
- How will delay affect the hourly demand levels?
- Will the capacity of Sea-Tac be exceeded as a result of the demand?

In evaluating the capability of the existing airport facilities, two terms are used: demand and capacity. Demand is the number of individuals and resulting aircraft operations that desire the use of air travel during a specific period of time. Capacity is the number of passengers or aircraft operations that can be processed during a specific period, with a corresponding level of delay based on a specific system and operational procedures. Demand for air travel is independent of capacity as long as sufficient capacity exists. If insufficient capacity exists, the level of activity accommodated by a facility would be less than the demand.

(1) Growth in demand for air travel will result from the forecast growth in the Region's population and income levels.

The Draft EIS was prepared based on the mid-range aviation demand forecast developed for the Master Plan Update which showed the following :

TABLE R-2
MASTER PLAN UPDATE FORECASTS

	Actual	Master Plan Update Forecast		
	1993	2000	2010	2020
Total Enplanements	9,400,000	11,900,000	15,300,000	19,100,000
Origin and Destination EPS	6,580,000	8,220,000	10,580,000	13,220,000
Aircraft Operations:				
Air Carrier	188,000	223,000	255,000	287,000
Air Taxi/Commuter	127,000	127,000	118,000	117,000
All-Cargo	16,000	20,000	23,000	27,000
General Aviation	8,100	8,900	9,500	10,300
Military	400	300	300	300
Total Operations	339,500	379,200	405,800	441,600

Source: 1994 Master Plan Update Technical Report No. 5 Preliminary Forecast Report, Port of Seattle. - these forecasts reflect the mid-range forecast. EPS = Enplanements

As many factors influence the growth of aviation demand, focus was placed on identifying the factors in this Region that have most affected the desire for air travel. Similar to most air carrier airports, this demand can be expressed as a function of three key factors, population, income and average air fares. As is described in *Master Plan Technical Report No. 5, Preliminary Forecast Report*, in 1993 the four county Central Puget Sound Region had a population of 2.95 million and employment of 1.58 million people. By 2020, population of the Region is expected to reach nearly 4 million people and employ about 2.3 million people. In addition, the per capita personal income (PCPI) in 1993 was approximately $15,000; the PCPI, in constant dollars, is expected to increase 36% to $20,364 by year 2020. As is described in the Draft EIS, the projected growth of the Region is nearly double that of the United States.

An aviation demand forecast model was developed for the Master Plan Update to explain the past changes in air travel demand. The model explains 99.5% of the past changes in domestic origin and destination (O&D) air travel demand in the Region. It demonstrates that the past growth in O&D enplanements at Sea-Tac is a result of changes in regional population, income and average air fares. Because population and income in the Region are expected to increase during the planning period, the number of operations are also expected to increase. In reaching its conclusions regarding the expected growth in demand, the Master Plan Update forecast made certain assumptions regarding average air fares which are not affected by either constructing or not constructing the proposed airport improvements.[1/]

(2) Capacity of Existing Facilities

As was described earlier, capacity is defined as the number of passengers or aircraft operations that can be processed during a specific period, with a corresponding level of delay based on a specific system and operational procedures. Airfield capacity is typically estimated on an hourly or annual basis. An hourly capacity is used most frequently when performing detailed

1/ It is not likely that constructing or not constructing the proposed Master Plan Update (including the proposed new parallel runway) improvements would have a significant enough impact on average air fares to affect noticeably the number of aircraft operations. Although a proportion of the costs of a new runway would be passed on to the traveling public through higher airfares, it is not expected that this cost would be great enough to affect air fares significantly. Likewise, failure to construct the improvements would increase operating costs for personnel, fuel, etc. And while these costs would be passed on to the traveling public through air fares, it is not expected to have a significant enough impact on air fares to affect noticeably the number of operations.

assessments of airfield operating performance, in studies such as the 1995 Capacity Enhancement Plan Update or airport master plan studies. Annual capacity assessments, or annual service volumes are often used in airport master plans and system plans for longer range planning. The annual service volumes or capacities were used in the 1992 Flight Plan and are most often referenced by the general public as the capacity of the Airport.

In 1991, the Flight Plan found that the annual service volume of the existing airfield at Sea-Tac is about 380,000 annual operations. This level is based on assumptions regarding the amount of delay that can be accommodated at Sea-Tac and in the national aviation system. The Flight Plan states:

> "The term average delay denotes a value for a number of aircraft within a period of time whereby one aircraft might experience only a few seconds of delay and another perhaps several minutes. Years ago, an average delay of 4 minutes was determined to be an acceptable level for airport planning. At this average, the distribution of delays during an hour are such that they range from a few seconds up to but never exceeding 20 minutes. Today, the 4 minute average is still recognized in the industry as a valid measure of tolerable delay. Numerous studies of airfield capacity and delay indicate that delays will start escalating quickly at the 4 minute average. Comparing the acceptable 4 minute average to other thresholds, average delays of from 5 to 7 minutes for air carriers over a period of time is considered a moderate level of delay, and average delays of 7 minutes and above are considered severe." [2/]

As is stated in the Draft EIS, the purpose of the proposed new parallel runway is to "Improve the poor weather operating capability in a manner that accommodates aircraft activity with an acceptable level of delay". While Sea-Tac has sufficient operating capability during good weather conditions, during poor weather today, the existing runway system produces extensive arrival delays. For instance, when weather transitions from VFR1 to VFR2, average arrival delay increases 1,040 percent (from 1.0 minute to 11.4 minutes). Delays further worsen when IFR1/2/3 conditions occur; arrival delay increases 2,070 percent over VFR1 (at 21.7 minutes in contrast to 1.0 minutes). It is important to note that average delays reflect that some flights would experience less delays, while others would experience substantially greater levels of delay.

It is theoretically possible for more than 380,000 operations to occur at Sea-Tac in a year, as evidenced in the 1992 Flight Plan EIS: "By expanding operations into the late evening and early morning hours and with increased average delay, the airport (Sea-Tac) can handle up to 460,000 operations per year."[3/] This theoretical operating capability reflects the elasticity that exists in airfield operating capability, particularly when little or no constrains exist during good weather conditions and where the Airport's passenger characteristic is dominated by origin and destination travelers, with no other efficient or viable alternative to air travel. However, it is not reasonable to accommodate that level of operations within Sea-Tac's present facilities because the delay involved in handling more than 380,000 operations would be significant, particularly during poor weather conditions, resulting in unnecessary operating costs to the airlines.

Table R-3A shows the average arrival delay, average departure delay and estimated taxi delay. Poor weather, defined as VFR2 and IFR conditions, occurs about 44 percent of the year. During such conditions, the arrival acceptance rate is reduced substantially, as only one arrival stream is permitted. Instead of an hourly arrival acceptance rate of 60, the single arrival stream limits arrivals to 36-48, and in extremely poor weather to 24 arrivals per hour. **Table R-3B** shows arrival delay during VFR and IFR conditions. As is noted, when poor weather occurs, delay at Sea-Tac increases exponentially.

2/ "*The Flight Plan Project: Draft Final Report and Technical Appendices including Draft Programmatic Environmental Impact Statement*", January 1992, Puget Sound Air Transportation Committee, Page B-57 (Working Paper 7, Page 6)

3/ *Flight Plan Final Environmental Impact Statement*, pp. 3-16. Also *The Flight Plan Project, Draft Final Report and Technical Appendices including Draft Programmatic Environmental Impact Statement*, January 1992 (p. B-90 Working Paper 7m, p. 11)

TABLE R-3A
AVERAGE ALL-WEATHER DELAY

	Average Delay (minutes) Existing Airfield			
Operations	Arrival	Departure	Estim. Taxi	Total Average Operation
345,000	7.7	1.3	0.1	4.5
425,000 *	22.2	2.6	0.2	12.4
525,000 *	63.7	11.6	0.4	37.7

TABLE R-3B
ARRIVAL DELAY

	Average Arrival Delay (minutes) Existing Airfield				
Operations	VFR1	VFR2	IFR1/2/3	IFR4	All-Weather
345,000	1.0	11.4	21.7	333.2	7.7
425,000 *	1.6	41.8	71.2	524.5	22.2
525,000 *	3.1	163.6	181.3	711.9	63.7

Source: FAA Capacity Enhancement Update, Data Package No. 12, June, 1995
* Assumes full implementation of the 2.5 nm separation.
Definitions of VFR1, VFR2, and IFR1/2/3/4 are provided in Table R-4.

(3) **Conclusion**

If the proposed new runway and other facility improvements are not constructed, the growth in demand for air travel would continue to occur as would the number of aircraft operations, because it is expected that the Region will continue to experience growth in population and income. It is theoretically possible for Sea-Tac to accommodate more than 380,000 aircraft operations per year, even though the accompanying delays would be significant, especially in poor weather conditions. Therefore, it is the professional judgment of the FAA, the Port and its technical consultants that it is reasonable to assume for purposes of this environmental analysis that the same number of operations would occur with and without the proposed new runway.

IF INCREASING DELAY AT SEA-TAC RESULTS IN FEWER ANNUAL OPERATIONS THAN WOULD OCCUR WITH THE PROPOSED NEW RUNWAY, THE IMPACTS OF THE "DO NOTHING" ALTERNATIVE WOULD BE DIFFERENT FROM (AND IN MOST AREAS WOULD BE LESS THAN OR OCCUR LATER THAN) THE IMPACTS OF THE "WITH PROJECT" ALTERNATIVES.

Some commentors stated that the number of operations without the proposed new runway would be less than would occur "With Project" because the increased costs and inefficiencies resulting from increased delay will cause travelers to use other airports or use alternatives to air travel. Given the lack of viable alternatives to Sea-Tac Airport for O&D passengers and the high percentage of O&D passengers at Sea-Tac, and given the lack of viable alternatives to air travel as discussed elsewhere in this EIS and on page R-6 of this appendix, it is not likely that the number of operations would decrease significantly even with the increasing delay that would occur without construction of the proposed new runway. Nevertheless, if the number of operations is less as a result of increased delay, the impacts of the "Do-Nothing" alternative would be different from the impacts of the "With Project" alternatives. In most areas of the environment, the impacts of the "Do-Nothing" alternative either would be less than the impacts of the "With Project" alternatives or would occur at a later time.

The Master Plan Update also assessed the capacity of the existing landside facilities at Sea-Tac Airport. This analysis, like the analysis conducted for the airfield, showed that the existing landside facilities are capable of accommodating the forecast growth in demand with a large amount of passenger and traffic congestion and delay. Unlike the airfield, the same service characteristics do not exist with surface travel. Passengers using Sea-Tac have several equally feasible means of accessing the Airport, through single-occupancy vehicles and private vehicles, as well as alternative surface routes. As congestion mounts on the highway system, passengers are likely to use arterials and to avoid the Airport's entrance roadway by parking at the off-site lots. The surface transportation analysis presented in the Final EIS presents an updated portrayal of how passengers would likely access Sea-Tac as a consequences of the Do-Nothing alternative. The revised assumption reflects a greater level of congestion on certain nearby roadways, which is the expected air passenger reaction to surface delays.

The following section presents a discussion of the potential environmental impacts of an alternative demand forecast. One of the alternative forecasts considered is aviation demand which is less than the Master Plan Update forecast. If there are fewer aircraft operations as a result of increased delay, the impacts of the "Do-Nothing" alternative (and the differences from the "With Project" alternatives) would be approximately as indicated in that discussion below. The discussion indicates that, if there are fewer aircraft operations as a result of increasing delay, the impacts of the "Do-Nothing" will be less than those of the "With Project" alternatives.

II. IMPACTS OF ALTERNATIVE FORECAST ASSUMPTIONS

Several commentors have suggested alternatives for how the Do-Nothing alternative would accommodate forecast activity levels:

- De-peaking of demand/flattening of the peaks
- Increased load factors and aircraft size
- Use of alternative modes of travel
- Use of alternative airports

The following sections summarize the findings of the Draft and Final EIS relative to these options.

(1) De-Peaking of Demand

One of the suggestions identified as a consequence of the high levels of delay associated with the Do-Nothing alternative is that aircraft operations would not incur delay, as the flights would be rescheduled to operate in periods with less delay. As is described in Chapter II of the Draft and Final EIS, the Do-Nothing alternative assumes that forecast levels of activity will be naturally "de-peaked" by virtue of the delay associated with higher levels of aircraft operations. Thus, actions that would be taken by air carriers to operate in non-peak periods to avoid delay, yet accommodate the forecast demand.

The primary vehicle available to airport users to avoid the delay by de-peaking is altering flight schedules. One approach to altering flight schedules would be to increase the scheduled flight duration time (also called block time). As has been shown by comparing past flight times with current flight times to the same city markets, the airlines have already gradually increased flight times to reflect increased delay in the system.[4] As a result, airlines have incurred delays and

[4] For instance, in 1990, the average block time for direct United Airlines flights from Sea-Tac to Los Angeles was 2 hours and 21 minutes. In 1995, the average block time was 2 hours and 34 minutes. Similarly for departures to Spokane, the average block time was one hour and 2 minutes in 1990, yet in 1994 the average block time was 3 minutes greater. To San Francisco, the average block time grew by 10 minutes between 1990 and 1995, from 1 hour and 54 minutes to 2 hours and 4 minutes. Similarly for arrivals to Sea-Tac from Spokane, the block time increased 10 minutes, while the block times increased 7 minutes when arriving from San Francisco.

inefficiency, and hidden these delays by increasing the block times. As changes in flight/block time extend the operating times of flight crews, increase fuel consumption, etc., such changes would increase operating costs to the airlines.

Another means of de-peaking would be requiring air carriers to operate in non-peak periods. Such a requirement is not feasible, as found by the Expert Panel on Demand and System Management in their December 8, 1995 final order. Instead, airlines could theoretically voluntarily re-schedule flights out of the peak periods. Theoretically, there is a point when the de-peaking of the demand through artificial means is no longer realistic, as airlines establish flight schedules in response to demand - when passengers and shippers desire air service. Airlines have some flexibility to modify schedules to account for anticipated delays, but such adjustments are typically limited to relatively small changes in scheduled arrival or departure times (i.e., less than 15-20 minutes). Substantial changes in actual flight schedules would not likely occur in large number, since such changes would result in flights being made when passengers do not wish to fly. Factors such as the desires of the traveling public, time zone limitations and flight crew scheduling are key determinants of flight schedules. If airlines choose to re-schedule flights (including an increase in the operating block times), the benefits of the proposed new parallel runway, as described by delay and delay savings, would be less than presented in this EIS. However, as capacity exists during the good weather conditions (VFR1), it is unlikely that the airlines would completely adjust their schedules to reflect the poor weather delay, due to passengers' desire to fly at specific times. Competition would continue to generate peaks in activity. Consequently, when poor weather occurs, flight delays would occur.

The assumptions of this EIS reflect the shifting of flight times, or de-peaking, as a result of delay associated with the Do-Nothing alternative. These high levels of delay automatically delay a small number of flights into hours when less activity occurs. As was assumed in the Do-Nothing alternative, the greatest shifting of flights due to delay would occur within 60 minute blocks. Thus, these shifts would not significantly alter the demand profile. Shifts greater than portrayed for the Do-Nothing alternative are not likely, until the Airport reaches its capacity, thereby forcing de-peaking. At that point, the Airport is not meeting its objective of providing efficient air transportation as demanded by the traveling public.

One of the arguments suggested in comments from the public is that airlines would cease or reduce service to Sea-Tac as delay increases. However, these comments do not reflect the passenger types using Sea-Tac. Enplaned passengers using Sea-Tac are dominated by origin and destination passengers (passengers wishing to access the Puget Sound Region) versus connecting passengers. Experience at other U.S. airports indicates that when an airport has a large number of connecting passengers, airlines can choose to schedule some connecting passengers through other airports or when demand is sufficient, overfly the connecting airport. However, as 70 percent of the Sea-Tac passengers are O&D, and due to the location of the Region relative to the population centers of the country, airlines would continue to serve the demand at Sea-Tac.

Whether delay occurs or flight schedules are adjusted to reflect increased operating block times, increased operating costs would accrue to the airlines. Thus, this option was considered the most realistic consequence of the demand and facilities available, and, thus was reflected as the Do-Nothing alternative assessed in the EIS. The reduced operating times associated with the implementation of a third parallel runway would result in a substantial cost savings to the airlines. As is described in the Draft and Final EIS, a new parallel runway would have saved the airlines $24 million if it had been available for use in 1994. The delays saving is expected to grow to around $59 million per year in 2000, $70 million per year in 2002 and $146 million when activity reaches 425,000 operations (near the year 2013). As a result, if the runway were available for use in year 2002, the delay savings would compensate for the cost of construction in a 5 year period. If completed later, the pay-back period would be sooner than 5 years.

(2) Increased Load Factors

Another suggestion is that passenger demand would continue during the peak periods such that airlines would increase the load factor on flights during these periods.

At Sea-Tac, higher load factors occur during the peak arrival and departure periods, especially on the longer haul non-stop flights. In general, lower load factors occur on shorter flight distances and during the non-peak periods. This peaking is a consequence of the desire of passengers to arrive and/or depart during specific windows of time. Demand for east coast service reflects time zone changes as well as the flight time due to the northwest coastal location of Sea-Tac. For instance, the earliest arrivals leave east coast cities by 7 a.m. with arrival at Sea-Tac scheduled for about 11 a.m. or later. Similarly, departures for the east coast typically leave Sea-Tac before 3 p.m. in order to arrive on the east coast before 10 p.m. While operations occur outside these windows, the associated load factors are typically less. In addition, the majority of the operations to the east coast (particularly during peak periods) are already being conducted with the larger aircraft in an airlines fleet. The forecast prepared for the Master Plan Update assumed an increase in aircraft seat size in the future, reflecting actions such as an airlines decision to replace smaller aircraft (B-737 and B-727) with larger aircraft (B-757 and B-777).

The north-south markets are currently being served by the high frequency shuttle operations (particularly in the California markets). The fleet mix servicing the north-south flights is dominated by B-737 aircraft, which facilitate quick aircraft service turnaround. Increasing the load factor or aircraft size is not likely in these markets, as during peak periods load factors are already high. In addition, to conduct the profitable quick-turn around necessary for the lower-cost, shuttle operations, airlines have found smaller aircraft more desirable.

When the options of increased load factors and/or increased aircraft sizes were considered during the Master Plan, it was found unrealistic. Delay at one airport, such as Sea-Tac, is not sufficient to influence an airline's fleet acquisitions. In addition, the power of an airline to control load factors is based on fare pricing. Average load factors can not realistically exceed 70 percent due to the law of averages. To achieve extraordinarily high average load factor, the airlines would have to set fares so low (to attract passengers to the non-peak periods) that they would be turning away substantial numbers of higher yield customers during peak periods. Yield management, in use by airlines today, is designed to match air fares, aircraft types, and demand in a manner that maximizes customer service and profit. Further increases in average load factors are not expected as a result of yield management without adverse impacts on profitability.

Similarly, current research indicates that airlines providing the greatest service frequency can attract more market share than their share of the seats in the market. The current trend toward smaller aircraft for the shorter-haul flights with greater frequency confirms the attempt by the airlines to increase load factors and profitability, while maintaining and increasing flight frequency. Thus, influences in flight scheduling were deemed more realistic and were reflected in the de-peaking alternative described previously.

(3) Alternative Modes of Travel

The Draft and Final EIS contains an extensive description of the other modes of travel and their potential as an alternative to the proposed improvements at Sea-Tac Airport. Commentors noted that if delay reaches a critical level at Sea-Tac, such as those associated with the "Do-Nothing" alternative, passengers would select another mode of travel. These alternative modes of travel could include, automobile, train, and bus and are only effective and efficient for trips within a 500 mile driving distance. Currently, less than five percent of current air passengers are traveling to cities within the 500 mile distance. In addition, the two principal state travel corridors, I-5 and I-90, are experiencing growing traffic congestion. Existing train service, and planned rail improvements do not provide competitive travel times or frequency of service to compete with air travel. It is unlikely that air passengers would change their mode of travel to slower and more congested alternatives. Alternative modes of travel were not considered to be a reasonable option within the year 2020 planning horizon. The forecast assumptions reflect these conditions and their potential impacts on air travel demand.

(4) Use of Alternative Airports

The Draft and Final EIS also contains an extensive discussion of the analysis conducted concerning the use of alternative airports. As was discussed, this is not a reasonable alternative and is not likely in the context of the Do-Nothing alternative.

(5) Environmental Impact of an Alternative Forecast Demand Assumption

To disclose the probable impacts associated with Sea-Tac Airport accommodating less or more aviation traffic than is forecast, several theoretical scenarios were assessed, extrapolating from the assessment presented in the EIS. The following scenario's were assessed: Case 1: Aviation demand grows slower, 85 percent of the levels forecast by the Master Plan Update; Case 2: Aviation demand grows 25 percent greater than forecast by the Master Plan Update; and Case 3: Same as Case 2, except the Do-Nothing is constrained to the capacity of the existing airfield.[5]

As a result, aviation demand in these scenarios could be as follows:

	2000	2010	2020
Master Plan Update Forecast			
Aircraft Operations	379,200	405,800	441,600
Enplaned Passengers	11,900,000	15,300,000	19,100,000
Est. total delay (min.)	12	17	24
Case 1: (15% slower growth)			
Aircraft Operations	360,240	365,220	375,360
Enplaned Passengers	11,305,000	13,770,000	16,235,000
Estimated total delay (min.)	8	9	11
Case 2: (25% greater growth)			
Aircraft Operations	398,160	466,670	552,000
Enplaned Passengers	12,495,000	17,595,000	23,875,000
Estimated total delay (min.)	16	30	53
Case 3 (25% greater growth with capacity limit)			
Aircraft Operations	398,160	460,000	460,000
Enplaned Passengers	12,495,000	17,343,500	19,895,900
Estimated total delay (min.)	16	30	30+

As is noted in this appendix, the Master Plan Update forecasts represent current professional estimates of how aviation demand will change in the future using a reliable relationship between population, income and air fares. However, to provide an estimate of the possible environmental impacts associated with different forecasts, the three cases noted above were assessed. This assessment focused on the Preferred Alternative - Alternative 3 (North Unit Terminal) with a new 8,500 foot long parallel runway and the Do-Nothing. The extrapolation from the impacts presented in the EIS was performed based on professional estimates of how the various environmental impacts would change in accordance with alternative aviation demands.

[5] These three cases were considered as they are representative of possible variations from the current aviation demand forecast. As of September 1995, actual aviation activity levels are 20 percent higher than a linear interpolation between the forecast dates. Thus a 15% slower growth rate would appear to represent a much slower growth rate than is currently actually materializing. A 25% faster growth rate was used as it is slightly higher than the most recent trend.

Table R-4 presents a summary of the probable key impacts of these cases.

(A) Case 1: Demand Grows at a Slower Rate than Forecast

Assuming that aviation demand grows at a slower rate, the proposed improvements identified in the Master Plan Update would not be needed in the time frame presented in Chapter II of the EIS. As a result of a 15% slower demand growth, average delay would not reach the 10 minute average total level until around the year 2015. However, as is noted, current poor weather conditions create severe delay conditions, and by the year 2000, would exceed Sea-Tac's desired average delay levels. Thus, while the runway would be needed today to address the poor weather operating deficiencies, this case tested delaying the implementation of the Master Plan Update improvements by 15 years. As the airfield capacity of Sea-Tac would not be exceeded with the Case 1 demand levels, the Do-Nothing and "With Project" activity levels were assumed to be equal.

Based on these demand and timing assumptions, environmental impacts were then extrapolated:

- *Noise and Land Use: With less aviation demand, the associated noise impacts would be less.* Based on the analysis conditions presented in the EIS, the effects on the Do-Nothing and "With Project" noise and land use impacts were assessed assuming a 15 percent slower aviation demand forecast. As is shown in **Table R-4**, while the precise numbers of people and housing units affected by DNL 65 and greater sound level would be less than forecast (by up to 20 percent), all future year impacts would continue to be substantially less than current impacts. The incremental impact caused by the proposed Master Plan Update improvements would be slightly less than the impacts presented in this EIS. When comparing the Do-Nothing alternative to the "With Project" alternative in year 2020 with less demand, the proposed improvements would impact an additional 1,050 people and 400 homes by DNL 65 and greater sound levels.

- *Air Quality: A slower forecast in aviation demand would result in less total air pollution: However, CO concentrations would continue to be exceeded at the key intersections in the Airport vicinity.* Based on the forecast assumptions of this scenario, the total quantity (inventory) of air pollution emitted in the study area was estimated assuming a linear relationship between activity levels and pollutant emissions. As is shown in **Table R-4**, with a 15 percent less growth in aviation demand, the forecast emission levels would be 15 percent less. The incremental impacts caused by the Master Plan Update improvements would be the same as those presented in this EIS.

  The pollutant concentrations associated with the area roadways were also assessed using a 15 percent lower aviation demand forecast. To demonstrate a worst-case evaluation, these 8-hour concentration estimates were extrapolated assuming that half of the traffic through the intersections are airport related, and were thus reduced accordingly. As less airport related surface traffic were to occur, less pollution would be emitted. As is shown, the same incremental relationship between the "With Project" and Do-Nothing alternative would exist with a 15 percent slower growth in aviation demand.

- *Water Resources (Floodplains, Streams, Wetlands, etc.): With a lower level of aviation activity the proposed improvements would impact the resources later in time.* Virtually all of the water resource impacts that were identified in the Master Plan Update EIS are not directly dependent upon the precise aviation demand forecast. Rather, water resource impacts is a function of the types of facilities that are available to accommodate the forecast demand. Until new facilities are constructed, there would not be new impacts on floodplains, streams, wetlands, or surface water runoff. As is shown in **Table R-4**, the water resource impacts would not be incurred until after year 2010 as the major new facilities would be under development after around 2015.

- *Property Acquisition would occur later in time, yet would eventually require the same number of homes and business as presented in this EIS for the Master Plan Update improvements.*

- *Socio-Economic Impacts* - A slower aviation demand forecast would result in the same property and sales tax losses but would not occur until later in time as acquisition would occur as presented in this EIS. Total jobs created due to aviation activity at Sea-Tac would grow at a slower rate than forecast in the EIS, due to the slower growth in aviation demand.

- *Earth/Fill Requirements* - As the proposed Master Plan Update improvements are needed, they would result in the same quantity of fill required to develop the third runway embankment and runway safety areas. As the quantity of fill would be the same, the construction related truck movements would be the same as presented for the Master Plan Update forecast. However, these impacts would not occur until later in time, sometime after the year 2015, when the proposed improvements are needed.

Noise and air pollution impacts would occur in proportion to the anticipated growth in aviation demand. Other impacts to the social and natural environment would not occur until construction was initiated, about 15-17 years later than forecast by the Master Plan Update.

(B) Case 2: Demand Grows at a Faster Rate than Forecast

The second case assessed reflects a greater growth in aviation demand than is presently forecast by the Master Plan Update. To estimate a 25 percent greater growth in year 2020, somewhat slower escalated growth rates were assumed for interim years. For this test case, year 2000 activity was consider to be five percent above the year 2000 forecast, while year 2010 was assumed to be 15 percent above the associated Master Plan Update forecast. As a result of this elevated activity level assumption, aviation demand and associated delay and congestion would be substantially greater than forecast - year 2000 average delay would be approximately 16 minutes, versus the Master Plan Update Do-Nothing assumption of approximately 12 minutes. Landside improvements would also be needed earlier in time; based on these forecasts, landside improvements could be needed 5-7 years earlier than forecast.

Assuming that the existing facilities can accommodate this demand, the following analysis was performed.

- *Noise and Land Use: This case would result in nearly the same incremental impact as forecast by the EIS*: Based on the analysis conditions presented in the Environmental Impact Statement, the impact on the Do-Nothing and "With Project" noise and land use impacts were assessed assuming the greater growth in year 2020 aviation demand. As with Case 1, all future year impacts would be less than the existing impacts, whether or not improvements are undertaken at Sea-Tac. The greatest incremental impact, relative to the Do-Nothing would occur in 2020, where 550 people in about 230 homes would be newly affected by DNL 65 and greater noise exposure.
- *Air Quality: A greater forecast in aviation demand would result in more total air pollution: CO concentrations would continue to be exceeded at the key intersections in the Airport vicinity, at a rate higher than forecast by the EIS.* With a faster growth in aviation demand, the forecast emission levels would be up to 25 percent greater than presented in the EIS. However, the incremental impacts on the emissions inventory caused by the Master Plan Update improvements would be the same as those presented in the EIS.

  The pollutant concentrations associated with the area roadways were also assessed using a 25 percent year 2020 greater aviation demand forecast. If more airport related surface traffic were to occur, higher concentrations of pollution would occur on area roads. As is shown, the same incremental relationship presented in this EIS between the "With Project" and Do-Nothing alternative would exist with a 25 percent faster year 2020 growth in aviation demand.

- *Water Resources (Floodplains, Streams, Wetlands, etc.): Water resource impacts would occur earlier in time, as the need for airport facilities would occur faster - however the impacts would be the same as shown in the EIS.* As is shown in **Table R-4,** the water resource impacts would not be before year 2000, as construction of most of the airport improvements would occur 5-7 years earlier than forecast.

- *Property Acquisition would be as projected for the Master Plan Update, and would require the same number of homes and business as presented in the EIS for the Master Plan Update improvements.*

- *Socio-Economic Impacts* - A faster aviation demand forecast would result in the same property and sales tax losses as acquisition would occur as presented in this EIS. Total jobs created due to aviation activity at Sea-Tac would grow at a faster rate than forecast in the EIS, due to the slower growth in aviation demand.

- *Earth/Fill Requirements* - As the proposed Master Plan Update improvements are needed, they would result in the same quantity of fill required to develop the third runway embankment and runway safety areas. As the quantity of fill would be the same, the construction related truck movements would be the same as presented for the Master Plan Update forecast.

Thus, as this example shows, if forecast demand grows at a rate faster than is presently forecast, the facilities would be needed earlier. Noise and air pollution impacts would occur in proportion to the anticipated growth in aviation demand.

(C) Case 3: The Theoretical Capacity Can Not Be Achieved And Assuming A Faster Growth in Aviation Demand

The final case assessed reflects a greater growth in aviation demand than is presently forecast by the Master Plan Update, yet assumes that some of the demand can not be accommodated if no airfield improvements are undertaken. Using the forecast assumptions of Case 2, the Airport's theoretical capacity of 460,000 was applied. Assuming that the theoretical capacity is exceeded in the planning horizon (in this case, the theoretical capacity would be exceeded before year 2010), the Do-Nothing level of activity would be less than the "With Project". The following activity assumptions were used:

	2000	2010	2020
Case 3: Do-Nothing (25% greater growth with capacity limit)			
Aircraft Operations	398,160	460,000	460,000
Enplaned Passengers	12,495,000	17,343,500	19,895,900
Estimated total delay (min.)	16	-30	30+
Case 3: "With Project" (25% greater growth)			
Aircraft Operations	398,160	466,670	552,000
Enplaned Passengers	12,495,000	17,595,000	23,875,000
Estimated total delay (min.)	16	30	53

Assuming that the existing facilities can not accommodate the forecast demand, the following analysis was performed.

- *Noise and Land Use: Because of unserved demand in the Do-Nothing alternative, the impact caused by the proposed improvements would be greater than forecast in the EIS.*

As is shown in **Table R-4**, all future year impacts would continue to be less than presently forecast. The greatest change between the Do-Nothing and the "With Project" would occur in 2020 when 92,000 operations would not be served by the existing airfield. The incremental impact in 2020 would be 2,460 people. Due to the insulation accomplished in the Port's Noise Remedy Program, mitigation beyond that presented for the Master Plan Update is not likely.

- *Air Quality: CO concentrations would continue to be exceeded at the key intersections in the Airport vicinity and the impact of the proposed improvements would be greater than forecast.* The pollutant concentrations associated with the area roadways were also assessed using a 25 percent year 2020 greater aviation demand forecast, assuming that the Do-Nothing is not able to accommodate the same level of activity. Because the incremental impact of the proposed improvements relative to the Do-Nothing would be greater, additional mitigation would be necessary, particularly in the longer-term period.

- *Water Resources (Floodplains, Streams, Wetlands, etc.): Water resource impacts would occur earlier in time, as the need for airport facilities would occur faster in time - however the impacts would be the same as shown in the EIS.* The water resource impacts would not be before year 2000, as construction of most of the airport improvements would occur 5-7 years earlier than forecast.

- *Property Acquisition would be as projected for the Master Plan Update, and would require the same number of homes and business as presented in the EIS for the Master Plan Update improvements.*

- *Socio-Economic Impacts* - A faster aviation demand forecast would result in the same property and sales tax losses as acquisition would occur as presented in this EIS. Total jobs created due to aviation activity at Sea-Tac would grow at a faster rate than forecast in the EIS, due to the faster growth in aviation demand. However, as the proposed improvements would accommodate a greater level of aviation demand, total jobs would be greater "With Project" than for the Do-Nothing alternative.

- *Earth/Fill Requirements* - As the proposed Master Plan Update improvements are needed, they would result in the same quantity of fill required to develop the third runway embankment and runway safety areas. As the quantity of fill would be the same, the construction related truck movements would be the same as presented for the Master Plan Update forecast.

Thus, as this example shows, if forecast demand grows at a rate faster than is presently forecast, the facilities would be needed earlier. Additional mitigation would be necessary in the later time periods if the demand exceeded the capacity. Noise and air pollution impacts would occur in proportion to the anticipated growth in aviation demand.

III. AIR QUALITY

A number of comments were raised concerning the precision of the air quality analysis and the results presented in the Draft EIS. Each of the individual comments are responded to in a later section (See response to comments R-10-1 through R-10-74). However, the following paragraphs summarize the key issues raised in the comments and how the Final EIS addresses these issues.

A number of comments were received concerning the assumptions used in the air quality analysis, particularly relative to aircraft emissions and pollutant levels. As was found in the State Implementation Plan, surface motor vehicles are the primary air pollutant generator in the Region. As is stated in the Draft and Final EIS, in King County, the largest **non-road** pollutant sources are:

- Carbon Monoxide: lawn and garden equipment,

- Volatile Organic Compounds - lawn and garden equipment
- Nitrogen Oxides - construction equipment;
- PM10 - aircraft and airport equipment.

It is important to note that other sources contribute 80 percent of the total pollutant levels in King County (non-road sources, such as airport activity, represent 20 percent of the pollutant emissions in the Region).

Residents expressed concern that the immediate Airport area should be the focus when examining pollutant levels. The EIS examined all major sources in the Airport area as part of the "Area Dispersion Analysis". As is shown on the next page, within the detailed study area used in this EIS, aircraft Carbon Monoxide contributions represent 7 percent of total CO emissions, while automobile emissions represent nearly 90 percent of these emissions. For VOC's, aircraft represent 20 percent of the area emissions. For NO_X aircraft represent nearly 38 percent of source contributions. Except for Sulfur Oxides, automobiles represent the greatest sources of pollution in the immediate airport area. Similar relationships exist for all major air carrier airports located in major urban areas.

A number of comment were also received concerning the total level of airport activity assessed in the Draft EIS. To reflect the maximum hourly level of departure activity, a test case was assessed before preparing the Final EIS. This test showed that pollutant levels would be slightly greater than presented in the Draft EIS, yet would be below the National and State Ambient Air Quality Standards with a maximum hourly level of departure activity.

The Final EIS contains an updated surface transportation analysis and associated air quality assessment. As was identified during the public comment period, the Puget Sound Regional Council (the Metropolitan Planning Organization) has selected a preferred surface transportation plan for the Central Puget Sound Region. As the Draft EIS analysis was prepared prior to the finalization of the Metropolitan Transportation Plan, the Final EIS has been prepared to reflect the preferred alternative. Thus, the surface transportation analysis and air quality analysis presented in the Draft EIS were updated during the preparation of the Final EIS. During this update process, many of the comments raised concerning air quality were reviewed and changes in the modeling/analysis were conducted. Chapter IV, Section 9 "Air Quality" and the associated Appendix D have been revised accordingly.

As is shown, the existing and forecast levels of surface traffic result in exceedances of the National and State Ambient Air Quality Standards in the intersections of the most severely congested roads: along International Boulevard at S. 188th Street and S. 170th Streets. Although traffic levels are expected to continue to increase in the immediate airport area regardless of the improvements proposed at Sea-Tac Airport, pollutant concentrations are expected to decline. This reduction is associated with actions associated with the Federal Clean Air Act and the Washington State Clean Air Act concerning automobile emissions reductions. The proposed airport improvements are expected to result in a slight increase in pollutant concentrations at these intersections when compared with the future Do-Nothing alternative. However, proposed mitigation would alleviate these increased concentrations.

AIRPORT AREA POLLUTANT CONTRIBUTIONS

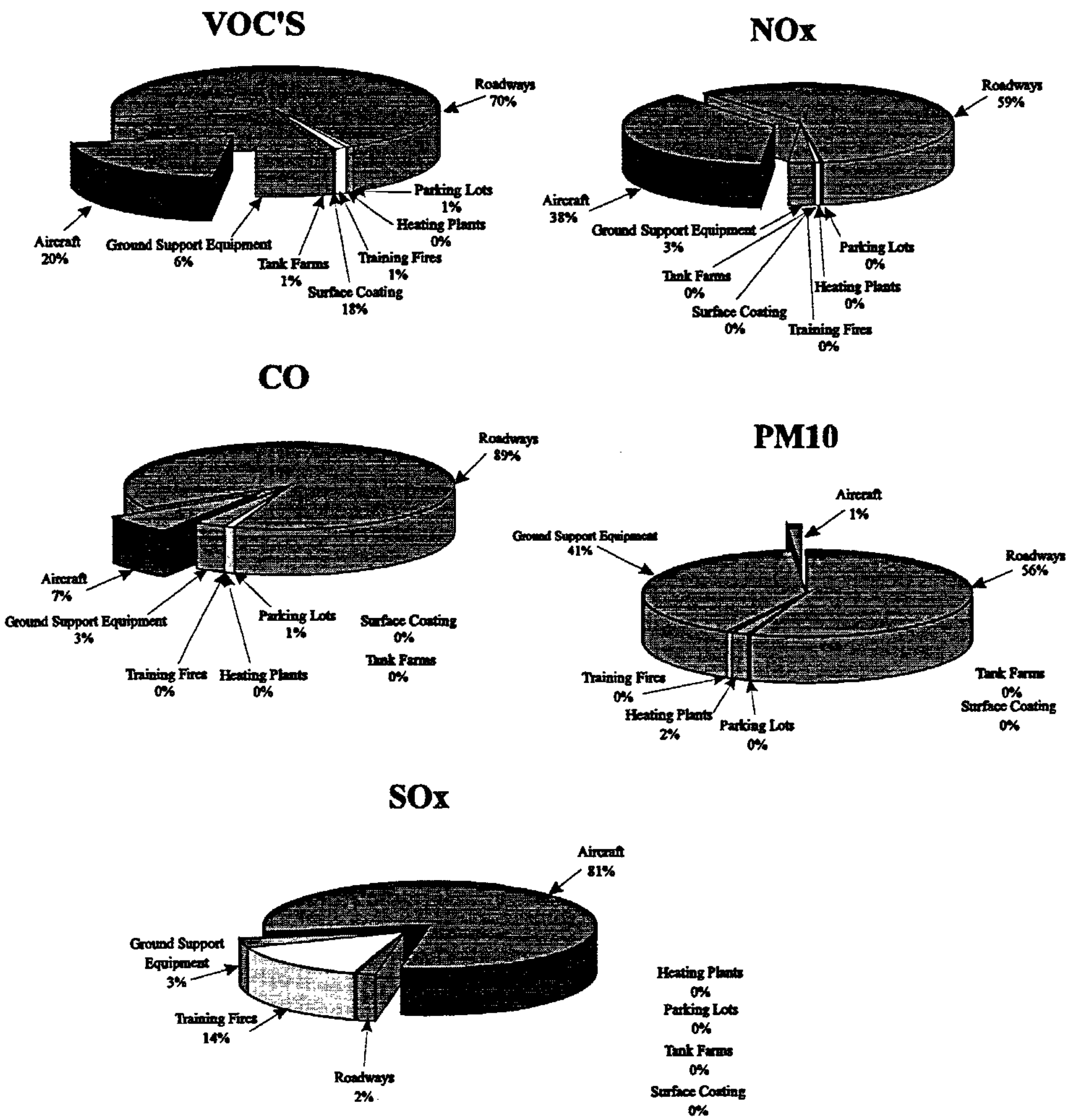


TABLE R-4

SUMMARY OF IMPACTS ASSOCIATED WITH ALTERNATIVE FORECAST ASSUMPTIONS

Aircraft Noise Impacts (65 DNL and greater noise exposure)

	Master Plan Update Draft EIS		15% Slower Forecast		25% Faster Growth		25% Faster Growth with Capacity Limit	
	Population	Housing	Population	Housing	Population	Housing	Population	Housing
1994 Existing	31,800	13,620	31,800	13,620	31,800	13,620	31,800	13,620
Alt 1 Do-Nothing								
2000	8,970	3,870	8,360	3,610	12,560	5,110	9,580	4,130
2010	9,450	4,060	8,430	3,620	13,620	5,790	10,820	4,650
2020	10,800	4,610	8,570	3,660	13,360	5,640	11,450	5,890
Alt. 3 (North Unit Terminal)								
2000	9,890	4,020	9,430	3,830	10,340	4,200	10,340	4,200
2010	9,860	4,190	8,940	3,800	11,230	4,770	11,230	4,770
2020	11,240	4,740	9,620	4,060	13,910	5,870	13,910	5,870

Emissions Inventory - Annual Tons of Pollutants Emitted

	Master Plan Update Draft EIS		15% Slower Forecast		25% Faster Growth		25% Faster Growth with Capacity Limit	
	Carbon Monoxide	Nitrogen Oxides	Carbon Monoxide	Nitrogen Oxides	Carbon Monoxide	Nitrogen Oxides	Carbon Monoxide	Nitrogen Oxides
Alt 1 (Do-Nothing)								
2000	976	1,234	927	1,172	1,025	1,296	1,025	1,295
2010	1,245	1,525	1,121	1,373	1,432	1,754	1,411	1,729
2020	1,875	2,047	1,594	1,740	2,344	2,559	1,953	2,132
Alt. 3 (North Unit)								
2000	986	1,234	937	1,172	1,035	1,296	1,035	1,296
2010	1,249	1,524	1,124	1,372	1,436	1,753	1,436	1,753
2020	1,833	2,006	1,558	1,705	2,291	2,508	2,291	2,508

Carbon Monoxide Concentrations at Receptor 2 (ppm) Note: AAQS 9 ppm)

	Master Plan Update Draft EIS		15% Slower Forecast		25% Faster Growth		25% Faster Growth with Capacity Limit	
	International Blvd./S 188th	International Blvd./S. 170th	International Blvd./S 188th	International Blvd./S. 170th	International Blvd./S 188th	International Blvd./S. 170th	International Blvd./S 188th	International Blvd./S. 170th
Alt 1 (Do-Nothing)								
2000	12.18	9.31	11.6	8.8	12.8	9.8	12.8	9.8
2010	11.55	8.96	10.4	8.1	13.3	10.3	13.1	10.2
2020	10.43	9.45	8.9	8.0	13.0	11.8	10.9	9.8
Alt. 3 (North Unit)								
2000	12.18	9.03	11.6	8.6	12.8	9.5	12.8	9.5
2010	10.57	8.96	9.5	8.1	12.2	10.3	12.2	10.3
2020	10.22	9.10	8.7	7.7	12.8	11.4	12.8	11.4

Source: Synergy Consultants. Inc. - extrapolated from materials presented in the *Draft and Final Environmental Impact Statement.*

TABLE R-4
SUMMARY OF IMPACTS ASSOCIATED WITH ALTERNATIVE FORECAST ASSUMPTIONS

Wetland Impact (Acres)

	Master Plan Update Draft EIS		15% Slower Forecast		25% Faster Growth		25% Faster Growth with Capacity Limit	
	Alt 1	Alt 3	Alt 1	Alt 3	Alt 1	Alt 3	Alt 1	Alt 3
2000	1.7	10.37	1.7	1.7	1.7	10.37	1.7	10.37
2010	1.7	10.37	1.7	1.7	1.7	10.37	1.7	10.37
2020	1.7	10.37	1.7	10.37	1.7	10.37	1.7	10.37

Stream Relocations (Linear Feet)

	Master Plan Update Draft EIS		15% Slower Forecast		25% Faster Growth		25% Faster Growth with Capacity Limit	
	Alt 1	Alt 3	Alt 1	Alt 3	Alt 1	Alt 3	Alt 1	Alt 3
2000	2,200	6,100	2,200	2,400	2,200	6,100	2,200	6,100
2010	2,200	6,100	2,200	2,400	2,200	6,100	2,200	6,100
2020	2,200	6,100	2,200	6,100	2,200	6,100	2,200	6,100

Floodplain Impacts (Acres)

	Master Plan Update Draft EIS		15% Slower Forecast		25% Faster Growth		25% Faster Growth with Capacity Limit	
	Alt 1	Alt 3	Alt 1	Alt 3	Alt 1	Alt 3	Alt 1	Alt 3
2000	0.00	7.2	0.00	0.00	0.00	7.2	0.00	7.2
2010	0.00	7.2	0.00	0.00	0.00	7.2	0.00	7.2
2020	0.00	7.2	0.00	7.2	0.00	7.2	0.00	7.2

Property Acquisition (total units of property)

	Master Plan Update Draft EIS		15% Slower Forecast		25% Faster Growth		25% Faster Growth with Capacity Limit	
	Alt 1	Alt 3	Alt 1	Alt 3	Alt 1	Alt 3	Alt 1	Alt 3
2000	0.00	7.2	0.00	0.00	0.00	7.2	0.00	7.2
2010	0.00	7.2	0.00	0.00	0.00	7.2	0.00	7.2
2020	0.00	7.2	0.00	7.2	0.00	7.2	0.00	7.2

Source: Synergy Consultants, Inc. - extrapolated from materials presented in the *Draft and Final Environmental Impact Statement.*

TABLE R-4

SUMMARY OF IMPACTS ASSOCIATED WITH ALTERNATIVE FORECAST ASSUMPTIONS

Socio-Economic Impacts (Loss of Taxes - Property taxes and Sales Taxes expressed in millions)

	Master Plan Update Draft EIS		15% Slower Forecast		25% Faster Growth		25% Faster Growth with Capacity Limit	
	Alt 1	Alt 3	Alt 1	Alt 3	Alt 1	Alt 3	Alt 1	Alt 3
Lost Taxes	0	2.4	0	2.4	0	2.4	0	2.4

Socio-Economic Impacts (Total Jobs - not including construction jobs)

	Master Plan Update Draft EIS		15% Slower Forecast		25% Faster Growth		25% Faster Growth with Capacity Limit	
	Alt 1	Alt 3	Alt 1	Alt 3	Alt 1	Alt 3	Alt 1	Alt 3
2000	205,690	205,690	195,405	195,405	215,975	215,974	215,975	215,974
2010	335,344	335,344	301,809	301,809	385,645	385,645	380,133	385,645
2020	418,632	418,632	355,837	355,837	523,290	523,290	436,075	523,290

Amount of Earth/Fill Needed (Million Cubic Yards)

	Master Plan Update Draft EIS		15% Slower Forecast		25% Faster Growth		25% Faster Growth with Capacity Limit	
	Alt 1	Alt 3	Alt 1	Alt 3	Alt 1	Alt 3	Alt 1	Alt 3
Fill Needed	2.4	23	2.4	23	2.4	23	2.4	23

Source: Synergy Consultants, Inc. - extrapolated from materials presented in the *Draft and Final Environmental Impact Statement.*

IV. RESPONSE TO INDIVIDUAL COMMENTS

Based on the comments received during the public comment period, the following unique comments were received. The numerical codes correspond to the bracketed index in the margin of each letter, as contained in **Appendix T**.

THE PROCESS

Comment R-1-1: Mr. Bader (Ravenna-Bryant Community Association), Mr. Forrey (Hawthornwe Hills Community Club), Mr. Klug (North East District Council), Mr. Mandel (Leschi's Community Council), Mr. Neuzil, and Mr. Peyton (Ravenna-Bryant Community Association) requested a copy of Draft Environmental Impact Statement (Draft EIS). Ms. Stuhring requested that copies of the Draft EIS be sent to the libraries of all those cities which had residents calling Sea-Tac Airport noise information line.

Response: A copy of the Draft EIS was made available to all groups and individuals requesting a copy. This included distribution to the Ravenna-Bryant Community Association, Mr. Forrey, Mr. Klug, Mr. Mandel, Mr. Neuzil, and Ms. Stuhring, as well as others as requested.

Additionally, copies of the Draft EIS were available for inspection at the following locations:

- Federal Aviation Administration, Airports Regional Office
- Port of Seattle, Aviation Planning, Sea-Tac Airport
- Puget Sound Regional Council, Information Center, Seattle
- Beacon Hill Library, Seattle
- Boulevard Park Library, Seattle
- Burien Library, Burien
- Des Moines Library, Des Moines
- Seattle Public Library, Seattle
- Federal Way Library, Federal Way
- Foster Library, Tukwila
- Tacoma Public Library, Tacoma
- University of Washington, Suzallo Library, Government Publications, Seattle
- Valley View Library, SeaTac

At the request of area residents, additional copies of the Draft EIS were forwarded to the Vashon Island Public Library, the Magnolia Library and to the Bellevue Library. Ms. Stuhring requested that other city libraries receive a copy of the Draft EIS based on noise complaint telephone calls placed to the Sea-Tac Noise Office from residents from those cities. However, as the libraries and citizens from other areas did not request copies, no additional library copies, beyond those referenced above, were distributed.

Although the Ravenna-Bryant Community Association indicated that the FAA had not responded to the request for a copy of the Draft EIS, one was mailed on May 10, 1995 to the requested address.

Comment R-1-2: Mr. Akers, Mr. Clifford, Ms. Taylor, Mr. Richardson (SEED), Ms. Lepley, Ms. Ford, and Mr. Peyton (Ravenna-Bryant Community Association) stated that copies of the Draft EIS were not adequately distributed in the southeastern portion of Seattle and that several libraries were not included in the distribution of the document.

Response: The Draft EIS was made available for public viewing at various locations; see response to comment R-1-1. The list of public libraries was expanded to include three additional libraries (Bellevue, Magnolia, and Vashon Island) based on calls from the libraries and/or residents in these areas. Any individuals or organizations requesting copies of the Draft EIS were supplied with a copy, and requests for copies to be placed in any libraries were also accommodated.

__*Comment R-1-3A*__*: Mr. Clifford, Mr. Kennedy, and Ms. Yamamoto commented that the Public Hearing should have come at the end of the 90 day comment period rather than earlier in the comment period. Commentors suggested that there was not ample time for the public to analyze the Draft EIS. Additionally, Ms. Yamamoto commented on the scheduled hours that were available to the public to view copies on file in public locations.*

__Response__: The Draft EIS was released to the public on April 27, 1995. Notification of the document's availability was published in area newspapers (Seattle Times, Seattle Post-Intelligencer, Tacoma News Tribune and Highline Times) on April 27th, (or the next applicable publication date) as well as in the Federal Register on April 24, 1995. On June 1, 1995, the Federal Aviation Administration and the Port of Seattle conducted a public information workshop and hearing concerning the Master Plan Update Draft EIS. The purpose of the workshop was to aid citizen understanding of the content of the Draft EIS, the methodologies used in the analysis, and the findings. A simultaneous hearing was conducted so that residents could formally submit their comments. The public information workshop/public hearing was conducted from 1:00 p.m. until 10:00 p.m. Additionally, to facilitate the general public's understanding of the proposed Master Plan Update improvements and resulting environmental impacts, the FAA conducted a second public hearing on June 14, 1995 from 6:00 p.m. To 10:00 p.m. The close of the formal comment period was August 3, 1995. Therefore, the public information workshop/public hearings occurred approximately one month after the opening of the formal comment period. The time between the opening of the formal public comment period and the close of the comment period afforded the public the maximum time to review and comment on the Draft EIS. Copies of the Draft EIS were available for public viewing during regular business hours in the FAA, Port and PSRC offices, as well as in the public libraries. Every attempt was made to ensure the availability of copies for review by the public.

__*Comment R-1-3B*__*: The Airport Communities Coalition suggested that the Draft EIS was deficient in its analysis of various issues and thus should be revised and then re-circulated for public review and comment.*

__Response__: The Federal Aviation Administration and the Port of Seattle, as well as many of the reviewing agencies, deemed that the Draft EIS was a thorough and comprehensive review of the environmental impacts associated with alternative ways of addressing the needs at Sea-Tac Airport. While the Final EIS reflects improved analysis in several areas which were conducted in response to public and agency comments, the underlying finding of EIS has not changed. As a result, the lead agencies have determined that a supplemental Draft EIS is not warranted.

__*Comment R-1-4*__*: Ms. Ford, Ms. Lepley, and Ms. Mason commented that the Public Hearing and Draft EIS notices should have been published in multiple languages to ensure widespread notice. Additionally, the Church Council of Greater Seattle, Ms. Ford, Ms. Lepley, Ms. Taylor, and Ms. Mason stated that the southeastern portion of Seattle had not been adequately notified of the proposed impacts of the Master Plan improvements, nor adequately notified of the Public Hearing and release of the Draft EIS. Additionally, Mr. Peyton and Mr. Bader (Ravenna-Bryant Community Association) requested a copy of notices of the public hearings. Mr. Olander requested a copy of the hearing transcript.*

__Response__: The announcement of the availability of the Draft EIS and associated public comment period was conducted in accordance with applicable Federal, State and local requirements. To ensure widespread distribution, formal legal notices were published in the three primary newspapers with areawide distribution: Seattle Times, Seattle Post-Intelligencer and the Tacoma News Tribune with 232,400; 204,300 and 129,000 daily circulation, respectively. To ensure that residents of the Airport's most severely impacted areas were notified, a legal notice was also published in the Highline Times

(119,500 circulation). In addition, on April 27, 1995, the FAA conducted a news advisory (briefing) to notify all news agencies that the Draft EIS was available and as to describe the findings of the document. A number of members of visual and written media chose to attend the media advisory and published material concerning the availability of the Draft EIS. Others chose to not attend.

All commentors during the scoping process were forwarded notices announcing the availability of the Draft EIS and the public hearing dates. As the second hearing was established after the release of the Draft EIS, no specialized mailings of hearing notices were conducted. Instead, notices were published in area newspapers. Mr. Olander was informed that prior to publication of the Final EIS, the transcripts would be available for review at the FAA's office and a copy was mailed to the Airport Communities Coalition's legal counsel.

***Comment R-1-5**: A number of the commentors requested additional time to review and prepare comments on the Draft EIS, and therefore requested an extension to the comment period. The following individuals made this comment: Mr. Akers, Mr. Benedum (Highline Community Hospital), the Church Council of Greater Seattle, Mr. Clifford, Ms. Ford, Ms. Lepley, the Regional Commission on Airport Affairs, Mr. Richardson (SEED), Mr. Wagner, and Mr. Wichert.*

Response: In compliance with Federal Aviation Administration Order 5050.4A, "Airport Environmental Handbook," (Chapter 9, paragraph 91e), the public and agency review period for the Draft EIS was initially established at 45 days. Based on comments received at the February, 1994 scoping meeting, this comment period was extended to 60 days. Prior to the release of the Draft EIS, the FAA and the Port agreed to a second extension (30 additional days), resulting in a 90-day comment period. Having granted two extensions, the FAA and Port of Seattle determined that no additional review and comment time was necessary.

The Regional Coalition on Airport Affairs (RCAA) requested that the FAA and Port of Seattle reopen the public comment period subsequent to the Expert Panel's final decision; however, the FAA has determined that this was not necessary, given that the public will have the opportunity to comment on submissions to the Expert Panel as part of the Expert Panel's process. Expert Panel findings that pertain to demand/system management that were available before the publication of the EIS were included in the Final EIS.

***Comment R-1-6**: The Southwest King County Community Group, Ms. DesMarais, Mr. Townsend, and the Regional Commission on Airport Affairs commented on the unavailability of resource materials. Additionally, the Southwest King County Community Group commented on the lack of information regarding telephone conversations and interviews, as well as on the limited hours in which resource materials could be reviewed at the FAA offices.*

Response: Standard FAA practice in preparing Environmental Impact Statements (EIS) results in the preparation of an Administrative Record that contains all reference material and detailed resources that underlie the analysis contained in the EIS. The Administrative Record for the Sea-Tac Airport Master Plan Update Draft EIS, containing over 300 references, was made available for public viewing at the FAA offices during normal business hours shortly after release of the document. The FAA also made a copy machine available to anyone wishing to reproduce material contained in the Record. A complete copy of the Administrative Record was provided to the Airport Communities Coalition.

The Draft and Final EIS contains references to material collected through telephone interviews with representatives of various agencies and organizations. As the information gained in telephone conversations and telephone interviews was not available in printed material, footnotes were provided indicating the name of the contact, the organization of the contact, and the approximate date of the conversation. All references, including the footnoted telephone conversations, were provided to enable others to independently confirm the underlying data. Formal written records of all telephone conversations and interviews were not maintained, and as such could not be included in the Administrative Record.

__Comment R-1-7__: *A number of comments were received requesting clarification of the roles of the Port of Seattle, the FAA and the Corps of Engineers in preparing the Draft EIS. The following individuals made this comment: Ms. Brown, Mr. Heavey, Mr. Jhaveri, Regional Commission on Airport Affairs, Southwest King County Citizens Community Group, and Ms. Stuhring. Several of these individuals indicated that the lead role by the FAA and Port resulted in the EIS being biased.*

__Response__: According to the National Environmental Policy Act (NEPA section 102), a Federal agency is required to implement procedures to make the NEPA process more useful to decisionmakers and the public and is required to be the preparer of EIS. According to FAA Order 5050.4A, (chapter 2, paragraph 13), "under the Airports Program the FAA is responsible for analyzing the environmental impacts and consequences of a proposed Federal action involving airports, for the environmental assessment and related documents, and ultimately for approving or disapproving the environmental documents and the Federal action. Although an environmental assessment submitted by an airport sponsor may be used in whole or in part, the FAA is responsible for the facts, opinions, and judgments upon which the environmental determination is based." The FAA is the Federal agency with responsibility over airport improvements and the mandated Federal agency for ensuring compliance with NEPA. Mr. Dennis Ossenkop, with over 18 years experience with NEPA studies, is the designated FAA official overseeing the FAA's role in the EIS.

In addition to the requirements of NEPA, the proposed improvements at Sea-Tac must also comply with the applicable provisions of the Washington State Environmental Policy Act (SEPA). The Port of Seattle has been delegated responsibility from the State of Washington for ensuring compliance with SEPA for Port sponsored actions. Ms. Barbara Hinkle is the responsible SEPA contact for this EIS within the Port. According to CEQ 1501.5, a Federal, State, or local agency, including at least one Federal agency, may act as joint lead agencies to prepare an environmental impact statement. Therefore, as a result of the Federal and State regulations, the FAA and the Port of Seattle entered into a Memorandum of Understanding to serve as joint lead agencies in the preparation of the EIS for the Sea-Tac Airport Master Plan Update.

Upon request of the lead agency, any other Federal or state agency which has primary regulatory jurisdiction by law shall be a cooperating agency. In addition, any other Federal agency which has special expertise with respect to any environmental issue that should be addressed in the EIS, may be a cooperating agency upon request of the lead agency. Therefore, at their request, the Corps of Engineers has been designated as a cooperating agency. The Corps of Engineers was designated as a cooperating agency based on its primary regulatory jurisdiction and expertise concerning wetland impacts. The Draft and Final EIS were prepared and reviewed by these parties to ensure that there was an accurate, objective and fair evaluation of the issues.

__Comment R-1-8__: *Mr. Peyton (Ravenna-Bryant Community Association) stated that comments submitted in the scoping process were not addressed in the Draft EIS and suggested that the FAA was not fair.*

__Response__: The FAA is responsible for analyzing the environmental impacts and consequences of a proposed Federal action involving airports, for the environmental assessment and related documents, and ultimately for approving or disapproving the environmental documents and the Federal action. The environmental review process is intended to be completed in an objective, fair and impartial manner while maintaining compliance within the NEPA and SEPA guidelines. Numerous comments were submitted during the scoping process in early 1994. The key issues and alternatives identified in the scoping comments were addressed in the Draft and Final EIS.

The issues which the commentor asserted were not addressed are discussed below.

- The Draft and Final EIS evaluated and considered direct and indirect impacts to the environment as well as the cumulative impacts associated with each category mandated by NEPA and SEPA. Additionally, the Draft and Final EIS address noise exposure levels from 60 to 65 DNL in Chapter IV, Section 1, "Noise" (see response to comment R-6-10).
- All proposed alternatives, including alternative modes of travel, demand management techniques, and alternative airport sites, were analyzed and are discussed in Chapter II, "Purpose and Need and Alternatives". An east-west runway was not assessed in the Draft EIS because prevailing winds in the Region are from north to south, limiting the use of such a runway. In addition, an east-west runway would create extensive environmental impacts. The Final EIS discusses alternative orientations beginning on page II-13.
- The Draft and Final EIS provide an inventory of noise sensitive facilities (churches, libraries, schools, and hospitals) listed in Chapter IV, Section 2 "Land Use". Additionally, noise contours are provided in Chapter IV, Section 1, "Noise" and site specific noise levels are provided in Appendix C.
- The commentor questioned if it was fair for one of the EIS sponsors to drum-up support for the proposed development. The comment appears directed at the activities of Air Washington. The Port of Seattle contributed $50,000 to Air Washington in 1994 to assess the airport needs of the business community in the Region. This funding, and the associated activities, were conducted separately from the Master Plan Update and the EIS. As is shown in the public comment period, numerous groups support the proposed improvements at Sea-Tac Airport.
- The commentor also indicated that consultants that participated in the AIRTRAC activities should be excluded from participation in the EIS. None of the consulting firms that aided in the preparation of the Draft EIS participated in the activities of AIRTRAC. Landrum & Brown, the prime firm used in preparing this EIS has never worked at Sea-Tac Airport, until being selected by the FAA for this EIS. Parametrix was added to the consulting team upon completion of the Draft EIS to aid in preparing the final mitigation plan for the preferred wetland mitigation site. Parametrix was a participant in the Flight Plan Study and in the 1991 Part 150 Noise Exposure Map Update, and their role in those planning efforts were determined to not affect their role in the Final EIS.
- The Draft and Final EIS present the impacts of Sea-Tac in year 1994, as well as the forecast impacts in the reasonably foreseeable future with and without the Master Plan Update improvements. Thus, impacts were examined through the year 2020. To show interim year impacts, conditions in year 2000 and 2010 were also presented. Impacts beyond year 2020 were not addressed. These impacts were considered to be very speculative due to the inability to accurately forecast so far into the future.
- The impacts on air quality caused by aircraft operations and by other sources are addressed in Chapter IV, Section 9 "Air Quality". Additionally, impacts to water quality have been addressed in Chapter IV, Section 10 "Water Quality".
- The use of the Airport by general aviation aircraft is minimal. The only effect the proposed improvements would have on general aviation would be the placement of the general aviation terminal facilitates. The placement of those facilities is contingent upon which terminal alternative is chosen.
- An environmental assessment was conducted by the FAA on the Four-Post Plan in March, 1990. The existing conditions described in this EIS reflect the implementation of the Four-Post Plan.
- Changes in surface cover were addressed in the Draft EIS in Chapter IV, Section 15 "Biotic Communities". The changes in impervious surface were also reflected in Chapter IV, Section 10 "Water Quality and Hydrology".

Comment R-1-9: *The Regional Commission on Airport Affairs commented that an index should have been made available in the Draft EIS.*

Response: A topical index was included in the Draft and Final EIS in Chapter VI, on page VI-10.

Comment R-1-10: *Mr. Burke, Ms. Lepley, and Mr. Peyton (Ravenna-Bryant Community Association) commented that the Draft EIS should have been prepared using clearer and more comprehensible language.*

Response: According to the Council on Environmental Quality (CEQ) regulations (section 1502.8), "Environmental impact statements shall be written in plain language and may use appropriate graphics so that decisionmakers and the public can readily understand them." Attempts were made to provide clear and concise explanations of the complex technical analysis. The Executive Summary provides an abbreviated summary of the EIS and highlights the major issues and conclusions or findings.

Comment R-1-11: *Comments were made that the Draft EIS and Master Plan Update were performed concurrently and that an EIS should be performed after a Master Plan has been completed. The following individuals made this comment: Ms. Brasher, and Southwest King County Community Group.*

Response: FAA Order 5050.4A, (chapter 5, paragraph 40) states "Agencies shall integrate the NEPA process with other planning projects at the earliest possible time to insure that planning and decisions reflect environmental values, to avoid delays later in the process, and to head off potential conflicts." Where project sponsors have some indication of the needs of their facilities, it is often encouraged that Master Plans be conducted simultaneously with environmental studies. This approach ensures that the appropriate depth of the environmental impact analysis is conducted during the appropriate planning process. Therefore, the order in which the EIS and the Master Plan Update have been conducted meets the spirit and intent of the NEPA process.

Comment R-1-12: *The Airport Communities Coalition and the Southwest King County Community Group requested that the Draft EIS and proposed Master Plan Update improvements adhere and comply with all applicable laws and regulations.*

Response: Comment noted. The Draft and Final EIS complies with all applicable Federal and State regulations. It is anticipated that implementation of the proposed improvements at Sea-Tac would be conducted in accordance with applicable laws and regulations.

THE EXECUTIVE SUMMARY AND CHAPTER I "BACKGROUND"

Comment R-2-1: *A comment was received concerning the authority of the Puget Sound Regional Council and its ability to sign and adopt resolutions. Ms. Frause and Mr. Frause submitted this comment.*

Response: The Puget Sound Regional Council (PSRC) is a cooperative organization composed of local jurisdictions and state agencies in the four county region of Central Puget Sound, including King, Pierce, Kitsap and Snohomish Counties. PSRC is not a governmental unit, but a planning organization governed by a General Assembly, an Executive Board (principally composed of locally elected officials), and a policy board to which citizens can be appointed.

The PSRC is designated as the region's Metropolitan Planning Organization (MPO) under federal law and the Regional Transportation Planning Organization (RTPO) under state law. MPOs are designated by the Governor in areas with urban populations greater than 200,000. The general authority of MPOs is based in federal statutes, specifically the Intermodal Surface Transportation Efficiency Act of 1990 (ISTEA), as amended. In 1994, the Washington State Legislature enacted the Regional Transportation Planning Act (SHB 1928) to refine the authority provided through the federal process to transportation planning organizations. This legislation was designed to improve integration between transportation and comprehensive land use planning among local and state jurisdictions. The regional transportation planning process is codified in RCW 47.80.030, RCW 35.58.2795, RCW 35.77.010, RCW 36.81.121, and RCW 47.80 (new section).

The Regional Transportation Planning Act was developed in fulfillment of federal mandates and requires MPOs/RTPOs to update a regional transportation strategy and address how each mode, including transit, shall implement growth management strategies. This is accomplished through the development of the Metropolitan Transportation Plan (MTP) which is consistent with countywide planning policies. MPOs and RTPOs are to certify that the transportation elements of local comprehensive plans are consistent with the MTP. A six-year improvement plan, based on projects and programs of regional significance, is to be developed, including a prioritized, financially constrained list of projects and programs.

The PSRC is responsible for the development and adoption of the MTP. In addition, they develop an associated land use plan that is based upon adopted local jurisdiction comprehensive plans and countywide Growth Management Policy Plans. Development of the MTP includes a comprehensive transportation planning work program, including an extensive public involvement program. The Regional Aviation System Plan (RASP) is part of the MTP. PSRC has coordinated with appropriate agencies, including the Port of Seattle, operator of Sea-Tac, concerning the future of the air transportation system in Central Puget Sound. Adoption of the MTP is the responsibility of the PSRC General Assembly. The Assembly or the Executive Board, acting with the authority of the Assembly, may issue resolutions concerning regional transportation programs as part of the MTP process. General Assembly Resolution A-93-03 and Executive Board Resolution 94-01 were adopted within the PSRC's statutory authority. See **Appendix S** "The Transportation Planning Process: Jurisdiction Roles, Responsibilities, and Relationships" for additional information.

Comment R-2-2: *Mr. Frause, Mr. Peyton (Ravenna-Bryant Community Association) and the Regional Commission on Airport Affairs requested the clarification of the relationship between the Puget Sound Regional Council and the Port of Seattle resolutions. It was also suggested that all of the Port of Seattle resolutions should be addressed.*

Response: The Port of Seattle is a municipal corporation of the State of Washington organized on September 5, 1911 under provisions of the laws of the State of Washington, now codified at RCW 53.04.010 of the Revised Code of Washington. In 1942, the local governments in King County selected the Port to operate Sea-Tac. To the present, the Port's operations encompass a major portion of the waterborne and air traffic in the Seattle area. Because of the Port's governmental status, the Port is eligible to be a member of the Puget Sound Regional Council (PSRC). See response to comment R-2-1.

The statutory authority and resolutions adopted by the Port of Seattle provide the ability of the Port to maintain, manage and operate transportation infrastructure. The Port's policy direction is provided by a five member port commission, whose membership is elected by the voters of King County. To establish policy that is implemented by Port staff, the Commission passes resolutions, such as Resolution 3125. Similarly, to direct the development of the MTP implementation of regional issues, the PSRC General Assembly passes resolutions.

Port of Seattle Resolution 3125 was adopted in response to the completion of the two year Puget Sound Air Transportation Committee Flight Plan Project. That project was a joint effort between the PSRC and Port of Seattle. The resolution authorized the Port, in cooperation with the FAA to conduct studies, prepare plans, and complete a site specific environmental impact statement in preparation for authorization of improvements at Sea-Tac Airport, including development of a third runway. The resolution also instructed the Port staff to implement a plan to accelerate the insulation program to insulate up to 5,000 eligible single family residences in the noise remedy program before commencing construction of the proposed new parallel runway and to complete all others on the waiting list prior to operation of the proposed runway. It further committed the Port to add new eligible residences identified through the EIS analysis. The resolution was amended to include additional mitigation studies and develop new programs to reduce impacts for noise, air quality, land use and community compatibility, natural environment and water resources, and public health and safety.

The PSRC is the metropolitan transportation organization and is responsible for conducting multi-modal studies in support of the Metropolitan Transportation Plan. Based upon the recommendations of the Puget Sound Air Transportation Committee Flight Plan Project, the PSRC General Assembly adopted Resolution A-93-03. This resolution incorporated the Flight Plan's preferred alternative for developing a major supplemental airport for the Region, plus the improvements at Sea-Tac including the proposed new runway into the MTP. In addition, the resolution directed the responsible agency to proceed immediately with a site specific environmental impact statement. The resolution also requested the FAA to consider potential modifications to the Four-Post Plan based upon a petition from local jurisdictions. At this time no petitions requesting any changes have been received.[g]

Resolution A-93-03 also initiated the major supplemental airport feasibility study. This study was to be conducted in two phases, if the first phase determined that a potential airport site or sites were possible. The study was terminated after phase one, when the analysis concluded there were no feasible sites within the four county Region. The PSRC Executive Board, acting with the authority of the General Assembly, adopted Resolution EB-94-01 which halted further site studies, but left standing the recommendation for the preferred alternative and improvements at Sea-Tac Airport including the proposed new runway. A final element of Resolution A-93-03 concerned the independent evaluation of (1) demand and system management programs and (2) noise reduction performance. To accomplish these objectives the PSRC authorized establishment of an "Expert Arbitration Panel on Noise and Demand/System Management Issues." The expert panel is responsible for performing the independent evaluation on these issues and reporting back to the PSRC no later than April 1, 1996. The third runway is authorized to proceed if the panel determines that demand/system management programs are pursued and achieved or determined to be infeasible; and noise reduction performance objectives are scheduled, pursued, and achieved, and based on measurement of real noise impacts.

Comment R-2-3: *Several comments were submitted concerning the Four-Post Plan evaluation to be made by the FAA as a result of the PSRC Resolution A-93-03. The following individuals made this comment: Mr. Peyton (Ravenna-Bryant Community Association).*

Response: The PSRC Resolution A-93-03 and subsequent Resolution EB-94-01 affirmed support for a third runway at Sea-Tac, subject to conditions described in response to comment R-2-2. Resolution A-93-03 stated that the PSRC requested the FAA to consider modifying the Four-Post Plan to reduce noise impacts, and the related impacts on regional military air traffic. The FAA has said it will consider changes if petitioned by officials of the affected jurisdictions. At this time no petitions have been received through the PSRC. Although no official requests have been received at this time to change the 4-Post plan, former Congressman Kreidler initiated discussions concerning making changes in the southern departure paths to route traffic over Puget Sound. See response to comment R-2-2. Agreement has not been reached with all the communities which would be effected by such a measure and consequently, it has not been implemented.

The FAA would not consider changes or alterations to flight tracks that would jeopardize safety or efficiency, or impose unwarranted restrictions or delays on the system users. However, if a community requests that an alteration to an existing flight track be made, and if that change would not negatively impact the safety or efficiency of the airspace system and if all communities which could be impacted by such an alteration are in agreement, the FAA would consider the proposed change.

[g] Then congressman Kreidler has initiated discussions concerning changes to the 4-Post Plan to the south of Sea-Tac. However, agreement has not been reached among the communities and no petitions have been received by the FAA. Congressman Tate is now pursuing this issue.

__*Comment R-2-4*__*: The Southwest King County Community Group suggested that resolutions from other organizations be included in Appendix A.*

__Response__: Appendix A of the Final EIS includes copies of the submitted resolutions: Resolution 92-001 from the City of Burien City Council, Resolution 594 of the City Council from the City of Normandy Park, and Resolution 674 from the City of Des Moines City Council, declaring opposition to the third runway Sea-Tac Airport.

__*Comment R-2-5*__*: A number of comments were received stating the Draft EIS did not adequately reflect the finding of the Demand/System Management and Noise Expert Arbitration Panel. The following individuals made this comment: Airport Communities Coalition, Ms. Brown, Mr. Dinndorf (Puget Sound Regional Council), Mr. Forrey, Ms. Gates, Mr. Hagstrom, Mr. Kennedy, Mr. Peyton (Ravenna-Bryant Community Group), Regional Commission on Airport Affairs, Southwest King County Community Group, Mr. Tate, Mr. Vance, and Ms. Vermeier.*

__Response__: The Puget Sound Regional Council (PSRC) established the Expert Panel on Noise and Demand/System Management Issues (Expert Panel) in June, 1994. The Expert Panel was established in compliance with PSRC Resolution A-93-03 (Draft and Final EIS Appendix A), which stated that:

> "The third runway shall be authorized by April 1, 1996:
>
> (a) unless shown through an environmental assessment, which will include financial and market feasibility studies, that a supplemental site is feasible and can eliminate the need for a third runway; and
>
> (b) After demand management and system management programs are pursued and achieved, or determined to be infeasible, based upon independent evaluation; and
>
> (c) When noise reduction performance objectives are scheduled, pursued, and achieved based on independent evaluation, and based on measurement of real noise impacts."

The Expert Panel on Noise and Demand System Management was directed to provide an independent evaluation of the issues identified in subsections (b) and (c), listed above. At the request of the PSRC, Washington State Secretary of Transportation appointed three members to the panel. Those appointed included Mr. William Bowlby, noise expert and Professor of Civil Engineering at Vanderbilt University in Nashville, TN; Mr. Scott Lewis, a Boston attorney specializing in airport, public and environmental law; and Ms. Martha Langelan, an economist from Chevy Chase, MD. Panelists were selected based upon "variation and depth of their professional experience and their ability to provide impartial judgment."

The Expert Panel is charged with making final, binding decisions on noise reduction efforts and demand/system management options, including the use of improved passenger rail service. The Expert Panel's authority is limited to these specific questions; their authority does not include making any determination on the validity of this EIS or the need for the proposed third runway at Sea-Tac. The Panel evaluated the feasibility of various demand/system management alternatives and determined that these can not be pursued and achieved to obviate the need for the proposed runway.. The Panel is also slated to validate the Port's noise reduction methodology and determine if noise reduction objectives are being pursued and achieved. Noise reduction programs must be demonstrated to reduce noise in a meaningful and measurable way.

Since its initial meeting in August, 1994, the Expert Panel has held several hearings and issued a number of information requests and decisions. The Expert Panel determined that the Port must develop a revised noise validation methodology, and concluded that the use of congestion pricing, gate controls, and high speed rail are not feasible as demand/system management methods within the meaning of Resolution A-93-03. The Panel's December 8, 1995 final order concurred that demand and system management actions would not obviate the need for the proposed new parallel runway. By early 1996 the Expert Panel is expected to make final determinations on the achievement of noise reduction objectives.

The Regional Coalition on Airport Affairs (RCAA) requested that the FAA and Port of Seattle reopen the public comment period subsequent to the Expert Panel's final decision; however, the FAA has determined that this was not necessary, given that the public will have the opportunity to comment on submissions to the Expert Panel as part of the Expert Panel's process. Expert Panel findings that pertain to noise or demand/system management that were available before the publication of the EIS were included in the Final EIS.

__*Comment R-2-6*__ *: The Regional Commission on Airport Affairs submitted several comments concerning the characterization of the Port of Seattle governmental structure and its authority to levy taxes.*

__Response__: The Port of Seattle is a municipal corporation authorized by the State of Washington within King County. The Port of Seattle has been authorized to levy and collect real property taxes to support marine, airport, rail and intermodal facilities, as well as provide supporting services. In addition, ports are authorized and operated to engage in economic development activities in supporting the Region's and State's activities. However, the taxes collected by the Port are not used to fund the operation or improvement of Sea-Tac Airport. The Airport is supported by passenger taxes and airline and concession fees. The Port of Seattle does not anticipate use of funds from the King County tax levy to complete the Master Plan Update improvements (see response to comment R-18-2).

__*Comment R-2-7:*__ *The Airport Communities Coalition and the Southwest King County Community Group requested clarification of the Port's past position of not building an additional runway at Sea-Tac.*

__Response__: As is stated in the 1985 Master Plan Update Executive Summary (Final Report, Page 1): "A series of policy guidelines and assumptions were developed to reflect both stated Port policy and institutional and environmental constraints. For example, it was determined at the onset that no new runways at Sea-Tac would be considered, primarily because (1) the existing runway configurations had previously been determined to provide adequate capacity for the planning period, (2) there had already been an enormous investment into the existing runways, and (3) construction of the proposed new runway would have a large environmental impact." This statement has been construed by many neighbors of the Airport as a commitment not to expand the existing airfield. It must also be noted that when the 1985 study was initiated, the findings of the Comprehensive Planning Review and Airspace Update Study had not been completed. The Comprehensive Planning Review and Airspace Update Study found that the assumptions of the Master Plan relative to the adequacy of the existing airfield were incorrect; poor weather conditions were beginning to create significant delays which would worsen in the future as airport activity levels grew. Thus, the 1985 Master Plan was conducted prior to the identification of a worsening poor weather constraint.

__*Comment R-2-8:*__ *Mr. Dinndorf (Puget Sound Regional Council) commented that the Draft EIS should respond to site level issues identified by the hearing examiner during the appeal of the Regional Council's Flight Plan non-project Final EIS. Additionally, Mr. Peyton (Ravenna-Bryant Community Association) commented that the Draft EIS uses the Flight Plan as a foundation of its conclusions, but uses forecasts derived from the Master Plan. Mr. Peyton additionally commented that the forecasts used for aircraft operations, growth in operations, and enplaned passengers conflict between the Flight Plan and the forecasts (Master Plan) which were used in the Draft EIS.*

__Response__: Despite the PSRC's adoption of Resolution EB-94-01, the Draft and Final EIS are required to consider all reasonable alternatives for satisfying the need. According to CEQ regulations (40 CFR section 1502.2g), "Environmental impact statements shall serve as the means of assessing the environmental impact of proposed agency actions, rather than justifying decisions already made." Thus, these earlier studies were reviewed. Independently, the FAA and the Port concluded that alternative airport sites were not feasible to satisfy the need for the proposed new parallel runway.

While not specifically noted as such, the EIS addresses the site specific comments raised in the Flight Plan Study.

Issues associated with the Flight Plan forecast are presented in response to comment R-3-9.

__Comment R-2-9__: Mr. Dinndorf (Puget Sound Regional Council) requested that additional language be added to Chapter I that reflects further clarification of the PSRC positions on Resolution A-93-03 and Resolution EB-94-01.

__Response__: Mr. Dinndorf suggested that the following language regarding the PSRC Resolution A-93-03 be included in Chapter I, "Background."

> "This resolution establishes three conditions for proceeding with a third runway at Sea-Tac: (1) the feasibility of a major supplemental airport, and whether it could be put into service in time to eliminate the need for a third runway; (2) implementation of noise reduction objectives; and (3) feasible demand and system management actions.
>
> In response to the requirement in A-93-03 for independent evaluation of demand/system management and noise reduction action for Sea-Tac, the Executive Board established an Expert Arbitration Panel to make decisions in these areas binding upon the Regional Council."

Mr. Dinndorf additionally suggested that the following description of Resolution EB-94-01 (on page I-4) should include additional paragraphs on noise, demand management, and incentives/compensation:

> "BE IT FURTHER RESOLVED, that the decision of the Executive Board of the Puget Sound Regional Council is to affirm the General Assembly's approval of a third runway for Sea-Tac, provided the project meets the independent evaluation of the noise and demand management conditions set out in Resolution A-93-03, and satisfies the environmental impact review process.
>
> FURTHER, the Executive Board recommends that the Region work with the State to enact legislation allowing for substantial and equitable incentives and compensation for communities impacted by the proximity of essential public facilities."

The additional language and clarification of the Resolution A-93-03, adopted by the PSRC, the requested description of Resolution EB-94-01 and additional paragraphs on noise, demand management, and incentives/compensation are reflected in Chapter I of the Final EIS.

__Comment R-2-10__: The Southwest King County Community Group commented on the fact that the Port of Seattle is the fourth largest container-load center in the U.S. Additionally, the Southwest King County Community Group suggested that the Draft EIS devoted too much discussion to the Marine Division of the Port of Seattle.

__Response__: Comments noted.

__Comment R-2-11__: Mr. Peyton (Ravenna-Bryant Community Association) suggested that the Draft EIS fails to mention that the extension of the railroad only extends to the waterfront and not to Sea-Tac. The commentor also noted that the City of Tacoma's contribution of $100,000 towards naming the Airport.

__Response__: Comments noted.

Comment R-2-12: Mr. Miedema commented that there are 37 airlines in operation at the Airport rather than 60, as mentioned in the Draft EIS.

Response: The number of airlines using Sea-Tac was verified as a consequence of this comment. The Draft EIS indicated that approximately 60 airlines use Sea-Tac. The most recent statistics indicate that 54 airlines are currently using Sea-Tac.

Comment R-2-13: The Regional Commission on Airport Affairs and the Southwest King County Community Group requested information concerning Sea-Tac's size (acres) relative to other domestic and international airports.

Response: The FAA published an Update to the National Plan of Integrated Airport System (NPIAS). The 1995 NPIAS indicates that there are 3,294 existing NPIAS airports in the United States, 415 of which are classified as primary commercial air carrier airports. Sea-Tac Airport is the twentieth busiest airport and encompasses approximately 2,500 acres. Sea-Tac Airport ranks as the nineteenth largest in physical size, in relationship to the top twenty-six airports ranked according to aircraft operations, as is shown in **Table R-12.**

Comment R-2-14: Two commentors suggested that the Executive Summary does not address or disclose adverse impacts from the proposed airport improvement projects. The following individuals made this comment: Mr. Peyton (Ravenna-Bryant Community Association) and Mr. Scarvie.

Response: According to the Council on Environmental Quality (CEQ) regulations (40 CFR section 1502.12), "Each environmental impact statement shall contain a summary which adequately and accurately summarizes the statement. The summary shall stress the major conclusions, areas of controversy (including issues raised by agencies and the public), and the issues to be resolved (including the choice among alternatives). The summary will normally not exceed 15 pages." The Executive Summary in the Draft and Final EIS meet these content requirements.

Comment R-2-15: Mr. Derrick (King County Department of Development and Environmental Services) suggested that the discussion of alternatives be expanded in the Executive Summary.

Response: The intent of the Executive Summary is to provide a brief discussion on the issues and impacts discussed in the Draft or Final EIS. See response to comment R-2-14.

PURPOSE AND NEED

Comment R-3-1: Seattle Community Council Federation and the Southwest King County Community Group requested clarification of the purpose and need being satisfied. The commentors indicated that the FAA has a different purpose/need from that of the Port of Seattle.

Response: As the Airport operator, the Port of Seattle has the responsibility for providing facilities to meet the needs of the air travelers of the area. Similarly, since the passage of the Federal Aviation Act in 1958, the Federal Aviation Administration (FAA and its predecessor) has been responsible for ensuring the efficiency of the National Air Transportation System and for fostering and regulating civil aeronautics and air commerce. Airport planning at the national level is the responsibility of the FAA, whose interest is to provide guidance for development of public use airports and to provide a framework of reference for the investment of Federal funds. In addition, the FAA is responsible for ensuring that planned airport improvements that use federal funds comply with the National Environmental Policy Act (NEPA). In fulfilling its responsibilities, the FAA coordinates with airport operators to ensure that the needs at the local level are reflected in the National Plan of Integrated Airport Systems. Thus, the needs for an individual airport are first identified at the local or regional level, usually through regional system plans or a master plan or master plan update. Chapter II contains a detailed description of the four individual purpose and need statements being assessed in this EIS. The proposed improvements address multiple purposes which are consistent with one another. These reflect the existing and future needs identified by the Port of Seattle in the Master Plan Update, and as independently confirmed by the FAA in this EIS.

Comment R-3-2: *The Regional Commission on Airport Affairs requested clarification of "the authority for the statement of 'overall objective' found at Draft EIS II-1. It is not compatible, on its face value with the statement of objective found in Chapter I".*

Response: Chapter I provides a summary of the background leading to the preparation of the Draft and Final EIS. The studies leading up to the preparation of the Master Plan Update resulted in the adoption of several resolutions (A-93-03 by the PSRC and 3125 by the Port of Seattle). These resolutions direct the activities of staff within these organizations. Resolution 3125 stipulated that the Port of Seattle is to conduct a Master Plan Update for Sea-Tac Airport. Several goals and objectives were established when the Master Plan Update was undertaken to ensure that the issues of concern in the resolutions would be addressed; see response to comment R-1-1 and R-2-2 concerning the roles of the FAA and Port of Seattle. Chapter II, Page II-1 of the Draft EIS (page I-12 of the Final EIS) shows the goals that were established by the Port of Seattle for the Master Plan Update study process. During the Master Plan Update study, the individual needs described by the Draft EIS in Chapter II (Final EIS in Chapter I) were identified. Various on-site alternatives were then identified by the Master Plan Update study to satisfy the needs.

Comment R-3-3: *Several comments were received requesting an explanation of why the Master Plan Update improvements were attempting to satisfy multiple purposes and needs. Comments were received from Mr. Frause.*

Response: The Draft and Final EIS identify the four key needs at Sea-Tac. These needs were identified during the Master Plan Update study, as key existing and future constraints on airport facilities. As a result, they could not be expressed accurately in one statement of need.

Comment R-3-4: *The Regional Commission on Airport Affairs and the U.S. Environmental Protection Agency asked if the purpose and need for the improvements at Sea-Tac is to reduce delays in the national aviation system.*

Response: As is discussed in the Draft and Final EIS, poor weather conditions result in extensive delays. As demand grows, delays at Sea-Tac are expected to grow exponentially. As Sea-Tac is currently the 20th busiest airport in the United States, delays at Sea-Tac can have a ripple effect throughout the national air transportation system. For instance, if a flight is late arriving at Sea-Tac, it can delay the departure time of a flight. Late departures from Sea-Tac can cause congestion and delay at downline cities. Similarly, if a flight can not leave an origin city, due to poor weather delays at Sea-Tac, ground and/or gate congestion could occur at the origin city. If delay is reduced at Sea-Tac, congestion could be reduced at other airports in the national aviation system. Therefore, as a by-product of addressing the constraints at Sea-Tac, increased efficiency in the national aviation system would be expected. However, reducing delay in the National Air Transportation System is not a purpose and need of these proposed improvements, but just a beneficial by-product of the improvements which are driven by local need.

Comment R-3-5: *Mr. Burke requested an explanation of why the separation between two parallel runways can not be less than 2,500 feet.*

Response: As is discussed in the Draft and Final EIS, during poor weather conditions Sea-Tac is limited to a single arrival stream due to the 800 foot separation between the parallel runways. Current FAA air traffic control rules require at least a 2,500-foot separation between parallel runway centerlines for two staggered or dependent arrival streams during poor weather. Development of a runway with a separation of less than 2,500 feet would not enable two arrival streams during poor weather conditions due to the requirement of increased lateral spacing when pilots are relying on their instruments and the wake vortex (wind turbulence) caused by aircraft landings. Therefore, poor weather arrival delay would not be reduced. Two parallel runways separated by less than 2,500 feet apart require that pilots be able to confirm visually that their aircraft are on the proper approach and that the wake vortices from aircraft ahead of them do not interfere. As is described in the analysis of technology alternatives, (Chapter II, Final EIS Page II-16) technologies do not exist to eliminate the wake vortex constraint.

Comment R-3-6: *Mr. Peyton (Ravenna-Bryant Community Association), and the Regional Commission on Airport Affairs indicated that the Draft EIS was not clear in its use of the term "Region" as well as "Master Plan Update."*

Response: The term "Region" was used in the Draft EIS to characterize the four county Central Puget Sound Region, consisting of King, Pierce, Kitsap and Snohomish counties. It was also used to characterize the overall Pacific Northwest Region (including the states of Washington, Idaho and Oregon). This has been reviewed and where appropriate, the correct "Region" modifier was used in an attempt to ensure clarity. The term "Master Plan Update" was used to refer to the planning study process. In places where the recommendations of the Master Plan Update process were identified, the term "Master Plan Update improvements" was used.

Comment R-3-7*: A number of comments were received concerning the assumptions of the aviation demand forecast and the Draft EIS's assertion that the proposed improvements at Sea-Tac would not increase the number of operations occurring at Sea-Tac. Individuals seeking substantiation of the assumptions include: Airport Communities Coalition, Ms. Brown, Ms. Burrage, Mr. Rohlfs (City of SeaTac), Ms. DesMarais, Mr. Frause, Mr. Jhaveri, Mr. Kennedy, Mr. Derrick (King County Department of Development and Environmental Services), Mr. Newby, Ms. Patterson, Mr. Peyton (Ravenna-Bryant Community Association), Mr. Rants, Regional Commission on Airport Affairs, Mr. Rosenberg, Mr. Scarvie, Southwest King County Chamber of Commerce, Southwest King County Community Group, and Mr. Vance.*

Response: The capacity of Sea-Tac is presently 380,000 annual operations. The Flight Plan Study found that this capacity can be stretched to about 460,000 annual operations as hourly peaks are spread (either though delay or flight scheduling). Based on the most probable forecast prepared for the Master Plan Update, the growth in regional population will produce a demand of 38 million passengers or 441,000 annual operations within the forecast period. Thus, the theoretical capacity of Sea-Tac would not be exceeded in the reasonably foreseeable future, although the inefficiency of operations would produce costly delays. Because the forecast demand for air travel can be accommodated with or without the planned improvements, the Do-Nothing and "With Project" alternatives were found to accommodate the same level of activity. The introduction to this appendix contains a detailed discussion of this issue.

Comment R-3-8*: The Airport Communities Coalition indicated several other options for Do-Nothing activity levels were possible. The Airport Communities Coalition indicated that the dramatic increase in delay associated with the Do-Nothing would result in spreading of the peak hours, increased load factors, and passengers choosing to use other modes of transportation or use other airports.*

Response: The introduction to this appendix contains a lengthy discussion of this issue. The Do-Nothing analysis contained in the EIS assumes that the large increase in delay during poor weather conditions would result in a shifting of the hourly activity levels, spreading the peak periods. The possibility of increased load factors, use of other modes of transportation, and use of other airports were also considered but were found to have a minor impact on airport activity. Chapter II contains a detailed description of the use of other modes and other airports. The introduction to this appendix elaborates on why increased load factors would not be likely.

__Comment R-3-9__: *Several commentors noted that the Master Plan Update forecast is not the same as the forecast prepared for the Flight Plan Study. Since the Master Plan Update is a more current forecast with different growth assumptions, several commentors indicated that it was not appropriate to rely on the findings of the earlier Flight Plan, or that the assumptions should have been formally questioned. Such comments were received from: Airport Communities Coalition, Ms. Brown, Mr. Jhaveri, Mr. Peyton (Ravenna-Bryant Community Association), Mr. Rants, and the Regional Commission on Airport Affairs.*

__Response__: In accordance with FAA Order 5050.4A, the FAA, and the Port of Seattle, and their consultants, reviewed the Flight Plan analysis to ensure that the assumptions and findings could be substantiated and that they reflect current conditions. Where the Flight Plan did not reflect current conditions, or could not be substantiated in light of current conditions, additional analysis was conducted. As a result, during the Master Plan Update, the Port of Seattle prepared a new aviation demand forecast to ensure that the assessment of existing and future facility was as accurate as possible.

The following table (**Table R-5**) compares the Master Plan Update forecast with the forecast prepared for the Flight Plan Final EIS.

TABLE R-5

COMPARISON OF THE MASTER PLAN UPDATE FORECAST TO THE FLIGHT PLAN FORECAST

	Enplaned Passengers		Annual Aircraft Operations	
	Master Plan Update Forecast	Flight Plan Forecast	Master Plan Update Forecast	Flight Plan Forecast
1993 Actual	9,400,000	9,400,000	339,500	339,500
1995	NA	11,500,000	NA	401,000
2000	11,900,000	11,800,000	379,200	411,000
2005	NA	NA	NA	NA
2010	15,300,000	14,500,000	405,800	447,000
2015	NA	NA	NA	NA
2020	19,100,000	19,200,000	441,600	524,000

Source: 1994 Master Plan Update Technical Report No. 5 Preliminary Forecast Report, Port of Seattle.
The Flight Plan Project, Final Environmental Impact Statement, October 1992.

Note: The Flight Plan Phase III forecast is for total passengers - thus the Enplanements noted above reflect total passengers divided by 2 to estimate enplanements.

The Flight Plan forecast, prepared in 1990, anticipated a greater level of aircraft operations per enplaned passenger than is currently forecast by the Master Plan Update. The Flight Plan forecast of enplaned passengers is very similar to the passenger forecast prepared for the Master Plan Update; however, the forecasts of aircraft operations differ substantially. The updated forecast reflects the more recent trends in aircraft operations, such as shuttle and low cost operator activity which emphasize flight frequency with high load factors. In addition, as is described in the Draft and Final EIS Chapter II, the FAA has independently confirmed the specific conclusions of the Flight Plan that were used in the Master Plan Update Draft EIS.

Comment R-3-10: Mr. Peyton (Ravenna-Bryant Community Association) and Mr. Rosenberg indicated that the Final EIS should account for any differences between the forecast prepared for the Master Plan Update and the FAA's Terminal Area Forecast.

Response: The EIS (Draft EIS page I-10 or Final EIS Page I-8) explained the differences between the forecast prepared for the Master Plan Update and the forecast prepared by the FAA as part of the Terminal Area Forecast (TAF). The TAF and the Master Plan Update forecasts both project growth at Sea-Tac to be above the national average. The TAF projects higher activity levels in the long-term because it is based on U.S. Office of Budget projections for growth in the national economy.

TABLE R-6

COMPARISON OF THE MASTER PLAN UPDATE FORECAST TO THE FAA'S TERMINAL AREA FORECAST

	FAA Terminal Area Forecast (TAF)		Master Plan Update Forecast	
Year	Operations	Enplanements	Operations	Enplanements
1993 Actual	339,500	9,400,000	339,500	9,400,000
1995	370,000	8,398,000	NA	NA
2000	417,000	11,358,000	379,200	11,900,000
2005	435,000	13,916,000	NA	NA
2010	NA	NA	405,800	15,300,000
2015	NA	NA	NA	NA
2020	NA	NA	441,600	19,100,000

Source: 1994 Master Plan Update Technical Report No. 5 Preliminary Forecast Report, Port of Seattle.

Comment R-3-11: The Regional Commission on Airport Affairs asked how the accuracy of the aviation demand forecast is affected by the projections of regional population growth.

Response:. Two approaches are typically used in developing aviation demand forecasts: top-down forecasting and bottom-up forecasting. In considering these methods, the bottom-up approach was used, since a strong correlation between air travel demand and regional population, income, and air fares was found. The model explained 99.5% of the variations in domestic origin and destination demand in the Region. Thus, it is reasonable to assume that if the Region grows faster or slower than is currently forecast by the Puget Sound Regional Commission, aviation demand would change accordingly.

Comment R-3-12: Mr. Green asserted "Table I-2 Historical Airport Activity, demonstrates that increasing enplaned passengers are being served by essentially level aircraft operations. These statistics would indicate that the need for a new runway is not being driven by the inability for Sea-Tac to serve increasing passenger activity".

Response: The commentor is correct. Enplaned passengers have increased substantially in the last decade, while aircraft operations levels have remained relatively flat. The need for the proposed new parallel runway is driven by the poor weather conditions that limit the arrival capability of the existing runway system. As is shown in Table R-3B, during good weather conditions (VFR1), arrival delays currently average about 1.0 minutes. However, when VFR2 conditions occur (about 19.7% of the year), arrival delay increases to an average of 11.4 minutes. When IFR1, IFR2 or IFR3 conditions are reached (about 24 percent of the year), average delays reach 21.7 minutes. As is discussed in the Draft and Final EIS, delays will worsen as activity levels grow. The proposed new parallel runway addresses the need to reduce poor weather operating delay at both current and future levels of activity.

__Comment R-3-13:__ *The Southwest King County Community Group requested clarification of the growth in cargo tonnage as well as all-cargo aircraft operations.*

__Response:__ Between 1985 and 1993 cargo tonnage grew at an annual rate of 7.8 percent. The Master Plan Update forecasts that air cargo tonnage will increase from 381,000 tons in 1993 to 880,000 tons by year 2020, an increase of approximately 131 percent. All-cargo aircraft operations are expected to grow at a much lower level, from 16,000 annual operations in 1993 to 27,000 annual operations in 2020, an increase of about 68 percent. The Draft and Final EIS note that about 46 percent of cargo is expected to be carried by passenger aircraft and 54 percent by all-cargo carriers. The analysis reflects this growth in cargo levels, as well as the associated aircraft operations and surface traffic.

__Comment R-3-14:__ *Mr. Peyton (Ravenna-Bryant Community Association) commented that "The Master Plan Update (p. iv) projects 525,000 annual operations in its delay analysis. Yet the environmental analysis omits any discussion of adverse environmental impacts of that volume of overflights". The Airport Communities Coalition made a similar comment.*

__Response:__ The FAA's Capacity Enhancement Update performed an analysis of aircraft delay based on levels of activity which were not associated with a specific year. The activity levels 425,000 (Future 1) and 525,000 (Future 2) were evaluated in the Capacity Enhancement Study. The Master Plan Update forecasts project that aircraft operations will reach 441,600 by 2020. Since an activity level forecast of 525,000 annual operations are not anticipated to be reached until after 2020, the environmental impacts of that level of operations was not assessed in the EIS. The relationship of that activity level to a given level of delay was provided to illustrate the relationship between activity levels and delay.

__Comment R-3-15:__ *Mr. Berger and Mr. Rosenberg suggested that growth of the Region should be limited to avoid the need for the Master Plan Update improvements.*

__Response__: Comments noted. However, the proposed new parallel runway is needed to address existing poor weather related delays.

__Comment R-3-16__: *Several commentors expressed a concern that the capacity analysis used in the Master Plan Update and Draft EIS was flawed. It was noted that information presented to the Demand and System Management Expert Arbitration Panel showed that actual delays are lower than the delays in the Draft EIS and the Flight Plan Study. These comments were received from Mr. Hagstrom, Mr. Peyton (Ravenna-Bryant Community Association), Southwest King County Community Group, and Mr. Rosenberg.*

__Response:__ The delay analysis presented in this EIS is the state-of-the-art method for assessing delays at a specific airport. At this time, there is no single measure of delay that fully captures all delays attributed to a particular airport. In the absence of a comprehensive delay measurement system, the most commonly used method for estimating current and future levels of delay for purposes of considering airport capital investment decisions is a simulation analysis. Simulation analysis is an industry accepted methodology for calculating airport delays that relies on the use of a validated simulation model and actual data on the existing and future airport operating environment.

The Demand/System Management and Noise Expert Panel has considered a number of sources of delay data, each showing varying levels of delay based on the factors measured. The responses to comments R-3-17 and R-3-18 explain the differences among the sources of delay data. The FAA's Air Traffic Management Operations System (ATOMS) data, which shows the number of aircraft operations experiencing 15 minutes or more of delay, shows that delays had declined consistently between 1990 and 1993. The Draft and Final EIS contain a discussion of the actions that the FAA has undertaken to reduce delay.

__Comment R-3-17:__ *The Regional Commission on Airport Affairs and Mr. Frause asked several questions concerning the definition of delay.*

__Response:__ Aircraft delay is one measure of the operating efficiency or performance of an airport system or its various components. It is defined as the difference between the actual time required for aircraft to pass through the system (or a component of the system, like the enroute airspace) and the optimal time achievable without constraints such as poor weather at the destination airport, lack of adequate runway or taxiway facilities, or airspace interactions with other airports. Aircraft delay results from multiple aircraft competing for limited facilities and can be influenced by a number of factors, such as:

- Ceiling and Visibility Conditions,
- Airfield Physical Characteristics,
- Air Traffic Control Procedures, and
- Aircraft Operational Characteristics.

When dealing with aircraft delay, it is important to understand that aircraft are often delayed at a location that is not the source of the delay. By means of FAA Central Flow Control Procedures, aircraft are routinely held at the origin airport rather than in airspace holding patterns during periods of reduced arrival acceptance rates at the destination airport. Accordingly, when weather conditions in Seattle preclude the use of dual approaches, aircraft destined for Sea-Tac are held either at the gate or on the airfield of the origin airport. Such delays often are attributed to the departure from the origin airport, rather than the arrival into Sea-Tac Airport.

The metrics used to measure delay vary widely and depend on the intended use of the data. For example, the FAA's Air Traffic Management Operations System (ATOMS) is an operational and tactical planning tool used to support decisions about real time air traffic control procedures and the deployment of air traffic control personnel and other resources. As such, ATOMS is used to collect data on the number of flights delayed 15 minutes or more during any one of the four stages of flight: departure, air traffic management, enroute, and arrival. These four segments coincide with the air traffic control division of workload used throughout the National Airspace System (NAS). For example, a flight that incurs 14.5 minutes of delay in the departure phase, 14.5 minutes of delay due to air traffic management, 14.5 minutes enroute and 14.5 in the arrival phases (a total flight delay of 58 minutes) would not be counted as a delayed flight using the ATOMS methods. Since ATOMS was not designed to assist with decisions about airport improvements, such as the proposed new runway at Sea-Tac Airport, it does not provide useful information about the source of a particular delay, nor does it quantify the aggregate minutes of delay experienced throughout the NAS due to constraints at a particular facility.

On-time performance, as reported through Airline Service Quality Performance (ASQP), is another measure of system performance that is often confused with delay. Through 14 CFR Part 234, certain U.S. airlines are required to report their on-time performance for information to consumers. On-time performance measures the historical tendency for a flight or group of flights to arrive early, on-time or late, relative to the flight's scheduled arrival time. Reviewing on-time performance data is an effective way of planning a trip or evaluating an airline's flight schedule. However, since airlines often add time into a flight schedule in anticipation of delay and to provide customers with a reasonable expectation of the arrival time at the destination, on-time performance provides little insight into airport system performance. Consequently, on-time performance data is not relevant to the determination of improvements necessary at any airport, including Sea-Tac Airport.

Another commonly used measure of delay is airline performance data, which is often referred to as block times or "out-off-on-in" times. For each flight, certain airlines record (often electronically) the actual time in which each aircraft pulls out of a gate (out time), the runway liftoff time (off time), the runway touchdown time (on time) and the gate arrival time (in time). Measures of aircraft delay for participating flights can be estimated by comparing this data to a minimum travel time.

Because of the cost of fuel, crew salaries and other direct aircraft operating expenses, airlines, airports and the FAA recognize that reductions in delay offer the potential to reduce airline operating costs. The average aircraft operation at Sea-Tac Airport costs $1,604 per hour or $26.73 per minute, according to the July 1995 Sea-Tac Airport Capacity Enhancement Plan Update. Reduction in delay due to a particular airport improvement, whether it be less than or greater than fifteen minutes, and regardless of where it is physically incurred, influences decisions about capital projects like the proposed new parallel runway at Sea-Tac Airport.

Comment R-3-18: *The Airport Communities Coalition, the Southwest King County Community Group, Mr. Buckingham, Mr. Frause, the Regional Commission on Airport Affairs, and Mr. Peyton (Ravenna-Bryant Community Association) requested an explanation of how the delay was calculated in the Draft EIS and how the SIMMOD delay analysis compared to the FAA's ATOMS delay, the ASQP, delay and block times.*

Response: The data used to quantify existing and future delay associated with Sea-Tac Airport was developed jointly by the FAA, the Port of Seattle and the airlines and general aviation community serving the Airport, through the Sea-Tac Airport Capacity Design Team. The technical analysis was performed for the Airport Capacity Design Team by the FAA Technical Center with oversight from the FAA System Capacity Office. The methodology used by the FAA's Airport Capacity Design Team has evolved over a twenty-year period and has become the established standard for assessing the benefits of capital projects and procedural changes at over 35 of the nation's busiest airport and airspace systems.

The central element of this methodology is the use of a validated airport/airspace simulation model. A simulation model is a computer program that replicates the decisions made by air traffic controllers based on the operating environment of a particular airport. The Sea-Tac Capacity Design Team used SIMMOD, one of the FAA accepted airport and airspace simulation models, as the basis for its analysis. This model requires detailed information about the Airport's operating environment, including:

- air traffic control procedures under various weather conditions,
- aircraft separation requirements,
- rules for dual and single approach runway operations,
- airfield taxi routings, runway crossings and runway assignment procedures,
- hold pad utilization and departure sequencing procedures,
- aircraft demand distributions (fleet mix, user group, time of day, etc.),
- airspace interactions with Boeing Field, and
- aircraft performance characteristics.

The model also uses data on various operational characteristics, such as aircraft speed and aircraft separation on final approach, to accurately consider the effect of variability in aircraft operations on airport system performance. Based on the input data, the model computes the time necessary for each aircraft to move through various segments of the system (such as taxi-out) relative to a minimum travel time. The difference between simulated actual and optimal time is defined as delay and is calculated for each aircraft during a 24-hour period. The results are then summarized in terms of the average delay per operation.

An important part of the FAA methodology is the calibration of the model input and the validation of model output. This calibration/validation process involves adjusting input assumptions, like aircraft speed, based on observations of local operations and comparing the output to actual measures of performance provided by the airlines. This process was performed at Sea-Tac Airport and provided assurances that SIMMOD was set up to accurately represent the existing operation, or "baseline". The model was then used to measure the expected impact of various system changes, like increased demand or the addition of the proposed new runway. The model was subsequently run to estimate delay expected to result from such changes. It was the results of these analyses that were used in the EIS to estimate the delay impact expected to result from the proposed new runway at various levels of future activity.

Other measures of delay and performance collected by the FAA, including ATOMS data, do not fully capture aircraft delays attributable to the current and future Sea-Tac Airport operation and, as a result, were not used in the EIS to quantify delay. Moreover, currently available delay reporting systems, like ATOMS, underestimate the delays that are incurred as a result of a reduced arrival acceptance rate at Sea-Tac Airport during single approach operations. The majority of delayed flights that occur as a result of Sea-Tac Airport limitations during these conditions are experienced not as arrivals into Sea-Tac Airport, but as departure delays on the ground of the origin airport. In fact, the real impact of these delays using ATOMS data is further concealed given the airline flight cancellation and consolidation practices. During long periods of low visibility at Sea-Tac Airport, airlines often begin to consolidate and/or cancel flights in order to minimize system impacts, schedule disruptions, and crew and aircraft scheduling limitations. The true inconvenience and cost to the traveling public and the airlines caused by Sea-Tac Airport delays, therefore, cannot be assessed by reviewing currently available ATOMS data.

The data below contrasts the types of delay data available for Sea-Tac:

Extrapolated ASQP (1994)	30,667 hours (14,128 hours for the reporting airlines)
SIMMOD (baseline)	24,725 hours (with an average of 4.5 minutes)
ATOMS (Sept. 1993-Oct. 94)	2,388 operations delayed 15 min. or more

As is described, these delay figures are not comparable.

Comment R-3-19: *The Airport Communities Coalition, Mr. Frause, the Regional Commission on Airport Affairs, and the Southwest King County Community Group requested an explanation of weather conditions and their occurrence at Sea-Tac. It was also requested that the percentage of time that poor weather occurs during peak operating time be presented, as well as the an explanation of how the weather conditions affect the acceptance rates.*

Response: Since airport performance varies based on weather conditions and the attendant air traffic control procedures, simulation scenarios were evaluated for as many as six unique operating configuration at Sea-Tac. Each configuration was defined based on air traffic control procedures used in connection with various weather conditions. The simulation results reflect the airfield performance expected under each scenario based on the volume and distribution of activity corresponding to an average day of the peak month. While the volume and distribution of activity may vary from day to day throughout the year at Sea-Tac, the use of average day peak month activity levels provides a representative sample of activity for planning purposes and is considered to be an industry accepted methodology. In order to consider the variation in weather data over the course of the year, ten years of hourly weather data were analyzed to provide the basis for calculating the weighted-average all weather delay statistics referenced in the Draft and Final EIS.

The annual average occurrence of each weather condition examined in the Draft and Final EIS and the corresponding runway configuration, based on hourly observations collected by the National Weather Service, is presented in **Table R-6**.

The use of ten years of hourly weather observations is a generally accepted practice for purposes of estimating the relative occurrence of poor weather of various ceiling and visibility conditions. While the duration and timing of any occurrence relative to peak operating periods may affect estimated delays, the use of a ten-year average against peak month average day activity levels provides a reasonable and methodologically acceptable estimate of the expected annual delay impact (even though the database may include 11 winters and 10 summers).

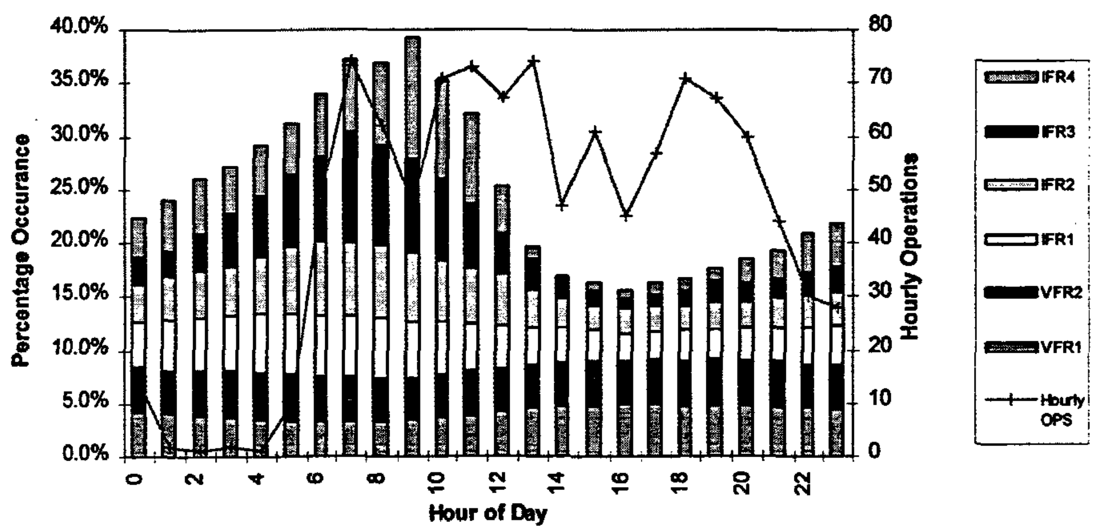
Table R-6

Operating Scenario	Ceiling/Visibility	Runway Operating Configuration	% of Occurrence
VFR 1	5,000 feet and above/ 5 miles and above	Independent Arrivals & Departures with dual approach streams	56.1%
VFR 2	2,500 to 4,999 feet/ 3 to 5 miles	Single arrival stream with additional aircraft under ceiling	19.7%
IFR 1	800 feet to 2,499 feet/ 2 miles and above	Single Approach Stream	17.0%
IFR 2	Not Applicable/ 1,800 RVR to 2 miles	One Approach Stream - Protect Glideslope	5.4%
IFR 3	Not Applicable/ 600 RVR to 1,799 RVR	Same as IFR 2 - No Arrivals to the North	1.5%
IFR 4	Not Applicable/ 600 RVR and below	Low visibility plan - one runway	0.3%

Source: Seattle-Tacoma International Airport - Capacity Enhancement Plan Update, July, 1995,
RVR - Runway Visual Range.

EXHIBIT R-2

Hourly Weather Observations



At many airports, severe weather occurs during the nighttime hours when aircraft operations are less. However, at Sea-Tac Airport, weather is rather constant through the day, with the exception of the most severe weather, which occurs most often in the morning. When examining the effects of weather on delay, the hourly observations of the various weather conditions were examined relative to the hourly level of aircraft operations. **Exhibit R-2** graphs, relative to the total occurrence of the individual categories of weather, the percentage occurrence of the weather conditions, contrasted with hourly aircraft operations. As the graph shows, VFR1, VFR2, and IFR1 (which account for 92.5% of the weather conditions) occurs relatively even throughout the day. The more severe weather conditions (IFR2, IFR3 and IFR4) occur much more predominantly during the morning hours. The most dominant hours of the most severe weather typically occur between 6 a.m. and 10 a.m. Peak departure hours are 7 a.m. - 9 a.m., and 1 p.m. - 2 p.m. while the peak arrival hours are 10 a.m. until noon. Thus there is a large overlap between the most severe weather occurrence and peak operating periods.

The application of the ten year average occurrence of each weather condition in quantifying an annual average delay level reflects the variability in weather data and the associated impact on delay. The commentors appear to assume that a weighted average all-weather delay condition was used in the Capacity Enhancement Study and Master Plan Update EIS. However, two average all-weather delay conditions were computed. The first reflects a weighted average all-weather condition. The second, which was used in the Draft and Final EIS, reflects the actual occurrence of poor weather during a 24-hour period, and the effects of demand and delay during those conditions. The data presented in this EIS reflects delay based on the actual weather conditions.

Comment R-3-20: *Several comments were received indicating that the Draft EIS overstated the need for the proposed new parallel runway by combining the poor weather conditions, specifically, the combination of IFR1, IFR2, and IFR3 and their associated operational requirements. Comments were received from Mr. Greene, Mr. Peyton (Ravenna-Bryant Community Association) and the Regional Commission on Airport Affairs.*

Response: The **Table R-6** shows the occurrence of each weather condition. Each of the weather conditions were considered separately. The close spacing between the existing parallel runways at Sea-Tac produces nearly identical operating procedures during IFR1, IFR2 and IFR3. Thus, for reporting purposes, operating capabilities during these weather conditions were combined.

Comment R-3-21A: *The Regional Commission on Airport Affairs, Mr. Peyton (Ravenna-Bryant Community Association), and Mr. Webb requested that the sources of delay costs and the maximum tolerable delay levels be presented in the EIS.*

Response: The average aircraft operating costs used in the Draft and Final EIS were developed by the FAA Airport Capacity Design Team (see response to comments R-3-18 and R-3-19). As described on page 25 of the final Capacity Enhancement report, the fleet mix used in calculating the weighted average operating cost reflects data from the quarter that ended September, 1994. Airline financial and ramp-to-ramp block hour data was derived from FAA Form 41 Schedule P-5.2. These costs represent the direct costs for operating the aircraft and include items such as fuel, maintenance, and crew costs, but do not consider the value of passengers time, flight cancellation and rescheduling costs, disruption to airline schedules or other intangible factors. The FAA supports the inclusion of the value of passenger time at a rate of $45 per hour for use in Federal cost benefit analysis. However, the value of passenger time was not incorporated into the Sea-Tac analysis in order to present a conservative estimate of the expected benefits of the proposed new runway.

The maximum "acceptable" delay for any single component of the National Airspace System – NAS -- (such as an individual airport) is extremely subjective and dependent on a number of factors unique to an individual facility. Factors that typically influence "acceptable" delay levels at airports include the relative occurrence of poor weather conditions, passenger expectations, airline cost of delay, and the effect of delays at other airports throughout the NAS. Since operating conditions are unique at each airport, a single level of acceptable delay that applies to all airports can not be established. However, the ten minute criterion used in the Sea-Tac Airport EIS is consistent with the application of accepted delay quantification methods used at airports throughout the NAS.

Simulation analysis using a calibrated model is the most widely accepted methodology for quantifying delay at a specific airport facility. Consistent with this methodology, the delay data prepared by the FAA represents the average 24-hour weather-weighted delay per operation associated with existing and future activity levels. As an annual average, this delay value includes the relatively low levels of delay which would be experienced during VFR1 conditions, when two arrival streams are available and during nighttime, weekends, and other periods of reduced demand. It also includes the much higher levels of delay which would be experienced during peak demand periods and during VFR2 and IFR conditions when operations are limited to a single arrival stream. The higher level of delay incurred by individual aircraft during these conditions (which occur 44 percent of the time at Sea-Tac) has a much greater impact on performance than one might expect from the all-weather average, as summarized below:

- Increased airline operating costs - When operating capability is reduced from two arrival streams to one arrival stream, airlines not only incur higher fuel burn and other aircraft operating costs associated with delay, but also the costs associated with canceled flights and disruption to system operations.
- Passenger Inconvenience - Poor weather delays mean canceled flights, missed connections, and more time spent waiting in airports for the traveling public.
- Degradation of NAS performance - The majority of delays incurred during poor weather are experienced on the ground of the origin airport by way of the FAA Flow Control Procedures. As a result, delay incurred 44 percent of the time due to constraints at Sea-Tac affect operations at origin airports from coast- to- coast.

Based on simulation analysis performed by the FAA and others at the nation's busiest airports, delay levels experienced by individual flights during poor weather conditions typically escalate to severe levels (i.e. an hour or more per operation) when the weighted average delay value is around ten minutes per operation. As a result, the FAA has described airports with average delays in excess of nine minutes per operation as severely congested. In its 1995 report to Congress, the FAA indicates that "beyond this point [9 minutes], delays are extremely volatile, and a small increase in traffic, adverse weather conditions, or other disruptions can result in lengthy delays that disrupt flight schedules and impose a heavy workload on the air traffic control system." Accordingly, a ten minute annual average-all weather delay value was used in the Draft and Final EIS as a basis determining the maximum level of tolerable delay.

__*Comment R-3-21B*__: *The Airports Community Coalition, Ms. Brown, Mr. Frause, the Regional Commission on Airport Affairs, and Ms. Brown questioned if there are any other delay reduction measures that could be undertaken to solve the delay issues at Sea-Tac.*

__Response__: The fundamental problem addressed by this EIS is the aircraft operational delays caused by the lack of dual approach procedures under certain weather conditions. The Draft and Final EIS address all known delay reduction measures which offer the potential to address this constraint. While it is possible that other delay reduction measures may exist now or in the future (such as the application of the Free Flight concept), there are no reasonable means of solving the poor weather single arrival stream other than those identified in the EIS. Other than the proposed new runway, the use of a Localizer Directional Aid (LDA), an air traffic procedure, offers the most promising opportunity for providing dual approach capability during a portion of the highest ceiling/visibility poor weather conditions. However, because the LDA approach would require aircraft to perform a "sidestep" or similar procedure to an existing runway, the single approach limitation would remain during the majority of poor weather conditions. See response to comment R-4-9.

__*Comment R-3-22*__: *Mr. Frause and the Regional Commission on Airport Affairs requested that the delay objectives at Sea-Tac be contrasted with the delay objectives at other airports. They also requested clarification of the system impact of improvements at Sea-Tac as well as other airports.*

__Response__: As is stated in the Draft EIS, "As is noted earlier, the NPIAS indicates that when average delay exceeds 7 minutes per operation, impacts occur to the national aviation system. However, specific airport planning guidelines have not been established to define an acceptable level of delay. Therefore, the FAA has relied upon the definition of locally acceptable delay levels, determined by airport users working in concert with the FAA and the airport operator." The April 1995 NPIAS reflects use of 9 minutes of total average delay as a determination of severe congestion. Delay objectives vary from airport to airport. For instance, at O'Hare, departure delays are excessive, particularly during poor weather. The 1990 Delay Task Force for O'Hare indicated that average all-weather delays should be reduced to under 10 minutes. At Dallas-Ft. Worth, the proposed new parallel runways were found to reduce average delays to 6-7 minutes. The purpose and need for improvements at each of these airports varies in accordance with the unique issues being faced by each airport.

The majority of Sea-Tac's arrival delay is experienced on the ground of the origin airport. As a result, aircraft awaiting clearance to depart the origin airport to Sea-Tac often result in increased workload for air traffic controllers at the origin airport, as well as taxiway and gate congestion to other non-Sea-Tac flights. Although these system delays were not quantified for the Draft or Final EIS (see response to comment R-3-18), a reduction in delays that are caused by the poor weather limitation at Sea-Tac would likely result in lower delays at other airports throughout the National Airspace System. In addition, a late arrival into Sea-Tac Airport due to a morning fog induced single arrival stream would likely be late on subsequent legs of its itinerary, even though the weather at Sea-Tac may have cleared up. This type of system delay savings would also occur as a result of the proposed new runway at Sea-Tac Airport, but was not included in the Draft EIS or Final analysis as the analysis focused on delay incurred in arriving to or departing from SeaTac.

<u>Comment R-3-23</u>: *Ms. Brown, the Southwest King County Community Group, and the Regional Commission on Airport Affairs requested an explanation of the delay reduction benefits of the proposed new parallel runway. It was also requested that the delay from taxiway crossings during poor weather be described.*

<u>Response</u>: The following table summarizes the delay reduction benefits associated with the availability of the dependent third parallel runway with a length up to 8,500 feet. As is discussed in the EIS, the primary use of the runway is expected to be for arrivals, although the proposed new runway would be used for departures on occasion. In addressing the existing poor weather operating constraint, the proposed new parallel runway would enable dual arrival streams during poor weather. Aircraft would land on existing Runway 16L and new Runway 16X, and depart on 16R and 16L. The availability of the second arrival stream would result in a 76 percent reduction in average total delays when activity levels reach 425,000.

TABLE R-7

COMPARISON OF DELAY

DO-NOTHING VERSUS THE PROPOSED NEW PARALLEL RUNWAY

	Do-Nothing				"With Project"			
Activity	VFR1	VFR2	IFR1	IFR2/3	VFR1	VFR2	IFR1	IFR2/3
345,000	1.0	11.4	21.7	21.7	1.0	1.7	1.9	9.0
425,000 *	1.6	41.8	71.2	101.0	1.6	2.6	3.1	85.9
525,000 *	3.1	163.6	181.3	219.4	3.1	7.3	10.1	281.1

	Do-Nothing Average		"With Project" Average	
	Arrival	Total Delay	Arrival	Total Delay
345,000	7.7	4.5	na	na
425,000 *	22.2	12.4	4.7	3.8
525,000 *	63.7	37.7	13.3	8.3

* Assumes 2.5 nm in-train separation.

Source: FAA Capacity Enhancement Update, Data Package 12, June 1995.

As several of the commentors noted, the usage of the proposed new parallel runway would result in an increase in the number of runway crossings. These commentors expressed concerns about safety. As is discussed in Chapter IV, Section 7 "Human Health", subsection (5) "Aircraft Accidents", the issue of additional runway crossings was reviewed extensively. The proposed new parallel runway would result in aircraft landing on 16X being required to taxi across existing Runways 16R/34L and 16L/34R to access the terminal area, increasing the number of runway crossings by about 44 percent. While those aircraft would be delayed in crossing runways, the delay reduction benefits of the second arrival stream far outweigh the delay from crossings. The delay was incorporated into data presented in the table above. As is described in the EIS, the additional runway crossings would increase the risk of a runway incursion by about 21 percent, increasing the annual occurrence of a runway incursion from 1.4 in 1993 to about 1.7 in year 2020. However, the FAA's air traffic personnel have indicated that the FAA has procedures for minimizing incursions though improved airfield signage and communications between pilots and air traffic control personnel.

Comment R-3-24: Several comments were received requesting clarification of the capacity of Sea-Tac with and without the proposed new parallel runway. Such comments were received from the Airport Communities Coalition, Mr. Bullard (Queen Anne Community Council), Regional Commission on Airport Affairs, Mr. Dinndorf (Puget Sound Regional Council), Mr. Scarvie, and the U.S. Environmental Protection Agency.

Response: As is described in the introduction to this appendix, the annual service volume capability associated with the existing Sea-Tac airfield is about 380,000 annual operations. However, as the Flight Plan demonstrated, the existing capacity of the airfield can be stretched to about 460,000 annual operations. During the Flight Plan Study, the annual service volume associated with the proposed third parallel runway was calculated to be about 480,000 annual operations.

Comment R-3-25: The U.S. Environmental Protection Agency suggested that the proposed new runway be evaluated as a departure runway instead of as an arrival runway.

Response: Inefficient airfield operations occur during poor weather conditions. Because the runways at Sea-Tac are only 800 feet apart, the existing airfield only allows a single arrival stream during VFR2 and IFR. As a result, the number of aircraft operations is currently reduced during poor weather conditions. Presently, simultaneous departure streams can occur during poor weather conditions. However, departure streams are not as sensitive to poor weather conditions as the arrival streams. Therefore, the purpose of a new parallel runway is to reduce poor weather delay, which predominantly affects arriving aircraft.

Although a third runway at Sea-Tac would primarily be used for arrivals, it would accommodate a limited number of departures during peak departure periods and other circumstances required to maintain flexibility in the traffic flow at the Airport. Consideration was given to assessing the usage of the runway primarily for departures. However, usage of this runway for departure is expected to be less than 5 percent of the year and thus, an extensive analysis of use for departures would substantially overstate what is expected to be the likely actual operation. The impact analysis includes the expected use of the runway for these departures. Additional discussion concerning the use of the runway is provided in response to comments R-6-13 and R-10-15.

Comment R-3-26: A number of commentors requested clarification of why the 600 foot extension to Runway 34R is needed. Commentors noted that the heavier aircraft (B747) could use the proposed new parallel runway. Comments of this nature were received from Mr. Peyton (Ravenna-Bryant Community Association), Regional Commission on Airport Affairs, Southwest King County Community Group, and Mr. Webb.

Response: The two aircraft types using Sea-Tac that require the greatest runway length are the B-747-200 and the B-747-400, when operating at maximum gross takeoff weight. These aircraft are commonly used in long-haul all-cargo service throughout the world. They require a runway length of 12,500 feet for full passenger loads to Hong-Kong, full passenger and cargo loads to Shanghai, and fully loaded all-cargo service to Tokyo, Amsterdam, Luxembourg and Taipei. Runway requirements for takeoffs increase substantially with greater flight distance and payload. The all-cargo service has a greater payload and, therefore, requires a greater runway length for a given flight distance.

Currently, Runway 16L/34R is 11,900 feet in length; the 600 foot extension would be necessary to accommodate the departures for the aircraft operating under the conditions described above. Additionally, the increased runway length would provide a greater margin of safety for other aircraft operating on the runway.

Based on the 12,500-foot requirement for departures, the proposed new runway, with a length of up to 8,500 feet would not be able to accommodate the departure of B-747-400 and -200 aircraft types. The EIS considers the development of the proposed new runway with a 12,500 foot length. However, it was determined to be unreasonable at Sea-Tac because of cost, social (acquisition and relocation), and environmental disruption that would occur relative to the ability to extend an existing runway with lesser cost and disruption.

The ability for Sea-Tac to provide warm weather non-stop service to the Pacific Rim is essential to the Puget Sound Region's remaining competitive for service to that region's expanding economy.

Comment R-3-27: Mr. Frause and Southwest King County Community Group questioned if the North or South Satellite and new facilities could be safely located at Sea-Tac, and if the facilities would be within the Building Restriction Line.

Response: As shown in Chapter II, "Purpose & Need and Alternatives", the terminal improvements would be located east of the runway system in the general vicinity of the existing terminal development and, therefore, outside the flow of airborne aircraft. The proposed terminal construction phasing is discussed in Chapter II, "Alternatives".

The proposed terminal improvements and aircraft parking areas fall outside the existing and future Runway Safety Areas (RSA) as well as the now obsolete Building Restriction Line (BRL), which was measured as 750 feet from the runway centerline. The FAA no longer strictly adheres to the BRL specifications for buildings or aircraft parking areas. The FAA typically uses taxiway and Runway Object Free Areas (ROFA), Runway Protection Zones (RPZ), and Runway Obstacle Free Zones (ROFZ). The proposed terminal building and aircraft parking positions fall outside of these critical surfaces. The FAA safety standards regarding terminal design were followed in the Master Plan Update study in determining the location and placement of the proposed terminal facilities.

Comment R-3-28: Regional Commission on Airport Affairs, Southwest King County Community Group, and Ms. Montgelas (WSDOT) requested clarification of how the embankment for the extension of Runway 34R and Runway Safety Area would be completed. The commentors indicated that the Draft EIS was not clear in how the extension of SR 509 and South Access would be completed; they also questioned the total length of embankment for extension and RSA, as well as the impact of this length on SR 509/South Access and who would build the tunnel/Des Moines Creek.

Response: Chapter II of the EIS demonstrates that a 600 foot extension is required to enable unrestricted non-stop service to the Pacific Rim during warm weather. This extension would also require the development of a Runway Safety Area (RSA) that extends an additional 1,000 feet beyond the threshold of the extended runway. Due to the terrain south of the existing airfield, an embankment must be developed to provide the requisite level ground. From the present runway safety area (which extends 535 feet beyond the end of the existing runway threshold), the recommended Master Plan Update improvements would extend the embankment an addition of 1,065 feet. Additional text has been included in the Final EIS to clarify the length of the embankment and to show the interface between the runway embankment, the proposed South Aviation Support Area (SASA), and one possible alignment of the South Access/SR 509 extension.

One commentor indicated that the design of SASA could adversely affect the development of the South Access/509 extension due to increased cost of tunneling. The Port of Seattle is committed to working with regional officials during the design of SASA to ensure that the plans for South Access/SR 509 can be reasonably accommodated. It is likely that resolution of this issue would not result in impacts greater than those shown in the EIS.

Comment R-3-29: *Southwest King County Community Group requested clarification of the purpose of the overnight pad and how it would operate.*

Response: The 2,500-foot separation between existing Runway 16R/34L and the proposed Runway 16X/34X provides sufficient space for an aircraft parking area. This area would be used to park aircraft overnight at the Airport. Passengers and cargo would be first unloaded at the appropriate facilities, east of the runway system. The aircraft would then taxi to the overnight pad for parking. This pad is not anticipated to be a helipad.

Comment R-3-30: *The Airport Communities Coalition, and the Regional Commission on Airport Affairs indicated that the Master Plan Update and Draft EIS did not examine the impacts to Boeing Field and Renton Airport that would occur from an increase in runway crossings at Sea-Tac. The Regional Commission on Airport Affairs asked if SIMMOD can assess these conditions.*

Response: One of the benefits of using a computer simulation to assess the impacts of alternative airfield improvements or procedural actions is ability to quantify impacts to the system. The FAA's 1995 Capacity Enhancement Study Update computed the number of runway crossings that would result from the use of the proposed new parallel runway at Sea-Tac. The delay analysis presented in the Draft and Final EIS discusses the impacts to the system from the runway crossings. The Capacity Enhancement Study Update also examined the impacts associated with interaction between Sea-Tac and Boeing Field. Renton was not directly considered because there are no significant airspace interactions with that airport. However, the simulation analysis reflected the air traffic procedures that control traffic at all regional airports, including Renton. The interaction with Boeing Field was reflected in the analysis, as arrivals to Boeing's Runway 13 would require a gap in the arrival stream to the proposed new runway at Sea-Tac.

Comment R-3-31: *Southwest King County Community Group stated "The chart shows a great increase in parking spaces, 10,000 or so more spaces for single cars. The health impacts from cars are admitted (SIC - omitted) in this DEIS. With the addition of 10,000 spaces how many more cars will come to Sea-Tac Airport each day? Would you devote more discussion in the EIS about how to discourage car use?" This comment was interpreted to be a suggestion that an additional purpose and need be included to reflect discouraging single-occupancy vehicle use of Sea-Tac.*

Response: The use of single-occupancy vehicle usage is an issue that involves more than Sea-Tac Airport, it is one that affects all traffic generators in the Region. The Port of Seattle has undertaken numerous steps to encourage passengers and employees to use transit and high occupancy vehicles. Total airport surface traffic is expected to increase from approximately 87,600 vehicles per average day in 1994, to approximately 161,500 vehicles per average day in year 2020 with or without airport improvements. In developing the three terminal alternatives, emphasis was placed on the use of high occupancy vehicles for access to the Airport to relieve congestion on the terminal surface roads. Such modes could include shuttles and light rail to divert passengers from private autos, taxis and limos. Additional public parking would be developed through a southern expansion of the parking garage and the development of a parking garage on the site of the current Doug Fox parking lot. In addition to the Port's active ride-share and commute programs aimed at reducing employee related vehicular traffic, the

Master Plan Update proposed the development of a new employee lot north of SR 518 to minimize congestion on International Blvd. Therefore, a specific purpose and need was not determined necessary.

Other regional and local initiatives are under study to increase vehicle occupancy rates. These initiatives should assist in reducing roadway congestion and single occupancy trips to the Airport. A more detailed discussion of alternative mode access to the Airport is provided in Chapter IV, Section 15, "Surface Transportation" of the Final EIS.

Comment R-3-32: *Southwest King County Community Group requested that the Final EIS clarify the type and location of facilities for the air traffic control tower (specifically alternative site 4), the site for general aviation and corporate activity, the runway safety area, and the ASR.*

Response: Comments noted. Chapter II of the Final EIS has been updated to provide further discussion concerning the alternative sites for the air traffic control tower, the general aviation and corporate facilities, the runway safety areas, and the ASR.

Comment R-3-33: *Mr. Frause requested clarification of narrow-body gate dimensions versus the dimensions required for widebody aircraft. He also asked if there are other gate classifications.*

Response: Airport planners typically use as many as five groups of aircraft gate dimensions. These dimensions are associated with the average wingspan of the typical aircraft in that group. These are:

Design Group	Maximum Wingspan	Typical Aircraft
Group I	49 feet	Metro
Group II	79 feet	Embarer
Group III	118 feet	MD-80
Group IV	171 feet	MD-11
Group V	213 feet	B-747-400

For purposes of the Master Plan Update, these groupings were used to develop a narrow-body equivalent gate index. The narrow-body aircraft would include those in Groups I through III. Widebody aircraft would make up the remaining groups.

Comment R-3-34: *Mr. Rohlfs (City of SeaTac) noted that the exhibits in Chapter II incorrectly showed residential development remaining in the areas after the proposed new parallel runway would be constructed.*

Response: The City of SeaTac is correct in that the exhibits showing the "With Project" alternatives were overlain on base maps which contained the West SeaTac subarea as it exists today. This was done to provide a reference point for the areas to be displaced. The Final EIS uses a base map for the "With Project" alternatives that reflects the completion of acquisition.

Comment R-3-35: *Ms. Brown, Regional Commission on Airport Affairs, and Mr. Sauer asked if a fourth parallel runway will be built in the future.*

Response: The purpose of the proposed third runway is to ensure efficient operations during poor weather conditions, since the existing runways are presently only able to accommodate a single aircraft arrival stream during poor weather. With the addition of the proposed new third runway and other proposed improvements, Sea-Tac Airport would be able to safely and efficiently accommodate aircraft operations through the planning horizon. The proposed phasing and cost estimates are discussed in Chapter II, "Alternatives".

To date, there have been no discussions or plans prepared regarding the need for a fourth parallel runway at Sea-Tac. The Capacity Enhancement Study, as summarized in the Draft and Final EIS, show that as activity levels grow in the future, delays would continue to rise, even with the development of the third runway. When activity reaches a 525,000 annual operations, delays at Sea-Tac would exceed current levels. See also response to comment R-3-36.

__*Comment R-3-36:*__ *Mr. Frause, Mr. Peyton (Ravenna-Bryant Community Association), Regional Commission on Airport Affairs, Mr. Scarvie, Mr. Sauer, and the U.S. Environmental Protection Agency questioned why the Master Plan Update and Draft EIS do not address airport requirements beyond the year 2020 and why only years 2000 and 2010 were considered in the Draft EIS.*

__Response__: The EIS presents the impacts in year 1994 and forecasts the impacts in future years with and without the proposed Master Plan Update improvements. The Master Plan Update found, and the FAA concurred in preparing the Draft and Final EIS, that forecasting conditions in the aviation industry more than 20-25 years becomes extraordinarily speculative. Thus, these studies focused on the aviation facility requirements through the year 2020. Impacts in interim years were evaluated to provide an indication of how impacts would change over time. See also response to comment R-3-35.

__*Comment R-3-37:*__ *The Regional Commission on Airport Affairs stated "we are enclosing two letters from the ATA that first did not support a 3rd runway with only a 2,500 feet separation and then reversed its position to support this separation, if the runway is at least 8,500 feet long... Please indicate source and present the 'statistics' that the ATA based this reversal on and any other information that was given to the airlines to convince them to change their mind."*

__Response__: In response to the Port of Seattle's coordination efforts with the airlines, the Air Transport Association indicated in their March 28, 1994 letter that "this letter is provided only from a Flight Operations and Air Traffic Control viewpoint and not meant to influence or exacerbate any ongoing controversy regarding this proposed project". Their March 28, 1994 letter also states the sources of their determination: Sea-Tac Airport Capacity Enhancement Plan Update, FAA Handbook 7110.65H and the 1993 Aviation System Capacity Plan. No further clarification has been requested from ATA and no other feedback is currently needed by Port or FAA efforts.

__*Comment R-3-38:*__ *The Airport Communities Coalition noted that the plans contained in the Master Plan Update and Draft EIS for the South Aviation Support Area (SASA) conflict with the plans that were approved in the 1994 Final EIS for SASA.*

__Response__: The 1994 Final EIS and Record of Decision for the South Aviation Support Area (SASA) contained a preferred alternative that consisted of:

- Relocation of three line maintenance facilities (currently located north of South 188th Street to the SASA) which were expected to be displaced by terminal development;
- Development of a base maintenance facility;
- Development of a hush house;
- Development of a ground service equipment facility; and
- Handstand for as many as 15 parked aircraft.

The alternatives addressed in this EIS would result in virtually the same land profile, with many of the same facilities as defined in the SASA Final EIS. Depending upon the "With Project" alternative, the SASA would include the displaced line maintenance facilities, the ground service equipment facility, a possible hush house, and a hardstand for aircraft. Where the Master Plan Update differs from the SASA EIS, is that the Master Plan Update recommends development of the displaced cargo facilities and/or cargo facility expansion in SASA. In addition, the Master Plan Update recommended the addition of dual taxi capability to and from the SASA, versus the single taxi lane assumed in the 1994 Final SASA document. This EIS assesses and reflects the differences among the types of facilities that would be located in SASA in the "With Project" alternatives.

ALTERNATIVES

Comment R-4-1: *Several commentors indicated that the statement of Purpose and Need in the Draft EIS was not clear and thus, the selection of alternatives was not clear. Some asked for clarification as to whether the purpose and need was to accommodate inevitable growth in demand or to foster an increase in demand and an explanation of how the alternatives meet these needs. The following individuals or groups offered this comment: Mr. Jhaveri, Mr. Rants, Mr. Towe, and Mr. Vance.*

Response: The Purpose and Need for the improvements at Sea-Tac Airport are discussed in Chapter I (page I-11 through I-18 of the Final EIS). There are four statements of need and purpose (page I-12) which address the key issues identified by the Master Plan Update. These are:

- Improve the poor weather airfield operating capability in a manner that accommodates aircraft activity with an acceptable level of delay;
- Provide sufficient runway length to accommodate warm weather operations without restricting passenger load factors or payloads for aircraft types operating to the Pacific Rim;
- Provide Runway Safety Areas (RSAs) that meet current FAA standards; and
- Provide efficient and flexible landside facilities to accommodate future aviation demand.

As was described in the Draft and Final EIS, population of the Central Puget Sound Region is expected to continue to outpace growth rates for the United States. Population, income and air fares are the primary determinants of air travel demand. These factors are expected to increase demand for travel by air. As is described in the introduction to the responses to comments, this growth in air travel demand is projected to occur, with or without improvements at Sea-Tac. Furthermore, the proposed new parallel runway would address existing poor weather arrival delays.

As is described in Chapter II of the Draft and Final EIS, the alternatives that satisfy the underlying needs were then examined. Due to apparent confusion concerning how the individual alternatives were identified, as well as how the alternatives meet the underlying need, the Final EIS contains a restructured Chapter I and II. Material from the Draft EIS concerning Purpose and Need were placed in Chapter I of the Final EIS. Chapter II of the Final EIS focuses on the alternatives.

Comment R-4-2: *The Airport Communities Coalition, Ms. Brown, Mr. Furney, Mr. Kennedy, Mr. D. Miller, Mr. Peyton (Ravenna-Bryant Community Association), Mr. Schuster (Wedgewood Community Council), Mr. Vance, and the Regional Commission on Airport Affairs indicated that that only one alternative was really considered or that the alternatives considered were too narrow.*

Response: Chapter II of the Final EIS identifies a broad range of alternatives for satisfying the needs. Alternatives are discussed in Chapter II "Individual Alternatives to Satisfying the Needs" (page II-1 through II-33) and "The Proposed Alternatives to be Assessed" (Final EIS Pages II-33 through II-42). The former section addresses the full range of alternatives, including the use of other modes of transportation, use of other airports, development of a new airport, use of technology, and the use of demand management. The latter section details the three development alternatives that were carried forward for further analysis in this EIS. These include the required no-action alternative (Alternative 1 - Do-Nothing) as well as three "With Project" alternatives: Alternative 2 - Central Terminal; Alternative 3 - North Unit Terminal; and Alternative 4 - South Unit Terminal.

Comment R-4-3: *Mr. D. Miller indicated that the Draft EIS should not have relied on PSRC's dismissal of off-site alternatives or the Flight Plan Study's assessment of impacts.*

Response: The relationship of the Master Plan Update EIS to previous studies is discussed in several locations in the EIS: Chapter I "Regional Airport Planning" (Final EIS pages I-4 through I-5); Chapter II "Use of Other Airports or Construction of a New Airport" (Final EIS pages II-6 through II-11); and Appendix B. See response to comment R-4-1.

With regard to the dismissal of off-site alternatives, the Puget Sound Regional Council's (PSRC's) determination that no feasible site exists for a major supplemental airport is only one of several factors that led the Port and FAA to the dismissal of that alternative in this EIS. Other reasons include the lack of a sponsor for a new airport; the lack of a funding source for a new airport; the time frame within which a new airport could be developed; and the ability of the market to support a major supplemental airport; see response to comment R-4-4. Thus, while the PSRC's determination that no sites exist was a factor in this EIS, the determination was based on several different factors. As is required by the Council on Environmental Quality, the FAA independently confirmed that a new airport would not satisfy the underlying need addressed by the EIS.

With regard to the use of Flight Plan's assessment of impacts, the Flight Plan Final EIS satisfied SEPA requirements for an environmental assessment of system level alternatives. The Flight Plan EIS and related materials are described in Appendix B and, for SEPA purposes, are incorporated by reference, as is stated in the Draft and Final EIS.

The Flight Plan EIS was prepared at a programmatic level. Programmatic EISs are prepared to assess system level improvements or changes where no site specific conditions have been determined. This approach permits evaluation of general conditions based upon proposed service levels and supporting infrastructure, while defining the parameters associated with a planned set of improvements. Programmatic EISs help establish the framework or envelope for accommodating future site specific alternatives. Site specific EISs are initiated to assess the particular characteristics of a set of alternatives, while addressing the special attributes of site development and program implementation. The information presented in that EIS enabled the PSRC General Assembly (see response to comment R-2-1) to select a preferred alternative for addressing the needs of the Puget Sound Region. The Master Plan Update EIS technical analysis represents a detailed examination of the Master Plan Update improvements (project) and site specific impacts, in accordance with the PSRC Resolution A-93-03.

Comment R-4-4: *Numerous commentors stated that alternative airport sites are feasible and should have been given greater consideration in the Draft EIS. Comments of this nature were received from "A Concerned Citizen", the Airport Communities Coalition, anonymous, Mr. Bartlemay, Ms. Bittenc, Ms. M. Clark, Communities Against Noise, Mr. Dalbec, Mr. Feuerstein, the Greater Federal Way Chamber of Commerce, Mr. Kennedy, Mr. Lund, Mr. D. Miller, Cameo Motel, Ms. Nelson, Mr. Newby, Ms. Parker, Mr. Peyton (Ravenna-Bryant Community Association), the Regional Commission on Airport Affairs, Ms. Sauer, Mr. Schneider, Mr. J. Schuster, Ms. N. Scott, the Southwest King County Community Group, Ms. Sternberg, Mr. Tate, Mr. Taylor, Mr. Vaa, Mr. Vance, Mr. Vonesh, Mr. Wagner, Mr. Watanabe, Mr. Webb, Ms. R.C. West, Mr. & Mrs. West, and Mr. Wibert. Suggestions for alternative sites include Bellingham, Boeing Field, Chehalis, Enumclaw, in Puget Sound, McChord, Moses Lake, Northeast Lewis County International Airport, Olympia, Paine Field, Sandpoint Naval Station for General Aviation, and pooling airport resources between Spokane and Portland.*

Response: The use of another airport or construction of a new airport was discussed in Chapter II (pages II-6 through II-11 of the Final EIS) as an alternative for satisfying Sea-Tac's poor weather operating needs. It was determined that the use of other airports was not a feasible alternative for several reasons. First, there is no sponsor or identified funding source for a new airport. Any general purpose government, including ports, may develop and operate airport facilities; however, at this point none have identified themselves as potential sponsors of such a project. MPOs and RTPOs, such as the PSRC, are not general purpose governments and do not have the authority to develop airport facilities. Second, a new airport cannot be developed in time to obviate the need for additional poor weather capacity at Sea-Tac, since it would take a minimum of ten to fifteen years to plan and develop a supplemental airport or a replacement airport. Third, market conditions would not allow a multiple airport system to be economically viable until aviation demand within the Region exceeds 10 million annual origin and destination (O&D) enplanements per year. This is projected to occur around 2010. Finally, the Puget Sound Regional Council (PSRC) has concluded that no feasible site exists for a supplemental airport in the four county Region.

This EIS addresses whether or not the use of other airports or the development of a new airport would obviate the need for capacity enhancements at Sea-Tac. This EIS does not address whether or not there will be a need for a multiple airport system at some point in the future. Based upon its evaluation of the Region's forecast air transportation needs, the Flight Plan Study recommended a multiple airport system with a third runway at Sea-Tac and two supplemental airports. Although PSRC determined that "no feasible site exists" and discontinued Phase II of the Major Supplemental Airport Study, it is possible that the issue would resurface as the Puget Sound Region collectively responds to increasing demand in the twenty first century. Thus, while a new airport would not address the needs identified in this EIS, the improvements in the Master Plan Update do not preclude the development of a supplemental airport.

Comment R-4-5: Mr. Dinndorf (PSRC) stated that "on (DEIS) page II-15, the paragraph that begins: 'The O&D air service area....' should include the word 'population'".

Response: Comment noted. Wording change is included in the Final EIS on page II-10.

Comment R-4-6: Mr. Dinndorf (PSRC) states that "the Stanwood/Conway, Marysville East and the Thun Field sites include two sites each".

Response: Comment noted. Wording change is included in the Final EIS on page II-7.

Comment R-4-7: The Airport Communities Coalition, Mr. Allen, Ms. M. Clark, Mr. Clymer, Mr. Creighton, Mr. Greene, Mr. Heavey, Mr. Miedema, Mr. Peyton (Ravenna-Bryant Community Group), Mr. Rees, Ms. N. Scott, Mr. Stark, Mr. Tate, Mr. Vance, Ms. R.C. West, Magnolia Community Club, the Regional Council on Airport Affairs, and the Seattle Community Council Federation expressed support for demand management in general, or recommended specific types of demand management such as gate controls, congestion pricing, diverting commuter traffic to another airport, or diverting all-cargo traffic to another airport. These commentors urged that the Final EIS give full consideration to demand management techniques as an alternative to runway development.

Response: The Draft and Final EIS address activity or demand management alternatives in Chapter II; "Activity or Demand Management Alternatives" (page II-11 through II-12 of the Final EIS). This section identifies the various types of demand management alternatives that are available, the types of demand management already in place at Sea-Tac, and the potential for demand management or system management techniques to obviate the need for a third runway. Types of demand management already in place at Sea-Tac include yield management, central flow control, and the diversion of general aviation to Boeing Field. However, additional demand management techniques were determined to be infeasible as an alternative to address the poor weather operational constraints at Sea-Tac.

Demand management alternatives were also evaluated in detail in the Flight Plan EIS as well as by the Demand/System Management and Noise Expert Arbitration Panel (see response to comment R-2-5). These activities are summarized in the Draft and Final EIS. The Flight Plan EIS found that "TDM (Transportation Demand Management) cannot be used to stop growth...TDM is most effective for 'buying time'...TDM will not eliminate the need for capacity improvements." The Flight Plan EIS and related materials are described in Appendix B and are incorporated into the Draft and Final EIS by reference, as is stated in Chapter I.

The Puget Sound Regional Council's Expert Arbitration Panel on Noise and Demand/System Management issued its Final Phase I Order on Noise and Demand/System Management Issues in July, 1995. The Expert Panel concluded that congestion pricing, gate controls, and high speed rail were not feasible as demand management methods within the meaning of Resolution A-93-03, as noted in their December 8, 1995 final order. The Expert Panel is expected to issue additional decisions concerning noise in early 1996. Due to the Expert Panel's public comment process the FAA has determined that it would not be appropriate to reopen the EIS comment period.

The Council on Environmental Quality (CEQ) regulations require that EIS's "rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated." Thus, the Draft and Final EIS address a number of sub-alternatives within each of the broader categories of alternatives. Then, the alternatives that were found reasonable and feasible were identified and grouped to form the alternatives which were assessed in detail.

Comment R-4-8: *The Southwest King County Community Group, Mr. Allen, and the Regional Commission on Airport Affairs indicated that cargo diversion should have been considered in more detail.*

Response: Port Resolution 3125 calls for the consideration of the diversion of all cargo-only operations to an alternative airport site. The Draft and Final EIS discuss the potential to divert cargo to another airport in Chapter II "Provide Efficient and Flexible Landside Facilities to Accommodate Future Aviation Demand" (beginning on page II-29 of the Final EIS). This section of the Final EIS reflects consideration of cargo diversion to an existing mixed use airport as well as development of a cargo-only airport. The diversion of cargo to a new or existing airport is not a feasible alternative for satisfying the needs addressed by this EIS because (a) cargo-only operations represent only 6% of total aircraft operations and (b) approximately half of all cargo is shipped in passenger aircraft. This level of diversion is not adequate to obviate or delay the need for the proposed third parallel runway. In addition, to the feasibility of cargo diversion as a means of obviating or deferring the need for the proposed third runway, the diversion of all-cargo to another airport may be an undesirable alternative. Connecting cargo carried on passenger aircraft (nearly half of all cargo) would have to be transported to another airport before taking off again. The additional time required to deplane, sort, transport, and enplane the cargo would reduce airport efficiency. Furthermore, transporting cargo between airports could significantly impact the surface transportation system. If the practice of transporting cargo in passenger aircraft were eliminated in order to direct all cargo to an alternate airport, the Region could experience inefficient use of aircraft, and unnecessary additional aircraft operations. Additionally, shifting cargo operations from Sea-Tac to another airport transfers associated impacts to another location, as in the case of the recent elimination of one Alaska Airlines nighttime cargo flight at Sea-Tac. Due to the nighttime limitations program, this flight can no longer operate at Sea-Tac and is now operating at Boeing Field, where it has generated opposition from the surrounding neighbors.

With regard to diverting cargo to off peak hours, the EIS reviews the use of pricing policies in Chapter II beginning on page II-6. As the EIS states, airports have not been successful in the past in changing the operating behavior of airlines through pricing. Since airport fees are a small percentage of airline operating costs, it would require a significant increase in fees to change the airlines' behavior. Such a dramatic increase in fees could raise unjust discrimination issues, be construed as placing an unnecessary burden on interstate commerce, and lower the Region's competitiveness in attracting cargo traffic. Consequently, using pricing policies to shift cargo traffic to off-peak hours is not a feasible alternative. The Nighttime Limitations Program at Sea-Tac was grandfathered under the 1990 Airport Noise and Capacity Act, which now limit an airport operator's ability to enact such restrictions on access to an airport.

<u>Comment R-4-9:</u> *A number of commentors suggested that other technology alternatives exist to eliminate or delay the need for the proposed new parallel runway. Suggestions of technology included: Localizer Directional Aids (LDA), global positioning systems (GPS), and precision runway monitors (PRM). Such comments were received from: the Airport Communities Coalition, Anonymous, Mr. Bullard (Queen Anne Community Council), Mr. Ellison, Mr. Greene, Mr. D. Miller, Mr. Peyton (Ravenna-Bryant Community Association), the Regional Commission on Airport Affairs, Mr. Schneider, Mr. Schuster (Wedgewood Community Council), the Southwest King County Community Group, Mr. Tate, and Mr. Webb. Several of these commentors indicated that inadequate consideration was given to the benefits of the technology and that future applications could adequately serve the needs of Sea-Tac.*

<u>**Response:**</u> Each of the technologies identified by the commentors was addressed in the Draft and Final EIS, Chapter II, along with other technologies that are currently under study.

- **Global Positioning System (GPS)** - Developed by the U.S. Department of Defense over the last 20 years, GPS/GNSS (Global Navigation Satellite System) is expected to allow aircraft to fly flexible and highly accurate flight tracks anywhere in the world using satellites to aid in navigation. GPS has essentially replaced the MLS as the next generation precision approach system. It has applicability in reducing delay and congestion at the surface of an airport, in addition to the terminal and enroute airspace. While GPS is expected to have major long-term benefits to the overall aviation system, it is not expected to address the wake vortex issues resulting from runway separations of less than 2,500 feet. Therefore, GPS would not enable dual approaches to the existing Sea-Tac runways during poor weather.
- **Precision Runway Monitor (PRM)** is an improved radar technology and controller display aid which enables the separation between parallel runways to be reduced and still enable two independent arrival streams. Based on tests of PRM at Raleigh and Memphis, the FAA has published dual simultaneous independent parallel approach procedures under poor weather with runways separated by 3,400 feet or more. Additional analysis is being performed by the FAA Technical Center to determine the minimum spacing below 3,400 feet with which PRM approaches can be accomplished. However, without additional technology to address wake vortices associated with aircraft movement, the PRM alone at Sea-Tac could not enable parallel approaches in poor weather because of the runway separations.
- **Localizer Directional Aid (LDA) Approaches** - The use of LDA approaches creates the appearance of the availability of widely spaced runways, where one stream is aligned with the runway and the other stream is offset by an established LDA distance. As a result, the approach minima for dual LDA/ILS approaches are typically higher than those for basic VFR minima. Therefore, this technology could be useful in reducing delays during VFR1 and VFR2, although it would not affect delays during IFR conditions.

  It may be possible at some time in the future for technology to relieve the wake vortex issues at separations less than 2,500 feet. However, this is not foreseen. See response to comment R-3-21B.

  The fundamental problem addressed by the EIS is aircraft operational delays caused by the lack of dual approach procedures under certain weather conditions. The Draft and Final EIS address all delay reduction measures which offer the potential to address this constraint. While it is possible that other delay reduction measures may exist now or in the future (such as the application of the Free Flight concept), there are no reasonable means of solving all of the poor weather constraints other than those identified in the EIS. Other than the proposed new runway, the use of an Localizer Directional Aid (LDA) approach offers the most promising opportunity for providing dual approach capability during a portion of the highest ceiling/visibility poor weather conditions. However, because the LDA approach would require aircraft to perform a "sidestep" or similar procedure to an existing runway, the single approach limitation would remain during the majority of poor weather conditions.

As is described in the preceding section, weather is categorized as:

Good Weather:	VFR1	56.1%	Poor Weather	VFR2	19.7%
				IFR1	17.0%
				IFR2	5.4%
				IFR3	1.5%
				IFR4	0.3%

The LDA would assist with addressing dual approaches during one of the five poor weather conditions, it would only be available during VFR2. Thus, the single arrival stream would not be addressed during 65 percent of the poor weather conditions, or 24.2% of all-weather conditions. As is described in the EIS, currently during VFR1 arrival delay currently averages about 1.3 minutes. This increases to 11.8 minutes in VFR2 and 22 minutes or more in IFR conditions. Thus, while the LDA would reduce delays during VFR2, it would not reduce the most severe delays that occur during IFR conditions.

An LDA would also mandate that aircraft not comply with established noise abatement arrival tracks on approach to the existing runways at Sea-Tac. In south flow, instead of arriving aircraft aligning their approach over the Duwamish industrial corridor, arrivals would most likely overfly the West Seattle ridge and then side step over to the runway within 2-3 miles. Due to the 300-400 feet higher elevation of properties located on the ridge, an increase in arriving aircraft noise and noticeably lower flying aircraft would be expected.

On behalf of the Regional Commission on Airport Affairs, G. Bogan and Associates prepared a detailed examination of the benefits of the an LDA to satisfying the need for a new parallel runway. The Bogan Report[7/] reaches the following two conclusions: 1) the weather analysis in the Draft EIS is incorrect; and 2) implementation of an LDA would achieve the purpose and need identified in the Draft EIS. The Bogan report bases its conclusions concerning weather conditions based on two years of weather conditions (1993 and 1994), whereas the Draft and Final EIS and 1995 Capacity Enhancement Plan Update based the weather conditions on 10 years of weather conditions (January 1982 through March 1992). Thus, while the EIS weather conditions reflect the varying weather that occurs from one year to another, the Bogan Report was based on a much more limited evaluation. While the Bogan Report makes a number of incorrect factual assumptions,[8/] its premise that the LDA would reduce delays due to its availability during VFR 2 conditions is correct. However, the Bogan Report overestimates the benefits of the LDA because:

- The LDA would not be available during 24.2% of the weather conditions (65 percent of the poor weather); a third parallel runway would address these IFR weather conditions;
- Future departure operations would be affected to a greater degree by the LDA, resulting in greater total future delay. A third parallel runway would enable the outboard runways to be used for arrivals during peak periods, with the inboard runway available for departures;
- As 60 percent of the delays occur during IFR conditions, the LDA would not address a significant majority of the existing and future delay;

While the FAA may pursue the LDA in the future at Sea-Tac Airport, it was found to not satisfy the need for the proposed Master Plan Update improvements.

7/ "Implementation of and LDA/DME Approach To Runway 16R in Lieu of a Third Runway at Sea-Tac Airport", G. Bogan & Associates, June 26, 1995.

8/ "Evaluation of 'Implementing an LDA/DME Approach to Runway 16R in lieu of a Third Runway at Sea-Tac Airport'", Federal Aviation Administration, December 20, 1995.

Comment R-4-10: *Several commentors expressed opinions that alternative modes of transportation, such as rail and telecommuting should have been considered in a more thorough fashion. Comments of this nature were received from Mr. Bader, Ms. M. Clark, Mr. Peyton (Ravenna-Bryant Community Association), Mr. Tate, the Regional Commission on Airport Affairs, Mr. Watanabe, and Ms. West. Mr. Watanabe suggested that rail connect the proposed new terminal facilities with downtown Seattle.*

Response: Chapter II "Individual Alternatives to Satisfying the Needs" discusses intercity rail as an alternative for reducing poor weather delay at Sea-Tac. Three basic classes of improved rail service are available as alternatives: (1) current rail service; (2) improvements to rail service in the existing right of way; and (3) true high speed rail operating in a dedicated right of way at speeds above 150 mph. These intercity rail alternatives have been evaluated based on a series of factors, including the timeframe within which improvements can be implemented, travel times between major markets, the cost of improvements, the reliability of funding for improvements, and the potential for higher speed rail service to divert passengers from Sea-Tac.

All three rail options (current service, higher speed service, and true high speed service) were determined to be infeasible as alternatives to increase poor weather capacity at Sea-Tac. Current rail service is not competitive with air travel and the diversion of significant numbers of passengers from air to rail is highly unlikely. Higher speed rail service (maximum speeds of 125 mph) is infeasible because of longer travel times resulting in a lack of competitiveness with air transportation, less than 5% of Sea-Tac's passengers are traveling to locations where rail could be a reasonable alternative mode, and higher speed service is dependent upon significant investment by the State Legislature in the rail system. Funding for this investment is undetermined beyond the current two year appropriation. True high speed rail was determined to be infeasible due to the time frame within which a high speed rail system could be implemented, the high degree of uncertainty of financing for costly right of way acquisition, and the conclusion that true high speed rail would divert less than five percent of passengers from Sea-Tac if true high speed rail were available by 2020. The PSRC's Expert Panel on Noise and Demand/System Management Issues concurred that true high speed rail is not a reasonable alternative in their Final Phase I Order on Demand/System Management Issues released on July 27, 1995. This was re-affirmed in their December 8, 1995 final decision concerning demand/system management issues.

The analysis of rail as an alternative for reducing all weather delay at Sea-Tac has been clarified in the Final EIS. Additional information has been provided about the nature of the rail system, the funding environment in which improvements could occur, and the specific factors that led to the determination that each of the rail options was infeasible.

One commentor indicated that the list of preparers of the Draft EIS did not include rail experts. The rail expert (Gary Molyneaux, Ph.D.) used during the preparation of the EIS analysis was inadvertently omitted from the list of preparers. The omission of Dr. Molyneaux from the list of preparers was corrected in the Final EIS.

Comment R-4-11: *The Airport Communities Coalition, Mr. LeCompte, Mr. Peyton (Ravenna-Bryant Community Association), Mr. Nelson, and Mr. Watanabe suggested on-site alternatives for Sea-Tac such as alternate runway lengths, viaduct-type 2-layer runway, runway configurations and orientations, taxiway configurations, and terminal/parking facilities.*

Response: Chapter II "Individual Alternatives to Satisfying the Needs" (pp. II-1 through II-33) sets forth the alternatives that are evaluated for meeting the identified needs. For each of the identified needs, several broad categories of alternatives were considered. Specific detailed options were then addressed for the alternatives found feasible or reasonable. Several of the alternatives identified in the comments were not specifically mentioned in the Draft EIS. The alternative of a two layered runway or runways suspended on piers was found infeasible for operational and cost reasons. See response to comment R-4-12 concerning alternative runway lengths.

The option of an alternative runway orientation was not addressed in the Draft EIS. The Final EIS reflects consideration of this alternative. However, as is stated in the revised text, this alternative, like the independent (over 2,500 feet separation) new runway, would result in substantial natural and built environment disruption, either through acquisition or, as would be the case of a diagonal runway, would create significant changes in areas overflown by aircraft.

__*Comment R-4-12*__*: Several commentors asked if runway lengths shorter than 8,500 feet were considered for the proposed new parallel runway. Individuals, groups, and jurisdictions with this comment were: Airport Communities Coalition, Mr. Rohlfs (City of Sea Tac), Mr. Frause, and Ms. Taylor.*

__Response__: Alternate runway lengths are discussed in Chapter II "New Runway Development Alternatives at Sea-Tac Airport" (pages II-12 through II-14 of the Final EIS) and in "The Proposed Alternatives to be Assessed" (pages II-33 through II-41). Table II-3 of the Final EIS presents the percentage of the 2020 fleet that would be able to land and take-off on runways with lengths of between 5,000 and 12,500 feet. The longer a runway, the greater the percentage is of aircraft types that can land or take off on that runway. Eight development options were identified with runway lengths of 5,200 feet, 7,000 feet, 7,500 feet, and 8,500 feet. The options analyzed in detail in the Draft and Final EIS have runway lengths of 7,000, 7,500 and 8,500 because these lengths achieved requisite delay reductions, in contrast with shorter lengths.

__*Comment R-4-13*__*: The Airport Communities Coalition, Mr. Frause, and Mr. Dinndorf (PSRC) asked what specific development efforts are included in the "With Project" include versus Do-Nothing.*

__Response:__ Chapter II, beginning on page II-36 provides a description of the individual actions that would be undertaken to complete each of the alternatives. The Final EIS clarifies the differences between the "With Project" alternatives and the Do-Nothing alternative. One commentor questioned if all of the existing runways would be extended. Based on the needs identified in the Master Plan Update, the extension of Runway 34R is recommended.

__*Comment R-4-14:*__ *The Airport Communities Coalition stated that this is called the Master Plan Update EIS, but no Master Plan Update document exists. The commentor stated that there is no specific information available about the proposed project or its phasing and that the proposal does not include the Airport Layout Plan required by NEPA.*

__Response__: As described in the response to comment R-1-11, the Master Plan Update and EIS were conducted concurrently. The Draft EIS served to assist the general public and regional decision-makers to understand the environmental impact of the alternatives, including the three concepts being considered in the Master Plan Update. Based on the findings of the Master Plan Update, Draft EIS and public comments, the Port staff selected the North Unit Terminal concept with an 8,500 foot long new parallel runway as the preferred alternative. The Final EIS has been prepared to reflect the selection of this alternative. However, to continue to enable regional decision-makers understand the impacts of the alternatives, the three runway lengths are also presented in the Final EIS, and are noted as a proposed runway with a length up to 8,500 feet. In December 1995, the Port of Seattle released the Final Master Plan Update report, summarizing the overall master plan process and findings that led to the selection of the preferred alternative.

An Airport Layout Plan (ALP) has been prepared for the Preferred Alternative (Alternative 3) and is available to the public upon request of the FAA. It has not been included in this EIS due to the complex, technical nature of the exhibit, which is approximately 20 inches by 30 inches. Exhibits II-5 through II-8 are simple graphic representations of the actual ALP illustration. See also Appendix B. Copies of a full size ALP are available upon request of the FAA.

Chapter II contains a detailed discussion of the specific construction projects included in each alternative that was found to satisfy the underlying needs. Included in this discussion is the identification of the construction elements of the various alternatives, displacements, and generalized construction staging.

Comment R-4-15: *Mr. Peyton (Ravenna-Bryant Community Association) noted that the Do-Nothing alternative actually included several improvements. The commentor felt that "Do-Nothing" was a misnomer.*

Response: The Do-Nothing alternative includes six actions which have already received environmental approval and are in varying stages of implementation: (1) implementation of declared distance procedures and displacements of the thresholds of Runways 16L and 16R to address the FAA mandated runway safety area requirements; (2) installation of an Instrument Landing System (ILS) on Runway 16L; (3) clearing and grading of the 34L runway safety area; (4) implementation of the South Aviation Support Area (SASA) approved by the 1994 Final EIS and Record of Decision; (5) implementation of an on-airport Hotel; and (6) development of the Des Moines Creek Technology Campus. All of these improvements are anticipated to be undertaken before 2000. By 2020, the Region is expected to have implemented the SR 509 Extension and South Access connection to Sea-Tac; thus, that project has been included in the year 2020 analysis.

Comment R-4-16: *The Regional Commission on Airport Affairs and Mr. Frause questioned why a preferred airfield alternative had been selected for the Draft EIS (the 8,500 foot long new runway), yet no preferred landside elements were identified.*

Response: Each of the "With Project" alternatives identified in Chapter II includes a new parallel runway located 2,500 feet west of existing Runway 16L/34R. Factors leading to the use of the 2,500 ft. separation in the alternatives carried forward for analysis are discussed in Chapter II, Section "Individual Alternatives to Satisfying the Needs" beginning on page II-1 of the Final EIS. The Draft and Final EIS address the range of runway lengths up to 8,500 feet. A preferred runway length was not identified in the Draft EIS - three specific lengths (7,000 feet, 7,500 feet and 8,500 feet) were assessed. See response to comment R-4-14. Based on cost and operational efficiency, the Port of Seattle selected the North Unit Terminal as the preferred terminal option (Alternative 3).

Comment R-4-17: *The Airport Communities Coalition noted that the "Delayed Alternative" was not considered in the Draft EIS, as is required by the Washington State Environmental Policy Act.*

Response: This alternative was included briefly in the Draft EIS as the "Blended Alternative". The Final EIS, Page II-18 contains additional discussion concerning the SEPA provisions concerning assessing the benefits and disadvantages associated with delaying the implementation of the proposed Master Plan Update improvements.

Comment R-4-18: *The Airport Communities Coalition and Mr. Kennedy stated that the EIS must examine the alternatives both separately and cumulatively. The commentor indicated that the Draft EIS prematurely dismissed a blended alternative and failed to consider the combination of a number of other landside and airside alternatives.*

Response: The President's Council on Environmental Quality regulations require that EIS's "Rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated." Chapter II, Section "Individual Alternatives to Satisfying the Needs" of the EIS sets forth the alternatives that are evaluated for meeting the identified needs. The broad categories of alternatives that were considered include (1) the use of other modes of transportation; (2) the use of other airports or construction of a new airport; (3) activity/demand management; (4) new runway development alternatives; (5) technology alternatives; (6) blended alternatives; and (7) landside development at Sea-Tac. Within each of these broad categories of alternatives, the EIS addressed a number of sub-alternatives.

The proposed new parallel runway would address the need to reduce poor weather operating delay at both current and future levels of activity. The blended alternative, encompassing the use of alternative modes, use of existing airports, and activity/demand management methods, was determined to be infeasible because the combined alternatives would not divert a sufficient level of airport activity to obviate or delay the need for the proposed third runway. Rationale leading to this determination are identified in Chapter II, Draft EIS pages II-22 through II-23 (see Final EIS page II-18 through II-19). Considered together, the alternatives included in the blended alternative does not meet the need. Therefore, the blended alternative was determined to be infeasible and was not included among the alternatives carried forward for additional analysis.

With regard to the range of alternatives considered, it is necessary to consider the breadth of options associated with each category of alternatives and the relationship between this EIS and past planning efforts/environmental assessments that have evaluated the feasibility of various options. Each of the broad alternative categories encompasses a number of specific strategies for addressing the given needs. Thus, while only one blended alternative category was considered, that blended alternative encompassed a wide range of possible combinations. Some specific alternatives may not have been directly mentioned in this EIS, but have been considered in previous studies such as Flight Plan and have been incorporated into the EIS by reference.

Comment R-4-19: *The Southwest King County Community Group noted an inconsistency in the review of potential sites for air traffic control facilities (Draft EIS page II-33). One part of the discussion states that Site 4 was not considered further, while another portion of the text states that Site 4 was selected as one of three preferred tower sites.*

Response: Comment noted. In response, the Final EIS has been prepared to clarify the various alternatives for the air traffic control tower.

Comment R-4-20: *Four commentors asked for clarification of how diversion of passengers from air to rail was calculated. The Airport Communities Coaliton, Mr. Peyton (Ravenna-Bryant Community Association), the Regional Commission on Airport Affairs, and the Seattle Community Council Federation submitted comments related to this issue.*

Response: Table II-2 (page II-2C) summarizes the percentage of origin and destination (O&D) passengers traveling between Sea-Tac and the top 25 cities. The focus is on O&D passengers because connecting passengers are unlikely to consider rail as an alternative to air travel. O&D passengers have a greater likelihood of considering diverting to rail, provided that travel time and service frequency are competitive. In 1993, Portland accounted for 2.7% and Spokane accounted for 2.0% of all O&D passengers. Vancouver, BC was not cited as one of the top 25 cities, with a share of 1% or less.

O&D passengers are only a percentage of total passengers. Portland and Spokane's percentage of total enplanements are 1.6% and 1.2% respectively. Thus, together the two cities constitute approximately 2.8% of total enplanements.

Given the small percentage of O&D passengers traveling from Sea-Tac to markets that would be served by either high speed rail or other improved rail service (less than 5%), it is quite conservative to state that less than 5% of all passengers could be diverted to rail. WSDOT estimates that 190,600 passengers annually could be diverted from air to rail if a high speed rail system were available by 2020. However, this would constitute less than 1% of all passengers in 2020 and less than 2% of operations in 2020. Diversions from air to rail would be even lower if high speed rail were not available.

__Comment R-4-21:__ *The Regional Commission on Airport Affairs asked for clarification of how diversion of passengers to rail was treated in demand projections for the Airport.*

__Response__: Given the very small percentage of passengers that are expected to divert from air to rail, the model projecting future demand for air transportation did not deduct any diversion to rail. WSDOT projects that less than 1% of all passengers would divert from air to rail in 2020 if true high speed rail were available. However, high speed rail is *not* expected to be available by 2020 given acquisition costs, the timeframe needed to develop, and the uncertainty of financing. Rail improvements in the existing corridor would be expected to divert even fewer passengers to rail. Consequently, the impact of such improvements on demand projections for Sea-Tac is minimal.

__Comment R-4-22__: *Several commentors stated that commuter aircraft should be diverted to another airport. Commentors suggested Boeing Field, Moses Lake, Paine Field, and McChord as potential sites for a commuter airport. This comment was made by Airport Communities Coalition, Mr. Heavey, Regional Commission on Airport Affairs, Ms. N. Scott, and Ms. West.*

__Response__: Commuter aircraft are defined as "those carriers that provide regularly scheduled passenger or cargo service on aircraft seating fewer than 66 passengers or holding cargo with 18,000 pounds of payload or less". The Draft and Final EIS discusses the potential to divert commuter traffic to another airport in Chapter II Section "Individual Alternatives to Satisfying the Needs" beginning on page II-1 of the Final EIS.

This alternative was found not to be feasible for several reasons. Most commuter aircraft carry connecting passengers, and restricting their access to Sea-Tac would disrupt the hubbing practices of the airlines and delay passenger travel. If commuter access were restricted, it is likely that some markets would use larger aircraft to have continued access to Sea-Tac. Other markets might lose service to the Region, forcing connecting passengers to drive to Sea-Tac rather than take a commuter flight. Additionally, if commuter traffic were diverted to another airport in the Region, it would be necessary to have ground transportation between that airport and Sea-Tac so that those passengers could make connecting flights at Sea-Tac. Without a rail transit connection available between the airports, significant congestion would occur on area roads. While the Region is considering a regional transit system, including bus and rail components, it is not proposed to serve other airport facilities. In addition, the transit system has not received voter approval, nor are the proposed construction and operation phases scheduled to become effective within the timeframe of the needs of Sea-Tac. An administrative action that would prevent or limit access to Sea-Tac by these uses may be discriminatory and most certainly be the subject of litigation. This alternative would substantially interfere with air transportation for large numbers of passengers.

EXISTING CONDITIONS/AFFECTED ENVIRONMENT

__Comment R-5-1:__ *Ms. Brown, Mr. Burke, Ms. Grubb, Mr. Scarvie, Mr. Soltis, Southwest King County Community Group, and Mr. Whitled submitted comments concerning the detection of grime, residue and soot particles in residential areas that they believe originate from aircraft exhaust.*

__Response:__ Residents have expressed concerns that the source of 'black speckles' or 'black residue' on their personal property is unburned jet aircraft fuel. In response to such concerns, the PSAPCA initiated a residue sampling program in the surrounding Airport area in January, 1994. Three samples of the black residue were collected and independently analyzed by a local air quality laboratory. The results indicated that the black speckles were a fungal material with associated green algae and minerals. According to the lab, the residues were inconsistent with burned diesel fuels such as aviation Jet-A fuel.

In response to continuing concerns from area residents, the Port of Seattle conducted a separate study of the residues. The study was initiated in January of 1995 and included the sampling of residues at three separate residences. Residue samples were collected from three residences and forwarded for laboratory testing to define the probable sources. One residence sampled (Site 1) is located less than one mile northeast of the Airport. The second site (Site 2) is located approximately three to four miles south of the Airport. Site 3 is located approximately one mile east of the Airport. To provide the laboratory with a comparable sample of actual aircraft exhaust residue, a residue sample from the exhaust outlet of a jet aircraft was collected. This sample was also forwarded to the same laboratory for comparison to the residential samples.

According to the laboratory, each of the residential samples exhibited characteristics that were unique to that particular site, i.e., color and composition. Overall, the composition of each site consisted of a variety of substances, including fungus, insect particles, minerals/soil, other particles, and soot. However, the percentage of soot exhibited at all three sites was small. Additionally, based on particle size, the soot at the off-airport residential sites was found to be more typical of motor vehicles or wood burning activities. The soot samples taken from the jet aircraft exhaust outlet consisted mostly of carbon soot less than twenty-two micrometers in size. The heavy soot in the jet exhaust sample prevented the identification of other substances. However, the important identification was the small size of the soot particles that were typical of aircraft engine combustion. Consequently, the majority of the soot identified from the three residential test sites was larger than the particle size that would be expected from aircraft engines. The results of the residue sampling program are included in Appendix D of the EIS.

<u>*Comment R-5-2:*</u> *A number of commentors expressed concern that the Draft EIS focused too narrowly on the immediate area around Sea-Tac Airport and did not address impacts and mitigation requirements in a broader area. Other commentors requested clarification of how the two study areas were defined (General Study Area and Detailed Focus Area). The following individuals or groups made this comment: Airport Communities Coalition, Mr. Akers, Mr. Bullard (Queen Anne Community Council), Ms. Brown, Mr. Dolvey, Ms. Elder, Mr. Frause, Ms. Frause, Ms. Gates, Magnolia Community Club, Ms. McDougall, the Osterman family, Mr. Peyton (Ravenna-Bryant Community Association), Regional Commission on Airport Affairs, Southwest King County Community Group, and Ms. Vermeier.*

<u>Response:</u> Within the framework of NEPA and SEPA guidelines, the Draft and Final EIS identifies all environmental impacts that are anticipated to occur as a result of the proposed airport improvements. Attempts were made to use consistent study areas where applicable. Several study areas were identified to enable presentation of the most significant impacts, as well as lesser impacts. For purposes of analyzing land use related environmental impacts associated with the Airport, a general study area was defined as the area potentially affected by existing and future noise exposure of 60 DNL and greater. The general study area encompasses approximately 29,650 acres of land including portions of unincorporated King County and all or portions of eight cities: Seattle, Tukwila, SeaTac, Normandy Park, Des Moines, Burien, Federal Way and Kent. The general study area encompasses the Port Noise Remedy Program boundaries and is the area presently most affected by aircraft overflights.

The detailed focus area is defined as the area which would be disrupted to construct the alternative improvements. This area includes all lands that might be acquired. It generally includes the Airport and the area within the immediate vicinity of the Airport. In some cases, however, the graphic image of the area shown varies depending on the type of impact being described.

When considering several environmental factors, other study areas were considered. For instance, when considering induced socio-economic impacts, the benefits of the Airport are Region-wide. Impacts from hauling would occur along the haul routes, with increasing impacts as the hauling activities converge upon the construction site, within the general study area. Thus, the study areas for these factors were broadened to represent where the impacts would be experienced.

__Comment R-5-3:__ *A number of comments indicated that the Draft EIS contained insufficient analysis pertaining to the cumulative impacts of the proposed Master Plan development. The following individuals made this comment: Airport Communities Coalition, Mr. Kennedy, Mr. Newby, Ms. Patterson, Regional Commission on Airport Affairs, Southwest King County Community Group, and Mr. Towe.*

__Response:__ Each section of Chapter IV, "Environmental Consequences" addresses the cumulative impacts (if any) anticipated to occur from the Master Plan Update improvements. Because of the number of comments received on the Draft EIS, a clarification of the actions included in the cumulative evaluation was included in the Final EIS in the introduction of Chapter IV.

A comment was received from the Southwest King County Community Group concerning cumulative impacts to air and water quality in regards to the additional consumption of energy and natural resources. The EIS addresses this issue on page IV.9-8 (Air Quality) and IV.22-7 (Energy).

A comment concerning the cumulative effects on surface transportation associated with the proposed on-airport hotel was received from the Regional Commission on Airport Affairs. The additional traffic levels associated with the proposed hotel would affect the terminal roadways and this analysis was addressed in Chapter IV, Section 15 "Surface Transportation" of the Draft EIS. The Final EIS includes a new appendix that focuses on the on-airport roadway system (see *Appendix O-B*) Additionally, the impacts to air quality associated with the increased vehicle trips as a result of the proposed hotel were addressed in Chapter IV, Section 9 "Air Quality".

__Comment R-5-4:__ *A number of comments were received concerning the existing air, noise and water impacts that were observed, as a result of operations occurring at the Airport. Most residents are concerned that existing air, noise and water conditions would only worsen as a direct result of the proposed Master Plan development. The following individuals made this comment: A Concerned Citizen, Airport Communities Coalition, Aircraft Noise Abatement Committee (ANAC), Mr. Alishokis, Ms. Alishokis, Ms. Allen, Mr. Akers, Ms. Amelia, Mr. Anderson, Mr. Ashunal, Mr. Austria, Mr. Bader (Ravenna-Bryant Community Association), Mrs. Balch, Ms. Bass, Mr. Bedayan, Mr. Berg, Mr. Berho Mr. Bittermann, Mr. Borgmann, Mr. D. Brown, Ms. H. Browne, Ms. Browne, Mr. Burke, Ms. Byrd, Ms. Cauble, Mr. & Mrs. Carlson, Church Council of Greater Seattle, Ms. Clark, Communities Against Noise (CAN), Mr. Clymer, Ms. Conner, Ms. Coyote, Mr. Creech, Mr. Depner, Mr. Dettman, Mr. Docherty, Mr. Driscoll, Ms. Dulaney, Mr. Eaton, Mr. Edwards, Ms. Elder, Mr. & Mrs. Engel, Ms. Engstrom, Ms. Erickson, Ms. Feckley, Ms. Ford, Ms. Gilbreath, Ms. Gates, Ms. Gendo, Ms. Gibbons, Mr. Keyes, Glen Acres Homeowners Association, Mr. Graham, Greater Federal Way Chamber of Commerce, Ms. Grubb, Mr. Hablin, Mr. Hales, Ms. Harding, Mr. Hatfield, Mr. Hauser, Mr. Helland, Ms. Heslop, Mr. Hess, Ms. Hill, Mr. Hitt, Ms. Horne-Webster, Mr. Horsley, Mr. Hoglund, Ms. Hubbard, Mr. Hultberg, Ms. Jackson, Mr. Jones, Ms. Judd, Ms. Karlinsey, Ms. Kellogg, Ms. Kemron, Ms. Kennedy, Ms. Kishida, Ms. Kishida-Haley, Mr. Klug (North East District Council), Ms. Kumar, Ms. Lang, Mr. LeCompte, Ms. Lepley, Ms. MacPherson-Krutskey, Mr. Maedche, Ms. Maes, Magnolia Community Club, Ms. Mason, Ms. Marshall, Ms. McCollier, Ms. McDougall, Mr. McGrath, Mr. & Mrs. McKinney, Ms. Moeller, Pink Keo Monorath, Ms. Moriyason, Ms. D. Miller, Mr. Miller, Ms. N. Miller, Ms. Moore, Ms. Nelson, Ms. O'Brien, Ms. Okamoto, Ms. O'Keefe, Ms. Osborne, the Osterman family, Mr. Peterson, Mr. & Mrs. Platt, Mr. Pomeroy, Prince of Peace Lutheran Church, Ms. Price, Mr. Priest, Queen Ann Community Council, Mr. Peyton (Ravenna-Bryant Community Association), Ms. Rannig, Mr. Rees, Regional Commission on Airport Affairs, Mr. Reardon, Mr. Rice, Ms. Richter, Mr. Rondaz, Mr. Rosenblatt, Ms. Ross, Mr. & Mrs. Saladis, Mr. Schuster(Wedgewood Community Council), Mr. J. Schuster, Ms. Scott, Seattle Community Council Federation, Ms. Shinyeda, both Ms. Sican's, Mr. Simons, Ms. Smith, Ms. Smith-Buehler, Ms. Sobers, Mr.*

Soltis, Ms. Sonislo, Ms. Spears, Ms. St. Laurent, Mr. Stankey, Ms. Stankey, Mr. Stark, Ms. Sternberg, Ms. Stonehocker, Ms. Swhela, Ms. Talley, Ms. Taylor, Ms. Terrell, Ms. Thomson, Mr. J. Thompson, Mr. Toepelt, Ms. Uriyu, Mr. & Mrs. Voeller, Mr. Webster, Mr. & Mrs. West, Ms. West, Mr. Whitled, Mr. Wiberg, Ms. Williams, Ms. Woodward, Ms. Yamamoto, and Mr. Yada.

Response: The existing environmental impacts associated with Sea-Tac Airport are discussed in Chapter III "Affected Environment" and throughout Chapter IV "Environmental Consequences" of the EIS. The environmental impacts anticipated to occur with the proposed Master Plan Update improvements are discussed in Chapter IV. In many instances, the environmental impacts associated with airport activity are expected to be less in the future in comparison to the existing impacts.

Comment R-5-5: *A number of commentors suggested that there have been a recent change in flight patterns. The following individuals made this comment: Mr. Akers, Ms. Allen, Ms. Amelia, Mr. Anderson, Mr. Austria, Mrs. Balch, Ms. Bass, Mr. Berho, Ms. Bittermann, Mr. Browne, Ms. H. Browne, Ms. Browne, Ms. Cauble, Ms. Coyote, Mr. Depner, Mr. Dettman, Mr. Driscoll, Ms. Nancy Dulaney, Mr. Edwards, Mr. & Mrs. Engel, Ms. Engstrom, Ms. Ford, Ms. Gibbons, Mr. Keyes, Ms. Harding, Mr. Helland, Ms. Heslop, Mr. Hess, Ms. Hill, Mr. Hitt, Ms. Horne-Webster, Mr. Horsely, Ms. Hubbard, Mr. Hultberg, Ms. Jackson, Mr. Jones, Ms. Judd, Ms. Joyce Karlinsey, Ms. Kellogg, Ms. Kemron, Ms. Kishida, Ms. Kishida-Haley, Ms. Kumar, Ms. Lang, Ms. Lepley, Ms. MacPherson-Krutskey, Mr. Maedche, Ms. Elaine Maes, Ms. Marshall, Ms. Mason, Ms. McCollier, Ms. Pink Keo Menorath, Ms. Moore, Ms. O'Brien, Ms. Okamoto, Ms. O'Keefe, Ms. Osborne, Mr. Peterson, Ms. Rannig, Ms. Rannig, Mr. Reardon, Mr. Rice, Mr. Richardson, Mr. Rondaz, Ms. Ross, Ms. Scott, Ms. Shineda, Mr. Schuster (Wedgewood Community Council), both Ms. Sican's, Mr. Simons, Ms. Smith, Ms. Smith-Buehler, Ms. Sobers, Ms. Spears, Ms. Stonehocker, Ms. Swhela, Ms. Talley, Ms. Taylor, Mr. Toepelt, Ms. Uriyu, Mr. Webster, Ms. Williams, Ms. Woodward, Mr. Yada.*

Response: The comments indicated that residents north of the Airport, particularly in Columbia City and the Rainier Valley, expressed concern over perceived increased noise exposure levels from aircraft overflights during the spring-summer of 1995. Based on these comments, the Port and FAA investigated the cause of the citizen comments. North flow arrivals and departures typically occur during VFR (good weather) conditions. Therefore, based on the number of "good weather days" that the Seattle area experienced in the spring and summer of 1995, Sea-Tac Airport operated, largely, in a north flow arrival and departure pattern. Additionally, the number of aircraft operations occurring at the Airport have grown over prior years. The increased number of aircraft operations and the increased occurrence of VFR weather conditions has resulted in additional operations to the north of Sea-Tac during good weather conditions. However, there has been no alteration in the flight patterns. In addition, the Port of Seattle has compared the flight tracks from prior periods with actual spring 1995 tracks. This comparison showed that that no changes in flight tracks are occurring to areas to the east. The FAA did discover that there was a slight drifting of tracks to the west in the Duwamish, where no comments were received. The FAA and Port are presently investigating the cause of this westerly drift.

Comment R-5-6: *Southwest King County Community Group requested that the land uses near Sea-Tac be clarified.*

Response: On page III-2 of Draft and Final EIS, the following is stated: "The majority of land surrounding Sea-Tac Airport is presently zoned 'Industrial' to permit airport-related land uses, 'Commercial' to permit the types of businesses located along SR-99, 'Urban-High or Medium' to permit the multifamily housing adjacent to SR-99, and 'Airport Use and Aviation Business Center' to permit the business park development occurring in areas directly adjacent to the airport." Thus, the majority of land directly surrounding Sea-Tac Airport is not zoned industrial only, but rather is zoned by the variety of land use classifications noted above. In addition, the SeaTac Comprehensive Plan (adopted 1994) classifies most airport lands owned by the Port of Seattle as "Airport Industrial," and retains the "Low

Density" residential land use designation for the West SeaTac area west of the airport pending completion of the West SeaTac Subarea Plan in 1996.

Comment R-5-7: *A comment was received stating that three of the future planned development items discussed in Chapter III are no longer being considered for development. Mr. Peyton (Ravenna-Bryant Community Association) stated that the RTA and the Regional Justice Facility were no longer being considered for development. Additionally, the Southwest King County Community Group commented that the Des Moines Technology Campus has not yet been accepted by the Des Moines City Council.*

Response: In March, 1995, voters from the counties of King, Snohomish and Pierce did not approve the proposed Regional Transit Authority (RTA) Plan. However, the RTA is considered a long-term regional transportation improvement project and is included in the Puget Sound Regional Council's adopted 1995 Metropolitan Transportation Plan. In addition, a revised RTA plan will likely be presented to the voters of King, Snohomish and Pierce Counties in 1996. The Final EIS surface transportation analysis includes the revised RTA Plan as described in Chapter IV, Section 15 "Surface Transportation".

The Federal Detention Center Final EIS was approved and construction has already commenced at the site. Additionally, the Federal Detention Center has been fully Federally funded for its construction. The Federal Detention Center is scheduled for operation by October, 1996 and is located at the southwestern intersection of 26th South and South 200th.

The Des Moines Creek Technology Campus Master Plan and SEPA Final EIS have been submitted for approval to the Des Moines City Council. To date, the proposed campus has not yet been approved by the Des Moines City Council. However, it is expected that the Council will vote on the Des Moines Creek Technology Campus project in the first quarter of 1996. An updated progress and status of the Des Moines Creek Technology Campus project has been included in Chapter III, "Affected Environment" of the Final EIS.

Comment R-5-8: *Mr. Frause requested that the future planned developments discussed in Chapter III, be further clarified and explained in relationship to the "With Project" conditions. Additionally, Mr. Frause requested that information on local and county future planned development; and information regarding local and county comprehensive land use plans, be incorporated into the Final EIS.*

Response: The issue of future planned development and the relationship of these regional actions to airport improvements have been clarified in Chapter III of the Final EIS. Information concerning planned development in the general study area is also included in Chapter III. Information concerning the local and county comprehensive land use plans is included in Chapter IV, Section 2 "Land Use" of the EIS.

Comment R-5-9: *The Southwest King County Chamber of Commerce commented on the effects of the existing and projected air quality impacts on the businesses along International Boulevard.*

Response: Chapter IV Section 9 "Air Quality" of the EIS contains a detailed examination of air quality conditions. In response to comments received concerning the surface transportation analysis, the surface transportation analysis was updated to reflect the current forecast plans, as was the air quality analysis. The analysis in the Draft, as well as the updated analysis in the Final EIS, shows that high concentrations of Carbon Monoxide currently exist along International Boulevard in the vicinity of Sea-Tac Airport. This analysis shows that currently, air quality conditions along this road do not exceed the hourly standard, but that the 8-hour standard is exceeded. While air pollution conditions are expected to improve in the future, regardless of the improvements undertake at Sea-Tac, the 8-hour CO standard is still expected to be exceeded. Air pollution conditions do not appear to adversely affect the business along International Boulevard.

Due to the increase in air pollution concentrations expected under the "With Project" alternatives, a number of mitigation measures are recommended. These include:

Intersection of International Boulevard and South 170th Street

- Dual, northbound left-turn lanes on International Boulevard and a high-capacity, eastbound free flowing, right-turn lane for South 170th Street.
- Relocation of employee parking at the South 170th Street parking garage to the proposed employee lot to be located north of SR 518.

The mitigation measures for this intersection would substantially decrease the amount of time in which vehicles would idle there and would reduce the amount of employee traffic accessing the South 170th Street parking garage by way of South 170th Street.

Intersection of International Boulevard and South 188th Street

- The reduction of employee parking at the South 170th Street parking garage would also reduce the employee related traffic in the existing terminal area, and at the intersection of International Boulevard and South 188th Street.

Additionally, the Port of Seattle continues to support the air quality initiatives which have been enacted in the Puget Sound Region to address regional air quality concerns. The proposed mitigation measures, as well as the air quality initiatives adopted in the Puget Sound Region, would help to reduce the potential for air quality impacts to those business located along International Boulevard.

Comment R-5-10: *The Southwest King County Community Group requested that the EIS define whether pollutants (glycol and ammonia) were initiated from Airport activities or from nearby communities.*

Response: As described by the Draft and Final EIS, Chapter IV, Section 10 "Water Quality and Hydrology", ethylene and propylene glycol are presently used in the deicing of aircraft, and urea and potassium acetate are used to de-ice runways at Sea-Tac Airport. Most of the aircraft deicing areas drain to the Industrial Waste System (IWS). However, some glycol and ammonia (from urea) have been observed in stormwater runoff. Because deicing is needed only a few times each year, relatively small quantities of these substances are used annually during Airport operations compared to other large airports.

Some heavy metals, particularly copper, lead and zinc appear to violate both chronic and acute toxicity standards for aquatic life. National and local studies of urban runoff have shown that copper, lead, and zinc are generally the most common and abundant metals in urban runoff. Therefore, Urban and Airport stormwater runoff contribute to elevated levels of pollutants in Miller and Des Moines Creeks during storms.

Comment R-5-11: *Southwest King County Community Group requested that the EIS substantiate the claim that existing surface waters generally appear good.*

Response: There are a number of surface water and ground water resources within the Airport area. Surface waters include Miller and Des Moines Creeks (and their tributaries) and Puget Sound. Miller and Des Moines Creeks are Class AA (extraordinary) with regard to water quality standards. As discussed in Chapter IV, Section 10 "Water Quality and Hydrology", the water quality generally appears to be good within the surface waters of Miller and Des Moines Creeks based on the presence of resident and anadromous salmonid populations (i.e. trout and salmon). Salmonids, which require cold, clean water, generally are indicators of good water quality.

__Comment R-5-12__ *: Mr. Frause requested information on habitat impacts in the project area as a result of the proposed airport improvements. Specifically, the commentor inquired about the fate of the areas not characterized as managed grassland.*

__Response:__ Refer to Chapter IV, Section 16 "Plants and Animals", for a more detailed description of the habitat impacts.

NOISE

__Comment R-6-1A__: *A number of commentors expressed concern about current levels of noise in the airport environs. Other commentors stated that they had not perceived a reduction in noise in recent years. Still others commented that noise has become worse in recent years or aircraft do not follow established procedures. The following individuals or groups made this comment: the Airport Communities Coalition, Ms. Brown, Mr. Frause, Mr. Forrey, Ms. Gates (City of Federal Way), Ms. McDougall, Mr. McGrath, Mr. Peyton (Ravenna-Bryant Community Association), Mr. Priest, Regional Commission on Airport Affairs, the Southwest King County Community Group, Mr. Wiberg, and Mrs. Whitled.*

__Response:__ Existing noise levels are detailed in Chapter IV, Section 1 "Noise" and Appendix C of the EIS. The patterns of noise exposure are representative of the use of flight management programs developed in past years, including the FAA's Four-Post air traffic control system, the initial runway heading departure procedures for jets, and the Port of Seattle's Noise Budget and Nighttime Limitations programs. Noise level reductions are demonstrated by the change in exposure identified by earlier planning studies. Every effort was taken to assure that the noise contours presented in this EIS for the existing conditions reflect average annual operational characteristics in 1994.

__Comment R-6-1B__: *A number of commentors expressed disbelief or found illogical the disclosure that future noise contour sizes would be reduced, given the addition of a third parallel runway and the addition of operations by passenger and heavy cargo aircraft. Other commentors are concerned that the Master Plan Update will increase noise over certain neighborhoods. The following individuals or groups made this comment: Regional Commission on Airport Affairs, Ms. Brown, Mr. Derrick (King County Department of Development and Environmental Services) Mr. Carpenter, Mr. Creighton, Mr. Frause, Mr. & Mrs. McKinney, Mr. Miedema, Regional Commission on Airport Affairs, Mr. Rolfs (City of SeaTac), Mr. Rosenberg, Mr. Schneider, Seattle Community Federation, and the Southwest King County Community Group.*

__Response:__ In accordance with Federal Aviation Regulation (FAR) Part 36, aircraft are categorized as Stage 1, Stage 2 and Stage 3 (the quietest). The Airport Noise and Capacity Act requires the phase-out of Stage 2 aircraft by year 2000. Stage 1 aircraft were phased-out in 1985. Due to advanced engine technologies and better design, each Stage 3 aircraft produces only a fraction of the noise energy produced by a similarly sized Stage 2 aircraft. To produce approximately the same total noise energy level, it would be necessary to increase the numbers of forecast Stage 3 operations by a factor proportionate to the ratio between the noise energy of the Stage 2 and Stage 3 aircraft. For example, if a Stage 2 aircraft is ten decibels louder than a comparably sized Stage 3 aircraft, ten times as many Stage 3 operations would be required to produce the same total noise level. In locations with mixed Stage 2 and Stage 3 operations, each Stage 2 aircraft removed from the fleet could be replaced by approximately ten similarly sized Stage 3 aircraft without enlargement of the noise exposure area. At Sea-Tac, the forecast increase in operations is approximately 30% over the next 25 years. The noise reduction results from the phase-out of Stage 2 aircraft would more than offset that growth in operations. Consequently, for the Do-Nothing alternative, the current noise contour sizes would exceed each future condition.

If one were to overlay the contours of the existing conditions (1994) on each individual future case (2000, 2010, 2020 for Alternatives 1 through 4), the areas beyond the anticipated boundaries of the

Airport are currently exposed to more noise energy than would occur in a foreseeable future year. A comparison of the "With Project" contours to "Do-Nothing" contours for the same year demonstrated that in each case, the development of a third parallel runway would slightly increase the size of the noise exposure pattern for that year. This occurs due to the re-distribution of noise energy among two or three runways. However, areas where significant noise exposure would result from the proposed improvements (an increase of 1.5 DNL or more at noise sensitive uses within 65 DNL) have either already been mitigated through the Port's existing Noise Remedy Program or are proposed for mitigation through the actions included in this EIS.

***Comment R-6-2**: Mr. Peyton (Ravenna-Bryant Community Association) and the Southwest King County Community Group requested clarification of the basis for a 1.5 DNL threshold of significance.*

Response: The FAA has determined that an increase of 1.5 decibels in the DNL level at any noise-sensitive location falling within the 65 DNL noise exposure contour is significant. This increase equates to an increase of approximately 41% in total noise energy, with a perceived increase of about 15% (based on a doubling of perceived noise with each ten decibel increase in overall DNL level) and an increase of approximately 3 percent in the proportion of persons highly annoyed by aircraft noise at 65 DNL. The 1.5 decibel or greater change at 65 DNL is established by FAA Order 1050.1D as the threshold requiring analysis of impacts in greater detail. Table IV.1-2 discloses the locations where noise increases are projected to exceed this thresholds of significance.

***Comment R-6-3**: Several commentors are concerned that the noise contours are inaccurate, as they do not reflect: a) new aircraft types; b) flights exempted from the Port's noise budget and nighttime limitations programs; c) ground noise; d) maintenance run-ups; e) commuter flights; f) helicopters; g) certain air traffic control procedures; h) flight procedure adjustments; and I) "the Port of Seattle current noise monitoring is the sole basis for the noise projections". The following individuals or groups made one or more expressions of this comment: Regional Commission on Airport Affairs, Mr. Peyton (Ravenna-Bryant Community Association), Regional Commission on Airport Affairs, Mr. Scarvie, and the Southwest King County Community Group.*

Response: The noise exposure analysis included in the EIS addresses each of the concerns expressed by the commentors. The following paragraphs individually outline the steps in the methodology that address each concern.

a) Commentors cited the Boeing 777 and new-generation SST as being absent from noise evaluations. While it is true that information on the B-777 has not yet been made available in format for inclusion in the noise model, the FAA Office of Environment and Energy has approved the use of the B-767-200 with JT-9-D as having equivalent noise levels and flight characteristics. In accordance with FAA requirements, that substitution was used for the projection of future noise levels generated by both the B767 and B777 aircraft. No noise data is presently available for the new-generation SST, although the FAA published a policy statement that it expects "any future SST airplane shall produce no greater noise impact on a community than a subsonic airplane certified to Stage 3 noise limits."[9] Its use at Sea-Tac is not forecast by the Master Plan Update, nor was it specifically incorporated into the computer input files for noise computations. However, as the SST would meet Stage 3 levels, another existing aircraft would likely serve as a surrogate, similar to the B-777 surrogate described earlier.

b) Although certain flights are exempted from restriction under the Port's noise budget or nighttime limitations program, all fixed-wing aircraft operations occurring at Sea-Tac were included in the development of noise exposure contours. See also response to comments R-6-28 and R-6-29.

[9] Federal Register, Vol. 59, No. 149, August 4, 1994, pg. 39679-80.

c/d) The noise effects of aircraft operating on the ground are considered in several ways in the noise exposure analysis: noise from aircraft taking-off or landing on the runway is incorporated into the flight mode evaluation of the simulation; taxi noise is incorporated through application of special Integrated Noise Model modeling techniques developed in conjunction with the FAA and the Volpe National Transportation Research Center at Massachusetts Institute of Technology; run-ups are a standard input component of the INM and frequency of occurrence information was derived from airport records for simulation.

e) Operations by commuter aircraft are included in all noise evaluations as evidenced by the large number of turboprop aircraft in the forecasts and operational mix (Tables C-2, C-9, C-10 and C-11).

f) Helicopter operations are not incorporated into the noise modeling for two reasons. First, a limited number of helicopter operations occur at Sea-Tac and the Master Plan Update did not forecast that helicopter users would become prominent in the future. Furthermore, the total noise energy level generated by helicopter aircraft is so much less than that produced by fixed wing aircraft that they would not appreciably change the noise contour patterns surrounding the Airport.

g) One commentor questioned why an LDA procedure, which was included in the FAA's 1995 Capacity Enhancement Plan Update, was not included in the noise modeling. Another commentor questioned why flight tracks indicated on the 1982 Part 150 Noise Exposure Map were not modeled. Both concerns are the result of using outdated information. See response to comment R-3-21B concerning the LDA. The flight tracks which indicated early turns from the Airport were not used because earlier studies had recommended the use of straight-out departure courses. The flight tracks used in development of the baseline and future noise exposure patterns were based on Automated Radar Terminal System (ARTS) data as described in Appendix C of the Draft and Final EIS.

h) One commentor expressed concern that aircraft takeoff profiles included in the data base of the INM were not adjusted to eliminate a problem found during a 1981 study of departure climb procedures at Sea-Tac. The study cited by the commentor was a review of flight profiles included in Versions 1 and 2 of the Integrated Noise Model (INM). INM Version 3.8 was released in 1983 to partially correct the discrepancies between observed and actual climb profiles. Further corrections were made to the climb descriptions of several of the loudest Stage 2 aircraft during a revision of the model's data base in 1993. Until the release of Data Base 10 in 1993, the model assumed that many Stage 2 aircraft using JT8D engines would maintain takeoff power until reaching 3,000' altitude. Profiles for these aircraft were modified with the release of Data Base 10 to reflect profiles as actually flown by the carriers. They incorporated thrust reduction segments in accordance with Advisory Circular 91-53 "Noise Abatement Departure Procedure", resulting in shallower climbs than had previously been modeled. These also adjusted the thrust settings used by aircraft during takeoff climb to reflect the use of thrust cutbacks between 1,000 and 3,000 feet of altitude. The revised and more accurate profiles have been a part of the standard model data base since 1989. The release of INM Version 4 in 1993 provided the capability to adjust profiles for variations in airport elevation and temperature, a feature which was not available on previous models and which is designed to introduce greater accuracy into the modeling process. Numerous reviews at many airports have indicated that differences between profiles flown and profiles in the model do not warrant modification of the profiles unless special thrust control measures are in effect at an airport.

i) One commentor expressed the belief that the noise analysis presented in the EIS is based "solely" on the noise monitoring program conducted by the Port of Seattle. As is discussed in Chapter IV, Section 1 "Noise Impacts", the analysis is based on an extensive review of airport operating conditions. A computer model, the Integrated Noise Model Version 4.11 was then used to project the impacts that are expected to occur in the future with and without the proposed Master Plan Update improvements. These computer projections have been contrasted with the actual measurements conducted by the Port. See response to comment R-6-5 which shows a strong correlation between the actual measurements and the computer projections.

__*Comment R-6-4*__: *The Airport Communities Coalition expressed concern that the noise contours are based on generic flight tracks and flight profiles and emissions and are inaccurate. The same reviewer suggested that the INM is highly sensitive to different sets of operational assumptions.*

__Response:__ The INM contours are sensitive to modifications in average operating conditions, rather than the effects of single occurrences. When the input data reflects the average conditions used by more than 300,000 flights, as each alternative does, major changes in the operation of the Airport must be accomplished to result in large changes to the contours. Based on the Port's sophisticated ANOMS System, an extensive review of flight tracks was conducted to ensure that the most accurate average flight tracks were used to assess noise exposure conditions.

Factors which would result in substantial changes in the contours include: the addition/relocation of another runway, particularly in a nonparallel alignment; a general revision of flight track locations near the Airport, especially as departures turn from runway heading; an adjustment in the percentages of north and south flow: a large change in the number of average day operations, as is the case with the three future years of projection. The commentor also suggested that noise levels would be affected by variations in global and national economies and security. While this is true, the general planning for the Master Plan Update and this EIS is based on reasonably foreseeable conditions and does not incorporate unforeseeable events that could occur.

__*Comment R-6-5*__: *Several commentors objected to the location of noise measurement sites in the Airport environs for the projection of contour locations. Others objected to the development of noise contours without noise measurements and demanded that the model be calibrated to noise measurements. Others question the differences between the noise contours disclosed on the Port's 1991 Part 150 Noise Exposure Maps and the Draft EIS contours. The following individuals or groups made one or more expressions of this comment: Airport Communities Coalition, Ms. Brown, Mr. Dinndorf (Puget Sound Regional Council), the Regional Commission on Airport Affairs, and Mr. Scarvie.*

__Response:__ The Integrated Noise Model has undergone a series of updates over the last fifteen years. The Noise Exposure Maps for the Airport, published in 1991, were developed with Version 3.9 of the INM, which was state-of-the-art at the time. The contours developed for the Draft and Final EIS were calculated using the then most recent Version 4.11 of the model. The data base information in Version 4.11 is updated from earlier versions, particularly in its more accurate definition of departure profiles flown by several aircraft equipped with JT-8D engines (B-727, B737-200, DC-9 and MD-80s). The revised profiles provide for the use of a thrust reduction initiated at approximately 1,200 feet altitude -- a procedure which has been in general use by air carriers for several years, but only incorporated into the model in June 1992. The revisions result in smaller contours for the same fleet mixes and numbers of operations, particularly if the JT-8D-equipped aircraft constitute a significant portion of the fleet. This is the reason that population and dwelling counts affected by 65 DNL from the Part 150 Study's 5-year forecast noise exposure contours (1995 Noise Exposure Map) are substantially larger than the same data for the existing conditions (1994) in this EIS.

The noise exposure contours for the EIS existing conditions were not developed using noise measurements collected at the Port of Seattle's noise monitoring sites. Noise monitoring sites are not sufficient in numbers and are not located at distances far enough from the Airport to be used in the delineation of the noise exposure contours. Although there are sufficient sites near the airport to provide information for input adjustment, the absence of sites at greater distance preclude the full array of data necessary for the modification of input information. Noise levels were computed for the baseline condition at each noise monitoring site as part of the grid analyses for this EIS. These are disclosed below in comparison to the measured level during the same period.

	LDN (dBA) Levels		
Location	Existing (1994) Noise Contour	1994 Measured Level	Difference
NMS-1	67.8	68.9	0.9
NMS-2	65.3	68.9	3.6
NMS-3	70.8	71.2	0.4
NMS-4	78.4	79.6	1.2
NMS-5	65.6	66.9	1.3
NMS-6	76.1	77.6	1.5
NMS-7	70.8	70.0	-0.8
NMS-8	68.2	68.1	-0.1
NMS-9	64.8	67.6	-3.2
NMS-10	68.0	69.2	1.2
NMS-11	70.3	73.9	3.6

Source: - Existing noise data extracted from INM evaluations by Landrum & Brown, 1995. Measured noise levels for 1994 supplied by Port of Seattle Noise Abatement Office for January through December 1994.

The locations of the Noise Monitoring System (NMS) sites are illustrated on Exhibits C-19 and C-20. The measured and calculated noise levels at each of the permanent monitoring locations used by the Port of Seattle generally fall within the bounds of reasonable expectation, typically described as three decibels. At sites NMS-2 and NMS-1, the measured level is 3.6 decibels greater than the computed level. Differences in exposure may be explained in part by a greater number of departures to the south during the twelve months of 1994 than was used in the development of existing contours, which reflect a south flow use percentage for 1993 and 1994. Site NMS-2 is exposed to more departure noise, while Site NMS-11 is near the Airport and exposed to a combination of back blast from south departures and approaches from the north. Measured noise levels also may include noise contributed to a location by sources other than aircraft.

Comment R-6-6: The Southwest King County Community Group expressed concern that contours were developed using Version 4.11 of the Integrated Noise Model (INM), rather than Version 2.7 as had been used in evaluations associated with a lawsuit.

Response: The latest version of the model in effect when a study is started is used for the development of all noise contours, unless special provisions are made for revisions using more recent updates released during the planning process. In this case, Version 4.11 was the most recent available version of the model. Contours using Version 3.9 of the INM are presented in Appendix C. This commentor referred frequently to INM Version 2.7 which has been obsolete since 1983. However, evidence produced in the west side law suit at Sea-Tac included historic sets of noise exposure contours which were developed with both Version 2.7 and later versions of the Integrated Noise Model.

Comment R-6-7: The Regional Commission on Airport Affairs submitted several comments concerning litigation that occurred in Chicago and the testimony provided by the Sea-Tac Airport EIS consultant project manager in that litigation.

Response: The Regional Commission on Airport Affairs referred to litigation (Ryan vs. City of Chicago), in which DuPage County brought suit against the City of Chicago (operator of Chicago O'Hare International Airport) concerning aircraft noise impacts on education. Ms. Mary Vigilante, then of Landrum & Brown, provided expert testimony in the case on behalf of the City of Chicago. Ms. Vigilante submitted an affidavit concerning how noise exposure from aircraft operations at O'Hare had declined between 1979 and the late 1980s. In accordance with a 1982 Court Decree and Intergovernmental Agreement, the noise exposure contours developed for O'Hare used an early version of the Integrated Noise Model (INM Version 2.7). Until recently, the City of Chicago or its consultants did not have reliable information concerning runway usage and flight tracks in use. Therefore, during that litigation, the plaintiffs attorneys asked numerous questions concerning the accuracy of the noise modeling process. Ms. Vigilante indicated that in lieu of information from the FAA's radar system, surrogate data had to be used. In addition, the plaintiff's attorneys requested that all of the underlying data used in the development of the noise contours be disclosed. The City of Chicago and Landrum & Brown complied with this request to the best of their ability, given the aged nature of many of the data elements. Following the request, the plaintiff's attorneys, as supported by the Court, requested that Landrum & Brown supply the plaintiff's with a step-by-step outline of how the noise model input data was constructed and provide greater detail concerning how the data in the affidavit was developed. Due to cost, the City of Chicago withdrew the affidavit.

Independently, the State of Illinois Department of Aeronautics (IDOT) was asked to evaluate the techniques used by Landrum & Brown in developing noise exposure contours for O'Hare. IDOT contracted with another consultant to review the data and assumptions used in the most recent contours, prepared with INM Version 3.11 as part of a Part 150 Noise Compatibility Study. Recognizing the limitations of data availability concerning flight tracks and runway use, the consultant recommended several improvements in Landrum & Brown's modeling process, although the consultant determined that this would have little or no effect on the accuracy of the contours that had been produced.

At Sea-Tac, the Port of Seattle has operated a sophisticated aircraft tracking system that uses data from the FAA radar system. Thus, these issues do not apply to the noise modeling at Sea-Tac.

Comment R-6-8: *Several commentors are concerned that the DNL metric using A-weighted decibels does not adequately reflect anticipated changes in the noise levels associated with the future conditions, but rather, the frequency of operation should be evaluated as well. The following individuals or groups made one or more expressions of this comment: Ms. Brown, Mr. Burke, Mr. Rohlfs (City of SeaTac), Mr. Furney, Ms. McDougall, Ms. Moeller, Mr. Peyton (Ravenna-Bryant Community Association), and the Regional Commission on Airport Affairs.*

Response: The DNL metric has been adopted for use as the principal metric in the evaluation of noise levels by all members of the Federal Interagency Committee on Noise (FAA, DOD, HUD, EPA, DOT) because it considers both the loudness of exposure and the duration of exposure (described as a function of the number of events on an average day). The A-weighting of the metric was developed to account for the sensitivity of the human ear to frequency levels produced by jet aircraft engines. Additional metrics have been provided in Appendix C of this EIS to describe single event noise levels, as well as the time that locations would be exposed to noise of various levels.

Comment R-6-9: *Several commentors requested that the noise analysis disclose: a) the distribution of DNL, single event and time above information in areas beyond the study area; b) single event patterns in north flow operations; c) population or noise sensitive facilities exposed to noise levels below 60 DNL. The following individuals or groups made one or more expressions of this comment: Airport Communities Coalition, Airport Noise Abatement Committee, Ms. Brown, Mr. Bullard, Mr. Burke, Ms. Gates, Mr. Peyton (Ravenna-Bryant Community Association), Regional Commission on Airport Affairs, Ms. Stuhring, and the Seattle Community Federation Council.*

Response: a) The EIS presents information on several metrics other than DNL at more than 1,200 separate locations within a study area which reaches well beyond the 65 DNL noise exposure contours for existing and future cases. These metrics include the 24-hour Leq, peak Sound Exposure Level, and duration (in minutes) each site is exposed to noise above 65, 75, 85, 95 and 100 decibels, as well as the DNL. The guidance provided by FAA Order 5050.4A requires the use of noise contours of 65 DNL and more, but suggests the use of a more detailed grid analysis if the proposed improvements are likely to benefit from additional analysis. This is the basis of the provision of the extensive grid tables and supplemental metric information presented for each alternative in Appendix C.

b) SEL footprints are presented in Exhibits C-2 through C-7 for single operations by several different representative aircraft types operating in both north and south flow conditions. Exhibits C-22 and C-23 indicate the location of flight tracks used in development of noise analyses for both the Draft and Final EIS which fall beyond the study area.

c) The determination of the number of persons, dwellings, or noise-sensitive facilities of various types in areas well beyond the 60 DNL is not required under the guidance provided by FAA Order 5050.4A. While such information might be interesting, it would not be particularly reliable or useful, because as modeled aircraft noise levels are decreased, the variability in the horizontal and vertical location of the aircraft increases to levels beyond the ability of the INM to adequately calculate. The model has internal limitations of 200 flight tracks and 200 different climb or descent profiles. These limits make computation of general contours at low DNL levels for multi-aircraft fleets unreliable. Within the 60 and 65 DNL contours, the variability is generally low enough to adequately define noise contours without substantive errors. Consequently, the lower levels of noise are rarely computed and impact levels within such lower contours are not available.

Comment R-6-10: *Airport Communities Coalition, Mr. Frause, Regional Commission on Airport Affairs, and the Southwest King County Community Group questioned why the 60 DNL was developed if it was not used for analysis.*

Response: The 60 DNL is used in the EIS, as the existing 60 DNL contour guided the location of the study area for the evaluations. Based on experience, it is generally assumed that the existing 60 DNL would contain all future 65 DNL contours, assuming that the alignment of the runway system is not significantly changed and the scheduled phase out of Stage 2 aircraft proceeds unimpeded. The Federal Interagency Committee on Noise (FICON) found in August 1992 that "...With respect to health and welfare effects, there is not a sufficiently large body of scientific data on the effects of aircraft noise around civilian airports and military air bases to warrant the mandatory inclusion of DNL 60 or lower contours in environmental impact analyses. Additionally, there has not been any generally accepted research that shows significant effects of aircraft noise at this level that would impact the public health and welfare."

Comment R-6-11: *Several commentors expressed concern that a Stage 3 fleet with increased operations will not be quieter than current conditions with a mixed Stage 2/Stage 3 fleet. The following individuals or groups made one or more expressions of this comment: Airport Communities Coalition, Ms. Brown, Mr. Rohlfs (City of SeaTac), Mr. Peyton (Ravenna-Bryant Community Association), Regional Commission on Airport Affairs, Southwest King County Community Group, Mr. Wiberg, and the Seattle Community Federation Council.*

Response: The phased change from a Stage 2 to Stage 3 fleet is set forth by the 1990 Airport Noise and Capacity Act and Federal Aviation Regulation Part 91. The conversion by carriers may be met by either 1) removing a percentage of its Stage 2 aircraft from operation by given deadlines, or 2) adding sufficient Stage 3 aircraft to its fleet to meet required percentages. Under the law, exemptions may be granted for up to four years, but all such requests for interim exemptions have been thus far denied.

Deadline	Phase-Out of Stage 2	Phase-In of Stage 3
12/31/94	25%	55%
12/31/96	50%	65%
12/31/98	75%	75%
12/31/99	100%	100%

The amount of noise energy present as a result of each alternative is a function of the loudness of individual aircraft, the numbers of those individual aircraft present in the average daily fleet, the number of flights during an average day, and the time at which the aircraft operate. The level of noise allowable under Federal Aviation Regulation (FAR) Part 36 increases as the number of engines and the weight of the aircraft increases. Consequently, some heavy Stage 3 aircraft are louder than some light Stage 2 aircraft. However, for aircraft which are the same weight, Stage 3 aircraft are quieter than Stage 2 aircraft.

Since noise energy is a logarithmic function, each increase of ten decibels represents a ten fold increase in noise energy. Therefore, if the noise levels of Stage 3 aircraft are only 3 decibels less than those of equivalent Stage 2 aircraft, it would be necessary for the number of Stage 3 operations to be doubled to obtain the same total energy level, assuming that the times of operation were the same in both cases.

Generally, Stage 3 aircraft are ten or more decibels quieter than equivalently used Stage 2 aircraft. Comparing Exhibit C-2 or C-2A (Stage 2 aircraft) to Exhibits C-3, C-4 or C-6 (Stage 3 aircraft) in Appendix C demonstrate the magnitude of the reduction between Stage 2 and Stage 3 aircraft. Therefore, although the number of operations are forecast to increase by 30% over the next 25 years, and many aircraft would fly long distances (with slower initial climb gradients) the level of energy associated with the operating fleet would be reduced. The comparisons of noise levels for the Do-Nothing cases at almost all locations in the Airport environs would demonstrate this reduction. For example, at grid location 963, Highline Community College the average day energy level for the 1994 day is 2.4 times the expected energy level in 2020, despite an increase of 30% in operations by that year.

__Comment R-6-12__: Ms. Brown, the Regional Commission on Airport Affairs, and the Southwest King County Community Group expressed concern that the projected increase in cargo operations was not adequately reflected by the noise model. These concerns cited increased operations at Christmas and during the summer, flights from origins where noise controls are more lenient, and changes in Stage 3 implementation schedules.

__Response:__ The noise exposure analysis presented in the EIS reflects existing activity and the activity in future years as forecast by the Master Plan Update. These forecasts incorporate not only increases in operations, but also anticipated changes in fleet mix as a result of both the introduction of new aircraft types and the scheduled transition of fleets from Stage 2 to Stage 3. Several cargo carriers have expressed an interest in and have begun preparations for the conversion of Stage 2 aircraft to Stage 3 noise levels through engine modification or re-engining. Such modifications were included in the noise projections for the year 2000. By the year 2010, all such aircraft are expected to be replaced by aircraft originally built to Stage 3 specifications. See response to comment R-3-13 concerning the cargo forecast.

Operations at specific times or during different periods of the year are not modeled separately, but rather are included in the averaging of operating conditions and displayed within the average annual day. For example, all B-747-400 aircraft expected to fly a Pacific Rim route during the projected year are included in a type/destination/time group which is then distributed over the flight tracks used by that group in proportion to its current usage.

__Comment R-6-13__: A number of commentors are concerned about the usage of the proposed third runway. These comments fell within four general groups: a) those requesting information on the number of operations to be expected on the runway; b) those requesting clarification of the projected users of the runway; c) those questioning that the runway would be used only in poor weather; and d) those desiring to see the effects of use of the runway for larger numbers of departure operations. The following individuals or groups made one or more expressions of this comment: Airport Communities Coalition, Ms. Brasher, Mr. Clifford, Greater Federal Way Chamber of Commerce, Mr. Hogland, Mr. Miedema, Regional Commission on Airport Affairs, Mr. Scarvie, Southwest King County Chamber of Commerce, and the Southwest King County Community Group.

__Response:__ a)Based on uses associated with each weather condition identified by the 1995 Capacity Enhancement Plan Update, in future years, the runway is expected to be used by 15.4% of all landings and 3.9% of all departures. South flow operations are expected 63.9% of the year and north flow is expected 36.1% of the time. The average annualized daily number of operations projected to use the proposed new parallel runway with a length up to 8,500 feet are as follows:

Year	Landings	Takeoffs
2000	80	20
2010	86	22
2020	93	24

Note: The numbers above reflect average annual daily operations. Conditions in any one year or on one day could be greater or less. See also response to comment R-10-15.

b) The EIS assessed the various types of aircraft that are capable of using the proposed new parallel runway. A runway with a length up to 8,500 feet is adequate to accommodate landings by virtually all of the aircraft using Sea-Tac. All but the largest/heaviest wide-body aircraft could use the runway for departures. The primary usage of the runway is expected to be for arrivals, to enable dual arrival streams during poor weather conditions. However, on occasion, such as peak departure periods or when a runway is undergoing maintenance, the proposed new parallel runway could be used for departing aircraft. Appendix C, Table 20 provides a summary of the percentage use.

c) The projected use of the proposed third runway represents the best estimate of how the runway would be used as prepared by aviation professionals, including air traffic control personnel, FAA capacity staff, Port of Seattle staff, and the EIS consultants. The runway uses are based on the findings of the FAA's Capacity Enhancement Study Update (1995) which considered six separate weather conditions. That study found that the proposed third parallel runway would be used principally for arrivals during weather conditions(Approximately 44% of the year) when visibility is less than 5 miles and ceilings are less than 5,000 feet. Appendix C Section 3.3.1 explains the basis of the projected runway usage. See also the response to comment R-10-15 for a more comprehensive treatment of the use of the proposed runway.

d) If the proposed third parallel runway were used for more departures than is projected, the noise exposure pattern would be expected to enlarge. The use of the runway by a large number of departures would however defeat the purpose of its proposed construction by reducing its availability for arrivals. Among the Stage 3 aircraft which would comprise the future operating fleet, the noise pattern associated with departures is much less pronounced than that of Stage 2 aircraft. Consequently, even if the runway were used for more departures than projected, the Stage 3 aircraft would produce overall DNL contours which are markedly smaller than the Stage 2 contours presently experienced by Aircraft neighbors.

__*Comment R-6-14*__: . *Mr. Akers, the Airport Noise Abatement Committee, Ms. Brasher, Ms. Hetzel, Ms. Ford, Mr. McGrath, Regional Commission on Airport Affairs, and the Southwest King County Community Group questioned how the flight tracks used in the noise analysis were developed and how they are used.*

__Response:__ Flight tracks actually flown from the Airport were used to develop the noise patterns, rather than tracks developed by theoretical definition of the noise abatement and standard operating procedures. For this analysis, flight tracks for existing conditions were developed through an assessment of ten days of Airport Radar Tracking System data compiled during 1994 by the Port of Seattle's Airport Noise and Operations Monitoring System (ANOMS). The INM flight tracks were developed to represent the average flight corridors used by more than 9,000 aircraft as captured by the radar for north and south flow conditions. The ARTS data for north flow departures generally reflect the use of jet noise abatement procedures which call for runway heading climbs until reaching altitudes of 4,000 feet Mean Sea Level (MSL) or more prior to the initiation of easterly turns. In south flow, departures may initiate turns at 3,000 ft MSL. The radar assessment did, however, show that departing jets track outbound along headings slightly to the left of the runway heading. The flight tracks were developed for the model to reflect this condition. During the late night hours, the use of the Duwamish departure over Elliot Bay was more prevalent than the runway heading procedure. Night track assignments were made to accommodate the greater use of that procedure.

Flight track assignments were made by importing the flight tracks from the ARTS into a Geographic Information System. Consolidated flight tracks for heavy jet, standard jet and propeller aircraft were then defined which represented corridors of operation by each group within 20-30 miles from the Airport. The data base of associated user information for each track was accessed to determine, from each runway, the proportion of operations by each group along each consolidated flight track during the day and night hours. Where more than one corridor was appropriate to describe the routes flown from Sea-Tac to another location, multiple tracks were defined. The track distribution data was then processed to a format suitable for computation using the Integrated Noise Model.

Comment R-6-15: *Several commentors expressed concern that flight track maps provided in Appendix C did not extend far enough from the Airport for them to determine the anticipated impact the project would have over areas beyond the study area. The following individuals or groups made one or more expressions of this comment: Airport Noise Abatement Committee, Ms. Brasher, Mr. Hetzel, Magnolia Community Club, and Mr. Peyton (Ravenna-Bryant Community Association).*

Response: Flight tracks beyond the study area are illustrated in Exhibits C-22 and C-23 which has been included in the Final EIS to clarify track locations used in modeling.

Comment R-6-16: *Mr. Scarvie and Southwest King County Community Group questioned why the EIS did not present the number of operations along each flight track. Instead, the EIS presents the percentage use of the tracks.*

Response: Tables C-14, C-15, and C-16 provide proportions of usage for the tracks used during the future Do Nothing alternative, while Tables C-21, C-22, and C-23 present the utilization under "With Project" alternatives. Details of the assignments of individual aircraft types are available in the input files for each alternative in the Administrative Record at the FAA Northwest Mountain Regional Airports Office. Their inclusion in the EIS has been made by reference, and the materials are available to any individual or group during normal business hours.

Comment R-6-17: *The Regional Commission on Airport Affairs and Mr. Rozdilsky expressed concern that run-up activity was not addressed in the noise modeling.*

Response: Noise generated by aircraft during run-up is one of several components evaluated by the noise model. The average day number, duration of run-ups, and type of aircraft were included in the assessment of noise exposure conditions. The noise energy from run-up activity was combined with flight and ground taxi noise to develop an overall portrait of the noise exposure pattern on an average annual day. Also, run-up activity is actively controlled on the airfield. Restrictions are in place which limit the conduct of run-ups during the late night hours, and all run-ups are conducted at positions on the airfield which are selected to minimize their effect on nearby neighborhoods. The assessment of run-up activity is described in Appendix C.

Comment R-6-18: *Several commentors asked for explanations of terminology used in the Draft EIS. These included: a) exposure vs. contour; and, b) "north threshold staggered south". The following individuals or groups made one or more expressions of this comment: Mr. Frause, and Ms. Stuhring.*

Response: a) The terms exposure and contour are often used interchangeably. ***Exposure*** refers to a pattern of noise, or level of that noise. ***Contour*** refers to a line connecting points of equal levels of noise.

b) The term referenced by the commentors pertains to the 7,500 foot long runway assessment. A "north threshold staggered south" means that the north end of the 7,500 foot long proposed new runway would begin south of the north end of the existing runways.

__Comment R-6-19__: *Two commentors asked for information on weather conditions during periods of measurement from which contours were developed. Another commentor asked for clarification of the effect of topography in the Rainier Valley on noise levels in that area. The following individuals or groups made one or more expressions of this comment: Mr. Burke, Mr. Frause, and Ms. Hill.*

__Response:__ The noise contours presented in the EIS were prepared using the Integrated Noise Model, a computer simulation model which computes noise levels for an average day of operation. Field measurements were not used to develop the locations of the noise contours. See Appendix C for the input used in development of the noise exposure patterns.

Noise levels reverberate in valleys where the source of noise is at a low angle to the receiver (close to the horizon). When the source is at a high angle to the receiver and the valley is relatively broad or shallow, as is the Rainier Valley, the reverberation is less pronounced, if at all. INM Version 4.11 takes into account topography when computing noise exposure. Aircraft noise models however, are not yet capable of computing reverberative effects of noise over variable surface covers (trees, clear areas, structures, etc.). Even so, the area is sufficiently distant from the areas of significant noise exposure that there is little likelihood that a reverberative effect would increase noise levels above 65 DNL.

Version 4.11 of the Integrated Noise Model enables the noise exposure contours to reflect surface elevation as a factor in noise levels on the ground. The slant range distance from individual aircraft flights to ground locations is calculated, appropriate noise levels are determined for that distance/thrust combination, and the associated noise energy is summed for all operations affecting the location. Topography is one of several factors used in determining the distance between the aircraft and the ground site.

__Comment R-6-20__: *Ms. Brown and Mr. Scarvie expressed concern about how noise patterns are affected by noise deflecting from walls and buildings.*

__Response:__ The Integrated Noise Model assumes a flat and grassy surface when computing noise contours, adjusted for variations in topography (see response to comment R-6-19). Interruptions by structures or forested areas to the flow of noise would, in reality, result in lower levels than the model predicts. If the barrier lies beyond the receiver from the source of noise, the barrier may reflect noise back on the receiver. The model is not yet capable of incorporating the reflective characteristics of berms and barriers. These features, however, are generally of a highly localized nature and do not substantially affect the location of the noise contours.

__Comment R-6-21__: *Three commentors expressed concern that noise from a combination of traffic using Sea-Tac and other airports creates a higher noise exposure than would Sea-Tac alone over neighborhoods north and west of downtown Seattle. The following individuals or groups made one or more expressions of this comment: Magnolia Community Club, Mr. Scarvie, and Mr. Wiberg.*

__Response:__ Noise contours prepared for Boeing Field for the years 1993, 1998 and 2008[10] were evaluated relative to the contours presented in this EIS for the existing, 2000 and 2010 cases. In the combined existing case (1993 Boeing Field and 1994 Sea-Tac), only one area which does not fall within the 65 DNL contour for one of the two airports would be included within a combined 65 DNL contour

[10] Although these contours were prepared for an update of the Boeing Field King County International Airport Part 150 Study, they have not yet been submitted to the FAA for acceptance as official Noise Exposure Maps.

for aircraft noise. This area is at the far north end of the existing Sea-Tac 65 DNL, in an area which consists of industrial land adjacent. In future years, the decreased size of the Sea-Tac contours would reduce noise in this area, such that the combined noise from Sea-Tac and Boeing Field would not result in areas affected by DNL 65 or greater. Furthermore, there is no difference in this finding for either the "Do-Nothing" or "With Project" alternatives.

Comment R-6-22: Ms. Brown, expressed concern about "significant" noise and vibration at locations 1.3 miles west of the 65 DNL contour.

Response: FAA guidelines have established a 1.5 DNL change at noise sensitive uses within the 65 DNL noise exposure contour as a threshold of significance. Chapter IV, Section 1 "Noise Impacts" and the accompanying Appendix C contain the grid analysis that was prepared to assess the noise level changes. The EIS shows that changes of 1.5 DNL or greater are expected to occur within the 65 DNL contour at 45 grid locations in the Airport environs. These are delineated in Table IV.1-2 of the Draft and Final EIS. It is important to note that each individual may perceive a significant change in a manner different than is quantifiable by 1.5 DNL. The Schultz curves on noise annoyance indicate that certain percentages of the population would be highly annoyed by noise at levels well-beyond the 65 DNL contour and thus may experience annoyance at greater or less noise level changes.

Grid point analyses were conducted for all scenarios of existing and future conditions. Several analytical points were located approximately 0.8 miles west of the existing 65 DNL contour and are indicated as the range of points from A29 to A40 on Exhibit C-18. At these locations, the DNL levels currently range from 54.7 to 59.0 decibels of DNL and are forecast to range, if the proposed third runway is constructed, from 51.3 to 58.8 DNL in year 2020. In each case, these levels, which lie approximately 1/2 mile east of the location indicated by the commentors, fall well below the thresholds of significant noise exposure.

Comment R-6-23: Several commentors asserted that there should have been an assessment of flight track changes above 3,000 feet altitude above ground level (AGL) in the Draft EIS. The following individuals or groups made one or more expressions of this comment: Airport Noise Abatement Committee, Ms. Hetzel, and the Southwest King County Community Group.

Response: FAA notice 7210.360 (Noise Screening Procedure for Certain Air Traffic Actions Above 3,000 Feet AGL) sets forth a methodology to determine if changes in flight tracks above an altitude of 3,000 feet above the ground could adversely affect noise levels. The methodology is particularly useful for the evaluation of air traffic measures which introduce extensive change to the location of flight tracks. The completed checklist for the evaluation, included in Appendix C of the EIS, indicates that none of the assumed flight tracks associated with the proposed third parallel runway would result in significant changes to aircraft noise patterns when the aircraft is between 3,000 and 18,000 feet AGL. The scenarios evaluated for this EIS assume the continued use of the flight corridors now in place once the third parallel runway is constructed. The assessment does not assume the development of new flight corridors beyond the proximity of the Airport other than the slight expansion of the existing corridors to accommodate flight tracks from the proposed new runway. The existing corridors are widened by the width of the separation between the runways.

Comment R-6-24: The Southwest King County Community Group expressed concern that the model should have included the noise associated with a new maintenance base (South Aviation Support Area).

Response: The noise levels associated with the development of the SASA were detailed in the Final EIS and Record of Decision for that project. The document is in the Administrative Record for this project, available at the FAA's Northwest Mountain Seattle Airports District Office. Taxi access to the south cargo and support area was included in the modeling of ground noise for this evaluation by applying the appropriate taxi use percentages from each runway end to the taxiway leading to the SASA area. Several of the noise exposure maps indicate a hook in the 75 DNL contour in the SASA area which reflects noise associated with these movements. See response to comment R-3-38.

__*Comment R-6-25*__: *Mr. Frause questioned the inclusion of roadway noise in the Draft EIS and expressed concern that it distracted from the analysis of aircraft noise.*

__Response:__ The purpose of combining the two sources in the EIS is to estimate the daily DNL noise produced by the combination of two separate noise sources -- aircraft and surface transportation. In no way does the combination of the two sources reduce the maximum sound level of the individual sources or the maximum sound level of the combined sources. The combination of roadway noise and aircraft noise is an approach to the disclosure of "total exposure". Total Exposure is defined as the combination of different simultaneous environmental sounds. In this case, the different simultaneous environmental sounds are aircraft and roadway noise. The combined noise levels are disclosed in Table C-35 for 110 locations where roadway noise levels were assessed. The levels and distribution of aircraft noise are fully disclosed, as they are applied to the Do-Nothing and "With Project" alternatives. Roadway noise levels are disclosed as they apply to each alternative. The combined effects are provided as supplemental information for public review.

__*Comment R-6-26*__: *The Regional Commission on Airport Affairs asked what steps the Port of Seattle has taken to ensure compliance with its noise abatement procedures and what penalties are in place to ensure the use of noise abatement measures.*

__Response:__ The Port currently monitors compliance with noise abatement procedures and reports non-compliance to the FAA, Noise Advisory Committee and airlines. The Port notifies the Chief Pilot of the associated airline when any aircraft strays from a departure corridor. No Port of Seattle schedule of penalties is in place relative to the use of flight tracks along the extended centerlines of the runways yet penalties exist relative to the Noise Budget and Noise Limitations Program. The Noise Budget includes a series of enforcement actions to support its provisions. These provide a series of penalties related to the degree of exceedence of a carrier's allowed noise level ranging to as high as $250,000 per quarter or $1,000,000 per year, dependent on the number of events which contribute to the exceedences.

The Nighttime Limitations Program provides for a series of graduated penalties for Stage 2 operations during the nighttime hours scheduled in the mitigation plan. The number of night hours covered by the agreement would apply to the full night period (10:00 p.m. to 6:59:59 a.m.) on October 1, 1995. Penalties for violations call for a letter of admonishment and meeting to develop a mitigation plan for the first offense per quarter, followed by penalties of $500, $1,000, and $2,000 for the second, third and each subsequent offense during a quarter.

__*Comment R-6-27*__: *Several commentors complained that the existing or proposed noise mitigation program is inadequate or that impacts from the last runway were not mitigated. Others complained that existing noise reduction promises have not been met. The following individuals or groups made one or more expressions of this comment: Mr. & Mrs. Alishokis, W. Ashunal, Mr. Bedayan, Ms. Brown, Ms. Byrd, Ms. Conner, Mr. Creech, Mr. Dettman, Mr. Eaton, Ms. Erickson, Ms. Gendo, Ms. Gilbreath, Glen Acres Homeowners Association, Mr. Hablin, Mr. Hales, M. Hatfield, Mr. Heavey, Mr. LeCompte, Mr. Matthews, N. Miller, Mr. Peyton (Ravenna-Bryant Community Association), Prince of Peace Lutheran Church, Mr. & Mrs. Platt, Ms. Price, Mr. Scarvie, Mrs. N. Scott, Ms. Sonislo, Southwest King County Chamber of Commerce, Ms. St. Laurent, Mr. & Mrs. Stankey, and Ms. Terrell.*

__Response:__ The Noise Budget, Nighttime Limitations program, and ground noise restrictions have resulted in the reduction of noise since their implementation in 1991. The flight corridors have been in effect for several years and have effectively restricted the great majority of jet flights to maintain runway centerline (a straight track) until reaching positions several miles from the Airport. These programs, coupled with the scheduled phase-out of Stage 2 aircraft have resulted in reductions of several decibels from 1991 existing noise levels. These programs would continue until Stage 2 aircraft are removed from the operating fleet. The effectiveness of these programs is monitored by the Sea-Tac Noise Advisory Committee.

In 1994, the Port completed the acquisition of the most severely noise effected residences. The Port has recently accelerated the soundproofing of residential properties in the mitigation program areas. See responses to land use mitigation comments R-7-32 and R-7-36.

Comment R-6-28: The Regional Commission on Airport Affairs, Mr. Peyton (Ravenna-Bryant Community Association), and Mr. Whitlock asked how the Nighttime Limitations program and the Noise Budget will be extended to include operation of the proposed new runway since they end prior to the time the runway will become operational.

Response: Both the Nighttime Limitations program and the Noise Budget are designed to specifically address the noise impacts associated with aircraft categorized as having FAR Part 36 Stage 2 noise levels. Consequently, the programs would expire with the completion of the scheduled phase out of such aircraft from the national operating system between 2000 and 2003. If for any reason that transition is delayed, the programs would be continued until the transition is complete. The Noise Budget exempts operations by government aircraft or aircraft in international service subject to a bilateral agreement. The Nighttime Limitations Program exempts the same two conditions as the Noise Budget, as well as emergency operations and placement for maintenance, a non-complying aircraft used in temporary replacement of a complying aircraft unable to perform the operation because of extreme circumstances, an aircraft delayed from a compliant time to a non compliant time as a result of factors beyond the control of the carrier. The programs are expected to expire prior to the construction of either the proposed new runway or the Extension of Runway 16L/34R.

Comment R-6-29: The Regional Commission on Airport Affairs, Mr. Peyton (Ravenna-Bryant Community Association), and Southwest King County Community Group expressed concerns that activity exempted from the provisions of the Nighttime Limitations and Noise Budget was not considered in the noise contours and grid analyses.

Response: All actual aircraft operations were modeled in the noise exposure contours. The exemptions from the Noise Budget and the Nighttime Limitations Program are indicated in the response to comment R-6-28. Although these exemptions are considerations as to the applications to individual flights at the Airport, both regular and exempted operations which occurred at the Airport are included in the development of the noise exposure contours. The noise model evaluations all operations occurring on an annual average day (Stage 2 and 3 jets; domestic and international flights; air carrier, commuter, private and government flights; day and night operations; flights, run-ups and taxi movements, etc.) to obtain as complete a portrait of noise conditions as is possible for the condition studied. No operations are exempted from modeling evaluations.

Comment R-6-30: The Regional Commission on Airport Affairs requested clarification of how the ground noise reduction program prohibits peak noise levels during the daytime.

Response: The Draft and Final EIS indicate that the focus of the ground noise control program "is to restrict noise events during the nighttime hours" (page IV.1-3). It does not "prohibit" any noise levels, but rather controls the ground operations which produce loud events. During the daytime hours, two factors are particularly applicable for the reduction of ground noise. First, on leaving the gate at the terminal, aircraft are pushed back to the taxi lanes by tugs rather than powering back under reverse thrust.

Second, when an aircraft is "run-up" for maintenance, the operation occurs at one of four designated locations along the east side of the runway complex. The positioning of these events at interior locations on the airport property limits (by distance and structural barrier) the noise levels to which surrounding neighborhoods are exposed.

__Comment R-6-31A__: *Airport Noise Abatement Committee, Mr. McGrath, Mr. Peyton (Ravenna-Bryant Community Association), and Mr. Zembruski suggested measures to mitigate noise in the Airport environs by establishing new or adjusted flight corridors.*

__Response:__ The commentors suggested a number of measures to abate existing noise levels by relocating flight tracks, generally beyond the 60 DNL contour. While suggestions of flight routing are of interest to the community at large, changes in flight routes beyond the 60 DNL noise exposure contour are not recommended by this EIS.

Two commentors suggested the use of the I-5 or Highway 99 corridors for the abatement of noise on either approach or departure. Unfortunately, these corridors are located east of the runway alignments and their use would require turns at low altitude to obtain benefit from their location. Further, many areas beyond the compatible areas along the highways would be subject to increased noise levels to the benefit of persons who live along the extended runway centerlines.

__Comment R-6-31B__: *Several commentors suggested measures to mitigate noise in the airport environs by installing noise berms or barriers. The following individuals or groups made one or more expressions of this comment: Mr. Burke, and the Osterman family.*

__Response:__ The use of berms, barriers and forested areas to interrupt the flow of noise from the source to the receiver is of limited benefit. The greater the distance between the barrier and the receiver, the less the effect in reducing noise. A barrier sufficiently high to effectively reduce noise levels beyond the barrier would need to be placed in areas not subject to height restrictions and clearance zones. These restrictions normally prevent the use of barriers in abating noise from aircraft on the runway due to terrain issues. It is anticipated that an earth berm would not be feasible to abate noise associated with the proposed new parallel runway. However, vegetative cover would provide assistance in noise reduction and would be considered in the design/development phases.

__Comment R-6-31C__: *Several commentors suggested measures to mitigate noise in the airport environs by requiring aircraft or the Airport meet state or local noise control codes. The following individuals or groups made one or more expressions of this comment: Mr. Derrick (King County Department of Development and Environmental Services) and Mr. Matthews, and Mr. Rees.*

__Response:__ Noise standards for aircraft are established by the U. S. Congress and regulated by the Federal Aviation Administration as a matter of national interest. Air carrier fleets are currently undergoing conversion from louder "Stage 2" to less loud "Stage 3" aircraft as defined by FAR Part 36. FAR Part 91 mandates a staged phase-out of Stage 2 aircraft by year 2000. The noise levels set by Federal statute have been found to pre-empt levels set by local/state authorities. Local governments are free to establish land use compatibility criteria which include noise levels. State and local codes also address the maximum level of noise from aircraft which is allowable at the fence from ground operations.

__Comment R-6-31D__: *Mr. Dinndorf (Puget Sound Regional Council) suggested that the Port should continue to monitor aircraft noise, including use of metrics other than the DNL. It was suggested that the monitoring should be included as mitigation.*

__Response:__ Comment noted. The Port will continue to operate its existing noise monitoring system and to perform monitoring as needed. Separate from this EIS , the Port of Seattle has stated its intent to upgrade the existing noise monitoring system. It is anticipated that the Port will begin developing specifications for a new system in 1996.

Comment R-6-31E: Several commentors suggested measures to mitigate noise in the Airport environs by raising the glide slopes to 3 degrees or more. The following individuals or groups made one or more expressions of this comment: Mr. Peyton (Ravenna-Bryant Community Association), and Mr. Zembruski.

Response: The ILS glide slope angles are the currently standard 3 degrees, with the exception of Runway 34R, which is 2.75 degrees. The Microwave Landing System approach to Runway 16R is 3.4 degrees. While increasing the approach angle would result in increased altitudes along the approach, the difference is rarely great enough to produce a perceptible reduction in noise on the ground. For example, an increase of 1 degree at a distance of 5 miles from the runway threshold would increase the aircraft altitude by 116 feet. The difference in noise level would be approximately 1/2 decibel which is imperceivable to the human ear.

Comment R-6-31F: Mr. Peyton (Ravenna-Bryant Community Association) suggested measures to mitigate noise in the Airport environs by requiring pilots to fly the aircraft in a manner consistent with safety that produces the least noise.

Response: Given the fact that safety is the pilot's highest priority, aircraft may be operated in a variety of manners for noise abatement. The "least" noise varies from one location to another. If take off procedures were implemented which provided the greatest noise reduction for the areas closest to the Airport, the areas at some distance (like north and northeast Seattle or Federal Way) would be exposed to greater noise levels. If procedures were implemented which benefited the residents of the more distant areas, the residents of areas closer to the Airport (such as Tukwila and Des Moines) would also be exposed to higher noise levels. The same factors apply to approaches and approach routes. Procedures are generally selected to affect the least amount of people possible. The selection of flight procedures must be tempered not only by considerations of safety, but by the distribution of land uses under the routes of flight.

Comment R-6-31G: Mr. Peyton (Ravenna-Bryant Community Association) suggested measures to mitigate noise in the Airport environs by installing monitors beyond the 65 DNL contour and establish penalties for diversions from established noise abatement procedure corridors.

Response: The Port of Seattle is currently reviewing its program of noise measurement and the location of its permanent monitoring sites. Locations beyond the 65 DNL may be included.

The provision of penalties by the Port for diversion from noise abatement takeoff corridors would not be effective as the Port does not have legal authority to govern flight track use. However, the FAA strictly regulates flight track use. The carriers fly established routes under FAA direction, based on requirements for separation between aircraft and clearance of obstructions. These routes widen as their distance from the Airport (ground) increases. Consequently, aircraft may appear to not be flying a procedural course at some distance from the Airport, when in fact they are. When under positive control, aircraft rarely deviate from established routes unless there is a justifiable reason. When those rare unjustified deviations do occur, FAA would pursue the matter of enforcement within its own guidelines.

Comment R-6-31H: Three commentors suggested measures to mitigate noise in the Airport environs by requiring that the noise budget and nighttime limitations program be fully implemented prior to construction of the proposed new runway. The following individuals or groups made one or more expressions of this comment: Mr. Scarvie.

Response: The nighttime limitations program was fully implemented on October 1, 1995. Effective October 1, 1995, the hours of the nighttime limitations program were expanded to 10 p.m. to 7 am. The Noise Budget is designed to address noise associated with Stage 2 aircraft which are scheduled for removal from the national operating fleet by the year 2000. Construction of the runway is anticipated at about the same time as the phase-out of Stage 2 aircraft is scheduled and the Noise Budget reached its goal. Further, the Port commission has directed that the existing insulation program for single family homes be completed prior to operation of the proposed new runway. The timing for construction and use of the proposed new runway would be guided by operating necessity rather than by noise abatement requirements.

Comment R-6-32: *Regional Commission on Airport Affairs expressed concern that the INM model does not adequately reflect aircraft noise levels and demanded that it be validated in accordance with standards of the National Institute of Standards.*

Response: The Integrated Noise Model has become the industry standard through its application over the last fifteen years on virtually every civilian noise exposure modeling evaluation conducted in the United States and in many foreign countries. Its internal algorithms are in accordance with the standards for the prediction of aircraft noise levels set forth in the document "Procedure for the Calculation of Airplane Noise In the Vicinity of Airports" published by the A-21 (Aircraft Noise) Committee of the Society of Automotive Engineers as its report SAE-AIR 1845 in March 1986. The data base has been continually updated with new manufacturers data as new aircraft types are introduced into the market.

During the early years of the models use, the FAA conducted validation tests of the model in attempts to cause it to better represent the way aircraft actually fly or to better portray the noise levels they produce. The model used for this environmental analysis is the fourth version of the original model and the 11th update of the data base of operational characteristics. It incorporates all of the validations of the computational algorithms and flight characteristics developed over the fifteen years since its introduction. Findings of studies conducted at the beginning of the 1980's were incorporated into Version 3 of the model in the early 80's. Better representation of the takeoff characteristics of numerous aircraft were incorporated in the improvements of data bases number 10 and 11. Improved algorithms for the calculation of noise at ground level during takeoff roll and the effects of terrain were incorporated in Version 4.

Comment R-6-33: *Two commentors asked why the Draft EIS did not respond to the concerns of the PSRC expert panel. The following individuals or groups made one or more expressions of this comment: the Regional Commission on Airport Affairs.*

Response: The Expert Arbitration Panel on Noise and Demand/System Management was established at the request of the PSRC to evaluate if the Port has accomplished a reduction noise impacts that can be measured on the ground. This panel was charged with the responsibility to evaluate actions which had taken place prior to and during its deliberations. The Panel was not charged with assessing the noise exposure forecasts associated with the presence or absence of a third runway at the Airport.

Comment R-6-34: *Several commentors cited a study of annoyance levels commissioned by the Airport Communities Coalition relative to the difference between "impacts" and "exposure levels". Others disputed the selection of 65 DNL as the basis for disclosure of impact levels and requested a literature search justifying the use of that level. The following individuals or groups made one or more expressions of this comment: Airport Communities Coalition, Mr. Frause, Ms. Vermeier, and the Regional Commission on Airport Affairs.*

Response: The perception of aircraft noise and its effects on individuals exposed to varying levels of aircraft noise is subjective. Guidance provided by FAA Order 5050.4A sets forth the criteria for the determination of the significance of a noise exposure level relative to environmental impacts on the exposed population. Common practice within the planning industry has equated the term "impacts" with the number of persons or dwellings exposed within various levels of noise. This does not mean that some persons who reside beyond the threshold of significance do not experience disruptions in their lives from aircraft noise. See also response to comment R-6-1 and R-7-7.

FAA Order 1050. 1D, attachment 2 (Policies and Procedures for Considering Environmental Impacts) states that the FAA's threshold of significance has been determined to be a 1.5 DNL increase in noise over any noise sensitive area located within the 65 DNL noise exposure contour. The 65 DNL threshold has been applied throughout this document to describe the numbers of persons, dwellings, and noise sensitive uses of each alternative.

***Comment R-6-35**: Mr. Ashunal expressed concern that aircraft vibration will damage structural walls and foundations and asks what will be done to mitigate it.*

Response: Stage 3 aircraft produce lower levels of vibration than do comparably sized Stage 2 aircraft, and therefore, the level of vibration will decline as Stage 2 aircraft are phased out of the fleet (see Appendix C, page 25 and Tables C-36 and C-36a through C-36i). The forecasts of operations project that Stage 2 aircraft and their modified derivatives (retrofit to meet Stage 3 noise levels) will disappear by the year 2010. It is important to note that the Port's noise programs have resulted in no Stage 3 operating at night.

***Comment R-6-36**: Several commentors requested the provision of additional information relative to noise model assumptions and input data. Other commentors requested the inclusion of the INM input files be included in the Final EIS. The following individuals or groups made one or more expressions of this comment: Mr. Rohlfs (City of SeaTac), and the Regional Commission on Airport Affairs.*

Response: The input to the Integrated Noise Model requires a complex assessment of the operating characteristics of the Airport and the distribution of these characteristics in a proportionally representative manner throughout the Airport environs. The input and output for each alternative presented in the EIS is available in the Administrative Record at the FAA's Northwest Mountain Regional Airports Office. The following information is provided to supplement the descriptive material provided in Appendix C of the EIS relative to the development of information for INM processing.

To assign flights to runways, the utilization of the runways was determined through an analysis of runway use data from September 1993 through August 1994 and a ten day sample of Automated Radar Terminal System (ARTS) data. These tracks are representative of average annual tracks. The number of arrival and departure operations during the day (7:00 a.m. - 9:59 p.m.) and night (10:00 p.m.-6:59 a.m.), conducted by three separate categories of aircraft (heavy jet, light jet and prop) were determined for each runway end.

Flight tracks were developed from the assessment of the ten days of ARTS data. Separate sets of INM departure and approach tracks were developed for each aircraft category. After INM flight tracks are identified for each runway end for each aircraft category, the proportion of operations using each track was determined. The actual radar data flight paths, color coded by aircraft category and runway end, were displayed on a computer screen and overlaid with the consolidated INM tracks. Each INM flight track was assigned to serve one or more of sixteen general flight headings (sectors) from the Airport. A sector is an angular portion of the airspace, shaped like a piece of pie, which has an angle of 22.5 degrees. The origin or destination of every flight to or from the Airport is assigned to one of these sectors dependent on its directional relationship with the Airport. Where more than one INM track was found to serve the same sector or group of sectors, the number of actual operations using each INM track was counted and compared to the total number of operations flying to the sector or group of sectors. All operations in the average day schedule were then assigned to the INM flight tracks for each aircraft group, based on the proportional uses determined by the analysis of actual radar data.

The Integrated Noise Model Version 4.11 database of default takeoff performance characteristics for each aircraft type were used in this analysis. In 1992, the FAA updated the aircraft performance database to Version 10, and ultimately Version 11. As a part of this update, the FAA enhanced the database by including procedures that more accurately reflect actual conditions. The database contains profiles for each aircraft for various weights. For departing aircraft, the takeoff roll requirements and rate of climb are determined by aircraft weight, elevation and temperature. The INM uses the distance an aircraft flies to its initial destination as a surrogate for the weight of the aircraft. The model automatically adjusts the takeoff data base information to reflect average temperature and airport elevation conditions. At Sea-Tac, the average temperature and elevation used for modeling purposes are 11 degrees Centigrade and 429 feet above mean sea level (MSL).

A standard three degree approach procedure is provided within the data base of the model which may be assigned to all aircraft. Three degree descent profiles, as defined by the INM were used to Runways 16R, 34L and 34R. Two special approach profiles were defined for local application. The approach profile for Runway 16L has a 2.75 degree glide slope angle, while a Microwave Landing System (MLS) approach, having a descent profile of 4.2 degrees, was prepared for Runway 16L.

In assigning aircraft and engine types to actual flights in the modeling process, *JP Fleets* [11/] was used. This document lists aircraft inventories of all major airlines. Aircraft/engine combinations were assigned to individual flights based on the percentage that each combination exists in the airline's fleet.

LAND USE

Comment R-7-1: *Mr. Rohlfs (City of SeaTac), Mr. Dinndorf (PSRC), and Mr. Peyton (Ravenna-Bryant Community Association) expressed that there were several global edits that need to be made and included in the Final EIS relative to land use issues.*

Response: The Final EIS reflects the following changes in factual data:

- a revised date of Spring 1996 for completion of an environmental review for the West SeaTac Subarea Plan;
- consistent reference to FAZ 3705 (not FAZ 3706) to identify and approximate the City of SeaTac's population and employment; and
- a change from PSRC to the U.S. Census as the source of Census data referred to for Census Summary Tape 1B.

Insofar as the names and locations of parks are concerned, Georgetown Playground, at the intersection of Carson Street South and South Homer Street, is correctly identified based on information from the Seattle Parks and Recreation Department. The name of South Park Playfield, located at 8th Street S. and S. Sullivan, was corrected as South Park Playground. In addition, the address of the Marine Technology Laboratory was corrected; it is located at 13201 16th Avenue S.W. in Burien, not at 18010 8th Street S. in the City of Burien. Since the Marine Technology Laboratory lies outside all applicable noise contours (i.e., less than 60 DNL), it was deleted from the inventory of parks in the Final EIS.

11/ JP Fleets, 94/95 Edition, Bucher Publications

Comment R-7-2: *The Airport Communities Coalition and Mr. Rohlfs (City of SeaTac) stated that the Land Use section does not accurately describe the acquisition areas. In particular, a commentor stated that the Land Use section of the Draft EIS did not mention the purchase of additional West SeaTac properties that would be necessitated by the "With Project" alternatives. Nor did it acknowledge the fact that additional relocation programs and funding would be necessary with all of the "With Project" alternatives. The City of SeaTac expressed concern that a number of businesses in the City of SeaTac's industrial area also could be acquired under all of the "With Project" alternatives. Finally, Alternative 4, South Unit Terminal, would require the acquisition of several properties on the northwest corner of the intersection of International Blvd. and S. 188th Street, and the commentor noted these properties were not shown on an exhibit in the Draft EIS.*

Response: Chapter IV, Section 6 "Social Impacts" lists all potential acquisition, both residential and commercial, for the Master Plan Update alternatives. Chapter IV, Section 2 "Land Use" of the Final EIS includes revised reference to this section, as well as discusses in more detail the land use changes expected to result in the West SeaTac area from "With Project" alternatives. Chapter IV, Section 6 also includes greater detail concerning relocation programs necessitated by "With Project" alternatives.

The concern by City of SeaTac that commercial business be allowed to remain in the area of the proposed new runway Protection Zone (south of S. 188th Street, between Des Moines Memorial Drive and 16th Avenue S.) is acknowledged. Although the EIS projects a "worst-case scenario" that assumes all commercial as well as industrial properties in the RPZ would be acquired, the use of avigation easements to allow businesses to remain would be fully investigated and implemented, if and where possible.

Finally, Exhibit IV.6-2 was revised to show the properties at International Boulevard and S. 188th that are expected to require acquisition under Alternative 4, South Unit Terminal (they were listed in EIS on page IV.6-7R).

Comment R-7-3: *Mr. Rohlfs (City of SeaTac) noted that "airport support facilities" such as the airport maintenance facilities proposed in the Master Plan Update (the L-shaped Port buyout area north of SR-518 and east of 24th Ave. S.) would not be allowed in the current City of SeaTac BP (Business Park) zone.*

Response: Any conflicts between City of SeaTac zoning or land use designations and the Master Plan Update alternatives are expected to be resolved as part of the continuing interlocal negotiation process between the Port and the City of SeaTac. This process would probably not be completed prior to issuance of the Final EIS. Whatever the outcome of these interlocal negotiations, any existing inconsistencies between the Master Plan Update and the current City of SeaTac comprehensive plan would be addressed to the extent required, as part of the future amendments to the City of SeaTac's comprehensive plan.

Comment R-7-4: *The City of Sea-Tac stated that the Final EIS should address the development potential of the land to be acquired in West SeaTac for implementation of the Master Plan Update. The area in question lies east of Des Moines Memorial Drive and west of the Airport.*

Response: Additional information has been included in Chapter IV, 6 "Social Impacts" of the Final EIS, see page IV.6-6. The West SeaTac Subarea Plan is expected to address future uses of these lands and will be completed in Spring 1996.

<u>*Comment R-7-5*</u>*: Ms. Vermeier stated that the proposed or adopted elements of the City of Normandy Park's land use plan would be violated by the Sea-Tac Master Plan Update.*

<u>Response:</u> The proposed Master Plan Update improvements would not have direct or construction-related impacts on lands within the City of Normandy Park. Construction-related and operational impacts on Walker and Miller Creeks (which flow downstream (west) through Normandy Park) within the City of SeaTac would be mitigated according to applicable criteria and regulations (see discussion of mitigation in Chapter IV, Section 10 "Water Quality and Hydrology" of the EIS). The proposed improvements also would not result in significant noise impacts on residential units or noise-sensitive facilities within Normandy Park. As stated on page IV.2-11 of the Draft EIS (page IV.2-13 of the Final EIS), although the City would continue to play an important role in the public comment process, Normandy Park would have no direct regulatory authority over the permits and approvals required for improvements identified by the Master Plan Update.

<u>*Comment R-7-6*</u>*: Ms. Brown and the Southwest King County Community Group requested a percentage, number, and a list of homes exposed to other sound levels.*

<u>Response:</u> The number of homes exposed to 60 DNL and above is included in Chapter IV, Section 2 "Land Use" of the EIS. This information satisfies FAA Order 5050.4A requirements to disclose the number of noise sensitive land uses exposed to significant noise levels (65 DNL or greater - significant impact levels for residential uses). Areas exposed to 60 to 65 DNL are considered marginally impacted and are presented for informational purposes.

<u>*Comment R-7-7*</u>*: The Regional Commission on Airport Affairs and Mr. Frause requested more detailed information concerning the populations that are most impacted by noise to assure that no one specific population is unfairly adversely impacted.*

<u>Response:</u> Exhibit IV.6-1 of the Draft and Final EIS shows the percentage of population for each census tract in the study area exposed to 65 DNL or greater noise levels for the year 2020. Tables IV.6-1 and IV.6-2 show a variety of demographic and socio-economic data for census tracts in the study area. Page IV.6-4 of the Draft EIS (page IV.6-7 of the Final EIS) notes that all Master Plan Update alternatives would meet the intent of Executive Order 12898 (Environmental Justice) to not adversely affect one sector of the community as measured by race, income, religion or age. Additional demographic and socio-economic information on the populations affected by noise or displacement has been included in the Final EIS.

<u>*Comment R-7-8*</u>*: A commentor questioned why daycare facilities were excluded both from the inventory of noise-sensitive facilities and from the analysis of air pollution impacts. This comment was made by the Southwest King County Community Group.*

<u>Response:</u> According to FAA land use compatibility guidelines (FAR Part 150, Table 1), daycare facilities are not considered noise-sensitive facilities in the same manner as schools, colleges, and vocational centers because their primary purpose is not academic instruction, even though some educational activities may take place. Consequently, daycare centers are not included in the list of noise-sensitive facilities. Air pollution impacts are not discussed in terms of land use; rather, air pollution impacts are evaluated on a site specific basis relative to exposure based on the National and State Ambient Air Quality Standards.

Comment R-7-9: *Several commentors stated that noise impacts on schools, educational facilities, and churches in noise-impacted areas will worsen and must be shown. This comment was made by the following: the Airport Communities Coalition, Ms. Brown, Mr. McGeehan, the Regional Commission on Airport Affairs, Mr. Schuster (Wedgewood Community Council), the Southwest King County Community Group, Mr. L. Thompson, Mr. Thompson, and Mr. & Mrs. Voeller.*

Response: Table IV.2-3 lists noise-sensitive facilities exposed to noise levels of 65 DNL or greater. Appendix C, Table C-27 of the Draft and Final EIS shows the DNL levels at each of the schools. Of the 29 schools listed on page 1 of Table IV.2-3, the "With Project" alternatives would create a significant increase in noise exposure at one school in comparison to the Do-Nothing alternative. School S-102 (Sea-Tac Occupational) is expected to incur an increase of about 3.1 DNL over the Do-Nothing.

Several schools that are currently impacted by noise levels of 65 DNL or greater would remain noise-impacted (i.e., at 65 DNL or greater) through 2020. However, noise levels at most of the schools are shown to decrease between now and the year 2020. In addition, several organizations submitted research studies concerning the impact of noise on learning environments. These research studies are noted.

The Marine Technology Lab was incorrectly located in the Draft EIS; it has been reanalyzed in its proper location and was found to be not affected by 65 DNL or greater aircraft noise levels.

Comment R-7-10: *Mr. Frause and Mr. Peyton (Ravenna-Bryant Community Association) questioned the Draft EIS claim that land use impacts will decrease in the future; moreover, that the tables do not show the impacts on each type of noise sensitive land use facility by year and alternative.*

Response: Land use impacts associated with each of the proposed Master Plan Update alternatives are discussed in detail in Chapter IV, Section 2 "Land Use" of the Draft and Final EIS. A comprehensive list of noise-sensitive facilities (including schools, libraries, hospitals, nursing homes, churches, and parks) is included in Table IV.2-2, which breaks down the noise impacts for each of these facilities, by alternative, for the years 1994 (existing conditions), 2000, 2010, and 2020. Please refer to response to comment R-6-1B for an explanation of why noise levels are expected to decline in the future.

Comment R-7-11: *The commentors believe that the Draft EIS confused the City of SeaTac's essential public facility designation of Sea-Tac Airport with approval of the Port's particular plans for construction of the third runway and associated actions. One commentor thought the Master Plan Update was inconsistent with one or more of the essential public facilities policies in the adopted King County Comprehensive Plan. The following individuals and organizations made this comment: Airport Communities Coalition, Regional Commission on Airport Affairs, and the Osterman family.*

Response: It is important to note that a major regional decision has been previously made by the Puget Sound Regional Council (Resolution A-93-03 in April 1993) to "pursue vigorously" the option of a third runway at Sea-Tac Airport. The resolution stated that "the third runway shall be authorized by April 1, 1996" subject to the satisfaction of several conditions (page I-3 of the Final EIS details the specific conditions). Jurisdictions in South King County are members of PSRC and were involved in that decision (although they may have disagreed with the outcome). These jurisdictions also have been involved with the planning process associated with the Master Plan Update and the third runway that has been continuing since 1994.

Commentors correctly note that there is a distinction between the existing facilities at the Airport and the proposed improvements associated with the Master Plan Update.

While the City of SeaTac's plan does not yet address in detail the development proposed under the Port's Master Plan Update, all adjacent municipalities have participated actively and are thus well aware, for their planning purposes, of a new parallel runway proposal and associated actions. In light of this and the fact that regional policies (i.e., PSRC Resolution A-93-03) have been adopted that call for and contemplate the construction of the third runway, adjacent jurisdictions should take this into account as they adopt 20-year GMA plans and regulations.

As a result of the PSRC decision, there is a regionally approved plan to expand Sea-Tac Airport, which also has been designated by the City of SeaTac as an essential public facility under the GMA. Because Sea-Tac Airport has been designated an essential public facility by the City of SeaTac, all nearby municipalities, including SeaTac, are required to adopt policies in their comprehensive plans and development regulations that do not preclude the operations associated with the Airport and the siting of essential public facilities (RCW 36.70A.200). As stated in the Draft and Final EIS, to the extent local jurisdiction policies seek to preclude the proposed improvements of the Airport, the policies may be inconsistent with Countywide Planning Policies, the VISION 2020 Update, PSRC resolutions, the essential public facility provisions of the GMA, and the King County Comprehensive Plan.

One commentor (the Osterman family) stated that the Master Plan Update development actions are not consistent with Policy F-220 of the King County Comprehensive Plan (see page IV.2-16 of the Final EIS for full text of all policies in the Plan relating to the siting of essential public facilities: Policies F-217 to F-222). The portion of Policy F-220 cited by the commentor states: "No single community should absorb an inequitable share of the facilities and their impacts."

Policy F-220 also states the following: "Siting should consider environmental equity and environmental, economic, technical, and service area factors. The net impact of siting new essential public facilities should be weighed against the net impact of expansion of existing public facilities, with appropriate buffering and mitigation. Essential public facilities that directly serve the public beyond their general vicinity shall be discouraged from locating in rural areas."

The proposed improvement of an existing facility (Sea-Tac Airport) provides an alternative to locating a new essential public facility in a rural area. Mitigation for adverse impacts of the Master Plan Update would be required and are detailed for each appropriate element of the environment in Chapter IV of the Final EIS. Thus, the Master Plan Update is not inconsistent with Policy F-220.

Comment R-7-12: Mr. Peyton (Ravenna-Bryant Community Association) reported that two or three schools in the Highline School District would have to be relocated as a result of construction of the third runway, despite the Port of Seattle's own recommendation that the schools be built at these sites and despite the Port's assurance that Sea-Tac Airport would not be expanded westward.

Response: The Draft and Final EIS note that no schools would need to be relocated as a result of the Master Plan Update "With Project" alternatives. As part of the SASA project (which would occur under the "Do Nothing" Alternative, as well as the "With Project" alternatives), the Seattle Christian School would be relocated and the vacated facilities demolished. Seattle Christian may remain at its current site for up to 2 years while its new facilities are being constructed in a location outside of the Noise Remedy Program area.

Comment R-7-13: *Mr. Rohlfs (City of SeaTac), the Airport Communities Coalition, the Southwest King County Community Group, Mr. Taylor (Department of Interior), and Mr. Webb stated that several parks will be significantly noise impacted by the proposed third runway. The commentors indicated that even though the project would not have a direct impact on Section 4(f) resources, the noise levels created by the project would indirectly impact the parks.*

Response: The "With Project" noise levels at Des Moines Creek Park (P44) and North SeaTac Park (P28) are noted in the Draft and on page IV.4-8A and page IV.4-8B of the Final EIS. As stated on page IV.4-4 of the Draft and page IV.4-7 of the Final EIS, the future "With Project" noise levels are considered compatible with these urban park uses, according to FAA's Land Use Compatibility Guidelines, since they do not exceed 75 DNL. As discussed in the EIS, these noise levels may not necessarily be consistent with recent local regulations adopted or proposed by Burien, Des Moines, and Normandy Park.

Comment R-7-14: *Airport Communities Coalition, the Southwest King County Community Group, and Mr. Derrick (King County Department of Development and Environmental Services) commented that the Draft EIS did not address all the resources that qualify for Section 4(f) protection. An inventory compiled by the Airport Communities Coalition lists all the Section 4(f) resources by type and jurisdiction. The Airport Communities Coalition states that the Draft EIS did not place adequate focus on properties built between 1945 and 1950.*

Response: The results of a new site survey and evaluation of additional potential Section 4(f) eligible resources, identified by the Airport Communities Coalition, is included as Appendix E-B of the Final EIS, and the results are summarized in Chapter IV, Section 3 of the Final EIS. None of the sites delineated in the Airport Communities Coalition review, affected by DNL 65 and greater noise levels, would be affected by 1.5 DNL or greater increase as a result of any of the Master Plan Update alternatives. Consequently, mitigation would not be required. The Washington State Office of Archaeology and Historic Preservation (SHPO) has determined that the methodology for evaluating properties in the acquisition area built prior to 1945 for eligibility to the National Register was sufficient (see Appendix E-B of the Final EIS).

Comment R-7-15: *Two commentors asked what would be done if there were impacts on historic or cultural sites. They also stated that an actual contingency plan should be outlined in the document. Commentors include Mr. Rohlfs (City of SeaTac), the Southwest King County Community Group, and Mr. Frause.*

Response: The Draft and Final EIS specify that a contingency plan must be developed if archeological finds are located during construction. Further actions are difficult to specify without knowing the actual nature of the find. A variety of mitigation plans could be developed for a specific find, and the impact on the construction schedule would depend on the nature of the find. The nature of the find also would determine the disposition of the artifacts.

Impacts on National Register properties would require a Memorandum of Understanding between the Port of Seattle and the Advisory Council for Historic Preservation. As noted in Chapter IV, Section 3, the State Historic Preservation Office (SHPO) has determined that none of the properties located within the acquisition area are eligible for inclusion in the National Register.

As noted in the response to comment R-7-14, no properties designated as historically significant by the Airport Communities Coalition (ACC) in its comments on the Draft EIS were determined to be affected by a 1.5 DNL or greater increase in noise exposure within the 65 DNL noise contour (see Appendix E-B and Chapter IV, Section 3 of the Final EIS).

Two properties in Burien have been previously inventoried by the King County Office of Historic

Preservation: the Brunelle House and the Bryan House. They were identified in the Draft EIS to be the only two properties of historic significance to be affected by a 1.5 DNL or greater increase within the 65 DNL noise contour as a result of the Master Plan Update alternatives. Subsequent to the issuance of the Draft EIS, the SHPO has determined that neither of these properties are eligible for the National Register of Historic Places. As a result, no mitigation for these properties would be required. Because these properties are located within the Port of Seattle's existing Noise Remedy Program area, however, these residences could receive soundproofing if desired by the property owners.

Comment R-7-17: *Two commentors stated that some resources may qualify for protection under Section 4(f) even when there is no direct taking, especially when they are substantially impaired in terms of their environmental, ecological, or historical significance. In particular, a commentor stated that the Draft EIS did not consider air quality impacts on Section 4(f) facilities. These comments were made by the Airport Communities Coalition and the Southwest King County Community Group.*

Response: Both the direct and indirect impacts of the Master Plan Update alternatives on Section 4(f) lands were evaluated in Chapter IV, Section 4 "DOT Section 4(f) Lands" of the Draft and Final EIS. Parks and recreation resources designated as "locally" or "regionally" significant by the cities of Burien, Des Moines, and Normandy Park are identified in Chapter IV, Section 4 (DOT Section 4(f) Resources) of the Final EIS. Properties of a historic nature designated by these jurisdictions as "locally significant" that are located within the 65 DNL for existing conditions (1994) or for any future Master Plan Update alternative are identified in Appendix E-B. As evaluated in Chapter IV, Sections 3 and 4, and Appendices E-A and E-B of the Final EIS, no Section 4(f) resources would be impacted, either directly or indirectly, as a result of any of the Master Plan Update alternatives. The proposed improvements would not significantly affect air quality at DOT Section 4(f) resources listed in Table IV.2-2. Air pollution impacts are not discussed in terms of land use; rather, air pollution impacts are evaluated on a site specific basis relative to exposure based on the National and State Ambient Air Quality Standards. For further discussion concerning air quality impacts, please refer to Chapter IV, Section 9 "Air Quality", and Section 23 "Construction Impacts".

Comment R-7-18: *The Southwest King County Community Group stated that the list of local historic sites included in the Draft EIS is incomplete. They suggested that several sites need to be added to the inventory of locally significant historical and/or Section 4(f) resources: Miller Creek, Walker Creek, and Des Moines Memorial Drive. The commentor also states that Miller and Walker Creeks should be designated as wildlife and waterfowl refuges.*

Response: The Airport Communities Coalition compiled a comprehensive inventory of locally significant resources and other eligible Section 4(f) facilities. This inventory is evaluated in Appendix E-B of the Final EIS, in Chapter IV, Section 3 "Historic, Archaeological and Cultural Resources", and in Chapter IV, Section 4 "DOT Section 4(f) Lands" of the Final EIS. Miller Creek, Walker Creek, and Des Moines Memorial Drive are not eligible Section 4(f) resources. As is stated on Page IV.4-1 of the Draft and Final EIS, DOT Section 4(f) provides for the protection of certain publicly owned resources including public parks, recreational areas, wildlife and waterfowl refuges of federal, state or local significance of land of a historic site of national, state or local significance. As neither Miller Creek nor Walker Creek are designated as wildlife or waterfowl refuges, nor are they contained as part of a public park or recreational facility, they do not qualify for Section 4(f) protection. Des Moines Memorial Drive has not been designated as locally significant facility by any local jurisdiction and thus does not qualify as a DOT Section 4(f) resource.

Comment R-7-19: *Mr. Akers and the Southwest King County Community Group commented that noise/vibration is causing degradation of historic sites and that historic sites will lose their designation, even if insulated. One commentor stated that Columbia City currently is impacted by vibration from daily overflights.*

Response: According to Part 150 of the Federal Aviation Regulations, residential land uses and properties of historic significance are generally compatible with noise exposure levels at or below 65 DNL. Columbia City (a neighborhood within the City of Seattle) is exposed to noise levels of less than 65 DNL under existing conditions and any future Master Plan Update alternative.

There is no indication that historic properties would be significantly impacted by noise and vibration from the proposed "With Project" alternatives (see response to comments R-7-14 and R-7-15). Impacts would occur if the properties were modified for noise insulation such that the historical integrity of the property was diminished. Modifications to properties eligible for or listed in the National Register would require approval by the Washington State Office of Historic Preservation (SHPO), and any modifications would be completed in accordance with the Secretary of the Interior's *Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings* (1983).

Local ordinances do not require approval for modification of structures considered locally significant. As a mitigation measure, local jurisdictions could enact ordinances that would require approval of all modifications to structures considered locally significant. Specific references regarding preservation policies have been cited in the additional historical analysis included in the Final EIS (Appendix E-B, Chapter IV, Sections 2 and 3). In addition, the local jurisdiction would need to adopt standards for rehabilitation of locally significant structures.

Comment R-7-20: *Two commentors stated that Vacca Farm constitutes a valuable local resource and should be considered a Section 4(f) facility; moreover, that Vacca Farm assists in the recharge of the Highline Aquifer, and as such, any impacts on Vacca Farm resulting from the proposed third runway would necessitate an analysis of impacts on the Highline Aquifer. This comment was made by: the Osterman family, and the Southwest King County Community Group.*

Response: In order to qualify for Section 4(f) protection, Vacca Farm must be determined to be a locally significant resource as defined in the U.S. Department of Transportation Act of 1966 and formally designated by the local jurisdiction in which it is located (City of SeaTac). The City of SeaTac has not designated Vacca Farm as a site of local significance under Section 4(f).

The Vacca Farm property contains four parcels of land, two of which are currently zoned for commercial use by the City of SeaTac; the other two are zoned for residential development. The King County Assessor's Office states that there are no restrictions on the type of development allowed at the Vacca Farm site. Potential impacts of the Master Plan Update alternatives on the Highline Aquifer are discussed in Chapter IV, Section 10 of the Final EIS and in Appendix Q-A of the Final EIS.

Comment R-7-21: *Mr. Peyton (Ravenna-Bryant Community Association) stated that the proposed third runway will impact farmland because the noise and air pollution associated with airport development will displace entire communities to other areas, which will increase pressure to develop farmland in these new areas. In addition, he indicated that a third runway will make southwestern King County less attractive to developers and will, thereby, accelerate growth in east King County, Pierce County, and Snohomish County.*

Response: The assumption that displaced residents would relocate to the Auburn, Kent, and Enumclaw areas is highly speculative. There is no way of determining to which communities displaced residents would move. Nor can one assume that displaced residents would move to areas that place additional pressure to develop farmland, particularly if these residents move to existing low-density areas targeted for urban or intensified development. Other factors such as distance from site of employment, length of residence in the community, and household income are more likely to determine the future residential location of displaced residents.

__*Comment R-7-22*__: *Two commentors requested clarification of which facilities will be acquired and their geographic location. Both Mr. Frause and Mr. Schneider made this comment.*

__Response:__ A list of properties to be acquired and their addresses are included in Table IV.6-4 of the Draft and Final EIS.

__*Comment R-7-23*__: *Mr. Gwinn, and the Southwest King County Chamber of Commerce commented that the Port of Seattle should acquire all commercial properties within the Runway Protection Zones (RPZs) to give residents proper compensation for a long-term loss.*

__Response:__ Please see the response to comment R-7-2. The EIS assumed worst case conditions that all residential and commercial properties within the RPZs for all "With Project" alternatives would be acquired. However, as was noted in the Draft and Final EIS, with FAA approval, the Port would offer to purchase avigation easements from commercial properties in lieu of acquisition. As a result of the City of SeaTac's comments, the use of avigation easements to minimize the acquisition of some of these properties is currently being evaluated.

__*Comment R-7-24*__: *Several commentors stated that previous noise mitigation measures made through the Noise Remedy Program (NRP) have been inadequate and have not significantly reduced noise levels inside residential units. In addition, commentors write that past mitigation followed illicit and unfair practices and that the terms and status of the NRP need to be clearly stated. Comment made by the following individuals and groups: Mr. Rohlfs (City of SeaTac), the Glen Acres Homeowners Association, Mr. LeCompte, Mr. Peyton (Ravenna-Bryant Community Association), Mr. Sauer, the Regional Commission on Airport Affairs, and the Southwest King County Community Group.*

__Response:__ The Port of Seattle would re-insulate homes that received only directional noise insulation on the side of the house that faces the existing runways. Additional soundproofing would be provided to homeowners to complete the other sides of these homes. The Port of Seattle's insulation program already includes ventilation systems that are equivalent to natural ventilation and maintains a 45 DNL maximum noise threshold for all habitable rooms.

The Port of Seattle complies with all Federal, state, and regional laws and regulations that govern its activities.

__*Comment R-7-25*__: *The Airport Communities Coalition and the Southwest King County Community Group indicated that several noise issues that are perceived to be not addressed by the EIS or not addressed in the Noise Remedy Program (NRP) include: the significance of a 1.5 DNL noise increase, the number of homes that will not be insulated for years, residents that have declined the avigation agreement, and the loss of integrity on historic properties that are noise insulated.*

__Response:__ An increase of 1.5 DNL or more in noise exposure ("With Project" compared to "Do Nothing") under the Master Plan Update alternatives for noise sensitive sites affected by 65 DNL or greater is considered significant according to FAA guidelines. As such, noise impacts that result in noise increases of less than 1.5 DNL are not considered significant under FAA guidelines as noted on page IV.4-5 of the Draft EIS (page IV.4-7 of the Final EIS). Residential units impacted by a noise level of 60 to 65 DNL (i.e., residences that are marginally impacted) are listed in Chapter IV, Section 2 "Land Use" of the EIS.

All eligible homes that choose to participate will be insulated by 2001. The number of eligible households that have not chosen to participate is approximately 4,000. However, about 75-80 new applications are being received each month. The Port conducted a study in 1994 to determine why people declined to participate in the insulation program, and less than seven percent of those surveyed indicated that the avigation easement was a reason.

There is no indication that historic properties would be significantly impacted by noise and vibration from the proposed "With Project" alternatives. Impacts would occur if the properties were modified for noise insulation such that the historical integrity of the property was diminished. Modifications to properties eligible for or listed in the National Register would require approval by the Washington State Office of Historic Preservation (SHPO), and any modifications would be completed in accordance with the Secretary of the Interior's *Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings* (1983).

Comment R-7-26: The Southwest King County Community Group questioned whether mobile homes located in the existing and/or future noise-impact areas can be mitigated through noise insulation measures.

Response: Mobile homes located in the existing or future noise-impact areas cannot be insulated because the materials used to insulate for noise are too heavy for such light structures. Through the Part 150 process, the FAA approved a Port of Seattle measure to financially assist mobile homeowners should their park be closed. So far, no mobile park owners have chosen to take advantage of this available funding. Vacated mobile home park land would then become available for commercial development. Some mobile home parks south of the Airport in the City of SeaTac are anticipated to be commercially developed.

Comment R-7-27: Mr. Dinndorf (Puget Sound Regional Council) recommended additions or corrections to the Land Use section of the Draft EIS.

Response: Comments noted. The following additions or corrections have been made in the Final EIS to Chapter IV, Section 2 "Land Use":

- Page IV.2-1 - Although PSRC was the source for the Master Plan Update of the Census Summary Tape File 1B (electronic census data) used in this section. The Final EIS reflects the use of U.S. Bureau of Census Data (page IV.2-1).
- Page IV.2-8 (column one, first full paragraph): The reference to the "VISION 2020 PLAN" was changed to reflect "VISION 2020".
- Page IV.2-10: Additional text has been included that discusses the review process in which PSRC is currently engaged regarding local comprehensive plans of King, Snohomish, Pierce, and Kitsap Counties (including jurisdictions in the Sea-Tac Airport vicinity). This consists of the following: (1) A mandatory certification by PSRC of transportation elements in local comprehensive plans that is required by State law (RCW 47.80); and (2) A coordination and consultation process between PSRC and local jurisdictions regarding the consistency of local plans with VISION 2020 Update policies. This is voluntary on the part of local jurisdictions.
- Page IV.2-17: The initial version of VISION 2020 has been cited as "VISION 2020: Growth and Transportation Strategy for the Central Puget Sound Region, Puget Sound Council of Governments (1990)."
- Page IV.15-12J: The surface traffic volume for Alternative 2 for 2020 at South 154th Street near International Boulevard has been corrected to 17,500 rather than 175,000, as indicated in the Draft EIS.
- Page IV.2-18: The title of VISION 2020 and MTP has been corrected to "VISION 2020: 1995 Update, Puget Sound Regional Council (1995)" and "1995 Metropolitan Transportation Plan." The number of RT-8.28 has been changed to RT-8.31 as reflected in the 1995 Update.

- Chapter II (Alternatives): The Do-Nothing and "With Project" alternatives in the Draft EIS assumed construction of the South Access/SR 509 project for the year 2020. Transportation volumes and the air quality modeling for the EIS reflected inclusion of this project. The Final EIS assumes the South Access/SR 509 project as part of the Do-Nothing alternative for the year 2020 only. As discussed in Chapters IV, Section 9 "Air Quality" and Section 15 "Surface Transportation Impacts" in the Final EIS, new air quality modeling has been conducted based upon new projected transportation volumes and assumptions associated with the MTP alternative adopted by PSRC in 1995.

<u>*Comment R-7-28*</u>*: Several commentors stated that the Port of Seattle plans, including the Master Plan Update, are required under the Growth Management Act (GMA) to be consistent with local land use plans and development regulations prepared pursuant to GMA. One commentor said the West SeaTac Sub Area Plan must be completed before the Final EIS is issued. One commentor noted several inconsistencies between the Master Plan Update and the adopted City of SeaTac Comprehensive Plan. The following persons or organizations made these comments: the Airport Communities Coalition, and the Osterman family.*

<u>**Response:**</u> As stated in the Draft and Final EIS, the consistency requirements of GMA impose a responsibility on the comprehensive plans of those counties, and the cities within them, who are required to plan under GMA to "be coordinated with, and consistent with the comprehensive plans adopted pursuant to RCW 36.70A.040 of other counties or cities with which the county or city has, in part, common borders or related regional issues." (RCW 36.70A.100). Accordingly, cities in the Airport vicinity are required by GMA to take into account and consult with neighboring municipalities, King County, and applicable regional bodies and planning documents in drafting their comprehensive plans and development ordinances. Also, as stated in the Draft EIS comment letter from PSRC (see response to comment R-7-27), the plans for Des Moines, Normandy Park, and Burien have neither been reviewed by PSRC for achieving consistency with VISION 2020 policies, nor by PSRC for the consistency of the transportation elements with the King County Comprehensive Planning Policies.

Although the Port of Seattle is not required to prepare comprehensive plans under RCW 36.70A.040, it has attempted to collaborate with neighboring jurisdictions such that Port plans, including the Master Plan Update, are compatible with local jurisdictions to the greatest extent feasible given the PSRCs regional mandate in Resolution A93-03 to proceed with planning for the proposed new parallel runway. The Port has participated, for example, actively in commenting on the recent planning activities and related environmental review on the interim comprehensive plans and development regulations adopted by several adjacent cities. Adjacent cities have participated and commented extensively in the years of planning leading up to the Master Plan Update study (i.e., the Port's Flight Plan Study process). The Port of Seattle currently is involved in negotiations with the City of SeaTac through an interlocal negotiations process to resolve jurisdictional authority issues in a mutually beneficial manner. It is anticipated that inconsistencies that may currently exist between the SeaTac Comprehensive Plan and the Master Plan Update improvements, including zoning and land use designations, will be resolved through these interlocal processes. This process will likely not be completed prior to issuance of the Master Plan Update Final EIS. After this interjurisdictional process has been completed and to the extent required under state law, the City of SeaTac will likely in future amendments to its comprehensive plans address any inconsistencies with the proposed Master Plan Update improvements, including those identified by commentors.

As stated in the Draft and Final EIS, the planning process for the West SeaTac subarea in the City of SeaTac is continuing. The West SeaTac Plan and EIS are not expected to be completed until Spring 1996. Under SEPA, an EIS is required to address only the consistency of the proposal with <u>existing</u> plans (WAC 197-11-440 (6)(d)(i)). There are no applicable regulations, under SEPA or NEPA, that would prohibit the Master Plan Update Final EIS from being issued prior to completion of the West SeaTac Plan. Conflicts between the existing zoning on the West SeaTac area and the proposed Master Plan Update improvements are discussed on page IV.2-8.

__*Comment R-7-29:*__ *The Airport Communities Coalition stated that the Master Plan Update would not comply with critical areas protection policies and regulations of cities in the Airport vicinity.*

__Response:__ The Master Plan Update would comply with all applicable state, Federal, and local critical area regulations. Applicable Federal, state, and local actions required for the Master Plan Update are detailed on pages III-9 and III-10 of the EIS. Federal, state, and local critical area regulations that may be applicable are discussed for each element of the environment in the corresponding section of Chapter IV of the EIS. As stated in the Draft and Final EIS, the Port of Seattle is involved in interlocal negotiations with the City of SeaTac concerning jurisdictional authority. The result of this process, which may not be completed until after the Final EIS is issued, is expected to resolve the issue of applicability of City of SeaTac critical area regulations to the Master Plan Update.

__*Comment R-7-30:*__ *The Southwest King County Community Group stated that, according to Washington State zoning laws, the siting of a maintenance base should not be in an urban or suburban populated area. Moreover, the commentor questions why such a large maintenance base is required for such a small airport as Sea-Tac.*

__Response:__ Decisions concerning zoning are not made at the state level, but rather by local jurisdictions themselves. Siting for the maintenance facility (SASA) was determined through inter-governmental coordination and is consistent with the City of SeaTac land use plans for the area, including the ABC (Aviation Business Center) zoning.

The size of a maintenance facility is not related to the size of the Airport in question but rather to the size and number of aircraft that need to be maintained by an airline or group of airlines.

__*Comment R-7-31:*__ *Mr. Dinndorf (Puget Sound Regional Council) requested discussion of how the Master Plan Update proposed action relates to various policies of the "VISION 2020 Update and Metropolitan Transportation Plan."*

__Response:__ The EIS discusses the relationship of the Master Plan Update to the following policies in the "VISION 2020 UPDATE and Metropolitan Transportation Plan":

RT-8.28 (corrected to RT-8.31), RF-3, RF-3.1, RF-3.3, and RF-3.4. The commentor asked for similar discussion for the following additional policies, which is provided below. Where applicable, reference is made to specific sections of the Final EIS that address these policies.

RC-2.6 "Give high priority to protecting and enhancing the natural environment and public health and safety when providing services and facilities."

The Master Plan Update would comply with all applicable Federal, state, and local critical area regulations. Applicable Federal, state, and local actions required for the Master Plan Update are detailed on pages III-9 and III-10 of the Final EIS. Mitigation for adverse impacts of the Master Plan Update and new parallel runway would be required and are detailed for each appropriate element of the environment in Chapter IV of the Final EIS. Issues of human health and safety are discussed in Chapter IV. Section 7 "Human Health of the Final EIS; as no significant degradation of safety would result from the Master Plan Update, no mitigation would be necessary.

RC-2.7 "In coordinating growth management for urban development with natural resource planning, promote urban development solutions that conserve water, energy, and land resources and protect air quality."

With regard to water conservation, Appendix Q-B (Water Conservation Plan) of the Final EIS outlines alternative water conservation techniques for the Port of Seattle, analyzes the costs and benefits of conservation alternatives, and develops a long-term water management plan. Applicable mitigation for impacts are detailed in the Final EIS Chapter IV, Section 10, "Water Quality and Hydrology"; Section 22 "Energy and Natural Resources"; and Section 9, "Air Quality".

RC-2.10 "Establish and maintain equitable allocations of public costs and revenue among the region's jurisdictions."

Chapter IV, Section 8 (Induced Socio-Economic Impacts) discusses impacts of the Master Plan Update alternatives on adjacent jurisdictions and special districts, including the Highline School District. Although the Master Plan Update "with project" alternatives could result in an initial lowering of property tax revenue and jobs, these impacts are expected to be offset by the induced socio-economic effects from construction and improved Airport facilities.

RH-4.4 "Preserve existing low-income, moderate-income and special needs housing and where appropriate serve it with transit. Promote development of institutional and financial mechanisms to provide for affordable housing, particularly housing located in and near urban centers and transportation corridors."

As discussed in the Social Impacts section of the Final EIS (page IV.6-6), the Master Plan Update would displace affordable housing units (both rental apartments and single-family houses) in the West SeaTac area, primarily due to the construction of the proposed new parallel runway. All acquisitions associated with the Master Plan Update would comply with the Uniform Relocation and Assistance Act.

RO-6.6 "Encourage the use of environmentally sensitive development practices to minimize the effects of growth on the region's natural resource systems."

As stated in the discussion under RC-2.6, the Master Plan Update would comply with all applicable Federal, state, and local critical area regulations. Mitigation for adverse impacts of the Master Plan Update and new parallel runway would be required and are detailed for each appropriate element of the environment in Chapter IV of the Final EIS.

RE-7.11 "Foster renewable resources in unincorporated rural areas and designated natural resource lands by establishing and promoting management practices that protect the long-term integrity of the natural environment and assure that the long-term productivity of designated resource lands are preserved."

This policy would not apply to the Master Plan Update because the proposed airport improvements are located within a designated Urban Growth Area (UGA) of King County, as opposed to within an unincorporated rural area. The proposed improvements also would not affect designated natural resource lands (agricultural, forest, or mineral resource lands).

RT- 8.6 "Promote efficient multimodal access to interregional transportation facilities such as airport, seaports, and inter-city rail stations."

As a result of Sea-Tac Airport being located on the planned Regional Transit Project's (RTP) proposed light rail line, the Airport is expected to be served by regional mass transit. A variety of bus routes currently serve the Airport.

RT-8.11 "Promote demand management and education programs that shift travel demand to non-single occupant vehicle travel modes and to off-peak travel periods, and reduce the need for new capital investments in surface, marine, and air transportation."

Demand management issues related to the Master Plan Update are discussed in Chapter II of the Final EIS. Expansion of the existing facilities at Sea-Tac Airport would support use of the planned RTP rail line (assuming the RTP is approved by voters for construction) and thus provide an alternative to use of the single-occupant vehicle. Expansion of Sea-Tac Airport would provide an alternative to constructing a new facility in a rural area. It is unlikely that a new rural facility would be served by the RTP (at least in the near future), resulting in an increase in the use of single-occupant vehicles.

RT-8.14 "Emphasize transportation investments that provide alternatives to single-occupant vehicles travel to and within urban centers and along corridors connecting centers."

Expansion of Sea-Tac Airport would support use of the planned RTP rail line and thus provide an alternative to use of single-occupant vehicles. The RTP would connect designated urban centers within King County.

RT-8.40 "Encourage, where possible, the use of local labor when building regional transportation systems and components which could generate new economic and employment opportunities."

The Port of Seattle would encourage, wherever possible, the use of local labor in construction activities resulting from implementation of the Master Plan Update.

Comment R-7-32: *The commentor noted that the Draft EIS states that planning issues are decided on a "county-wide" basis, and asked if the third runway decision was made on a "regional basis." This comment was made by the Southwest King County Community Group.*

Response: The referenced EIS text, page III-2 in Chapter III "Affected Environment", is a discussion of subarea planning processes in unincorporated King County. The point is made that subarea plans are subordinate to, and must be consistent with, planning policies and decisions set by countywide plans (i.e., the adopted King County Countywide Planning Policies and King County Comprehensive Plan). In this context, the Draft and Final EIS note that planning issues for unincorporated areas are decided on a countywide basis.

The issue of the third runway is not discussed in the above-referenced EIS text. It is assumed that the "decision" being referred to by the commentor about the third runway is Resolution A-93-03, made in April 1993 by the Puget Sound Regional Council (PSRC), which recommends that "the region should pursue vigorously, as the preferred alternative, a major supplemental airport and a third runway at Sea-Tac." If so, this decision was indeed made on a regional basis since it was made by PSRC, which is the regional metropolitan planning organization (MPO) for the four-county area (King, Snohomish, Pierce, and Kitsap County). This decision amended the Regional Air System Plan (RASP). See response to comment R-2-1.

Comment R-7-33: *Three commentors stated that they had additional questions pertaining to the Noise Remedy Program (NRP) and to the specifics referred to in the Draft EIS reference to the provision of "additional sound insulation." In particular, commentors wanted to address the cost issue of re-insulating homes that had previously been insulated without complete directional soundproofing, and the need to complete directional soundproofing. These comments were put forward by: Ms. Brown, Ms. Stuhring, and the Southwest King County Community Group.*

Response: Additional expenditures would be required to complete directional soundproofing for the remaining homes that received directional soundproofing only on the side of the home facing the runway. These expenditures are necessary to reduce interior noise. It is important to emphasize that the homes receiving additional directional soundproofing would receive it only on the sides of the house where it is currently missing or where less intensive insulation was installed. Thus, the Port of Seattle is using additional expenditures to provide an even more complete sound insulated environment (see response to comment R-7-24).

__Comment R-7-34__: *Mr. Wichert stated that sound insulation measures are inconsistent with one's desire to open windows for fresh air.*

__Response__: In addition to insulating walls and windows, the Port of Seattle provides residents impacted by noise with ventilation systems that draw fresh air into residential units. This mitigation measure eliminates the need to keep windows open.

__Comment R-7-35__: *Two commentors questioned what constitutes a cold climate home, the percentage of the housing stock that qualifies as a cold climate home under established criteria, and how such homes located in the noise-impacted areas will be mitigated. This comment was made by Ms. Brown, the Southwest King County Community Group, and the Regional Commission on Airport Affairs.*

__Response:__ Cold climate homes are defined as homes that were built from masonry (brick or stone) as opposed to wood stick frame construction. Generally, brick and stone constructed homes are better insulated than frame homes because of the heavier materials used in the construction process. In fact, mason-constructed homes show up to a 20-25 dBA reduction in sound inside as compared to noise outside. For this reason, brick and stone homes do not require noise insulation for walls (older plaster work is much thicker than sheet rock), although they still require insulation on windows and doors. Approximately 10 percent of the housing stock in the impacted areas is constructed with brick or stone materials.

__Comment R-7-36__: *Several commentors reported that housing appraisals made through the Transaction Assistance Program, based on comparables from out of the noise impacted area, are generally lower than those conducted by private non-biased appraisers. The recommended mitigation needs to be clarified. Moreover, by understating their market appraisals, the Port of Seattle is actually in a position to make (tax-exempt) money on previous purchases. In addition, purchased properties in the projected flight path for the creation of an extended approach transition zone for safety are not projected as for sale, movement or relocation. The Southwest King County Community Group, the commentor, also questioned how the Port of Seattle will address the use of these homes.*

__Response:__, The Port of Seattle complies with all applicable Federal, state and local laws and regulations that govern its activities. The Port offers fair market value in its appraisals through the Transaction Assistance Program, based on comparable appraisals outside the noise affected areas. As stated in the Draft and Final EIS, all residential properties in the Approach Transitional Area may be provided the option of being acquired by the Port of Seattle. This option would receive further consideration in the upcoming Sea-Tac Airport FAR Part 150 Noise Study Update (anticipated in 1996).

As is stated on Page IV.2-6 of the Draft EIS (Final EIS page IV.2-7) "In recognition of the fact that the standard Runway Protection Zone (RPZ) dimensions do not always provide sufficient noise and safety buffer to the satisfaction of nearby residents, the FAA would cost participate with airport operators to acquire " up to 1,250 feet laterally from runway centerline, and extending 5,000 feet beyond each end of the primary surface." If implemented, this would apply to all residential uses. The Port would then remove the house and attempt to convert the properties to compatible uses or have the properties serve as an open space buffer.

***Comment R-7-37**: Several commentors noted that, in adopting Resolution A-93-03 in April 1993, PSRC supported the proposed third runway project, subject to conditions including noise reduction and feasible demand and system management actions. Commentors noted that PSRC is in the process of coordinating with the State to enact legislation allowing for substantial and equitable incentives and compensation for communities impacted by proximity of essential public facilities. Others wrote to support the extended buyout plan. Another commentor stated that all acquisitions associated with the Master Plan Update must be addressed in the Final EIS and comply with the Department of Transportation's Uniform Relocation Assistance and Real Property Acquisitions Regulations for Federal and Federally Assisted Programs. A final commentor stated that the Noise Remedy Program needs to be expanded to incorporate Normandy Park and other neighborhoods that are subject to similar aircraft noise levels. The commentor also noted that noise impacts on businesses were inadequately addressed in the Draft EIS. This comment was raised by the following individuals and agencies: Mr. & Mrs. Carlson, Mr. Dinndorf (PSRC), Mr. Hickman, Mr. Derrick (King County Department of Development and Environmental Services), the Osterman family, Mr. Peyton (Ravenna-Bryant Community Association), and the Southwest King County Chamber of Commerce.*

Response: The Noise Remedy Insulation Program (NRP) was established by the Port of Seattle to mitigate airport noise impacts for homes forecast to be impacted by significant noise levels (i.e., noise that exceeds 65 DNL) in the year 2000. Based on the most current noise contours, the noise is reducing as predicted. The City of Normandy Park is not impacted by noise levels above 65 DNL, and is therefore not considered by FAA guidelines to require mitigation. The EIS notes, however, that the City of Normandy Park has adopted an interim plan which sets noise levels below the Federal guideline of 65 DNL.

Unlike residential land uses, a commercial use is considered to be compatible with aircraft noise below 80 DNL. A business may be relocated in the event that it becomes landlocked by adjacent residential acquisitions. Alternatively, when a business use also serves as a residence, it may qualify for acquisition or for sound insulation under the NRP in the same manner as a residential unit.

All potential acquisition required by the Master Plan Update alternatives are listed in Table IV.6-4 of the Draft and Final EIS. All displacements would comply with the Uniform Relocation Act of the U.S. Department of Transportation.

SOCIAL IMPACTS/INDUCED SOCIO-ECONOMIC IMPACTS

***Comment R-8-1**: Four commentors stated that the Draft EIS fails to consider the loss of neighborhood cohesion that would result from the acquisition of residential and commercial properties. Commentors also state that the document fails to recognize the total impact the Airport has on its community, including "quality of life." Commentors: Mr. Dodge, Mr. Mealy, the Regional Commission on Airport Affairs, and the Airport Communities Coalition.*

Response: Chapter IV, Section 6 "Social Impacts" of the Draft and Final EIS details the residential and commercial displacements that would occur under each of the Master Plan Update alternatives. Community character of neighborhoods on the west side of the Airport would be disrupted by the displacement of established residences and the presence of new airport activities to the west. Existing community cohesion in the West SeaTac area would be affected as displaced residents relocate, disengage from the community, and establish ties to other neighborhoods and communities. Predominant land use in this area would change from residential to airport and industrial/commercial uses. As stated in the Draft and Final EIS, this change also could result in greater long-term land use compatibility than presently exists in the West SeaTac area. SR 509 would be the limit of the acquisition area to the west, and would function as a buffer for remaining residences west of SR 509. Please see the revised discussion of disruption of community character and cohesion in the Final EIS.

Comment R-8-2: Mr. Chapin asked why owners of private residences receive more relocation assistance or benefits than owner-occupants of commercial properties.

Response: Owner occupied residential properties within the 65 DNL or greater noise exposure area are entitled to noise mitigation assistance because they are considered to be noise impacted; residential properties within the 75 DNL or greater noise exposure area are entitled to relocation assistance because they are considered not to be a compatible land use. Commercial properties are compatible with the anticipated noise levels and are not considered to experience significant adverse impacts. For this reason, commercial property owners are not entitled to the same noise mitigation assistance. Both residential and commercial properties that are displaced would be acquired in compliance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as described on page IV.8-10 of the Draft and Final EIS (page IV.8-12 of the Final EIS).

Comment R-8-3: The Southwest King County Community Group inferred that potential future acquisitions will not happen in a scheduled and timely manner, in light of perceived delays in past acquisitions and mitigation programs.

Response: In the past there have been some delays in acquisition and remediation programs under the 1974 SeaTac Communities Plan and the 1985 Part 150 Program. Some of the delays were related to the duration of negotiations with property owners. Other delays, such as those relating to demolition of purchased houses, occurred as a result of changes in requirements for the demolition of houses with lead paint, asbestos, and other materials of concern. The current noise remedy program for houses is scheduled to be completed by 2000; other facilities will be completed by 2003. Please see text beginning on page IV.6-3 of the Final EIS for a more detailed description of potential acquisitions.

Comment R-8-4: The Southwest King County Community Group requested clarification of the acquisition process including a specific time line for acquisition, relocation, and noise insulation.

Response: The current estimated time line for acquisition of properties would be three to four years, with the acquisition starting approximately four years prior to initiation of construction. The anticipated rate of acquisition is approximately 10 houses per month, based upon past acquisition activities. Please see the text beginning on page IV.6-3 of the Final EIS for further details of potential acquisitions.

Comment R-8-5: The Airport Communities Coalition, Ms. Brown, and Regional Commission on Airport Affairs stated that numerous indirect and induced costs, such as people delayed in traffic, noise disruptions, and health costs are not quantified.

Response: In accordance with FAA guidelines, the EIS addressed "shifts in the patterns of population movement and growth, public service demands, and changes in business and economic activities to the extent influenced by the Airport development". Induced and indirect socio-economic impacts related to personal income, property tax receipts, sales tax revenues, population growth and movement, and employment are discussed in Chapter IV, Sections 8 "Induced Socio-Economic Impacts" and Section 23 "Construction Impacts" of the EIS. The methodology used to identify induced and indirect impacts is discussed on page IV.8-1. No other significant induced or indirect impacts are directly attributable to the "With Project" or the Do-Nothing Alternatives; therefore, no further quantification is necessary. The potential induced and indirect socio-economic impacts identified by the commentors are related to the level of airport operations, which does not increase from the Do-Nothing Alternative for the "With Project" alternatives.

__*Comment R-8-6:*__ *Two commentors requested additional information and clarification in the presentation of net impacts concerning social and induced socio-economic impacts, especially with regard to the summary tables on page IV.8-1 of the Draft EIS. Commentors: Mr. Rohlfs (City of SeaTac) and Mr. Frause.*

__Response:__ The information requested is contained and discussed in Chapter IV, Section 8 "Induced Socio-Economic Impacts" and Section 23 "Construction Impacts" of the EIS with regard to potentially significant impacts. The tables contained on page IV.8-1 summarize information that is explained in detail in the remainder of Chapter IV, Section 8 for each runway length and terminal option. Effects on employment and business income (taxable sales) from business displacements that would result from the Master Plan Update alternatives are identified and discussed in the EIS. Because these effects from displacements were analyzed and found to be not significant, it is reasoned effects of displacements on personal income also would not be significant and, as such, it is not necessary to estimate them in the EIS.

__*Comment R-8-7:*__ *Two commentors requested greater substantiation of how negative impacts will be offset by positive impacts. Commentors: Mr. Rohlfs (City of SeaTac) and Mr. Frause.*

__Response:__ The direct effects of residential and business displacements are discussed on pages IV.8-4 through IV.8-9 of the Draft EIS (page IV.8-6 through IV.8-11 of the Final EIS). The net effects of residential and business displacements would be partially offset because some displaced residents and businesses likely would relocate within the same jurisdiction and/or area, as assumed in the EIS. In those cases, the positive effects associated with the residences, businesses, tax base, income, and employment would not be totally lost from the jurisdiction or area. Leasehold revenues also could be generated depending on airport uses in the acquisition area. The net effects of these displacements and impacts on local revenues would not be significant in the short or long-term, and it is not necessary to evaluate them further in the EIS. Please refer to response to comment R-7-2 for additional explanation of potential business displacements.

__*Comment R-8-8:*__ *The Southwest King County Community Group raised several issues regarding elderly residents in Census Tracts 290.01 and 289 in the City of Des Moines. Specific questions included, "What would the impact be on the City of Des Moines if these retirement homes (Judson Park and Wesley Gardens Retirement Homes) could no longer compete in their present locations (because of noise)?" and "What impacts will more noise and pollution have on the large population of elderly in Des Moines?"*

__Response:__ Table IV.6-1 highlights social and socio-economic characteristics of the general study area, including Census Tracts 290.01 and 289. Census Tracts 290.01 and 289 contain 26.6% and 14.6% elderly (65 and older) people, respectively (1990 U.S. Census); the results of the noise modeling described in Chapter IV, Section 1 "Noise Impacts" of the EIS show that with any of the future alternatives, almost all of Census Tract 290.01 is outside of the 65 DNL and greater noise exposure area, and only about half of Census Tract 289 is within the 65 DNL and greater noise exposure area. This scenario represents a significant improvement over 1994 existing conditions for all people living in those areas, including elderly populations. Because elderly residents in Des Moines, including those in retirement homes, would not be subject to increased noise and pollution as a result of the project, the competitiveness of area retirement homes is not expected to be adversely affected by noise issues.

__*Comment R-8-9:*__ *Mr. Peyton (Ravenna-Bryant Community Association) requested and suggested further clarification of the terms "acquisition" and "condemnation".*

__Response:__ Acquisition of property can be accomplished through purchase; condemnation (also known as eminent domain, a right of the government to take private property for public use by virtue of the superior dominion of the government over land within its jurisdiction); establishment of an easement; donation; or exchange. Unless received by donation, acquisition of private property requires the payment of just compensation to the property owner. It is expected that the majority of the property acquired for construction of the proposed new parallel runway or establishment of RPZ areas would be acquired through purchase of property; regardless, all property acquisitions would comply with the Uniform Relocation Assistance Act. During the Part 150 Acquisition Program, the Port of Seattle acquired 1,328 houses between 1974 and 1994. Of those 1,328 acquisitions, approximately 30 or 40 of them held out for the negotiation stage; none were condemned and none were settled in court.

Comment R-8-10: Three commentors suggested that the EIS dismisses the impacts on local property tax receipts. Commentors: Ms. Brown, the Regional Commission on Airport Affairs, and Airport Communities Coalition.

Response: Comment noted. The potential significant impacts of the "Do-Nothing" and "With Project" alternatives on property tax revenues of the cities of Burien and SeaTac are discussed in detail on pages IV.8-5 through IV.8-7 of the Draft EIS (page IV.8-7 through IV.8-9 of the Final EIS).

Comment R-8-11: The commentors suggested that the Draft EIS does not adequately assess displacements or the impacts on the community that would remain after the Port of Seattle acquires properties needed for the proposed runway. Commentors: Airport Communities Coalition, Mr. Forrey, the Osterman family, Regional Commission on Airport Affairs, Mr. Peyton (Ravenna-Bryant Community Association), Seattle Community Council Federation, and Mr. Wagner.

Response: Comment noted. The Draft and Final EIS states that the greatest disruptions and displacements would occur in the primary acquisition area located within the West SeaTac neighborhood. Displacements in a substantial portion of the West SeaTac area between 12th Avenue and SR-509 would occur for the "With Project" alternatives. Community character of neighborhoods in and adjacent to this area would be disrupted by the displacement of established residences and the presence of new airport activities. Please see the discussion of neighborhood cohesion and character on page IV.6-4 of the Final EIS, which has been revised to acknowledge that existing community cohesion would be affected as displaced residents relocate, disengage from the community, and establish ties to other neighborhoods and communities.

As discussed on page IV.6-5 of the Draft and Final EIS, all acquisitions would comply with the Uniform Relocation Assistance and Real Property Acquisition Policies Act. Under this Act, the Port of Seattle is responsible for "just compensation" for affected properties at "fair market values." Just compensation includes (where applicable) closing costs, moving costs, interest differentials, and replacement housing payments or rental differential payments.

Comment R-8-12: Mr. Peyton (Ravenna-Bryant Community Association) suggested that the number of airport-related jobs reported in the EIS is overstated, and requests a reference for the figures cited.

Response: Comment noted. The Port of Seattle and FAA believe that the numbers cited are reasonably accurate estimates. The source for estimates of airport-related jobs is the report, *Local and Regional Economic Impacts of the Port of Seattle*, prepared by Martin O'Connell Associates, May 31, 1994. Specific pages referenced are cited at the bottom of Table IV.8-1 on page IV.8-4 and at the bottom of Table IV.8-3 on page IV.8-13A in the EIS. For purposes of comparison, Table III-2, Page 61, in the Martin O'Connell Associates study displays the distribution of the 14,381 direct jobs generated by Airport activity within each major economic sector. This table indicates that 82.7% of the direct jobs are in the airline/airport sector. Table IV.8-2 of the EIS shows that of the 14,381 direct jobs there were 11,811 jobs held by residents of King County. Applying this 82.7 % number to the jobs held by residents of King County indicates that approximately 9,768 King County residents were in the airline/airport sector in 1994. This figure compares favorably to the 9,841 employment level for King County referenced in the respondent's letter that was derived from the 1987 *County Business Patterns*. Page IV.6-5 of the Final EIS contains revisions to the text that provides an improved context for understanding the estimates of employment.

__*Comment R-8-13:*__ *A commentor requested additional discussion and evaluation of the fiscal impacts on the Highline School District and other affected service districts. Commentors: Mr. Peyton (Ravenna-Bryant Community Association).*

__Response:__ As requested, the analysis has been expanded to include effects on property tax receipts accruing to the Highline School District and other affected service districts. This new information is included in the Final EIS on pages IV.8-7 through IV.8-9.

__*Comment R-8-14:*__ *The Regional Commission on Airport Affairs stated that the Draft EIS is mistaken in assuming that displaced residents will relocate in nearby neighborhoods, and requests that the Final EIS address the possibility that many residents will relocate far from the Airport.*

__Response:__ The Draft and Final EIS note that some displaced residents would choose to leave the immediate area around the Airport. The discussion in Chapter IV, Section 6 focuses on the ability of displaced residents to be absorbed by surrounding, remaining neighborhoods. The analysis concludes that the vacancy rate of the area is sufficiently high to absorb most, if not all of the displacements. If more displaced households relocated farther from the Airport, they likely would be able to choose from a greater supply of comparable replacement housing.

__*Comment R-8-15:*__ *Two commentors requested that the graphics in the Social Impacts section be improved to include information on the 7,000-foot and 7,500-foot runway lengths. Commentors: Airport Communities Coalition and Regional Commission on Airport Affairs.*

__Response:__ Please see the new exhibits in the Final EIS (Exhibits IV.6-3 and IV.6-4) that show anticipated acquisition areas for the 7,000-foot and 7,500-foot runway lengths.

__*Comment R-8-16:*__ *The Regional Commission on Airport Affairs questioned the assumptions used in the socio-economic impact analysis and the economic effects reported.*

__Response:__ Comment noted. As discussed on page IV.8-2 of the EIS, direct economic effects include employment resulting from airport activities carried out by airlines, airport management, fixed-base operators, and other tenants with a direct involvement in aviation at Sea-Tac Airport. The estimates of visitor contributions to the local economy are based on number of air travelers. The Port of Seattle and FAA believe that the numbers cited are reasonable and accurate estimates. The primary source of data for existing conditions, cited at the bottom of Table IV.8-1 on page IV.8-4 of the EIS, is the report, *Local and Regional Economic Impacts of the Port of Seattle*, prepared in 1994. This and all other cited sources, including documentation of consultation with state and local agencies and jurisdictions, are available for public review as part of the administrative record of this EIS.

__*Comment R-8-17:*__ *A commentor questioned whether the same economic opportunities created by the Master Plan Update alternatives at Sea-Tac would occur if the third runway were built at another site. Commentor: Southwest King County Community Group.*

__Response:__ The economic opportunities created at another site would depend on a number of factors including, among others, the location of the site, existing infrastructure and services at the site, proposed facility improvements at the site (if any), the actual level of airport activity and the success of the site in attracting passengers and air cargo. Thus, the induced socio-economic impacts could be greater or less than those anticipated to occur at Sea-Tac Airport.

<u>*Comment R-8-18*</u>*: Seven commentors expressed concern over impacts on multi-ethnic and low-income neighborhoods of Seattle and the possibility of special populations being affected. Several commentors state that flight paths have been shifting to the east, causing greater noise impacts in Beacon Hill and Rainier Valley over the past several years. Commentors: Church Council of Greater Seattle, Ms. Ford, Ms. Lepley, Ms. Moriyason, Mr. Peterson, Regional Commission on Airport Affairs, and Seattle Community Council Federation.*

<u>**Response:**</u> Please see the revisions on page IV.6-7 of the Final EIS for an expanded discussion of environmental justice issues, including more detailed census data. Furthermore, additional analysis of 1990 census data in acquisition areas was done to determine if special populations were disproportionately affected in these areas; the analysis concluded that special populations were not disproportionately affected. Please see page IV.6-7 of the Final EIS for further discussion of the analysis.

The EIS analyzes existing conditions and the future alternatives. It does not analyze changes in the noise environment prior to 1994. With all alternatives, the noise attributable to aircraft operating at Sea-Tac is predicted to be significantly less for residents of Beacon Hill and Rainier Valley by the year 2000, primarily because of the phase-out of noisier Stage 2 aircraft. No portions of Beacon Hill and Rainier Valley (City of Seattle) would be exposed to significant noise levels (65 DNL or greater) under the Master Plan Update "With Project" alternatives. For more details on noise impacts, see Chapter IV, Section 1 "Noise" of the Draft and Final EIS. In addition, for those commentors who were referring to a perceived recent change in airport operating procedures - see response to comment R-5-5.

<u>*Comment R-8-19*</u>*: Mr. Derrick (King County Department of Development and Environmental Services) asked if vacancy and displacement rates reported in the Draft EIS are for single-family or multifamily housing.*

<u>**Response:**</u> The displacement and vacancy rates are for single- and multi-family housing. This has been clarified on page IV.6-3 of the Final EIS.

<u>*Comment R-8-20*</u>*: Three commentors expressed concern that the Draft EIS did not address affordable housing issues such as how the proposed improvements would affect the affordable housing inventory in the area. Commentors: Airport Communities Coalition, the Osterman family, and Mr. Derrick (King County Department of Development and Environmental Services).*

<u>**Response:**</u> Please see revisions on page IV.6-5 of the Final EIS for additional discussion of affordable housing issues in the vicinity of the area affected by the proposed Master Plan Update improvements. The King County Growth Management Planning Council's Countywide Planning Policies have established targets for affordable housing in King County. Housing that costs no more than 30% of gross monthly income per month is considered affordable. According to the City of SeaTac Comprehensive Plan, households earning below 50% of the median income in King County can afford houses up to $81,300 or rent and utility payments of $452 per month; households earning between 50% and 80% of median income in King County can afford houses between $81,300 and $130,100, or rent and utility payments of $724 a month. The City of SeaTac has a set target of 198 new housing units affordable to people making 50% of the median income and 168 new housing units affordable to people making between 50% and 80% of the median income for a total of 366 affordable housing units by the year 2000.

For this study, affordable housing is considered housing affordable to households with 80% of the median income in King County. It is estimated that approximately 77% of the houses in the acquisition areas would be considered affordable, and 91% of the apartments in the acquisition area would be considered affordable. This translates to between 270 to 300 acquired affordable single-family houses and 24 to 237 acquired affordable apartments or condominiums under the "With Project" alternatives, depending on which alternative is considered.

Comment R-8-21: Mr. Graham suggested that the socio-economic analysis is lacking in its evaluation of the "Do-Nothing" alternative.

Response: As described in the Draft and Final EIS, the "Do-Nothing" alternative is based on Sea-Tac Airport remaining generally as it is today, with limited improvements that have already been subject to an environmental analysis. Growth in airport operations and the number of passengers served would occur under the Do-Nothing alternative but would be accommodated by the Airport operating at less efficient levels, as is described in detail in the introduction to this appendix. No alternative that would reduce the competitiveness and level of activity of the Airport from existing conditions is proposed at this time, nor is it considered to be reasonable, given the purpose and need for the proposed action. For these reasons, evaluation of such an alternative in the EIS is not necessary. The effects of the "Do-Nothing" alternative are evaluated in detail on pages IV.8-4 and IV.8-5 in the EIS.

Comment R-8-22: Three commentors suggested that property values could decrease adjacent to the proposed buyout areas and could result in lower property tax receipts. Commentors: Airport Communities Coalition, Ms. Brown, and Mr. Mealy.

Response: Comments acknowledged. Please see the revisions on page IV.8-7 of the Final EIS.

Comment R-8-23: Mr. Rohlfs (City of SeaTac) suggested that the Draft EIS does not identify the total for loss of property tax receipts of the City of SeaTac.

Response: Comment acknowledged. The Draft and Final EIS used the 1993 Tax Year Assessed Valuation. At the time of the analysis, these data were the most current available from the King County Assessor's Office. The commentor's use of more recent property valuation assessments suggests a 0.68% difference between the potential 1995 General Fund property tax loss of 3.68% to the City of SeaTac and the 1993 General Fund property tax loss of 3% as reported in the EIS. This suggests that the value of the displaced properties and their contribution to the City's 1995 property tax receipts has increased relative to other properties in the City that are farther from the Airport and/or would not be displaced.

SURFACE TRANSPORTATION

Comment R-9-1: Mr. Peyton (Ravenna-Bryant Community Association) reported that Appendix I indicates that it should contain a Surface Transportation report, but published copies were blank.

Response: Appendix I was intended to be left blank to avoid confusion in the numbering between Chapter I and the appendix. Inadvertently, the table of contents was prepared noting that Appendix I would contain the report, which was also listed as Appendix O. This was corrected for the Final EIS in the Table of Contents and Appendix I.

Comment R-9-2: Two commentors noted that the Draft EIS surface transportation analysis needs to be updated to reflect the adopted Puget Sound Regional Council's 1995 Metropolitan Transportation Plan. The following individuals made this comment: Mr. Dinndorf (PSRC), and Ms. Montgelas (WSDOT).

Response: The Draft EIS surface transportation analysis was based on the Package 3, the Demand Management/Expansion Package, of the Puget Sound Regional Council's (PSRC) Metropolitan Transportation Plan (MTP), as described in the PSRC's December 1994 Draft Metropolitan

Transportation Plan (MTP). At the time that the Draft EIS was prepared, the PSRC was in the process of updating the MTP and a preferred alternative had not been selected. Subsequently, a preferred alternative, other than Package 3 was selected. The primary difference between the adopted MTP and Package 3 is an aggressive congestion pricing element. Package 3 included this aggressive congestion pricing element, while the adopted MTP does not include a congestion pricing element. Due to this difference, higher levels of vehicular traffic and congestion would be expected with the adopted MTP. As a result, the regional traffic volumes forecast for this analysis are about 20% higher than forecasts used in the Draft EIS analysis.

Comment R-9-3: Several commentors stated that the Draft EIS surface transportation analysis needs to be updated now that the proposed Regional Transit Authority plan did not pass the public vote. The following individuals made this comment: Ms. Ayers, Mr. Peyton (Ravenna-Bryant Community Association), Southwest King County Community Group, Mr. Bush (METRO), and Ms. Montgelas (WSDOT).

Response: In March, 1995, voters from King, Pierce, and Snohomish Counties did not approve the proposed Regional Transit Authority (RTA) plan. However, the RTA is considered a long-term regional transportation improvement and is included in the Puget Sound Regional Council's adopted 1995 Metropolitan Transportation Plan. In addition, a revised RTA plan will be presented to the voters in 1996. The Final EIS surface transportation analysis includes the RTA as described in Chapter IV, Section 15 "Surface Transportation". Please refer to response to comment R-5-7 for further discussion.

Comment R-9-4: Mr. Rohlfs (City of SeaTac), and the Airport Communities Coalition commented that the Draft EIS surface transportation analysis is not consistent with the City of SeaTac Comprehensive Transportation Plan.

Response: The Final EIS surface transportation analysis has been updated to be consistent with the City of SeaTac Comprehensive Transportation Plan as described in Chapter IV, Section 15 "Surface Transportation" and in Appendix O.

Comment R-9-5: Two commentors noted that the Draft EIS surface transportation analysis considered the improvement of International Boulevard as a seven lane roadway. The design for International Boulevard consists of four general purpose lanes and a southbound HOV lane. The following individuals made this comment: Mr. Rohlfs (City of SeaTac), and Mr. Bush (METRO).

Response: The Final EIS surface transportation analysis has been revised to reflect this change as described in Chapter IV, Section 15, on page IV.15-4 of the Final EIS.

Comment R-9-6: Mr. Rohlfs (City of SeaTac) commented that the Draft EIS surface transportation analysis indicates that the intersections of Airport Expressway/Air Cargo Road and Airport Expressway/South 170th Street will need to be improved and signalized by the year 2010. The City of SeaTac Comprehensive Transportation Plan indicates that these intersections need to be signalized by the 1996/1998 time frame without consideration of a third runway. He requested that the surface transportation analysis be revised to reflect this.

Response: The Draft EIS assumed that the intersections of Air Cargo Road/Northern Airport Expressway and South 170th Street/Northern Airport Expressway would be signalized by the year 2000 analysis. This is consistent with the City of SeaTac's Comprehensive Transportation Plan. Additional surface transportation mitigation measures, consisting of geometric and signal improvements, were recommended in the Draft EIS for Alternatives 2 (Central Terminal) and 4 (South Unit Terminal) by the year 2010.

Comment R-9-7: *Mr. Derrick (King County Department of Development and Environmental Services) questioned why Alternative 3 impacts the surface transportation system in a different manner than the other Alternatives.*

Response: The improvements defined for Alternatives 2 (Central Terminal) and 4 (South Unit Terminal) are very similar in location, size, and scope, and therefore have very similar transportation impacts. However, the improvements defined for Alternative 3 (North Unit Terminal) differ in location and size, and therefore would have different transportation patterns. The differences between the proposed improvements include the construction of the Doug Fox parking garage for Alternative 2 and 4, the relocation of and development of new aircraft maintenance facilities within the South Aviation Support Area for Alternatives 2 and 4, the construction of an Employee North Parking lot for Alternative 3, the construction of Air Cargo warehouses for Alternative 3, and the construction of a State Route 518 interchange at 20th Avenue South for Alternative 3. In addition, the Do-Nothing assumptions were revised based on growth in regional roadway traffic and congestion on the Airport roadways. These differences combine to produce different transportation patterns for Alternative 3 and for Alternatives 2 and 4.

Comment R-9-8: *Mr. Peyton (Ravenna-Bryant Community Association noted that the Draft EIS does not mention the changes in the surface transportation system that appear in Exhibits II.3-2 through II.3-5.*

Response: Exhibits II.3-2 through II.3-5 present the four Alternatives considered in the Draft EIS (Final EIS Exhibits II-6 through II-8). The Master Plan improvements that occur for the Centralized Terminal, North Unit Terminal, or South Unit Terminal Alternatives and impact the surface transportation system are defined in the Surface Transportation Report, located in Appendix O of the EIS. In addition, the Transportation Improvement Projects (TIP) that outline the proposed improvements in the surface transportation system in the vicinity of the Airport are also defined in the Appendix O.

Comment R-9-9: *Mr. Peyton (Ravenna-Bryant Community Association) and Ms. Gates (City of Federal Way) had several questions concerning the impact of constructing an underpass for South 154th Street instead of relocating the roadway around the third runway embankment. He questioned if it would effect accident rates and if it would close the street to certain types of traffic.*

Response: Generally speaking, an underpass would be more expensive than relocating the roadway because the construction of an underpass structure would be required. An underpass that is designed to current standards would not be expected to increase the accident rates on that roadway. An underpass could also limit certain types of traffic since there would be height restrictions. It may also limit future expansion or widening of the roadway.

Comment R-9-10: *Mr. Frause, the Southwest King County Community Group, and Mr. Rohlfs (City of SeaTac) requested that the Draft EIS address the issue of street vacation and relocation.*

Response: In order to construct the third runway, part of South 154th/156th Street would need to be relocated, and several streets located east of Des Moines Memorial Drive South and in the "displacement zone" would need to be vacated. In addition, with the construction of the North Unit Terminal part of South 170th Street will need to be vacated. The Port of Seattle recognizes that it will need to coordinate with the City of SeaTac in order to address the impacts associated with street relocation and vacation as part of the overall acquisition plan. Please refer to response to comment R-18-16 for further discussion.

Comment R-9-11: *The Southwest King County Chamber of Commerce commented that the assumption that the southern entrance to the Airport would remain at level of service "C" through the year 2010, when it would be located one block from an intersection that today is at level of service "F", does not seem reasonable nor accurate.*

Response: : It is not uncommon to find two intersections, located in close proximity to each other, operating under two different levels of service ratings as long as the queue from one intersection does not interfere with the operation at the other intersection. The intersection at International Boulevard and South 188th Street experiences almost two times as much traffic as the intersection at 28th Avenue South and South 188th Street. In addition, the intersection of International Boulevard and South 188th Street has significant opposing traffic movements on several approaches. In this situation it would not be uncommon to find these two intersections operating at different level of service ratings.

Comment R-9-12: *The Airport Communities Coalition, Mr. Rohlfs (City of SeaTac), Mr. Derrick (King County Department of Development and Environmental Services), Ms. Brown, Southwest King County Chamber of Commerce, Ms. Montgelas (WSDOT), and Ms. Ayres commented that the Draft EIS does not adequately address the issues regarding south access either from South 188th Street or State Route 509.*

Response: The issue of south access has been addressed in the Final EIS in Chapter IV, Section 15 and in Appendix O.

Comment R-9-13: *Several commentors stated that the Draft EIS did not adequately describe the mode choice patterns and the origin-destination patterns of Airport related traffic. The following individuals made this comment: Southwest King County Community Group, the Airport Communities Coalition, Ms. Montgelas (WSDOT), and Mr. Bush (METRO).*

Response: The Final EIS summarizes the mode choice patterns for both the Do-Nothing Alternative and the Preferred Alternative (Alternative 3) in Chapter IV, Section 15 "Surface Transportation", Table IV.15-2 of the Final EIS. The origin-destination patterns for both the local surface transportation system and the regional transportation system are defined in Exhibits IV.15-1 and IV.15-2 of the Final EIS. Further discussion of the mode choice and the origin-destination patterns for Airport related traffic are included in Section 15, and in Appendix O of the Final EIS.

Comment R-9-14: *The Airport Communities Coalition suggested that the surface transportation analysis should be for design day conditions (e.g., an average August weekday) and not annual average conditions.*

Response: During the scoping process for the EIS several reviewing public agencies were contacted to define the scope of work for the surface transportation analysis. One of the questions asked of these agencies was whether the surface transportation analysis should be performed for annual average conditions, or design day conditions. The agencies indicated that annual average conditions would be adequate for the surface transportation analysis since all significant impacts would be identified.

Comment R-9-15: *Ms. Ayres commented that the Draft EIS does not define the surface transportation impacts between the years 2000 and 2020.*

Response: The Draft and Final EIS summarizes the surface transportation impacts for the year 2020. Surface transportation impacts from year 2000 through year 2020 are defined in Appendix O.

Comment R-9-16: *Mr. Derrick (King County Department of Development and Environmental Services), Mr. Dinndorf (PSRC), and Ms. Montgelas (WSDOT) commented that the Draft EIS surface transportation analysis should analyze future conditions both with and without the State Route 509 extension and South Access projects.*

Response: The EIS surface transportation analysis includes future conditions both with and without the State Route 509 extension and South Access projects for the year 2020 as defined in Chapter IV, Section 15.

Comment R-9-17: *The Airport Communities Coalition indicated that the Draft EIS surface transportation analysis ignored the impacts of increased air cargo truck traffic and split air cargo facilities.*

Response: The Draft and Final EIS surface transportation analysis addresses the increase in air cargo truck traffic, and the impacts associated with split air cargo facilities but the analysis was not complete. The Final EIS addresses the full impacts of increased air cargo truck traffic and split cargo facilities in Chapter IV, Section 15. See also response to comment R-3-13.

Comment R-9-18: *Mr. Frause questioned how is the Port of Seattle responsible for the impacts of Airport traffic on Washington State Department of Transportation (WSDOT) highways.*

Response: The fundamental focus of the EIS surface transportation analysis was to determine if the proposed Master Plan Update improvements cause significant adverse impacts on the surface transportation system. Several WSDOT highways are located within the surface transportation analysis area and are therefore part of the surface transportation system that was analyzed. The Port of Seattle would be responsible for mitigating significant adverse impacts caused by the proposed Master Plan Update improvements.

Comment R-9-19: *Mr. Dinndorf (PSRC) commented that the transportation improvement projects included in the Draft EIS surface transportation analysis should reference which local or county plan they are part of and the year of anticipated completion.*

Response: The transportation improvement projects included in the Final EIS surface transportation analysis include references to both jurisdiction and completion date as described in Appendix O of the Final EIS.

Comment R-9-20: *Several commentors suggested mitigation measures to be included in the Final EIS surface transportation analysis. The following individuals made this comment: Southwest King County Chamber of Commerce, Southwest King County Community Group, Mr. R. Taylor, Mr. Lewis (City of Tacoma), Mr. Bush (METRO), and Mr. Dinndorf (PSRC).*

Response: The Southwest King County Chamber of Commerce suggested that the proposed south access needs to be constructed concurrently with the proposed Master Plan Update improvements. The Southwest King County Community Group suggested that the Final EIS include Transportation Demand Management (TDM) strategies to reduce the amount of Single-Occupant Vehicles (SOV) traveling to the Airport. Mr. R. Taylor suggested that the proposed State Route 518 interchange at 20th Avenue South be considered for all Master Plan Alternatives. Mr. Lewis (City of Tacoma) suggested that the construction of dual right-turn lanes at the intersection of International Boulevard and South 188th Street could be a temporary mitigation measure until south access is completed. Mr. Bush (METRO) suggested incorporating preferential employee parking for carpools or vanpools as a possible TDM strategy. Mr. Dinndorf (PSRC) suggested incorporating the use of remote terminals as a possible TDM strategy, and in particular the proposed multimodal terminals being considered at the King Street Station (Seattle) and at the Tacoma Dome. Each of these comments regarding suggested measures are addressed in the Final EIS surface transportation analysis in Chapter IV, Section 15 and Appendix O.

<u>Comment R-9-21</u>: Several commentors stated that the Draft EIS is incorrect in its assumption that the "Do-Nothing" traffic volumes and the "With Project" traffic volumes are equal. The following individuals made this comment: Ms. Ayres, Mr. Newby, Mr. Peyton (Ravenna-Bryant Community Association), Ms. Hughes (Southwest King County Chamber of Commerce), and the Airport Communities Coalition.

<u>Response</u>: Each of the alternatives analyzed in the Draft and Final EIS are based on the aviation demand forecasts prepared for the Master Plan Update, as described previously in the introduction to this appendix. Therefore the "Do-Nothing" traffic volumes and the "With Project" air traffic volumes are equal. However, as is discussed in the introduction to this appendix, a re-assessment of the Do-Nothing alternative surface transportation volumes was conducted. Even though total aviation demand would not be affected by the Do-Nothing, the hourly levels of aircraft operations would be spread as a result aircraft arrival delay. In addition, mode splits and individual roadway link growth rates would be different in the Do-Nothing alternative, as described in the introduction to this appendix. This difference would reflect a greater use of arterial routes to the Airport as well as increased use of off-airport park-and-ride facilities and shuttles. Appendix O-C contains a detailed discussion of the impacts of increased surface traffic demand on the airport roadway system.

<u>Comment R-9-22</u>: Mr. Peyton (Ravenna-Bryant Community Association) commented that the Draft EIS surface transportation analysis does not include the impact of the traffic generated by the new parking garages.

<u>Response</u>: Each of the "With Project" alternatives analyzed in the Draft and Final EIS include the expansion of the existing terminal parking garage, and the construction of new parking facilities. The EIS surface transportation analysis includes the traffic generated by these new or expanded facilities. These traffic volumes were calculated based on existing trip generation characteristics and Port of Seattle parking policies.

<u>Comment R-9-23</u>: Several commentors noted that the Draft EIS does not reflect the Personal Rapid Transit (PRT) system as an option to mitigate transportation impacts. The following individuals made this comment: Mr. Rohlfs (City of SeaTac), Mr. Bush (METRO), and the Airport Communities Coalition.

<u>Response</u>: The Draft and Final EIS do not include the Personal Rapid Transit (PRT) system as a possible mitigation impact since there is insufficient information available to evaluate its effectiveness. However, Chapter III summarizes the Comprehensive Transit Supportive Land Use Master Plan recommendations of the City of SeaTac, which includes the PRT and improvements to the regional bus system. The Port of Seattle has been working with METRO, the City of SeaTac and WSDOT concerning transit options and how such options could interface with Sea-Tac. However, no preferred interface has been selected. The Port of Seattle is considering various Transportation Demand Management (TDM) efforts as part of the Master Plan Update which are described in Chapter IV, Section 15, and in Appendix O of the Final EIS. Pending the results of the City of SeaTac's Feasibility Studies, the PRT system could become part of the comprehensive TDM program.

<u>Comment R-9-24</u>: Mr. Rohlfs (City SeaTac), Ms. Montgelas (WSDOT), and the Airport Communities Coalition stated that the Draft EIS should address the Port of Seattle's responsibility to pay the City of SeaTac's Transportation Mitigation Impact Fees, or the Port's responsibility to make contributions to various Transportation Improvement Projects (TIP).

<u>Response</u>: : The Port of Seattle will coordinate with the City of SeaTac to determine the Transportation Mitigation Impact Fees required. The Port of Seattle acknowledges its pro-rata responsibility for future transportation improvement projects, and will coordinate with the appropriate agencies to determine the appropriate contributions.

__Comment R-9-25__: *Ms. Montgelas (WSDOT) commented that the Draft EIS did not fully address the concerns and impacts associated with the proposed 20th Avenue South interchange on State Route 518. Mr. Taylor indicated that this interchange should be in all alternatives.*

__Response__: The proposed new 20th Avenue South interchange on State Route 518 would require the removal of the existing eastbound South 154th Street off-ramp. However, the removal of this off-ramp could raise some access and circulation issues since South 154th Street is a regional arterial. The City of SeaTac could require additional transportation improvements to address these access and circulation issues. Due to the proximity of other existing interchanges, the Washington State Department of Transportation (WSDOT) will require a "six point added access" evaluation, and other improvements on State Route 518. The Port of Seattle will continue to coordinate with both WSDOT and the City of SeaTac to address these issues and perform the necessary evaluations.

__Comment R-9-26__: *The Airport Communities Coalition commented that the Draft EIS did not include the analysis of the on-Airport surface transportation system.*

__Response__: The on-Airport surface transportation system was analyzed as part of the Master Plan Update study process. Inadvertently, this information was left out of the appendices of the Draft EIS. This was corrected for the Final EIS in Chapter IV, Section 15 and is included in Appendix O.

AIR QUALITY

__Comment R-10-1__: *Several commentors noted that one section of the Draft EIS indicates that there are no exceedances of the standards, yet the roadway intersection analysis indicates that there would be exceedances of the standards. The Southwest King County Community Group, Mr. Frause, Mr. Kircher (Puget Sound Air Pollution Control Agency), and the Regional Commission on Airport Affairs requested that this be clarified.*

__Response__: The results of the area dispersion analysis indicate that development of the proposed new runway would not result in any new exceedances or worsening of existing exceedances of the Ambient Air Quality Standards. The intersection "hot spot" analysis for Carbon Monoxide indicated that potential exceedances of the standards would occur with Alternatives 2 and 4 at two highly congested intersections in the vicinity of the Airport. The EIS has been revised to clarify that additional exceedances could occur due to changes in motor vehicle traffic as evaluated by the roadway intersection analysis. The introductory key findings included on Page IV.9-1 of the Final EIS have been revised to reflect the suggested changes.

__Comment R-10-2:__ *Mr. Frause, Ms. DesMarais, Mr. Peyton (Ravenna-Bryant Community Association), the Airport Communities Coalition, the Regional Commission on Airport Affairs, and the Southwest King County Community Group commented that the State's 1990 inventory and the 1991 Ecology study showed substantially more CO, VOCs, and NO2 than for the Draft EIS. These commentors questioned why do the results and data input assumptions differ between the three studies.*

__Response__: As indicated in the Draft and Final EIS, there are a several reasons why the results of the air pollutant emissions inventory differ from both the State Implementation Plan (SIP) inventory and the 1991 Ecology study, including use of different assumptions concerning aircraft activity levels and the type of aircraft using the Airport; differences in time-in-mode and delay; differences in the number and variety of sources modeled; and use of different versions of the EDMS model. The following examines the key data input assumptions used in each study.

1. __Aircraft Type and Activity Levels__ - **Tables R-8 and R-9** present the differences in aircraft types modeled for the SIP inventory, the 1991 Ecology study, and for this EIS. The tables also compare

how aircraft activity has changed at the Airport over the past five years. In 1990, approximately 28 percent of all aircraft activity occurred by the larger 3 and 4 engine jet aircraft such as the B-747, DC-10, and L-1011. By 1994, activity by these types of aircraft had decreased by over 60 percent to about 12 percent of total activity. At the same time, activity by medium sized jets (i.e., MD-80, B-737) increased 61 percent reflecting the growth in activity by high frequency, low fare/no frills airlines.

The SIP inventory is based on 1990 aircraft operations levels (336,000 annual operations) versus actual 1994 used in the Draft EIS (380,000 annual operations). In comparison to the Draft EIS, the SIP inventory considered nearly three times the level of larger, older 3-4 engine jet aircraft such as the B-747 and B-727 than occurred in 1994. The SIP inventory also considered less than one percent turboprops in comparison to approximately 30 percent in the EIS. The EIS and SIP inventory considered nearly equivalent levels of large and medium 2-engine jet activity. However, the SIP inventory also considered a large number of 4-engine, small jet aircraft which the EIS did not. Both studies considered light single and twin engine piston aircraft. In comparison to actual aircraft activity levels, the SIP inventory overestimated the level of large jet activity and underestimated the level of turboprop activity actually occurring. The effect of the SIP inventory would be expected to result in higher NO_2 levels than for the EIS.

The 1991 Ecology study used August, 1989 operations data, and considered a peak hour of 71 departures or 142 total operations. As indicated in Chapter IV, Section 9 "Air Quality", the EIS analysis evaluated an average peak hour of 43.9 departures, or about 88 total operations. Consistent with the greater level of large jet activity occurring in 1990. The 1991 Ecology study considered a higher level of activity by the large, 3-4-engine jet aircraft with over twice the level considered by the EIS. The Ecology study did consider many of the newer aircraft types, but less than what was considered in the EIS (22% of the newer aircraft versus 45% for the EIS). The Ecology study also considered aircraft no longer in use at the Airport such as the BAC-111, 2-engine medium sized jet. Both studies considered approximately the same level of turboprop activity, except that the Ecology study evaluated nearly 5 times the level of 4-engine, heavy turboprop type aircraft than did the EIS, and did not consider any use by light single and twin engine piston aircraft. In comparison to actual aircraft activity levels, the Ecology study overestimated activity by medium jets (i.e., DC-9's), and underestimated activity by turboprops and general aviation aircraft. Greater use by large, 3-4 engine jet aircraft would result in higher NO_2 levels than for the EIS, and greater use by heavy turboprops would result in higher CO levels.

While the EIS analysis considered more of the newer, more NO_2 producing aircraft, both the SIP inventory and the 1991 Ecology study considered *more jet engines* by assuming substantially greater use by 3-4 engine aircraft and less use by turboprop aircraft. These differences occurred due to actual changes in the type of aircraft using the Airport since 1990, and differences in the way aircraft were chosen to be modeled. The effect would be expected to result in higher NO_2 and CO levels than identified by the EIS.

2. Time-In-Mode and Delay - **Table R-10** identifies the time-in-mode used for each of the three studies. The EIS inventory uses Sea-Tac Airport specific taxi-idle time-in-mode and assumptions concerning aircraft delay. The EIS air quality analysis focused on the average annual peak hour departure queue delay for all weather conditions identified by the FAA's simulation modeling (SIMMOD). For the existing condition, a total taxi/idle and delay time of approximately 11 minutes was considered for each aircraft departure. The EIS analysis also resulted in slight modification of the climb-out and approach time-in-mode based on mixing height.

Table R-10

Time-In-Mode

	Taxi-In/ Taxi-Out	Departure Queue	Takeoff	Climb-out	Approach
Draft EIS	8.11	2.89	0.7	1.51	2.74
1990 SIP Inventory	-- 26 Total --		0.7	1.9	3.5
1991 Ecology	6	10	0.7	1.9	3.5

Note: Presented for large aircraft. Time-In-Mode for turboprops and general aviation not shown.

In comparison, the SIP emissions inventory relied on standard default time in mode values for taxi-idle and delay, and for takeoff, climb-out and approach for a typical airport. It also used a total taxi/idle time and departure queue of 26 minutes. Accordingly, the SIP inventory is based on a much higher taxi/idle/delay time in mode than considered for the EIS. As CO levels are highly influenced by taxi/idle/and delay, emissions for this pollutant would be expected to be much greater for the SIP 1990 inventory levels than for the EIS.

The 1991 Ecology study also relied on different time-in mode assumptions than for the EIS. The primary difference in time-in-mode between the EIS and the Ecology Study was the use of departure queue time. The Ecology study used a peak hour departure queue delay of 10 minutes in comparison to just under 3 minutes for the EIS. The total taxi/idle and delay time is 16 minutes for the Ecology study as compared to 26 minutes for the SIP inventory, and 11 minutes for the EIS. The use of a higher delay value for the Ecology study would be expected to result in higher levels of CO and VOC's due to the departure queue. Combined with the use of a greater level of activity by 3-4 engine aircraft and greater delay, the result would be higher levels of CO, VOC's and NO2.

Refer to the response to comments R-10-14 and R-10-17 which discuss peak hour aircraft activity and aircraft departure delay time.

3. <u>Number and Variety of Sources Modeled</u> - The EIS considered a far greater variety of sources at Sea-Tac and in the vicinity of the Airport. The 1991 Ecology study modeled aircraft operations, motor vehicles, the main terminal parking garage, boiler, training fires, and fuel farms. The EIS analysis considered these sources and others including: aircraft ground run-ups; all on and off-airport related auto parking, as well as all long-term public and private off-airport lots, employee parking and rental cars; aircraft maintenance activities; and, all on-airport fuel storage facilities.

Three types of parking facilities were modeled, including the main terminal parking garage, airport employee parking lots, and an estimated 9,500 parking spaces in off-airport remote public and private lots. Therefore, a total of 24 on-and-off airport parking lots were considered. Included were the rental car operations, metered employee parking in the terminal area, and the main taxicab and limousine staging lots. Fuel storage facilities for all airport tenants were considered as opposed to fuel tanks for just United and Northwest as evaluated by the 1991 Ecology study.

In addition to the terminal area roadways, over 20 major roads and highways represented by 84 separate roadway segments were modeled. As requested by the air quality agencies at the outset of the EIS, all major roads within a mile of the Airport were considered. The Ecology study only considered the terminal area roadways.

4. <u>Changes and use of the EDMS Model</u> - Technical models such as the EDMS air quality model are continually updated and improved. The EDMS model has, over time, been revised to include updated aircraft emissions data, improvements in the modeling methodologies, and been "de-bugged" to correct previously unknown problems or errors. As noted by the 1991 Ecology report on page 11 of that study, the EDMS model was "currently under development, and thus still requires fine-tuning." In fact,

during preparation of the Draft EIS air quality analysis, a problem with the EDMS model was identified by the EIS consultants concerning the manner in which parking lots were considered by the model. The EDMS model was subsequently revised. This EIS analysis used the most current edition of the EDMS Version 944 model available.

The 1991 Ecology study used one of the earliest versions of the model. In addition to the change noted above, the EDMS model has been substantially modified from the earlier version. Among other changes, the EDMS model has been revised to include emissions data for many of the newer types of aircraft engines in use today. Updates to motor vehicle emissions are also included in the most recent version of the model. Another change focused on aircraft emission particulate data. Although more particulate data was included in the earlier EDMS version, the FAA has indicated that this data was not accurate. Therefore, the aircraft emissions standards included in the EDMS for particulates was revised by the FAA to include only that data for which reliable particulate information is known. The FAA has not updated the particulate data because no reliable data on aircraft particulate emissions is available to incorporate into the model. Accordingly, the most current version of the EDMS model now includes little information on particulates in comparison to the earlier version used by Ecology.

The EIS analysis also went beyond the Ecology study screening evaluation to the next, more detailed level of analysis. The EDMS model enables air pollutant evaluation in three levels of analysis: air pollutant emissions inventory; screening dispersion analysis; and refined dispersion analysis. The 1991 Ecology study prepared an emissions inventory and screening dispersion analysis which relied on application of worst case meteorological assumptions for wind speed, three wind directions (0, 170, 345), and other worst case input assumptions. The results of the screening analysis typically overestimates pollutant concentrations and are intended only to identify locations of potential exceedances and the need for further analysis. The EIS analysis in effect picked-up where the Ecology screening analysis ended by including a refined dispersion analysis which applied actual historic meteorological conditions. Typically, the results of the refined analysis are much lower than pollutant concentrations identified by the screening analysis (i.e., less than one-half), and reflect a more accurate portrayal of actual conditions.

In each case, the EIS analysis is based on the most recent information about actual operations and conditions at the Airport.

Table R-8

Comparison by Aircraft Type

General Aircraft Category	1995 Airport EIS	1994 Actual Activity[12/]	1990 SIP Inventory	1991 Ecology	1990 Actual Activity[1/]
Large Jet 3-4 Engines	B-747 DC-10 L1011 DC-8 B-727	B-747 DC-10 L1011 DC-8 B-727	B-747 DC10 L1011 – B-727	B-747 DC-10 – – B-727	B-747 DC-10 – DC-8 B-727
Large Jet 2 Engines	A-300 B-767	A-300 B-767	– –	A-300 B-767	A-300 B-767
Medium Jet 2 Engines	B-757 B-737 –	B-757 B-737 A-320	B-757 B-737 –	B-757 B-737 A-320	B-757 B-737 –
Medium Jet 2 Engines	MD-80 DC-9 –	MD-80 DC-9 BAC-111	MD-80 DC-9 –	MD-80 – BAC-111	MD-80 DC-9 BAC-111
Small Jet 4 Engines	–	–	BAE-146	–	–
Business Jet	–	–	–	–	–
Turboprop	– C-130 DHC-6 SF-340 CNA-441	B-99 C-130 – DASH7 –	B-99 C-130 – –	– – DHC-6 DASH-7 CNA-441	B-99 C-130 – DASH7 –
Twin Engine Piston	2-Engine Piston –	C-402 C-404	C-402 C-404	– –	C-402 C-404
Single Engine Piston	1-Engine Piston –	– C-172	– C-172	– –	– C-172

Table R-9

Comparison By Percent Aircraft Category

General Aircraft Category	1995 Airport EIS	1994 Actual Activity[13/]	1990 SIP Inventory	1991 Ecology	1990 Actual Activity[2/]
Large Jet 3-4 Engines (B-727, B-747, L1011, DC-10)	12%	11%	35%	28%	28%
Large Jet 2 Engines (A300, B-767)	2%	2%	4%	–	2%
Medium Jet 2 Engines (B-757, A320, B-737)	26%	27%	22%	16%	16%
Medium Jet 2 Engines (MD-80, DC-9, B-111)	24%	23%	18%	24%	24%
Small Jet 4 Engines (BAE-146)	–	–	17%	–	–
Business Jet (CNA-441)	–	–	–	3%	–
Turboprops (DHC-6)	30%	32%	1%	28%	31%
Twin Engine Piston	4%	4%	2%	–	2%
Single Engine Piston	2%	1%	1%	–	1%
	100%*	100%*	100%*	100%*	100%*

* May not add to 100% due to rounding.

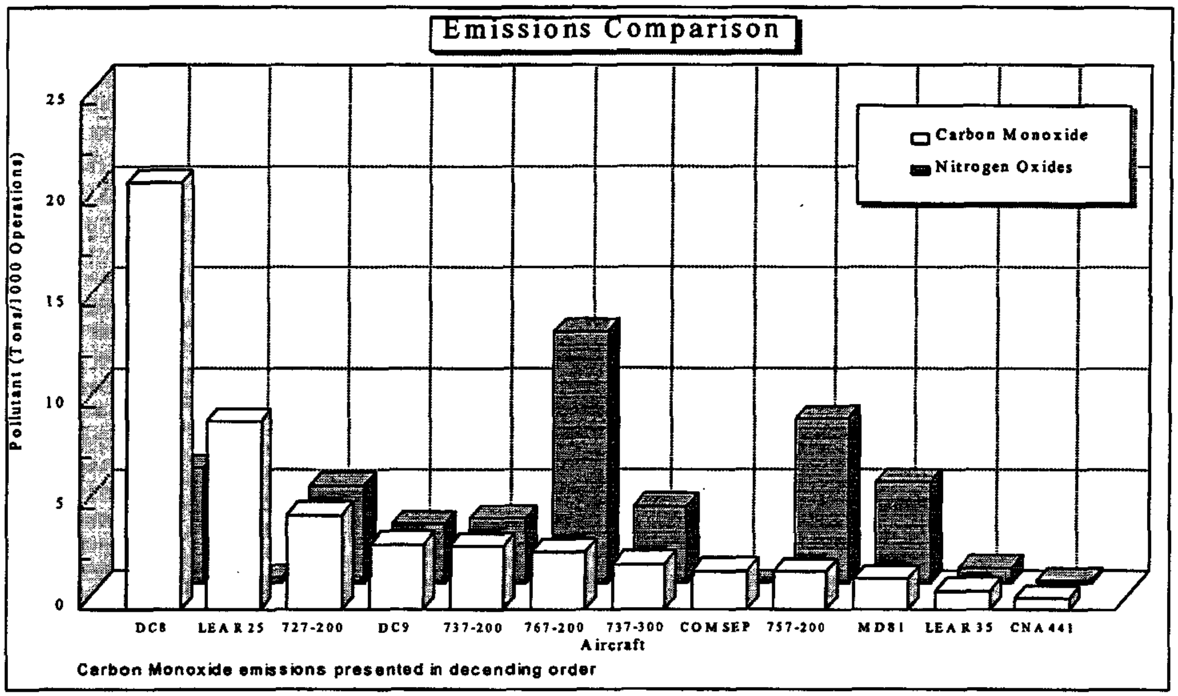
12/ Year-end total activity levels for Sea-Tac, Port-of-Seattle

13/ Year-end total activity levels for Sea-Tac, Port-of-Seattle

Comment R-10-3: *Two commentors requested that the EIS explain how different aircraft engines or fuels produce different levels of pollutants. The following individual and community group made this comment: Ms. Richter, Ms. DesMarais, Mr. Peyton (Ravenna-Bryant Community Association), and the Southwest King County Community Group.*

Response: Aircraft engine pollutant emissions are driven by a number of factors including the type of fuel burned (AVGas, JetA, JP-4, JP-8), the amount of fuel utilized, and engine design technology or efficiency. The factors that determine the quantity of pollutants emitted are the emission rates for each operating mode (i.e., take-off, climb-out, approach, taxi-in, taxi-out, and idle), the fuel consumption rate, and the duration of each operating mode. Perhaps the most important factor is the rate of fuel consumption. In designing many of the newer types of aircraft, manufacturers have placed greater emphasis on aircraft fuel efficiency and performance, which has resulted in a change in the level and type of pollutants generated. Accordingly, many of the more recently designed aircraft engines generally produce low CO emissions, while NO_2 emissions have tended to increase. In comparison, the older designed aircraft engines are far less fuel efficient, and typically emit considerably more CO and VOC's. The following illustrates the differences between many of the newer and older designed types of aircraft:

EXHIBIT R-3



For example, the DC-9 jet aircraft produces much more CO but less NO2, in comparison to its successor, the MD-81. The newer generation of aircraft such as the B-767 and B-757 produce comparatively low levels of CO and higher levels of NO_2 in comparison to the earlier aircraft. On a much smaller scale, the more recently designed small business jet aircraft, such as a Lear 35, produces five times less CO than its predecessor, the Lear 25.

The higher performance jet aircraft, with their higher rate of fuel flow during takeoff, climb-out and approach, generally contribute to higher NO2 emissions. Comparatively, the light single and multi-engine piston/propeller and turbo-prop aircraft produce high levels of Carbon Monoxide (CO) and Volatile Organic Compounds (VOC or hydrocarbons), particularly during taxi-in/taxi-out and during idle. In fact, based on the same level of operations, some light single and twin-engine piston aircraft would produce more CO than some jet aircraft such as an MD-81 or Lear 35 business jet. The differences are due primarily to engine design technology.

The type of fuel used can also influence the type of pollutants emitted. Small piston aircraft engines use AVGas fuel similar to low-lead gasoline used in cars, and are also similar in engine technology. Jet and turboprop aircraft use Jet A fuel. Jet A is similar to kerosene and is highly refined and unleaded (i.e., the same type of fuel as 'Coleman' fuel used for camping). The amount and type of particulates emitted would vary by fuel type, as might the type and amount of possible air toxic emissions. Auto fuel and AVGas may result in more Benzene and 1-3, Butadiene air toxics and leaded particulates. In comparison, Jet A fuel may result in emissions of high levels of polynuclear aromatic hydrocarbons.

To increase the octane levels for auto gasoline (to provide for a more complete combustion of the fuel), refineries in the past added lead. Because of health concerns, lead can no longer be added to auto fuels. With the regulated exclusion of lead from auto fuels, the refineries turned to other components to provide higher octane levels for the unleaded fuels. To increase octane, the 'BTX' compounds of Benzene, Toluene and Xylene are sometimes added to auto fuels to increase octane, and as a means to keep the required vapor pressure (the pressure at which gasoline would evaporate) of the fuel at a low level. Therefore, as indicated above, auto fuels may result in more Benzene emissions than do the aviation fuels. Aircraft jet engines on the other hand, do not require high octane fuels. Therefore, no BTX compounds are added to jet fuels.

As a result of the Puget Sound's status as "non-attainment" for Carbon Monoxide, auto gasoline suppliers to the Region are now required to supply "reformulated" gasoline for use between November 15 through March 1. The use of reformulated gasoline is expected to help reduce the CO emission levels that have a tendency to reach high levels during the winter months. Reformulated gasoline is defined as a gasoline for which the oxygen content has been increased by the addition of various "oxygenates". These types of fuels are considered to improve gasoline's combustion efficiency, particularly at cold temperatures, which subsequently reduces CO emissions by 10 to 20 percent. The effect on NO_2 emissions is less clear, and may actually increase. The use of reformulated gasoline is intended to accomplish similar results as the BTX compounds while also reducing CO emissions. The oxygenate compound found in reformulated gasoline used in the Seattle area is ethanol (a corn-based product). Like aircraft, emissions rates for automobiles are highly dependent on engine technology.

Comment R-10-4: *Ms. Richter and the Southwest King County Community Group suggested that the air quality analysis downplays the impact that Sea-Tac has on local air quality by contrasting such a large area or the Region with Sea-Tac.*

Response: The Draft and Final EIS considers a wide variety of air pollutant sources within the immediate vicinity of the Airport as there are many large sources in the airport vicinity that contribute to air pollution conditions. For example, the EIS considers a total of 24 on and off-airport parking lots. Included were the many private, long-term parking lots located along International Boulevard. Also included was the evaluation of over 20 major roadways and associated traffic (airport and non-airport traffic), including Interstate 5, SR 518 and SR 509. These sources were in addition to aircraft operations, terminal heating and cooling, training fires, fuel farms, maintenance activities, and terminal area traffic and parking. Appendix D provides a complete listing of the sources considered.

The evaluation of such a wide array of sources was considered partially in response to a request by the air quality agencies at the outset of the study. At that time, the U.S. Environmental Protection Agency requested that the analysis consider all major sources located within a mile of the Airport. For the most part, such sources are limited to the evaluation of motor vehicles and parking. As the EIS analysis has shown, motor vehicles are a major contributor to pollutants within the Airport area and cannot, therefore, be easily dismissed from consideration.

Airport related surface traffic occurs throughout the Airport area. With development, changes in area roadways and traffic volumes can occur. Therefore, the analysis considers the effect of such potential changes to area roadways and changes to traffic volumes with development. As Sea-Tac is just one component of an integrated transportation system serving the Puget Sound Region, the analysis considers the Airport's pollutant contribution in relation to the entire Region the Airport serves.

As indicated in the EIS, the majority of the pollutant emissions in the Region are generated by motor vehicles, and that "aircraft operating at Sea-Tac contribute less than one percent of the carbon monoxide emissions, nitrogen oxides, and volatile organic compounds for all mobile sources within the Puget Sound Region". Based on just the immediate Airport area, aircraft at Sea-Tac contribute about seven percent of the carbon monoxide, twenty percent of the nitrogen oxides, and thirty-eight percent of the volatile organic compounds. Therefore, even within the much smaller Airport study area, the majority of the pollutant emissions are generated by motor vehicles.

Comment R-10-5: *The Southwest King County Community Group, Ms. DesMarais, and Mr. Matthews suggested comparing the contribution of motor vehicle emissions to the area to aircraft emissions, by comparing the number of cars necessary to equal one aircraft operation.*

Response: Appendix D of the Draft and Final EIS presents the emissions summary for all sources for the existing conditions. As shown, emissions for motor vehicles in the immediate Airport area exceeds the pollutant levels for aircraft for all pollutants.

One operation by a DC-9 aircraft (landing-takeoff cycle - LTO) produces about 3,541 grams of CO per hour as compared to 557.4 grams CO per hour for one car traveling 30 miles per hour for one mile. Therefore, it would take approximately 6 cars traveling one mile at 30 mph to equal the CO generated by one DC-9 LTO.

Based on the total number of passengers using the airport on an annual basis, approximately 0.0002 tons per passenger of CO is generated for all aircraft operations. The average distance traveled by a passenger going to Sea-Tac is about 20 miles. Therefore, about 0.0004 tons CO are generated for each trip to the Airport (18.58 grams CO per mile times 20 miles). Therefore, the average trip to the airport to catch a flight produces more CO than the equivalent level of CO for one passenger for all operations at the Airport. Thus, the EIS appropriately concludes that automobiles are a major source of pollutants in the Puget Sound Region.

Comment R-10-6: *The Regional Commission on Airport Affairs stated that Sea-Tac should be treated as a "major stationary source" under the Washington State Clean Air Conformity Act.*

Response: As is discussed in the Draft and Final EIS, the Clean Air Act and the Washington State Clean Air Conformity Act establishes the criteria and guidance for demonstrating that transportation plans, programs, and projects located in non-attainment areas conform to the State's plan for achieving and maintaining compliance with the Ambient Air Quality Standards. Conformity applies to all roadway and transit projects to be funded or approved by the Federal Highway Administration (FHWA) or Federal Transit Administration (FTA) -- called transportation conformity. Non-roadway transportation projects, such as the proposed development at Sea-Tac are also governed by the regulations -- called general conformity.

There is no provision or identification of "stationary sources" regulated by the Washington State Clean Air Conformity Act.

The Washington Clean Air Act, however, addresses stationary sources which are broadly defined as "any building, structure, facility or installation that emits or may emit any air contaminant". Typically, stationary sources are limited in size to a single facility in comparison to the 2,500 acres at Sea-Tac. Additionally, although the Port of Seattle owns the land, many of the facilities on-airport (such as the maintenance hangars) are owned and maintained by the tenants using the Airport. These tenants have certain responsibilities and liabilities associated with their operation independent from the Port of Seattle. These facilities are issued operating permits by the Puget Sound Air Pollution Control Agency under Title V of the Clean Air Act as stationary sources. As indicated in Appendix D, there are four permitted maintenance facilities at Sea-Tac, including permitted activities by Weyerhaeuser, Delta, Northwest, and Alaska airlines. The terminal heating and cooling facility operated by the Port of Seattle is also permitted under Title V. Each of these stationary sources were considered in the air quality analysis.

Comment R-10-7: *The Southwest King County Community Group noted that Nitrogen Dioxide (NO_2) is the criteria pollutant while the Draft EIS refers to Nitrogen Oxides (NO_x). The U.S. Environmental Protection Agency suggested a new method for estimating NO_2 (instead of NO_x) for comparison with the AAQS. The Puget Sound Air Pollution Control Agency noted that the Draft EIS only refers to five criteria pollutants when there are six including lead.*

Response: The Final EIS correctly refers to the criteria pollutants as noted above. The EIS analysis was revised to reflect concentrations of NO_2 in accordance with methodology accepted by U.S. Environmental Protection Agency Region X, and outlined in the U.S. Environmental Protection Agency technical report "*Use of Ambient Ratios to Estimate Impact of NOx Sources on Annual NO_2 Concentrations.*"

Comment R-10-8: *The Southwest King County Community Group asked that the discussion in Appendix D concerning incidences of poor air quality within the Puget Sound Region be clarified.*

Response: The EIS includes a general discussion on typical conditions during which poor air quality may result within the Region. The discussion notes that high concentrations of Carbon Monoxide typically occur during November through February, during the colder winter months that are often accompanied by stable atmospheric conditions which reduce pollutant dispersion. Carbon monoxide in particular is emitted by incomplete combustion during colder weather when engines operate less efficiently. Higher concentrations typically result during peak, 'rush' hour traffic. Ozone levels are the highest on hot summer afternoons from mid-May to mid-September. Ozone occurs as a result of a chemical reaction in the ambient air between nitrogen oxides and volatile organic compounds generated over the entire Region.

Declaration of an "air pollution episode" or local "impaired air quality" may result during these months when poor dispersion persists for 24 or more hours. This information is typically summarized in the Air Quality Data Summary prepared by the Puget Sound Air Pollution Control Agency and produced annually. These summaries are typically unavailable for several months after the end of a full year to allow Puget Sound Air Pollution Control Agency time for processing and evaluation of an extensive amount of data. The most current information available at the time was utilized in completing the Draft and Final EIS air quality analysis.

The Puget Sound Air Pollution Control Agency uses the National Pollutant Standards index to report daily air quality. The values provide a way to summarize the air quality for the entire year into days of "good", "moderate", "unhealthful", and "very unhealthful" conditions. Any pollutant measurement exceeding the short-term ambient air quality standards causes the designation to be in the unhealthful or worse category. **Table R-11** presents the air quality conditions for the Seattle area over a fifteen year period. Included is the worst air quality day for each year and the pollutant of concern.

As shown, the air quality in the Seattle area has shown steady improvement since 1980 with only one "unhealthful" day designated since 1989.

Comment R-10-9: *Several individuals commented on odor's of unburned jet fuel and concerns over aircraft fuel dumping. The following individuals and organizations made this comment: Mr. Akers, Mr. Burke, Ms. Hill, Ms. Mason, Ms. Osborne, Mr. Peyton (Ravenna-Bryant Community Association), Mr. Rozdilsky, Mrs. Whitled, the Regional Commission on Airport Affairs, and the Committee on Aircraft Noise.*

Response: Fuel dumping, or the purposeful jettison or leakage of aviation fuel by aircraft as they approach or depart the Airport, is not common and is performed only in emergency situations when aircraft cannot land safely with the fuel present in the aircraft. If an aircraft must make an emergency landing before it has burned enough fuel to safely land, the pilots would have to "dump fuel" in order to reduce the aircraft's weight sufficiently enough to land. According to federal directive 7110.65J paragraph 9-6-1 through 9-6-5, aircraft may dump fuel as necessary in a declared emergency state. There are no restrictions as to where the aircraft may or may not dump fuel However, each airport has a recommended, pre-designated fuel dumping area for instances where fuel needs to be dumped if time permits. At Sea-Tac, FAA air traffic controllers have been instructed to direct aircraft in need of fuel dumpling to fly above 5,000 feet over the Puget Sound to allow time for the fuel to evaporate before reaching the ground, and to prevent non-evaporated fuel from reaching populated areas. Because any fuel release is irregular, impacts to natural habitats would be minimal. According to Mr. Tom Davidson, Assistant Manager of the Seattle TRACON facility, there have been no instances of emergency fuel dumping at Sea-Tac within the past two and one-half years.

Residents in the immediate vicinity of the Airport may also be reporting odors from aircraft queuing - this odor typically has more of an oily smell versus an odor like one would experience when fueling an auto. The pollutants that comprise this type of smell are accounted for in the air pollutant assessment presented in the EIS for precursor pollutants -- pollutant levels where the standards exist to protect human health and welfare.

There are many different types of odorous hydrocarbon compounds in jet exhaust which may be responsible for periodic "odor episodes". Typically, the most reactive or "volatile" hydrocarbons have the most potential to cause odor (i.e., cause a detectable odor at a lower concentration). The principal odor-causing hydrocarbon species in jet exhaust are the aromatic (fuel-related) and oxygenated (partially burned) hydrocarbons. Hydrocarbon emission rates are greatest during the low-power idle and taxi modes of the LTO cycle, when the engines are not operating as efficiently. During takeoff and climbout, for example, hydrocarbon emissions are greatly reduced since the engines operate with greater efficiency.

The most recent study concerning odors from jet engine exhaust was conducted at Boston's Logan Airport (*"Identification of Odorous Compounds From Jet Engine Exhaust at Boston's Logan Airport"*, December, 1992). Based on air monitoring at Boston Logan, three compounds - acetaldehyde, formaldehyde, and naphthalene - were present on a consistent basis above their respective odor recognition thresholds. Each of these compounds could be generated by the incomplete combustion of jet fuel. The odor impact depends on wind speed and direction, turbulence, and distance between the source and nearby residents. The odor recognition characteristics of these compounds is generally characterized as follows: Acetaldehyde is described as sweet, "apple ripened" and pungent; Formaldehyde is described as odor like hay, straw-like, and pungent; Naphthalene is described as having odor like tar, creosote, and mothballs.

As noted by the Boston study, the results were based on the minimum detectable limits because overall concentrations for these compounds was generally small. Additionally, no specific source or activity was identified as the primary source of these compounds. Moreover, the Boston study notes that motor vehicle exhaust also contains many of these same compounds. No conclusion was drawn as to the source, concentration, or potential impact to human health.

Table R-11

Puget Sound Region Air Quality History 1980-1995*

	Number of Days in Each Air Quality Classification During Each Year															
Air Quality	**1980**	**1981**	**1982**	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995***
Good	73	69	86	98	146	150	130	120	215	231	239	256	238	251	315	185
Moderate	275	267	268	258	218	202	226	238	146	134	126	109	127	114	50	27
Unhealthful	18	28	10	9	2	10	8	7	5	0	0	0	1	0	0	0
Very Unhealthful	0	1	1	0	0	3	1	0	0	0	0	0	0	0	0	0
Worst Air Quality Day for Year	Jan 23	Jan 15	Feb 6	Jan 28	Dec 6	Dec 12	Jan 7	Feb 6	Dec 3	Jan 19	Jan 16	Dec 15	Feb 3	Jan 11	Dec 23	Jan 3
Dominant Pollutant on Worst Air Quality Day**	PM	CO	PM	CO	PM	PM	PM	PM	CO	CO	CO	CO	CO	PM	CO	CO

* 1995 Information provided for January through July only.

** PM = Particulate Matter; CO = Carbon Monoxide

Source: Mary Hoffman, Data Specialist, Puget Sound Air Pollution Control Agency, September 1995

__Comment R-10-10__: *Several comments stated that the modeling does not comply with EPA guidelines which establishes the protocol for dispersion air modeling and selection of receptor locations. The following organization made this comment: Mr. Peyton (Ravenna-Bryant Community Association), and the Airport Communities Coalition. The U.S. Environmental Protection Agency submitted suggestions for selecting receptor locations and quantifying pollutant concentrations.*

__Response__: As indicated in the Draft and Final EIS, the selection of receptor locations was based on the initial evaluation of 200 grid point locations equally spaced at approximately 1,300 feet (410 meters) apart. An equally spaced grid was used independent of specific sensitive locations to ensure that the receptor locations were representative of the highest possible concentrations. Because there are many contributing pollutant sources located within the terminal area from traffic, parking lots, the heating and cooling plant, and even aircraft, a second more closely spaced grid of receptor locations was evaluated for the existing and future terminal areas. These receptor grids were spaced at approximately 295 feet (90 meters apart), for the existing terminal, and 131 feet (40 meters apart) for the proposed future South and North terminal alternatives.

Based on the screening analysis concentrations, the refined analysis focused on twelve receptors with the highest concentrations for representative locations on all 'sides' of the Airport. The receptors were spatially located in this manner to provide an indication of pollutant concentrations within the surrounding community areas. Included were receptor locations within McMicken Heights, Riverton Heights, the Bow Lake Trailer Park, and Angle Lake community areas in the City of SeaTac, and the Highline area of Burien. The receptor locations were located in areas where reasonable public exposure relative to the ambient air quality standards might occur. For example, the analysis indicated that the pollutant of concern off-airport relative to the ambient air quality standards is NO_2. As the NO_2 standard is based on annual concentrations, reasonable public exposure to annual conditions occurs within residential areas. Comparatively, short-term public exposure is more typically associated with the Carbon Monoxide 1-hour and 8-hour standard, and the 24-hour PM10 standard. Such exposure could occur along public access locations such as along roadways (i.e., waiting for a bus) and is more generally associated with emissions from automobiles.

Receptor locations within existing or future airport property, or along major roadways such as SR 509 were considered generally inaccessible to the general public and therefore not considered.

Not all receptor locations considered indicated possible exceedances of the air quality standards. In fact, for the existing condition, no exceedances were identified by the screening evaluation for Carbon Monoxide for the existing, future 2000 and 2010 Do-Nothing, and future 2000 "With Project" conditions. Future 2010 and 2020 "With Project" conditions indicated possible exceedances of the 8-hour Carbon Monoxide standard at only one receptor location (the Hotel receptor located in the terminal area). For NO_2, the screening analysis indicated potential exceedances of the annual standard at four receptors generally located immediately north and south of the Airport. Air pollutant concentrations in these locations are influenced by emissions from aircraft takeoffs.

To further confirm that the refined analysis had selected receptor locations at which the maximum concentrations would be found, the U.S. Environmental Protection Agency suggested performing an additional 'sensitivity' analysis for other nearby receptor locations that showed similarly high concentrations for the screening analysis. Accordingly, the refined analysis was also performed for the Draft and Final EIS for 1-2 additional receptors in the general area of the receptor selected for the refined analysis. As stated in the Draft and Final EIS, the results confirmed that the concentrations were representative of the maximum concentrations within those general areas. This methodology is consistent with the guidelines for selecting receptor locations, and was conducted in consultation with the U.S. Environmental Protection Agency.

Upon review of the Draft EIS, the U.S. Environmental Protection Agency suggested that the analysis should identify the highest concentration for all locations considered ambient air. This could include unfenced airport property, or sites located immediately adjacent to the Airport. Accordingly, for the Final EIS analysis, receptor locations modeled in the Draft EIS were moved closer to the Airport ("fenceline") and new receptor locations added. The receptor locations are based on air pollutant contours (pollutant contours or isopleths of equal concentration). The pollutant contours were created using a grid of 400 receptor locations equally spaced at approximately 300 meters apart. Appendix D of the Final EIS presents illustrations of the NO_2 and CO contours.

Although each of the revised receptor locations can be considered 'ambient' and publicly accessible, none are located in residential areas. The revised receptor locations now include commercial uses located to the northwest and southwest of the Airport, the City of SeaTac water reservoir north of the Airport, and undeveloped areas south of the Airport. At the request of the USEPA, the receptors also include new locations along South 154th Street and South 188th Street. The 154th Street receptor is located on the north side of the Airport approximately 650 feet (200 meters) north of Runway 16L. Airport property is located on either side of 154th Street along its entire length in the Airport area. South 188th Street travels through the Airport and under Runway 34R. Receptors were located on South 188th Street on either side of the entrances to the 188th Street tunnel under Runway 34R. Airport property is located on either side of the roadway in these areas.

The results indicate that moving the receptors to the "fenceline" minimally increases pollutant concentrations. For NO_2, the new receptor location at South 154th Street does indicate an exceedance of the annual NO_2 standard (0.08 ppm as compared to the 0.053 ppm NO_2. standard). It is not surprising that the highest concentrations would be located within several hundred feet from the ends of the runways. Nonetheless, prolonged public exposure at this location would not be expected relative to the longer-term annual standard. For Carbon Monoxide, concentrations increased by moving the receptors closer to the Airport, but all remained well below the 1-hour and 8-hour standard. The results of the revised analysis are presented in Appendix D of the Final EIS.

Comment R-10-11: *The Southwest King County Community Group asked that the receptor data presented in Tables D-21 and D-22 in the Draft EIS be clarified.*

Response: As indicated in response to Comment R-10-10, a screening dispersion analysis was used for the Draft and Final EIS to identify locations for conducting a more detailed, refined dispersion analysis. For the Draft EIS, the maximum pollutant concentrations were identified by 200 receptor locations in Tables D-21 through D-22. Separate tables were presented for each pollutant because it is possible that the maximum concentration for either pollutant could occur from different wind angles because the sources for each pollutant could vary. Concentrations for each of the 200-receptors modeled were shown for comparison purposes. However, the refined dispersion analysis focused only on those locations reasonably accessible to the public relative to the time periods specified by the Ambient Air Quality Standards. Accordingly, many of the receptors included in Tables D-21 and D-22 were not considered further in the Draft EIS because they were located on existing or future airport property, or within the right-of-way of major roadways generally inaccessible to the general public over a longer period of time.

Based on comments provided by the USEPA, the methodology used to select the refined dispersion analysis receptor locations has been revised for the Final EIS. Therefore the screening analysis as provided by Tables D-21 and D-22 in the Draft EIS was no longer used to identify receptor locations of maximum concentrations and are therefore not included in the Final EIS. The response to Comment R-10-10 identifies the receptor location methodology used in preparation of the Final EIS. The results and methodology are further described in Chapter IV, Section 9 and in Appendix D of the Final EIS.

Comment R-10-12: Mr. Peyton (Ravenna-Bryant Community Association) noted that the air quality analysis does not specifically consider facilities at the ends of the runway, such as Maywood Elementary School or the Burien Adventist Church.

Response: As indicated in response to Comment R-10-10, the analysis did not focus solely on sensitive receptor locations such as schools in search of the maximum concentrations possible. In fact, several schools such as Highline High School are located in the general vicinity of receptors for the refined dispersion analysis (Receptor 6 on Exhibit IV.9-2 of the Draft EIS). Additional school locations were indirectly modeled as part of the initial screening dispersion analysis illustrated by the receptor locations shown in Exhibit D-1. Included are the Olympic Junior High School (Receptor 0-3); North Hill School (Receptor N-3); Sylvestor Jr. High School (Receptor E-1); and the Thorndyke School (Receptor B-12).

Comment R-10-13: The U.S. Environmental Protection Agency indicated that 12 receptors modeled for the intersection analysis may not be adequate, and that their location was not in accordance with U.S. Environmental Protection Agency Region 10 accepted guidance.

Response: The receptors modeled for the intersection analysis were located in accordance with "Guidelines for Modeling Carbon Monoxide from Roadway Intersections", which indicates that receptors should be located where the maximum concentrations are likely to occur, and where the general public is likely to have access. The general criteria for receptor citing includes: 1) places of expected 1-hour and 8-hour maximum concentrations; 2) places where the general public has access over the time periods specified by the NAAQS, and 3) reasonableness. In general, the receptor locations were based on locations within parking lots of adjoining commercial establishments where pedestrians have continuous access, and near entrances of nearby commercial establishments. All corners of the intersections modeled include a commercial activity and structure, except for the Washington Memorial Cemetery location.

While the public could experience air pollutants at three meters (12 feet) from the roadway (i.e., waiting for a bus) for a one hour period, such exposure for eight hours would be very unusual. As the analysis shows, concentrations are well below the 1-hour CO standard, with 8-hour concentrations being the greatest at locations as close as three meters.

The modeling guidance does not specify the number of receptors to be modeled. Therefore, the number and location of receptors as modeled were located so as to uniformly locate receptors along the four corners of the intersection. More importantly, nearly all intersection receptors indicated the potential for exceedances of the AAQS.

Based on the comments of the U.S. Environmental Protection Agency, the Final EIS presents the concentrations at 3 meters from each roadway, for the maximum concentrations identified for as many as thirty-two locations.

Comment R-10-14: Clarify the peak hour level of aircraft activity used in the air quality analysis. The following individuals and organizations made this comment: Ms. Brasher, Ms. DesMarais, Ms. Wordian, Mr. David Kircher (Puget Sound Air Pollution Control Agency), Regional Commission on Airport Affairs, the Southwest King County Community Group, and the U.S. Environmental Protection Agency.

Response: In assessing peak levels of airport activity, three peaks occur: peak arrivals, peak departures and peak total traffic. To reflect the greatest amount of total traffic, the total operations peak hour was used (peak month average day). Accordingly, the air quality analysis evaluates a peak hour of about 88 operations (43.9 arrivals and 43.9 departures).

The ability to accommodate a large number of arrivals and departures is dependent on a number of factors including weather, type of aircraft (prop or jet, small or large), and on maintaining adequate spacing between aircraft. The largest number of peak hour departures that can be accommodated at Sea-Tac Airport in good weather is about 60 departures with the existing runways. Additionally, during a peak departure push, no more than 32 arrivals per hour can be accepted safely. The Airport currently has a peak demand of about 81 operations (59 departures and 22 arrivals) during the peak departure hour. This means that there are currently few aircraft wanting to land at Sea-Tac during the peak departure hour. Accordingly, to accommodate the estimated maximum number of departures (60 departures) during the peak departure hour, a number of conditions must exist. These conditions include good weather and excellent pilot visibility. Also needed is an aircraft fleet mix (the type of aircraft wanting to depart) that includes few large aircraft, and a high percentage of small, quick turning single or twin-engine propeller aircraft, and some turboprop aircraft (*see below the discussion on the effect of the current noise abatement procedures on departure capacity*). Accordingly, the peak number of departures that can occur is dependent upon the type and size of the aircraft involved, among other factors.

As indicated in Chapter IV, Section 9 and Appendix D, the air quality analysis was performed using the EDMS air quality model. The EDMS model assumes an equal number of arrivals as it does departures; users are presently unable to alter the ratio of arrivals to departures. It is presumed that the model was developed in this fashion, as to depart, an aircraft must first land. Thus, if the peak departure hour of 60 departures was used, the model would assume that a total of 120 aircraft operations would occur. This total operations level exceeds the current hourly capacity of Sea-Tac's airfield under good weather conditions (VFR1) by 20 percent and is about 30 percent above the existing demand.

During June, 1995, the U.S. Environmental Protection Agency identified a peak hour of total operations of 86 operations (43 departures and 43 arrivals). During the peak arrival hour (53 arrivals), about 31 departures occurred. Similarly, during the peak departure hour (59 departures), 22 arrivals occurred. Therefore, the highest number of total operations occurred when the airport experienced an equal number of arrivals and departures and is reflected by the EIS analysis.

Hourly aircraft activity counts maintained by the FAA Air Traffic Control Tower personnel over a longer period of time were reviewed to identify the peak hour level of aircraft departures. Based on this data, a peak hour of 63 aircraft departures was identified for August 31, 1995 between the hours of 7 a.m. and 8 a.m. The second highest peak hour was also observed in August on the 30th with 61 peak hour departures, also between 7 a.m. and 8 a.m. For the entire period for which records were available (8 months), no other hour exceeded 59 departures.

To determine the aircraft type in use on those days, actual radar data available through the Port of Seattle's Airport Noise and Operations Monitoring System (ANOMS) was reviewed. This data identified that the aircraft in use during the peak departure hour included fewer of the larger 3 and 4 engine jet aircraft and more of the light single and twin engine propeller and turboprop aircraft in comparison to the Draft and Final EIS analysis. The EIS analysis was based on use by all types of aircraft currently in use at the Airport, and not just those aircraft identified during the peak hour. As a result, use of a higher peak hour (63 departures in comparison to 43.9 departures for the EIS analysis) would result in less NO_2 concentrations at every location in comparison to the EIS. The NO_2 concentrations decrease because of the differences in aircraft types occurring during the peak departure hour as compared to the EIS average annual fleet mix. The peak departure hour would result in minimally higher 1-hour Carbon Monoxide concentrations at one receptor location (154th Street) in comparison to the EIS analysis, while the 8-hour Carbon Monoxide concentrations would either not change or actually decrease. Appendix D presents a more detailed discussion on modeling of the peak departure hour level of activity.

The Effect of the Existing Noise Abatement Procedures on Departure Capacity: The existing noise abatement procedures have a tremendous impact on departure capacity. These procedures require that departing jets essentially maintain heading until the aircraft reaches five miles or 3,000 feet altitude prior to initiating any turns. The procedures are designed to keep departing aircraft in the narrowest flight path possible to minimize the population exposed to departure noise. The procedures in turn affect departures due to the need to maintain adequate spacing (both lateral between the two runways and in-trail between aircraft) for a considerable distance from the Airport. The noise abatement procedures focus on jet aircraft departures. Departures by light single and twin-engine propeller aircraft, and some turboprops (up to a Dash-8 aircraft) can turn immediately off runway centerline as soon as sufficient altitude has been reached (at 1,000 feet altitude). With the availability of quick turns by aircraft that are not required to fly the noise abatement procedures, the required in-trail separation between departures would be reduced. Therefore, the maximum departure capacity is dependent upon a peak hour aircraft mix that includes a high percentage of the smaller, propeller aircraft.

The Effect of Poor Weather on Departure Activity: The Southwest King County Community Group and the USEPA questioned whether it may be possible that the highest level of pollutants would occur during worst case meteorology (i.e., IFR4 conditions).

During poor weather conditions the operating capacity (arrivals and departures) is reduced to 50 peak hour *landings and takeoffs*. Typically, rather than have aircraft wait at the ends of the runways waiting to depart, aircraft are generally held at the terminal gates. Therefore, it is very unlikely that a higher peak hour level of operations would occur, or that more emissions would result during poor weather. During IFR conditions when the airport cannot operate normally, arrivals are delayed, and departing aircraft are held at the gate, canceled, and/or flights are pushed back into later hours.

Generally, the possibility of a peak hour of airport activity and worse case meteorology occurring at the same time is rare if not highly unlikely. The peak hour for cars occurs during morning or afternoon rush-hours, while peak aircraft activity occurs between 11 am and 1 p.m. Additionally, meteorology associated with poor dispersion most often occurs at night. Air dispersion is typically good between 11 and 1 a.m., for example, a time period representative of peak aircraft activity. Concentrations of a pollutant are affected by turbulence of the local atmosphere. If the atmosphere is more turbulent, then there is increased mixing of pollutants, resulting in greater dilution and consequently lower pollutant levels. Greater turbulence generally occurs with poor weather conditions. Application of worst case meteorological conditions provides for minimal dilution and consequently higher pollutant levels.

The EIS air quality analysis assumes that the peak hour for aircraft, roadway and other sources occurs at the same time. The analysis also assumes that the worst case meteorological assumptions, such as cold temperature and calm wind conditions, also occur at the same time as the peak hour operational considerations. Since this is not the case, the analysis represents a worst case situation that may present an overestimation of pollutant concentrations.

Could a higher peak hour occur during a different time from the peak month (i.e., at Thanksgiving or Christmas): The Southwest King County Community Group and the USEPA also questioned whether a higher peak hour could occur outside of June, July or August (the peak months of activity), or when less than peak hour departures occur. Although holiday periods generally attract substantial passenger activity, this does not necessarily translate into more flights. As determined by the Master Plan Update and a review of historical data, operations during November represents only 83% of the August monthly operations total. Whereas August represents approximately 9.5% of the total annual operations, November represents only 7.9%. As stated in the Master Plan Update, total operations at the Airport typically peak during the summer months in July or August. Therefore, a higher peak hour level of operations would not be expected to occur outside of the summer months. In fact, FAA Tower Activity Counts over the Thanksgiving weekend (1995) confirmed that the maximum number of departures was 59. What is often experienced during the holiday periods are considerable delays (at the gate) due to poor weather which affects both arrivals and departures.

Could higher pollutant concentrations occur with less than the peak hour level of departures? As indicated above, the Draft and Final EIS analysis clearly indicate that the highest NO_2 concentrations were identified with less than the peak departure level of activity (i.e., 43.9 departures versus 63 departures). The FAA's activity counts for the Airport clearly indicate that as aircraft activity increases in the peak hour, the number of larger aircraft operating during the peak hour decreases. The revised analysis shows that the result is less NO_2 emissions. Even if the analysis considered that the average annual fleet (i.e., all the aircraft types in use) and the highest peak hour level of departures could occur at the same time (which the Tower counts and ANOMS data indicates does not occur), the change in pollutant levels would be minimal. Carbon monoxide levels would increase one percent or less, and NO_2 would increase eight percent or less. The largest change would occur at the Draft EIS Receptor 4 (the McMicken Heights area northeast of the Airport), at which concentrations would increase 0.003 ppm, increasing from 0.037 ppm to 0.040 ppm including background. Nonetheless, all receptor locations would result in concentrations less than the Ambient Air Quality Standards.

Comment R-10-15: Several groups questioned how a new third parallel runway would be used for arrivals and departures, and whether the effect of a new runway was adequately considered in the air quality analysis. The following organizations made this comment: Airport Communities Coalition, Regional Commission on Airport Affairs, Southwest King County Community Group, and the U.S. Environmental Protection Agency.

Response: As proposed, a third parallel runway is needed to reduce arrival delay incurred during poor weather conditions. Aircraft arrival delay increases during poor weather conditions as the existing runways are only able to accommodate a single aircraft arrival stream. Because of the narrow spacing between the existing parallel runways at Sea-Tac, simultaneous arrivals to both existing runways are permitted only in good weather conditions. Under poor weather conditions, arriving aircraft are either held on the ground in their originating city, slowed enroute, or are placed in holding patterns awaiting clearance to land at Sea-Tac and thereby incurring substantial arrival delay.

To reduce arrival delay during poor weather, the proposed new runway separated by 2,500 feet west of existing Runway 16L/34R is proposed. Its primary purpose would be to enable two separate arrival streams to Sea-Tac, thereby substantially reducing poor weather related arrival delay. Current FAA air traffic control rules require at least a 2,500 foot separation between parallel runway centerlines for two staggered or dependent arrival streams during poor weather to maintain the required aircraft separation. Dependent runway operations refer to conditions where aircraft arriving to one runway affects arrivals to a nearby runway. Because the existing runways at Sea-Tac are only 800 feet apart, the existing airfield only allows a single arrival stream during poor weather (VFR2 and IFR conditions). Based on the 10-year weather analysis performed by the Master Plan Update, poor weather occurs about 44 percent of the time. The FAA's Capacity Enhancement Study found a substantial delay reduction by having two arrival streams during poor weather (although staggered).

As a result, airports which have three parallel runways typically operate with arrivals on the outer runways, with departures on the inner runway and the runway(s) closest to the terminal complex. This is done to afford the most efficient form of airfield operation. With the availability of a third runway at Sea-Tac, it is expected that existing Runway 16L/34R and the proposed new runway would be used for arrivals. Departures would occur on the existing runways (16R/34L and 16L/34R).

On occasion, departures would occur on the proposed new runway. Such usage is likely to be associated with periods when the existing runways are closed for repair and maintenance. The air quality analysis considers that about 3-4 percent of all departures would occur on the proposed new parallel runway, and is only slightly higher than for the average runway end utilization with the proposed third runway presented in Appendix C, Table C-20. This usage represents a reasonable worst-case condition with use by approximately 3 aircraft departures during the peak departure hour. With such limited anticipated usage for departures, overall departure delay would only be marginally reduced (about 5 percent) with the availability of the proposed third parallel runway.

The use of a new parallel runway at any length and distance from the existing runways for departures is limited by several factors, including constraints associated with increased taxiing distances and increased runway crossings. The proposed new runway would be located 2,500 feet west of Runway 16L/34R, which is the closest runway to the terminal area. To use the proposed new runway for departures, aircraft would have to cross two active runways, resulting in added delay (time) and safety considerations. The result to the airlines would be increased fuel costs and a reduction in overall efficiency. Use of the proposed third parallel runway is further limited due to runway length. The proposed runway length of 8,500 feet does not provide sufficient runway length to be used for departure by a number of the larger aircraft including the B-747, DC-10, MD-11, L-1011, or B-767.

Lastly, departure capacity would be constrained by the existing noise abatement procedures. The current "straight-out" noise abatement departure procedures require that departing jets essentially maintain runway heading until the aircraft reaches five miles or 3,000 feet altitude prior to initiating turns. This procedure is designed to keep departing aircraft in the narrowest flight path possible to minimize the population exposed to departure noise. This in turn affects departures due to the need to maintain adequate spacing (both lateral between the two runways, and in-trail between aircraft) for a considerable distance from the Airport. In poor weather, aircraft are required to maintain an in-trail separation of 2 nautical miles compared to one-mile in good weather. Combined, the required in-trail separation and maintenance of the "straight-out" noise abatement departure procedures would greatly restrict the useful departure capacity of a third runway.

The noise abatement procedures do not restrict operations by light single and twin engine piston aircraft and some turboprops through the Dash 8. Once these types of aircraft reach 1,000 feet, they can then be turned outside of the noise abatement corridor. Accordingly, use of a new third parallel runway for departures could be used for the small, propeller engine aircraft that are able to turn quickly once sufficient altitude has been reached. The effect of the existing noise abatement procedures is further discussed in response to Comment R-10-14.

Because of the length of the computer analyses performed for the EIS, the actual output was not included in the appendix. However, these files are available in the Administrative Record; see response to comment R-1-6.

Comment R-10-16: *Four groups requested clarification of the taxi-in/taxi-out time and effect of runway crossings on the air quality analysis. The following organizations made this comment: Airport Communities Coalition, Regional Commission on Airport Affairs, Southwest King County Community Group, and the U.S. Environmental Protection Agency.*

Response: A discussion of the taxi-in/out time-in-mode used in the air quality analysis is included in Appendix D. Taxi distances were calculated for seven separate airfield operating locations to account for the fact that each location could result in aircraft using a different taxiing path. The seven operating locations included the north and south terminal satellites, Concourses A, B, C/D in the terminal area, and the general aviation apron and north cargo ramps. Taxi routings were based on observed operational patterns and discussions with the FAA Tower personnel. Different taxi routes were assigned to the various aircraft categories based on their typical operating capabilities and on information provided by the FAA. Table D-2 presents the time-in-mode by aircraft type used in the inventory analysis. This methodology was utilized for both the existing and future with and without Master Plan Update improvements.

The average taxi distance for each aircraft category, for both arrivals and departures by runway, was determined by weighting the measured taxi distances with the actual number of operations, by category of aircraft (large jet, small jet, and propeller aircraft), for each terminal area location. This was done for both day and night operations. While actual taxi distances do not vary from day to night, the number of operations by aircraft type vary at a given terminal location. The average taxi distance for arrivals and departures, both day and night for each of the aircraft categories, was calculated by applying the existing or future runway end use to the weighted-average taxi distance for each runway. From this the average taxi times were calculated based on a constant taxi speed of 15 knots.

Taxi/idle times for each alternative were calculated separately by the origination/destination location on-airfield used by each of the various airport users. The addition of the proposed South Aviation Support Area and proposed terminal improvements were modeled in combination with the proposed third parallel runway. As shown in Table D-2, taxi time is not anticipated to change drastically between each of the alternatives. This can be attributed to the very similar runway utilization and taxi/idle times used, which are only minimally affected by implementation of the proposed new runway or new terminal development option.

Crossing active runways would be expected to add to the taxi time. The results of the FAA's delay simulation modeling indicates that the additional time needed to cross the other runways with use of a third runway would result on average in the addition of approximately 40 seconds for arrivals, and about 10 seconds for departures. For the air quality analysis, the taxi distances and added time to cross two runways with a new parallel runway is weighted based on the actual number of operations expected to use that runway. As the majority of aircraft arrivals and departures are expected to continue to use the existing runways, the effect of added delay due to runway crossings for all operations is minimal relative to the use of the other runways.

Comment R-10-17: *Clarify departure delay and departure queue delay used in the air quality analysis. The following organizations made this comment: Airport Communities Coalition, Regional Commission on Airport Affairs, Southwest King County Community Group, and the U.S. Environmental Protection Agency.*

Response: The focus of the proposed third parallel runway is to reduce aircraft arrival delay experienced primarily during poor weather conditions. Nonetheless, a reduction in arrival delay would have a concurrent reduction (although small) in departure delay for aircraft waiting on the ground to depart. The availability of the proposed third parallel runway would be expected to reduce departure delay about five percent.

The air quality analysis methodology focuses on the average peak hour departure queue delay for all weather conditions identified by the FAA's simulation modeling delay analysis. For the existing condition, the average departure queue delay during the peak hour of 2.89 minutes was applied to each aircraft departure. Accordingly, the air quality analysis considered that each aircraft departure in the peak hour experienced an average 11 minutes of taxi-idle-delay time upon push-back from the gate and traveling to the end of the runway (8.11 minutes taxi time plus 2.89 minutes delay time for a total of 11 minutes).

Field observation confirmed that during the peak departure hours, aircraft queues include up to 9-10 aircraft with each aircraft in the queue waiting 6-10 minutes of more to depart. Some aircraft in the peak departure hour would experience substantially more delay, while others would proceed unimpeded from the gate to the end of the runway and departure in 5-7 minutes or less in total taxi time. The result is that not all aircraft line up in a queue waiting to depart even during the peak departure hour.

The differences in departure queue can also depend on whether the airport is operating in a south or a north flow (i.e., departures to the south or north). During south flow, aircraft queues during the peak departure hour can at times become rather long. Field observation confirmed that during south flow each aircraft departure experiences an average of 6-10 minutes in the departure queue waiting to depart. This reflects the availability of a long taxiway upon which aircraft can queue without blocking access to the terminal area gates or exit taxiways for arriving aircraft. During north flow, the space to line up aircraft is more constrained and aircraft are more often held in the terminal area apron areas. Field observation confirmed that the length and time spent in the departure queue during north flow is far less than for south flow departures (as observed, less than 3 minutes per departure).

The length of the departure queue is defined as a function of peak hour departures, runway capacity, and delay time. Departure delays result in aircraft queues which increase the time that aircraft engines must operate on the ground. With the proposed third parallel runway, the length of the departure queue would not be expected to be significantly reduced. As previously indicated, use of a new parallel runway at any length and distance from the existing runways for departures would be limited.

Nonetheless, departure delay time is expected to increase in the future with or without a new third parallel runway. This is due to the impact of weather related arrival delay on future departure procedures. With a new third parallel runway, the impact of weather related delay is expected to decrease considerably. A reduction in arrival delay has a concurrent reduction in departure delay for aircraft waiting on the ground to depart. Departure delay time and hence aircraft departure queue time would be reduced due to the ability to accommodate two separate arrival streams during poor weather conditions with a third runway. During poor weather, it is expected that arrivals would operate on existing Runway 16L/34R and the proposed new runway. Departures would occur on the existing runways, Runways 16R/34L and 16L/34R. With the ability to operate arrivals on a third runway, departure delay would decrease particularly during poor weather conditions. With a new arrival runway available, departures would not have to wait for arrivals.

Considerable interest was expressed in the what the affect would be on air pollutant emissions with peak departure activity and peak departure queue. The response to Comment R-10-14 address peak departure activity. The discussion above addresses many of the key understandings relative to departure queues. As indicated, it appears that substantial departure delay can occur during south flow with peak departure activity. Accordingly, the effect on air quality with an increased departure queue delay time over that identified by the simulation modeling was considered. As a reasonable worst case level of departure queue, the effect on air quality was examined based on a level of 10 minutes of departure queue with a peak level of departure activity. Accordingly, each aircraft departure was assigned a total of 18.11 minutes of time on the ground (8.11 taxi-idle time, and 10 minutes queue time). Based on this analysis, approximately 0.001 ppm additional NO_2 would occur at any receptor location modeled.

Therefore, tripling the departure queue delay over that identified by the simulation analysis would minimally affect NO_2 levels. Increased departure queue delay would be expected to increase the short-term 1-hour and 8-hour carbon monoxide concentrations. However, except as identified by the roadway intersection analysis, all 1 and 8-hour CO concentrations would remain well below the Ambient Air Quality Standards. Appendix D presents the results of several test case analyses, including the effects on pollutant levels of peak departure activity and peak departure queuing.

Comment R-10-18: Are general aviation aircraft considered in the air quality analysis and will they still be in use in the future. The following organizations made this comment: Airport Communities Coalition, Regional Commission on Airport Affairs, Southwest King County Community Group, and the U.S. Environmental Protection Agency.

Response: As shown in Table D-1, general aviation aircraft are expected to continue to use the Airport in the future. General aviation aircraft include use by single and twin engine piston aircraft, business jets, and some turboprops. In **Table R-8**, single engine piston aircraft are identified as 1-Engine-Piston; twin engine piston aircraft as 2-Engine-Piston, and turboprops include DHC6, SF340 and CNA441. Activity by general aviation aircraft is expected to remain about the same as it is today. The time-in-mode for general aviation users included in Table D-2 is represented by the PROP (propeller) aircraft type.

However, the on-airport location for general aviation users is expected to change depending on the terminal development option selected. Currently, general aviation users are predominantly located on the southeast side of the airfield, just south of the South Terminal Satellite. With development of the South Aviation Support Area (SASA), general aviation users would be relocated to SASA in the southernmost portion of the airfield. General aviation users would be relocated to this area with either the North or South Terminal options sometime after 2010. With the Central Terminal alternative, general aviation users would be relocated to the northernmost portion of the airfield to an area between Runway 16R/34L and the proposed third runway.

<u>Comment R-10-19</u>: *Clarify the meteorological input assumptions used in the air quality analysis, including the prevailing wind direction and wind speed used in the refined dispersion analysis. The following organizations made this comment: Airport Communities Coalition, Regional Commission on Airport Affairs, Southwest King County Community Group, and the U.S. Environmental Protection Agency.*

<u>Response</u>: The meteorological input assumptions used in the air quality analysis are presented in Appendix D. Ten year historical weather data (1984-1994) summaries for Sea-Tac for wind speeds ranging from 5 to over 20 knots indicate that the predominant wind direction is from the south, which occurred over 20 percent of the time between 1984 through 1994.

The refined analysis is based on actual wind speed and wind direction, and other meteorological conditions which were observed at Sea-Tac for each year over a five year period. The historical weather data was obtained from the National Oceanic and Atmospheric Administration (NOAA) for the five most recent years from 1989 through 1993. Therefore, wind speed, wind direction and other meteorological conditions varied for each of the 8,670 hours for each year modeled for the refined dispersion analysis.

The screening dispersion analysis is based on a wind speed of 1 meter per second. The purpose of the screening analysis is to maximize the pollutant concentrations downwind from the source to identify possible locations of exceedances of the ambient air quality standards. To determine the worst case wind angle (to identify maximum concentrations), thirty-six different wind angles at ten degree increments were modeled. Use of wind speed and 10 degree wind angles for the screening evaluation was confirmed with the regional air quality agencies.

<u>Comment R-10-20</u>: *The Southwest King County Community Group questioned if the mixing height information used in the analysis is the most recent data available.*

<u>Response</u>: The mixing height determines the limits of the vertical transport and diffusion of the pollutants (upward mixing of pollutants). A mixing height of 2,050 feet was used in the analysis based on "*Mixing Heights, Wind Speed and Potential for Urban Air Pollution throughout the contiguous United States*". The information identified by the U.S. Environmental Protection Agency is the most current information available and is based on historic recorded weather data. This report has not been updated. Puget Sound Air Pollution Control Agency indicated that a mixing height of 2,650 feet was utilized in preparation of the State's 1990 inventory based on mobile source guidelines. These mixing heights are similar and would not result in an appreciable difference in the air quality analysis.

<u>Comment R-10-21</u>: *Mr. Peyton (Ravenna-Bryant Community Association) asked if the embankment and ground elevation in the Airport area was accounted for in the air analysis.*

<u>Response</u>: Variation in terrain is not accounted for by the EDMS air quality model.

<u>Comment R-10-22</u>: *The Airport Communities Coalition, the Regional Commission on Airport Affairs and the Southwest King County Community Group questioned how pollutants disperse from Sea-Tac.*

<u>Response</u>: There are two primary air pollutants of concern in the airport environs: Carbon Monoxide and nitrogen dioxides. The major source of carbon monoxide is motor vehicles along the major roadways and in the terminal area. Carbon monoxide is also produced by idling aircraft during taxiing and while waiting to depart. Within the terminal area, there are many contributing pollutant sources including traffic, parking lots, the terminal heating and cooling plant, and even aircraft sources. Carbon monoxide concentrations, which have short-term ambient air quality standards, are typically localized and do not readily disperse.

Nitrogen dioxides are typically produced by higher vehicle speeds and fuel flow and are typical of aircraft takeoffs. As the majority of the NO_2 emissions generated at an airport are due to aircraft takeoff, it is reasonable that the higher levels of NO_2 are found at either end of the airfield (north and south ends of the airport). Accordingly, NO_2 concentrations gradually decrease away from the Airport. Therefore, the highest concentrations for NO_2 are those locations closest to the Airport. Emissions of NO_2 with use of a third runway would not be expected to differ substantially over concentrations that occur with the existing airfield. As indicated in response to comment R-10-14 above, the proposed third parallel runway is expected to be used for approximately 3-4 percent of all departures (i.e., 2-3 aircraft during the peak hour). Therefore, NO_2 concentrations from aircraft takeoffs on the proposed third parallel runway would not be expected to differ substantially over the existing condition.

To further illustrate how air pollutants disperse from the Airport, air pollutant contours or 'isopleths' were prepared (i.e., contours of equal pollutant concentrations). The isopleths were used to identify maximum pollutant concentrations and to identify receptor locations for conducting the revised air quality analysis presented in Appendix D (Exhibits D-1 through D-4 of the Final EIS). The isopleths indicate the general distribution of NO_2 and CO. The isopleths are based on the maximum concentration by worst case wind angle identified by the results of the screening dispersion analysis. As shown by the air quality analysis, the screening analysis overestimated pollutant concentrations in comparison to the results of the refined dispersion analysis which showed no exceedances of the AAQS for NO_2.

__*Comment R-10-23*__: *The Regional Commission on Airport Affairs, and the Southwest King County Community Group questioned how much nitric acid and oxides of nitrogen result from each fire fighting training exercise, and how are any associated wastes disposed.*

__Response__: Pollutant emissions from fire fighting training exercises were considered in the air quality analysis. Tables D-3 present the results of the emissions inventory, which includes training fires. As shown, training fires currently contribute less than 1 percent of the CO, about 1 percent for VOC's, and less than one percent for NO_2, for all sources at the Airport. The total NO_2 produced is estimated at 0.32 tons per year. In 1994, approximately 79 individual training fires occurred. The Port of Seattle has indicated that actual usage today is far less (approximately 28 training fires annually). Additionally, in 1996 the burn pit will be closed, and all fire fighting training will be conducted at Moses Lake until 1997, when a new fire fighting training center at North Bend is complete.

Based on the 1994 level of training activity, approximately 8 pounds of NO_2 are generated by each training fire. The fuels used for training include Jet A and a limited amount of unleaded gasoline. As shown in Tables D-5 and D-6, based on the screening dispersion analysis, off-airport concentrations of CO and NO_2 attributed to training fires were not detected. Therefore, it was determined that training fires are a minor source of air pollutants at the Airport.

To extinguish the training fires, the firefighters use a foaming compound called Aqueous Film Forming Foam (AFFF), which is primarily glycol and water. Nitric acid does not appear to be a by-product of the training exercises.

__*Comment R-10-24*__: *The Southwest King County Community Group noted that the 1991 Ecology study and the 1993 study for Chicago Midway Airport indicated much higher particulate concentrations due to jet aircraft operations.*

__Response__: Both the 1991 Ecology study for Sea-Tac and the 1993 Chicago Midway Airport study referenced in Chapter IV, Section 7 "Human Health", indicated higher particulate concentrations due to jet aircraft operations. Both studies relied on the EDMS air quality model. However, both the 1991 Ecology study and Chicago Midway studies were based on one of the earliest versions of EDMS model.

Although more particulate data was included in the earlier EDMS version, this data was not accurate. Therefore, the aircraft emissions levels included in EDMS for particulates was revised to include only that data for which reliable particulate information is known. The emissions data was not updated because reliable data on aircraft particulate emissions is not available to incorporate into the model. Accordingly, the most current version of the EDMS model now includes little information on particulates in comparison to the earlier versions used by Ecology and for Chicago Midway.

Coordination with the air quality agencies indicated that they are aware of the limited availability of particulate data for aircraft sources. To date, the U.S. Environmental Protection Agency has not revised the aircraft engine particulate data to include additional information on particulates.

Comment R-10-25: *The Regional Commission on Airport Affairs, and the Southwest King County Community Group asked why no analysis was conducted for Ozone.*

Response: Ozone is created from a complex series of atmospheric reactions when hydrocarbons and Nitrogen Oxides accumulate in the atmosphere and are exposed to sunlight. Ozone can often form miles from the pollutant sources. A comprehensive evaluation of ozone would, therefore, require consideration of all major sources within the entire Puget Sound Region. Accordingly, a proposed projects potential contribution to ozone production is typically evaluated by examining emissions of the precursor pollutants hydrocarbons and Nitrogen Oxides.

Comment R-10-26: *The Southwest King County Community Group commented on the differences in climatalogical descriptions between the air quality chapter and the health/noise chapter.*

Response: Appendix D provides a general description of the climate in the Puget Sound Region. The discussion describes the "winter" period from November through February as "relatively mild". In contrast, Chapter IV, Section 7, "Human Health", refers to the "typical cold climate home.... in the Sea-Tac vicinity". Both references accurately describe conditions within the Puget Sound Region. The air quality analysis is based on an average annual temperature of 40 degrees F. According to a review of ten year historical weather data, the average winter temperature (December, January, February) was 41 degrees.

Comment R-10-27: *Mr. Kircher (Puget Sound Air Pollution Control Agency) and Mr. Burke noted that the Tables were difficult to understand, and suggested use of graphics to better explain the results. The U.S. Environmental Protection Agency also suggested that Tables IV.9-5 through IV.9-10 present more information than is necessary, and that only the bottom line results should be presented.*

Response: Comments acknowledged. The presentation of results in the Final EIS has been simplified and makes greater use of graphics where possible.

Comment R-10-28: *Southwest King County Community Group requested clarification of Page D-26, Column 1 and 2, paragraphs 4 and 1 (of the Draft EIS) which indicates that exceedances of the AAQS may occur due to increases in vehicles in the terminal area.*

Response: This comment refers to a discussion of the future Do-Nothing, Alternative 1. As described in that section, roadway traffic in the terminal area is anticipated to increase in the future with or without the proposed improvements. Therefore, all the future conditions (including the Do-Nothing) are expected to accommodate a greater level of traffic over current conditions. The screening dispersion analysis, which takes into consideration changes in motor vehicle traffic, indicate the potential for exceedances of the 8-hour Carbon Monoxide standard for the Do-Nothing alternative in the terminal area. Therefore, the terminal area receptors were selected for a more detailed, refined dispersion analysis. The anticipated changes with implementation of the proposed Master Plan Update improvements are described for Alternatives 2, 3 and 4.

Comment R-10-29: The Southwest King County Community Group asked why aircraft and other airport sources were not included in the roadway dispersion analysis.

Response: The roadway dispersion analysis using CAL3QHC was performed to complement the areawide dispersion analysis performed using the EDMS model, and therefore only focuses on emissions generated by motor vehicles in the immediate vicinity of an intersection. Using the EDMS model, the area dispersion analysis was performed for all sources including roadways. Therefore, combining the results of the area dispersion with the results of the intersection analysis would result in "double counting" the motor vehicle emissions. To account for the pollutant concentrations by sources not included in various analyses, a background concentration was added for all of the dispersion analysis.

However, the screening dispersion analysis does enable the identification of the contributions by the various sources modeled. Both the screening and intersection analyses are based on worst case wind angle and meteorological conditions. Based on the screening dispersion analysis, the contribution of aircraft and other airport sources to pollutant levels at the intersections modeled can be determined. As indicated in Chapter IV, Section 9 "Air Quality", the roadway intersection dispersion analysis indicated possible exceedances of the Ambient Air Quality Standards at two intersections: South 170th and International Boulevard, and South 188th and International Boulevard. For both intersections, aircraft emissions would contribute less than 0.02 ppm of CO for both the 1-hour and 8-hour CO concentrations. Therefore, the contribution of aircraft emissions to CO concentrations at these intersections is minimal in comparison to the high levels identified for motor vehicles. Accordingly, the background concentrations used in the roadway dispersion analysis account for the contribution by aircraft and all other non-roadway sources.

Comment R-10-30: The U.S. Environmental Protection Agency and the Airport Communities Coalition requested that the modeling assumptions used in the construction vehicle dispersion analysis be clarified.

Response: The following summarizes several comments concerning the modeling assumptions used in preparation of the construction vehicle analysis:

1. The modeling of routes to be used by the haul trucks omits consideration of truck traffic peaks - The construction vehicle modeling is based on the peak hour of haul truck activity, and also the peak hour of airport related and non-airport related traffic. Table IV.23-2, "Summary of Expected Off-Site Borrow Source Haul Routes" identifies the haul routes and vehicle trips depending on the location of the fill material. The number of truck trips modeled is based on data presented in Chapter IV, Section 23, "Construction Impacts", and in Table D-16 of the Final EIS. The emission factors used are from MOBILE5A and PART5, both U.S. Environmental Protection Agency approved air quality models. The haul trucks construction site modeling includes the quantification of emissions associated with activities at both the construction site and at the borrow sites.

2. NO_2 was not modeled for vehicular traffic emissions - The construction vehicle dispersion analysis was conducted using the CALINE3 dispersion model. This model predicts dispersion of inert pollutants such as Carbon Monoxide and suspended particulates. Use of the CALINE3 model for NO_2 dispersion is unreliable because it is unable to adequately model the dispersion of highly reactive compounds that disperse over a wide area and for which there are no short-term ambient air standards available. Typically, the construction related haul-trucks would include large diesel-fueled dump trucks, many as large as semi-truck trailers. Accordingly, concentrations of CO and PM10 are the pollutants of primary concern with use of haul trucks.

3. Receptors were placed too far away from the haul routes - The receptors were located in accordance with "Guidelines for Modeling Carbon Monoxide from Roadway Intersections", which

indicates that receptors should be located where the maximum concentrations are likely to occur, and where the general public is likely to have access relative to the time periods specified by the Ambient Air Quality Standards. The modeled receptors were located approximately 60 feet from the route of travel, focusing on areas of residential development along the route. As the analysis indicated no potential exceedances of the short-term 1-hour CO standard, these locations represent areas where the public could be exposed over periods specified by the short-term 8-hour Carbon Monoxide, and 24-hour PM10 standards. The response to comment R-10-10 further describes how the receptors were located for the Draft EIS analysis. The USEPA subsequently indicated that all receptors should be located at three meters from the edge of the roadways, irrespective of the adjoining land uses and expected limits to public exposure. Accordingly, the receptor locations have been revised for the Final EIS.

4. The U.S. Environmental Protection Agency requested that the analysis include 'entrained dust'. The Final EIS has been revised to include emission factors for entrained dust based on use of the PART5 USEPA model. The input assumptions used in PART5 were obtained in consultation with the Department of Ecology and the USEPA. The results are presented in Section 23, "Construction Impacts" of the Final EIS.

5. Construction vehicles such as cement trucks, bulldozers, scrapers, rollers, dump trucks and diesel generators were not included in the emissions inventory, minimizing CO and PM10 concentrations - Typically, the construction related haul-trucks would include large diesel-fueled dump trucks, many as large as semi-truck trailers. Emission factors, therefore, were considered for heavy duty gasoline vehicles and heavy duty diesel vehicles typical of construction haul-truck related activity. Vehicles such scrapers, rollers, and generators typically would only operate at the borrow sources and the construction site and were considered in the calculation of fugitive dust emissions for those sites. However, rollers and scrapers would not be expected to operate along the haul routes and therefore were not considered in the construction vehicle dispersion analysis.

6. On-site fugitive dust emissions during construction and at the borrow sites were not included - Chapter IV, Section 23 of the Draft and Final EIS describes the results of the fugitive dust evaluation for both the borrow and construction site locations. The dispersion modeling focuses on the change in air pollutants that might be expected along the construction vehicle haul routes.

7. Nearby particulate non-attainment areas along the Duwamish and in south Seattle and Kent could be adversely affected - The air quality analysis indicates that off-airport particulate emissions from construction related activities would be concentrated at the construction and borrow sites. Additionally, none of the proposed borrow sources are located in either Duwamish or Kent; however, depending upon how the material is transported to Sea-Tac, these locations could serve as transfer sites (transfer from barge at the Duwamish or transfer from rail in the Kent valley). As is described in response to comment R-12-7, it is not possible to identify precisely how the material would be transported from a specific location to Sea-Tac. The location of any necessary transfer sites and subsequent permitting, would be the responsibility of the successful haul bidder.

Comment R-10-31: The Southwest King County Community Group commented that traffic volumes used in the analysis were not presented, requesting clarification on how the number of cars used in the air quality analysis was identified in relationship to aircraft and operations levels.

Response: The traffic volumes used in the air quality analysis are based on the information presented in Chapter IV, Section 15 "Surface Transportation" and Appendix O. As indicated in that section, peak hour conditions along all roadways were identified. The heaviest traffic conditions of the day in the airport area peaks between 5:00 p.m. and 6:00 p.m. Comparatively, aircraft activity indicates that the busiest period occurs between 11:00 a.m. and 1:00 p.m. The air quality screening dispersion analysis assumes that the peak hour for aircraft and motor vehicles occurs at the same time.

The existing traffic volume data on the area roadways was obtained from the City of Sea-Tac, the Washington State Department of Transportation, and from a series of traffic counts collected in the study area specifically for the Sea-Tac Master Plan Update. These counts were taken in August and September, 1994, and consisted of peak hour turning movements at major intersections, as well as 24 hour volumes on various roadway segments and highway ramps. Counts were conducted during each road segment's daily peak period. The actual traffic volumes used, intersection signalization, and other intersection characteristics were based on level of service (LOS) computations for each intersection similar to the data presented in Appendix O. The actual LOS calculations and traffic volumes used in the analysis are presented in the Final EIS.

__Comment R-10-32:__ The Southwest King County Community Group submitted numerous comments concerning the Air Quality Survey air toxics monitoring methodology and analysis of results. Several commentors also requested further explanation as to the potential implications of the toxics Air Quality Survey monitoring program. The following individuals made this comment: Ms. Christy, Ms. DesMarais, Mr. Kircher (Puget Sound Air Pollution Control Agency), Regional Commission on Airport Affairs, , and U.S. Environmental Protection Agency.

__Response__: An air toxics monitoring program (known as the Air Quality Survey) was initiated by the Port of Seattle in response to public interest over a 1991 air modeling study by the Washington State Department of Ecology. The Ecology study indicated that Airport operations could be a significant source of air pollutant emissions, noting possible concerns over air toxic concentrations, particularly for Benzene. The Ecology study modeled estimated pollutant concentrations using the screening dispersion mode of the EDMS air quality model. The Air Quality Survey was initiated in 1993 and was completed in 1995. The air toxics monitoring program is summarized in Appendix D.

The objective of the Air Quality Survey, therefore, was to provide a preliminary survey particularly for VOCs (from which Benzene is derived), and to assess sampling techniques that could possibly be used in more extensive air quality surveys. The study was intended as a survey and was not intended to provide a comprehensive identification of all potential emission sources. The methodology and analysis of results as presented in the Air Quality Survey were determined independently of the EIS analysis. However, the methodology and results of that study appear to be reasonable, and are therefore included in the EIS to present a historical background on previous air quality studies and monitoring results.

Air monitoring was conducted at thirteen locations. Most of the monitoring locations were on-airport and not publicly accessible. Only two sites were monitored off-airport, with one site located along International Boulevard in the general location of South 184th Street, and another site located at a residence in Normandy Park, two miles west of the Airport. In addition to monitoring for Carbon Monoxide, the program included sampling for fifty-five air toxics.

The results indicated that Benzene was detected in every sample collected, and that other air toxics such as Freon, Toluene, Ethylbenzene, Xylene, and 1,2,4-Trimethylbenzene were found in nearly all samples as well. Benzene has been the primary toxic compound of concern as identified in the 1991 Ecology screening study. The highest average Benzene concentration collected was at a site along International Boulevard. The lowest average concentration occurred at the former Maywood School site (now the Noise Remedy Office), downwind from the Airport. The Normandy Park location had the lowest concentration of Benzene recorded, and generally had the lowest average concentrations for most of the air toxics sampled, and was the lowest for Carbon Monoxide, Benzene, Toluene, Ethyl Benzene, Xylene, and Trimethylbenzene. However, the Normandy site was also the highest for Tricloroethane and Methyl Chloride.

Accordingly, the study noted little difference in VOC concentrations based on locations upwind or downwind from the Airport. The study indicated that several key VOCs were consistent with automobile exhaust and did not resemble the VOC profiles associated with aircraft emissions. The monitored levels for Benzene were well below the modeled values identified in the 1991 Ecology study.

Formaldehyde, Acetaldehyde, and Acrolein were also monitored, but were limited to sampling at three locations, all on-airport at the terminal gates or at the ends of the runways. No off-airport locations were sampled for these compounds. Concentrations of Formaldehyde and Acetaldehyde were found in every sample taken at each location. Formaldehyde and Acetaldehyde concentrations were highest with winds from the south. Acrolein concentrations were higher with winds from the west. Concentrations downwind were typically higher than at the upwind location, suggesting that sources for these compounds were potentially within the Airport. The study states that all Formaldehyde and Acetaldehyde concentrations were within the range reported for other similarly sized urban areas.

In addition to air toxics, the Air Quality Survey also monitored for Carbon Monoxide. The lowest average CO concentrations were at the Normandy Park site. The highest concentration was identified on-airport at Runway End 16L. All CO samples, including along International Boulevard, were below the 8-hour ambient air quality standard (5 ppm or less in comparison to the 9 ppm standard), and were far less than the maximum predictions from the Ecology screening study. Additionally, the measured CO levels did not follow any distinctive pattern that would indicate that aircraft operations were a significant source.

The monitored concentrations were compared to the WSDOE's Acceptable Source Impacts Levels (ASILs). The ASILs are not regulatory standards, and concentrations above the ASILs are allowable and typically found in urban areas. The ASILs are used to assess the risks associated with a new industrial stationary source, and were not intended to assess the health risks from a multi-source urban environment such as around an airport. As noted by Puget Sound Air Pollution Control Agency's comments, the ASILs are "overprotective" because they are designed to be used as a screening mechanism when reviewing industrial equipment. Nonetheless, predicted concentrations above the ASILs may trigger more refined health risk analyses or control technology reviews. Suspected carcinogens have risk-based annual ASILs and other toxic air pollutants have threshold-based 24-hour average criteria. The Air Quality Study found that concentrations for several air toxics were above the annual ASILs, including Benzene, Carbon Tetrachloride, and Formaldehyde. Only one air toxic (Acrolein) exceeded the 24-hour ASIL.

The Study concluded the following:

- Concentrations for several air toxics at all monitored locations were above the annual ASILs for Benzene, Carbon Tetrachloride, and Formaldehyde, and the 24-hour ASIL for Acrolein.
- Concentrations observed at Sea-Tac were within a range exhibited in other similarly sized urban areas (such as Boston, St. Louis and Houston), and that the pollutant profiles for most of the air toxics were indicative of automobile exhaust and not due to aircraft exhaust.
- Monitored concentrations for Benzene and Carbon Monoxide were considerably below the values predicted by the 1991 Ecology study modeling estimates. The highest concentrations of Benzene were found along International Boulevard.
- No significant differences in upwind versus downwind concentrations were observed for most VOCs; however, Formaldehyde concentrations downwind were typically higher than at the upwind location, suggesting that sources for this compound were potentially within the Airport. However, no off-airport locations were monitored for this compound.

The study suggests that air toxic concentrations would be high throughout the Region due particularly to the influence of automobile exhaust. The study also suggests that additional study may be warranted to further evaluate possible sources of Formaldehyde, Acetaldehyde, and Acrolein.

Mr. Burke commented that meaningful comparisons for the air toxics monitoring survey are not possible because the study presents peak measurements as compared with annual standards. As indicated, the air toxics Air Quality Survey monitoring program was a preliminary, short-term survey of air toxics over a four day period. The objective of the Air Quality Survey was to provide a preliminary survey of air toxics that could possibly be used to assess sampling techniques in a more extensive air quality survey. The study compares the results of a four-day sampling program to the annual-average Acceptable Source Impact Levels (ASILs). Accordingly, it is difficult to assign meaningful significance to short-term measurements as compared to longer-term guidelines. In other words, as the monitored data was for a limited, short-term period, it is not certain if the actual levels on an annual basis would be exceeded.

To provide additional understanding of the air toxics values measured, the study also compares the results to air toxics levels in other similarly sized urban areas and concludes that the level of air toxics identified appear to be typical of levels identified in other urban areas. The U.S. Environmental Protection Agency commented that it is difficult to conclude that the results of a short-term sampling program can be used to define ambient levels as "typical", noting that "the Port should be cautious in concluding that the .... monitoring effort is of sufficient "robustness" to draw conclusions about "typical" conditions". Nonetheless, the study results confirmed that air toxics are present throughout the Region, and that high concentrations of air toxics would continue with or without the proposed airport improvements due primarily to the contributions to air toxic levels by automobiles.

__Comment R-10-33__: Five groups asked how the results of the various air monitoring programs conducted at the airport and presented in the Draft EIS compare to the results of the air pollutant modeling programs. The following individual made this comment: Mr. Kircher (Puget Sound Air Pollution Control Agency), Ms. Christy, Regional Commission on Airport Affairs, Seattle Community Council Federation, Southwest King County Community Group, and U.S. Environmental Protection Agency.

__Response__: Perhaps the best comparison of air monitoring and the air modeling results is for Carbon Monoxide along the terminal curbfront in the location of the proposed Hotel. The air monitoring program was conducted November, 1994 through January, 1995; the results are presented in Appendix D. For purposes of comparing pollutant concentrations with the Hotel monitoring program, the EIS air modeling dispersion analysis included a modeled receptor location at the proposed Hotel location.

The results of the monitoring program indicated concentrations of CO well below the 1-hour and 8-hour standards. The EDMS air modeling results as presented in the Draft and Final EIS also showed levels below the standards. However, both the 1-hour and 8-hour modeled concentrations were at least a third higher than observed by the actual field monitoring data. For example, the highest monitored level was 6.0 ppm for the 1-hour concentration, and 4.5 ppm for the 8-hour concentrations. In comparison, including the addition of background concentrations, the 1-hour modeled concentration was 13 ppm and the 8-hour concentrations was about 7 ppm. Therefore, based on the actual air monitoring conducted, the air modeling analysis included in the Draft and Final EIS overestimated the pollutant levels at this location.

Several other short-term air monitoring programs that have been conducted at the Airport to ensure compliance with the Washington Industrial Safety and Health Act (WISHA). As indicated in Appendix D, the concentrations of Carbon Monoxide and Nitrogen Dioxide monitored have been well below the WISHA standards for employee exposure. The results of the WISHA monitoring are generally not directly applicable to the community and the ambient air quality standards, and are therefore not easily comparable to the modeling results presented in the EIS. Nonetheless, the results of these earlier monitoring programs are presented for information purposes, and generally confirm that pollutant levels, primarily within the terminal area curbfront, are within acceptable employee exposure limits.

Comment R-10-32 discusses the results of an air toxics monitoring program conducted at Sea-Tac Airport between 1993 and 1995 for the Port of Seattle. The air toxics monitoring program is referred to as the Air Quality Survey, a summary of which is included in Appendix D. Air monitoring was conducted at thirteen locations over a four day period. Most of the monitoring locations were on-airport and not publicly accessible. Only two sites were monitored off-airport, with one site located along International Boulevard in the general location of South 184th Street, and another site located at a residence in Normandy Park two miles west of the airport. In addition to monitoring Carbon Monoxide concentrations, the program included sampling for fifty-five air toxics.

The results of the Air Quality Survey indicated that concentrations for several air toxics at all monitored locations were high, and were above the annual Acceptable Source Impact Levels (ASILs) for Benzene, Carbon Tetrachloride, and Formaldehyde, and the 24-hour ASIL for Acrolein. As the measured data was for a limited averaging period, it is not certain if the actual annual levels would be exceeded. However, a comparison of the measured averages was made of the annual ASILs.

Accordingly, the estimated annual concentrations estimated in the Draft and Final EIS are not easily comparable with the short-term measured averages observed in the Air Quality Study. The EIS analysis estimated concentrations of three air toxics: Benzene, 1,3-Butadiene, and Formaldehyde. The Air Quality Survey considered concentrations of Benzene and Formaldehyde, but not 1,3-Butadiene. Further, monitoring of Formaldehyde was limited to on-airport locations. Therefore, the comparison of air toxic concentrations between the two studies is limited. Nonetheless, both the EIS analysis and Air Quality Survey indicates possible exceedances of the ASILs. Both studies indicated that automobile exhaust emissions appeared to be the primary source of air toxics within the Region.

In addition to air toxics, the Air Quality Survey also monitored for Carbon Monoxide. The results indicate that the monitored concentrations are about one-half the modeled concentrations at its greatest difference. The Air Quality Survey included monitoring along International Boulevard in the general location of South 184th Street. All CO samples, including along International Boulevard, were below the 8-hour ambient air quality standard (5 ppm or less in comparison to the 9 ppm standard). The EIS included an analysis of roadway intersections along International Boulevard, at South 170th Street and also at South 188th Street. The Air Quality Survey recorded an 8-hour CO concentration of 4.5 ppm. This concentration is less than one-half the modeled concentration at its greatest difference. Additionally, the Air Quality Survey confirmed the low CO concentrations for locations immediately to the north and south of the Airport, with the modeled concentrations identified by the EIS dispersion analysis slightly higher (0.5 ppm greater) than the measured levels.

Comment R-10-34: *Mr. Kircher (Puget Sound Air Pollution Control Agency), Southwest King County Community Group, and the U.S. Environmental Protection Agency requested a clarification of the air toxics methodology used in the air quality analysis.*

Response: Chapter IV, Section 7 "Human Health" and Appendix D, describe the air toxics inventory modeling methodology. The response to comment R-10-35 further discusses the meaning of the risk assessment analysis results.

The air toxics modeling methodology is a screening analysis used to determine the pollutant concentrations for air toxics in the surrounding airport area. The air toxics evaluation provides two ways in which to compare changes in air toxics emissions with and without the proposed airport improvements:

- An air toxic emissions inventory in tons per year, identifying concentrations of VOCs, Benzene, 1,3-Butadiene, and Formaldehyde; and
- A comparison to the Department of Ecology's Acceptable Source Impact Levels (ASILs)

The air toxics concentrations are based on the relationships between hydrocarbons and various air toxics identified by a more detailed air toxics study conducted at Chicago Midway Airport for the U.S. Environmental Protection Agency. The Chicago Midway Study was used as it is the only known study of possible cancer effects of an airport, and is the most current evaluation of air toxics in an Airport area. The assumptions, methodology, and conclusions for that study appear to be reasonable and acceptable for use in the determination of air toxics for other airports. However, the area around Chicago Midway is highly urbanized and congested with concentrated residential areas mixed with light industrial and commercial uses. Although the Sea-Tac area is urbanized, it is far less developed than the Midway area. Accordingly, use of the pollutant relationships established by that study would be expected to be higher than for the Sea-Tac area, and therefore, could result in an overestimation of pollutant concentrations.

To establish the hydrocarbon emissions and concentrations identified through dispersion analysis, the results of the emissions inventory and dispersion modeling presented in Chapter IV, Section 9 "Air Quality " was used. This analysis is based on use of the EDMS model, and the modeling methodology, input assumptions and sources considered are identified in Appendix D. The output of the EDMS model are an emissions inventory, as summarized in Table IV.7-2, and a dispersion analysis by modeled receptor location. Hydrocarbon emissions are an output of the EDMS model. Based on the pollutant relationships identified in the Midway study, the VOC emissions were converted to levels for Benzene, 1,3-Butadiene, and Formaldehyde. The conversion factors used in the analysis are presented on page D-64. The level of VOC emissions output from EDMS are multiplied by a factor to convert to Total Organic Gases, and then by separate factors for converting to Benzene, 1,3-Butadiene, and Formaldehyde.

The receptor locations considered in the analysis for Sea-Tac Airport are shown in Exhibit IV.9-1 of the Final EIS. These receptor locations were initially selected for further, more detailed analysis based on the screening dispersion analysis. The response to comment R-10-10 discusses the receptor location methodology. Based on the refined dispersion analysis, the VOC concentrations at each receptor was identified and converted to the three air toxics as described above.

Tables IV.7-3 and IV.7-4 compares the air toxic concentrations by receptor location to the Acceptable Source Impact Levels (ASILs). The concentrations presented in this table do not consider population. The response to Comment R-10-35 describes how to interpret comparisons to the ASILs.

<u>Comment R-10-35</u>: *Two commentors stated that the EIS air toxics analysis contains insufficient information to adequately evaluate the risk assessment analysis for air toxics. The following individual made this comment: Ms. Brown, Mr. Burke, and Airport Communities Coalition.*

<u>Response</u>: Comments noted. The commentor is correct as insufficient information exists to indicate a direct correlation between airport activity and cancer cases. As a result, the additional quantities of potential carcinogenic pollutants that a proposed project might create are usually contrasted with the ASILs. The ASILs are established for known or probable carcinogens. The ASILs apply specifically to each air toxic, not for a combination of all toxics.

<u>Comment R-10-36</u>: *Ms. Brown asked what mitigation efforts will be implemented if the annual levels of air toxics in the area are exceeded.*

<u>Response</u>: As indicated in the previous response, the Washington State Department of Ecology has established Acceptable Source Impact Levels (ASILs) for known or probable carcinogens. The ASILs are not regulatory standards, and concentrations above the ASILs are allowable and are found in urban areas. The ASILs are designed to be used as a screening mechanism, particularly for reviewing industrial stationary sources, and were not intended to assess the health risks from a multi-source urban environment such as around an airport. The ASILs are considered "overprotective". Nonetheless, predicted concentrations above the ASILs may trigger more refined health risk analyses or control technology reviews.

Chapter IV, Section 7 "Human Health", presents the air toxics evaluation including a comparison to the ASILs. The evaluation is based on the incremental change in concentrations between the Do-Nothing and "With Project" alternatives. Therefore, the proposed airport improvements would not be expected to result in an increase in the incidence of cancer cases and no mitigation would be required.

Comment R-10-37: *The Southwest King County Community Group stated that the study on which the air toxics analysis is based indicated that the major contributor to cancer risk was aircraft, which contradicts the analysis prepared for the Master Plan Update EIS.*

Response: The EIS air toxics analysis is based on the hydrocarbon and air toxic pollutant relationships defined by the U.S. Environmental Protection Agency study for Chicago Midway Airport. As stated in the executive summary (page xvii) of that study, "Cars, trucks, buses and trains are the major contributors of carcinogens accounting for about 25% of the total estimated cancer cases.....aircraft engine emissions from Midway Airport and non-road mobile sources (such as lawn mowers and snowblowers....contributes approximately 11% of the total cancer cases." Both studies (the Midway study and the Draft and Final EIS), therefore, conclude that the major contributor to cancer risk are motor vehicles.

The commentor further states that the Midway study compares air toxic emissions for aircraft and motor vehicles for which aircraft are shown to be the major source of air toxics. This would be expected since the Midway study focuses on only airport sources, and includes data on motor vehicles for only three on-airport parking lots and a short segment of the terminal area roadway. The surrounding off-airport roadways and parking lots were not considered. Accordingly, as very little information is included in the Midway study for motor vehicles in comparison to the Draft and Final EIS analysis, a large disparity in emission levels would be expected.

Comment R-10-38: *Mr. Kircher (Puget Sound Air Pollution Control Agency) requested an identification of toxic air contaminants for which information is reasonably available, showing contributions by various source types and pollutants to risk in that geographic area, and incorporating graphics to present the results.*

Response: As indicated in response to comment R-10-34, the air toxics assessment is based on the relationships between hydrocarbons and various air toxics identified for an air toxics study conducted for Chicago Midway Airport. That study evaluated the presence of three air toxics derived from levels of hydrocarbons including Benzene, 1,3-Butadiene, and Formaldehyde. The Chicago Midway study was used as it is the only known study of possible cancer effects of an airport. Because the EIS analysis is based on the relationships between pollutants identified in that study, the EIS analysis is limited to the evaluation of Benzene, 1,3-Butadiene, and Formaldehyde. Therefore, conversion factors for other air toxics are not available from that study.

Chapter IV, Section 7 "Human Health" presents the emissions inventory for the toxics considered. In comparison to contributions by motor vehicles, aircraft are a minor source of toxic emissions within the Airport environment, with motor vehicles contributing over 70 percent of the toxic emissions and aircraft about 20 percent. The analysis presented in the Final EIS was prepared to clarify the contributing sources and make greater use of graphics to present the results.

Comment R-10-39: *Ms. Richter stated that airport communities are suffering from high cancer rates and high incidences of respiratory illness caused by jet fuel in the atmosphere. Additionally, several individuals questioned if increased aircraft emissions will result in increased deaths due to cancer. The following individuals made this comment: Mr. Burke, Ms. R. Clark, Mr. Osaki, Mr. Scarvie, Ms. Thomson, and Ms. Wordian.*

Response: Chapter IV, Section 7 "Human Health", presents an air toxics emissions and concentrations of the various air toxics compared to the Washington State Department of Ecology Acceptable Source

Impact Levels (ASIL). Therefore, the proposed improvements would not be expected to result in an increase in the incidence of cancer cases. The response to comment R-10-34 and R-10-35 further discusses this topic. Additionally, the response to Comment R-10-3 discusses the various differences and components of aviation fuels.

__Comment R-10-40:__ *Ms. Wordian requested that the EIS discuss Benzene concentrations at the Seattle Christian School.*

__Response__: As indicated in response to comments R-10-2, the 1991 Ecology study identified possible concerns over high concentrations of air toxics, especially Benzene. In particular, the Ecology study identified possible high Benzene levels in the location of the Seattle Christian School, and suggested that such concentrations may be due to aircraft activity. The Seattle Christian School is located approximately one-quarter mile directly south of the Airport.

The Draft and Final EIS air quality analysis did not evaluate estimated concentrations for air toxics at this location because it is now owned by the Port of Seattle and would soon be incorporated into the future airport property. With environmental approval to develop the South Aviation Support Area, the Port of Seattle acquired the Seattle Christian School in February, 1995. By mid-1997, the school will be relocated to a new facility currently under construction located northwest of the intersection of South 184th and Military Road. Therefore, this property and all adjoining properties would be included within the future airport boundary. One of the criteria used in selecting receptor locations was to exclude all existing and future airport property that is or would be inaccessible to the general public.

As noted in response to comment R-10-32, however, the monitored concentrations for Benzene were considerably below the values predicted by the 1991 Ecology study modeling estimates. The highest concentrations of Benzene were found along International Boulevard and are related to cars on that road.

__Comment R-10-41:__ *The Regional Commission on Airport Affairs suggested that aircraft emit many different chemicals, some of them highly toxic; they commented that the Draft EIS fails to discuss these chemicals and the standards for them.*

__Response__: In addition to evaluating the relationship of the proposed airport improvements to the criteria pollutants defined by the Ambient Air Quality standards (listed in Table IV.9-1), an evaluation of air toxics was also prepared and is described in Chapter IV, Section 7 "Human Health". The air toxics evaluation is also presented in Appendix D, beginning on page D-63. Additionally, Appendix D summarizes the results of several previous air monitoring programs at the Airport, including an air toxics Air Quality Survey completed in January, 1995.

The U.S. Environmental Protection Agency has not established regulatory standards for air toxics. However, the Washington State Department of Ecology has adopted Acceptable Source Impact Levels (ASILs) which are typically used to assess the risks associated with a new industrial stationary source, and were not intended to assess the health risks from a multi-source urban environment such as around an airport. See response to comment R-10-34 and R-10-35.

__Comment R-10-42:__ *The Southwest King County Community Group questioned why future growth in aircraft activity would increase air toxics by five percent while automobile-related air toxics are expected to decrease by five percent.*

__Response__: Chapter IV, Section 7 of the Draft and Final EIS acknowledges that aircraft activity is expected to increase in the future at Sea-Tac with or without the addition of a third runway. Based on this increase, airport related air pollutant emissions would be expected to increase. At the same time, motor vehicle traffic would grow. However, based on U.S. Environmental Protection Agency emissions data, it is anticipated that improvements in future motor vehicle emission would offset the continued growth in traffic.

Comment R-10-43: *Three commentors requested an explanation of how the sites selected for the residue sampling were selected, the sampling methodology, and why no residue was attributed to aircraft sources. The following individuals made this comment: Mr. Burke, the Airport Communities Coalition, Mr. Scarvie, and Southwest King County Community Group.*

Response: As indicated in Appendix D, beginning on page D-60, the Port of Seattle conducted a residue sampling program at three residences in the surrounding airport environment and one on-airport source as part of the EIS process. The three residential sampling sites were based on locations at which the owners had previously expressed concern over residues or fuel odors. Two of the locations were provided to the Port of Seattle by Ms. Terry Anderson, a city council person for the City of SeaTac. A third site, located in Des Moines, was provided through State Representative Greg Fischer's office. One residence sampled was located just north of SR 518 and the Airport in the Riverton Heights area of SeaTac. This site was the closest to the Airport and aircraft flight paths. A second site was located in a trailer park immediately to the east of the Airport and terminal area. A third location was located approximately 3-4 miles south of the Airport in the City of Des Moines, just west of the existing runway centerlines.

The analysis of the residue samples collected was performed by AMTest Labs located in Redmond, Washington. AMTest Labs provided the sampling containers and procedures for collecting the samples. Wearing surgical gloves, the samples were collected using a two square inch piece of gauze thoroughly wetted with methanol. Covering approximately 100 centimeters, the gauze was rubbed in a circular motion on the surface to be tested to collect the residues. The gauze was then deposited in a lidded small glass jar. The jars were then labeled and placed in a cooler until they could be brought to the lab. The areas to be sampled were identified in consultation with each resident reporting the presence of residue.

The lab performed analyses for a microscopic examination, a test for polynuclear aromatics, and a heavy metals exam. The composition at each site consisted of a variety of substances, including fungus, insect particles, minerals and soils, other unidentified particles, and soot. Although all samples collected contained soot, the percentage of the overall samples was small. Additionally, based on particle size, the soot was identified by the lab as more typical of motor vehicles or wood burning activities. Or, the *majority* of the soot identified was larger than the particle size that would be expected from aircraft engines. Although the lab could not rule out contributions by aircraft sources to these samples, the analysis indicates that contributions by aircraft at these sites are minimal at best.

In reviewing the results of the residue sampling with the lab, other types of sampling such as canister sampling (actual air sampling similar to that conducted for the Air Quality Survey air toxics monitoring) was discussed. However, the lab indicated that no additional value could be expected from a more detailed air sampling program because of the low levels of polynuclear aromatics present in the residue samples analyzed. The lab indicated that levels of these types of compounds would have been expected in much higher concentrations if aircraft sources were suspected to warrant additional evaluation.

Comment R-10-44: *Mr. Peyton (Ravenna-Bryant Community Association) stated that the analysis is deficient as levels of Benzene were not presented, and that there is no breakout of the components for particulate matter such as for lead.*

Response: As presented in the Draft and Final EIS, Chapter IV, Section 7 "Human Health", an air toxics risk assessment was performed for Benzene, 1,3-Butadiene, and Formaldehyde. Additionally, the results of the 1993 Air Quality Survey sampling program for air toxics are included in Appendix D. That study evaluated levels of fifty-five air toxics, including Benzene. The air monitoring study indicated that concentrations for Benzene would exceed the annual WSDOE Acceptable Source Impact Levels (ASILs). However, both the Air Quality Survey and the EIS analysis indicated that automobile exhaust was the primary source for Benzene in the Airport area. Therefore, high levels of Benzene and other air toxics could be expected with or without the proposed airport improvements.

High levels of lead particulates due to aircraft fuels and exhaust is unlikely because the majority of the aircraft operating at the Airport use JetA aviation fuel. JetA fuel is a highly filtered form of kerosene and does not include lead. Low lead fuel (AVGas) is utilized primarily by the single and light twin engine piston aircraft, which accounts for about six percent of all aircraft operations at Sea-Tac. Emissions data for lead particulates from general aviation aircraft is currently not available. However, as there are few operations at Sea-Tac conducted by the smaller piston aviation aircraft, it would appear that lead particulate emissions would be minimal.

__Comment R-10-45__: Mr. Peyton (Ravenna-Bryant Community Association) stated that by not considering emissions above 3,000 feet, the analysis disregards aircraft pollution over Seattle and on most approaches.

__Response__: The Emissions and Dispersion Modeling System (EDMS) evaluates the design and operational characteristics of an airport by modeling aircraft emissions primarily during all operational modes including takeoff, climb-out, approach and taxi/idle/delay. Emissions are calculated for climb-out and approach up to 3,500 feet. Emissions from higher altitudes cannot produce significant ground concentrations because they are discharged at altitudes that preclude any discernible impact to ground level air quality conditions.

__Comment R-10-46__: Mr. Webb, Ms. Brown, and Southwest King County Community Group questioned if construction vehicles were included in the total airport air quality dispersion analysis.

__Response__: The impact of the proposed improvements on air quality are addressed in two sections of the EIS. Construction related impacts are presented in Chapter IV, Section 23 "Construction Impacts". Impacts associated with the improvements, after construction is implemented in presented in Chapter IV, Section 9 "Air Quality". Air pollution levels during the construction period for all motor vehicles including construction related vehicle trips were considered in the evaluation of construction related impacts. The evaluation of construction related impacts is discussed beginning on page IV.23-9, and in Appendix D (beginning on page D-68) of the Final EIS.

__Comment R-10-47__: Mr. Peyton (Ravenna-Bryant Community Association) and Mr. Frause asked if the proximity of the third runway to Des Moines Memorial Way will cause particulate drift on motorists on the highway.

__Response__: It is anticipated that the potential for fugitive dust from construction impacting Des Moines Memorial Way or other areas would be minimized through use of various control measures. A fugitive dust plan would be identified which would specify the mechanisms to be used to control fugitive dust, such as watering or use of chemical stabilizers. Chapter IV, Section 23 "Construction" discusses fugitive dust emissions beginning on page IV.23-10.

__Comment R-10-48__: The City of SeaTac questioned how construction related air quality impacts can be called short-term when construction will take approximately 2.5 years.

__Response__: Construction impacts are typically considered short-term and temporary in nature. Construction impacts cover a specific period of time, and, upon completion, do not continue. Because construction related activity includes short but intense periods of activity, the air quality analysis focuses on air pollutants for which there are 'short-term' ambient air quality standards (AAQS). Accordingly, the air quality analysis focuses on concentrations of Carbon Monoxide (CO) and particulate matter (PM10). The AAQS for CO include standards for 1-hour and 8-hour concentrations. For particulate matter, the AAQS include both a 24-hour and longer-term annual average. Concentrations of CO and PM10 are of primary concern with use of haul trucks.

__*Comment R-10-49:*__ *Mr. L. Jones, Mr. Scarvie and Ms. Feckley expressed concern that the EIS does not consider the impact of moving 23 million cubic yards of fill and resulting possible fugitive dust emissions. Mr. Frause asked where the impact of drifting dust particles discussed in the EIS and what will be the impact of fugitive dust from a "million" truck loads of soil.*

__Response__: Chapter IV, Section 23 and Chapter V discuss construction related impacts and mitigation requirements. To minimize the fugitive dust transport, unpaved roads and inactive portions of the construction site would need to be either watered or chemically stabilized during dry periods. Development of construction plans would include identification of a fugitive dust plan. A Construction and Earthwork Management Plan would be developed during the design phase to support haul route permit requests and regulatory agency reviews, and may include additional route mitigation. However, all pollutant levels, along each of the haul routes are well below the Ambient Air Quality Standards and Washington State standards for these pollutants. Therefore, no additional mitigation is expected for these areas. See also response to comment R-16-19

__*Comment R-10-50:*__ *Three commentors requested an explanation of the relationship between air conformity, issuance of the Governor's Certificates, and issuance of the FAA's Record of Decision. The following individuals and organization made this comment: Mr. Frause, Ms. Stuhring, Southwest King County Community Group.*

__Response__: Chapter IV, Section 9 "Air Quality" describes the Clean Air Act Conformity process. As indicated, conformity is defined as demonstrating that a proposed improvement conforms to the State Implementation Plan's purpose of "eliminating or reducing the severity or number of violations of the national ambient air quality standards and achieving expeditious attainment of such standards." Conformity applies to Federal actions occurring in areas designated non-attainment for any of the criteria pollutants included on Table IV.9-1. The Airport is located in the Ozone and Carbon Monoxide non-attainment areas.

Although the conformity determination is a Federal responsibility, State and local air agencies are provided notification and their comments requested. The Federal agency must provide a 30-day notice of the Federal action and draft conformity determination to the appropriate U.S. Environmental Protection Agency Region, and State and local air control agencies. The Federal agency must also make the draft determination available to the public to allow opportunity for review and comments. The draft conformity determination is included in this Final EIS. While a conformity notification and determination process can be incorporated in to the National Environmental Policy Act process, it can also be a stand alone process. A final conformity statement will be issued prior to or as part of the Record of Decision.

Certification from the Washington State's Governor's Office is required for a grant for a proposed new runway indicating that the proposed Master Plan Update improvements would comply with all applicable air quality standards. Certification is issued in the form of a Governor's Air Quality Certificate. It is planned that issuance of the Governor's Air Certification would occur prior to issuance of the FAA's Record of Decision.

__*Comment R-10-51:*__ *Two groups asked how commitments to air quality mitigation will be provided, and who will be responsible for implementing the mitigation measures. The following individuals made this comment: Ms. Brown, Mr. Kircher (Puget Sound Air Pollution Control Agency), and the Southwest King County Chamber of Commerce.*

__Response__: The Clean Air Act Conformity determination of conformity requires a commitment to mitigation, if necessary. Any mitigation measures must be identified, and the process and schedule for implementation and enforcement explicitly described. If mitigation is required to demonstrate conformity, the sponsoring Federal agency must obtain written commitments to implement mitigation measures. Any licenses, permits or approvals must be conditioned on implementation of the mitigation measures. Therefore, the conformity determination process requires that the sponsor provide written commitments to any required mitigation plans. It is anticipated that commitments to mitigation would be included in the FAA's Record of Decision (ROD). The FAA's ROD is intended to include the appropriate assurances (commitments to mitigation), conclusions, or findings concerning a proposed action. The Record of Decision is the FAA's commitment to implement the measures necessary to mitigate adverse incremental air pollutant impacts that may occur as a result of the proposed airport improvements.

Comment R-10-52: *The Southwest King County Community Group questioned if the air quality mitigation measures identified along International Boulevard would result in increased traffic, causing more adverse environmental impacts.*

Response: Chapter IV, Section 9 "Air Quality" identifies mitigation measures associated with anticipated air quality impacts along International Boulevard and intersections at South 170th Street, and South 188th Street. The proposed roadway improvements include added left-turn lanes, dedicated high capacity right turn lanes, and reduced employee traffic and parking within the terminal area. Although a high level of traffic is anticipated along International Boulevard with or without the proposed airport improvements, the terminal alternatives would result in changes in traffic along various roadways in the airport area. The mitigation measures focus on reducing vehicle idling due to the increase in traffic at these intersections with the terminal options. The proposed mitigation measures primarily address airport related traffic, and are unlikely to result in added other traffic to an already heavily traveled thoroughfare.

Comment R-10-53: *Four commentors questioned why improvements or mitigation measures to International Boulevard are not being pursued immediately. The following individuals made this comment: Mr. Matthews, Mr. Rohlfs(City of SeaTac), Southwest King County Community Group.*

Response: napter IV, Section 15 "Surface Transportation" identifies several roadway improvements that are expected to occur within the area with or without the proposed airport improvements. For example, a southbound HOV (high occupancy vehicle) lane and additional improvements along International Boulevard are currently underway. The Washington State Department of Transportation (WSDOT) is responsible for maintaining and implementing improvements along SR 99. According to the WSDOT and City of SeaTac, the improvements occurring along International Boulevard are intended to address roadway traffic through the year 2003 after which planned improvements such as South Access and the SR 509 Extension would help reduce future traffic congestion along International Boulevard.

As indicated in the EIS, improvements to International Boulevard as a result of the proposed airport improvements would be needed by 2010, as the mitigation would substantially decrease the amount of time vehicles idle at the intersections with development of the terminal improvements. Improvements in addition to the HOV lane necessary to address already high traffic volumes are not planned prior to 2010 at this time. However, the Port of Seattle is committed to reducing air pollutant levels by reducing emissions from various sources at the Airport. A number of on-going considerations have focused on reducing the number of vehicles accessing the airport by providing alternatives to single-occupancy vehicle access to and from the Airport. Other actions have addressed motor vehicle idling along the terminal curbfront. Airport staff rigorously monitor access by taxi's and limousines and buses and idling within the terminal area. The Draft and Final EIS lists several additional mitigation actions that could be undertaken to further reduce air pollutant concentrations at the Airport including 1) Financial disincentives for single occupancy driving to the Airport; 2) Convenience disincentives/incentives; 3) Develop improved airport access roads that attract users off the area roadways.

__*Comment R-10-54:*__ *The Airport Communities Coalition commented that the analysis did not identify the impacts on air quality that would occur when the employee parking is relocated from South 170th street to north of SR-518.*

__Response__: Although the future employee parking lot to be located north of SR 518 was considered in the air quality analysis, the effect of additional employee traffic for this location with mitigation was not considered because the proposed mitigation measures were subject to further review. The changes in employee traffic and parking, and proposed mitigation along International Boulevard are evaluated in the Final EIS air quality analysis.

__*Comment R-10-55:*__ *Six individuals or groups reported that none of the proposed mitigation measures suggested in the past have ever been incorporated or committed to. Comments were received from: Ms. Brown, Mr. Burke, Mr. Dinndorf (Puget Sound Regional Council), Mr. Peyton (Ravenna-Bryant Community Association), Regional Commission on Airport Affairs, and the City of SeaTac.*

__Response__: In the past, several studies have been completed related to the Airport, including the 1993 Final EIS for the South Aviation Support Area (SASA); the 1992 Final EIS Flight Plan study; and the 1991 Ecology study on air pollutant levels. The South Aviation Support Area Final EIS did not identify air quality mitigation measures, as no significant impacts were identified associated with that project. Similarly, the Flight Plan EIS examined mitigation, but, as the EIS was programmatic in nature, implementation of mitigation is dependent upon the analysis in the site specific EIS, such as the Master Plan Update EIS. The 1991 Ecology study included several recommendations for improving air quality. The Ecology study was not a project-related evaluation, and therefore, no specific mitigation was required. The Ecology recommendations and current status are as follows:

1. <u>Minimize queuing and engine idling for all aircraft</u> - Although the addition of a third runway is proposed to primarily address arrival delay, a slight reduction in aircraft departure delay would also result. Therefore, the proposed third runway partially satisfies the overall objective of this recommendation. Indirectly, the Airport's existing noise abatement procedures also work to reduce aircraft idling emissions. Currently, the existing noise abatement procedures require that aircraft be pushed back from the terminal gates using tugs versus using the engines to 'power-back' from the gates. Once aircraft have been sufficiently backed away from the gates into the terminal apron areas, the aircraft engines are started and the aircraft can then proceed to taxi to the end of the runway. The result is less engine idling and emissions, particularly within the terminal area.

2. <u>Development and implement a plan to reduce the Nitrogen Oxide emissions from takeoffs</u> - The 40 CFR Part 87 contains engine emission standards that apply to large commercial passenger jets. The FAA is responsible for implementing the standards, and it does so through engine certification data provided by the manufacturers. Under Section 231 of the Clean Air Act, as amended, the U.S. Environmental Protection Agency is empowered to set standards for emissions from aircraft. To date, engine emission standards are not proposed for modification. Accordingly, the Port of Seattle is unable to establish alternative engine emission standards beyond those established by the U.S. Environmental Protection Agency.

3. <u>Support a strong inspection and maintenance (I/M) program to reduce motor vehicle emissions</u>. An I/M program is in effect in the Puget Sound Region and is the responsibility of the Washington State Department of Ecology.

4. <u>Promote public transportation to and from Sea-Tac</u> - The Port of Seattle remains committed to public transportation alternatives, and continues to support the proposed Regional Transit Authority (RTA) which would provide direct public rail transportation access to the Airport. Additionally, the Port of Seattle has supported a trip reduction strategy which has several components: employee shuttle bus service to remote public and employee parking to reduce vehicle trips in the terminal area; support for

the regional light-rail transit system; and limiting passenger drop-off and pickup and vehicle idling at the terminal through vigorous enforcement and by successfully providing short-term parking alternatives (i.e., metered short-term public parking within the terminal area).

5. Consider switching the ground support vehicles from gasoline to an alternate, cleaner burning fuel such as natural gas or propane. The dispersion analysis did not identify any exceedances of the Ambient Air Quality Standards, and indicated that pollutant emissions from ground service vehicles would not result in high pollutant concentrations off-airport. The use of alternative fuels for ground service vehicles would primarily reduce carbon monoxide levels. The reduction in other pollutants (i.e., NO_2 and hydrocarbons) is less certain. The primary benefit in reduced emissions from ground service vehicles would be centered on the terminal area. As the dispersion analysis did identify any exceedances of the Ambient Air Quality Standards in the terminal area, the costs associated with conversion of the ground service vehicle fleet outweigh the known benefits at this time. Nonetheless, as indicated in Chapter IV, Section 9, the Port of Seattle would continue to explore ways in which to encourage the airlines to voluntarily add alternative fueled ground service vehicles as they look to replace their equipment.

6. Consider indirect source legislation/rules to control the effects of airport - Neither the U.S. Environmental Protection Agency nor the state of Washington has indirect source regulation which would apply to the proposed airport improvements. In the 1990 amendments to the Federal Clean Air Act, the regulations pertaining to aircraft or indirect sources were not changed from the 1977 provisions.

7. Conduct a refined study to determine if Benzene emissions pose a significant health risk to the adjacent communities - The Port of Study initiated an air toxics monitoring study in 1993, the results of which are summarized in Appendix D. As indicated by that study, the predominant source of Benzene emissions in the Airport area appear to be related to automobile traffic.

Mitigation measures are identified in the Draft and Final EIS concerning roadway improvements along International Boulevard. Further, the Port of Seattle has identified several additional actions that could be undertaken to further reduce air pollutant concentrations. The response to comment R-10-51 identifies the commitment to mitigation necessary as part of the Clean Air Act Conformity determination process.

Comment R-10-56: Mr. Burke noted that the exhibit on page IV.9-19K shows the location of air modeling receptors. He expressed concern that no receptors were directly under the flight path where they would get the highest pollutant concentrations.

Response: The criteria used to select the receptor locations to be modeled included excluding receptor locations located within existing or future airport property, or within the right-of-way for major roadways such as SR 518. The areas located directly along the runway centerlines (i.e., under the flight paths) are all located within the existing or future airport boundary. All receptor locations not included within the existing or future airport property boundary or major roadway right-of-way were evaluated for the maximum pollutant concentrations for those areas. The response to comment R-10-10 addresses receptor selection methodology.

Comment R-10-57: The U.S. Environmental Protection Agency asked if the effect of increased emissions associated with increased approaches and landings has been addressed in the analysis.

Response: As indicated in response to comment R-10-15, a third parallel runway is proposed to reduce arrival delay incurred during poor weather conditions. The actual number of aircraft approaches and landings would not be expected to increase over the Do-Nothing condition, but the level of arrival delay incurred would decrease appreciably. A reduction in arrival delay has a concurrent reduction in departure delay for aircraft waiting on the ground to depart.

Airports which have three parallel runways typically operate with arrivals on the outer runways, with departures on the inner runway and the runway closest to the terminal complex. It is expected that existing Runway 16L/34R and the proposed new runway would be used for arrivals. Departures would occur on the existing runways (16R/34L and 16L/34R). This change in operating configuration was considered in the air quality analysis.

__Comment R-10-58:__ *The Southwest King County Community Group noted that the 1991 Ecology Study suggested studying the feasibility of switching the ground support vehicles at Sea-Tac from gasoline to an alternative, cleaner burning fuel such as natural gas, ethanol or methanol.*

__Response__: Ground service equipment (GSE's) are those vehicles owned and operated by the airlines and airport operators to service aircraft (i.e., refueling, baggage loading, food servicing, etc.). GSE's typically use either unleaded gasoline or diesel fuel, and the emissions from these vehicles is dependent upon the amount of time they are operated to service each aircraft.

Use of alternative fuels includes compressed natural gas (CNG), propane gas, methane gas (M-85), reformulated gasoline (RFG), and electricity. Certain vehicle emissions can be reduced by the use of alternative fuels, but the reductions in pollutant levels is highly dependent on the type of fuel and engine technology of each manufacturer. Propane has typically been the alternative fuel considered when considering the conversion of ground service vehicles to use of an alternative fuel. **Exhibit 1** illustrates the change in pollutant levels for carbon monoxide, nitrogen oxides, hydrocarbons, and formaldehyde for each alternative fuel in comparison to unleaded gasoline. For all alternative fuels, carbon monoxide levels are consistently reduced the greatest amount in comparison to other pollutants. However, depending on the fuel and engine manufactures, certain pollutant levels may actually increase with use of various alternative fuels. For NO_2, the pollutant levels are generally reduced, but for propane for example, NO_2 levels would be actually higher depending on the manufacturer. Propane would also result in increased emissions of hydrocarbons, and in some instances, increased emissions of formaldehyde, again depending upon the manufacturer. All of the alternative fuels would appear to result in decreased emissions of 1,3-Butadiene, benzene, and acetaldehyde.

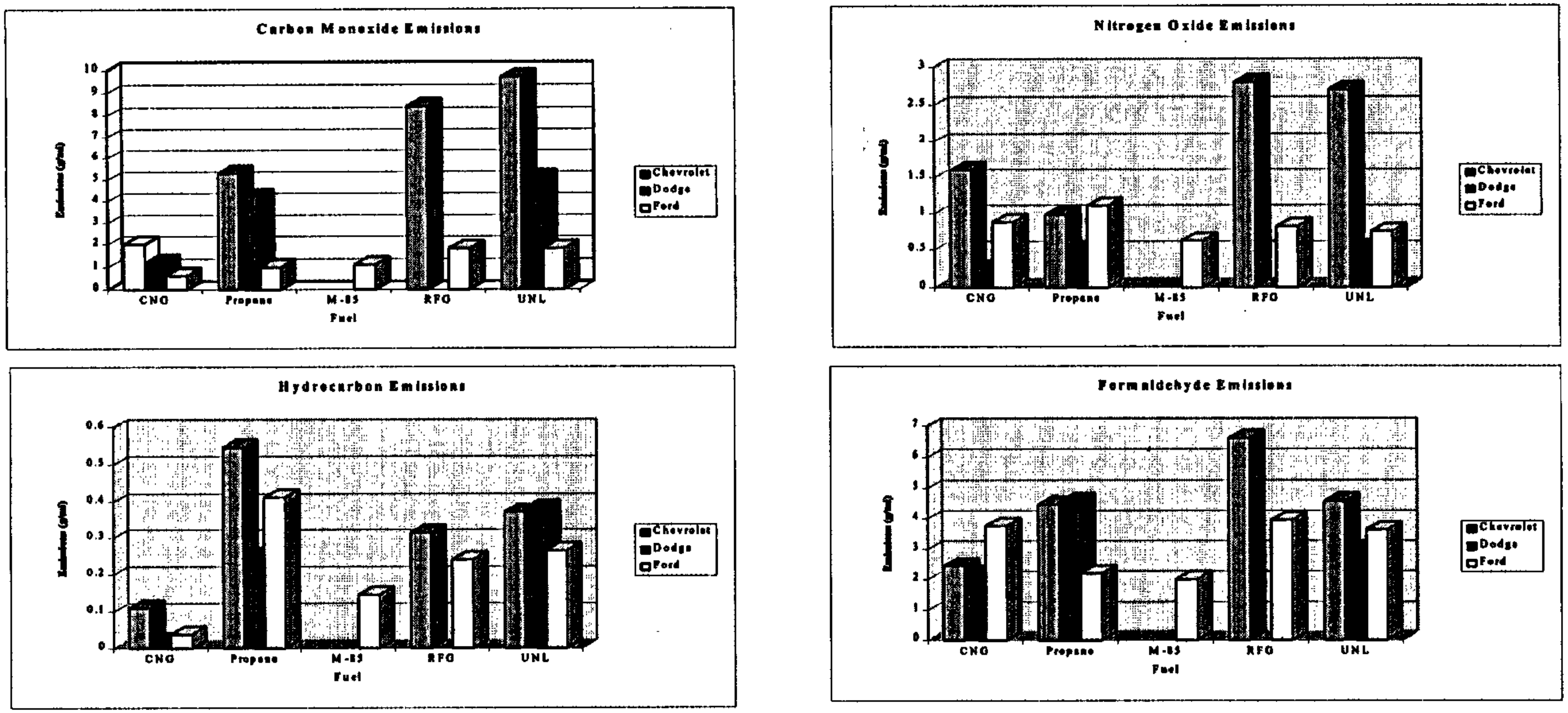
As shown in Appendix D, Table D-3, ground support vehicles (GSE) do contribute to emissions of CO, VOC, and NO_2 at Sea-Tac. Excluding motor vehicles, GSE are the second largest contributor to these pollutants after aircraft for the on-airport sources. GSE emissions represent approximately 40 percent of the CO emissions, 8 percent of the NO_2, and 30 percent of the VOC as compared to aircraft sources. Nonetheless, the screening dispersion analysis indicated that pollutant emissions from ground service vehicles would not result in high pollutant concentrations off-airport. Generally, ground service vehicles are concentrated in the terminal area. Accordingly, pollutant concentrations within the terminal area are most affected by their use.

Switching to natural gas, propane or another alternative fuel would be expected to primarily reduce CO emissions at the Airport, particularly within the terminal area. As shown by the areawide dispersion analysis, no exceedances of the ambient air quality standards were identified within the terminal area.

An electric ground service vehicles are classified as 'Zero Emissions Vehicle' (ZEV) due to zero tailpipe emissions. The 'zero emissions', however, is attached to a large price tag. The principal cost factors for an electric vehicle fleet include vehicle price, price of electrical consumption, battery life and replacement cost, and vehicle maintenance costs. Current electric vehicle technology prevents many airlines from considering electronic vehicles as an option. Additionally, although electric vehicles would reduce emissions on-airport, the potential for increased emissions in the Region might occur due to increased power plant emissions.

The type of ground service equipment used by each airline and the fuels used to operate such equipment is a function of number of factors including the intended use and capability of the equipment, availability of equipment and fuel, and cost. As airlines replace their GSE equipment, their primary consideration is generally cost. In addition to the cost of retrofitting existing GSE or the cost of purchasing new equipment, added cost occurs from facility expenditures associated with the development of fueling stations and equipment. The increased costs of converting and operating with alternative fuels has prevented widespread usage of alternative use fuel vehicles. The economic considerations of GSE's using alternative fuels are generally based on vehicle operations costs, fuel costs, and maintenance costs. For example, the development of refueling stations is generally too large a cost for an airline to sustain in order to support a large fleet of GSE's used across expansive airport grounds.

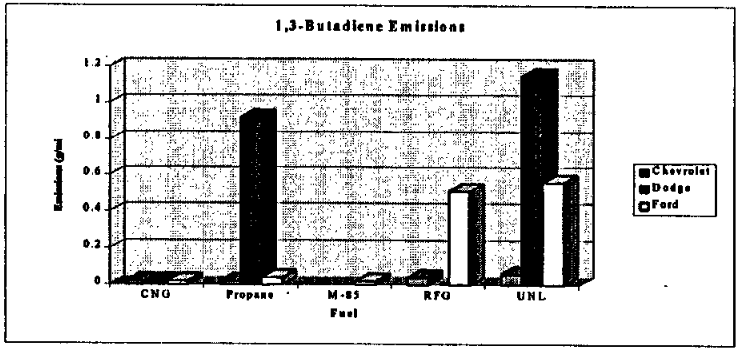
EXHIBIT R-4
(Page 1 of 2)
Exhaust Emissions by Fuel Type

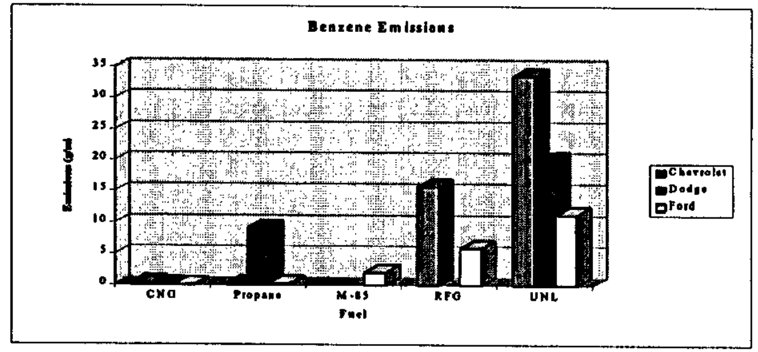


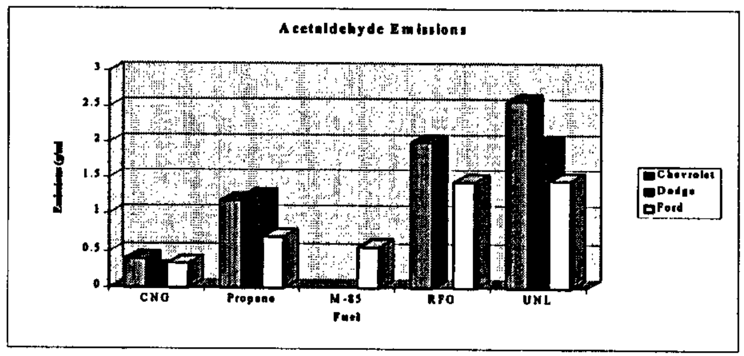
Note: CNG = Compressed Natural Gas; Propane = Propane gas; M-85 = Methanol; RFG = Reformulated Gasoline; UNL = Unleaded Gasoline

Source: Clean Fleet, South Coast Alternative Fuels Demonstration, Analysis Report No. 4: "Vehicle Exhaust Emissions-Early Mileage Results," July 1994.

EXHIBIT R-4
(Page 2 of 2)
Exhaust Emissions by Fuel Type







Note: CNG = Compressed Natural Gas; Propane = Propane gas; M-85 = Methanol; RFG = Reformulated Gasoline; UNL = Unleaded Gasoline

Source: Clean Fleet, South Coast Alternative Fuels Demonstration, Analysis Report No. 4: "Vehicle Exhaust Emissions-Early Mileage Results," July 1994.

As outlined in Chapter IV, Section 9 of the EIS, the Port of Seattle would continue to explore ways in which to reduce pollutant levels at the Airport including ways in which to reduce VOC emissions attributed to GSE equipment operated at the Airport.

Comment R-10-59: *The Southwest King County Community Group noted that it appears that the number of aircraft operations may represent only takeoffs and not include landings. The following individual made this comment: Southwest King County Community Group.*

Response: The air quality analysis considers both arrivals and departures. The Draft and Final EIS presents the analysis of total operations at 43.9 arrivals and 43.9 departures, for a total of about 88 operations during the peak hour. This level of total operations is similar to activity levels observed by the U.S. Environmental Protection Agency in June, 1995. The response to comment R-10-14 discusses use of peak hour operational levels.

Comment R-10-60: *The Southwest King County Community Group asked why the recommendations from Puget Sound Air Pollution Control Agency on background CO values was increased.*

Response: Appendix D of the Draft EIS describes the background concentrations used in the EIS air quality analysis. The background concentration used for the 8-hour CO is 3.5 ppm, and 5.0 for the 1-hour background concentration. Background values for the EIS analysis were identified in consultation with the Department of Ecology, U.S. Environmental Protection Agency, and Puget Sound Air Pollution Control Agency. The background concentrations are based on air monitoring results within the Region, and/or regionally accepted levels used in other studies.

Comment R-10-61: *The Southwest King County Community Group requested clarification of the differences in estimates of particulate matter between the 1991 Ecology study and the Draft EIS.*

Response: Response to comment R-10-2 discusses many of the differences between the 1991 Ecology study and the EIS analysis which resulted in substantial differences in estimations on pollutant levels. As noted, aircraft emissions data for particulates as included in the EDMS model has been revised since completion of the 1991 Ecology study. The Ecology study used one of the earliest versions of the model issued. The earlier versions of the EDMS model included more data on particulates which the FAA subsequently determined was inaccurate. The most current version of the EDMS model includes substantially less particulate data than the earlier versions. Currently, there is little data available on aircraft related particulate matter.

Comment R-10-62: *The Southwest King County Community Group suggested verifying the wording on page D-2, column 1, "quality" should be "quantity".*

Response: As noted, this has been corrected in the Final EIS.

Comment R-10-63: *The Southwest King County Community Group stated that the amount of pollution that is generated by aircraft engine maintenance run-ups during testing does not appear to have been factored into the inventory for SASA.*

Response: Aircraft engine maintenance checks are conducted at Sea-Tac and are included in the air quality analysis. Upon completion of engine repairs, it is routine to perform a high power engine run-up for safety purposes. These run-ups are typically conducted at 80 to 100 percent of full power for up to five minutes operating time. The frequency and duration of engine run-ups varies. Engine run-ups are conducted for all types of aircraft operating at the Airport. Information on the number, type of aircraft, average duration of run-up and location was obtained from the Port of Seattle, Run-Up Authorization Form data maintained by the Port of Seattle Noise Office. Most maintenance run-ups last less than 20 minutes at power levels ranging from idle to below 80 percent of full power. Full power run-ups usually last five minutes or less.

The air quality analysis includes the assessment of a ground run-up for a B-747 aircraft for five minutes at full takeoff power for one engine and fifteen minutes idle power. The B-747 aircraft was modeled as it produced the highest total pollutant emissions of all aircraft types conducting run-ups, and which is expected to continue to operate at the Airport through the 2020 study planning horizon. A total of nine run-ups by a B-747 per day were considered in the analysis. A review of the Port of Seattle's run-up information for the past two years indicated that the maximum number of run-ups occurring on any one day was seven in April 1, 1994. Six of the run-ups were by a B-747 and one by an MD-80. A review of the run-up data indicated that the conduct of such a large number of run-ups by a B-747 was highly unusual. For example, the next busiest day for run-ups (six on October 1, 1993), run-ups were conducted by two B-727's, three DC-8's, and one MD-80.

Accordingly, the EIS analysis represents a reasonable worst case evaluation of aircraft ground run-ups. Additionally, the EDMS model was adjusted to more accurately reflect the effect of full power takeoff thrust typically used during an aircraft ground run-up in addition to idle thrust (without adjustment, the EDMS model only considers idle thrust). Based on the Port of Seattle's run-up data, the primary run-up location today is currently at the south end of the airfield with the nose of the aircraft pointing south.

__Comment R-10-64__: The Southwest King County Community Group noted that the 1991 Ecology Study indicated that CO emissions from all other sources including automobiles were just 1/6th of the contribution due to aircraft; why does the EIS analysis indicate such a large contribution by automobiles.

__Response__: The EIS analysis considers a wide variety of air pollutant sources within the immediate vicinity of the Airport as there are many airport related activities in addition to aircraft that generate pollutants. Airport related traffic, for example, occurs throughout the airport area. Additionally, changes in area roadways and traffic volumes can occur with airport development. Therefore, the analysis must consider the effect of such potential changes to area roadways and changes to traffic volumes in the Airport area.

Accordingly, the EIS analysis considers all of the terminal related parking, as well as all of the off-airport long-term parking along International Boulevard. Also included was the evaluation of over 20 major roadways and associated traffic volumes, including along Interstate 5, SR 518, and SR 509. These sources were in addition to aircraft operations and other on-airport sources. The evaluation of such a wide variety of sources was partially considered in response to a request by the regional air quality agencies at the outset of the study to consider all major sources located within a mile of the Airport. For the most part, such off-airport sources focus on the evaluation of motor vehicles and parking.

The 1991 Ecology Study was a screening level evaluation that did not consider as extensive an array of sources as did the EIS analysis. For automobiles, the Ecology study only considered traffic and parking within the immediate terminal area. Accordingly, the Ecology study showed minor contributions to CO emissions by automobiles in comparison to the EIS analysis.

The response to Comment R-10-2 discusses the number and variety of sources modeled between the two studies, while the response to Comment R-10-4 describes the study area considered.

__Comment R-10-65__: The Southwest King County Community Group asked why the results of the screening dispersion analysis are so much greater than for the refined dispersion analysis.

__Response__: The results of the screening dispersion analysis typically overestimate pollutant concentrations, often by a considerable margin. The basis for the screening analysis is to represent worst case conditions, which are the combinations of operational activity and meteorological conditions encountered during the year which result in the highest concentration of air pollutants. In addition, the analysis assumes that the peak hour for aircraft, roadways and other sources occurs at the same time. Since this is not the case, the evaluation represents a worst case situation that may present an overestimation of pollutant concentrations. The purpose is to identify locations were possible exceedances of the AAQS *might* occur. The modeling input assumptions are described in Appendix D.

The refined dispersion analysis is based on actual year-long weather data that includes winds from all directions and actual wind speeds and turbulence as recorded by the National Oceanic and Atmospheric Administration. In comparison to the screening analysis, the refined analysis no longer assumes that all types of activities occur at the same time. The refined analysis applies "temporal" factors that provide an indication of hourly, weekly, and monthly activity or utilization for each of the different pollutant sources. For those receptor locations which indicated possible exceedances of the Ambient Air Quality Standards during the screening dispersion analysis, a more detailed 'refined' dispersion analysis was conducted. Typically, the results of the refined analysis are less than identified initially by the screening analysis.

Comment R-10-66: *The Southwest King County Community Group noted that the Hotel location does not appear to be included in the initial screening dispersion of 200 locations.*

Response: For consistency with the evaluation of the terminal area hotel Final EIS, the hotel receptor location was added in addition to the 200 screening analysis receptors. The hotel evaluation included the conduct of air monitoring along the existing terminal curbfront. The availability of actual monitoring data enabled a comparison with the results of the modeling analysis. Therefore, the hotel location was added to the terminal area receptor locations evaluated by the grid analysis presented in Tables D-21 and D-22 in the Draft EIS. Based on the screening dispersion analysis, the concentrations for other receptor locations in the northern portion of the terminal area (where the hotel would be located) showed similar concentrations as for the specific hotel receptor location. As indicated in response to comment R-10-33, the EIS modeling for the hotel location overestimated the pollutant concentrations by approximately one-third based on the air monitoring conducted for that location.

Comment R-10-67: *The Southwest King County Community Group questioned why 350,000 aircraft yearly flying over an urban area would not contribute more air pollutants than automobiles.*

Response: As is shown in the Draft and Final EIS, aircraft do contribute to the production of air pollutants in the overall area. However, the 350,000 aircraft operations are spread out over an entire year, and are diminished in influence by the considerable volume of automobile traffic in the Region. For example, Interstate 5 handles on average over 200,000 daily vehicle trips on certain segments, while portions of SR 509 are used daily by 60,000 vehicle trips, and up to 80,000 trips along SR 518. Based on the busiest roadway segments for those major roadways located in the immediate airport area, approximately 600,000 surface vehicle trips occur on daily in the Airport area. On an annual basis, this would equal over 200 million annual vehicle trips by cars, buses, trucks, and motorcycles. This does not include the numerous smaller arterials and residential streets used within the area. Accordingly, a comparison of air pollutant levels attributed to either aircraft operations or to motor vehicle traffic is heavily influenced by the extensive non-airport related motor vehicle traffic in the airport area.

Appendix O presents the detailed surface transportation traffic levels in the Airport area, and presents the 1994 average annual daily traffic for various roadway segments evaluated.

Comment R-10-68: *The U.S. Environmental Protection Agency commented that the word "unusually" should be deleted from the discussion of stability class.*

Response: Appendix D was revised accordingly.

EARTH IMPACTS

Comment R-11-1: *Several people commented that the Draft EIS omitted information regarding erosion, landslide, and seismic hazard areas that have been identified by King County; that information regarding hazard areas was inconsistent throughout the Draft EIS, and that impacts of construction within these erosion and seismic hazard areas was not discussed in sufficient detail. These comments were made by Ms. Brown, Ms. Clark, Mr. Scarvie, and the Southwest King County Community Group.*

Response: Exhibit IV.19-2 shows all erosion, landslide, and seismic hazard areas within the study area that are identified on sensitive areas maps prepared by the King County Department of Parks, Planning, and Resources and the City of SeaTac. These hazard areas are described on pages IV.19-4 and IV.19-5 of the Draft and Final EIS.

Landslide hazard areas have been identified by King County west of the Airport, along the shore of Puget Sound. These landslide hazard areas are not shown on Exhibit IV.19-2 because they are located outside the study area. No construction would be done in these landslide areas under the proposed alternatives as defined in the EIS. Landslides identified during a stream survey along Miller Creek (Appendix F of the Draft and Final EIS) are discussed on page IV.19-4 of this Final EIS.

Erosion hazard areas within the study area north of S. 192nd Street have not been inventoried by King County or the City of SeaTac. Erosion impacts in this area are addressed on page IV.19-13 of the Final EIS. Erosion and sedimentation estimates have been completed since publication of the Draft EIS; and are discussed in Section 10 "Water Quality and Hydrology" and Section 23 "Construction" of this Final EIS. No excavation would be done within the erosion hazard area identified on Borrow Source Area 2.

Measures to stabilize subgrade material within the two seismic hazard areas located on the site of the proposed new runway are addressed on page IV.19-11 of the Draft EIS (page IV.19-12 of the Final EIS). The EIS correctly identifies seismic hazard areas at the north end of Borrow Source Area 1. The sentence on Draft EIS page IV.19-5 that states no seismic hazard areas occur in Area 1 has been corrected (see page IV.19-5 of the Final EIS). Additional information regarding seismic activity in the vicinity of the Airport and stability of the proposed Airport fill is included in the Final EIS.

Comment R-11-2: *Some commentors had questions regarding grading and excavation on the site of the proposed third runway, and design of the runway embankment. One commentor suggested the fill estimates were too high and could be reduced by leveling the site using only on-site material and using retaining walls along the west side of the embankment. Another commentor wanted to know how much wetland area would be excavated for construction of the proposed new runway. Others commented that the Draft EIS did not adequately address aesthetic impacts of the third runway on surrounding communities, and mitigation for those impacts, including landscaping an embankment design. These comments were made by Mr. Tinker, Mr. Peyton (Ravenna-Bryant Community Association), Mr. Rohlfs (City of SeaTac), and the Southwest King County Community Group.*

Response: Fill estimates shown in Table IV.19-1 include the volume of fill material that could be obtained during excavation and leveling of the runway site. On-site material would be used to the greatest extent possible. Not all on-site material would be suitable for use in embankment construction, however. Geotechnical investigations of the proposed runway site indicate approximately 3.1 million cubic yards of the material excavated on site likely would meet the required strength and compressibility criteria. Up to 17 million cubic yards of off-site fill, in addition to on-site material, could be needed to complete construction of the third runway.

Three slope options are being considered for the embankment west of the proposed third runway: an unreinforced earth embankment with slopes no steeper than 2 horizontal to 1 vertical; a reinforced earth embankment, which would allow construction of steeper slopes than the unreinforced embankment; and a reinforced earth wall. Although reinforced earth walls would require less total fill and less encroachment on adjacent lands than the other slope options, they require extensive quantities of high-quality fill material, which may preclude the use of available on-site material. Additionally, reinforced earth walls typically have a maximum height range of between 40 and 50 feet. The proposed new runway would require fill heights in excess of 100 feet. The proposed runway likely would be constructed using each of these three slope options along different segments of the embankment, depending on subsurface conditions, proximity of existing roads and buildings, and depth of fill.

Soils in wetlands areas generally are unsuitable for use as subgrade or fill material and likely would be removed from the proposed new runway site. Up to 7.5 acres of wetlands on the proposed runway site could be affected. Wetland impacts are addressed in Chapter IV, Section 11 of the Draft and Final EIS.

Aesthetic impacts of the proposed new runway have been included in Chapter IV, Section 24 "Aesthetics and Urban Design" of this Final EIS.

Comment R-11-3: *Two commentors questioned the meaning of the term "borrow source area" and wanted to know if fill material derived from these areas would eventually be returned. This comment was made by the Southwest King County Community Group, Mr. Frause, and Mr. E. Wichert.*

Response: Fill material excavated from borrow source areas for use in construction of the Master Plan elements would not be replaced. In the geotechnical field, the term "borrow" means material excavated for use as fill in another area, and does not imply the material is returned.

Comment R-11-4: *Some commentors expressed the opinion that the Draft EIS did not adequately address construction impacts associated with borrow operations and increased truck traffic along the fill haul routes. In particular, commentors were concerned with impacts on Des Moines Creek Park, adjacent residences and businesses, and local communities. This comment was made by the Airport Communities Coalition, Mr. Rohlfs (City of SeaTac), the Southwest King County Community Group, and Mr. Gumm (Prince of Peace Lutheran Church).*

Response: Additional analysis of construction traffic impacts on local residences and businesses has been completed and is presented beginning on page IV.23-4 of this Final EIS. Air and noise impacts associated with borrow operations and transportation are presented beginning on pages IV.23-8. Social impacts associated with acquisition of residential and commercial property are addressed in Chapter IV, Section 6 "Social Impacts" in the EIS.

Comment R-11-5: *Mr. Hopkins noted that most fill material obtained from on-site borrow sources would not qualify as all-weather fill, and questioned whether or not the delays in embankment construction resulting from adverse weather conditions have been factored in to the construction schedule. The commentor also noted that all-weather material is more seismically stable than other fill material.*

Response: The comment is acknowledged. Imported select fill and on-site borrow material derived from some advance outwash units can generally be placed and compacted year-round, while avoiding periods of heavy or sustained rainfall. Most recessional outwash and other units of advance outwash can also be used during the winter months outside periods of rainfall, providing moisture content can be controlled. Some recessional outwash, weathered till, and till should be placed and compacted only during the drier months. A construction schedule representing worst-case weather conditions is included in Chapter IV, Section 23 "Construction Impacts" of this Final EIS. To reflect the effects of weather on construction, instead of 300 days construction per year, 270 days of construction were used in the Final EIS for transport of off-site material and 210 days of on-site material.

Comment R-11-6: Ms. Brown and Mr. Frause expressed concern regarding the stability of the proposed runway embankments on portions of the site that have steep slopes or that have soils with low compressibility, such as wetlands. They also questioned the effect on embankment stability of wet weather and increased vibration associated with increased air cargo traffic.

Response: Keying and benching would be used when placing new embankment fill along steep slopes. Benching is a construction technique that involves excavating a series of benches (wide terraces) on a hillslope to create level surfaces on which to place and compact the fill, and to prevent the fill from sliding down along the native soil/embankment fill interface. Keying involves excavating a trench along the toe of the embankment and backfilling it with compacted fill to provide a strong foundation for structural reinforcement.

The existing ground in the vicinity of the runway extension or the proposed new runway would not be affected by potential increases in vibration. Fills required in these areas would be placed to minimize post-placement settlement. Settlement of underlying native soils would occur as a result of the surcharge pressure or "weight" of the embankment fills. These settlements would be expected to be minor and would occur during placement of the embankments. Settlement would be minor especially where the underlying native soils consist of recessional outwash or glacial till. Significant post-placement settlement could occur in areas where the underlying native soils consist of soft silt or organic-rich material. These soft soils would be excavated and removed from the site, and replaced with suitable material to minimize post-placement settlement of the embankments. During construction, the embankment fill would be compacted to such a degree that post-placement settlement resulting from saturation of the fill material would be within acceptable limits.

Comment R-11-7: Mr. Vaa asked whether the runway fill would extend to First Avenue South.

Response: The runway fill would not extend to First Avenue S. The westernmost extent of the proposed runway fill is Tenth Avenue S. Please refer to Exhibit IV.19-1.

Comment R-11-8: Commentor wanted to know the location of the proposed SR-509 corridor within Borrow Source Area 4, and asked if a map showing the future alignment of SR-509 was available. Comment was submitted by the Southwest King County Community Group.

Response: The SR 509 corridor bisects Borrow Source Area 4 from the northwest to the southeast, dividing the area into two parcels; no material would be excavated from the highway corridor. Proposed alignments for SR 509 are addressed in the *SR-509/South Access Road Corridor Draft EIS and 4(f) Evaluation,* which was published in December 1995.

Comment R-11-9: In commenting on the earth analysis in the Draft EIS, Mr. Rohlfs (City of SeaTac) noted that impacts and mitigation resulting from excavation of the on-site borrow sources are not addressed.

Response: The Earth section of the Draft and Final EIS addresses impacts on earth resources, including topography, erosion and sedimentation, slope stability, and earth hazard areas. Other environmental impacts resulting from excavation of the borrow areas and associated mitigation are addressed under each element analyzed in the Draft and Final EIS. For example, surface and groundwater impacts and mitigation are addressed in the Chapter IV, Section 10 "Water Quality and Hydrology". Additional discussion regarding borrow source area impacts has been included on page IV.10-7 of the Water section, beginning on page IV.19-5 of the "Earth Impacts" section, and section 23 "Construction Impacts" of this Final EIS.

CONSTRUCTION IMPACTS

***Comment R-12-1**: Ms. Brown questioned if construction/construction related activities already started. Commentor questioned whether the July 1995 surveying of 192nd Street and Des Moines Way is related to third runway or other non approved Airport projects.*

Response: The specific activities described are related to a mitigation improvement imposed by the City of SeaTac on a private development and is not related to the third runway or other Airport related projects. Construction of the improvements recommended by the Master Plan Update has not been initiated.

***Comment R-12-2**: Mr. Rohlfs (City of SeaTac), the Southwest King County Community Group, and the Airport Communities Coalition questioned why construction impacts are called short-term when construction is occurring so long. Several commentors questioned the description of a multiyear activity as short-term and also raised issues regarding impacts related to air quality and health relating to the duration of construction activities.*

Response: Construction activities involving the hauling of embankment material and the construction of the third runway, the expansion of Runway Safety Areas, and the haul of fill material for South Aviation Support Area are anticipated to occur over a 3 year period between 1996 and the year 2000. In review of environmental issues, impacts are typically considered either as short-term or permanent. As construction activities are not permanent, they are considered as short-term.

***Comment R-12-3**: A comment was made by Ms. Wieting (United States Department of Commerce) requesting notice of any disturbance or removal of national geodetic survey monuments, and requesting funding be included to replace disturbed or removed monuments.*

Response: Comment acknowledged. The Washington Administrative Code, Section 332-120-030, requires that no survey monument be removed or destroyed before a permit is obtained. This section requires all government agencies to identify and replace all survey and geodetic monuments disturbed or removed by construction activities for which it is the sponsor. An application and approved permit is required by the Washington Department of Natural Resources.

During the design process, all monuments within the construction area would be located and specific provisions for replacing or relocating the monuments would be included in the construction specifications.

***Comment R-12-4**: The Southwest King County Community Group, questioning what a minor arterial was, and the use of 'satisfactory' as part of summary of access routes impact review.*

Response: A common set of terms is used by public agencies to classify roadways within their jurisdiction as to function and type of roadway for planning, design and operational purposes. Roadways are broadly classified as either arterials or local access roadways within King County. Arterial roadways are further defined as principal, minor or collector depending on access control and roadway function. Minor arterials tend to be continuous routes connecting community centers with partially controlled access to abutting properties.

The summary review represented in Table IV.23-2 of the EIS for off-site material sources and Table C-2 of Appendix J for on-site material sources was used to evaluate potential haul routes considering six criteria outlined in Sub-Appendix 2 of Appendix J. The term satisfactory was used if the review of potential haul routes found the conditions described for each of the criteria to be existing.

Comment R-12-5: *The Airport Communities Coalition and Ms. Milne commented that the Draft EIS does not identify the need to obtain mining permits from the Department of Natural Resources and land use permits for material sites and that the Draft EIS gives inadequate consideration to impacts from mining operations.*

Response: Comment acknowledged. Contacts with the Department of Natural Resources indicate that use of the on-site sources may require either a mining permit or a mining reclamation plan depending on whether those sites are determined to be contiguous to airport property. Land use, administrative and/or grading permits from the cities of Des Moines or SeaTac could be necessary for the use of on-site sources. This EIS reviews use of on-site sources. See Final EIS page IV.23-2 for additional discussion of on-site material sources. The permit status of the off-site sources identified for potential use has been clarified and is listed in the Final EIS, Appendix J. Environmental review for use of off-site sources occurred as part of the permitting review.

Comment R-12-6: *Several commentors requested an explanation of the 21.1 to 26.4 million cubic yard fill requirements identified in the Draft EIS and an indication of the availability of this volume of material within the Region. Several commentors raised this concern, including the Airport Community Coalition, Ms. Brown, Mr. Heavey, the Osterman family, Ms. Schreier, Mr. Schneider, the Southwest King County Community Group, and Mr. Webb.*

Response: Fill requirements for the third runway, the relocation of S. 154th Street, and improvements to the existing Runway Safety Areas (RSA) were considered in the Draft and Final EIS as occurring between 1996 and the year 2000. The fill requirements for these projects are estimated to be 21.11 million cubic yards after inflation for shrink and swell during transport. The extension of Runway 34R and the South Aviation Support Area would require an additional 5.29 million cubic yards after inflation, for a total fill requirement of 26.4 million cubic yards. The fill requirements for the South Aviation Support Area is also expected to occur by 2000, while the 34R extension is now planned to occur between 2015 and 2020. Fill requirements and schedules were re-examined in response to comments on the Draft EIS. See the Final EIS Section 23 "Construction Impacts" for additional discussion.

Eighteen potential material sites were identified and analyzed for feasibility and potential impacts in Appendix J of the EIS. Several material sites are currently operating and permitted in the Puget Sound area in addition to the 18 potential off-site sources identified in the Draft EIS that could supply some or all of this material. A combination of permitted sites may be used if these projects proceed to construction. A construction project of this size could allow new material sites to be economically developed and permitted by the time of construction. See the Final EIS page IV.23-4 for additional discussion on potential off-site material sources.

Comment R-12-7: *Commentors questioned whether an EIS was or will be done on the off-site borrow source areas. Several commentors asked whether an EIS will be completed on the use of a specific off-site material. Comments of this nature were received by the Airport Community Coalition, Mr. Amero (City of Pacific), Mr. Booth (City of Auburn), Ms. Hansen, Mr. Heavey, Mr. Derrick (King County Department of Development and Environmental Services), Mr. Luther (City of Black Diamond), Mr. Rozdilsky, Mr. Peyton (Ravenna-Bryant Community Association), and Mr. Webb.*

Response: At this time the specific material site(s) and amounts of material from each site(s) that would be used are not known. Permitted material sites received environmental review as part of the regulatory process that granted permits and established conditions of operation. Several municipalities have recently or are in the process of adopting truck route ordinances that may impose additional conditions on operations from individual material sites. The successful construction bidder would be required to comply with local permits, operating conditions and restoration associated with the site(s) and haul routes included in his or her bid package. This is standard procedure for construction projects in the Puget Sound area.

<u>Comment R-12-8</u>: *The Southwest King County Community Group asked if contaminated soils in Borrow Source areas would be used as fill for the proposed new runway. Several commentors raised questions about the impacts on adjacent residential areas from use of on site material sources 1-4, impacts on the underlying aquifers from use of source 5, and the proximity of sources 1, 2 and 3 to Des Moines Creek Park. These comments were made by the Airport Communities Coalition, Mr. Grumm, and the Southwest King County Community Group.*

<u>Response:</u> As stated on page IV.19-6 of the EIS, a landfill is located in the north part of Borrow Source Area 5. The landfill is reported to contain 50,000 to 70,000 cubic yards of petroleum-hydrocarbon contaminated street sweeping material. The contaminated material was not included in the fill estimates for Area 5, and would not be used as construction fill. Please refer to the response to comment R-11-4 regarding impacts on residents adjacent to the on-site borrow sources and Des Moines Creek Park. Refer to the response to comment R-13-21A and R-13-21B regarding impacts on aquifers underlying the on-site borrow areas.

<u>Comment R-12-9</u>: *Mr. Rohlfs (City of SeaTac), Mr. Webb, the Southwest King County Community Group, and Ms. Montgelas (WSDOT) requested an explanation of possible on-site borrow locations and fill requirements for each project element. They also asked how borrow sites would be graded and reclaimed and the effect of use of the material from the on site sources on the proposed alignment of SR-509.*

<u>Response:</u> On-site material sources 1-8 are identified in Exhibit IV.23-1 of the Final EIS. Minimum and maximum available material quantities are identified in Chapter IV, Section 23 "Construction Impacts". Mitigation could be further established by specific conditions of permits including those that might be required by the Department of Natural Resources and the cities of Des Moines and SeaTac. The proposed alignment of SR-509 would affect borrow rates on site sources 1 and 4. If used, borrow sites 1 and 4 would be graded in such a way as to facilitate construction of SR-509.

<u>Comment R-12-10</u>: *Several commentors questioned the Draft EIS haul process assumptions of 300 days per year and 16 hours per day due to constraints caused by weather impacts on roadways and construction activities and also because of permit conditions including operation hours and weight restrictions established by local agencies on use of routes or material sources. They requested an explanation of the truck trip calculation Commentors raising these questions included the Airport Communities Coalition, Ms. Brown, Mr. Bartlemay, Mr. Heavey, Mr. and Mrs. McKinney, Mr. Peyton (Ravenna-Bryant Community Association), Mr. Scarvie, the Southwest King County Community Group, Mr. and Mrs. Voeller, and Mr. Webb.*

<u>Response:</u> See the Final EIS, Section 23 "Construction Impacts", for further discussion on the haul process. Several factors have been considered in establishing the haul assumptions. At this time the specific material sites or haul routes are not known. Expected material sites and roadways were analyzed to identify the feasibility and expected impacts from a haul process of this size and duration. The material haul process is expected to take more time than actual placement and compaction of material in the embankment. It may occur during portions of the construction process that haul material would be stockpiled, either in the embankment area or nearby. Wet weather conditions that affect construction activities would not affect the hauling of the Class A material to the stockpile area. Contacts with construction firms operating in the Puget Sound area indicate that hauling could be affected by weather conditions involving snow, ice or heavy rains. They suggest using 270 days as an estimate of days available for haul activities. Thus, the analysis contained in the Draft EIS was updated.

The material sites closest to the Airport have operating restrictions on hours, generally 10 to 12 hours per day on-site activities and in some cases truck traffic. Material sites further away from the Airport in rural areas have lessor restrictions, enabling activity to occur for 16 to 24 hours. A contractor could haul from several of the nearest sites during the restricted periods and from lessor restricted sites during other times. Sixteen hours a day, or two eight hour work shifts was selected as a reasonable assumption for use in the Final EIS.

Access to the Airport construction site could occur by several roadways and streets. Truck activity on local streets is expected to cause potential impacts to residents and at some locations increases in congestion is likely to cause restrictions on hours of truck activities. Construction truck activities in the area of the Airport could be restricted to use of the State Highway System, arterials designated as truck routes, Port roadways and properties to avoid creating these concerns. See the Final EIS, Section 23 "Construction Impacts" for details on expected access routes.

Comment R-12-11: Several commentors stated that the construction truck traffic will cause significant increases in congestion, particularly during the afternoon (PM) peak period and that specific impacts should be identified. Metro asked that the Final EIS address issues relating to construction caused congestion that might affect bus schedules. This comment was made by the Airport Community Coalition, Mr. Allen, Ms. Ayres, Ms. Brown, Mr. Bush (METRO), Mr. Dolvey, Mr. Lewis, Mr. Newby, Ms. Parker, Mr. Peyton (Ravenna-Bryant Community Association), Ms. Pompeo, the Southwest King County Community Group, Ms. Smith, Mr. Tate, Mr. Townsend, Mr. Vaa, Mr. and Mrs. Voeller, and Mr. Webb.

Response: Comments acknowledged. See Final EIS, Section 23 "Construction Impacts" and Appendix J for analysis of peak hour congestion. Assumptions regarding haul volumes and duration were reexamined in response to comments on the Draft EIS and potential changes in the Master Plan Update improvements construction schedule were identified. Level of service analysis of airport area intersections and freeway ramps impacted by the anticipated hauling were performed and are included in Appendix J of the Draft and Final EIS. Expected haul routes were also re-examined for existing conditions and routes with conditions considered to be concerns were noted in Table IV.23-3 of the EIS. The Final EIS contains additional levels of service analysis regarding freeway operations near the Sea-Tac. See response to comment R-12-7.

Comment R-12-12: The Airport Communities Coalition commented that there is a difference between the total haul quantities listed in Appendix J, and the analysis presented in Chapter IV, Section 23 of the Draft EIS.

Response: Comment acknowledged. At the time the Draft Surface Transportation Construction Report (presented in Appendix J) was completed, the third runway construction was scheduled to occur prior to the year 2000. The Runway Safety Area expansion and Runway 34R extension were scheduled for construction to occur after 2000. Chapter IV, Section 23 "Construction Impacts" of the Draft and Final EIS reflected changes in the Master Plan Update improvement schedule. See the Final EIS, Section 19 "Earth Impacts" and Section 23 for revised estimates of total fill required.

Comment R-12-13: Several commentors requested that haul routes expected to be used should be clearly identified. This comment was made by Mr. Townsend, Mr. Rohlfs (City of SeaTac), and Mr. Derrick (King County Department of Development and Environmental Services).

Response: Comment acknowledged. Appendix J of the Final EIS identifies potential haul routes.

Comment R-12-14: Mr. Peyton (Ravenna-Bryant Community Association) questioned if road detours would reroute traffic onto residential streets?

Response: Road detours may occur during the relocation of S. 154th/156th Street but others are not anticipated at this time. No detours to local residential streets are anticipated. Such detours could require permits from Burien, Des Moines or SeaTac and would have to demonstrate need and minimal duration.

Comment R-12-15: Numerous commentors indicated that the Draft EIS must address specific impacts and mitigation (such as roadway destruction) associated with the use of haul routes and the requirement of local permits for use of municipal roads. These comments were made by the Airport Communities Coalition, Mr. Bartlemay, Mr. Booth (City of Auburn), Ms. Brown, Mr. Rohlfs (City of SeaTac), Mr. Frause, the Greater Federal Way Chamber of Commerce, Mr. Derrick (King County Department of Development & Environmental Services), Mr. Matthews, Ms. Milne, the Osterman family, Mr. Overholt, Mr. Peyton (Ravenna-Bryant Community Association), Mr. Tate, Mr. Vaa, Mr. and Mrs. Voeller, Ms. Montgelas (WSDOT), and Mr. Webb.

Response: Depending on the outcome of the construction bidding process a number of permitted material sites may be used by the successful contractor to supply the required fill. The specific sites, volumes of material that may come from a site, and specific haul routes are not possible to determine at this time. It is standard procedure for construction projects in the northwest that a contractor is responsible for supplying the needed material, and for complying with all local permitting conditions. The contractor would include in the construction bid price to the Port, the expenses of fees, mitigation imposed by local agencies, and the cost of restoration. It is anticipated that the contractor may need haul route agreements from WSDOT, King County, and several municipalities.

Comment R-12-16: Two commentors stated that the Final EIS must consider not just the Airport construction haul traffic but the other construction activities that may be going on at the same time such as roadway improvements and the Regional Transit System. This comment was made by Ms. Pompeo and the Southwest King County Community Group.

Response: Comment acknowledged. The Final EIS, Chapter IV, Section 23 "Construction Impacts" identifies regional projects that could affect area traffic flows.

Comment R-12-17: Several commentors raised concerns about erosion and sedimentation control measures, the amount of dust and control of debris from a truck haul, and the effects of truck exhaust on air quality. These comments were made by Mr. Bartlemay, and Mr. Dodge.

Response: Chapter IV, Section 23 "Construction Impacts" and Section 10 "Water Quality and Hydrology" of the Final EIS reflect expanded discussion concerning potential erosion and sedimentation impacts from construction activities. Loss of dirt and debris from the truck haul activities could be mitigated by a requirement placed in the construction bid package requiring covered loads.

Comment R-12-18: Mr. Peyton (Ravenna-Bryant Community Association) requested additional information concerning the impact of construction activities on area schools.

Response: Five schools are located near or along potential construction haul routes other than SR 509 and SR 518, and could be adversely affected: Angle Lake School, Maywood School, Normandy Christian, Sunnydale Elementary, and Sunny Terrace Elementary. Use of haul routes located exclusively on Port-owned property would help reduce effects on some of the schools listed; please see Chapter IV, Section 23 "Construction Impacts" for additional discussion concerning potential construction related impacts on local schools.

<u>*Comment R-12-19*</u>: *Several commentors raised concern that social and economic impacts of construction are not disclosed. This comment was made by the Airport Communities Coalition, Ms. Brown, Mr. Rohlfs (City of SeaTac), Ms. Hughes (Southwest King County Chamber of Commerce), Southwest King County Community Group, and Mr. and Mrs. Voeller.*

<u>Response:</u> Any potential cost of unemployment benefits paid to construction workers after completion of the work is not evaluated in the EIS. It is not significant relative to the cost of the Airport improvements nor can it be assumed that the work force would be unemployed as opposed to moving on to other construction projects in the Region. The potential for residency of future permanent employees and contract labor cannot be known at this time; however, Table IV.8-2 on page IV.8-10A of the Draft and Final EIS shows the existing distribution of direct airport jobs by residence. At present, 96% of all wage and salary workers reside within the Puget Sound Region. A similar distribution would be expected to continue into the future. Please see additions on page IV.23-6 of the Final EIS concerning potential social impacts related to construction activities.

<u>*Comment R-12-20*</u>: *The Southwest King County Community Group requested that the Stamina 2.0 assumptions (noise and construction noise) be presented in the Final EIS.*

<u>Response:</u> General assumptions used in the STAMINA 2.0 roadway noise analysis program are presented in the Final EIS, Chapter IV, Section 1 "Noise." The following paragraph provides a more detailed description of the STAMINA 2.0 input assumptions used in the analysis. The Sea-Tac analysis area was divided into nine regions. Each region was developed as a system of nodes and links representing all roadways that contribute to significant noise. Each region contained a number of noise sensitive receiver locations. A total of 110 noise sensitive receiver locations were tested in the study area. The roadway and receiver locations are defined by a three dimensional coordinate system established for the analysis area and based upon the forecast roadway network proposed by the Puget Sound Regional Council. Subsequent to the release of the Draft EIS, the Council revised its projected roadway network and all analyses associated with roadway noise have been re-computed for presentation in the Final EIS.

Roadway alignments were described as a series of straight line segments (links) defined by segment endpoints (nodes). Noise sensitive receiver locations are defined by nodes. The source-receiver path was also defined by alpha and shielding factors. The alpha factor enables the user to change the sound propagation rate between the source and receiver. This is necessary to model specific field conditions for hard site (pavement/hard ground) or soft site (grass covered) conditions. Both hard and soft site alpha factors were used in the Sea-Tac analysis. The use of shielding factors allows the user to apply excessive attenuation caused by shielding by buildings, houses, trees, or other terrain features. Varying shielding factors were used in the Sea-Tac analysis to describe site-specific conditions. Vehicle densities (traffic volumes) in the form of peak hour vehicles were provided for each roadway segment. Three primary vehicle types (vehicle classifications) are defined in STAMINA 2.0: cars, medium trucks and heavy trucks. Again, vehicle classifications were provided for each roadway segment. Finally, vehicle travel speeds provided for each roadway segment were entered into the STAMINA 2.0 program. The STAMINA code calculates noise emissions for each vehicle type as a function of travel speed. Generally, the greater the travel speed, the greater the acoustic intensity. Detailed computational spreadsheets are available in the Administrative Record at the FAA's Northwest Mountain Regional offices.

STAMINA 2.0 produces two separate forms of output: hourly A-weighted energy equivalent sound levels for each receiver (hourly Leq), and "acoustics" information related to the effectiveness and dimensions of tested noise barriers. The A-weighted sound level, Leq(h), considers the loudness of events and the number of single noise events which occur over the period of an hour. The Leq(h) levels were subsequently extrapolated to estimated annual DNL levels and combined with aircraft noise levels to provide total noise energy estimates for the existing case and each future alternative.

Construction noise levels were computed by adding expected construction traffic levels to the forecast surface traffic levels along designated haul routes. This construction traffic included 57 hourly heavy vehicles on Des Moines Memorial Drive from S. 200th Street to SR 509 to the Airport property; 14 heavy vehicles per hour were added to 24th Street to 156th Street to the Airport property; and 95 hourly heavy vehicles were added from the off ramp of SR 509 to 160th Street to Airport property.

__*Comment R-12-21*__: *Mr. Peyton (Ravenna-Bryant Community Association), and Mr. Rohlfs (City of SeaTac) commented that construction traffic from other airport construction vehicles was not assessed.*

__Response:__ Comment noted. The Final EIS considers traffic from other concurrent construction activities; see Chapter IV, Section 15 "Surface Transportation".

__*Comment R-12-22*__: *Several commentors suggested that EIS should consider alternative construction techniques as a way to mitigate impacts of construction truck activities. Suggested were use of a barge/conveyor system, the use of rail as potential transport alternatives, and the use of alternative material sources such as river dredging for flood control. A temporary access should be built off SR 518 to reduce impacts on residential areas. These comments were made by Mr. Anderson, Mr. Clifford, Mr. Ferullo, Mr. Hopkins, Ms. Kittilsby, Mr. Mehlhoff, Mr. Miles, Mr. Riggs, Mr. Wozniak, Mr. Vaa, and Mr. Yanez (City of Snoqualmie).*

__Response:__ Comment noted. The use of alternative haul methods, alternative material sources and alternative haul routes would be considered and discussed in the Final EIS. The use of a conveyor belt system offers considerable mitigation opportunities related to truck haul activities but has several potential environmental concerns. Several routes for establishing a conveyor system were considered: up SR 509 from the Duwamish, to the east in to the Kent Valley, and from Puget Sound on the west. The later was the only alternative that is believed to be physically and financially feasible. To use the conveyor belt system, it would be necessary to construct a temporary off-loading facility near the Des Moines Marina. Relocation or reconstruction of a nearby Senior Center Hall could be required. The corridor of the conveyor belt system lies within or near the Des Moines Beach Park. Shoreline, land use, and other permits would be expected to be necessary. The rail alternative would require a rail spur line and truck hauling from the spur(s). Material supply by rail may not be sufficient to meet a contractor's needs due to other railroad operations which could limit haul trains to one per day. As a result, trucks are considered as the most likely conveyance method.

__*Comment R-12-23*__: *Ms. Brown commented that demolition would result in asbestos impacts and cost to remediate.*

__Response:__ Cost estimates for removal and disposal of asbestos-containing materials associated with facilities demolition would be assessed on a site-by-site basis after a full characterization at the site is completed. This level of analysis is beyond the scope of this EIS and would be conducted at the design and development phase of the Master Plan project actions. Removal and disposal of asbestos-containing material is discussed in the Draft and Final EIS on page IV.21-8.

__*Comment R-12-24*__: *Ms. Brown and Ms. Bitenec commented that contamination tests should be conducted for fill used in construction.*

__Response:__ Contaminant testing of on-site fill would be conducted as required by applicable permits for excavation and removal of fill from the on-site borrow source areas.

__*Comment R-12-25*__*: Mr. and Mrs. Matthews commented that the Final EIS should consider that these improvements will exhaust area material sites and increase the cost of fill material, increasing the cost of future regional construction projects.*

__Response:__ There are several permitted sites within the Puget Sound area that could supply some or all of the required material. There are ample amounts of material available. A construction project of this size could allow new material sites to be economically developed and permitted by the time of construction, creating additional sources and supplies.

__*Comment R-12-26*__*: Several commentors requested specific plans be developed and mitigation costs be identified to repair haul roads. Mitigation measures need to be permanent to withstand the construction duration. South 188th Street should not be used as a haul route. There should be independent monitor of construction mitigation efforts. Construction activities and mitigation should be coordinated with WSDOT's Construction Coordination office. These comments were made by the Airport Communities Coalition, Mr. Rohlfs (City of SeaTac), Mr. Matthews, Mr. A. Miller (Trout Unlimited), the Southwest King County Chamber of Commerce, the Southwest King County Community Group, Mr. Tate, and Ms. Montgelas (WSDOT).*

__Response:__ Comment acknowledged. Impacts related to Airport construction activities would be mitigated as needed and as possible. See response to comment R-12-15. The contractor awarded the construction contract would be required to comply with all local permits, conditions and mitigation requirements for use of material sites, and haul roads. The contractor would haul during permitted hours and carrying legal loads. Mitigation requirements for use of the specific off site source(s) and routes the contractor chooses to use and the haul process he proposes for use would be the responsibility of the contractor to negotiate and establish with the appropriate agencies. The Port anticipates that the contractor awarded Airport construction projects would include as part of his bid price the expenses of fees, the effects of mitigation conditions, and the cost of restoration. See response to comment R-12-9. Construction access roads in the area of the Airport to be used by the Contractor would be specified. All contractors would have the option of seeking permits for use of other routes from the appropriate jurisdictions. This is standard for construction projects in the Northwest.

__*Comment R-12-27*__*: The analysis of congestion impacts from truck traffic was inadequate and inaccurate. Truck volumes should have been increased by a Passenger Car Equivalency Factor of 3.0 to account for increased impacts of heavy trucks on intersections, arterials, and freeways. A peak hour factor of 1.5 should be used to account for "bunching" of trucks. Several commentors expressed this concern, including the Airport Communities Coalition, the Greater Federal Way Chamber of Commerce, Mr. Hopkins, and Ms. Brown.*

__Response:__ Comment acknowledged. Levels of service (LOS) analysis of Airport area intersections and freeway ramps, impacted by the anticipated truck hauling, were performed and are included in Appendix J of the Draft and Final EIS. The Final EIS contains additional construction-related surface transportation analysis, including a freeway operation assessment. The LOS analysis for Airport area signalized intersections assumes a Passenger Car Equivalency (PCE) factor of 1.5 in order to calculate an adjustment factor for heavy vehicles, which is in conformance with the requirements of the 1985 and 1994 Highway Capacity Manual. The suggested PCE value of 3.0 is only appropriate for freeway operational analysis and is not a direct multiplier as suggested by the commentor. A peak hour bunching factor is included in the construction surface traffic impact analysis performed for the Final EIS.

__*Comment R-12-28:*__ *Ms. Brown commented that the Final EIS should consider that the intersection of S. 188th Street and Pacific Highway and southbound ramp of SR 518 and SR 509 are high accident locations.*

__Response:__ Construction haul traffic is not anticipated to use S. 188th Street between Pacific Highway South (International Boulevard) and I-5. The City of SeaTac provided comments on the Draft EIS requesting that section of S. 188th not be considered as a haul route. See response to comment R-12-10. Washington State Department of Transportation (WSDOT) records indicate 20 accidents occurring at the intersection of State Route 509 and State Route 518 between July of 1992 and June of 1995. The majority of these accidents involved red light violations by either westbound through or southbound left turning vehicles. Only 2 accidents during this 3-year period involve the westbound left turn movement. Increased truck traffic on any leg does not impose any increased safety risk.

__*Comment R-12-29:*__ *Mr. Rohlfs (City of SeaTac) commented that the Draft EIS does not provide sufficient information to address the specifics of construction of the individual airport projects. Individual EIS's will be required for the relocation of S. 154th/156th Street, filling and grading activities for the third runway, creek relocation, and terminal projects.*

__Response:__ The Final EIS contains information needed to evaluate the range of impacts and needed mitigation associated with constructing the third runway, and with the roadway and creek relocations associated with the relocation of S. 154th/156th Street; see Chapter IV, Section 23 "Construction Impacts". The Draft EIS analysis, and the analysis that was completed for the Final EIS, comply with the spirit and intent of the National Environmental Policy Act (NEPA) and the Washington State Environmental Policy Act (SEPA) for disclosure of likely impacts associated with a proposed project. The successful bid contractor would establish their preferred haul routes and supply mechanisms/off-site sources and seek the necessary permits to complete the hauling of materials. This is standard practice within the Pacific Northwest to require the successful bid contractor to obtain the necessary permits for hauling.

WATER QUALITY, HYDROLOGY, FLOODPLAINS AND COASTAL ZONE MANAGEMENT

__*Comment R-13-1:*__ *Mr. Peyton (Ravenna-Bryant Community Association) requested identification of the cumulative impact of the Master Plan Update and induced long-term development on flooding and wetland functions.*

__Response__: As discussed in the cumulative impacts and mitigation sections of Chapter IV, Sections 10 "Water Quality and Hydrology", Section 11 "Wetlands", and Section 12 "Floodplains" of the Draft and Final EIS, all of the Airport improvements must meet existing development standards, including floodplain development, stormwater management, and sensitive areas protection measures. City of SeaTac and Washington floodplain development standards and City of SeaTac sensitive areas regulations prohibit reductions in 100-year flood storage capacity and require control of stormwater runoff rates at or below the existing flow rates for the 2-, 10-, and 100-year design storm events. These regulations are designed to prevent flooding problems and maintain flood flows at or below existing levels in order to protect human life and property. Development can change the timing and duration of flows in a watershed and subsequently change wetland hydrology and associated wetland functions and values (e.g., flood attenuation and wildlife habitat). The EIS presents the impacts and discusses the likely impacts from other known induced development.

<u>*Comment R-13-2*</u>*: Commentors asked if the discussion of streamflow stabilization, control of streamflow, and subdrains in Chapter IV, Section 19 (Earth) of the Draft EIS refers to relocation of Miller Creek. Commentors also requests definition of the term "dewatering" and that a discussion be provided of the third historic fuel spill. These comments were received from the Southwest King County Community Group and Mr. Derrick (King County Department of Development and Environmental Services).*

<u>**Response**</u>: In Chapter IV, Section 19 "Earth Impacts", the discussion of streamflow refers to stormwater runoff within two large swales that cross the site of the proposed runway. During rainfall events, these swales collect surface water from the surrounding uplands and drain westward to Miller Creek. These swales are not streams, however, and are not part of the Miller Creek stream channel. Where these swales would be filled to construct the runway embankment, streamflow within the swales would be intercepted and controlled to protect embankment fill stability. Subdrains would be installed to drain seeps beneath the embankment fill.

As used in Chapter IV, Section 19, dewatering is the removal of shallow, perched groundwater encountered during excavation by using pumps or digging trenches that drain the water away from the area of excavation.

Please refer to the additions in Chapter IV, Section 10 of the Final EIS (page IV.10-6) which addresses the nature of the third historic fuel spill at the Airport.

<u>*Comment R-13-3*</u>*: A commentor requested clarification of the apparent conflict in lines 12 and 21 on page IV.10-8 on the amount of area being impacted by construction activities. Include disturbances in borrow site areas in the construction impact area estimates. This comment was received from Mr. Derrick (King County Department of Development and Environmental Services).*

<u>**Response:**</u> As indicated in Chapter IV, Section 10 of the Draft and Final EIS, potential temporary increases in suspended solids or other pollutants in Miller and Des Moines Creeks from construction depend on several factors including the size of the construction area, proximity of potential receiving waters, soil type, slope, cover, and effectiveness of erosion and sediment controls (i.e., potential delivery of sediments). There is no conflict in the numbers identified on page IV.10-8 of the Draft EIS in lines 12 and 21. The apparent confusion between these numbers is that the first number refers to phase 1 construction activities, which would result in the disturbance of an estimated 193 acres. By contrast, the number on line 21 (249 acres) was the preliminary estimate of the total runway construction area. Revised estimated impact areas in each basin are presented in Table IV.10-7.

The discussion of potential construction impacts on water quality in Chapter IV, Section 23 of the Final EIS (Page IV.23-10) has been expanded to include potential impacts on surface water quality from activities at borrow source areas. Sediment yield estimates from sheet and rill erosion of fillslopes and cutslopes at construction and borrow sources area sites are presented in Table IV.23-6 of the Final EIS. Estimated sediment yields do not necessarily represent actual additional sediment loading received by Miller and Des Moines Creeks, but represent the total amount of material eroded from fillslopes and cutslopes. Only a portion of the sediments would actually reach the creeks. Actual loading to the creeks depends on the surface topography and the effectiveness of erosion and stormwater controls. Such controls would reduce erosion and the amount of eroded material delivered to Miller and Des Moines Creeks.

Estimated total annual sediment yields from borrow source areas and fill embankments combined, during, and up to one year after construction would range from between about 142 to 357 tons per year in the Miller Creek basin and about 120 to 300 tons per year in the Des Moines Creek basin, depending on the effectiveness of erosion controls. The range in estimated sediment yields depends in the effectiveness of erosion controls; lower values assume higher erosion control and higher values assume lower erosion control. As vegetation becomes established on fillslopes and cutslopes following completion of construction, average annual sediment yields would decrease exponentially to about 48 tons per year in the Miller Creek Basin and to about 36 tons per year in the Des Moines Creek Basin. As mentioned earlier, only a fraction of material eroded from fillslopes and cutslopes (sediment yields) would be expected to be delivered to Miller and Des Moines Creeks.

Sediment yielded from fillslopes and borrow source areas and actual amount of sediment reaching the creeks would be expected to be reduced by removal of suspended solids by stormwater management facilities (i.e., wet vaults, wet ponds, and biofiltration swales). The primary mechanism for delivery of sediment from these sites to Miller and Des Moines creeks is in stormwater runoff as suspended solids. It is assumed that all sediment yielded from fillslopes and cutslopes would be delivered to stormwater management facilities and proposed conceptual stormwater runoff controls wet vaults, wet ponds, and biofiltration swales would remove at least 80% of suspended solids in stormwater runoff. Therefore, 20% of the estimated sediment yields would be delivered to Miller and Des Moines Creeks as total suspended solids (TSS). Please see Chapter IV, Section 23 for a more detailed discussion on erosion and sedimentation estimates.

During and up to 1 year after construction, it is estimated there would be an increase in TSS loading of between about 28 to 71 tons per year to Miller Creek and between about 24 to 60 tons per year to Des Moines Creek. Based on estimated existing sediment loadings (as TSS) for Miller Creek and Des Moines Creek, these represent estimated increases of about 11 to 27% (Miller) and 14 to 36% (Des Moines) during and up to one year after construction. As vegetation becomes established the first year after completion of construction, average annual increased sediment loading would be expected to decrease exponentially to about 10 tons per year on Miller Creek and 7 tons per year on Des Moines Creek; these represent an increase of about 4% compared to existing total loading for both creeks. These estimated increased loadings may be higher than actual loadings, as some of the eroded material would be expected to be deposited at the base of slopes and would not be delivered to stormwater runoff facilities or Miller and Des Moines Creeks. Actual increases in sediment loading to the creeks depends on the effectiveness of the erosion and sediment control measures implemented as part of an approved erosion and sediment control plan. Numbers could be higher if untreated stormwater runoff from construction and borrow source areas reaches Miller and Des Moines Creeks.

Activities at borrow source areas could affect groundwater resources by altering geology and changing groundwater recharge, movement, and discharge patterns. In general, precipitation percolates through shallow mantles of soil to underlying glacial till (except at borrow source area 3 where till is generally absent), contributing to seasonally perched groundwater, shallow groundwater recharge, and shallow groundwater discharge to Miller and Des Moines Creeks (along slopes near the creeks). Removal of glacial till layers at most borrow source areas would expose underlying advance or recessional outwash deposits increasing potential recharge and susceptibility to contamination of the shallow or uppermost aquifer, which is located in advance outwash deposits. Removal of glacial till layers and exposure of more permeable advance and recessional outwash could result in proportional reductions in perched groundwater or increases in upper aquifer (advance outwash aquifer) recharge. Potential impacts on perched groundwater and upper aquifer recharge, discharge, and movement patterns depends on the geology at these sites, proposed grading plans, and new site development. Please see Chapter IV, Section 23 (Construction Impacts) and Chapter IV, Section 10 (Water Quality and Hydrology) of the Final EIS for a more detailed discussion of potential impacts to surface and groundwater.

__Comment R-13-4__: Several commentors questioned the Draft EIS discussion that shows a 700% increase in water use and states that the Draft EIS should discuss how much of the projected increase is due to operation of the proposed new runway and how much would result from passenger use. Comments received from the Southwest King County Community Group, the Southwest King County Chamber of Commerce, Ms. Batayola (Seattle Water Department), Mr. Caldwell, Mr. Schneider, Mr. Pompeo, Mr. Miedema, Mr. Mealy, and Ms. Brasher.

__Response:__ Please see the new text on page IV.18-1 of the Final EIS. The description of existing conditions for water usage discussed on page IV.18-1 of the Draft EIS was corrected and the new text shows a smaller increase in projected water use and identification of the water source for the increase. Projected water use shown in the Draft EIS was inaccurate because estimates were based on peak summer use and incorrect passenger forecasts.

__Comment R-13-5__: Mr. Derrick (King County Department of Development and Environmental Services) requested discussion of the potential impacts on all water districts.

__Response__: The discussion of potential construction and operational impacts on groundwater resources has been revised to include all water districts operating wells in the vicinity of proposed improvements (Chapter IV, Section 10 of the Final EIS, beginning on page IV.10-11). The Seattle Water Department and Highline Water District operate three and two wells, respectively, in the Highline Aquifer and Deep Aquifer. The presence of existing low permeability silts, clays, and glacial till between potential sources of contamination and these aquifers restricts infiltration and percolation of contaminants originating on the ground surface downward into the aquifers. For this reason, the aquifer currently have a low susceptibilities to contamination and are unlikely to be adversely affected by Airport operations.

Construction activities could have impacts on Highline Aquifer susceptibility to contamination and recharge. If excavation of materials at on-site borrow source areas removes glacial till (i.e., aquitard) that now restricts movement of contaminants downward into advance outwash deposits and the uppermost aquifer, potential susceptibility to contamination could increase. The potential risk of contamination would depend on several factors, including the depth of advance outwash or other materials between the aquifer surface and contamination, the characteristics of these deposits (e.g., particle size distribution), and the type, characteristics (e.g., fate and transport) frequency, and quantities of any contaminants spilled on the ground surface. These factors would influence movement of contaminants and the potential of spilled materials to reach the aquifer. Refueling or maintenance of construction equipment would not be conducted at borrow source areas to avoid spills of diesel fuel, hydraulic fluid or lubricants that could otherwise occur. Implementing best management practices, such as installing proper temporary fuel storage and spill containment or designated maintenance areas would eliminate or further reduce spills and contamination potential.

Construction activities could potentially increase or decrease aquifer recharge. Excavation activities at borrow source areas could potentially increase aquifer recharge by removing aquitards (i.e., glacial till), exposing more permeable advance outwash, and increasing infiltration of precipitation. Construction of additional impervious surfaces could reduce infiltration of precipitation and recharge of the aquifer. Potential increases or decreases in recharge would be expected to be proportional to the total area contributing to recharge of the aquifer. In addition, please see responses R-13-17, R-13-19, and R-13-21B.

__Comment R-13-6__: The Southwest King County Community Group requested identification of the amount of additional impervious surface that would result from the proposed Master Plan Update improvements.

__Response__: As shown in Table IV.10-2 of the EIS, the additional impervious area of the "With Project" alternatives would be 98 acres in the Miller Creek basin (about 2% of the basin area) and 95 acres in the

Des Moines Creek basin (about 3% of the total basin area). The total additional impervious surface area for the two basins is 193 acres.

Comment R-13-7: *Several commentors requested information concerning impacts on water flows in the creeks. Comments were received from Mr. Brazil, Mr. A. Miller (Trout Unlimited), and Mr. Peyton (Ravenna-Bryant Community Association).*

Response: Potential impacts on flows in Miller and Des Moines Creeks include increased high flows and reduced base flows. These potential impacts would be mitigated by constructing stormwater runoff management facilities that meet applicable detention requirements of the Washington Department of Ecology's *Stormwater Management Manual for the Puget Sound Basin*, which are more stringent and protective than those of *the King County Surface Water Design Manual*. The City of SeaTac, however, has adopted the *King County Surface Water Design Manual*. Because conceptual stormwater management facilities were designed using the *Stormwater Management Manual for the Puget Sound Basin*, these facilities meet City of SeaTac (i.e., *King County Surface Water Design Manual*) regulatory requirements. To mitigate potential reductions in shallow groundwater discharges and to avoid incremental reductions in base flows in these creeks, infiltration facilities would be constructed where feasible. The potential impacts on flows in Miller and Des Moines Creeks from the proposed improvements and mitigation measures are discussed in Chapter IV, Section 10 of the Final EIS.

Comment R-13-8: *Two commentors requested clarification on the available storage capacity and existing settings of the Lake Reba detention facility; also, identification of existing stormwater management facility design requirements. Comments were received from Mr. Rohlfs (City of SeaTac), Regional Commission on Airport Affairs, and the Southwest King County Community Group.*

Response: The control structure that regulates flow out of the Lake Reba detention facility is being evaluated by the Port of Seattle to determine the most effective way to use the storage volume in the facility for attenuating upstream flow rates. Under the existing control structure settings, the facility is capable of storing flood flows slightly below the 100-year event. The capacity of the Lake Reba detention facility, current operations, potential additional storage capacity, and design requirements of new stormwater runoff management facilities are discussed in Chapter IV, Section 10 of the EIS.

Comment R-13-9: *Southwest King County Community Group requested description of the Tyee Pond stormwater management facility and plans to replace it.*

Response: The Tyee Ponds are a regional stormwater management facility constructed as an open surface pond. The storage capacity of the pond is about 24 acre-feet. A discussion of the Tyee Pond flood storage value is presented in Chapter IV, Sections 10 "Water Quality and Hydrology" and 12 "Floodplains" of the Draft and Final EIS. The pond would be relocated and enlarged as part of the South Aviation Support Area (SASA)project. The relocated and enlarged pond would be a three-celled system with 40 to 45-acre feet storage capacity located north of the main SASA footprint. The first two cells would be densely vegetated emergent wetland cells for enhanced biofiltration and water quality improvement and the third cell would be off-line, providing detention for large storm events.

Comment R-13-10: *Southwest King County Community Group requested a description of the type and locations of Des Moines Creek Technology Campus stormwater management facilities.*

Response: The City of Des Moines and the Port of Seattle have prepared a separate Final EIS for the Des Moines Creek Technology Campus. Stormwater management facilities would be constructed to treat and control runoff from the Des Moines Creek Technology Campus. These facilities would discharge to Des Moines Creek. Locations and descriptions of conceptual stormwater management facilities, including detention ponds and biofiltration swales, are presented in the Final EIS on the Des Moines Creek Technology Campus.

Comment R-13-11: *Ms. Burrage, Mr. Caldwell, Mr. Rohlfs (City of SeaTac), Mr. A. Miller (Trout Unlimited), the Regional Commission on Airport Affairs, and the Southwest King County Community Group requested clarification on airport NPDES permit issues, discussion of sludge and overflow from the Industrial Waste System, and discussion of pollution in Miller and Des Moines Creeks.*

Response: National Pollution Discharge Elimination System (NPDES) permit requirements, permit issues, potential water quality impacts on aquatic biota in Miller and Des Moines Creeks, pollutant loading to the creeks, and Port's Industrial Waste System (IWS) overflows are discussed in Chapter IV, Sections 10 "Water Quality and Hydrology" Section 16 "Plants and Animals" and Appendix M of the EIS. The NPDES permit for the Airport establishes specific and general requirements for stormwater runoff and IWS effluent discharges as well as specific monitoring and reporting requirements.

A stipulated settlement was reached on a NPDES permit appeal. Conditions of the settlement generally provide for increased public involvement provisions, such as review of discharge monitoring reports, formation of a Monitoring Team with representatives appointed by the appellants, and notification of any violations of permitted discharge limits.

A Clean Water Act citizen suit action has been filed by the Waste Action Project against the Port of Seattle that alleges violations of the Port's NPDES permit. The Port has denied all liability and the case is in litigation. Please see also responses to comments R-13-12, R-13-13, R-13-15, R-13-23.

Up until 1981 lagoon sludge was periodically removed from lagoon 1 and land farmed (i.e., tilled to enhance natural biodegradation of contaminants) in an upland area north of the IWS treatment plant in the vicinity of a proposed snow equipment storage shed. This practice was abandoned in 1981. A 1990 study of the land farmed sludge site found a layer of contaminated soil between 9 and 15 feet thick with total petroleum hydrocarbon (TPH) concentrations varying from 130 to 1,800 parts per million (ppm). The Model Toxics Control Act (MTCA) defines and regulates disposal of hazardous and dangerous wastes and establishes specific clean-up levels, depending on zoning and existing or proposed land uses (e.g., industrial, commercial) in Washington. TPH levels for some of the land farmed sludge layer are well above the MTCA Method A clean-up levels of 200 parts per million (ppm), which is applicable to this site. Samples were tested for benzene, ethylbenzene, toluene, and Xylene (BETX) contamination. BETX levels were below MTCA Method A clean-up levels. No TPH levels above MTCA clean-up levels were found in samples collected at the contact between the land farmed sludge layer and underlying fill. Prior to construction of the snow equipment storage shed, some TPH-contaminated soils may require off-site disposal at an approved facility in accordance with applicable regulations. A 1990 study of lagoon sludge sediment indicated that pond sludge was not a dangerous waste according to MTCA standards. Ecology (which implements MTCA) has permitted the sludge to remain in the IWS lagoons pending completion of the IWS Engineering Report, which is required as part of the NPDES permit. Pond sludge will be removed and the pond relined in 1996.

The IWS does not discharge to Miller Creek and only discharges (i.e., overflows) to Des Moines Creek during extremely large storm events (100-year) when IWS lagoon storage capacity is exceeded. Pollutant levels in Des Moines Creek during such events have not been identified but are likely to be very low because of the dilution effect of the large volumes of water that would be present during such an event. The Port of Seattle, through the NPDES permit process, is currently examining the capacity of the IWS and evaluating the need to expand treatment capacity and upgrade the facility to provide sufficient capacity to handle additional industrial waste quantities created by expansion activities.

A summary of the existing pollutant loading estimates from the annual stormwater monitoring report indicate that airport stormwater runoff is generally comparable to urban stormwater runoff from medium residential and residential/commercial areas is presented in the Final EIS (pages IV.10-5).

As indicated in Chapter IV, Section 10 of the Draft and Final EIS (pages IV.10-3 and IV.10-4), water quality in Miller and Des Moines Creeks has been degraded by urbanization and increased stormwater runoff. The Airport covers about 30% of the Des Moines Creek Basin and about 5% of the Miller Creek basin. Miller and Des Moines Creeks are rated as Class AA (extraordinary). Stormwater runoff from the Airport and urban areas in these basins contribute to occasional violations of selected Class AA water quality standards

Annual pollutant loadings for seven pollutants (TSS, BOD, TP, copper, lead, zinc, and oil and grease) in Airport stormwater runoff have been estimated based on water quality monitoring data. Pollutant loadings were estimated for these pollutants for the remainder of the Miller and Des Moines Creek basins by multiplying a range of established low and high loading rates for different land uses (e.g., open space, commercial, residential) by the appropriate land use areas. Total annual pollutant loadings were then calculated by adding Airport contributions to the remainder of these basins (Table IV.10-7). Based on estimated loading rates, the Airport contributes to between about 2 and 39% of the total TSS, BOD, TP, copper, lead, zinc, and oil and grease pollutant loads in the Des Moines Creek basin and between less than 1% and about 4% of the total loading for these pollutants in the Miller Creek basin. The relative contributions of these pollutants to the total pollutant loadings is generally lower than the proportional contributing area of each basin that the Airport covers (i.e., 30% of the Des Moines Creek basin and 5% of the Miller Creek basin) with only one exception. The exception is the estimated Airport contribution to total copper loading (39%) for Des Moines Creek when the lower loading rate values for estimating the contributions from other land uses in the basin is used. Estimated contributions from the Airport to the total pollutant loadings for these pollutants supports the statements that Airport runoff is generally comparable to or cleaner than stormwater runoff from other urban areas in these basins for these pollutants and that sources of pollutants to the creeks are widespread in these basins. It should be noted; however, that based on limited Airport stormwater monitoring for dissolved metals (i.e., copper, lead, and zinc), a majority of the copper and zinc appears to be in dissolved ionic forms. Therefore, the Airport may contribute to a higher percentage of the total dissolved copper and zinc pollutant load in Miller and Des Moines Creeks.

Other pollutants sometimes found in Airport stormwater runoff include glycols and ammonia. In general, glycols are more than two orders of magnitude below levels reported to cause acute toxic effects.[14] Glycols, which have a high biochemical oxygen demand, may contribute to depressed dissolved oxygen or cause chronic effects on aquatic biota (e.g., reduced growth rates or increased susceptibility to disease). Because glycols are generally present during colder periods when dissolved oxygen levels are high, it is unlikely dissolved oxygen levels in areas of Miller and Des Moines Creek receiving Airport stormwater runoff would reach levels that cause chronic or acute effects on aquatic biota. In addition, levels of ammonia detected in stormwater runoff appear to occasionally exceed acute and chronic toxicity standards and may cause adverse effects on aquatic biota in receiving waters of Miller and Des Moines Creeks.

Anti-icing and deicing of aircraft and anti-icing of runways has contributed to small quantities of glycols and ammonia in airport stormwater runoff. As discussed in the Final EIS (page IV.10-4), additional studies of Miller and Des Moines Creeks are being conducted to evaluate the relative pollutant contributions of airport operations, potential impacts of stormwater runoff on these receiving environments, and toxicity of stormwater to aquatic biota.

__Comment R-13-12:__ Commentors requested expansion of the discussion of the Industrial Waste System (IWS) and potential water quality mitigation. Comments received from Mr. Brazil, Mr. Rohlfs (City of SeaTac), and Mr. & Mrs. West.

__Response__: As indicated in Chapter IV, Section 10 "Water Quality and Hydrology" of the Final EIS, the IWS is a separate conveyance system that collects and conveys wastewater from airport tenants in the cargo, hangar, and gate areas, including deicing and anti-icing wastewater, to three IWS lagoons. The wastewater is treated by a dissolved air flotation treatment facility in the southwest corner of the Airport.

[14] *Seattle-Tacoma International Airport De-Icer/Anti-icer Study*, Prepared by Woodward-Clyde Consultants for the Port of Seattle, 1993.

Wastewater is treated at the IWS to meet permit effluent limitations before being discharged to the Midway Sewage Treatment facility deepwater outfall and Puget Sound.

As discussed in Chapter IV, Section 10 of the Final EIS (pages IV.10-16 to IV.10-20), mitigating potential water quality impacts from airport operations includes correction and elimination of interfaces between the IWS and the stormwater drainage system (SDS) which would aid in reducing the quantity of deicing fluids (e.g., glycols) that enter Miller and Des Moines Creeks. Other mitigation measures include implementation of stormwater pollution prevention and spill prevention, control, and countermeasures plans. In addition, engineering studies have been conducted and are currently being conducted by the Port of Seattle to identify methods for improving the treatment efficiency of the existing IWS and evaluate the need for upgrading and increasing the capacity of the IWS to handle future operations. These studies are summarized in the Final EIS on page IV.10-3).

Comment R-13-13: A commentor requested discussion of whether pollution from airport operations contributes to toxic conditions for fish in Miller and Des Moines Creeks. Comment received from Mr. Peyton (Ravenna-Bryant Community Association).

Response: As discussed in Chapter IV, Section 10 "Water Quality and Hydrology" and Section 16 "Plants and Animals" and Appendix M of the EIS, water quality in these creeks has been affected by urbanization, including commercial and residential development. For example, Class AA water quality standards for selected parameters, including dissolved oxygen, temperature, and fecal coliform bacteria, are sometimes exceeded. Concentrations of total metals (e.g., copper and zinc) occasionally reach levels that may indicate exceedance of Class AA water quality standards. Because metals data are reported as total metals and state water quality standards are based on dissolved forms of metals, it is uncertain whether levels of these metals exceed chronic or acute toxicity standards. As mentioned in Chapter IV, Section 10 of the Final EIS, the Port of Seattle has initiated a study to monitor the quality of stormwater receiving environments (i.e., Miller and Des Moines Creeks) and conduct toxicity tests on stormwater runoff. Objectives of this study also include identification of the relative pollutant contribution from airport operations and identification of other sources of pollutants to these creeks.

As indicated in response R-13-11 and Chapter IV, Section 10 of the Final EIS (page IV.10-5), stormwater runoff from the Airport contributes between about 2 and 39% of the total TSS, BOD, TP, copper, lead, zinc, and oil and grease to the Des Moines Creek basin. About 61 to 98% of the annual pollutant loading for these pollutants in the Des Moines Creek basin comes from stormwater runoff from residential, commercial, and other land uses. The estimated relative contribution from the Airport for the total loadings of these pollutants in the Miller Creek basin is between less than 1 and 4%. Based on these pollutant loadings, clearly the Airport contributes to occasional violations of Class AA water quality standards, but pollutant sources are widespread and a majority of the total pollutant loads for these seven pollutants comes from stormwater runoff from other urbanized areas within each basin.

Comment R-13-14: Mr. Peyton (Ravenna-Bryant Community Association) requested assessment of the effects of the deposition of atmospheric pollutants from jet engine emissions on streams.

Response: A number of residents in the vicinity complained of residue, believed to be an outfall from jet overflights. As a result, the Puget Sound Air Pollution Control Agency and the Port of Seattle have conducted residue testing to determine the content and possible source of the residue; see response to comment R-5-1. While trace amounts of aviation flight related emissions could be present, none of the samples taken by either agency found aviation activity as the primary source. Thus, no significant impacts on area water courses are expected due to jet engine air pollution emissions.

<u>Comment R-13-15</u>: Three commentors requested discussion of the potential effects of deicing fluid on Miller and Des Moines Creeks. Comments received from Mr. Brazil, Mr. Bolles, Ms Matthews,, and Mr. Smith.

<u>Response</u>: As discussed in Chapter IV, Section 10 of the Draft and Final EIS (page IV.10-4), solutions containing glycols, urea, and potassium acetate are used for de-icing and anti-icing aircraft and runways at the Airport. Glycols have been detected in stormwater runoff from the Airport As indicated in Chapter IV, Section 10 of the Final EIS (page IV.10-6), the *Annual Stormwater Monitoring Summary Report* reported concentrations of deicing fluids in stormwater runoff ranging from <5 to 479 mg/L. Glycol quantities resulting in observed concentrations in stormwater runoff in this range are generally small compared to the volumes used during deicing events. For example, about 58 gallons of glycol would be required to produce the concentration of 275 mg/L observed at Outfall 003 on February 17, 1995. These volumes represent a small fraction of the total volume of deicing and anti-icing fluids used during a typical application. Most of the anti-icing and deicing fluids used during airport operations are contained and treated by the Port's Industrial Wastewater System.

Glycols have a high biochemical oxygen demand (BOD). Decomposition of glycols (and other chemicals with high BOD) may depress dissolved oxygen levels. As indicated in the discussion in Chapter IV, Section 10, these fluids are used and present in stormwater runoff during colder months when dissolved oxygen levels are high or saturated and streamflow volumes are high; thus, they are diluted and their effects on BOD minimized. Also, the quantities present in stormwater runoff are small (e.g., a few gallons). Because of these factors, deicing and anti-icing fluids are not expected to contribute to a reduction in dissolved oxygen levels in Miller and Des Moines Creeks that is lethal to aquatic biota.

Concentrations of glycols observed in stormwater runoff, potential impacts on water quality, and the toxicity of glycols to aquatic biota are discussed in Chapter IV, Section 10 "Water Quality and Hydrology" and Section 16 "Plants and Animals" of the Final EIS and in Appendix M.

<u>Comment R-13-16</u>: Ms. Stuhring requested that the source of airport activity generated ammonia be identified.

<u>Response</u>: As indicated in Chapter IV, Section 10 of the Draft EIS (page IV.10-5 of the Final EIS), ammonia comes from the degradation of urea, which is used to de-ice runways.

<u>Comment R-13-17</u>: Ms. Batayola (Seattle Water Department) requested that confirmation be obtained from the Washington Department of Ecology on the status of groundwater contamination clean-up activities.

<u>Response</u>: As stated in Chapter IV, Section 10 "Water Quality and Hydrology" of the Draft and Final EIS, there are several areas of localized contamination of perched (i.e., on top of glacial till) and shallow (upper aquifer) groundwater resources from leaking underground storage tanks and fuel distribution systems. No contamination has been observed of the deeper Highline aquifer, which is used as a source of drinking water. As stated in Chapter IV, Section 7 "Human Health" and Chapter IV, Section 10 "Water Quality and Hydrology", these localized areas of contamination are in various stages of characterization, monitoring, and remediation (i.e., clean-up).

Some of the localized areas of groundwater contamination have been characterized and cleaned up. At others, the contamination is in the process of being characterized and appropriate remediation to protect environmental and human health would follow. Management of groundwater contamination at the Airport is being conducted according to all applicable environmental regulations, including the Washington Model Toxics Control Act (MTCA). The Washington Department of Ecology (Ecology) is responsible for implementation of MTCA, including listing areas or sites of known contamination and delisting sites as clean-up activities are completed. Ecology has confirmed that some areas of contamination have been cleaned up. Additional discussion on the status of remediation activities and confirmation of groundwater contamination management activities is included in Chapter IV, Section 10 of the Final EIS (page IV.10-9).

__Comment R-13-18__: Mr. Derrick (King County Department of Development and Environmental Services) requested clarification of the potential for stream channel erosion.

__Response__: Chapter IV, Section 10, Appendix F, and Appendix P-B of the EIS indicate there is some existing stream channel erosion and sources of sediment downstream of the Sea-Tac Airport. One of the major sources of sediment, from farming activity at Vacca Farm (near 160th Street S.W.), would be eliminated as a result of the proposed Master Plan Update improvements and Miller Creek channel relocation, thereby reducing a major sediment source. In addition, hydrologic modeling using required detention and release rates indicates that increased channel erosion from the proposed airport improvements is not expected to occur.

__Comment R-13-19__: A commentor requested a description of actions that are being taken to prevent contaminated groundwater from reaching Miller and Des Moines Creeks. This comment was received from Mr. Derrick (King County Department of Development and Environmental Services).

__Response__: As indicated in Chapter IV, Section 10 "Water Quality and Hydrology" of the Draft and Final EIS, there are several areas of known localized contamination in shallow perched groundwater and the upper aquifer (advance outwash); see page IV.10-7 of the Final EIS. Based on previous geotechnical studies and ongoing groundwater monitoring, localized areas of contaminated shallow groundwater are occasionally perched on top of glacial till, within fill, or in laterally discontinuous lenses of sand within glacial till deposits that do not discharge to Miller and Des Moines Creeks. The upper or shallow groundwater aquifer, located in advance outwash deposits, generally flows west and discharges to Miller Creek and Des Moines Creek where the creeks intersect advance outwash deposits. As indicated in response R-13-17, management of groundwater contamination is proceeding in accordance with all applicable rules and regulations. Remedial actions are being designed in coordination with Ecology as necessary to prevent potential threats to human or environmental health, including potential discharges of contaminated groundwater to Miller or Des Moines Creeks.

The Port of Seattle has recently completed a groundwater study that characterizes subsurface geology, aquifers, and aquitards, groundwater occurrence, movement, and recharge and discharge relationships in the vicinity of the Airport (Appendix Q-A of the Final EIS). In addition, a proposed study would evaluate potential impacts of known contamination sources on the intermediate or advance outwash aquifer. Information from these studies would be used to guide on-going groundwater management activities. The results of the completed study are summarized in Chapter IV, Section 10 of the Final EIS (beginning on page IV.10-7).

__Comment R-13-20__: Ms. Batayola (Seattle Water Department) requested that the EIS identify the location and description of the three Highline Aquifer production wells.

__Response__: Chapter IV, Section 10 of the Final EIS (Exhibit IV.10-4) identifies the location of the three Highline Aquifer production wells and describes the Seattle Water Department artificial recharge and recovery program. The SWD has developed a well field in the Highline Aquifer (intermediate) as part of an artificial recharge and recovery demonstration program to augment the drinking water supply during peak summer demand periods. The Seattle Water Department operates three production wells in the Highline Aquifer. All three wells are located north of the Airport in the Highline Aquifer. Treated Cedar River water is injected into the wells (fall-spring), stored temporarily, and later withdrawn during peak summer demand periods (summer-early fall). In addition, please see response R-13-21B.

Comment R-13-21A: *Several commentors requested the conduct of additional studies as necessary to characterize existing groundwater recharge, discharge, and movement (i.e., springs and seeps) on the west side of the Airport in the vicinity of the proposed third runway and to identify potential groundwater mitigation. Comments received from Mr. Rohlfs (City of SeaTac), the Regional Commission on Aviation Affairs, Mr. Caldwell, the Southwest King County Community Group, Ms. Batayola (Seattle Water Department), Mr. Derrick (King County Department of Development and Environmental Services), and Mr. Harris (Highline Water District).*

Response: Chapter IV, Section 10 of the Final EIS (beginning on page IV.10-7) summarizes the results of a recently completed study and the objectives of additional groundwater studies being conducted by the Port of Seattle. In addition, please see response to comment R-13-3 and R-13-19.

Comment R-13-21B: *A number of commentors noted that, if existing groundwater contamination migrates to aquifers used by the Highline Water District, potable water could become contaminated, creating a potential health hazard. Comments of this nature were received from Mr. Rohlfs (City of SeaTac), the Regional Commission on Aviation Affairs, Mr. Caldwell, the Southwest King County Community Group, Ms. Batayola (Seattle Water Department), and Mr. Harris (Highline Water District).*

Response: Numerous factors influence the fate and transport (or movement) of contaminants in groundwater, including the physical and chemical characteristics of the contaminants (e.g., water solubility, viscosity, molecular structure), the physical and chemical characteristics of the geological units (e.g., particle size distribution, structure, hydraulic conductivity), the quantity of contaminants present, groundwater movement patterns, and contaminant degradation rates.

As indicated in responses R-13-17 and R-13-19 and in Chapter IV, Section 10 of the Draft, there are several areas of localized groundwater contamination at the Airport. The Highline Water District and the Seattle Water Department (SWD) have two and three operating wells, respectively, in the Highline Aquifer and Deep Aquifer (please see response R-13-20). The generalized direction of groundwater movement is away and/or cross gradient from the SWD wells and therefore, there is no risk of movement of existing contamination to those wells. The predominant groundwater flow direction is cross gradient from the Highline Water District wells, although some limited component of flow could be toward those wells.

Risk of contamination to the Highline Water District wells depends on the fate and transport mechanisms affecting movement of groundwater contaminated by jet fuel and gasoline. Perhaps the most important factors affecting the partitioning, distribution, and movement of contaminated groundwater at the Airport are the physical properties of the contaminants (i.e., primarily jet fuel) and the physical properties of the subsurface environment (i.e., geology). Jet fuel and gasoline are the most common contaminants present in localized areas of contamination at the Airport. The hydrocarbon constituents of jet fuel and gasoline have relatively low water solubilities and a high affinity to adsorb onto (bind to) silt, clay, and sand particles that are abundant in the geologic deposits present beneath the Airport. Because of the physical and chemical characteristics of contaminants and the geologic deposits beneath the Airport, contaminant adsorption and retention capacities are high and there is limited movement of contaminants. In addition, glacial till and clay aquitards above the Highline Aquifer and Deep Aquifer have low to very low hydraulic conductivities, ranging from about 0.3 to 0.00003 feet per day, and low flow rates. Both the Des Moines well and the Angle Lake well are over a mile south or southwest of the nearest area of localized contamination near the Alaska Airlines hangar, and there is no indication from groundwater monitoring well data that contamination is moving toward either of these wells. All of these factors indicate that contaminant movement downward into the Highline Aquifer or Deep Aquifer is unlikely and poses little risk to the wells. Consequently, existing areas of localized contamination do not present a threat to human or environmental health.

__Comment R-13-22:__ *Mr. Frause requested identification of the potential for pollutants in stormwater runoff to infiltrate detention basins and contaminate shallow groundwater.*

__Response__: As indicated in Chapter IV, Section 10 of the EIS, conceptual stormwater management facilities include underground storage vaults, which would not allow stormwater to enter underlying groundwater. These detention facilities generally are designed to hold water for short periods of time. The primary purpose of detention facilities is to detain stormwater runoff and prevent flooding and not to allow infiltration of stormwater. Additional analyses are being conducted by the Port of Seattle, as discussed in the Final EIS (page IV.10-7), to examine the potential for using infiltration facilities. Stormwater facilities designed for infiltration would pre-treat the stormwater to remove pollutants before the water was infiltrated. Please refer to Chapter IV, Section 10 of the Final EIS (page IV.10-7) for a detailed discussion on the potential contamination of shallow groundwater from detention facilities.

__Comment R-13-23:__ *The Regional Commission on Airport Affairs stated that settlements from past litigation established specific measures for protecting the aquatic resources of Miller and Des Moines Creeks.*

__Response__: Chapter IV, Section 10 of the Final EIS (page IV.10-20) includes a summary of the provisions relevant to Des Moines and Miller Creeks that are contained in the Stipulated Settlement Agreement and Agreed Order of Dismissal, which dismissed Mrs. Brasher's, Normandy Park Community Club's, and the City of Des Moines' appeal of the Port's NPDES permit.

__Comment R-13-24__: *The Southwest King County Community Group and Mr. Bolles requested that the correct confluence of Walker and Miller Creeks be shown on Exhibit IV.10-4.*

__Response__: The confluence of Walker and Miller Creeks is farther west than the area covered by Exhibit IV.10-4. The alignment of Walker Creek within the area covered by Exhibit IV.10-4 is correct.

__Comment R-13-25:__ *Several commentors requested an assessment of the potential impacts on Walker Creek from the construction of the proposed runway. Comments received from Mr. Bolles, Mr. Frause, and the Southwest King County Community Group.*

__Response__: Potential construction and operation impacts on Walker Creek from the proposed improvements would be the same as those for Miller and Des Moines Creeks if stormwater runoff is discharged to Walker Creek. Potential construction and operational impacts on surface waters of Miller and Des Moines Creeks are discussed in Chapter IV, Section 10 of the EIS. In addition, an intermittent or ephemerally flowing reach of Walker Creek would be filled, requiring relocation and replacement of the filled section as indicated in Appendix P of the EIS and Appendix P (Final Stream Mitigation Plan) of the Final EIS.

Immediately downstream of the affected reach, Walker Creek flows through a large, beaver-impounded wetland complex. Downstream of the wetland complex the creek is confined and channelized as a result of adjacent residential development. Habitat in the creek has been altered and degraded by urbanization. Chapter IV, Section 10 of the Final EIS has been revised to include a brief discussion of the existing habitat conditions immediately downstream of SR 509.

__Comment R-13-26:__ *Mr. Derrick (King County Department of Development and Environmental Services) stated that some of the locations of historic flooding on Miller Creek have been incorrectly identified.*

__Response__: Chapter IV, Section 10 of the Final EIS has been revised to address the correct locations of historic flooding problems.

Comment R-13-27: Three commentors requested identification of regulations governing creek relocation. Comments received from Mr. Clifford, the Regional Commission on Airport Affairs, the Southwest King County Community Group, and Mr. Rohlfs (City of SeaTac).

Response: Creek relocation and realignment can be performed in accordance with existing regulatory requirements, including an approved stream mitigation plan, temporary water quality modification (Washington Department of Ecology), Federal Clean Water Act Section 404 (U.S. Army Corps of Engineers), and hydraulic project approval (Washington Department of Fish and Wildlife) permits. Refer to Chapter IV, Section 10 and Appendix P of the Final EIS for discussion of proposed stream relocations and applicable regulatory requirements.

Comment R-13-28: A commentor requested substantiation that there is little or no risk of exposure to stormwater-borne pollutants during recreation. This comment was received from the Southwest King County Community Group.

Response: As indicated in Chapter IV, Section 7 of the EIS, Miller and Des Moines Creeks do not support contact recreation (e.g., swimming or wading) during stormflow events when pollutants in airport stormwater runoff would be present in these streams. During storm flow events, large volumes of water traveling at high velocities preclude contact recreation. Therefore, there is little or no risk of exposure to stormwater-borne pollutants. In addition, many pollutants in stormwater runoff are bound to suspended solids that pass through the creeks and into Puget Sound, resulting in quickly diminishing concentrations of pollutants as storm events pass and base flow conditions return (page IV.10-4). Please refer to Chapter IV, Section 7 "Human Health" and Section 10 "Water Quality and Hydrology" of the EIS for a discussion of the potential for exposure to stormwater-borne pollutants and the potential for water quality impacts from stormwater runoff.

Comment R-13-29: Two commentors requested identification of potential impacts on Des Moines and Miller Creeks from borrow site activities. Comments received from Mr. Harris (Highline Water District) and the Southwest King County Community Group.

Response: Excavation at borrow source areas could result in temporary increases in suspended solids if soils eroded from cutslopes reach Miller and Des Moines Creeks. If borrow source area activities remove glacial till layers exposing underlying advance or recessional outwash deposits, groundwater recharge and discharge patterns could be altered. Total surface area at borrow source areas in the Des Moines Creek and the Miller Creek basin that would be disturbed by proposed borrow source area activities is approximately 171 acres and 52 acres, which is about 3% and 1% of the total basin area for each basin, respectively. As long as no impervious surfaces are developed, groundwater recharge would continue to occur at these borrow source areas; however, discharges to the creeks may be reduced if groundwater discharge patterns are changed.

Comment R-13-30: A commentor stated that the decision not to take fill from Borrow Area 8 has nothing to do with mitigation. Comment received from Southwest King County Community Group.

Response: Comment noted.

Comment R-13-31: The Southwest King County Community Group and Mr. Frause stated that another agency, instead of the Port of Seattle, should certify consistency with the Coastal Zone Management policies and programs.

Response: As indicated in Chapter IV, Section 13 of the Draft and Final EIS (page IV.13-1), the Washington Department of Ecology determines the consistency of the proposed airport improvements with the Coastal Zone Management Act (CZMA) and the Washington Coastal Zone Management Program (CZMP) and must review the Port of Seattle certification statement for compliance with the CZMA and CZMP.

Comment R-13-32: *Several commentors requested explanation of mitigation and protection measures for surface and groundwaters and suggests mitigation. Comments received from Ms. Brown, Mr. Rohlfs (City of SeaTac), Mr. Frause, Mr. Harris (Highline Water District), Mr. Matthews, Mr. A. Miller (Trout Unlimited), the Regional Commission on Airport Affairs, Mr. Schneider, Ms. Batayola (Seattle Water Department), and Southwest King County Community Group.*

Response: Prior to discharging stormwater runoff, relocating Miller or Des Moines Creeks, or placing fill in the 100-year floodplain, the Port of Seattle must demonstrate, to the satisfaction of the applicable regulatory agencies (e.g., U.S. Army Corps of Engineers, and Washington Department of Fish and Wildlife, and City of SeaTac, if applicable) (see response to comment R-7-28 concerning the applicability of City of SeaTac critical area regulations to the Master Plan Update) in proposed mitigation plans that existing habitat and floodplain capacity would be replaced. In addition, these regulatory authorities must approve proposed mitigation plans prior to impacts on the existing resources. Stormwater runoff and Industrial Waste System discharges must meet National Pollutant Discharge Elimination System (NPDES) permit requirements, which include regular water quality sampling and reporting to the Washington Department of Ecology. Refer to Chapter IV, sections 10 "Water Quality and Hydrology", Section 12 "Floodplains", and Section 16 "Plants and Animals", and Appendices G and P of the EIS for detailed discussions of existing surface water and groundwater quality, floodplains, and stream habitat; potential impacts on these resources; and mitigation measures. Also, the Final EIS contains a discussion of the conclusions of recent groundwater studies and recommended mitigation measures.

WETLANDS

Comment R-14-1: *Several commentors questioned how much wetland would be affected by the proposed improvements and whether impacts would be less if off-site borrow areas were used. These comments were received from Ms. Brown, Mr. Clifford, Mr. Derrick (King County Department of Development and Environmental Services), and the Southwest King County Community Group.*

Response: About 10.4 acres of wetland would be filled or otherwise directly affected by construction of the proposed Master Plan Update improvements, including the proposed new parallel runway. Borrow Area 8 would not be utilized, and wetlands in this area would experience no direct impacts from excavation. The affected area would be decreased by approximately 2 acres if none of the on-site borrow areas were utilized. This value represents all direct wetland impacts that could occur as a result of the proposed airport improvements. See Tables IV.11-1 and IV.11-2 for a detailed listing of wetlands and the direct impacts on them.

Comment R-14-2: *Four groups submitted comments indicating that a wetland at 1000 S. 158th Place S. was not identified in the Draft EIS and sought clarification on the number of wetlands that would be affected by SASA. These comments were received from Mr. Rohlfs (City of SeaTac), Mr. Derrick (King County Department of Development & Environmental Services), Regional Commission on Airport Affairs, and Southwest King County Community Group.*

Response: All wetlands listed in the City of SeaTac's Critical Areas Map, the King County Sensitive Areas Map Folio, and the U.S. Fish and Wildlife Services National Wetland Inventory were included in the impact analysis. Additionally, wetlands were identified in off-site areas by aerial photograph interpretation and visual inspection from public roadways. A visual inspection of the area at 1000 S. 158th Place in the City of SeaTac did not identify any wetlands. Existing wetland inventories, including the City of SeaTac's Critical Areas Map, do not identify a wetland at this location.

__Comment R-14-3:__ *Three commentors stated that wetland impacts outlined in the Draft EIS are inconsistent with those described in the Flight Plan Project Phase III, Working Paper 11. These comments were received from the Airport Communities Coalition, the Regional Commission on Airport Affairs, and the Southwest King County Community Group.*

__Response:__ Wetland areas described in Flight Plan Working Paper 11 represent a general estimate of the total in the acquisition area that might be affected by the proposed new parallel runway at Sea-Tac. It is important to note that the working paper was prepared at a programmatic level (see response to comment R-4-3). The paper does not attempt to quantify area of, or extent of, wetland impacts. Wetland acreage values expressed in the Master Plan Update EIS represent the wetlands for which detailed review occurred including wetland delineations, aerial photograph interpretation, and existing inventory data. Working Paper 11 estimated 100 acres of wetland in the airport area. The EIS identifies almost 150 acres of wetland, with direct impacts affecting about 10 acres.

__Comment R-14-4:__ *Mr. Heavey expressed concern that if off-site borrow sources were used, wetland impacts could result. (Off-site is defined as: lands not owned by the Port of Seattle other than the "on-site" borrow sources, identified as Borrow Areas 1, 2, 3, 4, 5, and 8).*

__Response:__ Imported fill would come from permitted and approved quarry and borrow locations. Wetland impacts associated with these locations have been addressed in the environmental documentation that was required for permitting of the borrow source.

__Comment R-14-5:__ *Mr. Frause and the Southwest King County Community Group asked for clarification of where the Port of Seattle will and will not excavate for borrow material.*

__Response:__ The Port of Seattle has committed to not use Borrow Area 8 as a source of fill for the proposed Master Plan Update improvements. However, as is identified in the EIS, other areas such as Borrow Areas 1, 2, 3, 4, and 5 that may be utilized as borrow sources, as well as other Port owned land in the vicinity of Sea-Tac Airport.

__Comment R-14-6:__ *Mr. Rohlfs (City of SeaTac) requested an expanded analysis of stream and floodplain mitigation.*

__Response:__ The Draft EIS contained a very preliminary concept for mitigating impacts to streams and floodplains. Through additional coordination with the Corps of Engineers and the City of Auburn, a detailed mitigation plan has been prepared and is presented in Appendix P.

__Comment R-14-7:__ *Several commentors stated that wetland mitigation should be done within the basin and disagree with the rationales expressed for conducting mitigation outside the basin. These comments were received from the U.S. Army Corps of Engineers (Corps), Airport Communities Coalition, Mr. Anderson, Mr. Rohlfs (City of SeaTac), Mr. Derrick (King County Department of Development and Environmental Services), Mr. Matthews, Mr. Miedema, Mr. A. Miller (Trout Unlimited), the Osterman family, Ms. Patterson, Mr. Peyton (Ravenna-Bryant Community Association), Regional Commission on Airport Affairs, Ms. Batayola (Seattle Water Department), and Southwest King County Community Group.*

__Response:__ The Port of Seattle is committed to attaining "no net loss" of wetland function or area. Wetland functions such as floodwater attenuation and stormwater storage would be replaced within the basin. Wetland area would be mitigated outside the basin because there are no identified sites within the Miller or Des Moines Creek drainages that could contain the area necessary to compensate for the anticipated impacts. Please see the revised mitigation plan available in Appendix P.

Regarding FAA draft Advisory Circular 150/5200, at the time of preparation of this EIS, it was anticipated that the Advisory Circular will be finalized. These guidelines would recommend that wildlife attractions, including wetlands, within 10,000 feet of runways be removed or otherwise controlled to reduce the risk to the traveling public. A detailed compensatory wetland mitigation plan has been formulated to replace the functions lost or diminished while attempting to ensure a reduced risk to human health, safety, and welfare. Appendix P contains the mitigation plans for the development of compensatory wetland mitigation, as well as the relocation of Des Moines and Miller Creeks.

Comment R-14-8: *Mr. Tate stated that wetland mitigation outlined in the Draft EIS fails to address impacts in the Sea-Tac area.*

Response: The Port of Seattle is committed to attaining "no net loss" of wetland function or area. Due to the developed nature of the airport area, and the 10,000 foot guideline for wildlife attractants, land is not available in the Miller or Des Moines Creek Basins. Wetland functions such as floodwater attenuation and stormwater storage would be replaced within the basin. The wetland function of wildlife habit[illegible]ich has been deemed a hazard to aircraft operations, would be mitigated outside the basin. Plea[illegible] the revised mitigation plan in Appendix P.

Comment R-14-9: *The Southwest King County Community Group asked about the role of regulatory agencies in oversight of wetland impacts.*

Response: The U.S. Army Corps of Engineers has the authority to regulate activities in wetlands under Section 404 of the Clean Water Act. The Washington State Department of Ecology oversees Section 401 of the Clean Water Act. A detailed description of permits required and the responsible agency is contained in the EIS. Also, see response to comment R-1-7.

Comment R-14-10: *Mr. & Mrs. McKinney and the Southwest King County Community Group expressed concern as to whether regulations protecting wetlands were being observed and whether creation of new wetlands is an acceptable action.*

Response: Various federal, state, and local laws regulate activities within wetlands. The Port of Seattle is working with the appropriate jurisdictions to ensure that impacts on wetlands are consistent with all applicable regulations. In addition, the Corps of Engineers (the Federal agency with expertise in the area of wetlands, wetland impacts, and mitigation) has served as a cooperating agency in the preparation of this EIS; see response to comment R-1-7. Wetland creation is considered by regulatory agencies to be an acceptable form of compensatory mitigation for unavoidable impacts.

Comment R-14-11: *The Airport Communities Coalition states that there was insufficient analysis of alternatives to wetland impacts.*

Response: The U.S. Army Corps of Engineers states in their comment letter (August 31, 1995) that the Draft EIS appears to consider a reasonable and appropriate range of alternatives to satisfy Section 404(b)(1) guidelines. The U.S. Army Corps of Engineers would also complete an alternatives analysis before permits to alter wetlands are issued.

Comment R-14-12: *The Southwest King County Community Group requested a listing of the Best Management Practices to be implemented.*

Response: The Best Management Practices most suitable for the proposed action are included in the mitigation plan presented in Appendix P.

__*Comment R-14-13*__: *A number of commentors requested that specific detailed mitigation plans be included in the Final EIS. This comment was received from Airport Communities Coalition, Mr. Rohlfs (City of SeaTac), Regional Commission on Airport Affairs, and the Southwest King County Community Group.*

__Response:__ A site-specific wetland mitigation plan is included as Appendix P of the Final EIS and is summarized on pages IV.11-6 of the Final EIS.

PLANTS AND ANIMALS

__*Comment R-15-1*__: *The Airport Communities Coalition, Ms. Brown, Mr. Rohlfs (City of SeaTac), and the Osterman family expressed concern that the Draft EIS did not provide sufficient analysis of the potential impacts on plants and animals and threatened and endangered species. Specifically, one commentor expressed concern regarding the effects of the proposed airport improvements on bald eagles living near the Airport. This commentor asked if proof of bald eagle use of the Airport vicinity could lead to denial of the proposed improvements or delay of the approval process. Several commentors requested that information regarding bald eagle sightings around Angle Lake be incorporated into the Final EIS. One commentor requested documentation of potential impacts on red-tailed hawks in the study area and identification of measures to mitigate impacts on this species.*

__Response:__ The effects of the proposed airport improvements on bald eagles are presented in Appendix K of the Final EIS. The Biological Assessment documents regular use of the study area and surrounding vicinity by non-breeding resident, migrant, and wintering bald eagles. Therefore, further proof of non-breeding eagle use of the study area would have no effect on the review and approval process for the proposed improvements.

Following publication of the Draft EIS in April 1995, a new bald eagle nest was documented at Angle Lake (east of Sea-Tac Airport). An addendum to the Biological Assessment providing an analysis of potential effects of the proposed airport improvements on the eagle pair at Angle Lake has been presented to the USFWS for review. Final determination of effect from the USFWS of "not likely to adversely affect" was received in December 1995 following review of the Biological Assessment and the addendum. Associated agency correspondence is presented in Appendix A of the Final EIS.

Red-tailed hawks regularly occur in unmanaged grassland and wetland habitats in the study area. A detailed description of these habitats and their associated wildlife species is located in Appendix M of the Draft and Final EIS. Impacts on red-tailed hawks as a result of the proposed improvements include habitat removal, habitat degradation, and disturbance associated with construction. Refer to page IV.16-8 and IV.16-9 of the Final EIS for a more detailed discussion of potential impacts associated with the proposed improvements.

__*Comment R-15-2*__: *The Airport Communities Coalition expressed concern that the threatened and endangered species and critical habitats investigation was too limited in focus and that surveys for several state- and federally-listed threatened and endangered species were not conducted. These species include the pileated woodpecker, great blue heron, northwestern pond turtle, and the northern red-legged frog. The commentor suggested that the Draft EIS did not adequately address the extent of upland habitat impacts and, in turn, did not assess the impacts on threatened and endangered species occurring in these habitats.*

__Response:__ Field studies conducted for the EIS and the Biological Assessment (Appendix K) included habitat surveys for all state- and federally-listed or proposed threatened and endangered species that are known to have the potential to occur in the study area, including pileated woodpecker, great blue heron (not a state or federally listed or proposed threatened or endangered species), northern red-legged frog, and the northwestern pond turtle. Refer to Chapter IV, Section 16 "Plants and Animals" and Section 17 "Endangered Species of Flora and Fauna" and Appendices K and M of the EIS. Habitat impacts are presented on pages IV.16-8 and IV.16-9 of the Draft and Final EIS.

Comment R-15-3: Two commentors requested clarification of study area terminology used in the Draft EIS relative to plants and animals and endangered species. Mr. Peyton (Ravenna-Bryant Community Association) and the Southwest King County Community Group made this comment.

Response: The detailed study area (described relative to biotic resources throughout the EIS) is the 4-square-mile area surrounding the Airport that is bound by Highway 99 to the east, S. 140th Street to the north, SR 509 and Des Moines Memorial Drive to the west, and S. 216th Street to the south. Refer to page IV.16-1 of the Final EIS. Study area boundaries were determined using preliminary site plans to incorporate the proposed Master Plan Update alternatives and their potential impacts.

The study area described in Appendix K of the EIS is defined as the area along the Puget Sound shoreline from approximately 1 mile south of Brace Point to approximately 1 mile north of Salt Water State Park (refer to Appendix K, page K-9). This area was delineated as the study area because it is the closest concentrated bald eagle and peregrine falcon use area to the Airport. The study area included the territory of the only known nesting pair of bald eagles in the vicinity of the Airport.

After completion of the draft Biological Assessment, additional information identifying a new eagle nest in the vicinity of Angle Lake was provided. As is noted, the proposed improvements would not affect the eagle nest at Angle Lake.

Comment R-15-4: The Southwest King County Community Group and Mr. Peyton (Ravenna-Bryant Community Association) stated that the Draft EIS did not address potential indirect impacts on threatened and endangered species occurring in habitats immediately outside the area of the proposed airport improvements.

Response: The only state- or federally-listed or proposed threatened or endangered species likely to regularly occur in habitats surrounding the proposed airport improvements is the red-legged frog. Impacts on red-legged frog populations outside the impact area as a result of construction and operation of the proposed improvements would be negligible and primarily related to increased competition from displaced individuals that may translocate from disturbed areas on the construction site. Bald eagles, peregrine falcons, great blue heron, and pileated woodpeckers occasionally occur in habitats surrounding the area; however, impacts on these species as a result of the proposed improvements would be negligible due to their limited use of the area.

Comment R-15-5: The Southwest King County Community Group stated that several Priority Habitat Areas, as identified by the Washington Department of Fish and Wildlife, are located within the vicinity of the Airport. These areas include wetlands and open spaces located along Des Moines Memorial Drive South and the Miller Creek wetlands complex. The commentor expressed concern that threatened and endangered species have the potential to inhabit these areas.

Response: Field studies conducted for the Draft and Final EIS and the Biological Assessment included habitat surveys for all state- and federally-listed or proposed threatened and endangered species known to have the potential to occur in the study area. The red-legged frog, a federal candidate species for listing as threatened or endangered, was observed in wetland areas and other aquatic habitats throughout the study area, including wetlands associated with Miller Creek. Refer to Chapter IV, Section 17 "Endangered Species" and Appendix K of the Draft and Final EIS for a detailed discussion of threatened and endangered species occurring in the area.

__Comment R-15-6__: Mr. Frause asserted that pollutants that affect fish and aquatic biota must also affect people.

__Response__: The potential impacts of pollutants on water quality and aquatic biota are described in Chapter IV, Section 10 "Water Quality and Hydrology and Section 16 "Plants and Animals" and Appendix M of the EIS. Water quality in Miller and Des Moines Creeks has been degraded by urbanization. Water quality occasionally violates some Class AA water quality standards (e.g., pH, temperature, and dissolved oxygen) and frequently exceeds the fecal coliform bacteria standard. In addition, the concentration of some metals (e.g., copper and zinc) during storm events may occasionally exceed Class AA chronic and acute toxicity standards. As indicated on page IV.10-4 of the Draft and Final EIS, because available data on the concentrations of metals are reported as total metals, and because state water quality standards are based on dissolved ionic forms, it is uncertain whether or not chronic and acute toxicity standards for these metals are occasionally violated. Increases in pollutant loading to these creeks during storms could contribute to violations of Class AA water quality standards (Draft EIS page IV.10-9 or Final EIS page IV.10-13) and have adverse effects on aquatic biota.

Concentrations and constituents of stormwater runoff from the Airport generally are similar to those from other urban areas in the Puget Sound Region. The Port of Seattle is conducting additional studies on water and sediment quality in the receiving environment (i.e., Miller and Des Moines Creeks) to determine stormwater toxicity and relative pollutant contributions from the Airport, as well as to evaluate the conditions of these creeks. Please refer to Sections 10 and 16 of the Final EIS for discussion of potential impacts of pollutants on water quality and aquatic biota.

Potential impacts on people from polluted water depend on the types of pollutants, concentration of pollutants, and the frequency and duration of exposure to pollutants. Low concentrations of pollutants from airport stormwater runoff are present during storm events and high flows. Because there is no ingestion of creek water and little or no contact with stormwater runoff in Miller and Des Moines Creeks, there is little risk of exposure, and potential impacts on people thus are unlikely. Please refer to Chapter IV, Section 7 "Human Health" of the EIS (page IV.7-9 of the Final EIS) for potential impacts on human health. In addition, as described in Chapter IV, Section 7 of the EIS, other potential routes of exposure to pollutants are through consumption of contaminated fish and shellfish or skin contact with contaminated sediments. Neither of these is expected to be a likely route of exposure because: (1) metals and other pollutants generally found in airport stormwater runoff do not bioconcentrate or bioaccumulate, (2) Miller and Des Moines Creeks do not support commercial fisheries, and (3) pollutants in sediments are expected to be at low concentrations and in forms that are bound to sediments and not absorbed through the skin.

__Comment R-15-7__: The Southwest King County Community Group requested additional information on air and water quality and noise impacts on wildlife and threatened and endangered species.

__Response__: Refer to Appendix K of the EIS for a detailed description of potential impacts on bald eagles and peregrine falcons in the study area. Additional text pertaining to noise impacts on wildlife is included on page IV.16-8 of the Final EIS. Refer to Appendix M, pages 8 through 10, for a discussion of water quality impacts on aquatic biota.

__Comment R-15-8__: Ms. Brown asked for an explanation of the impact of the proposed airport improvements on salmon if they are added to the endangered list.

__Response__: Impacts of the Master Plan Update alternatives on coho salmon, cutthroat trout, and other aquatic biota include potential changes in stream flow, water quality, and fish habitat as described in Chapter IV, Sections 10 "Water Quality and Hydrology" and Section 16 "Plants and Animals" and Appendices M and P of the EIS. Potential construction and operational impacts on fish habitat and water quality from the Master Plan Update alternatives would be reduced or avoided by implementation of proposed mitigation, including stormwater management facilities, stormwater pollution prevention plan, erosion and sediment control plans, and the Spill Prevention Control and Countermeasures Plan. The National Marine Fisheries Service has evaluated existing data and determined that none of the Washington coho salmon stocks are threatened or endangered species.

__Comment R-15-9__: Mr. Derrick (King County Department of Development and Environmental Services) expressed concern that the Draft EIS did not adequately address impacts on amphibians as a result of altered wetland hydrology and/or decreased water quality in the study area.

Response: Alterations in wetland hydrology and water quality in the study area as a result of construction and operation of the proposed airport improvements would be minimized or avoided by proposed mitigation, as discussed in Appendices G and P of the EIS. Hydrologic modeling for the proposed improvements indicates no significant shift in flow regimes is expected to occur in the study area. In addition, no stormwater discharge into wetlands is expected to occur. Therefore, impacts on amphibians in the study area as a result of decreased water quality and/or hydrologic alterations are expected to be minimal.

__Comment R-15-10__: One commentor requested identification of unclassified vegetation areas in Exhibits IV.16-1 and IV.16-2. Mr. Derrick (King County Department of Development and Environmental Services) submitted this comment.

Response: Unclassified vegetation areas in Exhibits IV.16-1 and IV.16-2 are developed areas with little or no wildlife habitat value. Such areas include parking lots, roads, and densely populated residential areas.

__Comment R-15-11__: A commentor noted the Draft EIS did not adequately address impacts on wildlife as a result of land use changes and habitat degradation in the proposed airport improvement area. Mr. Rohlfs (City of SeaTac) submitted this comment.

Response: Impacts on wildlife and wildlife habitat as a result of the proposed airport improvements are presented on pages IV.16-8 and IV.16-9 of the Draft and Final EIS.

__Comment R-15-12__: Two commentors suggested that the Port of Seattle make a commitment to restock fish in the affected streams as part of stream mitigation. Comments received from Mr. Frause, Mr. Matthews, and Mr. Peyton (Ravenna-Bryant Community Association).

Response: Comment noted. As mentioned in Chapter IV, Sections 10 "Water Quality and Hydrology" and 16 "Plants and Animals" and Appendix P of the EIS, proposed improvements at the Airport would require relocation of sections of Miller Creek and its tributaries. Prior to creek relocations, the Port of Seattle would require several permits and would have to demonstrate that replacement habitat is as good or better than the habitat that would be affected by Master Plan Update improvements. By creating more complex and diverse habitat types than exist on Miller Creek (see Appendix F of the EIS for description of existing habitat), the conceptual stream relocation plan presented in Appendix P would improve fish habitat compared to existing conditions. This plan was developed in coordination with state and federal regulatory agencies. The Port of Seattle also would consider other mitigation opportunities, such as participating in proposed Trout Unlimited habitat restoration projects.

__Comment R-15-13:__ Mr. Frause requested information on habitat impacts in the area as a result of the proposed airport improvements. Specifically, the commentary inquired about the fate of the areas not characterized as managed grassland.

Response: Refer to pages IV.16-5 through IV.16-7 of the Draft and Final EIS for a detailed description of habitat impacts.

HUMAN HEALTH

Comment R-16-1: *Mr. Bader, Regional Commission on Airport Affairs and the Southwest King County Community Group requested an explanation of the ground crossing movement of aircraft and the potential this may cause for accidents to occur.*

Response: This comment pertains to how aircraft would move from the proposed new runway to the terminal area and the means by which ground collisions can be avoided as the aircraft taxi across the existing runways. In response, it should first be noted that the Air Traffic Control Tower at Sea-Tac is charged with the responsibility of managing safe and efficient aircraft operations, both on the ground and in the air. The operating rules of the ATCT are based on the principle that safety always has precedence over efficiency (or capacity). Adherence to this principle would ensure that the safe movement (taxiing) of aircraft while on the ground would not be adversely affected by the operation of the proposed new runway.

To accomplish this end, the air traffic controllers would hold aircraft taxiing to and from the proposed new runway from crossing the existing runways until it is safe for them to cross; that is, they would ensure that there is a safe time interval between takeoffs and landing on the existing runways before they clear an aircraft to cross. During peak operating periods, this would sometimes require that they sacrifice some capacity of the existing runways to provide enough break in traffic to allow a group of aircraft to taxi across safely. This reduction of capacity is accounted for in the calculations of the total capacity increase resulting from the proposed new runway. This reduction in capacity to permit runway crossing would not be substantial and would not justify the massive landfill requirements and other development costs required to construct a new terminal on the west side of the Airport. See response to comment R-3-23.

Comment R-16-2: *Mr. Bader and Ms. Brown believe that the Final EIS should analyze the probable consequences and frequency of aircraft collisions.*

Response: A review of aircraft accident statistics for Sea-Tac Airport for the past decade shows that no aircraft have collided in flight when operating to or from the Airport in local airspace. Thus, there would be no basis on which to speculate on the probable frequency of collisions and, by extension on the probable consequences of such collisions. The provision of a new parallel runway would enhance overall margins of safety by reducing airspace congestion and controller workload.

Comment R-16-3: *Mr. Buckingham wants to know how runway incursion rates will be affected by the proposed third runway.*

Response: Runway incursion rates are already so low as to preclude reliable statistical projections of how they would change. However, it can be reasonably concluded that the propensity for runway incursions would decrease with the addition of the proposed third runway. This increase in safety margins should occur because congestion on the airfield and in the local airspace, as well as controller and pilot workload, would be reduced as a result of the increase in operational capacity. See response to comment R-3-23.

Comment R-16-4: *Mr. Frause wants to know how airplane fuel spills and fires would be handled in the event of a "seismic shake" and how would the Port responds in the case of severe fires.*

Response: The Port of Seattle ARFF (Aircraft Rescue and Fire fighting) division have prepared emergency response plans for all likely types of emergencies and major disasters involving the Airport and its associated operations. These plans include earthquakes and fires. The emergency response plans would be updated to include the proposed new runway operations, expanded terminal facilities, and other changes to the Airport brought about under the proposed action being assessed in this Final EIS. In the event of a major fire that would require resources beyond those available by the Port, a mutual assistance agreement would enable adjacent local jurisdictions to provide assistance.

Comment R-16-5: Mr. Bader, Ms. Brown and Southwest King County Community Group want to know why the synergistic health effects on humans who were exposed to noise, air pollution, construction impacts and ground water combined were not discussed?

Response: No studies have successfully linked these different sources of pollution from aircraft and other airport operations to an identifiable combined or synergistic effect on humans. Since there has been so little agreement from studies of the health effects of single sources of aviation-related pollutants, as discussed throughout Chapter IV, Section 7 of the EIS, it would appear to be unlikely that researchers would successfully link the combined effects of multiple sources in the foreseeable future.

Comment R-16-6: The Regional Commission on Airport Affairs believes that the list of research submitted should be studied and included in the Final EIS:

Response: The health effects from high noise levels from various sources have been the subject of many studies around the world. Undoubtedly, there are adverse health effects from noise. This EIS summarizes the changes in aircraft and surface transportation noise and identifies how the proposed Master Plan Update improvements would affect noise levels and populations exposed to various levels. The EIS also summarizes the studies of human health effects from noise. Most noise studies do not address health effects specifically from aircraft noise sources. Of the sources that assess aircraft noise, disagreements as to the effects exist. Therefore, this EIS has disclosed the finding of the studies to aid decisionmakers with understanding the impacts. The results of those reviews are discussed in Chapter IV, Section 7 "Human Health".

Comment R-16-7: A commentor noted that on Page IV 7-5 of the Draft EIS, it was stated that " .. some residences would encounter higher sound levels than they might have incurred with the Do-Nothing and others could actually experience lower sound levels." Southwest King County Community Group would like "could" and "higher" to be defined. In addition, the commentor would like to see additional examples of where the lower sound levels would occur. Only one example is given in the area of Southern Heights Park.

Response: The word "could" should be "would". This has been corrected in the Final EIS. The term "higher" can not be more specifically defined, since the statement refers to a wide range of potential changes in noise levels depending upon the time frame, development alternative, and location of the receptor. Specific changes in noise levels for such varying conditions are provided in Chapter IV, Section 1 "Noise Impacts" of the EIS.

Comment R-16-8: Regional Commission on Airport Affairs and Mr. Forrey questioned why the Draft EIS document didn't include the calculation of property values based on the analytical approach developed in the report, The Effect of Airport Noise on Housing Values?

Response: The Booz-Allen & Hamilton study prepared for the FAA (dated September 15, 1994) outlined a viable method of examining the effects of airport noise on housing values at the national level by using an approach referred to as the "neighborhood pair model." A series of studies conducted at Baltimore-Washington International Los Angeles International, and New York LaGuardia and Kennedy International Airports determined that the neighborhood pair model is viable and helps establish the boundaries of the effect that airport noise has on housing values at a given airport. However, Booz-Allen recommended that their approach not be used at this time to determine property values. In the *Summary and Conclusions* section of the report, it was stated that "the magnitude of this impact [of noise on property values] cannot be estimated at the national level at this time, since the results varied across a wide range for the Airports studied, and only a small sample of airports was considered." However, the general findings of this report are within the range of possible impacts presented in Chapter IV, Section 7 "Human Heath" impacts.

<u>*Comment R-16-9*</u>*: Several commentors stated that the Draft EIS is incorrect in its conclusion that there are no significant impacts on property values. Questions include: Why didn't the Draft EIS address the effects of aircraft noise on property values when there have been several studies conducted on this issue? Comments received from Airport Communities Coalition, Ms. Brown, the Glen Acres Homeowners Association, Ms. Hill, Ms. Osborne, Mr. Peterson, the Regional Commission on Airport Affairs, the Southwest King County Community Group, Ms Thomson, Mr., Thompson, and Ms. Thomas.*

<u>Response:</u> The Draft and Final EIS utilized the FAA research on property values provided in a 1985 study as footnoted in Chapter IV of the EIS (*Aviation Noise Effects*). Based on the FAA's review of historical studies, the FAA concluded that property values, as a general rule, might be reduced by approximately 1% per decibel above 65 DNL. As indicated in the statements from commentors, other studies have shown larger decreases in value per unit of noise increase. However, the commentors did not note that other studies have also shown no decrease, specifically studies conducted by real estate appraisers and litigation at Toledo, Cincinnati, and Minneapolis. More specific to the issue at Sea-Tac Airport, recent litigation over nuisance, inverse condemnation, and trespass by residents in the West SeaTac area. The jury failed to award damages to the other plaintiffs. [*Favro et al v. Port of Seattle* (No. C92-1634Z)]. Outcomes of other similar cases include:

<u>Toledo Express Airport (TOL)</u>: Analysis was conducted on properties located within the noise contour which were sold after Burlington Express began night cargo flights at TOL. Based on a review of 60 to 70 properties that sold between 1991 and 1994, there appeared to be no evidence of lost valuation. In fact, of those properties, all appeared to sell for more than the previous sale amount. The recent sale of one home in the direct flight path and within the 65-70 DNL noise contour indicates the same result. The home sold for $73,000 in 1989 and in 1995 it sold for the asking price of $87,500. This home is identified in the latest TOL noise study for an insulation easement option pending FAA approval and funding.

<u>Cincinnati/Northern Kentucky International Airport (CVG)</u>: From 1992 to present, CVG has been in the process of acquiring single-family homes within the 65 DNL noise contour (based on the 1997 noise contours). The appraisal process used for the this acquisition of property included a total of six comparable appraisals (comps) for each parcel. Three of the comps were located within the noise contour and three of the comps were for properties located outside of the noise contour. (The Airport chose this process of using six comparables in order to demonstrate that property located within the noise contours did not have lower market values.)

This process was conducted on approximately 220 parcels. A summary review of each individual parcel and the comparable appraisals showed that there was no diminution of market value for the properties acquired by the Airport.

<u>Minneapolis-St. Paul International Airport</u>: In June 1970, a class action lawsuit was filed against the Metropolitan Airports Commission (MAC) in the Minnesota State Court on behalf of several thousand south Minneapolis property owners. During pre-trial hearings the case was dismissed and sent to the Minneapolis Supreme Court where the opinion of the Court said that it was not proper to litigate this type of case (noise effects on property values) as a class action suit because it was too specific to the individual property owner. (*Ario v. Metropolitan Airports Commission*, 367 N.W.2d 509 (Minn. 1985) (claim of residential market value diminution by aircraft noise).

The case, argued during two trials (the second was a jury trial), both found in favor of MAC. MAC's legal counsel used detailed appraisal data (four comparables were used) supplemented by a computer regression analysis of Minneapolis-St. Paul real estate transactions. This analysis found that there are 12 factors that predict the sale price of a house. Noise was not one of these factors. The principal argument of this litigation ascertained that noise was a factor in south Minneapolis which may have limited the number of people available to buy a particular piece of property, but because of the other amenities there in south Minneapolis, there was always a pool of buyers available to maintain market value.

From the above points it can be concluded that there is a wide range of demonstrated property value effects, depending upon the Airport in question. Litigation at Sea-Tac Airport, in particular, failed to award damages due aircraft noise and the data presented demonstrates increasing property values.

Comment R-16-10: *Regional Commission on Airport Affairs asked why the Draft EIS doesn't discuss the current litigation by the approximately 120 homeowners in Burien, Des Moines and SeaTac against the Port for diminution of property values, loss of quiet use and enjoyment, and trespass of their property?*

Response: The case, litigated in the US District Court of the Western District of Washington, *Favro et al v. Port of Seattle* (No. C92-1634Z), was based upon 12 test cases alleging nuisance, inverse condemnation, and trespass. The jury recently failed to award damages in the test cases that were a part of a much larger consolidated lawsuit. At this point in time, the attorneys for the Port of Seattle are not releasing information about this litigation since it has not yet been determined what would happen with the rest of the lawsuits. The remaining 122 cases are pending and a trial date for these cases has not yet been set.

Comment R-16-11: *The Southwest King County Community Group believes that only one method of measuring noise should be used, particularly in the physiological and psychological sections of the EIS.*

Response: There are two types of noise events that potentially could adversely affect human health: brief noise emissions that could interrupt human activities and, in the extreme, cause actual pain to the listener, and; longer term noise exposure that could result in mental and physical diseases or adversely impact property values. These two types of noise events require entirely different descriptors (single-event metrics versus cumulative noise exposure metrics). As a result, the EIS presents both noise measures.

Comment R-16-12: *Mr. Peyton (Ravenna-Bryant Community Association) questioned if aircraft lights shine through home windows, affecting motorists and blinding pedestrians.*

Response: Lighting associated with the Master Plan Update alternatives is not expected to result in off-airport impacts due to the use of shielding techniques. Lighting emissions are discussed in detail in Chapter IV, Section 7 "Human Health" in the Draft EIS beginning on page IV.7-13 (Final EIS page IV.7-14). As no complaints have been received concerning light emissions from aircraft overflight, none are anticipated with the proposed Master Plan Update improvements.

Comment R-16-13: *The Southwest King County Community Group requested clarification of terms used in describing water quality.*

Response: Existing water quality conditions and potential impacts on surface and groundwater quality are discussed in Chapter IV, Section 10 of the EIS. Potential impacts on human health from exposure to stormwater-borne pollutants are discussed in Chapter IV, Section 7 of the Draft and Final EIS (pages IV.7-9 to IV.7-11). Potential impacts on water quality from the Master Plan Update alternatives would be minimized or reduced by implementation of required mitigation, such as compliance with applicable regulations, including the NPDES permit for stormwater, and IWS system discharges and stormwater management requirements. The levels or concentrations of various pollutants in airport stormwater runoff have been monitored and continue to be monitored by the Port of Seattle. In addition, the Port of Seattle is beginning a stormwater receiving environment monitoring study that would include identification of water and sediment quality, evaluation of stormwater toxicity, and identification of the relative contribution and sources of pollutants. Monitoring locations on Miller and Des Moines Creeks upstream and downstream of the Airport would identify water quality and determine the relative contributions and pollutant sources and relative health of these streams (see Chapter IV, Section 10 of the EIS).

As indicated in Table IV.10-3, concentrations of pollutants observed (e.g., copper, lead, and zinc) in airport stormwater runoff samples are generally in the parts per billion range (e.g., 0.022-0.043 mg/L copper). These concentrations would likely be further reduced or diluted to a few parts per billion or less upon mixing with the receiving waters of Miller and Des Moines Creeks. Therefore, residents living adjacent to these creeks could potentially be exposed to pollutant concentrations on the order of a few parts per billion. As stated in Chapter IV, Section 7 of the EIS, however, residents are unlikely to be exposed to even these low levels of stormwater-borne pollutants because creek water is not used for drinking water, and recreation or contact with water does not occur during such storm flow events.

__Comment R-16-14__: Mr. Bader states that the distribution list omits the National Transportation Safety Board (NTSB).

Response: In accordance with Federal law, the FAA is responsible for ensuring safety within the national airport system. The NTSB does not typically review EISs and, as such, is not listed on the President's Council of Environmental Quality (CEQ) regulations required distribution list. As an official representative of the NTSB did not request a copy of the report, none were provided.

__Comment R-16-15__: Mr. Schuster (Wedgewood Community Council), Mr. Buckingham, Mr. Bader, Ms. Clark, Mr. Scarvie and the Regional Commission on Airport Affairs are concerned about the increased potential for aircraft crashes on or near Sea-Tac and the increased exposure to risk for residents in surrounding communities (e.g., Seattle, Burien, Tukwila, SeaTac, Normandy Park, Des Moines, Kent, Federal Way, Auburn, etc.).

Response: The Port of Seattle, the airlines, and FAA officials responsible for air traffic control and the safe operation of aircraft understand these concerns. Airports such as Sea-Tac are usually located close to or within the cities they serve. Because flights to and from these airports must overfly neighboring populated areas, the FAA has developed aircraft and airport safety standards that have nearly eliminated the likelihood of aircraft crashes into occupied areas. Most of these standards pertain to safe separation between aircraft, resulting in enhanced safety. These separation requirements, in turn, limit the number of operations that can occur to and from each runway during a given time period.

To accommodate higher aviation demand at Sea-Tac Airport while maintaining the same level of operating safety, a new parallel runway is proposed. The proposed new runway would be designed and operated in accordance with the same safety standards that have served the Sea-Tac Airport community well for several decades. Chapter IV, Section 7 contains a detailed discussion concerning the how the accident rate would change in the future, with or without the proposed new parallel runway and other Master Plan Update improvements.

With regard to the development of the runway, the FAA notifies developers of FAR Part 77 limits for development which could obstruct approaches to runways. The FAA would also specify the use of runway protection zones and related building restriction lines areas. These areas represent the locations where the highest incidence of aircraft accidents occur and which should remain free and clear of structures and human habitation. FAA studies have shown that, on average, aircraft accidents occur once in every 1.2 million operations, and that the majority of those accidents occur in the airport's runway protection zones which are within 1,000 feet of the runway ends.

Comment R-16-16: *The Regional Commission on Airport Affairs believes that the Final EIS should discuss the consequences to the ATC system resulting from an increase in the number of larger and faster aircraft interweaving their flight patterns through the airspace of several different airports in the Seattle area.*

Response: Construction and operation of the proposed third parallel runway would not change the types of aircraft capable of operating at the Airport and thus would not affect the size and speeds of aircraft using the Airport. Thus, as aircraft operations would increase whether or not the proposed new runway is built at Sea-Tac, the same interweaving of flight paths of Sea-Tac and other area airports would occur. The FAA would not allow operations to occur in an unsafe manner and thus, has established procedures for sequencing and separating aircraft operating to various airports in the Region.

Comment R-16-17: *Regional Commission on Airport Affairs questioned how many airports have both runway ends aimed at major cities on hills with tall buildings.*

Response: The possible implication by the commentor is that the runways at Sea-Tac Airport point at tall buildings located on nearby hills. In fact, Sea-Tac Airport is located at an elevation of 429 Mean Sea Level (MSL) compared to Puget Sound (sea-level). To the north of SeaTac, ground elevation raises about 125 to 400 feet. The tallest buildings in the area are located in the central business district of Seattle, about 17 miles to the north of the Airport. The tallest is the Columbia SeaFirst Building (1,049 MSL). Aircraft are presently required to be at a minimum of 3,200 MSL while flying near the Seattle central business district when making an ILS approach to Runway 16R. When making a VOR approach to Runway 16R, aircraft need to be at a minimum elevation of 2,000 MSL.

Comment R-16-18: *Mr. Scarvie requests that accident rates and Port liability be included in the executive summary.*

Response: There is always a subjective judgment involved in selecting which material should be placed in the executive summary. In making such decisions, the principal criterion is to avoid making the summary so long that readers would find it overwhelming or confusing. Consequently, executive summaries typically focus on key findings. See response to comment R-2-13.

Comment R-16-19: *Mr. Scarvie requests that the Boeing County Airliner article detailing accident rates by phase of flight be included in the Final EIS.*

Response: Comment noted.

Comment R-16-20: *Mr. Scarvie questioned why the 0.4 per year accident rate would hold at a constant level while the air traffic is projected to increase by 30 percent.*

Response: A review of the number of accidents at Sea-Tac Airport in the past decade (see Final EIS Table IV.7-5), suggests that the anticipated growth in activity would not affect aircraft accidents. However, due to rounding, the influence is not shown; due to such a low historical accident rate, the growth in activity is not expected to substantially increase the risk of an accident. Those data show that there were seven years with no accidents and three years -- 1986, 1989, and 1992 -- with one accident each. During this time period, total annual operations increased 50 percent from 224,052 to 339,459. This would suggest strongly that accident rates are decreasing over time at Sea-Tac Airport.

Comment R-16-21: *The Southwest King County Community Group questioned if the clear zones at the Airport will be of sufficient size to protect people around the Airport.*

Response: Runway Safety Areas (RSAs) are and would be provided for all runway ends to protect aircraft that land short or overrun the runways on landing. Runway Protection Zones (RPZ's) are and would be provided to all runway ends to protect people on the ground where aircraft are at their lowest flight levels. Additional areas of buffer beyond the RPZ's have been and would be acquired for noise abatement, providing collateral benefits of additional safety buffer beyond the FAA standards.

__Comment R-16-22__: Ms. Osborne and Mr. Schuster (Wedgewood Community Council) stated that the Draft EIS failed to consider the potential for fuel dumping. One of the commentors questioned the effects of fuel dumping on health.

__Response:__ Aircraft arriving and departing Sea-Tac do not regularly dump fuel; only in extreme emergency conditions is fuel jettisoned. Occasionally residents perceive that the streams seen from the aircraft on takeoff as fuel leaking or dumping. These vapors are exhaust emissions and water vapor trails from wings moving through air. Fuel dumping only occurs in extreme emergency situations, when an aircraft can not land safely with the amount of fuel onboard. It is rarely done and, when done, is usually accomplished away from the Airport at higher altitudes where the fuel would evaporate before reaching the ground. As the fuel evaporates before reaching ground no adverse health impacts would occur. See response to comment R-10-9.

__Comment R-16-23__: Mr. Bader notes that the Human Health section indicates that six factors were assessed, but only five were discussed -- fuel spills were not discussed.

__Response:__ The reference to the sixth factor was a typographical error. During early drafts of the Draft EIS, this section contained a discussion of impacts from fuel spills. As this material was already presented in Chapter IV, Section 10 "Water Quality and Hydrology", it was removed from Section 7 "Human Health", yet the reference was not corrected. The Final EIS contains a corrected reference in Section 7.

__Comment R-16-24__: Mr. Bader and Regional Commission on Airport Affairs believes that OSHA noise standards are not an acceptable measure for safety for residents in the Sea-Tac area.

__Response:__ As is indicated in the EIS, there are no sound level standards for aircraft overflight noise levels. However, the Occupational Safety and Health Administration (OSHA) has established workplace noise level standards to protect the health and welfare of workers. The context in which the OSHA standards are discussed in the EIS relates to the potential for auditory damage to humans. This is a physiological effect of noise that occurs irrespective of the affected individual's attitude toward the noise source.

__Comment R-16-25__: Mr. Bader and Mr. Benedum (Highline Community Hospital) would like the Port or FAA to commission an independent epidemiological health risk assessment to study birth defects and cancer in communities near the Airport.

__Response:__ An independent epidemiological health risk assessment would entail long-term investigations at numerous airports over a long period of time, perhaps as long as two or three decades. Such a study is beyond the capability of the Port of Seattle and could not be accomplished in time to assist in the decisions being assessed in this Final EIS. Instead, the FAA and the Port rely on published research findings, as interpreted by other studies for the Federal government.

__Comment R-16-26__: Regional Commission on Airport Affairs stated that the Draft EIS misquotes the finding of the Federal Agency Review of Selected Airport Noise Analysis Issues (FICON) by inferring that FICON concluded that noise-related health effects are so low that they cannot be related to the satisfaction of the research community.

__Response:__ The statement from FICON as it was quoted in the text of the Draft EIS is "In spite of years of study attempting to isolate the effects of airport noise on humans, the impacts appear to be so low that they cannot be related to the general satisfaction of the research community, particularly for noise levels below DNL 70." Although it was not quoted in the Draft EIS, FICON goes on to state "the issue of whether significant non-auditory health effects results from aircraft noise still remains and requires additional research." The second quotation has been added to the Final EIS to clarify the paragraph.

__Comment R-16-27:__ Regional Commission on Airport Affairs requested clarification of what original research has been done by FICON.

__Response:__ The Federal Interagency Committee on Noise (FICON) was formed in December 1990 with the basic charter of reviewing specific elements of the assessment of airport noise impacts contained in documents prepared in pursuant to the National Environmental Policy Act (NEPA) and to Federal Aviation Regulation (FAR) Part 150, and to make recommendations regarding potential improvements to that process. FICON was composed of representatives from the Department of Transportation, Defense, Justice, Veterans Affairs, Housing and Urban Development; the Environmental Protection Agency; and the Council on Environmental Quality who coordinated their input from within their respective agencies. FICON conducted no original research. Their activities were confined to the review of existing research in the field of aircraft noise exposure.

__Comment R-16-28:__ The Southwest King County Community Group believes that the Final EIS should report on current American research into the effects of noise, air quality, water quality, fuel spills, radio transmissions and light emissions, and safety."

__Response:__ The EIS, Chapter IV, Section 7 "Human Health", provides a review of recent, published research into the health effects of these pollution sources.

__Comment R-16-29:__ The Southwest King County Community Group and Mr. Thompson believes that the Draft EIS should state that loss of sleep leads to emotional problems such as depression, fatigue, and irritability which in turn can lead to hyper tension, alcoholism, heart attacks, sclerosis of the liver, increased use of tranquilizers and violence.

__Response:__ References to the effects of sleep deprivation have been added to Chapter IV, Section 7 of the Final EIS.

__Comment R-16-30:__ On page IV 7-4, column 2, paragraph 3 of the Draft EIS it is stated that "Recent comparisons of appreciation rates for residential property near Sea-Tac to properties in comparable areas located away from the Airport and to the average appreciation for King County properties, found no impact attributable to proximity to Sea-Tac." The Southwest King County Community Group and Regional Commission on Airport Affairs questions where the studies and research was performed for this comparison.

__Response__: A study contained in the *Sea-Tac Airport Vicinity Land Use Inventory Project* analyzed the relationship of assessed values of noise-impacted and non-noise-impacted parcels to potential airport noise effects on property values, the rate of property value increase, and the magnitude of the effect. For the study, a limited sample of 32 residential, 6 commercial, and 4 industrial parcels were chosen; the parcels chosen were evenly distributed in areas surrounding the airport.

The study found that for residential parcels, the average yearly rate of increase in assessed value for the sample noise-impacted properties was not appreciably different from the average percent increase of the comparable non-noise impacted neighborhood for the 30-year period. The commercial/industrial parcels showed no adverse effect of aircraft noise on assessed property values; noise-impacted commercial properties appreciated an average of 0.3% more per year than non-noise-impacted commercial properties, and noise-impacted industrial parcels appreciated 3.8% more per year than non-noise-impacted industrial parcels. The study concluded that neither the existence nor the magnitude of any general effect on rates of appreciation of property values from airport noise was demonstrated.

In addition, in February 1995, claims of 12 plaintiffs alleging inverse condemnation, nuisance, and trespass were tried before a jury in Federal District Court. The jury awarded no damages. Similar claims of other plaintiffs still are pending.

Comment R-16-31: *Southwest King County Community Group stated that the Seattle area is not a cold climate; thus, residents are outside throughout the year. They indicated that interior insulation does not help people who are outside.*

Response: The commentor's concern applies to virtually all areas of the country. Interior noise insulation only deals with activities carried on in the home and leaves the outdoor areas of the property unmitigated. In that respect, while the Puget Sound Region is known for its desirable outdoor activities character, the Seattle area is more typical of colder-climate areas, during 4-6 months of the year, evening and night temperatures average at or below 50 degrees.

Comment R-16-32: *Regional Commission on Airport Affairs and Southwest King County Community Group questioned why the issue of real-estate values were discussed in the human health section of the Draft EIS rather than in the section dealing with socio-economic impacts?*

Response: According to DOT/FAA Order 5050.4A *Airport Environmental Handbook* paragraph 47e(4) and paragraph 85d the discussion of induced socioeconomic impacts is to include shifts in patterns of population movement and growth, public service demands, changes in business and economic activity to the extent influenced by the airport development, effects on regional growth and development patterns, spin-off jobs created, and induced impacts on the natural environment.

The human health section of the EIS presented issues associated with impacts to human health from noise, air pollution, water pollution, fuel spills, radio transmissions and light emissions, and accidents. As discussed earlier in this section, the Final EIS found no demonstrable link between aircraft noise levels and property values. However, rather than omit the information, the EIS recognizes the potential for stress on local residents who fear that there would be adverse impacts. Therefore, the discussion of property value impacts was addressed in the noise impacts section of Chapter IV, Section 7, Human Health.

Comment R-16-33: *Most of the graphics in the Draft EIS do not show Federal Way, the third largest city in the county and the sixth largest city in the state. Mr. Priest questioned why the Draft EIS does not address the potential noise impacts, health impacts, congestion, and property values in this community from the third runway.*

Response: The northern portion of Federal Way lies within the generalized study area and, as a result, is shown on all graphics that depict noise and land use patterns. In response to public comment, additional exhibits were added to Appendix C (Exhibits C-22 and C-23) to show the INM assumptions for flight tracks further away from the Airport. In addition, other impacts described in the EIS that affect the overall Region, also include impacts to municipal jurisdictions such as Federal Way; these regional impacts include social and induced socio-economic impacts. In addition, construction hauling from sites south of Sea-Tac Airport would likely use I-5 to transport material to the construction site. Federal Way and other southern cities are shown in Appendix J relative to possible haul routes.

Comment R-16-34: *Southwest King County Community Group would like to know what is the exact number of homes in the new flight path of the third runway.*

Response: There is no way to quantify the number of homes "in the flight path" to an airport because the flight path is actually an indefinite, general path taken by a preponderance of aircraft. The generalized flight tracks used to graphically portray average paths to an airport are helpful in illustrating where the aircraft normally fly, but they do not provide finite boundaries for quantitative analysis.

Noise impacts of the proposed runway, on the other hand, can be quantified in accordance with DOT/FAA Order 5050.4A *Airport Environmental Handbook* paragraph 47e and paragraph 85a(1)(3), which is based on the number of houses identified within the 65 DNL noise contour (a finite area) experiencing a significant increase in noise due to the proposed new runway.

Comment R-16-35: Ms. Brown questioned why the Draft EIS documentation is inconsistent in its discussion of property value impacts. She requested that the inconsistencies between the statement in Chapter IV page 7-4 that there is no change in property value when assessing economics and the statement in Chapter IV page. 7-5, "noise property value related stress" will continue upon implementation of the third runway be clarified.

Response: The two statements are shown below, as they appear in Chapter IV of the Draft EIS:

- Page IV.7-4 - "Recent comparisons of appreciation rates for residential property near Sea-Tac to properties in comparable areas located away from the Airport and to the average appreciation for King County properties, found no impact attributable to proximity to Sea-Tac."
- Page IV.7-5 - "To assess one element of stress, a worst case evaluation of property value impact was performed. This assessment was based on the assumption of 1 percent decrease in property value per DNL over 65 dBA. As discussed earlier, this overstates the impact of noise at Sea-Tac on property values. As is shown in Table IV.7-1, noise exposure would increase to some residences with the "With Project" alternatives and decrease to others. Thus, it is anticipated that airport noise property value related stress would continue in the future upon implementation of the Master Plan Update alternatives."

There is no contradiction between the two statements. The first describes the result of recent comparisons of property values in King County, near and far from the Airport, which fail to demonstrate a measurable adverse impact of aircraft noise on property values locally. The second acknowledges that property owners around airports perceive that noise impacts their property values, a perception which, in the presence of increased noise impacts, creates emotional stress. The 1% rate of reduction of property value is a potential worst case illustration based on the findings of *Aviation Noise Effects*, referenced in Chapter IV, Section 7, shown to illustrate the potential level of stress that might be created, either in fact or only perceived.

Comment R-16-36: Ms. Osborne and Mr. Rohlfs (City of SeaTac) questioned how changes in flight patterns will affect the property values of communities located in Southeast Seattle on the western side of the Airport and have these changes been addressed through analysis in an EA/EIS process?

Response: See response to comments R-16-8, R-16-9, R-16-30 and R-16-32. Some studies of noise effects on property values have shown that aircraft noise may decrease the value of residential property located around airports; however, other valuation studies by real estate appraisers have shown no decreases in value.

Comment R-16-37: Southwest King County Community Group would like to know what is the definition of "slight" when explaining that airport noise has only a slight impact on property values?

Response: A "slight" impact on property values was meant to include reductions of approximately 1 percent (or less) decrease per decibel above 65 DNL. According to the research cited in the Draft and Final EIS (page IV.7-4), the decrease in property values was calculated for two study groups and ranged from 0.6 to 2.3 percent per decibel increase of cumulative noise exposure and a mean of 0.8 percent devaluation per decibel change in DNL. The study summarized the results by concluding "The bottom line is that noise has been shown to decrease the value of property by only a small amount -- approximately 1 percent decrease per decibel (DNL)."

<u>Comment R-16-38</u>: *Why did the Draft EIS cite property value information from studies that are 20 to 30 years old rather than current information? Comments received from Regional Commission on Airport Affairs and Southwest King County Community Group.*

<u>**Response:**</u> The review of research on property values is provided in a 1985 study from the FAA Office of Environment and Energy as footnoted in the Draft EIS. This study was used as the primary reference in the Draft and Final EIS for two reasons: it references research conducted in the 1960's when the impact from aircraft noise was greater as jet aircraft first entered the fleet and it includes a comprehensive review of a large number of published studies. A recent study, published in 1994 by the FAA found results similar to these earlier studies.

ENERGY AND NATURAL RESOURCES AND HAZARDOUS MATERIALS

<u>Comment R-17-1</u>: *Commentors request that the Final EIS discuss the potential relocation, or abandonment, of electrical distribution lines; provide additional analysis of electrical power and gas use; and identify the location and impacts of the switching station and substation. Comments of this nature were received from Ms. Mulder (Seattle City Light) and the Southwest King County Community Group.*

<u>**Response:**</u> As discussed on page IV.18-5 of the Draft and Final EIS, the extent of off-airport abandonments depends on the final acquisition area. However, the Final EIS notes that the extension of Runway 16L/34R could affect Seattle City Light (SCL) electrical distribution lines. If this runway were extended, SCL's 26 kilovolt electrical distribution lines located along South 154th Street and South 156th Way may need to be relocated.

As discussed on page IV.18-4 of the Draft and Final EIS, public services and utilities provided by nearby cities and others would be affected slightly by changing airport demands. There would be little impact on off-airport services either from displacement or interruption in public services. No significant impacts are anticipated; therefore, further analysis of public services and utilities is not necessary.

The final location for the switching station and substation would be determined during the final design phase. No significant impacts are anticipated; therefore, further analysis is not necessary.

<u>Comment R-17-2</u>: *The Southwest King County Community Group requested that the fuel usage in BTU's be translated into gallons.*

<u>**Response:**</u> The aircraft operations forecast indicates a growth of 30 percent between 1993 and 2020. Based on the growth in aviation demand and activity levels, the future fuel use in gallons was calculated and is provided for Alternatives 1 through 4 in the EIS in Table IV.22-1. The aircraft fuel consumption in millions of gallons is listed for the years 1994, 2000, 2010, and 2020.

<u>Comment R-17-3</u>: *Mr. Schneider and the Southwest King County Community Group questioned the projected growth in electrical usage.*

<u>**Response:**</u> Future electrical usage was determined to increase 24 percent over existing levels by the year 2020 in Alternative 1, and increase by 65 percent over the Alternative 1 (Do-Nothing) usage for Alternatives 2 through 4 ("With Project"). As is stated in the Draft and Final EIS "sufficient capacity exists in the existing utility supply network to accommodate the increased energy consumption by airport facilities, with or without additional airport development". Therefore a new substation is not expected to be needed to handle future electrical needs.

<u>Comment R-17-4</u>: Mr. Burke asked for an explanation of the differences between jet fuel and auto fuel.

<u>Response:</u> Based on information from the Environmental Protection Agency, auto gas is presently filtered for low particulate emissions which are found in relatively high concentrations in jet fuel. There are, however, certain "carcinogenic chemicals" present in auto gas that are comparatively in lower amounts in jet fuel. Auto gas contains higher levels of Benzene, and 1-3, Butadiene where jet fuel contains a higher level of particulates. These higher levels of Benzene and Butadiene make auto fuel much more volatile than jet fuel. Both the Benzene and 1-3, Butadiene, and particulate emissions have been determined to possess the capability to incur carcinogenic effects on humans. Particulates, in particular, have been linked to, or is known to possibly result in cancer, asthma, lung-related deaths, and cardiac problems. See also response to comment R-10-3.

<u>Comment R-17-5</u>: The Southwest King County Community Group questioned where the additional fuel required for increased airplane activity will be stored. The commentor also wanted clarification on the number of fuel tanks Delta Airlines operates. Finally, the commentor wanted additional information about the Olympic Pipeline tank farm - how the tanks are filled, and what safeguards are employed to guard against leaks and spills.

<u>Response:</u> Clarification of the number of fuel storage and other aboveground and underground storage tanks and who is responsible for those tanks is provided in the Draft and Final EIS on pages IV.21-2 and IV.21-3. Additional information on the Olympic Pipeline storage tanks is included in the Draft and Final EIS in on pages IV.21-3 and IV.21-4.

<u>Comment R-17-6</u>: Mr. Frause and Ms. Bittenc had several questions regarding hazardous substances at the risk sites identified in the Draft EIS. These questions concerned the kinds of hazardous substances, how they are handled and treated, who is responsible for them, who is the emergency responder, and the likelihood of environmental contamination from hazardous substances at the risk sites. The commentor also wanted clarification as to which sites were the responsibility of the Port of Seattle.

<u>Response:</u> The Draft EIS does not specifically identify all types of hazardous materials and waste used or generated at the Airport or the off-airport properties; in accordance with NEPA and SEPA, the EIS addressed only those substances that would be affected by the proposed Master Plan Update improvements. In general, these types of hazardous materials and waste used or generated on-airport include petroleum products such as fuels and lubricants, solvents, PCBs, and metals. They exist as both solids and liquids, and some may be explosive or flammable. Hazardous materials used at the Airport are manufactured off-site. Handling and treatment of these substances varies, and depends on specific materials involved.

"In the vicinity" refers to sites outside Port of Seattle owned and operated properties on and adjacent to the Airport. The Port of Seattle is not responsible for activities and waste on properties they do not own or operate. Local fire departments would be responsible for emergency response to properties off the Airport. The locations of these properties are identified in Table IV.21-1 and in Exhibit IV.21-1.

Suspected or confirmed hazardous materials and waste constituents for each site were not listed in the Draft EIS. The Final EIS provides an additional table (Table IV.21-2) containing a list of contaminants (by general category as presented in the Washington State Department of Ecology's *Toxic Cleanup Program Site Information System Confirmed and Suspected Contaminated Sites Report*) for each site identified in Table IV.21-1.

The Draft and Final EIS states in Chapter IV, Section 21 that a Construction Hazardous Management and Contingency Plan would be developed to outline procedures for removal, storage, transportation, and disposal of known hazardous wastes encountered during construction activities. Implementation of construction best management practices and procedures outlined in the aforementioned plan would minimize the chance of, but would not guarantee prevention of, hazardous materials being introduced to the environment.

Comment R-17-7: *The Southwest King County Community Group wanted clarification on the costs and time required to clean up environmental contamination resulting from the underground fueling system at Sea-Tac Airport and proposed locations of new underground storage tanks needed as a result of the proposed project.*

Response: Groundwater contamination from leaking underground fueling systems is addressed in Chapter IV, Section 10 "Water Quality and Hydrology" of the Draft and Final EIS. Additional information is provided in the Final EIS to more thoroughly describe the existing underground fueling system related contamination, its severity, and ongoing efforts to remediate it. Future fuel storage strategies and locations.

Comment R-17-8: *The Southwest King County Community Group indicated concern with the presence and status of leaking and other underground storage tanks on Port of Seattle property on and in the vicinity of the Airport. Also of concern was their impact on the aquifer.*

Response: Clarification of the number of fuel storage and other aboveground and underground storage tanks and who is responsible for those tanks is provided in the Final EIS in Chapter IV, Section 21 "Hazardous Waste" in the applicable subsections. Residential underground storage tanks have been removed from all properties acquired by the Port of Seattle as part of its Noise Reduction Program (NRP) since approximately 1990. These properties include the areas formerly known as Riverton Heights and Marine View Estates. Prior to 1990, residential fuel storage tanks in NRP buyout areas were left in place.[15/] Groundwater contamination from leaking underground fueling systems is addressed in Chapter IV, Section 10 "Water Quality and Hydrology of the Draft and Final EIS. Additional information is provided in the Final EIS to more thoroughly describe the existing problem and ongoing efforts to remediate it.

Comment R-17-9: *A commentor questioned whether litigation is pending concerning the Port's handling of hazardous waste. This comment was received from the Southwest King County Community Group.*

Response: Please see response to comments R-13-11 regarding pending litigation concerning a citizen clean water act suit for alleged violations of the Port's NPDES permit.

Comment R-17-10: *A commentor had several questions related to the use of the burn pit at the Airport for firefighter training, and the use of contaminated fuels and fire foam at the burn pit. These comments were received from the Southwest King County Community Group.*

Response: Information on the use of the fire pit to burn contaminated fuel, and the disposition of fire foam used for training exercises, is included in Chapter IV, Section 21 "Hazardous Waste" of the Final EIS. The Port of Seattle Fire Department has conducted, until 1995, annual fire fighting training at the burn pit located near the southwest corner of the Airport. Typically, such training occurs over a three-night period during November. Use of the burn pit was suspended during 1995. A facility at Moses Lake, Washington, is planned to be used in 1996, and a permanent fire fighter training facility at North Bend, Washington is anticipated to be in use in 1997.

[15/] Personal communication with Earl Mundy, Port of Seattle, September 7, 1995.

__Comment R-17-11__: *The King County Community Group requested clarification on the presence of, or the potential for, contamination at the SASA and new runway area. This commentor also wanted clarification on the purpose of the concrete batch plant.*

__Response__: Appendix L of the Draft and Final EIS contains a detailed environmental site assessment for the proposed new runway development area. As part of the Final EIS for the South Aviation Support Area, an environmental site assessment was conducted and is included in the Master Plan Update EIS by reference.

The concrete batch plant is an existing facility, located northwest of the existing runways and immediately north of S. 154th Street, that is used to mix concrete when concrete repair work is required at the Airport.

__Comment R-17-12__: *A commentor believed there was an inconsistency regarding the presence of contamination at a site (Sunset Park/Tub Lake Dump) and the use of that site as part of the North SeaTac Park. The commentor wanted to know if the Port of Seattle was the owner of the site, and if so, for how long, and who was responsible for any groundwater contamination resulting from contaminants located there. The commentor also questioned the appropriateness of using a park site as a borrow source. These comments were received from the Southwest King County Community Group.*

__Response:__ The status of the Sunset Park/Tub Lake dump site is summarized in Chapter IV, Section 21 "Hazardous Waste" beginning on page IV.21-7 of the Final EIS. North SeaTac Park is administered and is being developed by the City of SeaTac on land leased to the City by the Port of Seattle. North SeaTac Park is outside the areas being considered as borrow source sites. The Sunset Park/Tub Lake Dump site is located on property owned by King County. King County is responsible for any environmental contamination resulting from their activities at this location, including leaked fuel from underground storage tanks. Other contaminates identified at this location were the result of dumping by the military during World War II.

__Comment R-17-13__: *The Southwest King County Community Group stated that the EIS should contain the "exact plan" for addressing hazardous materials at the Airport.*

__Response:__ The Port of Seattle is in the process of developing a fuel and hazardous substances spill control plan to address hazardous materials issues at Port of Seattle-run facilities at Sea-Tac Airport. A pollution prevention plan also has been prepared for Port-related airport activities (*Sea-Tac International Airport Pollution Prevention Plan*). These plans are expected to be updated periodically to reflect changing conditions at the Airport. Airport tenants are responsible for developing and keeping current equivalent plans and policies for their activities at the Airport.

__Comment R-17-14__: *Mr. Derrick (King County Department of Development & Environmental Services) stated that, "We assume the Port of Seattle is working with the Washington State Department of Ecology to mitigate these concerns (impacts to the shallow and intermediate aquifers and potential for contaminated fill under existing runways) and encourage adjacent property owners not to cause impacts to the Port of Seattle's property."*

__Response:__ Comments noted. Please see responses to comments R-13-5, R-13-9, and R-13-21B.

***Comment R-17-15**: Mr. Derrick (King County Department of Development & Environmental Services) noted that Table 1 (Risk Sites) in Appendix L of the Draft EIS does not include all the suspected contaminant sites listed for the Airport in Ecology's Toxic Cleanup Program Confirmed and Suspected Contaminated Sites Report.*

Response: As shown in Figure 2 of the Draft and Final EIS, Appendix L, that ESA covered only the area affected by placement of the third runway, immediately west-northwest of the Airport. A separate ESA was performed for the SASA property as part of that Final EIS, and is included by reference in the Master Plan Update EIS. Other Sea-Tac Airport sites were not listed because they did not fall within the search radius of the agency database search.

***Comment R-17-16**: Ms. Batayola (Seattle Water Department) stated that the Energy and Natural Resources analysis should reflect the conservation efforts underway for water usage.*

Response: Comments noted. The water consumption analysis presented in the Final EIS reflects a conservation plan, which is included in Appendix Q-A.

MISCELLANEOUS

***Comment R-18-1**: The Regional Commission on Airport Affairs indicated that Sea-Tac is part of the overall air transportation system. As part of the system, they questioned how many airports have 3 parallel runways and how the improvements identified for Sea-Tac compared to improvements that are planned at other airports in the country.*

Response: After publication of the Draft EIS in April 1995, the Federal Aviation Administration published an Update to the National Plan of Integrated Airport System (NPIAS). The 1995 NPIAS indicates that there are 3,294 existing airports in the United States, 415 of which are classified as primary commercial air carrier airports. In addition, the Federal Aviation Administration publishes annually a summary of the actions that the Federal Aviation Administration and airport operators have available to improve the capacity of the National Air Transportation System; the Aviation Capacity Enhancement (ACE) Plan. The ACE Plan identifies the causes and extent of capacity and delay currently experienced in the system and outlines various planned and ongoing FAA projects which have the potential to reduce the severity of the problem. The Regional Commission on Airport Affairs also asked about safety at these airports. Safety issues at other airports was not evaluated in this EIS as it is not relevant. As has been discussed, the FAA has determined that a new parallel runway at Sea-Tac can be operated safely.

Based on the findings of these reports, **Table R-12** lists the improvements planned for the busiest airports in the country:

Comment R-18-2: *A number of comments were received which indicated a concern for the quantity of funds that would be necessary to complete the runway and other improvements. The comments focused on whether or not the taxpayers would pay for the improvements, and how funds would be derived. Comments concerning the financing of the Master Plan Update improvements were received from: Ms. Brown, Ms. Bonney, Mr. Bullard (Queen Anne Community Council) Mr. Forrey, Mr. & Mrs. Matthews, Mr. Peyton (Ravenna-Bryant), Regional Commission on Airport Affairs, Regional Commission on Airport Affairs, Mr. Scarvie, Ms. Schreier, Ms. Springer, Mr. Tate, Mr. Wagner, Mr. Vaa, and the Southwest King County Community Group. Ms. Brown indicated that the Master Plan Update does not meet the requirements of the Washington State Environmental Policy Act (SEPA) concerning economically practical.*

Response: As is shown in the Draft and Final EIS, implementation of *all* of the improvements identified in the Master Plan Update could cost approximately $1.5 billion (Final EIS page II-43). This includes the following elements:

- Land Acquisition - $82-147 million
- New Parallel Runway, runway extension, runway safety areas and taxiway improvements - $280-429 million
- Terminal facilities - $ 681 million
- Roadway improvements - $264 million
- Other landside improvements - $74 million

As is noted in Chapter II, the Port of Seattle anticipates the use of Federal funds derived from the Aviation Trust Fund to complete eligible improvements, as well as the use of Passenger Facility Charges, fees from airport tenants, and airport revenue bonds. Comments concerning the Draft EIS indicate that residents are concerned that funds collected from local residential real property taxes would be used. While the Port of Seattle collects revenues from the King County tax levy, none of these funds are currently used at Sea-Tac Airport, and none are anticipated to be used in completing the proposed Master Plan Update improvements.

The Port has evaluated the cost of the improvements and determined that the improvements are financially feasible using airport revenue sources. One measure of financial feasibility is cost per enplaned passenger (CPE). A comparison of the CPE at Sea-Tac to other commercial airports is shown below. Currently, the cost of maintaining and operating Sea-Tac results in a $6.13 cost per enplaned passenger. Implementation of the Master Plan Update could increase the CPE in any one year to under $11. In comparison, the annual cost per enplanement at other airports is as follows:

Airport	Cost per Enplanement
Detroit Metro (1994)	$ 5.14
Sea-Tac	$ 6.13
San Jose (1994):	$ 7.67
Orlando (1994)	$ 8.51
Chicago O'Hare (1994)	$ 8.85
Miami International (1995)	$ 8.94
Pittsburgh (1995 estimated)	$11.18
Honolulu	$11.64
New Denver International:	$18.15

Some commentors indicated that the increased costs from implementing the proposed new parallel runway (and other Master Plan Improvements) would increase landing fees to airlines such that aircraft operations would decrease. The cost per enplanement reflects the cost of all improvements and maintenance. As is shown above, the costs are not above the cost per enplanement at several other airports, and thus would not result in reduced aircraft operations upon completion of the improvements.

TABLE R-12
COMPARISON OF 25 BUSY AIRPORTS

Airport	1994 Aircraft Operations	Number of Run-ways	Does the Airport Have 3 Parallel Runways	Total Acres	Planned Improvements	NPIAS Listed Cost of Improvements (Thousands)
Chicago - O'Hare (ORD)	883,062	6	No	7,000	No plans underway - State is examining a new airport	269,006
Dallas-Forth Worth (DFW)	840,405	6	Yes	18,000	Extending existing close in parallels to 13,400 feet. Environmental approval for new East and West parallels , estimated cost of 1 runway - $340 million.	405,050
Atlanta - Hartsfield (ATL)	715,920	4	Yes	3,750	New general aviation runway in under consideration	487,203
Los Angeles (LAX)	689,888	4	Yes	3,500	Master Plan currently underway	103,363
Miami (MIA)	557,680	3	No	3,300	New carrier Runway 8,600 feet, 800 feet north of existing Runway 9L/27R, estimated cost of $170 million.	325,462
Denver Internat. (DIA)	530,839	5	Yes	33,900	A second future phase proposes the construction of up to six more runways upon demand	454,222
Las Vegas (LAS)	495,940	4	No	2,820	No runways planned, existing runways being improved.	51,579
Phoenix (PHX)	490,015	2*	No	2,232	A new 9,500-foot third parallel Runway 7/25 is under construction. An extension of Runway 8L/26R is under consideration	154,143
Oakland (OAK)	472,810	4	No	2,500	A runway extension is under consideration.	21,154
Boston - Logan (BOS)	470,318	4	No	2,400	A new uni-directional commuter runway(Runway 14/32) , an extension of Runway 15L/33R to 3,500 feet, and a 400 foot extension of runway 9 are being studied	638,183
Charlotte/Douglas (CLT)	462,994	3	No	5,000	Plans are to open a third parallel 8,000 foot runway west of Runway 18R/36L in 1999. Also a fourth parallel runway east of 18L/36R is being studied.	99,193
Minneapolis-St, Paul (MSP)	454,723	3	No	3,005	Taxiway improvements to recent extension to Runway 4/22 expected to be completed by late 1996.	258,660
Pittsburgh (PIT)	442,376	4	Yes	10,000	None anticipated	235,750
Newark (EWR)	436,686	3	No	2,027	None anticipated	1,070,548
San Francisco (SFO)	422,190	4	No	5,400	None anticipated	209,391
Philadelphia (PHL)	402,984	3	No**	2,200	A new 5,000 foot parallel commuter Runway 8/26 has been proposed estimated cost $215 million.	471,257
Salt Lake City (SLC)	392,570	4	Yes	6,781	Completed construction of a new 12,000 foot runway parallel estimated cost $120 million.	112,931
Honolulu (HNL)	359,569	4	No	4,480	Not available	1,369,471
Houston Intercont. (IAH)	355,694	4	No	9,000	Extension to Runway 14R/32L to begin in 1996. Work on a $44 million new Runway 8L/26R to begin in 1997. New Runway 9/27 is also planned, estimated cost $44 million.	53,924
Seattle-Tacoma (SEA)	**353,052**	**2**	**No**	**2,500**	**New parallel runway with a length up to 8,500 feet being considered**	**439,868**
Memphis (MEM)	349,338	4	Yes	900	New Runway 18E/36E under construction - estimated cost $88.8 million. An extension of Runway 18L/36R is expected to start in 1997 at a cost of $58 million.	246,260
J.F. Kennedy (JFK)	343,252	5	No	4,930	N/A	309,528
La Guardia (LGA)	337,737	2	No	662	N/A	126,986
Orlando (ORL)	337,573	4	Yes	14,672	Runway 17L/35R under construction is expected to be operational in 2000 estimated cost $115 million.	596,461

* An additional runway is under construction as this table was being prepared

** A new runway, currently approved, would create 3 parallel runways

Area - Based on phone calls to the airports identified above, Port of Seattle, August 1995

Ms. Brown indicated concern that the project, and its mitigation would not be practicable under WAC 11-440 (6),c, iv and 197-11-660 (2) which state:

> 197-11-440: "(iv) Indicate what the intended environmental benefits of mitigation measures are for significant impacts, and may discuss their technical feasibility and economic practicability, if there is concern about whether a mitigation measure is capable of being accomplished."
>
> 197-11-660 "states "Decisionmakers should judge whether possible mitigation measures are likely to protect or enhance environmental quality. EISs should briefly indicate the intended environmental benefits of mitigation measures for significant impacts (197-11-440(6)). EISs are not required to analyze in detail the environmental impacts of mitigation measures ..."

As is shown, using the industry standard guide of cost per enplanement, the costs of improvements at Sea-Tac, including the environmental mitigation are financially feasible. Thus, the Master Plan Update improvements and environmental mitigation are economically practical.

Comment R-18-3: Ms. Brown, Mr. Vaa, Mr. & Mrs. West indicated that the cost of the proposed new runway would be substantially greater than the cost of developing a new runway at other major airports in the country.

Response: In contrasting the cost of developing the proposed new runway at Sea-Tac, care must be exercised in what is actually considered a cost of the proposed new runway. This cost, without environmental mitigation, would include, the land necessary for acquisition, the development of the embankment, the concrete for the runway and associated taxiways/connections and navigational aides. At Sea-Tac, the development of a runway with a length up to 8,500 feet would cost up to $481 million.[16] While this cost is greater than most other new runway development, which does not incur the movement of substantial amounts of earth, these costs are not infeasible. In addition, when comparing the cost of improvements at Sea-Tac to other alternatives for satisfying the aviation needs of the Region, these costs are less than the alternatives. A review of the costs in **Table R-12** indicates that these are all not comparable, as it appears that these costs primarily only include the cost of pavement, without earth movement, environmental mitigation, etc.

Comment R-18-4: Ms. Vermeier requested a clarification of how the improvements to the Runway Safety Areas (RSAs) would be funded Her testimony indicated that the Port has already received funding from the FAA to address the RSAs, yet the Master Plan Update and EIS have not been completed.

Response: Ms. Vermeier's comments refer to the statement in the Draft EIS: "The FAA issued a grant to the FAA which includes the following condition: By acceptance of this grant, the sponsor agrees that the safety areas for Runway 16L/34R will be improved to dimensions acceptable to the FAA...." The acceptance of the grant was for funds to maintain the existing runways. As is stated in the Draft and Final EIS, any alternation in the existing runways would require the Port to bring the existing runway safety areas up to standard. To ensure compatibility with the overall future plans for the Airport, the resolution of the runway safety area issue was also addressed in the Master Plan Update and, thus, included in the EIS.

Comment R-18-5: Mr. J. Thompson indicated that the detention center location on the maps in the EIS are incorrect.

Response: The maps that this commentor is referring to are the maps with "Lake Reba Detention facility" directly north of Sea-Tac Airport. This label refers to the Lake Reba stormwater detention facility. This label has apparently been confused with the planned Regional Justice Facility, also called the Federal Detention Center that is planned for south of the Airport.

[16] Cost Estimates prepare by P&D Aviation dated April 21, 1995

Comments R-18-6: *Several commentors recommend that construction and demolition waste be quantified for each alternative and that the Port investigate and implement a recycling program. Comments received from Mr. Hansen (King County Solid Waste Division), the Southwest King County Community Group, and Mr. Rohlfs (City of SeaTac).*

Response: The discussion on page IV.20-2 of the Final EIS reflect the inclusion of specific language regarding collection and disposal of construction, demolition and land clearing debris.

As discussed on page IV.20-3 of the Draft and Final EIS, the projected quantity of waste generated at the Airport would not significantly affect King County solid waste disposal practices and facilities. No significant impacts are anticipated; therefore, further analysis of solid waste is not necessary. Currently, the Port of Seattle is investigating both solid waste and construction and demolition waste recyclers and programs. An effective and efficient program would be implemented in the future.

Comment R-18-7: *King County Solid Waste Division requested wording changes to correct or clarify data in the Draft EIS.*

Response: Comments noted and are reflected in the Final EIS.

Comment R-18-8: *Mr. Mealy, Ms. Brown, Greater Federal Way Chamber of Commerce, Ms. Hill, the Osterman family, and Southwest King County Community Group asked how all impacts will be mitigated. The Airport Communities Coalition requested additional information concerning mitigation (in general).*

Response: Chapter V contains a detailed description of the actions required to mitigate significant impacts on the natural and built environment. As is shown all of the significant adverse environmental impacts can be mitigated.

Comment R-18-9: *The Regional Commission on Airport Affairs asked if the FAA had ever considered the enactment of a High Density Rule for Sea-Tac due to the close proximity of Boeing Field, Sea-Tac and Renton.*

Response: In 1968, the Federal Aviation Administration issued Title 14 of the Code of Federal Regulations, Part 93, "The High Density Traffic Airport Rule." The rule was promulgated to provide a temporary solution to airspace congestion at several major busy airports in the nation. Part 93 established a limit on the number of movements that certain airports could actually efficiently handle. Limits were established for general types of aircraft activity such as Air Carriers and Scheduled Air Taxis and were based on capacity of the airport during Instrument Flight Rule (IFR) conditions. Such conditions are considered to be "worst case" weather conditions and were assumed to exist 100 percent of the time.

Only five airports in the United States were subjected to the Quota Rule. These airports are: John F. Kennedy, LaGuardia, Newark, Washington National, and O'Hare. Since the enactment in 1968, the rule has been revised several times to reflect the improvements made at the airports and in the National Airspace System. Some of the affected airports, and carriers operating at the airports, have recently sought permanent removal of the Rule. No evidence exists to indicate that the airspace in the Seattle area warrants consideration of application of a High Density Rule.

Comment R-18-10: *Mr. Peyton (Ravenna-Bryant Community Association) expressed concern that the analysis provided in the Draft EIS is not sensitive to the overall condition of the human environment.*

Response: This EIS has been prepared in accordance with NEPA and SEPA procedural guidelines and is intended to provide discussion of all factors that have a bearing on the proposal's environmental consequences. The purpose of these procedural guidelines is to declare policy that would encourage productive and enjoyable harmony between humans and their environment, promote efforts that would prevent or eliminate damage to the environment, and stimulate human health and welfare.

__*Comment R-18-11:*__ *Mr. Peyton (Ravenna-Bryant Community Association) and the Southwest King County Community Group indicated that the past Master Plan for Sea-Tac indicated the Port "would not expand the runways".*

__Response:__ As is stated in the Executive Summary of the 1985 Master Plan (Final Report, Page 1): "A series of policy guidelines and assumptions were developed to reflect both stated Port policy and institutional and environmental constraints. For example, it was determined at the onset that no new runways at Sea-Tac would be considered, primarily because (1) the existing runway configurations had previously been determined to provide adequate capacity for the planning period, (2) there had already been an enormous investment into the existing runways, and (3) construction of the proposed new runway would have a large environmental impact." This statement has been construed by many neighbors of the airport as a commitment not to expand the existing airfield. It must also be noted that when that study was initiated, the findings of the Comprehensive Planning Review and Airspace Update Study had not been completed. Thus, that Master Plan was conducted prior to the understanding that Sea-Tac Airport would require airfield expansion to address the growing poor weather constraint.

__*Comment R-18-12A:*__ *Mr. Peyton (Ravenna-Bryant Community Association) indicated concern that the Draft EIS does not adequately assess displacements or the impacts on the community that would remain after the Port acquires property needed for the proposed runway.*

__Response:__ On pages IV.6-3 and IV.6-4 the Draft and Final EIS discusses the disruptions and displacements that would occur in the primary acquisition area located within the West SeaTac neighborhood. Displacement of a substantial portion of the West SeaTac area between 12th Avenue and SR-509 would occur. Disruptions and displacements would occur equally for all of the "With Project" alternatives. Page IV.6-3 further notes that some people may choose to leave the area, but, it appears that nearby neighborhoods would be able to absorb those residents wishing to remain in the area.

The commentor suggests that property values may decrease and that "neighbors will scatter to distant places to be replaced by people with no prior connection with each other or the community." Although this scenario is possible, the potential impacts likely would not result in significant adverse impacts.

Page IV.6-4 includes further discussion of community cohesion in the West SeaTac area. Residences that remain on the west side of SR-509 and Des Moines Memorial Drive South would notice the affects of displaced residences on the east side of SR-509 and Des Moines Memorial South visually, as well as effects on community functions and organizations such as churches, block-watch programs, and schools. Conversation of some of the acquired land to park or open space areas would help to counteract some of the potential losses in community cohesion by providing a location for other community activities. Please see Page IV.6-4 for further discussion.

As discussed on page IV.6-4, acquisition would comply with the Uniform Relocation Assistance Act. Under this Act, the Port is responsible for "just compensation" for affected properties at "fair market values." Just compensation includes (where applicable) closing costs, moving costs, interest differentials, and replacement housing payments or rental differential payments.

__*Comment R-18-12B:*__ *The Southwest King County Community Group requested that text in the Draft EIS regarding acquisition of homes be revised concerning the past acquisition program.*

__Response:__ Please see page IV.6-2 of the Final EIS for a summary of the two most recent acquisition programs, the Sea-Tac Communities Plan of 1974, and the Part 150 Program of 1985.

Comment R-18-13: *The Southwest King County Community Group asked if all applicable rules and guidelines would be followed for wetlands, creeks, aquifer and Underground Storage Tank impact.*

Response: All applicable Federal, state and local regulations and guidelines related to wetlands, creek headwater relocation, creek basin relocation, aquifer protection, and underground storage tanks would be followed. Currently, the Port of Seattle is negotiating an interlocal agreement with the City of SeaTac which would clarify the application and implementation of the Port versus the City regulatory provisions relative to the Master Plan Update improvements. See also response to comment R-7-28 concerning compliance with local critical areas protection policies.

Comments R-18-14: *The Southwest King County Community Group requested that the Draft EIS discuss minor impacts on public services and utilities and identify the water source for the projected increase in use. Also, the Draft EIS should address building a water reuse facility to satisfy the projected increase in demand, identify the completion date for construction of the domestic pumping system, and discuss sanitary sewer impacts under each alternative.*

Response: Minor impacts on public services and utilities are discussed on page IV.18-4 of the Draft and Final EIS. Public services and utilities provided by nearby cities and others would be affected slightly by changing airport demands. There would be little impact, either from displacement or interruption, on off-airport services provided by jurisdictions. No significant impacts are anticipated; therefore, further analysis of public services and utilities is not necessary.

The discussion of existing conditions for water usage discussed on page IV.18-1 of the Final EIS shows less increase in projected water use. Please see the revisions on page IV.18-2 of the Final EIS showing the estimated completion date for construction of the domestic pumping system.

Comment R-18-15: *A commentor notes concern that the Draft EIS does not mention that the Port will coordinate with the Seattle Water Department regarding implementation of a water conservation plan and relocation of the 36-inch Bow Lake water line. Comment was received from Ms. Batayola (Seattle Water Department).*

Response: The Final EIS was prepared to state that "the Port of Seattle would coordinate with Seattle Water Department for relocation of the 36-inch Bow Lake line. Relocation of the pipeline would comply with Seattle Water Department design requirements. Port of Seattle would reimburse Seattle Water Department for all costs associated with relocation, including staff time, construction coordination, and other costs directly associated with the relocation. In addition, Port of Seattle would coordinate with Seattle Water Department to implement a water conservation plan. Please see the new text on page IV.18-6 of the Final EIS.

Comment R-18-16: *Several commentors expressed concern that the Draft EIS does not discuss the issue of necessary street vacations west of the Airport or the extent to which the Port would abandon both off-site and on-site public services and utilities. Also, the Draft EIS does not identify the source for the projected increase in water use. Comments received from the Southwest King County Community Group, Mr. Frause, and Mr. Rohlfs (City of SeaTac).*

Response: The City of SeaTac and Port of Seattle recognize that implementation of the proposed improvements at the Airport would from time to time require that some street right-of-way be vacated and acquired by Port of Seattle. As a result, the City and the Port of Seattle executed a Memorandum of Understanding on May 26, 1993, which states that the City would exchange 42.7 acres of vacated street right-of-way for a 6-acre parcel owned by Port of Seattle. Currently, the City and the Port of Seattle are negotiating vacations on approximately 25 acres of right-of-way that provide access to property already owned by the Port.

The extent of on-site or off-site public services and utilities to be abandoned would be determined during the final design phase.

The description of existing conditions for water usage identified in the Final EIS on page IV.18-1 of shows a smaller increase in future use and identifies the water source for the increase; see response to comment R-13-4.

Comment R-18-17: Southwest King County Community Group questioned the location and impact of the Airport Rescue and Fire Fighting (ARFF) facilities in years 2000, 2010 and 2020.

Response: The Master Plan Update would require the development of a replacement ARFF facility if the North Unit Terminal is built, as this alternative would result in terminal development displacing the existing facility. As a result, the existing facility would be demolished and a new ARFF built north of the existing facility, slightly north of the North Unit Terminal. From the comment, it appears that residents have confused the office, and equipment storage ARFF with what is known as the burn pit. The burn pit is a location where fire fighting and rescue drills are conducted. Currently, a burn pit is located on the southwest corner of the airfield. Due to public concerns with this facility, independent of the Master Plan Update improvements, the Port is making plans to move this facility to North Bend, to a site that would serve as a regional fire practice/drill burn pit. The proposed new burn pit is anticipated to be available in 1997.

Comment R-18-18: Mr. Dinndorf (PSRC) requested that the EIS estimate any additional costs and assess the jurisdictions' ability to fund utility projects consistent with the capital facilities elements of their comprehensive plans.

Response: As discussed on page IV.18-4 of the Draft and Final EIS, public services and utilities provided by nearby cities and others would be affected slightly by changing airport demands. There would be little impact on off-airport services either from displacement or interruption in public services. No significant adverse impacts or costs are anticipated; therefore, further analysis of public services and utilities is not necessary. Funding for utility projects consistent with the capital facilities elements of comprehensive plans is the responsibility of that jurisdiction.

Comment R-18-19: Ms. Brown states "(2a) Why doesn't the last section of the Draft EIS Chapter 5 (4. Degree of Controversy) mention the allegations of improper procedures? (2b) Can the project be delayed if it can be proven that the public was given misleading information".

Response: Ms. Brown refers to comments in the local newspapers from elected officials expressing concern with the activities of the Demand/System Management and Noise Expert Arbitration Panel and the Major Supplemental Airport Study. To the knowledge of the Port of Seattle and the FAA, there have been no formal filing of charges of improper procedures in the conduct of studies associated with the Draft or Final EIS. Ms. Brown refers to alleged bribes in the context of the June 1, 1995 Public Hearing on the Draft EIS. As the Hearing Transcript notes (Page 38), Ms. Prichart provided the hearing officer with a can of Almond Roca (a locally produced candy). His comment in accepting the Almond Roca was "I've never accepted a bribe before, but since I don't have to make a decision on this case, I think I will, and I will share them with other staffers who might be inclined."

Ms. Brown also believes that the public was provided with mis-information, as "Draft EIS Chapter 5 appears to assume that the information provided by the Port to the public is comprehensive and accurate. It assumes the University sessions and meetings, were information tools. According to newspapers accounts, participants at the University sessions said the teachers were unable to answer important questions....." As is reflected in the Draft and Final EIS, the Port of Seattle conducted several mechanisms to brief the public of the findings of the Master Plan Update as the study was being conducted, so that input could be received as the study progressed. Some residents were frustrated that a final plan was not available immediately so that all of the questions could be answered. Answers were provided to questions that could be answered, and if answers were not available, residents were informed of when answer would be available.

Comment R-18-20: *The Regional Commission on Airport Affairs had questions regarding the Sea-Tac Communities Plan (1976) and the relationship of that plan to the current Master Plan Update.*

Response: The Sea-Tac Communities Plan (1976) was a policy document produced from a joint planning effort by King County and the Port of Seattle. The plan, which covered an area of approximately 44 square miles surrounding Sea-Tac Airport, addressed the Airport's relationship to surrounding communities, with the goal of achieving land use compatibility. Sea-Tac Airport was expanded in the late 1960s, and the increase in air traffic and noise had a major impact on nearby residential areas. The plan recommended establishing a comprehensive Noise Remedy Program to acquire residential properties affected by aircraft noise, install noise insulation in other residential areas, establish aviation easements, and provide property advisory services. Water quality and surface water drainage were analyzed for Miller and Des Moines Creeks, and a land use concept for the Airport and immediate surroundings was developed.

The 1976 Sea-Tac Communities Plan was followed, and supplemented, by several plans prepared either by King County or the Port of Seattle, including the Sea-Tac Area Update (1988) and the 1985 Sea-Tac Airport Master Plan. The Sea-Tac Communities Plan did not recommend at that time (1976) the addition of the proposed new runway. The Sea-Tac Communities Plan forecast a total of 7,550,000 passengers enplaned by 1993. The Master Plan Update, as noted in Chapter I of the Draft and Final EIS, indicates that the actual total of enplaned passengers for 1993 was 9,400,000 (Final EIS page I-8). Passenger growth at Sea-Tac Airport from 1976 to 1993 thus has been considerably greater (25%) than anticipated in the Sea-Tac Communities Plan. See also response to comment R-18-11.

Comment R-18-21: *Mr. Rohlfs (City of SeaTac) requested that the Draft EIS provide further analysis of the following: police and fire service, law enforcement relative to vice activity, and the criminal element typically associated with airports.*

Response: Under the Do-Nothing (Alternative 1), the demand for public services would increase and the adequacy of those services could be compromised (see page IV.18-4 of the Draft and Final EIS). Public services provided by nearby cities and others would be affected slightly by changing airport demands under the "With Project" alternatives. There would be little impact on services provided by off-airport jurisdictions, either from displacement or interruption in public services. No significant impacts are anticipated; therefore, further analysis of public services and utilities is not necessary.

The Final EIS was prepared to address impacts from the Master Plan Update improvements on law enforcement activities. As is shown, implementation of the proposed action would not likely result in increased vice activity at the Airport. As a result, no significant impacts on public safety are anticipated.

Comments R-18-22: *Mr. Rohlfs (City of SeaTac) and the Airport Communities Coalition had questions or comments related to permitting issues. One commentor noted that two of the potential off-site borrow areas identified in the Draft EIS currently are not permitted. Another commentor noted that the Port needed to obtain a wetlands permit from Washington State Department of Ecology and the Washington Department of Fisheries and Wildlife. The City of SeaTac requested that stormwater runoff mitigation and detention facilities be designed in accordance with the City's adopted code, which references the King County Surface Water Design Manual.*

Response: The permit status of each of the proposed off-site borrow source areas has been updated for the Final EIS. The permits anticipated to be required for the Master Plan Update are noted in Chapter II of the EIS. The Port of Seattle would obtain a water quality certification (Section 401) from the Washington State Department of Ecology, and a hydraulic project approval (HPA) permit from the

Washington State Department of Fisheries and Wildlife. The U.S. Army Corps of Engineers would be responsible for issuing a Section 404 permit for the filling of wetlands.

As stated in Chapter IV, Section 10 "Water Quality and Hydrology" the Draft and Final EIS, the Port is committed to providing detention facilities and stormwater runoff mitigation pursuant to standards set by the Washington State Department of Ecology. These standards are more stringent than those in the *King County Surface Water Design Manual,* which is referenced by the City of SeaTac's adopted code. As stated on page IV.2-9 of the Draft EIS (Final EIS page IV.2-9), the Port of Seattle is involved in interlocal negotiations with the City of SeaTac concerning jurisdictional authority. This process, which may not be completed until after the Final EIS is issued, is expected to resolve the issue of applicability of City of SeaTac regulations to the Master Plan Update. This resolution would include requirements relating to detention facilities and stormwater runoff.

Comment R-18-23: The Southwest King County Chamber of Commerce requested more definitive plans to improve the aesthetic qualities associated with the existing airport as well as the planned improvements.

Response: Comment noted. Chapter IV, Section 24 "Aesthetics and Urban Design" of the Final EIS contains an expanded presentation concerning general objectives of the Master Plan Update to improve the visual quality of the airport area. As these guidelines suggest, as the design for additional facilities are undertaken, these aesthetic guidelines should be incorporated in to the design process.

Comment R-18-24: Mr. Peyton (Ravenna-Bryant Community Association) commented that no visual impact images are shown concerning the west side embankment. Further, they stated that the exhibits in Appendix N do not show "the view of citizens and communities on the ground" nor do they describe any impacts that would occur from ground shadow.

Response: The Final EIS contains improved analysis and definition of the proposed embankment for the proposed new parallel runway. As is shown, in the revised "Aesthetics and Urban Design" section, the views of area citizens would not be adversely affected by the proposed embankment, due to the amount of construction related acquisition that is proposed and the distances that the remaining residences would be located. Based on this comment, a review of shadows was conducted to determine how the proposed embankment would affect area residences. This analysis showed that the existing embankment provides a shadow during early morning. The proposed embankment would slightly add to the shadowing by about 15 more minutes a day or less.

Comment R-18-25: Mr. Rohlfs (City of SeaTac) requested that the Final EIS contain a discussion of the City of SeaTac's planned transit center and pedestrian links to International Boulevard, as well as the aesthetic qualities associated with the Master Plan Update improvements along International Boulevard.

Response: Chapter III, "Affected Environment" of the Final EIS includes a brief description of the actions that the City of SeaTac is either planning to undertake to improve International Boulevard or would like to see undertaken. These plans reflect information from the *City of SeaTac Transit Supportive Land Use Master Plan* which was briefly cited in the Draft EIS page III-7 (Final EIS page III-8). See response to comment R-18-23.

Comment R-18-26: Ms. Brown questioned how litigation would affect the construction schedule.

Response: Litigation could affect the timing of the implementation of the proposed Master Plan Update improvements. However, until such litigation is filed it is not possible to define the type of impact that would result.

<u>Comment R-18-27</u>: Mr. Derrick (King County Department of Development and Environmental Services) requested that the language be clarified as to the impacts of the "With Project" alternatives, as they felt that the impacts caused by the proposed Master Plan Update improvements were not clear.

<u>Response:</u> King County's comments appear to be related to several sections comparing the impact of the "With Project" alternatives to the Existing conditions. In the Final EIS, all sections contrast the impacts of future years "With Project" to the comparable year Do-Nothing alternative. To supply the reader with other comparative information, the impacts of the future "With Project" impacts are also identified.

<u>Comment R-18-28</u>: The Regional Commission on Airport Affairs asserted "Comment IV-2-12 -- Statutes -- citation of. In citing statutes of the State of Washington, the FEIS should follow the standard practice..."

<u>Response</u>: The Draft EIS and Final EIS used the standard citations to the Revised Code of Washington. However, it appears that the commentor is referring to the individual comprehensive plan citations of the applicable jurisdictions. These are not intended to be citations to the RCW, but are the appropriate citations to the respective jurisdictional comprehensive plans as cited in the text.

<u>Comment R-18-29</u>: A number of commentors indicated that the Draft EIS did not provide a thorough analysis and evaluation of all adverse impacts that would result from the proposed Master Plan Update. Comments were received concerning a) flight safety b) quality of life issues; c) health impacts, d) adverse surface transportation impacts; e) impacts of the Four-Post; e) impacts to Section 4(f) Lands, and f) cost-benefits.

<u>Response:</u> Most of the comments of this nature indicated concern that the evaluation focused on the areas closest to Sea-Tac Airport (see response to comment R-5-2) or that the Executive Summary did not accentuate all of the adverse environmental impacts (see response to comment R-2-14). The Draft EIS contains an exhaustive review of the existing and future environmental impacts across 26 categories. Included are impacts from noise, surface transportation, air pollution, human health (which addressed flight safety), DOT Section 4(f) park lands, etc. Chapters II and IV discuss the costs and benefits of the Master Plan Update.

<u>Comment R-18-26</u>: Numerous commentors suggested alternative language or commented concerning typographical errors. Comments of this nature were received from the Southwest King County Community Group, Mr. Peyton and the Regional Commission on Airport Affairs.

<u>Response:</u> Each of these comments were reviewed relative to the text included in the Draft EIS. Where appropriate, changes were made.

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APPENDIX S

THE TRANSPORTATION PLANNING PROCESS

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APPENDIX S

THE TRANSPORTATION PLANNING PROCESS:
Jurisdiction Roles, Responsibilities, and Relationships

Washington State and its local units of government are authorized to own, operate, and provide a variety of transportation systems, intermodal facilities, and services. The roles, responsibilities, and relationships of the state and local jurisdictions for the planning, development, and funding of these activities are established in state and federal statutes and mandates. The principal statutes include the Washington State Growth Management Act, Clean Air Washington Act, Regional Transportation Planning Act, High Capacity Transportation Act, Intermodal Surface Transportation Efficiency Act (ISTEA), and Clean Air Act.

These governing statutes and mandates provide for a collaborative relationship between the state and local jurisdictions in developing a comprehensive transportation system. Regional Transportation and Metropolitan Planning Organizations (RTPOs and MPOs) have been established to provide a framework where the state and local jurisdictions come together to coordinate transportation system development through adoption and implementation of the metropolitan transportation plan (MTP). The state and local jurisdictions retain ownership and responsibility for developing their transportation facilities, but use the regional MTP process for development, coordination, funding, and implementation of infrastructure and programs.

Washington State Departments

The Washington State Transportation Commission sets transportation policy for the Washington State Department of Transportation (WSDOT), implements the planning process and monitors progress toward meeting the state's 20 year planning goals. The WSDOT provides policy direction through the Statewide Transportation Planning Process. This process includes State Policy Plans, Statewide Transportation Improvement Program, and Management System Plans for highway pavement, bridges, highway safety, traffic congestion, public transportation and equipment, and intermodal transportation facilities and systems. These six management system plans provide information and assist MPOs and RTPOs in planning, programming, and funding transportation system goals.

The Washington State Department of Ecology prepares the State Implementation Plan for Air Quality. This plan is required by the Clean Air Act. State implementation plans are required for carbon monoxide, ozone, and particulate matter. These plans are used by MPOs and RTPOs in developing Congestion Mitigation and Air Quality Improvement Programs.

Metropolitan Planning Organizations and Regional Transportation Planning Organizations

Metropolitan Planning Organizations are designated by the Governor in areas with urban populations greater than 200,000. RTPOs include areas under 200,000 population. MPOs are cooperative organizations composed of local jurisdictions within a region and are responsible for Transportation Management Areas. MPOs are not governmental units, but planning organizations governed by an executive board principally composed of locally elected officials and a policy board to which citizens can be appointed.

The Puget Sound Regional Council (PSRC) is the designated MPO for the four county metropolitan region of Central Puget Sound. It is responsible for development and adoption of the long range Metropolitan Transportation Plan. In addition, the MPO develops an associated land use plan that is based upon adopted local jurisdiction comprehensive plans and Countywide Growth Management Policy Plans. The planning process is guided by the MPO Executive Board. A comprehensive transportation planning work program is completed by the PSRC, including an extensive public involvement program. This study and evaluation process may include work performed by consultants, task forces, and expert panels, deemed necessary by the MPO, to assess transportation projects, associated impacts, and other issues required to develop and adopt the MTP. Final adoption of the MTP is the responsibility of the PSRC General Assembly. The Assembly is composed of all jurisdictions that are members of the MPO.

The MTP is required to be financially constrained and reflect the regional land use planning assumptions. The MTP serves as the basis for project selection in the regional Transportation Improvement Program. This Program provides a list of prioritized projects, including efforts to ensure compliance with clean air goals. In addition, MPOs develop a collaborative process for the implementation of the regional congestion management system and other statewide management systems. MPOs are guaranteed a share of authority for federal Surface Transportation Program funds.

Counties

Counties comply with federal and state mandates to receive funding support for projects. Counties regulated by the Growth Management Act prepare a Six Year Comprehensive Plan with a Transportation Element. This Transportation Improvement Plan contains the projects to be submitted for federal funding consideration. The projects identified in the plan are selected through a countywide process to ensure public involvement. The selection process is completed through the MPO process, where county elected officials participate in the regional project selection process. Counties maintain responsibility for local transportation projects funded by local transportation revenues, although projects are coordinated through the MTP.

Cities

Cities comply with federal and state mandates to receive funding support for projects. Cities regulated by the Growth Management Act prepare a Six Year Comprehensive Plan with a Transportation Element. This Transportation Improvement Plan contains the projects to be submitted for federal funding consideration. The projects identified in the plan are selected through a citywide process to ensure public involvement. The selection process is completed through the MPO process, where city elected officials participate in the regional project selection process. Cities maintain responsibility for local transportation projects funded by local transportation revenues, although projects are coordinated through the MTP.

Transit Agencies and Departments

Transit agencies and departments participate in regional transportation planning through the MPO. Transit agencies or departments may identify capital projects for funding under the Surface Transportation Program and participate in the project selection process through the MPO. Transit funds may be obtained from federal programs such as Federal Transit Administration Title III, the competitive portion of the Surface Transportation Program and Congestion Mitigation and Air Quality Program, and the WSDOT local program element of the competitive component of the Surface Transportation Programs.

Public Port Districts

Public port districts are general purpose governments authorized in state statutes, established through local referendum, and governed by an elected commission. Port districts are authorized to own and operate a variety of transportation and related facilities, including railroads, airports, marine vessels, trucks, and harbor and intermodal facilities. Ports also have authority to operate trade missions, economic development programs, and supporting facilities. Ports participate in regional transportation planning through membership in the MPO and development of the MTP. Transportation and intermodal facilities are identified as part of the Metropolitan Transportation Plan. Federal mandates, through ISTEA, place a high level of emphasis on the economic importance of intermodal connections and support targeting transportation investments on improving intermodal efficiencies. Ports may obtain transportation project funding support through the competitive portion of the Surface Transportation Program and Congestion Mitigation and Air Quality Improvement Program. In addition, funds may be requested on a competitive basis from the WSDOT Local Programs Division, including the enhancements and safety programs.