Biological Assessment

Master Plan Update Improvements Seattle-Tacoma International Airport

Federal Aviation Administration

Port of Seattle

June 2000

Parametrix, Inc.

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BIOLOGICAL ASSESSMENT FOR THE REINITIATION AND INITATION OF CONSULTATION FOR CERTAIN MASTER PLAN UPDATE IMPROVEMENTS AND RELATED ACTIONS

BIOLOGICAL ASSESSMENT
MASTER PLAN UPDATE IMPROVEMENTS

SEATTLE-TACOMA INTERNATIONAL AIRPORT

Prepared for

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EXECUTIVE SUMMARY

This Biological Assessment (BA) is prepared for reinitiation and initiation of consultation by the Federal Aviation Administration (FAA)[1] and initiation of consultation by the U.S. Army Corps of Engineers (ACOE) with the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) (the Services) under Section 7 of the Endangered Species Act (ESA). Section 7(a)(2) of the ESA requires federal agencies to ensure, in consultation with the Services, that their actions do not jeopardize listed species or adversely modify their designated critical habitat. To fulfill the requirements of Section 7, action agencies must reinitiate (or initiate) consultation if new species are listed or critical habitat designated that may be affected by a discretionary agency action. See 50 C.F.R. § 402.16; 50 C.F.R. §402.03. As discussed below, recent listings of salmonids by the Services serve as the basis for this ESA Section 7 consultation.

Section 305(b) of the Magnuson-Stevens Act and associated implementing regulations provide that Federal agencies must consult with NMFS concerning all actions that may adversely affect designated essential fish habitat (EFH). NMFS EFH guidance documents provide that EFH consultations should be combined with ESA consultations to accommodate the substantive requirements of both Acts. Therefore, the enclosed BA analyzes the effects of FAA and ACOE actions on designated EFH.

On July 3, 1997, FAA issued a record of decision (ROD) for approving Master Plan Updates (MPU) development actions that were adopted by the Port of Seattle (Port) on August 1, 1996, as amended on May 27, 1997. These actions were necessary for FAA to provide support for: (1) a new 8,500 ft dependent air carrier runway; (2) a 600-foot extension of runway 34R; (3) extend runway safety areas to meet FAA standards; and (4) for various landside MPU improvements scheduled to be completed through the year 2010. FAA is presently consulting with the Services over construction of navigation aids, future grants, and grants issued since May 24, 1999 related to implementation of certain Seattle-Tacoma International Airport MPU (STIA) improvements. This consultation also covers FAA's future approval of certain passenger facility charges (PFCs) for collection and use authorizations related to implementation of MPU improvements.

The ROD was based on a multi-year environmental process which included a February 1996 Final Environmental Impact Statement (FEIS) and a May 1997 Supplemental EIS (SEIS) prepared for the MPU development project. A BA was prepared in support of the ROD, which analyzed the effects of relevant MPU actions on the bald eagle and the peregrine falcon. That BA concluded that the proposed actions were not likely to adversely affect the species. FWS concurred with that determination.

On March 24, 1999, and November 1, 1999, respectively, the Services listed Puget Sound chinook salmon and Puget Sound bull trout. The FAA is now reinitiating and initiating formal consultation with the Services for these species over certain actions for which it possesses discretionary

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[1] In accordance with applicable regulations, the FAA designated the Port of Seattle as its non-Federal representative for the purposes of preparing this biological assessment. See 50 C.F.R. § 402.08.

involvement or control. Through this BA the ACOE also initiates formal consultation with the Services concerning its approval of a Clean Water Act (CWA) Section 404 permit application pertaining to the STIA MPU improvements.

The STIA MPU improvements are necessitated by the growing inability of the airport to efficiently support existing and future regional air travel demands. Airport activity is expected to increase as a result of regional population growth, regardless of these proposed improvements. MPU improvements, which are intended to reduce delays in aircraft operations, include upgrading the roadway system, terminal space, gates, cargo, and freight processing space to improve efficiency, reduce congestion, and improve the quality of service provided to the community.

This BA concludes that the proposed FAA and ACOE actions: (1) "may affect" but are "not likely to adversely affect" bald eagles, Puget Sound chinook salmon, and Puget Sound bull trout; (2) "may affect" but are "not likely to destroy or adversely modify" designated critical habitat of chinook salmon; (3) within the range of expected circumstances, will have "no effect" on marbled murrelet or its designated critical habitat; and (4) will not adversely affect designated pelagic or west coast groundfish EFH.

LISTED SPECIES ADDRESSED

Consultation with the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) identified the endangered peregrine falcon (*Falco peregrinus*), threatened bald eagle (*Haliaeetus leucocephalus*), and threatened Coastal/Puget Sound bull trout (*Salvelinus confluentus*) as potentially occurring near the project. Subsequently, peregrine falcons were delisted on August 25, 1999, and thus are not addressed further in this report. Marbled murrelet (*Brachyramphus marmoratus*) were reported to the ACOE as occurring in the project area in November 1999. In December 1999, and dates thereafter, the potential presence of marbled murrelets in the action area was discussed with USFWS and it was concluded they would be addressed in a revised BA.

NMFS identified Puget Sound chinook salmon (*Oncorhynchus tshawytscha*), a threatened species, as also occurring in the project vicinity. NMFS has also designated critical habitat for Puget Sound chinook salmon in the project vicinity.

PROPOSED ACTION

Implementing the STIA MPU will involve the construction of runways, taxiways, borrow areas, runway safety areas (RSAs), FAA and navigation aids (e.g., the new Airport Traffic Control Tower, airport surveillance radar [ASR], and airport surface detection equipment [ASDE]), airfield building improvements, terminal and air cargo area improvements, roads, parking, the South Aviation Support Area (SASA), stormwater management facilities and the Industrial Wastewater System (IWS) facilities. Implementation of the STIA MPU also involves acquisition and demolition of certain structures and soundproofing others together with relocation and transaction assistances. At this time, FAA is consulting over construction of the FAA control tower and navigation aids, future grants, and grants issued since May 24, 1999 related to implementation of certain STIA MPU improvements, and approval of certain as yet unapproved passenger facility charges (PFC) for collection and use authorizations related to implementation of MPU improvements. Included in the proposed action will also be the relocation of Miller Creek, the development of avian habitat at a mitigation site near the Green River in Auburn, and certain other actions for which a CWA Section

404 permit is required from ACOE. The "action area" for this proposed action was determined to be the area of the airport project construction and vicinity where direct, indirect, or cumulative effects could reasonably be expected to occur (i.e., the aquatic habitat of Miller, Des Moines, and Walker creeks downstream of the airport and the associated nearshore estuary, and the IWS Puget Sound outfall).[2] The Auburn wetland mitigation site and vicinity, where indirect or cumulative effects could reasonably occur, are also included in the action area.

WATER AND FISH RESOURCES

Potential effects of the proposed MPU were evaluated in the BA by first considering the water and fish resources (critical habitat) present in the identified action area. Two primary hydrologic systems are located in the action area—Miller Creek Basin and Des Moines Creek Basin. Additionally, the Auburn Wetland Mitigation site is located within the Green/Duwamish Watershed. The Miller Creek watershed drains approximately 8 mi^2 of predominantly urban area, mostly within the cities of Burien and SeaTac, and provides habitat for coho salmon (*O. Kisutch*), threespine stickleback (*Gasteroseus aculeatus*), pumpkinseed sunfish (*Lepomis gibbosus*), black crappie (*Pomoxis nigromaculatus*), and cutthroat trout (*O. clarki*). Walker Creek, a tributary of Miller Creek, joins this creek approximately 300 ft upstream from the mouth. A highly urbanized watershed that is estimated to be 23 to 49.4 percent impervious surface, the Miller Creek basin has undergone extensive alteration. The result is that the riparian and stream habitats available for fish use are degraded.

The Des Moines Creek watershed covers about 5.8 mi^2 of predominantly residential, commercial, and industrial area lying within the cities of SeaTac and Des Moines, and a small area of unincorporated King County. The native salmonids present in parts of Des Moines Creek include chum (*O. keta*) and coho salmon, cutthroat and steelhead (*O. mykiss*) trout as well as the non-native warmwater fish species pumpkinseed sunfish (*Lepomis gibbosus*) and largemouth bass (*Micropterus salmoides*). The approximate area of impervious surface in the Des Moines Creek basin is estimated to range from 32 to 49 percent. Overall, urbanization has degraded the aquatic habitats in Des Moines Creek.

The Green River watershed comprises some 482 mi^2. Of the more than 30 fish species identified in the Green River basin, eight are anadromous salmonids, including chinook salmon, coho salmon, sockeye salmon (*O. nerka*), chum salmon, pink salmon (*O. gorbuscha*), steelhead, coastal cutthroat trout, and bull trout (*Salvelinus confluentus*). Within this watershed, a 67-acre (ac) parcel of land west of the Green River in the City of Auburn has been chosen to provide off-site wetland habitat mitigation by creating in-kind replacement of wetland habitat functions, primarily for avian species. Additionally, overwintering bald eagles use the Green River for foraging, and may perch in trees located 300 ft from the mitigation site.

Natural and hatchery populations of chinook salmon are currently found in the Green/Duwamish River watershed, the Puyallup River watershed, and in the marine areas adjacent to the mouths of Miller and Des Moines creeks. Recent spawning surveys of Miller, Walker, and Des Moines creeks

[2] A water tower will be constructed in the Outfall 012 and 013 subbasins that drain to Gilliam Creek and the Green River. This project will redevelop existing impervious surfaces and have no impact on Gilliam Creek or the Green River, as discussed in the BA.

have not observed any use of these creeks by chinook salmon. Additionally, there is no evidence to support the historical use of these creeks by chinook for spawning or rearing.

The freshwater portions of both Miller and Des Moines creeks do not contain essential critical habitat features; rather, such features are limited to the estuary areas of both creeks. While parts of both creeks are accessible to these fish, there is no documented historical use of either creek by chinook salmon. Additionally, the general features (habitat flow regime and morphology) are not conducive to chinook use for spawning or rearing. Critical habitat for chinook salmon is restricted to the mouths of Miller and Des Moines creeks where salinities would support use of this species in its marine life-stages. Outmigrating juveniles that have completed their osmotic adjustment to marine salinities (i.e., smoltification) do not return to freshwater during the first year. Similarly, returning adults do not enter freshwater until they reach their natal stream for spawning. Future use of the streams by chinook (i.e., through straying from other basins) is unlikely and not expected. This is because the overall characteristics of these basins, including spawning substrate accumulations and particle sizes, stream width, and hydraulic conditions appear inadequate to support chinook on a long-term basis, even under restored conditions. Consequently, fish migrating in Puget Sound and passing the mouths of Miller and Des Moines creeks will use only the creek estuaries for feeding and resting.

The Green River, adjacent to the Auburn wetland mitigation site is critical habitat for chinook salmon. At this location, the river is a migration corridor for adult salmon returning to spawn in the fall, and for juvenile chinook out-migrating to Puget Sound during the spring months. During fall and early winter months, salmon would undergo intragravel development. During winter and spring months, juvenile salmon would be expected to rear in the area.

Although the USFWS has not defined critical habitat for bull trout, analysis of the needs for this fish indicate that it is highly unlikely that Miller and Des Moines creeks provide the habitat features required, other then estuary habitat for anadromous adult and semi-adult bull trout that may be present in Puget Sound. These creeks do not meet this species' cold water temperature requirements.

WILDLIFE RESOURCES

Bald eagles, which are present in the action area, have established nesting sites and foraging perches in these areas that could be potentially affected through various disturbances. Overall, construction and operation of the airport during and after implementation of the MPU improvements are not expected to adversely effect bald eagles. Additionally, construction of the Auburn Wetland Mitigation site is anticipated to provide habitat to waterfowl (eagle prey), and thus provide potential benefit to wintering eagles nests or forage sites. Consequently, an overall determination for the STIA MPU improvements project was made that this project "may affect," but is "not likely to adversely affect" bald eagles (Table E-1).

Marbled murrelets are much less likely to be present in the action area, but they have been observed in Puget Sound (greater than 1.5 miles from proposed construction). Designated critical habitat for marbled murrelets (old growth forest) does not exist in the project vicinity. Given the rarity of marbled murrelets in adjacent marine waters, as well as the distance between STIA and these marine waters, the water quality benefits to be derived from the STIA MPU, the absence of marbled murrelet designated critical habitat in the action area, and the very low probability of an aircraft striking a murrelet, the project was determined to have "no effect" on marbled murrelets or its critical habitat (Table E-1).

Table E-1. **Summary effect determinations for wildlife species.**

Common and *Scientific name*	ESA Status	Life Stages Considered	Critical Habitat	Effects Determination
Bald eagle *Haliaeetus leucocephalus*	T	Nesting and wintering	Not identified	May affect, not likely to adversely affect
Marbled Murrelets *Brachyramphus marmoratus*	T	Nesting and foraging	None present	No effect

T = threatened

WATER QUALITY IMPACTS AND MITIGATION

Potential water quality impacts to Miller and Des Moines creeks, resulting from construction and operation of MPU improvement projects and associated mitigation actions, include construction sedimentation, as well as sediment and erosion control practices that themselves may result in potential impacts (e.g., changes in stream temperature and pH, release of flocculation agents, and changes in base and peak flows). Potential water quality impacts in the proposed MPU action area related to operations include changes in storm water quality and quantity associated with increased impervious surfaces, airport anti-icing and de-icing operations, application of nutrients and pesticides to landscape management areas, as well as hydrology changes in hydrology affecting Miller and Des Moines creeks.

Operations at STIA following implementation of the MPU projects could affect water quality through the discharge of conventional pollutants and chemicals used in ground and aircraft de-icing to adjacent creeks, and the discharge of these same chemicals to the Puget Sound in IWS effluent. Overall, the MPU improvements will result in a greater volume of stormwater undergoing detention and treatment. This will be accomplished through retrofitting areas currently inside and outside of the project area as these improvement projects are completed as well as detaining and treating all stormwater associated with new impervious surface. An additional result of the retrofitting will be reductions in copper and zinc currently discharged to Miller, Walker, and Des Moines creeks through the collection and routing of stormwater to the IWS system that currently goes to these creeks. The concentrations of zinc and copper in this stormwater will be either unchanged from existing baseline conditions or lower than stormwater currently discharged from areas lacking water quality treatment. Therefore, the proposed actions will not increase the exposure of chinook salmon or bull trout to copper or zinc attributable to the MPU improvement projects at the mouths of Miller or Des Moines Creeks. Similarly, in the unlikely event that either adult chinook salmon or bull trout could wander into these creeks, the proposed action will not increase their exposure to zinc and copper. Additionally, chinook critical habitat present at the mouths of Miller and Des Moines creeks will not be adversely affected by any changes in water quality related to MPU project construction or operations.

Analysis of aircraft anti-icing and de-icing fluids (ADAFs) used at STIA as well as the projected loadings of copper and zinc to stormwater and IWS effluent indicate that the concentrations of these chemicals will not significantly impact either chinook salmon or bull trout or at the IWS outfall or these fish or chinook critical habitat present at the mouths of Miller and Des Moines creeks. For example, this analysis found that all types of ADAFs used at STIA are present at maximum concentrations in stormwater or IWS effluent at least seven times below their relevant toxicity thresholds to chinook salmon or bull trout. Similar comparisons of relevant toxicity thresholds to the predicted amounts for zinc at the IWS outfall indicates that these concentrations are 4 to 64 times below the LC50 value for chinook and 20 to 300 times below the LC_{50} value for bull trout for the time periods assessed. Copper concentrations in the vicinity of the outfall are predicted to be between 1.4 and 21 times below the chinook LC50 and 4 to 55 times below the bull trout LC50.

None of the predicted concentrations of zinc or copper at the mouths of Miller and Des Moines creeks for these exposure periods will result in any significant adverse effects on chinook salmon or bull trout or their critical habitat over the 49 years that were modeled. This conclusion is based on these observations: (1) zinc concentrations in each exposure location are always below the adverse affects level; (2) copper concentrations at the mouths of Miller and Des Moines creeks are always below the brook trout[3] copper toxicity value, (3) copper concentrations for exposure durations relevant to the toxicity tests used to develop these toxicity values (96 hours or more) are significantly below the chinook copper toxicity values; (4) copper concentrations at the Midway Sewer District Outfall 10 meters or more from the diffuser ports are significantly below the toxicity values, and (5) bioavailable concentrations of copper and zinc in Miller and Des Moines creeks will likely be much less than those presented here. The active foraging behavior of the adult chinook and bull trout that could be present in the vicinity of the marine outfall will further reduce their exposure to these chemicals.

The effect of stormwater runoff on critical habitat downstream of the Port discharge points was also assessed through toxicity testing of Miller Creek and Des Moines Creek downstream of STIA stormwater outfalls. These tests demonstrated no toxicity to either fathead minnows or the invertebrate, *Daphnia pulex*. In addition to instream samples, whole-effluent toxicity (WET) testing of STIA stormwater discharge outfalls using these same test organisms was performed. Overall, these tests demonstrated an overall lack of toxicity in samples consisting of 100 percent stormwater from Port discharges on samples reflective of the future conditions after the MPU projects have been completed.

All identified water quality impacts will be mitigated (to maintain or improve the existing baseline condition) by establishing and maintaining water quality treatment best management practices (BMPs). These BMPs are not only protective of listed species and their critical habitat but they also meet or exceed the requirements of the Washington State Department of Ecology's (Ecology) Manual (Ecology 1992). Additionally, existing developed areas lacking BMPs consistent with the Manual will be retrofitted with water quality treatment BMPs, to the maximum extent practicable, to further protect listed species and their habitat. The MPU improvements will treat both new pollutant generating impervious surface (PGIS) and existing impervious areas in a ratio of 1:1.89 (for each acre of new impervious surface, 0.45 ac of existing impervious will be retrofitted). Additional measures to mitigate water quality impacts include source control and the operation and expansion of an IWS to treat stormwater runoff generated from high-use areas.

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[3] Brook trout were used as a surrogate for bull trout in this analysis. This was necessary due to the unavailability of published bull trout toxicity data.

In addition to the proposed water quality BMPs, existing degraded wetlands in the Miller Creek and Des Moines Creek basins will be enhanced to: (1) restore water quality functions, (2) benefit water quality by eliminating existing pollution sources from agricultural land, (3) increase settling and mechanical trapping of particulates, (4) remove metals and other toxics that bind to particulates, (5) reduce and bind metals in humic material, (6) biologically remove and uptake nutrients, and (7) enhance the Miller Creek buffer.

HYDROLOGIC IMPACTS AND MITIGATION

MPU improvements will increase impervious surface areas in the Miller Creek and Des Moines Creek watersheds, which could further increase stormwater runoff rates, volumes, and pollutant loads to the receiving streams. Additionally, the filling of wetlands could affect stormwater storage, ground water recharge, and groundwater discharge, all of which could affect the hydrology of surface streams.

The Port will construct stormwater conveyance, detention, and treatment facilities to manage runoff from both newly developed project areas and existing airport areas, as described below. The net result of flow controls for the MPU improvements will be to reduce peak flows in Miller, Walker, and Des Moines creeks downstream of the STIA discharges. These actions will enhance baseline hydrologic conditions in the streams and associated estuaries. The target flow regime will achieve the level of flow control required by regulations and reduce flows in the stream channels to a stable condition that reduces sedimentation in the creek estuaries where chinook critical habitat is present.

The Port has proposed mitigation in each watershed to compensate for any potential reductions in base flows in Miller and Des Moines creeks. This will be accomplished through the acquisition of real property in the Project Area, which will concomitantly transfer all water rights associated with these properties to the Port. On Miller Creek, the Port is acquiring and will cease exercise of water right permits, certificates, and claims associated with acquired properties. Additionally, any unapproved water uses will be terminated once these properties have been acquired. The Port is currently proposing to transfer these water rights in the Miller Creek drainage to the Washington Department of Ecology's Trust Water Rights Program[4]. On Des Moines Creek, the Port will augment flow using an existing well to which it already has all required water rights. The effects of these actions will compensate for any potential reductions in base flows[5] related to MPU Improvement projects in Miller or Des Moines creeks.

AQUATIC HABITAT IMPACTS AND MITIGATION

Wetland and stream habitat impacts resulting from MPU improvements include relocating approximately 980 ft of Miller Creek and the direct permanent filling of 18.33 ac of wetlands as well as temporary construction impacts to 2.17 ac of wetlands. Impacts to streams resulting from MPU improvements include filling approximately 980 ft of Miller Creek.

Several on-site mitigation elements are proposed to compensate for the MPU improvement projects' potential impacts to stream, wetlands, and aquatic habitat. The mitigation establishes 48.06 ac of on-

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[4] Such a transfer will be dependent on acceptance by Ecology.

[5] Maintenance of base flows will ensure adequate flows of freshwater at the estuaries of the mouths of Miller and Des Moines creeks where critical habitat for chinook salmon can be found.

site wetland enhancement and stream buffer that will be restored and protected in perpetuity from future development. In-basin mitigation is directed toward restoring all impacted wetland and stream functions, except avian habitat. In-basin mitigation is also directed toward removing certain existing land use conditions that degrade on-site wetland and aquatic habitat. Mitigation for wildlife habitat (bird and small mammals) is provided out-of-basin and consists of creating a large, high-quality wetland system in the city of Auburn at the mitigation site. Overall, this mitigation will maintain or enhance baseline conditions in the creeks and critical habitat in their estuaries.

EFFECTS DETERMINATION FOR CHINOOK SALMON

Chinook salmon have not been documented to occur in the Miller Creek, Walker Creek, or Des Moines Creek basins upstream of their discharge with Puget Sound (Batcho 1999, personal communication; Des Moines Creek Basin Committee 1997; Hillman et al. 1999). Therefore, direct effects of construction and operation are not expected to affect the freshwater life stages or critical habitat of chinook salmon. Although results of this action are intended to improve baseline habitat conditions for salmonids in the Miller Creek and Des Moines Creek basins (through increased stormwater management and habitat restoration), future use of the streams by chinook (i.e., through straying from other basins) is unlikely and not expected. Therefore, since chinook salmon do not occur in these basins, construction and operation of the project will have no effect on freshwater stages of chinook salmon in the Miller Creek or Des Moines Creek basins proper. When the potential effects of the proposed STIA MPU improvements on chinook salmon and its estuarine and marine habitats in the action area are considered relative to the proposed conservation measures, the action agencies determine the proposed action "may affect" but is "not likely to adversely affect" this species and "may affect" but is not likely to destroy or adversely modify designated critical habitat (see Table E-2).

EFFECTS DETERMINATION FOR BULL TROUT

Bull trout are not known to have occurred in the Miller Creek and Des Moines Creek watersheds, and they have not been found in recent creek evaluations (Batcho 1999, personal communication; Des Moines Creek Basin Committee 1997; Hillman et al. 1999). Therefore, construction and operational phases of the proposed action will have no direct or indirect effects on freshwater phases of bull trout in Miller or Des Moines creeks. Anadromous phases of bull trout originating from other Puget Sound basins could potentially inhabit nearshore marine areas at the outlets to these basins. When the potential effects of the proposed STIA MPU improvements on bull trout and its estuarine and marine habitats in the action area are considered relative to the proposed conservation measures, the action agencies determine the proposed action "may affect" but is "not likely to adversely affect" this species (see Table E-2).

Table E-2. Summary effect determinations for fish species.

Common and *Scientific name*	ESA Status	Life Stages Considered	Critical Habitat	Effects Determination
Chinook salmon *Oncorhynchus tshawytscha*	T	Freshwater and marine phases	Estuaries of Miller and Des Moines creeks and Marine Waters at the IWS Outfall	May affect, not likely to adversely affect
Bull trout *Salvelinus confluentus*	T	Freshwater and marine phases	Not identified	May affect, not likely to adversely affect

T = threatened

4. WATER AND FISH RESOURCES

Baseline watershed and fish habitat conditions in drainage areas affected by MPU improvement projects are described below. The effects of the projects on listed species are evaluated in Chapter 9. The distribution of fish species in Miller, Walker, and Des Moines creeks is shown in Figure 4-1.

Effects were evaluated in terms of criteria (no effect, may affect, beneficial, insignificant, and discountable) defined by the NMFS (1996), Washington Habitat Conservation Branch in its *A Guide to Biological Assessments* (revised March 23, 1999) and *Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale* (NMFS 1996):

> *May affect, not likely to adversely affect is the appropriate conclusion when the effects on the species or critical habitat are expected to be beneficial, discountable or insignificant. Beneficial effects have contemporaneous positive effects, without any adverse effects to the species or habitat. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur. Based on best judgement, a person would not (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur.*

The effects determination (Chapter 9) for each fish species is made based on the extensive mitigation measures to protect and maintain baseline conditions incorporated into the project (see Chapters 7 and 8). These mitigation measures include mitigation for potential water quality impacts (Section 7.1), increases in stormwater runoff (Section 7.2) and for impacts to stream and wetland habitat (Section 7.3). Tabulated summaries of baseline conditions for Miller Creek, Des Moines Creek, the creek estuaries, and the Green River near the Auburn Mitigation Site are presented below.

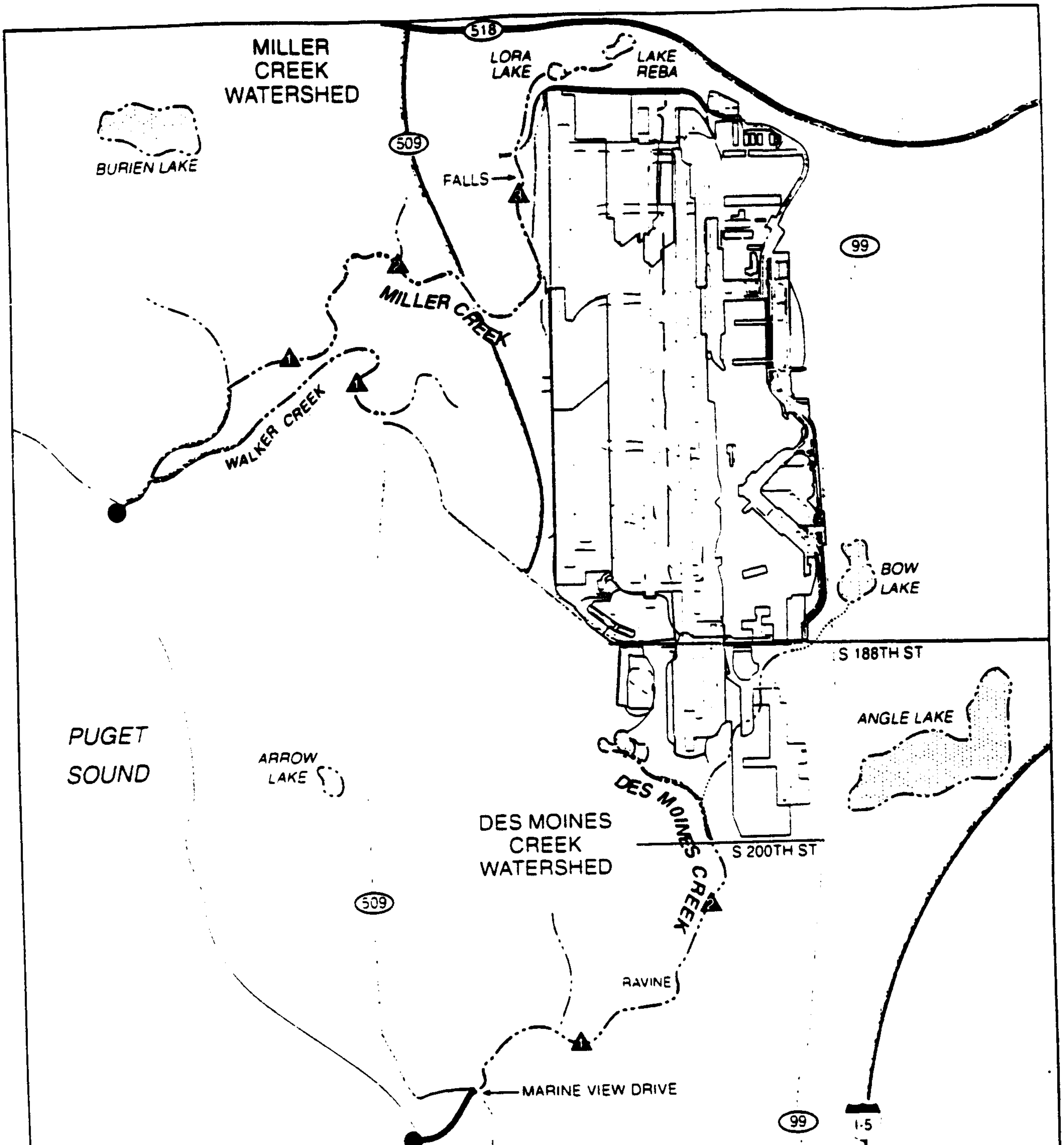
4.1 HYDROLOGIC SYSTEMS

STIA drains to Miller Creek (and its Walker Creek tributary), Des Moines Creek, and the Green River via Gilliam Creek. STIA's NPDES-Permitted stormwater outfalls are shown in Figure 4-2. STIA's NPDES-permitted IWS outfall to Puget Sound is shown in Figure 3-3.

4.1.1 Miller Creek Basin

The Miller Creek watershed drains approximately 8 mi^2 of predominantly urban area, mostly within the cities of Burien and SeaTac (see Figure 3-2). STIA facilities located in this basin include the north end of runways 16L and 16R and north air cargo facilities, an area of about 162 ac representing about 3 percent of the watershed. Flows in Miller Creek originate at Arbor, Burien, Tub, and Lora lakes, Lake Reba, and from seeps located on the west side of STIA.

The uppermost reaches of Miller Creek (above approximately river mile [RM] 4.1), extend north of SR 518. The Hermes depression, in the northwestern part of the basin, is artificially drained and piped to a tributary to Arbor Lake. This portion of the watershed drains a gently rolling plateau between the Duwamish/Green River valley and Puget Sound. Although the watershed is generally highly developed, several small bogs, depressions, and wetland lakes remain in the upper basin; this



Data Sources Des Moines Creek Basin Committee (1997). Hillman et al (1999). Parametrix 1999a

Parametrix, Inc. Sea-Tac Airport Stormwater Management Plan 556-2912-001(48) 4:00 (K)

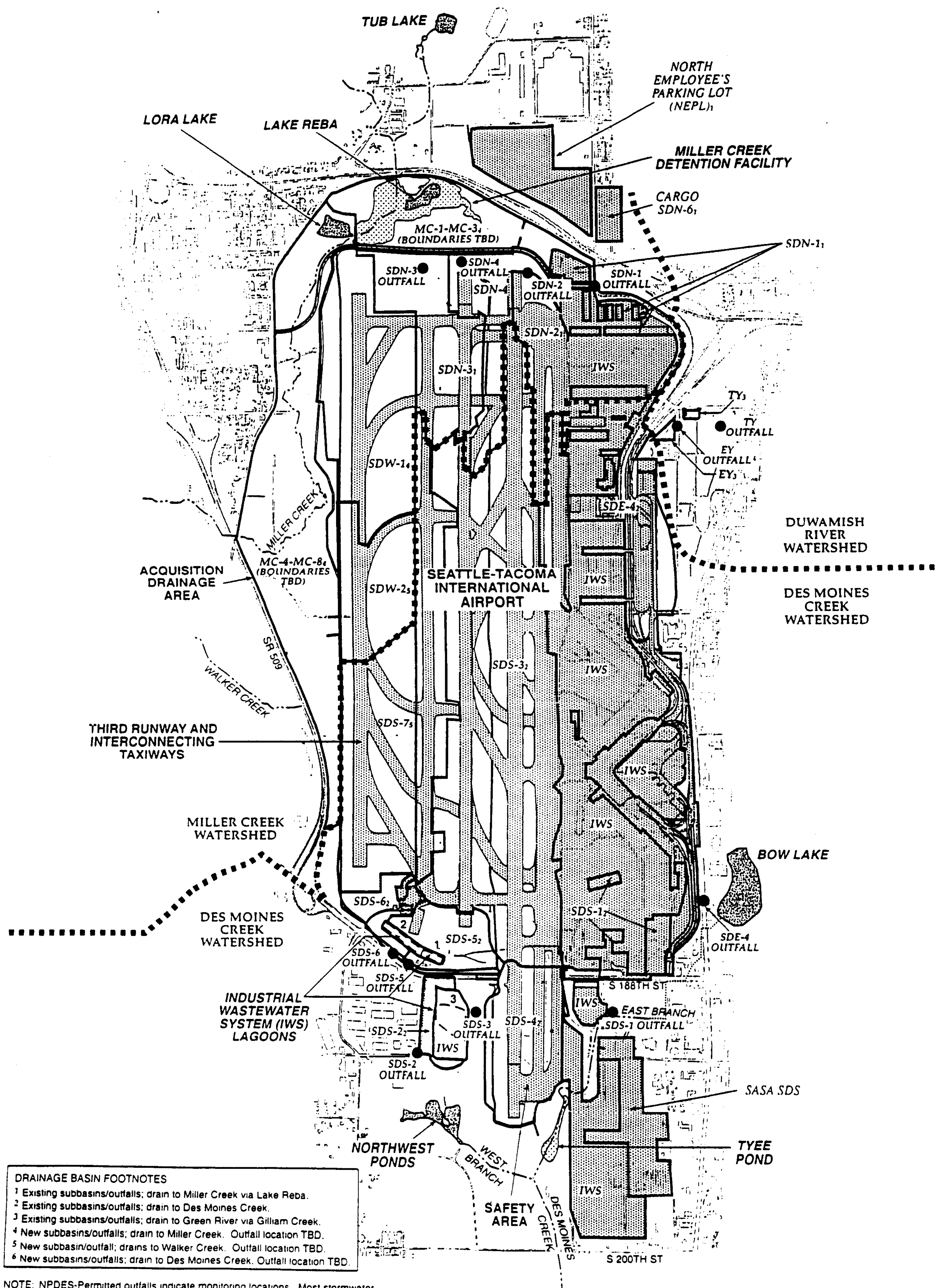
— · —	Stream	▬	Coho, Cutthroat, Steelhead, Chum
········	Piped Stream	▬	Coho, Cutthroat.
	Lake	— · —	Cutthroat, Pumpkinseed Sunfish
●	Potential Chinook and Bull Trout Habitat	▬	Pumpkinseed Sunfish, Largemouth Bass, Cutthroat
▲	Rivermile	▬	Cutthroat, Coho, Chum
		— · —	Cutthroat, Pumpkinseed Sunfish, Threespine Stickleback

N

SCALE IN FEET

0 1500 3000

Figure 4-1
Current Fish Use of Des Moines Creek, Miller Creek, and Walker Creek Basins



NOTE: NPDES-Permitted outfalls indicate monitoring locations. Most stormwater must be conveyed through additional storm drainage pipes before reaching receiving waters. Existing NPDES outfalls locations may be changed during future permit renewals.

Port of Seattle/Biological Assessment/556-2912-001(48) 6/00 (K)

- Drainage Basin Divide
- SeaTac Airport Drainage Basin Boundaries
- SDS-2 SeaTac Airport Drainage Basin Name
- Water Features
- Impervious Surface Area
- NPDES-Permitted Outfall (Existing)

SCALE IN FEET 0 750 1,500

N

Figure 4-2
Future Storm Drainage System Subbasins and Existing NPDES-Permitted Outfalls

area formerly had a more extensive network of headwater wetlands that buffered the stream from winter storms and provided recharge during summer dry periods (May 1996).

In reaches downstream of 1st Avenue S. (RM 1.8), Miller Creek flows through a well-incised ravine and cuts through glacial material before entering Puget Sound via a small estuary. The outlet stream from Burien Lake enters the ravine reach at RM 1.2. A sewage treatment plant operates alongside Miller Creek at approximately RM 1.0. Walker Creek, an anadromous fish-bearing stream that originates in wetlands west of STIA and SR 509, enters Miller Creek approximately 300 ft upstream of its mouth, in a park just upstream of the Miller Creek estuary (see Section 4.1.2).

A waterfall, which drops over a hardpan lip at about RM 3.1, has been described as a complete barrier to upstream migrations of anadromous fish (Williams et al. 1975; Ames 1970). That assessment agrees with local historical anecdotes that make many references to salmon in Miller Creek up to about the waterfall location, but not beyond (see Figure 4-1). Recent spawning surveys conducted by Trout Unlimited (Batcho 1999, personal communication) have also identified this waterfall as the upper limit to coho salmon distributions in Miller Creek.

While this waterfall appears to serve as an effective migration barrier based on these reports, empirical information suggests that salmonids may be capable of leaping the waterfall. Parametrix measured hydraulic conditions of the waterfall on November 8, 1999, during the period when spawning coho salmon are present in Miller Creek. On this date, stream flow was estimated to be 12 cubic ft per second (cfs) and was below bank-full conditions. The vertical drop of 4 ft (measured from the upstream crest to the surface of the plunge pool) was within the maximum jumping height (7.3 ft) reported for coho salmon (Reiser and Peacock 1985). The plunge pool at the base of the waterfall was 5.7 ft deep and exceeded the vertical drop by more than 1.25 times, thereby providing good leaping conditions for upstream migrants (Stuart 1962). The falling water enters the plunge pool at a nearly 90-degree angle, allowing a standing wave to develop, which provides fish with additional vertical momentum to surmount the falls. Water upstream of the crest is approximately 6 inches deep, which is the minimum depth necessary for successful landing by coho salmon (Powers and Orsborn 1985). Surface velocities measured upstream of the falls crest ranged from 11 to 12 ft per second, within the limits of sustained and lower darting swimming speeds reported for coho salmon (Bell 1973).

While these observations suggest coho salmon may be physically capable of ascending the waterfall, several factors may explain why they have not been reported upstream of this location:

- Hydraulic conditions are variable during the spawning season, and are not often conducive to ascending the falls.
- Observations of spawning coho in Miller Creek are limited, and may not have occurred when coho salmon may have been present above the falls.
- Upstream habitat conditions are not favorable to the perpetuation of coho salmon capable of ascending the waterfall.
- The need to ascend the waterfall may be density dependent and coho salmon do not occur in numbers sufficient to prompt leaping into vacant habitats. Alternatively, those coho unable to successfully defend spawning areas below the falls are also unable to ascend the falls.

Sampling has found threespine stickleback (*Gasterosteus aculeatus*), pumpkinseed sunfish (*Lepomis gibbosus*), black crappie (*Pomoxis nigromaculatus*), and cutthroat trout (*O. clarki*) in Miller Creek above these falls (see Figure 4-1; Parametrix 1999a). The warmwater fish species are associated with Lora Lake and Lake Reba, and the lower velocity, fine substrate reaches of upper Miller Creek. Only coho and cutthroat were found rearing below the falls at RM 3.1 (Parametrix 1999a). However, chum salmon (*O. keta*) also spawn in lower Miller Creek (Hillman et al. 1999). During these surveys, no chinook or bull trout were observed.

Downstream from the falls, culverts under 1st Avenue S. and roads near RM 2.0 have been evaluated as impassable to fish (Williams et al. 1975; Ames 1970). However, adult coho have been found upstream of the culverts (Batcho 1999, personal communication).

The lower basin has benefited from instream habitat restoration conducted by Trout Unlimited. The goal is to increase the pool to riffle ratio of stream project segments from the original value of 13:87 calculated when work began in the 1980s, to a level approaching 50:50 (Batcho 1999, personal communication). The goal is to also improve pool quality for rearing juvenile salmonids and increase habitat complexity. Coho salmon returning to the lower basin appear to have responded favorably; recent returns number about 300 adults per year. In fully restored habitat, the expectation is that Miller Creek would support between 700 and 1,200 adult coho per year (Batcho 1999, personal communication).

Miller Creek enters Puget Sound through a private park in the City of Normandy Park. During low tide, the stream flows onto a low-gradient rocky beach composed of 3-inch-minus[17] coarse and fine gravels embedded with sand. To the north, for several hundred feet, the ordinary high water mark (OHWM) is defined by breakwater walls protecting residential property. To the south, for approximately 200 ft, the OHWM is defined by wrack[18] and LWD. The mouth of Miller Creek is affected by tidal activity, which alters stream morphology for approximately 150 ft upstream. Along this tidal channel, the stream is approximately 15 ft wide with overhanging salt marsh vegetation including Pacific silverweed (*Potentilla pacifica*), saltweed (*Atriplex patula*), and sedge (*Carex* sp.). This 15 ft by 150 ft (~ 0.05 acre) area comprises the estuarine area of Miller Creek.[19] (See Section 4.1.2 and Appendix G for further details.)

Low numbers of chum salmon redds were reported by Hillman et al. (1999), who tallied five chum redds in the lower 2.8 km (1.75 mi) of Miller Creek during the 1998-1999 spawning period. These redds were all below 1st Avenue S. Chum salmon commonly spawn in lower stream or river reaches, close to tidewater; they are less exacting in their choice of spawning material than other Pacific salmon. Because emergent fry migrate quickly to saltwater, instream habitat is less critical to their success than for species such as trout or coho, which rear for one to two years in the stream.

The confluence of Miller and Walker creeks is approximately 300 ft upstream from the mouth of Miller Creek. Upstream from the confluence, Walker Creek has a diversion pipe that draws water into a small pond impounded by a control weir. Water leaving the pond enters Miller Creek

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[17] Indicating that 95% of the gravel present would pass through a 3-inch screen.

[18] Wrack is seaweed and other marine debris that is cast up on shore.

[19] This estuary may have been larger prior to development of a private park in the vicinity.

approximately 10 ft upstream of the outfall to Puget Sound. The 3-ft-wide channel is incised approximately 1.5 ft and is tidally influenced from the confluence with Miller Creek to approximately 100 ft from the control weir. Salt marsh plants occur near its confluence with Miller Creek, and cat-tails (*Typha latifolia*) dominate the channel upstream near the control weir.

Estimates of impervious surfaces within the Miller Creek basin range from 49.4 percent based on aerial photo analysis (May 1996) to 23 percent using digitized land use data and Geographic Information systems (Parametrix 1999b). King County Surface Water Management (1987) reported an intermediate value of 40 percent[20].

Condition of Fish Habitat in Miller Creek

The Washington Department of Fisheries reported that Miller Creek had undergone extensive alteration and "total deterioration" due to heavy residential and commercial growth in the drainage in the early 1970s (Williams et al. 1975). Stream conditions necessary to adequately support spawning and rearing of salmonids "were virtually nonexistent" upstream of 1st Avenue S. (RM 1.9) due to excessive amounts of sand and silts that comprised 70 to 100 percent of the bottom substrate (Ames 1970). King County's Surface Water Management (1987) evaluation of the Miller Creek basin noted that the high level of urbanization had degraded water quality, increased the volume and rate of storm flows, promoted erosion and mass wasting processes, and destroyed riparian habitat and vegetation.[21] These factors (summarized in Table 4-1) had greatly reduced the habitat quality of streams, which in turn affect fish populations.

Miller Creek Stream surveys have been completed by Trout Unlimited (1993), Luchessa (1995), Parametrix (1999a), and Hillman et al. (1999). The 1995 survey by Luchessa was conducted as a Level I Stream Special Study using King County methodology (King County Building and Land Development 1991). Surveys agreed on Miller Creek's deteriorated habitat, particularly in the upper basin above RM 1.9. Factors contributing to loss of instream habitat included: degradation of water quality by pollutants, sediment, eutrophication of lakes and wetlands, and filling of wetlands; loss of protective streamside vegetation; loss of instream large organic debris, natural meanders, and other diversity. In addition, high water temperatures in Miller Creek during the summer constitute a water quality concern, as do high fecal coliform counts, low dissolved oxygen (DO) levels, and residues of lawn and garden chemicals, especially in the upper reaches (Parametrix 1999a).

In Miller Creek, benthic macroinvertebrate sampling near the MPU projects found benthic index of biotic integrity[22] (B-IBI) scores of 10. These scores are similar to scores observed in other urban streams subjected to hydrologic and habitat degradation (Kleindl 1995; Fore et al. 1996; Horner et al. 1996; Ecology 1999a; May et al. 1997). Studies of Puget Sound lowland streams have demonstrated that the macroinvertebrate community, as evaluated through B-IBI analysis, correlates to fish use.

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[20] These variations are due to differences in analytical methods and resolution available.

[21] Despite reported water quality degradation, Miller Creek is not on the 303(d) list of impaired waterbodies.

[22] B-IBI for Puget Sound lowland streams (Kleindl 1995) quantifies the overall biotic condition of a stream based on measurements of benthic macroinvertebrate diversity, abundance, and species composition. B-IBI scores for streams in the Puget Sound lowlands correlate with levels of urbanization (Fore et al. 1996; Horner et al. 1996) and fish use (Ecology 1999a; May et al. 1997).

Table 4-1. Environmental baseline conditions in Miller Creek, near Seattle-Tacoma International Airport.

	Environmental Baseline			
Pathways: Indicators	Properly Functioning	At Risk	Not Properly Functioning	Explanation
Water Quality:				
Temperature			X	Commercial, residential, and agricultural modifications to vegetation along the stream corridor have impacted ambient stream temperature. Causes of increased stream temperatures include the loss of riparian shading, impervious surfaces within the watershed, and the existing stormwater conveyance system. Daily fluctuations in water temperatures are greater in areas where riparian shading has been reduced. Stormwater systems and impervious surfaces have altered basin hydrology by conveying runoff rapidly to the stream. Runoff collected from impervious surfaces during summer may periodically contribute to temperature problems. Reduced infiltration may cause reductions in base flows, which may increase water temperatures during the summer low-flow periods.
Sediment			X	Urban developments within the watershed have altered native soils and vegetation resulting in increased sedimentation in Miller Creek. Sedimentation from agricultural runoff as well as from channel alterations occurs at Vacca Farm. Several reaches with heavy sedimentation (highly embedded substrates) are apparent. Unmaintained culverts in low-gradient reaches tend to retain small substrates and reduce the capacity of the streambed to mobilize. Historic changes such as stream channelization and the removal of LWD have increased stream degradation and fine sediment input. Historic loss of wetlands further reduces the basin's capacity to buffer sediment inputs.
Chemical and Nutrient Contamination		X		Residential development has resulted in replacement of riparian vegetation with lawns. Agricultural runoff from urban development may contain fertilizers, herbicides, pesticides, metals, oil and grease as pollutants that flow directly into the creek. Failed septic systems may also discharge nutrients and oxygen demand to the creek. The increase in nutrients could increase primary production and respiration, ultimately reducing DO, especially during summer.
Habitat Access:				
Physical Barriers			X	Several culverts may be barriers to migrations of resident and anadromous fishes at different times of the year, depending on flow conditions. The lack of LWD in the channel and alteration of stream hydrology may alter the ability of fish to pass a natural fall at approximately RM 3.0.

Table 4-1. Environmental baseline conditions in Miller Creek, near Seattle-Tacoma International Airport (continued).

Pathways: Indicators	Environmental Baseline: Properly Functioning	At Risk	Not Properly Functioning	Explanation
Habitat Elements:				
Substrate			X	Gravel accumulations suitable for spawning by anadromous salmonids occur at several locations in the channel. Smaller accumulations suitable for resident salmonid spawning are more frequent; however, most spawning substrates are heavily embedded with silt and sand at levels greater than 30%.
Large Woody Debris			X	Historically, LWD has been cleared from the channel. The reduction or elimination of a native riparian area has impacted the recruitment of coniferous LWD. Loss of LWD has altered channel morphology resulting in reduced sinuosity, decreased pool to riffle ratio, and limits cover and habitat. Non-coniferous LWD recruitment occurs; however, it is routinely cleared from streams by homeowners.
Pool Frequency			X	Several deep pools exist. However, most are formed by modified channel features (e.g., below culverts, riprap, etc.) and lack quality habitat cover.
Off-channel habitat			X	Residential development has increased channelization and degradation, thereby eliminating opportunity for hydrologically connected seasonal habitats along stream margins. This has decreased side channel salmonid rearing habitat. Historic filling of riparian wetlands and armoring of stream banks may have decreased hydrologic connection to secondary channels.
Refugia			X	Channelization and reduction of instream structure decreases resting areas for fish. Loss of LWD and increased channel scouring reduces habitats available, especially low-velocity areas for juvenile fish. Riparian alterations, channelization, and lack of LWD result in few bank undercuts. Development to stream banks, channelization, and filling has resulted in loss of wetland and side channel habitat for rearing fish. Riparian impacts reduce overhead cover.
Channel Conditions and Dynamics:				
Width/Depth Ratio			X	Width/depth ratios vary considerably along the length of Miller Creek, but are generally low in channelized reaches and more favorable in less-developed reaches.
Streambank Condition			X	Condition of streambanks in the basin is variable. The Vacca Farm reach is channelized; however, riparian vegetation tends to stabilize these reaches with minor undercuts. Several reaches through residential neighborhoods contain large non-coniferous trees that stabilize banks with undercuts. Other areas are armored with riprap or other artificial bank structures. Lower reaches contain areas with natural banks, but most associated vegetation is relatively small.

Table 4-1. Environmental baseline conditions in Miller Creek, near Seattle-Tacoma International Airport (continued).

Pathways: Indicators	Environmental Baseline: Properly Functioning	Environmental Baseline: At Risk	Environmental Baseline: Not Properly Functioning	Explanation
Channel Conditions and Dynamics (con't):				
Floodplain Connectivity		X		Except for the Vacca Farm area, incised streams of this nature lack a significant floodplain. Some wetlands are hydrologically connected to the channel. In the mid-basin, many residential yards are modified to drain directly to the stream banks, and stormwater is conveyed directly back to the channel. Wetlands have been filled to enlarge developable areas. Impervious surfaces are extensive and may comprise up to 49% of the basin area.
Flow/Hydrology				
Peak/Base Flows			X	Negative effects of stormwater runoff in the upper basin have been moderated through regional and STIA detention ponds. Most runoff from residences and roads in the mid and lower basin is conveyed directly to the channel, with little or no detention. Current conditions result in strong hydrographic peaks immediately following precipitation. Reduced infiltration and water withdrawals reduce summer base flows.
Drainage Network Increase			X	Impervious surfaces are extensive throughout the basin including the airport, roads, residences, and commercial development. Most runoff from impervious surfaces is conveyed through an extensive network of stormwater pipes and open drainage ditches. This increase in drainage network accentuates peak runoff rates.
Watershed Conditions:				
Road Density and Location			X	Roads, parking lots, and other impervious surfaces are extensive throughout the basin.
Disturbance History			X	Human disturbances in the basin are extensive. Residential development in the mid and lower basin have maintained some riparian areas.
Riparian Reserves			X	Riparian areas have been extensively altered. The upper basin associated with the airport has little functioning riparian area. Riparian areas are extensively altered in agricultural areas. Limited functioning riparian areas exist in residential areas, but these are fragmented and have been invaded by exotic species which dominate many locations.

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Specifically, coho salmon abundance diminishes in streams with B-IBI scores of 33 or lower; these degraded stream reaches were used by resident cutthroat and not by anadromous salmon (Ecology 1999a; May et al. 1997). These findings are consistent with observations of fish use in Miller Creek and support surveys that suggest the portions of the creek adjacent to the Master Plan Projects do not currently provide high-quality habitat for coho salmon.

4.1.2 Miller Creek Estuary

A small estuary occurs where Miller Creek enters Puget Sound. Analysis of baseline conditions in the estuary (Table 4-2) indicate significant modification of this area by park development. As Miller Creek approaches the beach (Appendix G, Figure G-1), it is bordered by a private park to the south and several houses to the north. The park is mainly a grassy area with deciduous trees growing near the creek bank. The creek enters the beach about 75 ft downstream of a small footbridge and an adjacent house (Appendix G, Figure G-1).

The shoreline adjacent to Miller creek is predominantly gravel and sand with driftwood marking the high tide mark. This shoreline type continues for several hundred feet north and south of the creek where houses and cement bulkheads have been built at the high tide mark. The slope of the upper intertidal beach is moderate, dropping approximately 5 ft over a distance of 30 ft, then gentle into the water, dropping approximately 4 ft over 150 yards to mean lower low water (MLLW).

The intertidal zone at the mouth of Miller Creek is composed predominantly of mixed gravel and sand. Some cobble, boulders, and sandy areas are less present. The creek channel in the upper intertidal zone contains more cobble than adjacent areas.

The channel is vegetated with green algae (*Enteromorpha intestinalis).* The substrate has some attached barnacles, mussels, and snails. Upper intertidal areas adjacent to the stream have very little algae or other attached marine life, however amphipods and isopods are abundant under rocks and in the sand. In the middle intertidal zone, *E. intestinalis* becomes less abundant in the creek channel, while barnacles and mussels become the dominant species adjacent to the creek. In the lower intertidal zone, the creek channel is poorly defined and the substrate within and adjacent to the creek channel are similar (mixed gravel and sand). Barnacles and mussels are present, but less dense than found in the middle intertidal zone. Additionally, species of brown, red, and green algae are all sporadically present and bivalve siphons can be observed in the sandy areas.

4.1.3 Walker Creek

Walker Creek drains an approximately 2.5-mi^2 subbasin of the Miller Creek watershed. The creek originates in a 30-ac wetland (Wetland 43) located between Des Moines Memorial Drive and SR 509. The stream flows through both residential and commercial development before its confluence with Miller Creek approximately 300 ft upstream from Puget Sound. Much of the riparian areas adjacent to the creek have been eliminated or altered by adjacent development.

Walker Creek parallels Miller Creek for roughly one-half its length and they share similar effects from urbanization. KCSWM (1987) reports several problems in the Miller/Walker Creek watershed created by urbanization; these include excessive runoff from streets, parking lots, and

Table 4-2. **Environmental baseline conditions in the Miller Creek estuary, near Seattle-Tacoma International Airport.**

Pathways: Indicators	Environmental Baseline: Properly Functioning	At Risk	Not Properly Functioning	Explanation
Water Quality Elements:				
Sedimentation and Turbidity		X		Urban development in the watershed has likely altered rates of sediment deposition and turbidity in the estuary compared to natural conditions. Increased rates of sediment deposition could decrease food availability for salmon.
Dissolved Oxygen		X		Removal of riparian vegetation can increase water temperature and biological production. Especially during warm weather, these factors can reduce DO and cause stress for salmon.
Water Contamination		X		Runoff from urban development in the watershed has likely increased nutrient loading to the estuarine environment. Runoff from urban development may also contain various inorganic and organic contaminants.
Sediment Contamination		X		Urban and shoreline development increases the potential for sediment contamination in the estuaries.
Physical Habitat Elements:				
Substrate/Armoring			X	Miller Creek estuary is located within a private park and is confined on both sides with riprap and incised banks. The substrate is composed of gravels embedded with fines.
Depth/Slope		X		The inter-tidal beach is a low-gradient shallow stream section confined by a rocky bar. The reach of estuary above the mouth is a low-gradient shallow depositional area confined by armored and incised stream banks.
Tideland Condition/ Filling of Tidelands			X	Tidelands have been filled to create parkland. Natural wetlands have been filled and are now confined by the park and development.
Marsh Prevalence/ Complexity			X	Tidally influenced wetlands are very small, isolated, and dominated by exotic species. Most of the Miller Creek Estuary has been filled to create a park.
Refugia		X		A side channel in the Miller Creek estuary exists as a small drainage from an artificial pond which may provide refugia during high flows. Overhanging bank vegetation and undercut banks are present for several hundred feet above the estuary.
Physical Barriers	X			No artificial physical barriers are present. Two footbridges cross the stream near its mouth.

Table 4-2. Environmental baseline conditions in the Miller Creek estuary, near Seattle-Tacoma International Airport (continued).

Pathways: Indicators	Environmental Baseline: Properly Functioning	At Risk	Not Properly Functioning	Explanation
Current Patterns	X			Current patterns in offshore areas have not been modified by in-water structures.
Salt/Fresh Water Mixing Patterns and Locations		X		The saline influence of Miller Creek Estuary is limited to a few hundred feet above the mouth of the stream. The saline influence is limited to the incised stream and its small side channel and has likely been reduced by filling of wetlands. Elevation, grade, and flow rates limit the upper extent of the saline influence of Miller Creek.
Biological Habitat Elements :				
Benthic Prey Availability	X			Filled tidelands have reduced estuarine habitat available to benthic prey. Potential diversity and abundance appear normal for the given substrate.
Forage Fish Prey Availability	X			Based on macrophyte and benthic prey availability, we presume that typical forage fish prey are present.
Marine Vegetation	X			Where substrate allows, typical green, red, and brown macrophytes are present in the intertidal zone.
Exotic Species			X	Non-native vegetation (grass and blackberry) dominate the creekside vegetation above Miller Creek's bank. No exotic marine vegetation is present.

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commercial areas that has increased the volume and rate of storm flows. These increased flows have lead to mass-wasting and stream erosion, flooding, and loss of habitat. Runoff from this development has also reduced water quality and impaired fish usage.

Even though coho salmon occur in the lower reaches of Walker Creek (Batcho 1999, personal communication), the absolute upstream limit of coho use has not been documented. Coho use in Walker Creek is approximated in Figure 4-1. Hillman et al. (1999) conducted spawning surveys in Walker Creek from October 1998 to March 1999, and tallied 66 coho redds in the lower 3.6 km (2.3 mi). They also found seven chum redds up to river mile (RM) 1.35, and one potential cutthroat redd in the lower 1500 ft of the creek. During these surveys, chinook or bull trout were not observed.

While a small portion of the Walker Creek watershed (approximately 5.2 ac) will be developed for the third runway project, the project will not remove or directly alter fish habitat in Walker Creek. The runway project would fill about 0.26 ac of Wetland 44 (upslope of the defined Walker Creek channel and fish habitat). Potential indirect impacts to the creek could occur as a result of changes in water quality and hydrology.

4.1.4 Des Moines Creek

The Des Moines Creek watershed covers about 5.8 mi^2 of predominantly residential, commercial, and industrial area lying within the cities of SeaTac and Des Moines; it also includes a small area of unincorporated King County (Des Moines Creek Basin Committee 1997). STIA occupies 23 percent of the upper Des Moines Creek watershed. Baseline environmental conditions in the creek (Table 4-3) are highly modified from natural conditions by a variety of development and land-use practices.

The headwaters of the east branch (considered the mainstem by most locals) originate at Bow Lake, 3.7 RM from Puget Sound. The upper half mile of the east branch, from Bow Lake downstream to about RM 3, is conveyed through underground pipes. The west branch originates from the Northwest Ponds stormwater detention complex located at the western edge of the Tyee Valley Golf Course and joins the east branch at approximately RM 2.4. Downstream of S. 200th Street (RM 2.2), the stream flows through Des Moines Creek Park, a forested riparian wetland. The park includes an incised ravine at about RM 1.8. The ravine is a high-gradient reach in which the stream has cut to hardpan for most of the length providing little quality fish habitat. The creek is paralleled within this ravine by a paved trail and/or service road and sewer line protected in places by rock bank armoring.

Documentation of fish use in Des Moines Creek is provided in a Des Moines Creek Basin Committee report (1997) and Hillman et al. (1999), and is mapped in Figure 4-1. A variety of native salmonids use the lower 0.4 mile (below Marine View Drive), and include chum, and coho, as well as cutthroat and steelhead (*O. mykiss*) trout. Only steelhead, cutthroat, and coho are known to pass the partial migratory blockage under Marine View Drive. Coho use extends to approximately RM 1.5. The upper plateau reach supports a mixture of cutthroat and non-native warmwater fish species, particularly pumpkinseed sunfish. Largemouth bass (*Micropterus salmoides*) are found in lower numbers than pumpkinseeds in the upper creek. Warmwater fish found in the creek mainstem are presumed to be contributed by larger populations in Bow Lake,

Table 4-3. **Environmental baseline conditions in Des Moines Creek, near Seattle-Tacoma International Airport.**

Pathways: Indicators	Environmental Baseline: Properly Functioning	At Risk	Not Properly Functioning	Explanation
Water Quality:				
Temperature			X	Commercial and residential development in the stream corridor have impacted riparian conditions, affecting stream temperature. Daily fluctuations in water temperatures are greater in areas where riparian shading has been reduced such as the Tyee Valley Golf Course. Stormwater systems and impervious surfaces have altered basin hydrology by conveying runoff rapidly to the stream. Runoff collected from impervious surfaces during summer may periodically contribute to temperature problems. Reduced infiltration may cause reductions in base flows, which may increase water temperatures during summer, low-flow periods.
Sediment			X	Urban development within the watershed have resulted in alteration of native soils and vegetation resulting in increases in the sediment discharge and transportation in Des Moines Creek. Several reaches with heavy sedimentation (highly embedded substrates) are apparent. Historic changes such as stream channelization and removal of large woody debris (LWD) have increased stream incision and fine sediment input. Historic loss of wetlands may reduce capacity of basin to buffer sediment inputs.
Chemical Contaminant/ Nutrient		X		The Tyee Valley Golf Course may be a source of fertilizer and chemical runoff. Increases in nutrients increase biological activity in the creek, ultimately reducing DO, especially during summer. Residential and commercial development near Bow lake or parking lots south of the runway has likely increased loading of fertilizers, pesticides, metals, and organic hydrocarbons (oil and grease) to the creek.
Habitat Access:				
Physical Barriers			X	Several weirs on the Tyee Golf Course and culverts on Marine View Drive or South 200[th] Street may be barriers to resident and anadromous fish at different times of the year, depending on flow conditions.
Habitat Elements:				
Substrate			X	Gravel accumulations suitable for spawning by anadromous salmonids occur at several locations in the lower reaches of the channel. Smaller accumulations suitable for resident cutthroat trout spawning are more frequent. Most spawning substrates are heavily embedded with silt and sands.

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Table 4-3. Environmental baseline conditions in Des Moines Creek, near Seattle-Tacoma International Airport (continued).

Pathways: Indicators	Environmental Baseline: Properly Functioning	At Risk	Not Properly Functioning	Explanation
Large Woody Debris			X	LWD has been cleared from the channel. The reduction or elimination of a native riparian area has impacted the recruitment of coniferous LWD. Loss of LWD has altered channel morphology resulting in reduced sinuosity, decreased pool to riffle ratio and limits to cover and habitat. Coniferous and non-coniferous LWD recruitment occur below S. 200th St. on the east bank of the stream (Parametrix 1997).
Pool Frequency			X	Des Moines Creek streambed does not meet optimal pool frequency conditions in the Tyee Valley Golf Course. Channelization, increased sediment input, alterations to the hydrograph, removal of LWD, and riparian alterations have decreased pool frequency and may have impacted the development of future pool. A high pool frequency occurs below S. 200th St. where the stream grade increases to a step/pool system formed mainly by boulders.
Pool Quality			X	The stream is channelized within the Tyee Valley Golf Course where a few deeper pools exist, especially below weirs. Quality habitat features do not exist within these pools. Boulders and some LWD form several deep pools below S. 200th St.
Off-channel habitat			X	Channelization through the Tyee Valley Golf Course has eliminated opportunities for hydrologically connected habitat along stream margins resulting in a decrease in side channel rearing habitat. Below S. 200th, the steep slope of the creek confines the channel, offering little off-channel habitat.
Refugia			X	Channelization and reduction of instream structure decreases hydraulic heterogeneity resulting in the loss of resting areas for fish. Loss of LWD and increased channel scouring reduces habitats available, especially low velocity areas for juvenile fish. Riparian alterations, channelization, and lack of LWD result in few bank undercuts. Channelization and filling has resulted in loss of wetland and side channel habitat for rearing fish. Riparian impacts also reduce overhead cover. Within the ravine south of S. 200th St., the steep slopes offer some overhanging vegetation and LWD.
Channel Condition & Dynamic:				
Width/Depth Ratio			X	Width/depth ratios vary considerably along the length of Des Moines Creek, but is generally low in channelized reaches and more favorable in less developed reaches.
Streambank Condition			X	Condition of streambanks in the basin is variable. The upper portion of the stream is largely culverted or channelized through parking lots, streets, and a golf course. Stream width is narrow, with portions of the banks containing riprap. Lower reaches (below S. 200th St.) of the stream contain areas with natural banks and forested riparian vegetation.

Table 4-3. **Environmental baseline conditions in Des Moines Creek, near Seattle-Tacoma International Airport (continued).**

Pathways: Indicators	Environmental Baseline: Properly Functioning	At Risk	Not Properly Functioning	Explanation
Floodplain Connectivity		X		Large wetlands are connected to the channel occur on the Tyee Valley Golf Course. Some stormwater detention exists in the upper basin associated with STIA. Wetlands have been filled to enlarge developable areas.
Flow/Hydrology:				
Peak/Base Flows			X	Impervious surfaces are extensive and may comprise up to 49% of the basin area. Little of this area receives adequate stormwater management. Return of stormwater in the upper basin has been moderated through detention ponds associated with airport runoff. Most runoff from residences and roads in the mid and lower basin is conveyed directly back to the channel, with little or no detention. Current conditions likely result in strong hydrographic peaks immediately following precipitation.
Drainage Network Increase			X	Impervious surfaces are extensive throughout the basin and include the roads, residences, commercial development, and airport facilities. Most runoff from impervious surfaces is conveyed through ditches and pipe systems to the creek without adequate stormwater management.
Watershed Conditions:				
Road Density & Location			X	Roads are extensive throughout the basin.
Disturbance History			X	Basin disturbances are extensive, however, parkland or residential development in the mid and lower basin have maintained some riparian areas.
Riparian Reserves			X	Riparian areas have been extensively altered in the upper reaches. The riparian areas upstream of S. 200th St. are extensively altered by golf course and other development. Lower reaches contain a relatively continuous riparian corridor. The width of the corridor is variable and frequently limited by residential uses and exotic species.

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and possibly also the Northwest Ponds. Chinook salmon and bull trout have not been observed in Des Moines Creek.

A cascade at RM 1.5 in the ravine reach was mapped as impassible to upstream-migrating fish (Williams et al. 1975). However, recent surveys have not identified this cascade as a fish barrier (Resource Planning Associates et al. 1994). The Midway Sewage Treatment Plant is located at RM 1.1 where the ravine widens. The channel in this reach contains several aging weirs originally intended to be fish-passage structures; in their present state they may act as impediments to fish passage. Just below the treatment plant, the gradient decreases and the stream develops a floodplain that allows a more meandering channel, better habitat conditions, and well-developed riparian vegetation.

At Marine View Drive (RM 0.4), a 225-ft-long box culvert conveys the creek under the roadway, but acts as an impediment to migrating salmon and trout because of its high velocities (greater than 7 ft per second) and length (225 ft) (Des Moines Creek Basin Committee 1997). Below Marine View Drive, the stream reach through Des Moines Beach Park provides some of the most accessible and more heavily spawned fish habitat in the system. Hillman et al. (1999) found coho and chum redd densities of 26.3 and 20.0 redds/mi, respectively, during studies in this reach in 1998-1999.

Condition of Fish Habitat in Des Moines Creek

King County has estimated that the Des Moines Creek basin is 32 percent impervious surface, based on digitized land use data and Geographic Information systems (Parametrix 1999a). May (1996) reported a value of 49.1 percent, based on aerial photo analysis. Previous stream studies and habitat inventories dating back to 1974 (Des Moines Creek Basin Committee 1997) established that Des Moines Creek has been severely degraded by urbanization. Little usable salmonid habitat exists in the system upstream of S. 200th Street. Downstream of S. 200th Street, where the stream flows through a forested wetland area, a short reach harbors resident trout and pumpkinseed sunfish. Better native fish habitat exists in meanders below the Midway Treatment Plant; however, the culvert under Marine View Drive restricts migrating salmon and trout from reaching this habitat. The stream reach through Des Moines Beach Park provides the most fish use, with coho salmon, chum salmon, cutthroat trout, and steelhead observed in this reach.

Des Moines Creek is on the Washington State 303(d) list of impaired water bodies for exceeding standards for fecal coliform levels at both storm flows and base flows (Parametrix 1999a; Ecology 1998a; Des Moines Creek Basin Committee 1997). High water temperatures in summer have also been identified as a water quality concern (Parametrix 1999a; Des Moines Creek Basin Committee 1997).

Des Moines Creek enters Puget Sound through Des Moines Park located in the City of Des Moines. During low tide, the stream flows onto a low-gradient rocky beach composed of 3-inch-minus coarse and fine gravels embedded with sands. To the north, for several hundred feet, the OHWM is defined by a wrack of large woody debris. To the south for approximately 50 ft, the OHWM is defined by breakwater walls protecting residential property. Beyond the house to the south, the beach is composed of riprap protecting the Des Moines Marina.

4.1.5 Des Moines Creek Estuary

A small estuary is present where Des Moines Creek enters Puget Sound. Baseline environmental conditions (Table 4-4) in this estuary have been highly modified by park development. Before entering the beach, Des Moines Creek runs through Des Moines Beach Park consisting of lawn, roads, parking areas, etc. (Appendix G, Figure G-1). Two bridges cross the creek and the stream bank is stabilized with riprap.

The marine shoreline for about 200 ft north of Des Moines Creek is stabilized with riprap before a vegetated bluff starts and continues north. Approximately 400 ft north of Des Moines Creek some houses are protected by cement bulkheads located near the high tide mark. Immediately south of the creek, a riprap wall runs south and west across the beach to a fishing pier and the Des Moines Marina. Within the marina, the shoreline continues as riprap. The beach at the creek mouth and north of the creek has a gentle slope, dropping approximately 5 ft over 100 yards. South of the creek mouth, the riprap wall drops steeply from the high tide mark to the lower intertidal zone over a span of 25-30 ft.

The intertidal zone at the mouth of Des Moines Creek is composed of gravel and sand with some cobble and boulders. This substrate type is fairly uniform throughout the intertidal zone north of the creek. South of the creek, starting at the fishing pier, riprap covers the entire intertidal zone. *E. intestinalis* is the dominant algae in the upper intertidal zone, covering cobble and boulders about 75 ft into the Des Moines Creek channel. Lesser amounts of *E. intestinalis* are attached to rocks adjacent to the creek with barnacles sporadically present. The middle intertidal zone is dominated by barnacles and mussels, except for in the stream channel where *E. intestinalis* dominates most cobble with some presence of barnacles. The lower intertidal zone continues to have abundant numbers of barnacles and mussels with green, brown, and red algae being common. Isopods, shore crabs, and snails were more readily found in this zone and bivalve siphons were periodically observed in sandy areas. The riprap south of the creek hosts an intertidal community very different from the gradual beach to the north of the creek. Here, the majority of the intertidal zone is densely occupied by barnacles, mussels, and the red algae *Mastocarpus papillatus*. Littorina snails, and limpets are also abundant throughout this area.

4.1.6 Green River

The Green River watershed is comprised of some 482 mi^2. Development of the Green/Duwamish watershed has resulted in a variety of changes to the basin's suitability for salmonids. This development includes the diversion of Black and White rivers during the early 1900s, construction of Howard Hansen Dam (RM 64) that blocks access to significant habitat, diking of the mainstem below RM 38, forest practices, agriculture, urbanization, and industrialization in the lower Duwamish River. Of the original Green/Duwamish estuary, 97 percent has been filled; 70 percent of its original flow has been diverted to other basins, and 90 percent of the original floodplain is no longer flooded on a regular basis (USACOE 1997; USEPA 2000a). The city of Tacoma diverts flows in the upper watershed for use as a municipal water supply. The middle portion of the basin remains primarily rural; however, agriculture has increased sediments and nutrients in the river, degrading water quality as well as salmon spawning and rearing habitats. The lower reaches are becoming increasingly urbanized. The tidally influenced Duwamish Waterway has been extensively dredged and channelized for maritime use by the Port of Seattle and private industry.

Table 4-4. **Environmental baseline conditions in the Des Moines Creek estuary, near Seattle-Tacoma International Airport.**

Pathways: Indicators	Environmental Baseline: Properly Functioning	At Risk	Not Properly Functioning	Explanation
Water Quality Elements:				
Turbidity		X		Urban development in the watershed has likely altered sediment deposition rates and turbidity in the estuary compared to natural conditions. Increased rates of sediment deposition could decrease food availability for salmon.
Dissolved Oxygen		X		Removal of riparian vegetation can increase water temperature and biological production. Especially during warm weather, these factors can reduce DO and cause stress for salmon.
Water Contamination		X		Runoff from urban development in the watershed (including the nearby marina) has likely increased nutrient loading to the estuarine environment. Runoff from urban development also contains various inorganic and organic contaminants.
Sediment Contamination		X		Urban and shoreline development (including the nearby marina) increases the potential for sediment contamination in the estuary
Physical Habitat Elements:				
Substrate/Armoring			X	The estuary is located within the Des Moines Beach Park and is confined on both sides with riprap. The substrate is composed of gravels embedded with fines. Several pieces of woody debris and root wads are cabled within the riprap.
Depth/Slope		X		The inter-tidal beach is at approximately a 3% grade. Creek flow is dispersed over gravels and cobbles. The reach of estuary above the beach is a low-gradient shallow depositional area confined by armored banks.
Tideland Condition/ Filling of Tidelands			X	Tidelands have been filled to form the Des Moines Beach Park.
Marsh Prevalence/ Complexity			X	No vegetated wetlands are present.
Refugia			X	The saline influence of Des Moines Estuary continues a few hundred ft upstream of the riprap-confined mouth of the stream. No refugia exist within this area.
Physical Barriers				The Des Moines Estuary is confined to a narrow channel by riprap and a footbridge. A log weir confines the end of the saline influence.

Table 4-4. Environmental baseline conditions in the Des Moines Creek estuary, near Seattle-Tacoma International Airport (continued).

Pathways: Indicators	Environmental Baseline: Properly Functioning	At Risk	Not Properly Functioning	Explanation
Current Patterns			X	The nearby marina may have altered current patterns compared to natural conditions.
Salt/Fresh Water Mixing Patterns and Locations			X	The log weir at the upstream end of the estuary reduces the extent of mixing during high tides.
Biological Habitat Elements:				
Benthic Prey Availability		X		Riprap in the intertidal zone south of the creek has altered the habitat available to benthic prey in the marine environment. North of the creek, substrate conditions appear natural, and benthic prey abundance and diversity appears typical.
Forage Fish Prey Availability		X		The steep grade of the riprap south of the creek alters nearshore habitat and fish species present.
Marine Vegetation		X		The channel and the stream banks are unvegetated from the mouth to the upper extreme of the saline influence. Riprap south of the creek hosts macrophyte communities which differ from those on natural substrate.
Exotic Species		X		Vegetation adjacent to the channel consists of non-native lawn species.

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Of the more than 30 fish species identified in the Green River basin, eight are anadromous salmonids (i.e., chinook salmon, coho salmon, sockeye salmon, chum salmon, pink salmon, steelhead, sea-run cutthroat trout, and bull trout) (Tacoma Public Utilities 1998). Chinook and other salmon spawn in the Green River, several hundred feet from the wetland mitigation site (Pentec Environmental 1999; Malcolm, personal communication, 1999). Baseline environmental conditions in the Green River near the wetland mitigation project (Section 4.2) are summarized in Table 4-5.

4.1.6.1 Gilliam Creek

Gilliam Creek is a small creek that discharges to the Duwamish River in the vicinity of the Auburn wetland mitigation site. This creek is a tributary to the Duwamish River and is used mainly by resident fish because of migration barriers that limit anadromous fish passage (Taylor Associates 1996 in City of Tukwila 1997). This creek, which has been impacted by development, is extensively culverted and receives stormwater runoff that causes high peak flows and low base flows. Culverts limit adult salmonid access to this tributary. The resident fishes expected to inhabit this stream and long piped sections include cutthroat trout, western brook lamprey (*Lampetra richardsoni*), carp, peamouth (*Mylocheilus caurinus*), largescale sucker (*Catostomus macrocheilus*), threespine stickleback, and sculpin.

Construction of the new water tower will occur in the basins that drain to Gilliam Creek through stormwater outfalls 012 and 013. The potential impact to Gilliam Creek could be increased turbidity and sedimentation during construction. As there will be no increase in impervious surface associated with the water tower construction nor will land use practices change, there will be no changes in hydrology or water quality after the tower is constructed.

4.2 AUBURN WETLAND MITIGATION SITE

The Auburn wetland mitigation site is a 67-ac parcel of land, located west of the Green River in the City of Auburn. The mitigation is planned to provide off-site avian habitat mitigation (see Figure 1-1) to provide in-kind replacement of wetland habitat functions (primarily for avian species) that cannot be mitigated within 10,000 ft of STIA due to wildlife attractants discussed in FAA Advisory Circular #150/5200-33 (1997b).

The site is bordered by active agricultural fields to the north and south, abandoned pastures to the west, and the Green River to the east. The area slopes to the northwest, with elevations ranging from 45 ft in the northwest corner to 52 ft along the eastern property boundary. King County is proposing to construct a trail along the Green River, east of the proposed mitigation project.

The parcel, which was farmed in the past, now supports (1) upland pasture grasses and forbs common to abandoned agricultural land in the Puget Sound basin and (2) an emergent wetland. Overall, habitat quality at the site (and the adjacent grass-dominated uplands) is low due to a dominance of invasive plant species, low plant diversity, and lack of habitat structure. Small mammals may use the area for feeding and breeding, but the site lacks cover from predation. The site may provide foraging habitat for raptors, such as northern harriers (*Circus cyaneus*) and red-tailed hawks (*Buteo jamaicensis*). Bald eagles could forage along the Green River, adjacent to the site. For most passerine bird species, the site lacks habitat structure for nesting, protection from predation, thermal cover, or perching. A narrow band of shrub vegetation along the site's southern boundary offers limited forage and perching habitat. The site is currently zoned single-family residential (R2) by the City of Auburn; the 1995 Comprehensive Plan designation is single-family (Auburn 1995).

Approximately 6 ac of emergent wetlands occur on the site (David Evans and Associates 1995; Parametrix 1996). The wetland bisects the site and directs runoff across the site. Wetland hydrology is sustained by a seasonally high groundwater table, which is at or near the ground surface during much of the rainy season. Soils have relatively low permeability. The wetland extends to the north where it physically connects to the 100-year floodplain of the Green River backwater area through a series of roadside ditches and drainage channels. During rainy periods, the wetland conveys surface water from farmland south of the site north toward the Green River.

The action areas for the Master Plan improvement projects includes the Auburn mitigation site to be directly affected by project construction, and downslope drainage ditches that could be indirectly impacted by the project. The potential indirect impacts include changes in hydrology or water quality as a result of construction activities.[23] These drainage channels connect the Auburn Mitigation Site to the Green River (see Figure 3-4).

The completed project will connect to the Green River (about 1 mile north of the site) via (1) a flood control outlet channel north of the project, which connects to (2) an existing drainage channel that flows along 277th Street and then (3) north via culverts under the road embankment, which connect to (4) existing channels that flow north to the Green River (see Figure 3-4). Rainwater and seepage runoff from the site will drain from the site to the Green River. During flood events, the Green River will back water into drainage channels and the wetland mitigation (events greater than the approximate 10-year flood). The existing farm drainage ditch between the site and South 277th Street will be enlarged to create the outlet channel for the wetland[24]. All other drainage channels will be unchanged by the project.

Adjacent areas of the Green River support chinook salmon and bull trout. Overwintering bald eagles use the Green River for foraging, and may perch in trees located 300 ft from the mitigation site.

The wetland mitigation is not expected to provide fish habitat. Due to the elevation of the mitigation site relative to the Green River, and conditions of the channel connecting it to the Green River (potential passage barriers, length, depth, duration of flow, etc.), it is unlikely that the wetland will be accessible to listed fish species. Flows in the outlet channel are expected to be intermittent, and quite slow when they occur. The wetland mitigation might provide slight beneficial indirect effects for fish in the Green River through export of organic matter and invertebrate food production. Other expected benefits to Green River fish from the mitigation site include flood storage and water quality improvement functions, though fish could access the projects during flood events greater than the 10-year flood.

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[23] This includes discharges of construction dewatering. These discharges will be made to the Green River using existing ditches and outfalls. Discharged water will meet state water quality standards, and include pre-discharge treatment for sediment removal if necessary.

[24] The Port has secured easements necessary for enlarging this ditch.

Table 4-5. **Environmental baseline conditions in the Green River near the Auburn Wetland mitigation project.**

Pathways: Indicators	Environmental Baseline: Properly Functioning	Environmental Baseline: At Risk	Environmental Baseline: Not Properly Functioning	Explanation
Water Quality:				
Temperature		X		Maximum temperature criterion are exceeded for this section of the Green River (RM 35) as listed on Ecology's 303(d) list for temperature (Caldwell 1994).
Sedimentation		X		Bank erosion and runoff may cause high levels of sedimentation within the Green River.
Chemical and Nutrients		X		This section of the Green River is at risk from elevated concentrations of nutrients and fecal coliforms.
Habitat Access:				
Physical Barriers		X		No barriers to fish access exist.
Habitat Elements:				
Substrate		X		Primarily gravel, increased levels of silt could lower the value of this reach for spawning and rearing fish.
Large Woody Debris		X		Due to clearing in riparian areas, limited sources of LWD exist.
Pool Frequency		X		Pools are present, channelization and lack of LWD lower the frequency of pools.
Pool Quality		X		Pool quality is diminished by the lack of LWD.
Off-channel Habitat		X		Limited due to diking farming of riparian areas.
Refugia			X	Lack of LWD and off-channel habitat limits the ability of rearing fish to seek refuge at this site.
Channel Condition /Dynamics:				
Width/Depth Ratio		X		This reach of the Green River appears to be incising.
Stream bank Condition		X		The stream bank on the west side is steep, arising from the OHWM and flood plain at a slope of 3:1 or greater. Banks on the east side are gentler and include an area of forested wetland.

Table 4-5. Environmental baseline conditions in the Green River near the Auburn Wetland mitigation project (continued).

Pathways: Indicators	Environmental Baseline: Properly Functioning	At Risk	Not Properly Functioning	Explanation
Floodplain Connectivity		X		Connectivity is reduced by agricultural drainage ditches.
Flow/Hydrology:				
Peak/Base Flows		X		Natural flow regime altered by urban and reservoir developments.
Drainage Network		X		Natural drainage network altered by urban and agricultural development.
Watershed Conditions:				
Impervious Surface		X		Impervious surface lacking stormwater treatment has altered natural flow regime and contaminant loading.
Disturbance History	X			Agricultural, forestry, water management, and urban development have created significant disturbances in the watershed.
Riparian Reserves		X		Limited riparian habitat is present or preserved.

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The project will require up to 440,000 cy of earth movement. The entire excavation will occur at least 200 ft from the top of the Green River bank. The existing surface water connection between the site and the Green River is more than one mile; this distance will remain unchanged. As with every STIA construction site, the erosion and sedimentation controls described in Section 7.1.3.2 will be applied during construction of the wetland and outlet channel, and construction will occur only in the dry season. In addition, the proposed project is a large depression excavation that is lower than the land between the river and the new wetland. Therefore, stormwater will be collected in the excavation. BMPs would prevent runoff with sediment from entering drainage channels that ultimately drain to the Green River.

In the vicinity of the wetland mitigation project, no woody or native vegetation would be removed, and bald eagle perch habitat would not be directly affected. In the long term, wetland and buffer vegetation planted as part of the wetland mitigation could provide additional perch habitat and the open water and emergent habitats could provide additional forage habitat for eagles.

King County Parks Department has proposed a recreational trail on land it owns adjacent to the wetland mitigation site. The trail project is independent of the wetland project, and its impacts on the environment (and listed ESA species) would be evaluated by the County when engineering and other planning documents are available.

To allow site excavation to begin during May, the shallow water table will be lowered with a dewatering system consisting of well-points and pumps. Groundwater collected by this system will be discharged to the Green River through existing surface ditches. The volume of dewatering water will be very small (2-8 cfs) compared to typical Green River flows (250-2000 cfs that occur during months when the system will operate), and therefore, unmeasurable and insignificant changes to river flows are expected. Dewatering discharges will meet water quality standards, and will be discharged through existing outfalls in a manner that will not cause bank erosion.