3.4 SURFACEWATER AND PLANTS AND ANIMALS

3.4.1 INTRODUCTION

This chapter describes the biological resources of the SW Everett/Paine Field Subarea and the basins that drain the SW Everett/Paine Field Subarea. Existing conditions, development impacts on biological resources, and mitigation opportunities are identified.

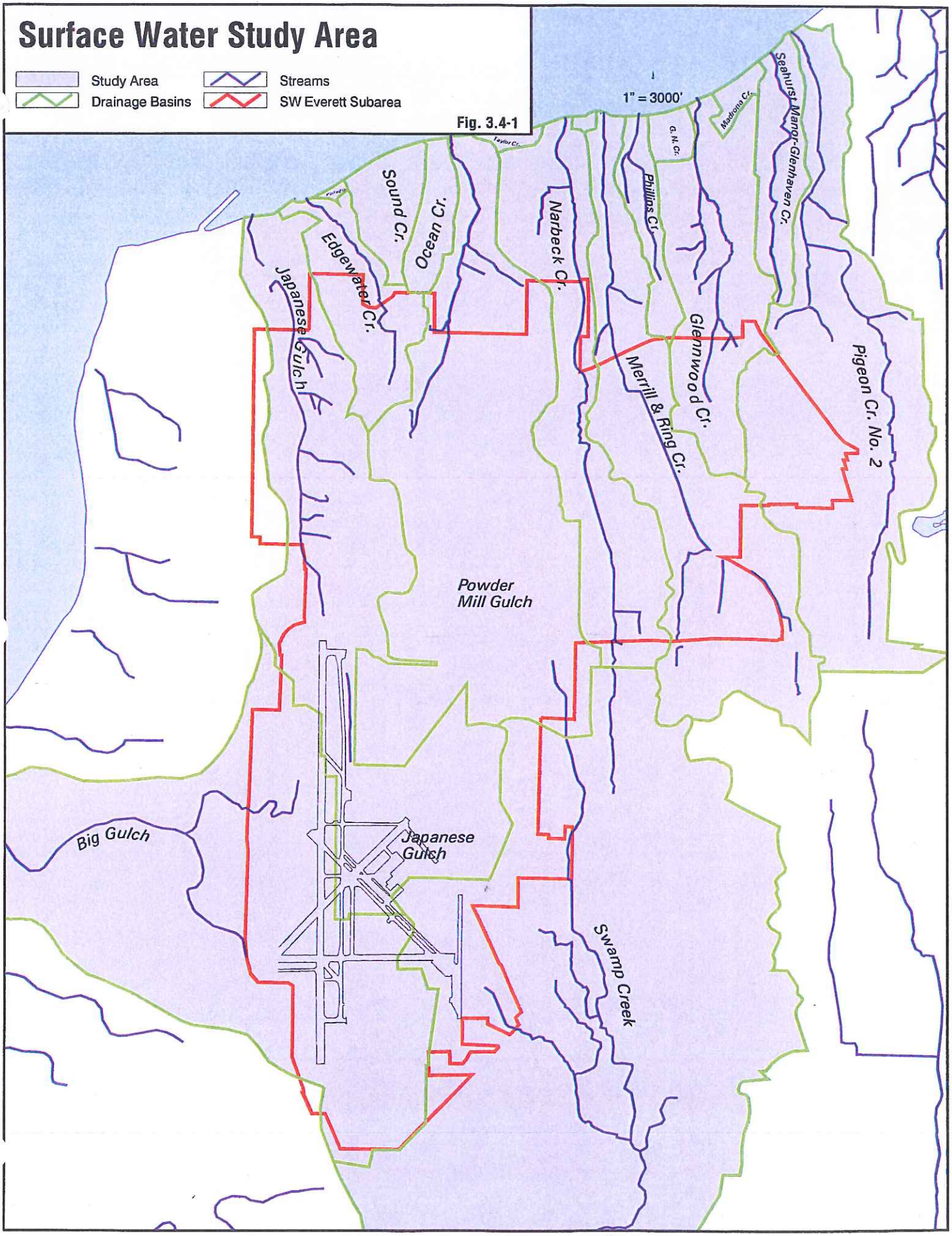
The study area for this section of the DEIS is defined by the watershed boundaries of streams that drain the 3,935-acre SW Everett/Paine Field Subarea, which is the planning area defined by the City of Everett as the SEPA/GMA Pilot Integration Project. The study area is approximately 8,300 acres and includes the SW Everett/Paine Field Subarea, coastal slopes to the south and east of Mukilteo, and the upper part of the Swamp Creek watershed (Figure 3.4-1). The study area was dictated primarily by watershed boundaries so that the cumulative impacts of development within the SW Everett/Paine Field Subarea on fish and wildlife populations and habitats could be addressed.

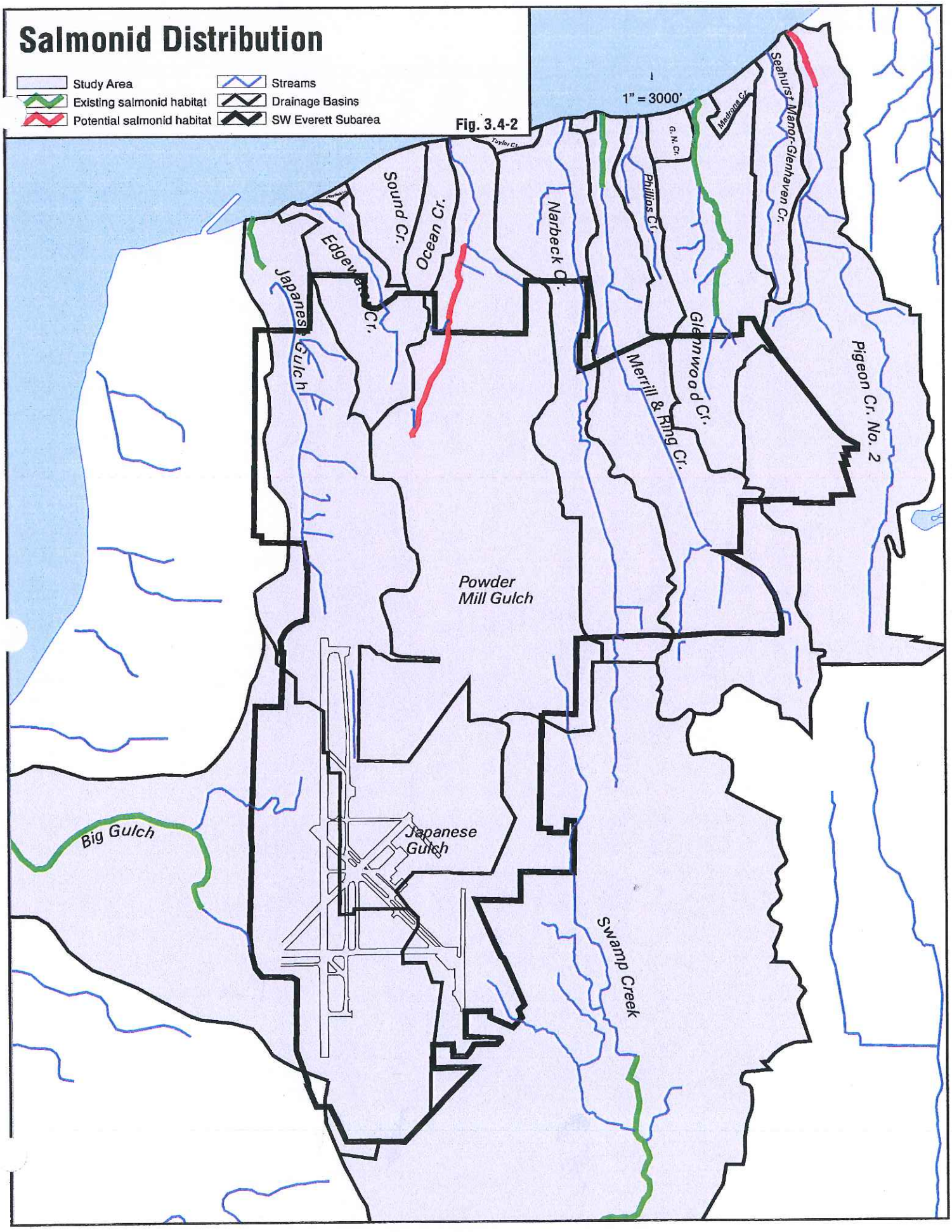
The study area has been affected by logging, urbanization, and industrial development over the past 100 years. Most of the upper plateau (the center of the study area) is zoned for industrial development (Figure 2.3-2), and about 75 percent of its development capacity has been realized (Figure 2.4-2). The developed industrial land is either impervious surface—located within the Boeing facility, Paine Field, and the Bomarc facility—or bare earth—located on the Associated Sand & Gravel Company Inc. property. The coastal slopes are undergoing rapid residential development.

Throughout the study area there is undeveloped land supporting native or semi-native vegetation that provides habitat for wildlife, contributes to groundwater recharge, and regulates peak and base flow in streams. The network of undeveloped land supports over 100 native wildlife species, including threatened species such as the bald eagle. Over 60 wetlands, including Class I wetlands such as sphagnum bogs, forested wetlands, and a beaver pond, occur throughout the study area. Five of the twelve streams draining the plateau—Big Gulch, Japanese Gulch, Merrill and Ring Creek, Glenwood Creek, and Swamp Creek—support salmonids in at least part of their courses (Figure 3.4-2). The Washington Department of Fish and Wildlife (WDFW) has identified several priority habitats within and adjacent to the study area (Figure 3.4-3).

The challenge faced by the SEPA/GMA Pilot Integration Project is to incorporate planned industrial development and protection of significant natural resources in the area. Some land will remain undeveloped under existing plans because it is protected as parks and/or open space or because it includes Environmentally Sensitive Areas (ESAs)[1]. Implementation of the current Comprehensive Plan, however, would lead to some adverse impacts on the natural resources of the area, including fragmentation and isolation of wildlife habitat, conversion of

[1] ESAs are wetlands, streams, groundwater discharge areas, fish and wildlife conservation areas, native growth protection areas, geological or seismic hazard areas, and slopes of 25 percent or greater adjacent to or associated with one or more of the previously listed sensitive areas.


Surface Water Study Area
Study Area
Drainage Basins
Streams
SW Everett Subarea
Fig. 3.4-1
1" = 3000'
Seahurst Manor-Glenhaven Cr.
Madrona Cr.
G. N. Cr.
Phillips Cr.
Narbeck Cr.
Sound Cr.
Ocean Cr.
Edgewater Cr.
Japanese Gulch
Glennwood Cr.
Merrill & Ring Cr.
Pigeon Cr. No. 2
Powder Mill Gulch
Big Gulch
Japanese Gulch
Swamp Creek


Salmonid Distribution
Study Area
Existing salmonid habitat
Potential salmonid habitat
Streams
Drainage Basins
SW Everett Subarea
Fig. 3.4-2
1" = 3000'
Seahurst Manor-Glenhaven Cr.
Madrona Cr.
G. N. Cr.
Phillips Cr.
Narbeck Cr.
Sound Cr.
Ocean Cr.
Edgewater Cr.
Japanese Gulch
Glennwood Cr.
Merrill & Ring Cr.
Pigeon Cr. No. 2
Powder Mill Gulch
Big Gulch
Japanese Gulch
Swamp Creek

vegetated headwaters to impervious surface, and alteration of surface flow and stormwater drainage patterns and erosion rates. This chapter describes and assesses the natural resources of the study area so that informed decisions can be made about appropriate mitigation measures.

3.4.1.1 Streams Draining the Study Area

The study area is in the rain shadow of the Olympic Mountains and receives 800 to 900 mm of precipitation annually. The soils are primarily derived from glacial till. The area was last occupied by glaciers 10,000 to 12,000 years ago, when the Vashon Continental glaciation retreated. Most of the soils are young, coarse, nutrient-poor, and excessively drained near the surface. A low-permeability "hardpan" is typically encountered 1 m below the soil surface. The SW Everett/Paine Field Subarea is situated on a till plateau that is drained by 12 basins including (in counter-clockwise order, starting from the west) Big Gulch, three small unnamed streams between Big Gulch and Japanese Gulch, Japanese Gulch, Edgewater Creek, Powder Mill Gulch, Narbeck Creek, Merrill and Ring Creek, Phillips Creek, Glenwood Creek, Glenhaven Creek, Pigeon Creek #2, and Swamp Creek (Figure 3.4-1). Swamp Creek drains into the Sammamish River just upstream of Lake Washington; the other creeks drain into Puget Sound.

Morphology[2] and Natural History

With the exception of Swamp Creek, all of the streams in the study area have similar morphologies and natural histories. They are young Holocene erosional features that are naturally unstable. The streams are in the process of downcutting through the till plateau and will continue to do so even without the additional hydrological impacts from future development. They flow through steep-walled gorges as they rapidly drop 500 ft. from the plateau to Puget Sound. Past residential and industrial developments have avoided disturbing unstable slopes, so most of these streams feature an intact—though not pristine—riparian corridor, at least through the gorge sections.

Swamp Creek's channel morphology is different from that of the other streams in the study area. The headwaters of Swamp Creek are in a broad, flat, southeast-trending basin. About 1,500 acres of its watershed lie within the study area. Swamp Creek flows from its source, a scrub-shrub wetland in Kasch Park, south through Stickney Lake to Lake Washington. The reach between Stickney Lake and the Sammamish River (located south towards Lake Washington and outside of the study area) provides regionally important habitat for cutthroat and rainbow trout and for sockeye and coho salmon.

Channel erosion is a concern for most streams draining the study area because of their erodible substrates and relatively steep channel gradients. Increasing peak flow rates and volumes, eliminating riparian vegetation, and removing in-channel woody debris can increase channel erosion rates. The riparian corridors and riparian processes are intact for most of the streams, but peak flow increases may increase channel erosion rates.

[2] Structure and form.

Human Disturbance

All of the streams in the study area have experienced similar types of human disturbances. These disturbances have included hydrologic change from land conversion, increased channel and bank erosion due to peak flow increases, conversion of riparian vegetation from mature conifers to a mix of deciduous trees and shrubs, confinement of flow through culverts at road and railroad crossings, and sloughing of stream hillsides from the clearing of vegetation and introduction of residential drainage.

Early development in Everett modified the streams heavily (Dilgard). It is possible that many of these streams were used to skid logs during early harvest operations. In addition, railroads, roads, powder mills, communities, and sawmills were constructed in the creeks and associated ravines.

Surfacewater Quality

Results of City of Everett Monitoring. Surfacewater quality within the Subarea varies by stream. Summaries of water quality data collected by the City from 1990 to 1992 are shown in Table 3.4-1. The data and water quality standards are available for review in the Planning Department. Note that the City did not collect water quality data for Big Gulch.

All of the streams met state water quality standards for pH, and temperature, except that Swamp Creek had two samples that exceeded temperature criteria. All of the streams also met state water quality standards for ammonia, arsenic, chromium, and nickel.

All of the streams, except Powder Mill, exceeded standards for fecal coliforms. High levels of fecal coliforms are likely due to pets. However, failing septic systems are known to occur in Edgewater Drainage Basin, and likely occur in other portions of the study area. Powder Mill may have lower levels of fecal coliforms since less residential development occurs in the basin compared to the other drainage basins.

All of the streams except Glenwood periodically exceeded standards for turbidity. Glenwood may have lower turbidities because of high infiltration rates in the upper portion of the drainage basin, and since little of the upper basin is developed. Glenwood Creek was impacted substantially by Associated Sand and Gravel mining activities in the past. However, Associated has isolated the runoff from all plant areas and recirculates it on site, so turbidity levels downstream are not currently impacted by mining activities.

All of the streams periodically exceeded standards for lead and cadmium. Sources of these pollutants include cars and catalytic converters. However, it is important to note that in early testing the detection limits for cadmium and lead were higher than the State standard. In those cases, the detection limit was assumed for the sample. Therefore, water quality may actually be better than shown.

Copper and zinc standards were also exceeded in some of the streams, with the most frequent occurring during storm flow events (collected in Powder Mill, Glenwood, and Pigeon Creek #2).

Snohomish County Monitoring. Snohomish County and METRO have conducted monitoring of surfacewater quality in Swamp Creek Basin. Results of the monitoring are included in the

Table 3.4-1
Compliance with Water Quality Standards for Surfacewaters of the State of Washington (WAC 173-201A)
(Assumes Swamp Creek is Class AA , all other streams in Subarea are Class A)
Samples Collected September 1990 to September 1992

	Japanese (Base Flow)	Edgewater (Base Flow)	Powder Mill (Base Flow)	Powder Mill (Storm Flow)	Narbeck (Base Flow)	Merrill & Ring (Base Flow)	Glenwood (Base Flow)	Glenwood (Storm Flow)	Pigeon #2 (Base Flow)	Pigeon #2 (Storm Flow)	Swamp Creek (Base Flow)
fecal coliforms	X	X		NA	X	X	X	NA	X	NA	X
temperature				NA				NA		NA	exceeded in 2 of 15 samples
pH				NA				NA		NA	
turbidity	3/8	2/8	3/8	NA	2/8	3/8		NA	1/8	NA	1/8
ammonia				NA				NA		NA	
arsenic											
cadmium	2/8	2/8	5/8	6/12	2/8	2/8	2/8		2/8		2/8
chromium											
copper		1/8	1/8	10/12	1/8	2/8		4/6		4/6	
lead	4/8	7/8	8/8		8/8	8/8	3/8	1/6	1/8		8/8
nickel											
zinc				11/12				1/6			

X: The State water quality standard for fecal coliforms was exceeded when all samples over the two year period were used in calculating the geometric mean.
NA: Data not collected.
Blank: The State water quality standard was met.

Fractional Numbers:
Baseflow data: Approximately 11 water samples were taken per year. The results were averaged by season (Fall, Winter, Spring, Summer). The numerators represent the number of seasons where the seasonal average exceeded the State water quality standard. The denominator represents the total number of seasons during the period covered by the data.

Stormflow data: 4-5 water samples were collected per storm event. Data for these samples was averaged to create a value for each storm event. The numerators represent the number of storm events where the average value exceeded state water quality standards. The denominator represents the total number of storm events during the period covered by the data.

Note: It is important to note that in early testing the detection limits for cadmium and lead were higher than the State standard. In those cases, the detection limit was assumed for the sample. Therefore, water quality may actually be better than shown.

Swamp Creek Watershed Management Plan Final Technical Supplement. The closest monitoring station to the Subarea is at 117th and Highway 99. At that location, Snohomish County found that state water quality standards for fecal coliforms, turbidity, copper, lead and zinc were exceeded.

Department of Ecology. In 1987, the Department of Ecology collected water and sediment samples from Paine Field drainages, including Big Gulch and Swamp Creek. The study found that:

- Sediments at the outlet of the Boeing retention pond that discharge to Powder Mill Gulch had very high concentrations of PCB, and was a source of cadmium, lead, mercury and zinc to the gulch.
- Sediments in one drain to Big Gulch appeared to be contaminated with the herbicide simazine. General water quality in the drain was also poor, as evidenced by the presence of foam, a reddish-brown floc on the bottom, and high specific conductivity, ammonia, hardness, and total organic carbon.
- Water and sediments in the 100th St. SE ditch were contaminated by a range of metals and organic chemicals. A bioassay showed the water was acutely toxic. A spill of cutting fluid at Paine Field was the likely source of one or more chemical contaminants.
- Moderately elevated concentrations of PCB were detected in sediments collected from upper Swamp Creek drainage, Marshy Lake (the wetland at the south end of Paine Field's runway), and the Paine Field runway retention basin.
- Sediments in Stickney Lake had elevated concentrations of arsenic, lead, mercury and zinc.
- An elevated mercury concentration was measured in water from the mouth of Big Gulch.
- Elevated concentrations of mercury and total cyanide were detected in the discharge from the Paine Field SE retention pond.
- Phosphorus concentrations in water samples from Japanese Gulch, Powder Mill Gulch, the 100th St. SE ditch, and Paine Field SE retention pond were sufficient to cause nuisance plant growths.

Since this report was completed, Boeing has taken steps to eliminate PCB contamination and has constructed a sedimentation basin and peat filters to control runoff quality. Snohomish County Airport (Paine Field) has taken steps to control herbicide contamination, has cleaned up most contaminated portions of the site, and has increased policing of tenants to prevent contamination. Paine Field has a Stormwater Permit issued by the Department of Ecology under which they are required to develop and implement a Stormwater Pollution Control Plan (SWPPP). The contents and requirements for this plan are detailed in the permit, but the intent is to require the identification of necessary source control measures and the implementation of adequate stormwater treatment. There are approximately 10 to 15 industrial permittees in the Paine Field area.

Known Contamination of Streams/Riparian Corridors. Known contamination in the study area includes effluent from the production of cement and cement products in Pigeon Creek #2 and possible contamination from a sawmill in the east fork of Pigeon Creek #2. Past impacts included contamination of Pigeon Creek #2 with high pH water from cement truck wash water, and lining of the creek bottom with cement due to poor waste disposal practices. Indications of contamination from production of cement and cement products are also present in Glenwood Creek, north of Merrill Creek Parkway.

Powder Mill Creek has been contaminated in the past by jet fuel from the Boeing property to the point where no life was left in the stream. In the past few years, Boeing has made major improvements to their stormwater treatment facilities, and benthic invertebrates are returning to the stream.

Big Gulch has been impacted by release of firefighting foam (AFFF) from Tramco facilities at Paine Field. In 1993, three releases of AFFF occurred due to testing of a fire system and malfunctions. Recently, in February 1996, the fire suppressant system was activated when a transformer exploded. In about 17 minutes, the time it took to turn off the system, approximately 242,000 gallons of AFFF mixed with water was released. The foam/solution was discharged into Big Gulch and associated wetlands, and also entered the sanitary sewer system. While no direct fish kill has been documented and AFFF is not expected to kill fish eggs, the AFFF kills the food sources for fish and also adversely affects functioning of Olympus Terrace's wastewater treatment plant at the mouth of Big Gulch. AFFF continues to be released into the stream each time it rains and runoff from impacted wetlands and ditches enters the stream. It is expected to take 6 months to a year for the aquatic insects to be replenished. The Department of Ecology issued a Notice of Violation to Tramco in March 1996 for the unpermitted release of AFFF to sanitary sewer and surfacewaters. A follow-up Administrative Order will be isued which will require Tramco to work with Snohomish County to develop a plan to mitigate the impacts of AFFF run-off to sanitary sewers and surfacewaters.

Pollutants and sediments from washing and de-icing airplanes on the runway is also impacting water quality of drainage from Paine Field.

Sediment Quality in Port Gardner Bay. The Washington State Department of Ecology completed a study of sediments in Port Gardner Bay near the mouths of creeks and slightly offshore (near the mouths of Japanese Gulch Creek, Edgewater Creek, Powder Mill Creek, Narbeck Creek, Merrill and Ring Creek, Phillips Creek, Glenwood Creek, and Pigeon Creek #2). (Ecology Report #95-301.) In December 1993, sediments were sampled at 17 sites for priority pollutants (metals, volatile organics, semivolatile organics, and at 4 sites, PCBs). No priority pollutants were found at high concentrations and many sites had no detectable organic priority pollutants. Volatile organics were found at eight sites, all at low levels. No sediment standards have been issued for volatile organics. The study concluded that concentrations of organics, metals and PCBs are consistently low in the study area (Port Gardner Bay near the mouths of the streams) and indicate no contamination problems.

Fish Habitat

None of the streams in the study area has ever provided large amounts of anadromous fish habitat, even before human disturbance. Some of the larger streams, however, including Big Gulch, Japanese Gulch, Merrill and Ring Creek, Glenwood Creek, and Swamp Creek, do include some low gradient, salt water-accessible reaches with flows sufficient to provide suitable habitat for coho, chum, and steelhead. These streams can also provide habitat for sea-run and resident cutthroat trout. Powder Mill Gulch could support a small resident cutthroat trout population in its middle reaches with some habitat restoration and continued water quality control by Boeing. The lower reaches of Pigeon Creek #2 could possibly support a small salmonid population with control of peak flows and of upstream erosion delivering and depositing sand in the lower reaches, improvement of fish access from Puget Sound, and protection of the channel from human disturbance. Existing and potential salmonid

distributions are mapped in Figure 3.4-2, and Table 3.4-2 provides summary of data regarding each basin in the study area.

Table 3.4-2
Salmonid Distribution in the Study Area

Stream	Existing Salmonids	Potential Salmonids
Japanese	coho	
Edgewater	none	none
Powder Mill	none	cutthroat trout
Narbeck	none	none
Merrill and Ring	coho (8 salmonids - species unknown observed in June 1995)	
Glenwood	cutthroat trout	
Pigeon #2	coho (1 coho smolt captured in March 1993)	coho
Swamp	cutthroat trout and coho	
Big Gulch	cutthroat trout and coho	

Property Concerns

With the exception of Swamp Creek, none of the streams in the study area causes significant flooding problems. There are no residential or commercial developments within the flood plains of the creeks draining directly to Puget Sound, but the Olympic Terrace Water District does operate a wastewater treatment plant near the mouth of Big Gulch that may be affected by high flows in the Big Gulch system. Many residential and commercial structures are located adjacent to Swamp Creek and have the potential to experience flooding from Swamp Creek. Though the primary area of flooding concern in the Swamp Creek drainage is in the Kenmore area, far downstream of the study area, hydrologic change in the study area will still worsen flooding there.

3.4.1.2 Vegetation and Wildlife

Overview

The study area lies in the Western Hemlock (*Tsuga heterophylla*) Zone described by Franklin and Dyrness (1984), and the plant communities are much like those found elsewhere in the Western Hemlock Zone. The upland forested areas are dominated by second- or third-growth mixed or deciduous forest communities. Deciduous forests are dominated by red alder (*Alnus rubra*) with occasional bigleaf maple (*Acer macrophyllum*) and black cottonwood (*Populus balsamifera* var. *trichocarpa*). The limited areas of conifer forest are dominated by western hemlock and Douglas-fir (*Pseudotsuga menziesii*). Western red cedar (*Thuja plicata*) occurs primarily along stream courses. Common understory shrubs include salal (*Gaultheria shallon*), Oregon-grape (*Berberis nervosa*), sword fern (*Polystichum munitum*), and salmonberry (*Rubus spectabilis*). Poorly drained areas support bogs as well as forested, scrub-shrub, and emergent wetlands. In some of these wet areas there are pockets of shore pine (*Pinus contorta*) and western white pine (*Pinus monticola*). Although many of the vegetation communities found in the study area are still relatively common in some parts of the Puget Sound region, they are rapidly diminishing in urban and suburban areas such as Everett and western Snohomish County.

Landscaped areas in the study area contain a wide variety of vegetation. The vegetation in large industrial areas and city parks consists of ornamental trees and shrubs, often planted in parking strips or around buildings. In residential areas there are more native tree and shrub plantings, and residual second and third growth native vegetation can be left relatively intact following residential construction. Most of the residential areas, however, are so densely developed that very few corridors of contiguous vegetation are present between housing developments.

Appendix 3.4-1 provides technical definitions for vegetation communities. Appendix 3.4-2 provides a list of plant species found in the study area.

Wildlife species expected to use the SW Everett/Paine Field Subarea are listed in Appendix 3.4-3. Of the approximately 120 species that are likely to use the Subarea throughout the year, 68 have been documented in previous studies and by personnel involved in the present project. Many neotropical migrant birds, which are likely to be common in the Subarea, have not been documented by these sources. This likely reflects the timing of field studies rather than actual presence of any given species.

Plant communities form the basis of wildlife communities; they provide the primary productivity upon which animals depend, along with nesting and denning sites, escape cover, and protection from adverse weather. Most of the wildlife species that occur in the area use several of the habitats to obtain all their life-history needs. In general, more complex plant communities with more structural diversity and more plant species provide higher-value wildlife habitat than less complex vegetation communities. More complex plant communities have more niches for wildlife and usually support more animal species than do less complex communities. The Subarea provides relatively diverse habitats and is expected to support diverse wildlife populations. Key components of the diversity of the Subarea are the forested ravines and the wetlands. These features provide structures and species not generally found in upland deciduous second-growth forest. The ravines are linked at their mouths by the

railroad right-of-way and at their headwaters by currently undeveloped second-growth forest. Many of the wetlands are also linked by patches of undeveloped land, enabling a variety of wildlife to take advantage of the forage (including both plants and animal prey) and water available in wetlands while remaining within protective cover.

Forested Areas

Deciduous forest is the dominant vegetation community[3] in the study area. Deciduous forest is dominated by red alder (*Alnus rubra*) and big-leaf maple (*Acer macrophyllum*) in the overstory, with Himalayan blackberry (*Rubrus procerus*) and sword fern (*Polystichum munitum*) in the understory. Other understory species include salmonberry (*Rubus spectabilis*), red huckleberry (*Vaccinium parvifolium*), trailing blackberry (*Rubus ursinus*), red elderberry (*Sambucus racemosa*), vine maple (*Acer circinatum*), and thimbleberry (*Rubus parviflora*). The shrub understory can be quite dense. Deciduous forest occurs in sapling, pole, immature, and mature habitat stages in the study area (age classifications are defined in Appendix 3.4-1).

Red alder-dominated deciduous forest provides primary breeding and feeding habitat for about 60 vertebrate wildlife species, and it provides secondary habitat for about 100 other species (Brown 1985). Many of those species are birds, but bird use varies with the season. Winter use is limited since deciduous forest offers poor thermal cover in winter. It is, however, important as spring breeding habitat because of the abundance of insect forage among the new leaves. Some typical species of this habitat include American robin (*Turdus migratorius*), northern flicker (*Colaptes auratus*), deermouse (*Peromyscus maniculatus*), and raccoon (*Procyon lotor*).

Conifer forest is not common in the study area. It occurs primarily on the Boeing property, where it is dominated by Douglas-fir and western hemlock, with a sparse understory of Oregon grape, sword fern, salal, and red huckleberry. Pacific yew also occurs in the understory (Dames and Moore 1991). The yew grove is discussed in more detail in the Locally Important Habitats Section, below.

Although small in area and extent, coniferous forest in the study area is expected to support a variety of wildlife. Birds are usually found in greater numbers during fall and winter, with smaller numbers in the spring and summer breeding season. Some typical species known to occur are red-tailed hawk (*Buteo jamaicensis*), golden-crowned kinglet (*Regulus satrapa*), western flycatcher (*Impidonax difficulis*), dark-eyed juncos (*Junco hyemalis*), winter wrens (*Troglodytes troglodytes*), varied thrush (*Ixorius naevius*), Swainson's thrush (*Catharus ustulatus*), chestnut-backed chickadee (*Parus rufescens*), and Steller's jay (*Cyanocitta stelleri*).

Common mammal species observed and expected in the conifer forest habitats include deermouse (*Peromyscus maniculatus*), mountain beaver (*Aplodontia rufa*), Douglas' squirrel (*Tamiasciurus douglasi*), and raccoon (*Procyon lotor*). Bats (*Eptesicus fuscus*) are expected to forage and roost in these habitats, but they are rarely observed due to their nocturnal habits. Several amphibian species occur in these forests, including northwestern salamander

[3]The classification system used in this chapter to describe vegetation communities, wildlife habitats, and land cover types is based on the classification systems used by the Washington State Gap Analysis Project and the Interagency Committee for Outdoor Recreation (1993). Appendix 3.4.1 contains the details of this classification system.

(*Ambystoma gracile*), ensatina (*Ensatina eschscholtzi*), and Pacific tree frog (*Pseudacris [Hyla] regilla*).

There are patches of conifer-hardwood mixed forest within the study area, generally in the vegetated ravines. (This is a relatively uncommon forest type in the study area.) Conifer-hardwood mixed forest is dominated by red alder and big-leaf maple but also contains Douglas-fir, western hemlock, and western red cedar. There may also be small numbers of western white pine scattered throughout the mixed forests. Mixed forest occurs in sapling, pole, immature, and mature stages within the study area. Mixed forest stands are not connected to one another by corridors of similar habitat but are often connected by stands of deciduous forest.

There are a few wildlife species that specifically seek out mixed forests because of the proximity of both coniferous (often good nesting and hiding cover) and deciduous (often good for insectivorous foraging) elements. Species generally attracted to one or the other forest type will also occupy mixed forest.

Riparian forests are of particular importance as wildlife habitat; they are often a critical source of diversity for surrounding ecosystems (Thomas, 1979). Riparian habitats are generally more productive in plant and animal biomass than are surrounding vegetation communities (Thomas 1979, Hoover and Wills, 1987). In addition to providing a water source, they form an important movement corridor for many species (Thomas, 1979). Riparian areas are used especially by amphibians for such movement. Riparian areas are also important for supporting band-tailed pigeons (*Columba fasciata*) during the young rearing season. Band-tailed pigeons feed on mineral springs in spring, converting the minerals into "pigeon milk" which is fed to the squabs (Milner, 1995).

Snags (standing dead trees) and dead and downed woody material are important to habitat quality in all forests. Snags are important to wildlife as they provide nest sites, feeding areas, roosting sites, and wintering sites. Pileated woodpeckers (*Dryocopus pileatus*), downy and hairy woodpeckers (*Picoides pubescens* and *P. villosus*), northern flickers (*Colaptes auratus*), red-breasted nuthatches (*Sitta canadensis*), and black-capped (*P. atricapillus*) and chestnut-backed chickadees excavate nest cavities in snags. In later years, other species such as flying squirrels (*Glaucomys sabrinus*), bats, owls, and small birds use these cavities as dens, nest sites, or hibernation sites. Tall snags are often used by bald eagles (*Halaeetus leucocephalus*) as perch and roost sites. Downed wood is an important habitat component for ground-dwelling wildlife; it provides cover, resting, and reproduction sites for these species. Downed organic matter is also an important component in nutrient cycling in ecosystems. The decomposition of downed organic matter provides nutrients that enrich the soil, increase plant productivity, and improve wildlife habitat. There are few snags and little dead and downed woody material in the forests in the study area.

Bald eagles currently nest in the study area, but not within the SW Everett/Paine Field Subarea. However, eagles sometimes move nest locations within their territories, and the riparian forested areas which have trees with the necessary very thick branches provide potential nesting sites. Eagles frequently roost and hunt within the study area, with observations ranging from the large wetlands at the south end of Paine Field runway to smaller wetlands north of the Subarea.

Wetlands (See Section 3.4.1.7 for additional information on wetlands.)

Palustrine wetlands are freshwater non-tidal wetlands that are vegetated with trees, shrubs, or persistent emergent plants. Although ponds may be associated with them, palustrine wetlands do not necessarily have open water. They can be classified as emergent, scrub-shrub, and forested types. They are found throughout the study area.

Emergent wetlands are dominated by erect, rooted plants. They may contain woody species but are not dominated by them. Typically they are dominated by cattails, bulrushes, rushes, or sedges. Wet pastures dominated by rushes or sedges are classified as emergent wetlands. Emergent wetlands are often associated with open water and thus are commonly used by waterfowl such as mallards (*Anas platyrhynchos*).[4] The wetlands are also habitat for pond-breeding amphibians such as Pacific tree frog and northwestern salamander. Other species, including great blue heron (*Ardea herodias*), red-winged blackbird (*Agelaius phoeniceus*), and raccoon feed in these areas. Emergent wetland habitat in the study area is generally scattered and limited in size. It occurs primarily along stream coridors and as isolated pockets in forested scrub-shrub wetlands. Exceptions include Narbeck Swamp, the mouths of Pigeon Creek #2 and Japanese Gulch, and in disturbed areas.

Scrub-shrub wetlands are dominated by woody vegetation that is less than 20 ft. in height. Vegetation height distinguishes scrub-shrub from forested wetland. The woody vegetation may be shrubs, young trees, or trees that are stunted due to environmental conditions. Willow thickets are a common example of palustrine scrub-shrub wetland. Scrub-shrub wetland with several vegetation strata provides a diverse habitat. The tree and shrub layers offer nesting, perch, and roost sites for a variety of birds. Typical nesting birds in this habitat include robin, rufous-sided towhee, and song sparrow. These birds may be preyed upon by Cooper's and sharp-shinned hawks (*Accipiter cooperii* and *A. striatus*), along with coyotes (*Canis latrans*) and raccoons. Scrub-shrub wetlands are most common along stream corridors in the study area and at Kasch Bog, and are often associated with a forested component consisting of red alder. Wetlands in developed areas often have native plants such as willow, red-osier dogwood, salmonberry and elderberry in the shrub component, although non-native Himalayan blackberry also is present.

Forested wetlands are dominated by trees. Typical western Washington forested wetlands include western red cedar swamps, red alder swamps, and Sitka spruce swamps. The most common forested wetlands on the SW Everett/Paine Field Subarea are riparian swamps dominated by red alder and black cottonwood, with an understory of salmonberry, creeping buttercup (*Ranunculus repens*), and soft rush (*Juncus effusus*).

Most wetlands and wetland buffers in the study area have been affected by urbanization to some degree. Impacts include physical damage from grading, filling, and logging; changes to hydrologic regime and water quality due to inputs of urban stormwater; and introduction of invasive exotic plant species. Many wetlands on the industrial sites were either filled or excavated into shallow ponds which were sometimes used for detention. These excavated

[4] Wetland sizes in the study area are too small to maintain wetland obligate populations such as wood ducks, hooded mergansers, great blue heron, American bitterns and Virginia and sora rails. Studies completed in deep water marsh habitats suggest that wetland sizes ranging from 50 to 247 acres are necessary to preserve waterfowl populations. The urban wetlands found in the study area likely function primarily as stop over points for wetland obligates during migration. (Martin-Yanny, 1992)

ponds are often fringed with emergent vegetation, willows, and red alder. Wetlands have also been created as mitigation for filling or altering other wetlands. A few of the wetlands are relatively unaffected by development. These are mostly found north and west of Boeing and north of Merrill Creek Parkway and Seaway Boulevard.

Developed Areas

Grassland habitat occurs throughout the study area. Small (< 2-acre) patches occur in areas of previous disturbance and usually contain weedy, introduced grass species. Larger grasslands include two golf courses as well as lawns associated with commercial and residential landscaping.

Grasslands provide habitat for insectivores such as Townsend's mole (*Scapanus townsendii*), rodents such as deermouse (*Peromyscus maniculatus*), and many ground-foraging birds such as American robin (*Turdus migratorius*), dark-eyed junco (*Junco hymalis*), and Brewer's blackbird (*Euphagus cyanocephalus*). These species are preyed upon by other wildlife, including red-tailed hawk (*Buteo jamaicensis*) and coyote. Larger grassland areas with greater vertical foliage structure are expected to support a wider variety of species and a greater number of individuals than do smaller grassland areas and mowed lawns.

Shrublands are scattered in small patches throughout the study area. Native shrublands provide primary breeding habitat for about 45 wildlife species and primary feeding habitat for about 70 species (Brown 1985). However, because many exotic plants are aggressive colonizers, shrublands are often dominated by non-native species. The shrublands in the study area are often dominated by exotic plant species and often consist of a single plant species, typically Scot's broom (*Cytisus scoparius*) or Himalayan blackberry (*Rubus discolor*). These species can form almost monotypic (single-species) stands with little herbaceous understory.

Such non-native shrublands are expected to support fewer native wildlife species than do diverse native shrublands, because native wildlife species have not evolved with, and are seldom adapted to use, these exotic plant species. Exotic monotypic shrublands can, however, support relatively high densities of a few species. For example, common yellowthroats (*Geothlypus trichas*) can nest in extremely high density in pure Scot's broom.

Industrial development is a major land cover type in the study area. Heavy development, such as aggregated buildings and paved parking lots, covers much of the SW Everett/Paine Field Subarea. These areas are almost devoid of vegetation. Medium and light development are also major land cover types. These areas may support some vegetation, but the vegetation is generally sparse and weedy.

Industrial areas provide low-value habitat for wildlife. They contain little vegetation and are subject to disturbance from traffic and other human activities. Species found in these areas are tolerant of human activity and are generally very common. Reptiles and amphibians are rarely found in this cover type. Several mammal species occur, but birds are the most abundant terrestrial vertebrate wildlife group. Depending on the amount of vegetation, species such as American crow, European starling (*Sturnus vulgaris*), American robin, raccoon, and black and Norway rats (*Rattus rattus* and *R. norvegicus*) can be expected to use these habitats.

Landscaped lawns are associated with industrial, commercial, and residential developments. Landscaped shrublands, which consist of patches of tended shrubs and flowers interspersed with mown grass, are also common. These landscaped areas provide some wildlife habitat, but the habitat is less complex than natural habitats. Common species in these areas are robin, crow, Steller's jay, dark-eyed junco (*Junco hyemalis*), black-capped chickadee, song sparrow (*Geospiza melodia*), and house sparrow (*Passer domesticus*). On occasion, Western screech-owls (*Otus kennicottii*) and sharp-shinned hawks will forage in these habitats. Coyotes may use these areas, but they are seldom observed because of their secretive habits.

3.4.1.3 Wildlife Corridors

The term "wildlife corridor" is used to describe one potential use of an area of habitat. Usually the actual use of an area cannot be confirmed. Typically, the term "corridor" is applied to narrow areas that "link" large habitat blocks. For example, a railroad right-of-way offers cover to coyotes moving between Carkeek Park and Golden Gardens Park in Seattle, and the Sammamish River Park Trail could conceivably link Marymoor Park to the Inglewood Country Club and Lake Washington.

Wildlife corridors can provide habitat in themselves, connect larger blocks of habitat, and allow for relatively free movement of animals among larger habitat blocks that would otherwise be isolated. This allows continual use of habitat patches that are not themselves large enough to support sustainable breeding populations, preventing local extinctions in otherwise suitable habitat. Movement routes also allow individuals to move from a habitat area used for one activity, such as feeding, to a habitat area used for another activity, such as resting. It is important to remember that in the vast majority of cases, the actual function of the corridor is not known.

The ability of any given species to use a corridor depends on its body size, its general "willingness" to move ("vagility"), and its "comfort zone" with respect to uncovered (developed) areas. In addition, the ability of an animal to perceive its environment on a landscape scale will influence its ability to use narrow corridors to move between patches of habitat. For example, deer and coyote are much more likely to move in a particular direction influenced by the presence of a corridor. Migrating amphibians, on the other hand, tend to move randomly with respect to the landscape and so are as likely to leave a corridor and wander into inhospitable territory as they are to follow the corridor to an area of suitable habitat.

Because of a lack of empirical data on corridor use, it is difficult to know the appropriate width for wildlife corridors. More research has been expended on functions of wetland and stream buffers of various widths and on the effect of induced edges (such as the edge between an undeveloped corridor and a developed parcel) on animal behavior and distribution. The Washington Department of Fish and Wildlife has produced recommendations for buffer widths on wetlands (Washington Department of Wildlife 1992). They recommend 300 foot buffers for wetlands in urban areas and 200 foot buffers on wetlands in rural settings. The 300 foot buffer is considered adequate to enable deer to move and forage in the vicinity of an urban wetland, and a 200 foot buffer is adequate for deer in a more rural setting with less contrast between the wetland and its surrounding habitat. Note that deer need a buffer of approximately 600

feet around fawning areas (Muller, 1996). Corridors that are narrower than the ideal width for deer are likely to allow movement of smaller animals, while limiting deer movement.

The vegetation in the corridor will also impact wildlife movement. Corridors with a mix of trees, shrubs and groundcover provide cover for a wider variety of species, and dense cover can provide more protection. Conifer forest provides more year around cover than deciduous forest.

Currently there is a large block of undeveloped habitat in the north part of the Subarea (Figure 3.4-4). In addition, a block of undeveloped habitat links several small wetlands along the west side of Paine Field, in Big Gulch. Outside the Subarea, the stream corridors of Merrill and Ring Creek, Phillips Creek, and Glenwood Creek are currently linked by undeveloped habitat. While buffers occur along portions of Swamp Creek and its tributaries near the Subarea, few large areas of habitat remain. Kasch Park bog and nearby wetlands and buffers provide the largest areas of existing habitat.

The railroad corridor along the Possession Sound shoreline does not include much cover in some places. However, it links many of the stream systems and may provide a biological link between the vegetated streams and ravines.

There are currently two designated wildlife corridors in the study area. These were designated per the requirements of the City's Environmentally Sensitive Areas Ordinance. They are located on Boeing property and include:

- A 60 foot wide corridor adjacent to John Fluke property and also between wetlands north of the 40-307 parking area (Figure 3.4-4). Note that 15 feet of the corridor may be used for a biofiltration swale.
- A 200 foot wide open space strip immediately south of Seaway Blvd at 36th Ave., along with a 60 foot wide vegetated corridor linking the Japanese Gulch open space area to the Powder Mill Gulch open space area.

In addition, Boeing was required to provide landscaping along the edges of all yards/parking areas abutting Japanese Creek and Powder Mill Creek.

While not specifically provided for wildlife habitat, buffers between single family neighborhoods and the industrial area can act as wildlife corridors.

- A buffer a minimum of 150 feet wide was required between Intermec and the neighborhoods to the north. This buffer provides a connection between Powder Mill Gulch and Edgewater Creek.
- The concomitant agreement for the Bhend property required that buffers adjacent to residential areas be determined in the site plan review process. For the detailed site plan reviewed in SEPA #15-92 (Griffen Company proposal), a 60 foot wide buffer was required along the north property line and a 150 foot wide buffer was required along the east property line. This buffer would connect into the Intermec buffer and could also provide a link between Edgewater Creek and Japanese Gulch. (Note that the current owner does not plan to pursue the approved site plan, and the required buffers could change based upon approval of a revised development plan for the site.)

Currently Undeveloped Land

Undeveloped Land (Wetlands, Detention Ponds, Open Space & 25% + Slopes)

Parks (Private & Public)

Buffers

25% + Slopes

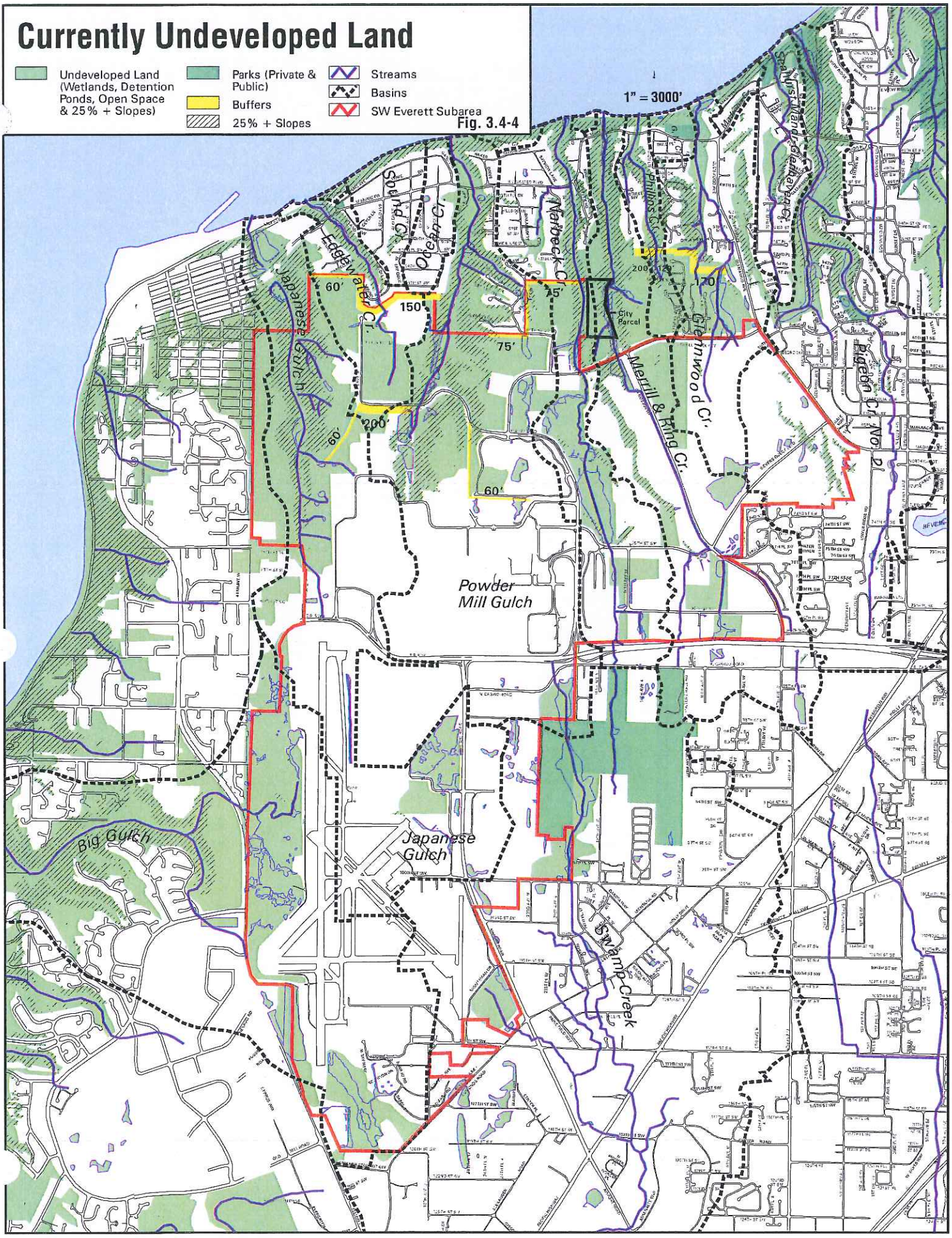
Streams

Basins

SW Everett Subarea

1" = 3000'

Fig. 3.4-4



- The Seaway Center Master Plan requires a minimum 75 foot wide, site obscuring buffer adjacent to residential areas. Up to 25 feet of the buffer may be used for drainage facilities, pedestrian trails and passive recreation facilities. The required buffers for Seaway Center would provide connections between the Narbeck and Powder Mill ravines.

Several buffers have also been required in residential developments to the north of the Subarea that will also function as wildlife corridors:

- The residential development of Merrill Creek was required to provide a buffer between the site and the residential areas to the north, with the width of the buffer ranging between 120 and 200 feet. This corridor links the Glenwood Creek, Phillips Creek and Merrill and Ring Creek systems.
- The approved site plan for Glenwood Terrace residential development provides a corridor approximately 170 feet wide connecting the east and main forks of Glenwood Creek. This extends to the north (by wetland GC 7) and connects into the buffer required on the north end of the Merrill Creek residential development.

In addition to the corridors listed above, the City owns a parcel of land between Narbeck Creek and Merrill and Ring Creek (to the east of Seaway Center Lot 3). This parcel was dedicated to the City for open space/recreation purposes. Trails and minor structures may be constructed in this area; however, the majority will remain as open space, and will function as a large wildlife corridor/habitat connecting Narbeck and Merrill and Ring Creeks.

3.4.1.4 Locally Important Habitats

Conifer forest is uncommon in the study area, although it would have been the dominant cover type prior to significant disturbance. The red alder that dominates the present forest is a relatively short-lived species that can be expected to naturally die and fall after about 80 years. In contrast, the dominant conifer species of the region (western hemlock, Douglas-fir, and western red cedar) are very long-lived and can be expected to stand for centuries where not disturbed. Moreover, conifer forests provide winter thermal refuge for mammals and resident birds. The impact of development on existing conifer stands should be considered during siting and mitigation. Alder forest should also be protected where feasible, because they create the appropriate soil and light conditions necessary to germinate and support conifer growth.

One of the mixed forest stands on the Boeing property contains a relatively high density of Pacific yews. Originally containing 872 yew trees (Dames and Moore 1991), about 45% were eliminated by construction of Boeing parking lots and facilities in 1993. An additional SEPA review is required for removal of yew trees beyond that approved in the 1991 EIS for the Boeing expansion. Boeing has planted yew trees on their property to create a mitigation bank for potential removal of additional yews in the future. However, the yews that occur on a greater than 25% slope are not likely to be removed for future development.

3.4.1.5 Priority Wildlife Species

There are two bald eagle nesting territories in the study area. One is in the Pigeon Creek #1 watershed, protected by Forest Park. This creek does not drain the SW Everett/Paine Field Subarea, but Forest Park is connected to habitat in the SW Everett/Paine Field Subarea via Howarth Park and the railroad right-of-way. The second nesting territory is centered in a ravine in Mukilteo adjacent to the Sound. The eagles forage along the coast as far south as Big Gulch. The nesting ravine and the coastal land connecting this ravine to Big Gulch is presently protected from development by steep slopes.

A great blue heron nest was identified in the Pigeon Creek #2 basin (just outside the SW Everett/Paine Field Subarea boundary) in 1993 (Norman, 1993). Construction in the immediate vicinity of the nest was originally delayed until 1998. However, the site is heavily disturbed and no herons have used the site since 1993 (Milner, pers. comm.); therefore, building restrictions were eliminated. In addition to nearby construction, land around the nest tree was used for ATV racing by locals. Moreover, single nests of great blue herons are rare and unlikely to persist. Another colony may be present near the mouth of Japanese Gulch. Its presence was suspected in 1993 (Norman, 1993); several nests were seen in the Fall of 1995 (Cunningham, pers. comm.). However, the status of the nests has not been confirmed by the Washington Department of Fish and Wildlife (Milner, pers. comm.).

3.4.1.6 Limiting Undesirable Wildlife

Paine Field, like all airports, is vulnerable to disruption and accidents due to wildlife on the runways and in the flight paths. Although many wildlife species can impact aircraft, in general, the species of most concern are black-tailed deer, coyote, and Canada goose. Planning should include limiting the attractiveness of the runways to these species. Actions could include removing vegetative cover in a 600 ft. buffer around the runways, keeping the grass between the runways very short with frequent mowing and no irrigation, and installing fencing.

The Federal Aviation Administration (FAA) has issued a Draft Advisory Circular, AC No: 150/5200, which states that wildlife attractions, such as wetlands, are considered incompatible with airports if located within 10,000 feet of any edge of a turbine-use runway. The advisory states that wetlands normally provide prime conditions for many species of wildlife. When development on or off airport property requires wetland replacement or mitigation, the airport owner should oppose any measures to establish wetlands within 10,000 feet of the runway.

3.4.1.7 Wetlands

Wetlands were inventoried within the SW Everett/Paine Field Subarea, as well as within the study area to the north of the Subarea. See Figure 3.4-5 for the location of wetlands. Note that wetlands were not delineated, and that the boundaries were estimated. Many small wetlands were not mapped, particularly wetlands along stream corridors where the wetlands could not be accurately located. See Appendix 3 for a description of the mapping methodology.

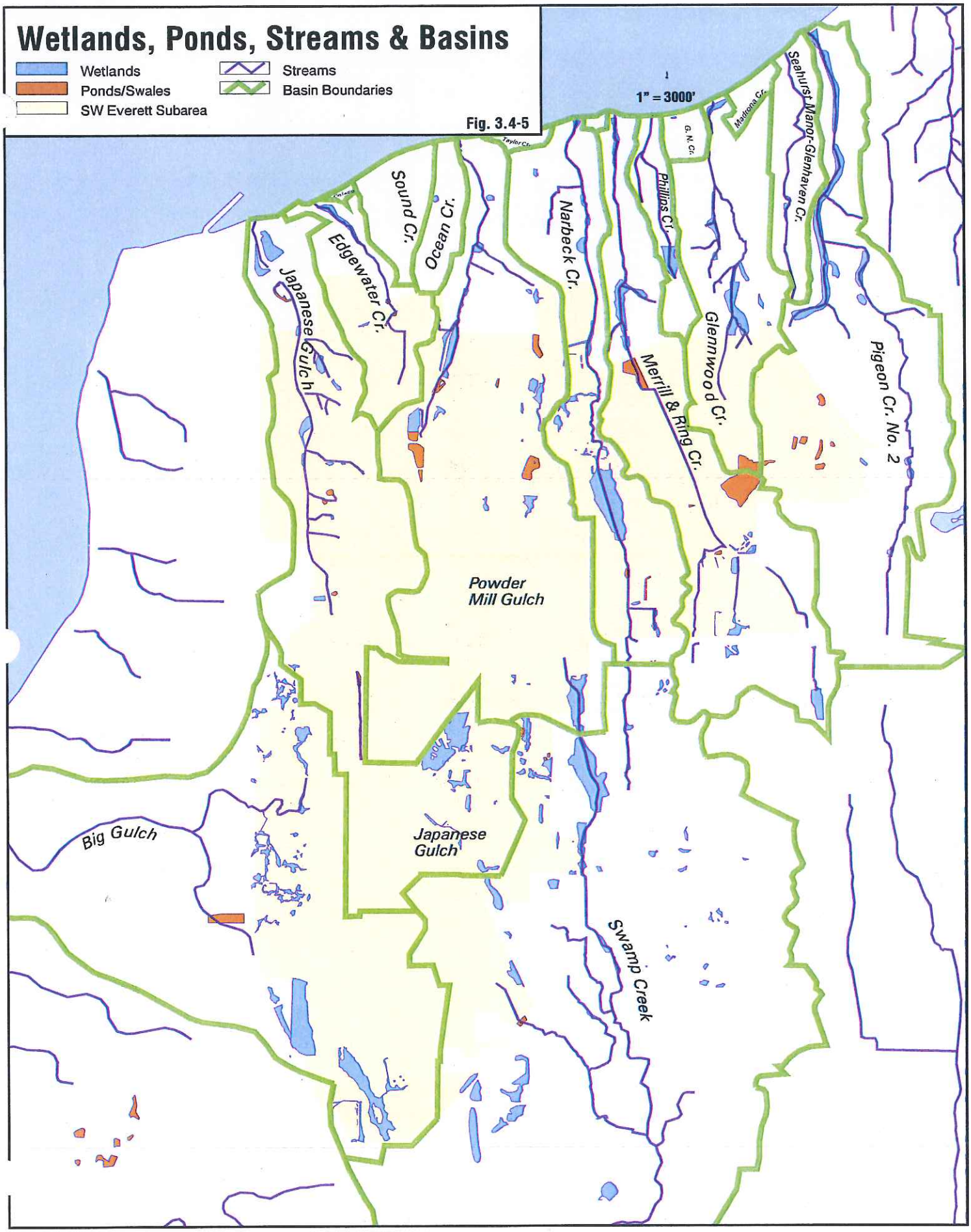

Wetlands, Ponds, Streams & Basins
Wetlands
Ponds/Swales
SW Everett Subarea
Streams
Basin Boundaries
1" = 3000'
Fig. 3.4-5
Taylor Cr.
G. N. Cr.
Madrona Cr.
Seahurst Manor-Glenhaven Cr.
Phillips Cr.
Sound Cr.
Ocean Cr.
Narbeck Cr.
Edgewater Cr.
Japanese Gulch
Merrill & Ring Cr.
Glenmwood Cr.
Pigeon Cr. No. 2
Powder Mill Gulch
Big Gulch
Japanese Gulch
Swamp Creek

Photo 3.4-1
Narbeck Swamp

Photo 3.4-2
Seaway Center Wetland Mitigation, Lot 5b

Wetland Assessment Methodology

Wetlands and streams in the study area were assessed using the Wetland and Buffer Functions form developed by Sarah Cooke. The assessment examines 8 wetland functions and their associated functional attributes in order to determine the level at which those functions are performing. The characteristics of the attributes are assigned a numeric score of 1 through 3 depending on the level of performance of the attribute associated with the performance of the function. The relationship between performance of the function and specific attributes is based on existing wetland research and literature.

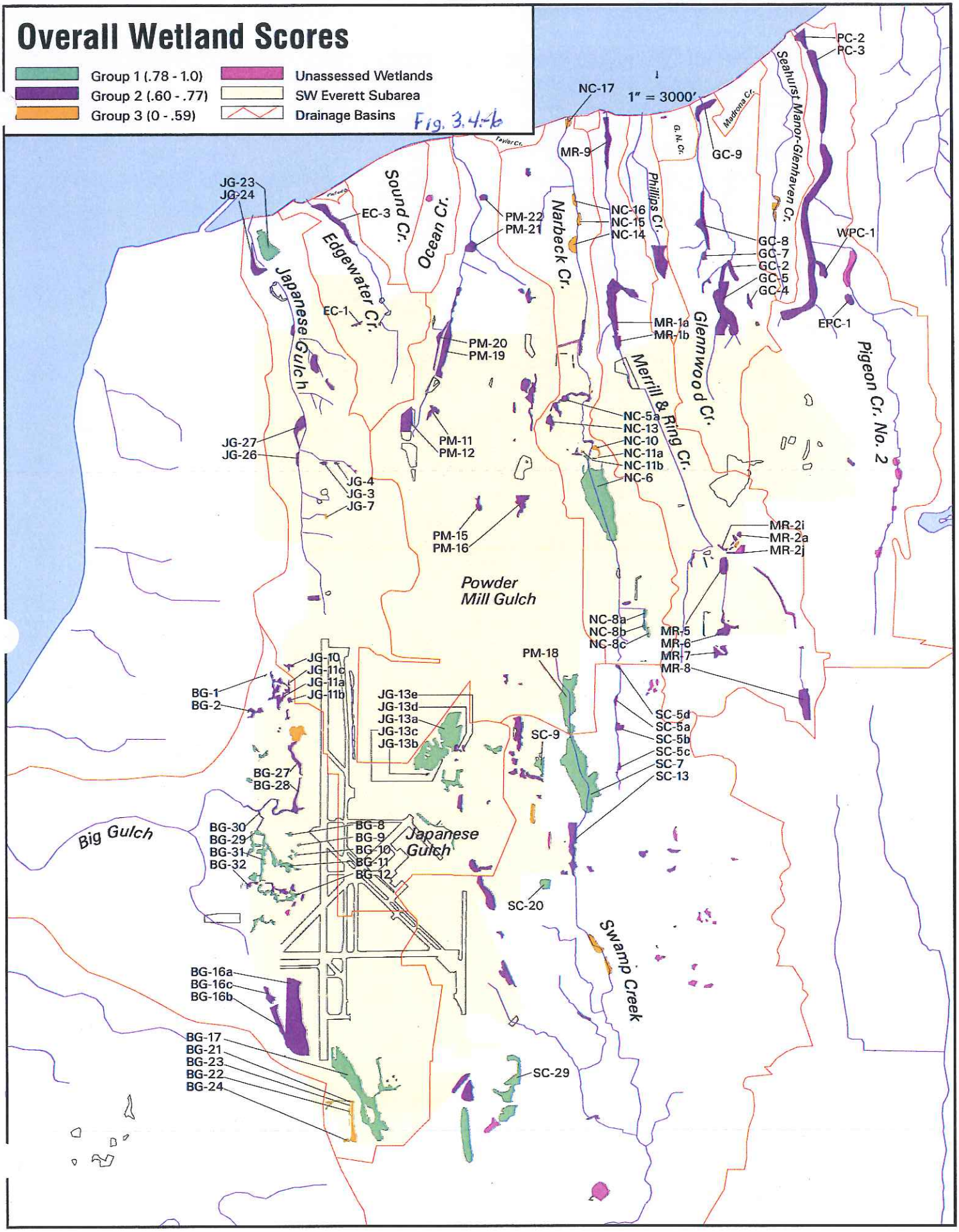
Because the method cannot assign an exact number to the actual performance of the function and relies instead on an indirect quantification relative to the wetlands assessed, it is considered a semi-quantitative method. Additionally, the method cannot be used to assign an absolute value to an individual wetland for calculating compensation ratios or acreage.

The method consists of: 33 indicator questions for the habitat, water quality improvement, base flow and stormwater control functions; and 7 questions for the cultural and socioeconomic value. Both Pentec Environmental and the City conducted the assessment in the field, with the City concentrating on the streams and wetlands just north of the study area draining into Port Gardner Bay. All field assessment teams had a wetland biologist present, with a wildlife biologist and hydrologist present on some of the consultant's teams. Field work was conducted from spring to winter of 1995.

All data were reviewed by the City staff (project manager and wetland biologist) and all inaccuracies and inconsistencies corrected. Based on this review and in consultation with Sarah Cooke and Pentec Environmental, City staff modified the method by adding, rewording and deleting indicator questions in order to improve its accuracy. Appendix 3.4.4 contains a draft of the methodology and Appendix 3.4-5 contains the assessment scores for individual wetlands.

Analysis of Wetland Assessment Data

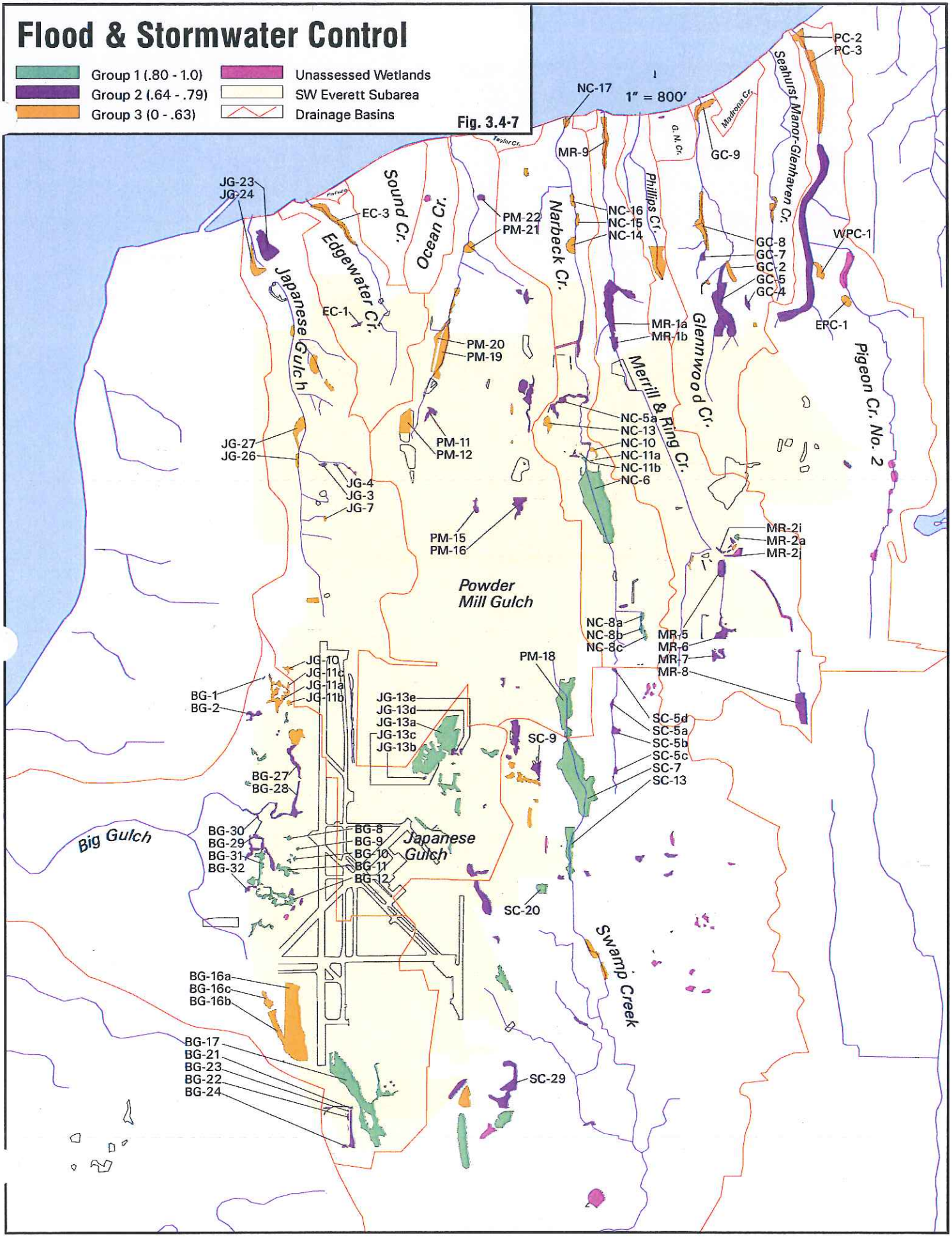
Once the wetland scores were calculated, the frequency distribution of the scores were examined for each function and three wetland groups established based on either an identified clumping and/or break in the data distribution. The three wetland groups were identified as Groups 1, 2 and 3, with Group 1 representing wetlands that were performing functions at the highest level and Group 3 at lowest level. These functions for all wetlands were mapped and presented in Figures 3.4-6 through 3.4-11. Assumptions regarding the inherent value of the wetland should not be made from these scores. For example, a Group 3 wetland for the "habitat function" indicates that the wetland performs that function at a lower level than a Group 3 wetland in the study area, but it does not indicate that such a wetland has no ecological function or potential for enhancement and should therefore be filled. Further, a Group 1 wetland ranking does not automatically indicate that there is no potential for enhancement.

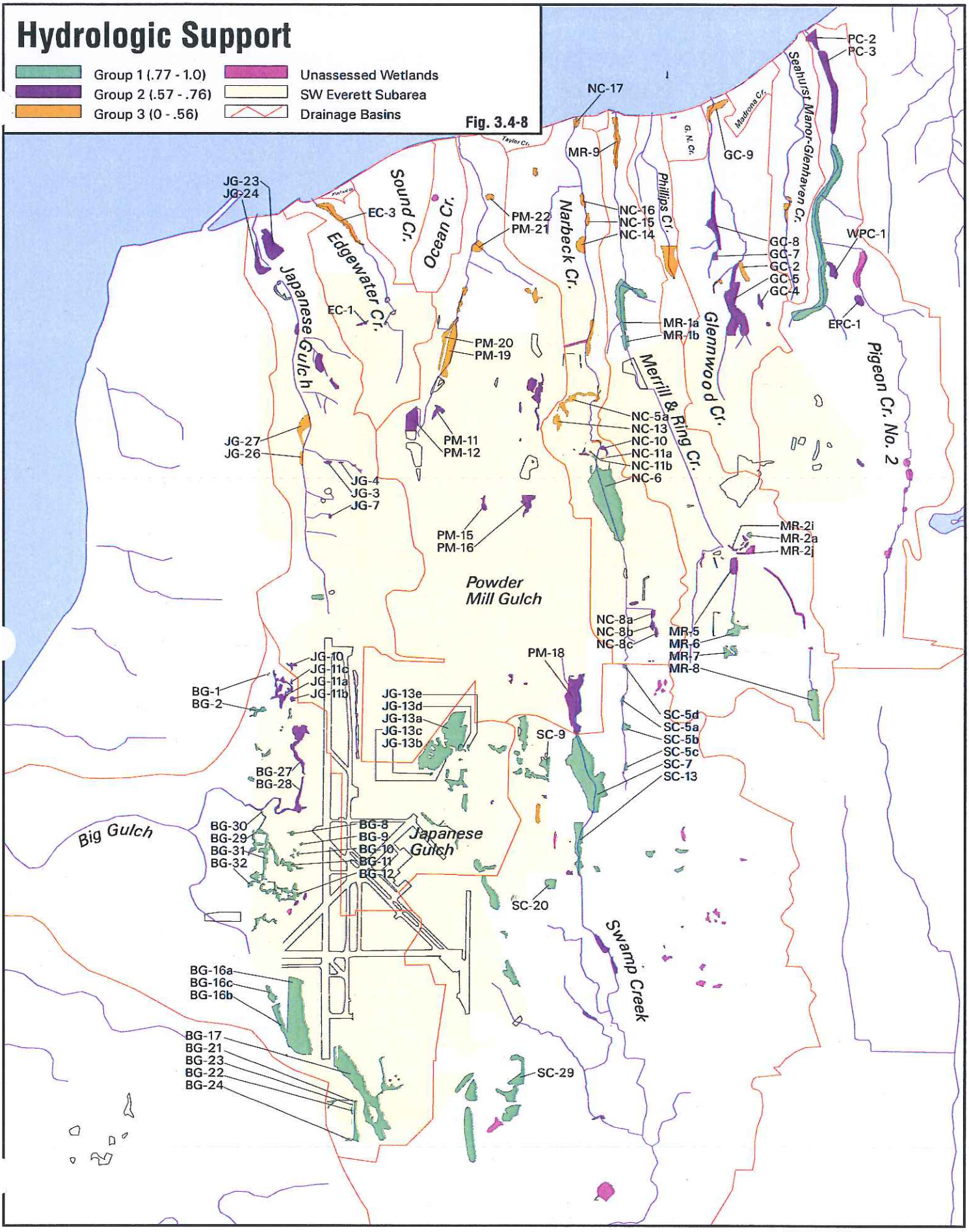

Overall Wetland Scores
Group 1 (.78 - 1.0)
Group 2 (.60 - .77)
Group 3 (0 - .59)
Unassessed Wetlands
SW Everett Subarea
Drainage Basins
Fig. 3.4-6
1" = 3000'
NC-17
PC-2
PC-3
Seahurst Manor-Glenhaven Cr.
Madrona Cr.
G. N. Cr.
Taylor Cr.
MR-9
GC-9
Phillips Cr.
Narbeck Cr.
Ocean Cr.
Sound Cr.
Edgewater Cr.
Japanese Gulch
Glenwood Cr.
Merrill & Ring Cr.
Pigeon Cr. No. 2
JG-23
JG-24
EC-3
EC-1
PM-22
PM-21
NC-16
NC-15
NC-14
GC-8
GC-7
GC-2
GC-5
GC-4
WPC-1
EPC-1
MR-1a
MR-1b
PM-20
PM-19
NC-5a
NC-13
NC-10
NC-11a
NC-11b
NC-6
JG-27
JG-26
JG-4
JG-3
JG-7
PM-11
PM-12
PM-15
PM-16
MR-2i
MR-2a
MR-2j
Powder Mill Gulch
NC-8a
NC-8b
NC-8c
MR-5
MR-6
MR-7
MR-8
PM-18
JG-10
JG-11c
JG-11a
JG-11b
BG-1
BG-2
JG-13e
JG-13d
JG-13a
JG-13c
JG-13b
SC-9
SC-5d
SC-5a
SC-5b
SC-5c
SC-7
SC-13
BG-27
BG-28
Big Gulch
BG-30
BG-29
BG-31
BG-32
BG-8
BG-9
BG-10
BG-11
BG-12
Japanese Gulch
SC-20
Swamp Creek
BG-16a
BG-16c
BG-16b
BG-17
BG-21
BG-23
BG-22
BG-24
SC-29

Flood & Stormwater Control

Group 1 (.80 - 1.0)
Group 2 (.64 - .79)
Group 3 (0 - .63)
Unassessed Wetlands
SW Everett Subarea
Drainage Basins

Fig. 3.4-7




Hydrologic Support
Group 1 (.77 - 1.0)
Group 2 (.57 - .76)
Group 3 (0 - .56)
Unassessed Wetlands
SW Everett Subarea
Drainage Basins
Fig. 3.4-8
PC-2
PC-3
NC-17
MR-9
GC-9
Seahurst Manor-Glenhaven Cr.
Madrona Cr.
G. N. Cr.
Phillips Cr.
Taylor Cr.
Sound Cr.
Ocean Cr.
Narbeck Cr.
Edgewater Cr.
Japanese Gulch
Merrill & Ring Cr.
Glennwood Cr.
Pigeon Cr. No. 2
Powder Mill Gulch
Big Gulch
Japanese Gulch
Swamp Creek
JG-23
JG-24
EC-3
EC-1
PM-22
PM-21
NC-16
NC-15
NC-14
GC-8
GC-7
GC-2
GC-5
GC-4
WPC-1
ERC-1
MR-1a
MR-1b
PM-20
PM-19
NC-5a
NC-13
NC-10
NC-11a
NC-11b
NC-6
JG-27
JG-26
PM-11
PM-12
JG-4
JG-3
JG-7
PM-15
PM-16
MR-2i
MR-2a
MR-2j
NC-8a
NC-8b
NC-8c
MR-5
MR-6
MR-7
MR-8
PM-18
JG-10
JG-11c
JG-11a
JG-11b
BG-1
BG-2
JG-13e
JG-13d
JG-13a
JG-13c
JG-13b
SC-9
SC-5d
SC-5a
SC-5b
SC-5c
SC-7
SC-13
BG-27
BG-28
BG-30
BG-29
BG-31
BG-32
BG-8
BG-9
BG-10
BG-11
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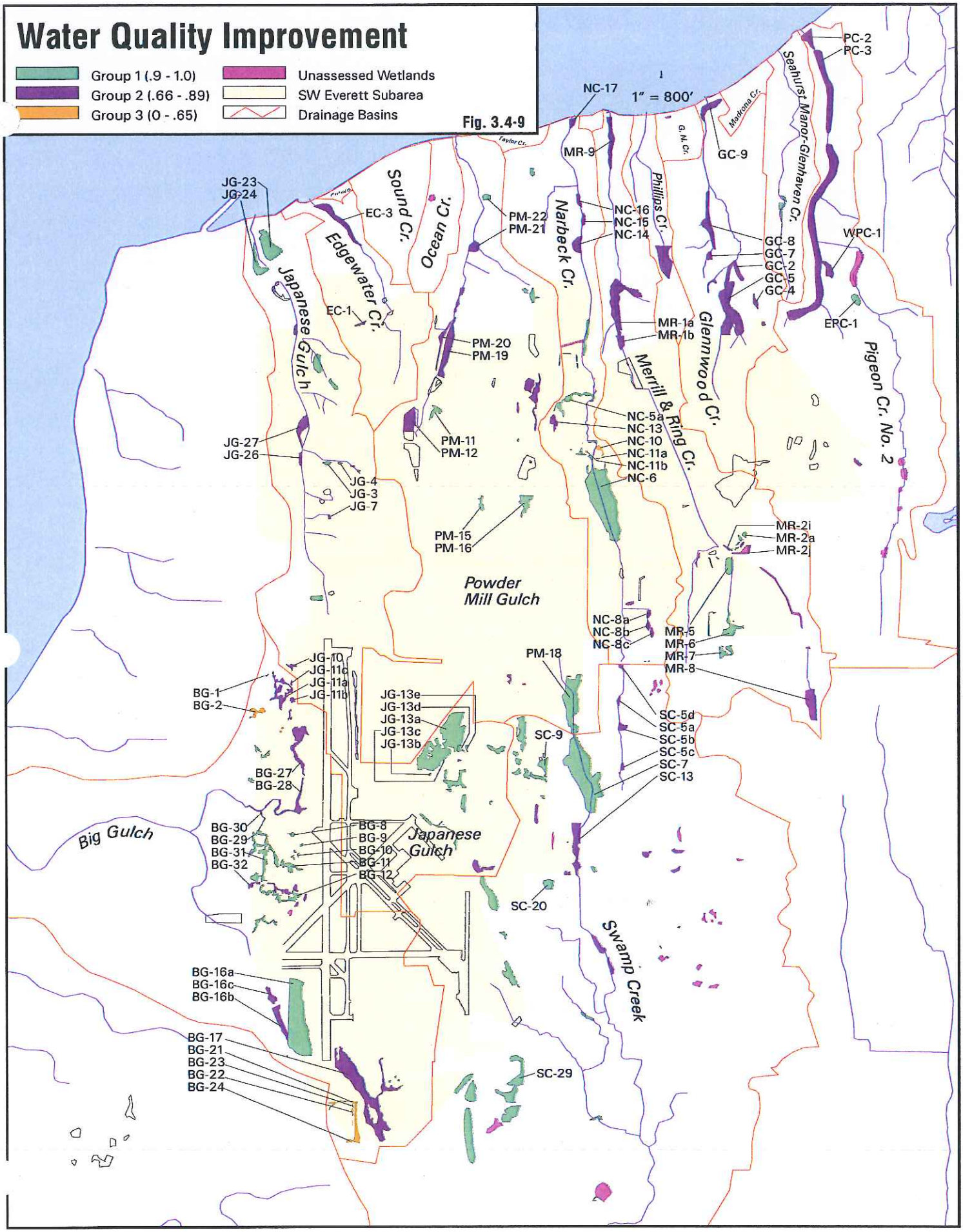
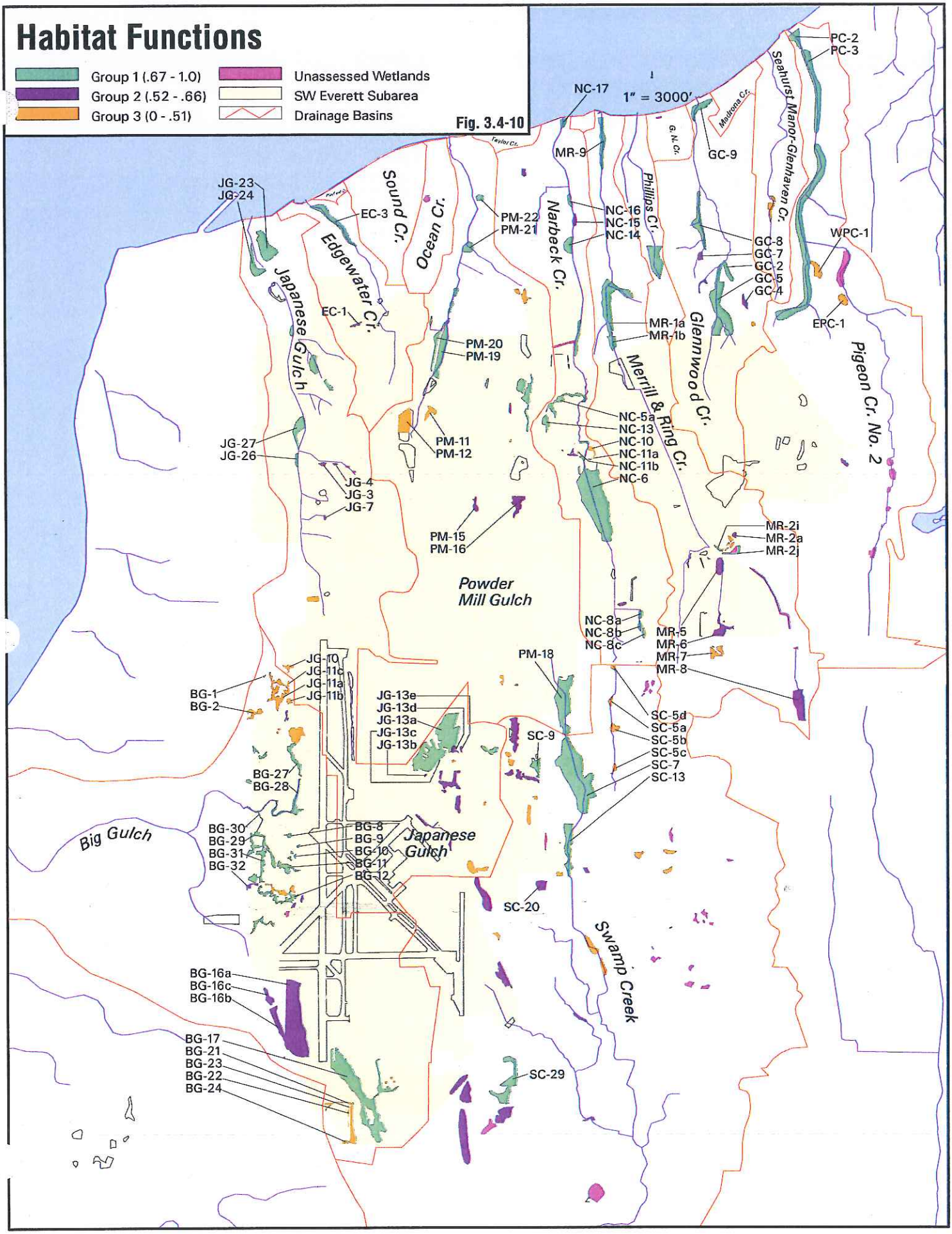
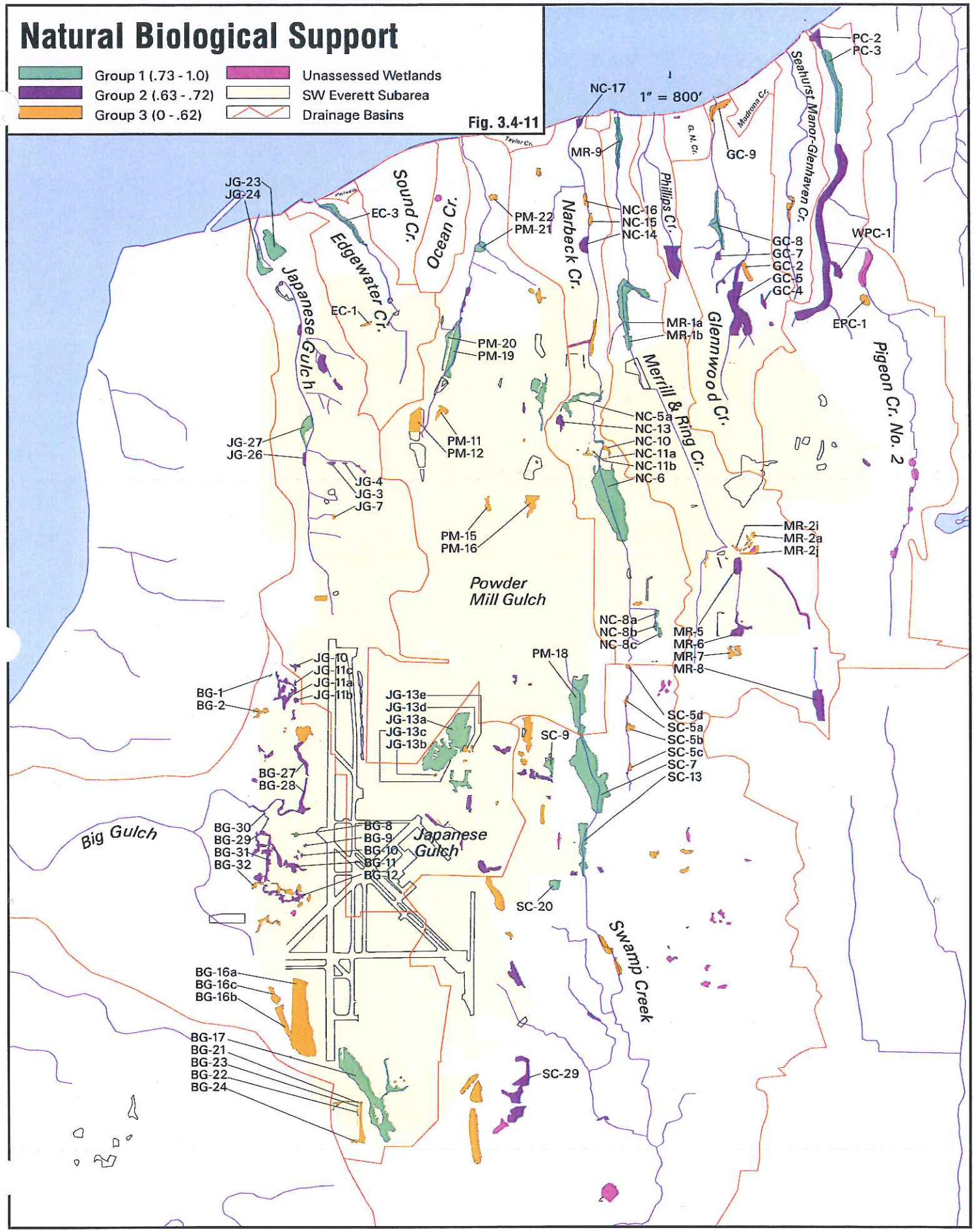
BG-21
BG-23
BG-22
BG-24
SC-29


Water Quality Improvement
Group 1 (.9 - 1.0)
Group 2 (.66 - .89)
Group 3 (0 - .65)
Unassessed Wetlands
SW Everett Subarea
Drainage Basins
Fig. 3.4-9
1" = 800'
Sound Cr.
Ocean Cr.
Edgewater Cr.
Japanese Gulch
Narbeck Cr.
Phillips Cr.
Glennwood Cr.
Merrill & Ring Cr.
Seahurst Manor-Glenhaven Cr.
Pigeon Cr. No. 2
Madrona Cr.
G. M. Cr.
Taylor Cr.
Powder Mill Gulch
Big Gulch
Japanese Gulch
Swamp Creek
NC-17
MR-9
GC-9
PC-2
PC-3
WPC-1
EPC-1
JG-23
JG-24
EC-3
EC-1
PM-22
PM-21
NC-16
NC-15
NC-14
GC-8
GC-7
GC-2
GC-5
GC-4
MR-1a
MR-1b
PM-20
PM-19
NC-5a
NC-13
NC-10
NC-11a
NC-11b
NC-6
JG-27
JG-26
JG-4
JG-3
JG-7
PM-11
PM-12
PM-15
PM-16
MR-2i
MR-2a
MR-2j
NC-8a
NC-8b
NC-8c
MR-5
MR-6
MR-7
MR-8
PM-18
JG-10
JG-11c
JG-11a
JG-11b
BG-1
BG-2
JG-13e
JG-13d
JG-13a
JG-13c
JG-13b
SC-9
SC-5d
SC-5a
SC-5b
SC-5c
SC-7
SC-13
BG-27
BG-28
BG-30
BG-29
BG-31
BG-32
BG-8
BG-9
BG-10
BG-11
BG-12
SC-20
BG-16a
BG-16c
BG-16b
BG-17
BG-21
BG-23
BG-22
BG-24
SC-29


Habitat Functions
Group 1 (.67 - 1.0)
Group 2 (.52 - .66)
Group 3 (0 - .51)
Unassessed Wetlands
SW Everett Subarea
Drainage Basins
Fig. 3.4-10
1" = 3000'
Sound Cr.
Ocean Cr.
Edgewater Cr.
Japanese Gulch
Narbeck Cr.
Phillips Cr.
Merrill & Ring Cr.
Glennwood Cr.
Seahurst Manor-Glenhaven Cr.
Pigeon Cr. No. 2
Powder Mill Gulch
Big Gulch
Japanese Gulch
Swamp Creek
JG-23
JG-24
EC-3
EC-1
JG-27
JG-26
JG-4
JG-3
JG-7
PM-22
PM-21
PM-20
PM-19
PM-11
PM-12
PM-15
PM-16
NC-17
MR-9
NC-16
NC-15
NC-14
MR-1a
MR-1b
NC-5a
NC-13
NC-10
NC-11a
NC-11b
NC-6
GC-9
GC-8
GC-7
GC-2
GC-5
GC-4
PC-2
PC-3
WPC-1
EPC-1
MR-2i
MR-2a
MR-2j
NC-8a
NC-8b
NC-8c
MR-5
MR-6
MR-7
MR-8
PM-18
SC-9
SC-5d
SC-5a
SC-5b
SC-5c
SC-7
SC-13
SC-20
SC-29
JG-10
JG-11c
JG-11a
JG-11b
BG-1
BG-2
JG-13e
JG-13d
JG-13a
JG-13c
JG-13b
BG-27
BG-28
BG-30
BG-29
BG-31
BG-32
BG-8
BG-9
BG-10
BG-11
BG-12
BG-16a
BG-16c
BG-16b
BG-17
BG-21
BG-23
BG-22
BG-24


Natural Biological Support
Group 1 (.73 - 1.0)
Group 2 (.63 - .72)
Group 3 (0 - .62)
Unassessed Wetlands
SW Everett Subarea
Drainage Basins
Fig. 3.4-11
1" = 800'
Sound Cr.
Ocean Cr.
Edgewater Cr.
Japanese Gulch
Narbeck Cr.
Phillips Cr.
Merrill & Ring Cr.
Glennwood Cr.
Seahurst Manor-Glenhaven Cr.
Pigeon Cr. No. 2
Powder Mill Gulch
Big Gulch
Japanese Gulch
Swamp Creek
JG-23
JG-24
EC-3
EC-1
JG-27
JG-26
JG-4
JG-3
JG-7
JG-10
JG-11c
JG-11a
JG-11b
BG-1
BG-2
BG-27
BG-28
BG-30
BG-29
BG-31
BG-32
BG-8
BG-9
BG-10
BG-11
BG-12
BG-16a
BG-16c
BG-16b
BG-17
BG-21
BG-23
BG-22
BG-24
JG-13e
JG-13d
JG-13a
JG-13c
JG-13b
PM-22
PM-21
PM-20
PM-19
PM-11
PM-12
PM-15
PM-16
PM-18
SC-9
SC-20
SC-29
SC-5d
SC-5a
SC-5b
SC-5c
SC-7
SC-13
NC-17
MR-9
NC-16
NC-15
NC-14
MR-1a
MR-1b
NC-5a
NC-13
NC-10
NC-11a
NC-11b
NC-6
NC-8a
NC-8b
NC-8c
MR-2i
MR-2a
MR-2j
MR-5
MR-6
MR-7
MR-8
GC-9
GC-8
GC-7
GC-2
GC-5
GC-4
PC-2
PC-3
WPC-1
EPC-1

Results of Assessment

Overall Score. Figure 3.4-6 depicts the Overall Score for the wetlands assessed within the study area. This figure combines all of the scores for the habitat, water quality improvement, baseflow/groundwater support and stormwater control functions into one score. Of the 189 wetlands within the study area, only 22 wetlands (11%) scored in Category 3, the lowest level of performance of wetland functions. Therefore, wetlands within the study area are performing wetland functions at a moderate to high level, indicating that the existing system of wetlands and streams is functioning as a viable ecosystem. Given these results it is important that:

- All functions of these wetland/stream habitats be protected and replaced onsite and/or in the same drainage basin when impacted, unless the importance of any of these functions on a landscape basis is not significant (e.g. replacing wildlife habitat for a small - 0.5 acre or less - isolated wetland that is located in an upper basin surrounded by urban development and is not within a riparian or wildlife corridor); and

- Functions performing at lower levels relative to the same functions in similar habitats in the study area should be enhanced and/or restored on site and/or in-basin, unless the importance of these functions on a landscape basis is not significant (e.g. restoring amphibian habitat in a small isolated upper watershed wetland is not as important as restoring and/or enhancing the stormwater control function).

In general, headwater wetlands scored in the Group 1 category with Category 2 and 3 wetlands located in the mid and lower portions of the watershed. One exception, is a large riparian wetland (JG23) located at the mouth of Japanese Gulch which ranked as a Group 1 wetland. It should be noted that this overall score is heavily influenced by the larger number of "non-habitat" functions such as flood/storm water control, hydrological and water quality improvement functions relative to the smaller number of habitat functions. Because the headwater wetlands tended to score in the Group 1 category for the flood/storm water control, hydrological control and water quality improvement functions, this resulted in a relatively lower overall score for the lower watershed wetlands. However, the lower watershed wetlands tended to score higher for the wildlife functions relative to the upper watershed wetlands.

The Group 1 wetlands tended to be either a large single wetland greater than 5 acres, or a large complex of small and moderate sized wetlands within a large area of undisturbed buffer (e.g. BG 8 to 12 and BG 29 to 32, west side of Paine Field). The large Group 3 1 wetlands consisted of Kasch Bog (SC7) and Swamp (PM18), Boeing Lake (JG 13) and Narbeck Swamp (NC6).

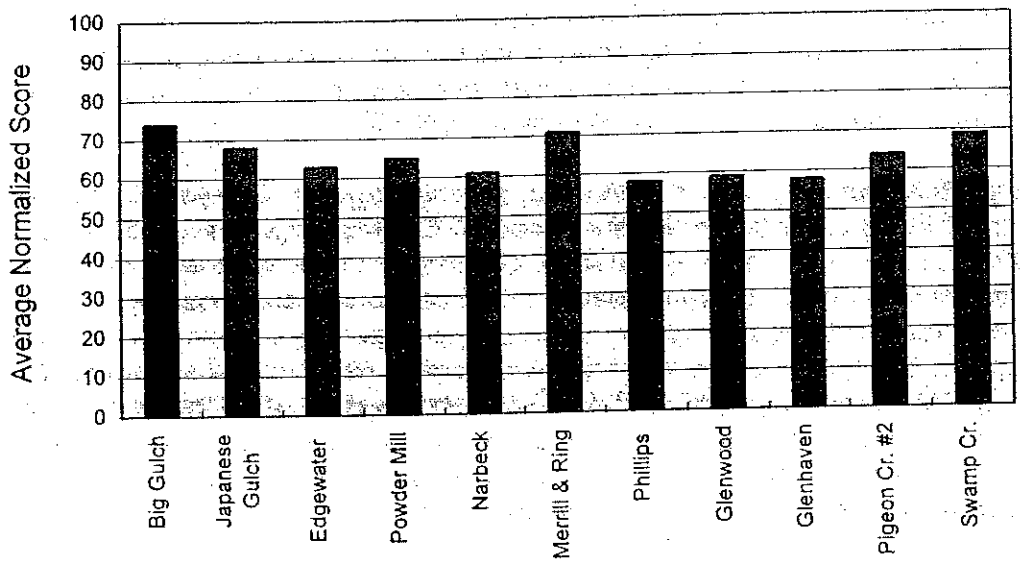
Lower Narbeck Creek had the highest number (4) of Class 3 wetlands indicating a high degree of disturbance within that corridor. Glenhaven Creek, due to development of its entire watershed and degraded buffers had all three of its wetlands rank in Class 3 (GLC 1a,b,c).

Flood/Storm Water Control and Baseflow Function Scores. Figures 3.4-7 and 3.4-8 depict Groups 1, 2 and 3 wetlands for the Flood/Storm Water Control and Baseflow functions for the study area. Figures 3.4-12 and 3.4-13 provide comparison of the scores for the flood/storm water and baseflow function for all basins in the study area. Class 1 wetlands for this function reduce peak flood flows and maintain a more constant velocity and volume of water over a

longer period of time. These hydrological characteristics are essential to a high performance of biological functions for all wetlands. If Class 1 wetlands for the flood/storm water function are located in the headwaters of a watershed, they have a significant "positive" impact on all functions for wetlands located downstream.

For the study area, the Class 1 wetlands for this function were all located in the headwaters of the watershed. These wetlands formed in glacial ice melt depressions on the relatively level Mukilteo terrace and have restricted or bermed outlets. As a result, they have significantly greater ability to store flood/storm waters and release these waters over a longer period of time than study area wetlands located lower in the basins within stream corridors. It is critical that the existing Class 1 wetlands for the flood/storm water and baseflow function in the upper basin be protected.

Figure 3.4-12
Flood / Storm Water Control Functions
Average Wetland Score by Drainage Basin



Group 3 wetlands consisted of riparian and slope wetlands located in the middle and lower reaches of study area basins; these wetlands typically have limited storage capacity and unrestricted outlets resulting in limited flood and stormwater control. Slope wetlands, however, are often important contributors to baseflow for streams and riparian wetlands.

Water Quality Improvement Function. Figure 3.4-9 provides an overall depiction of the Groups 1, 2 and 3 ranked wetlands for the water quality improvement functions. Figure 3.4-14 compares the water quality improvement scores for each of the study area basins. Overall, this was one of the highest scoring functions indicating that this function is being performed at a high level by the study area wetlands. Out of 187 wetlands, only 12 wetlands fell within the Group 3 category.

Figure 3.4-13
Hydrologic Support Functions
Average Wetland Score by Drainage Basin

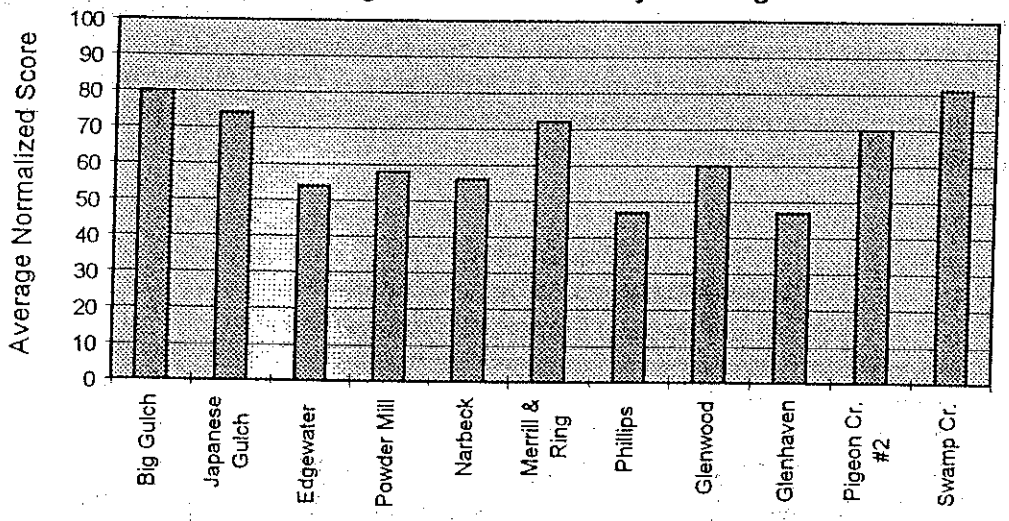
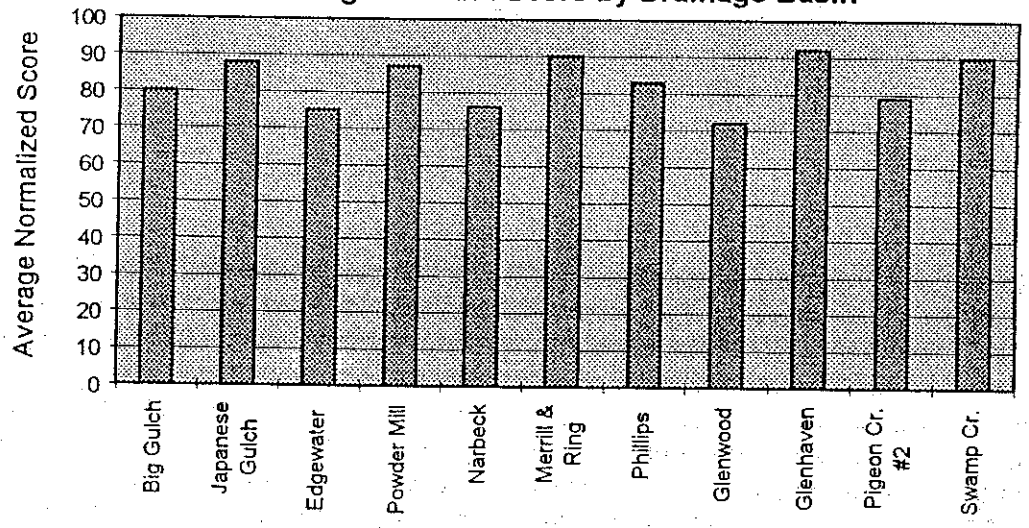


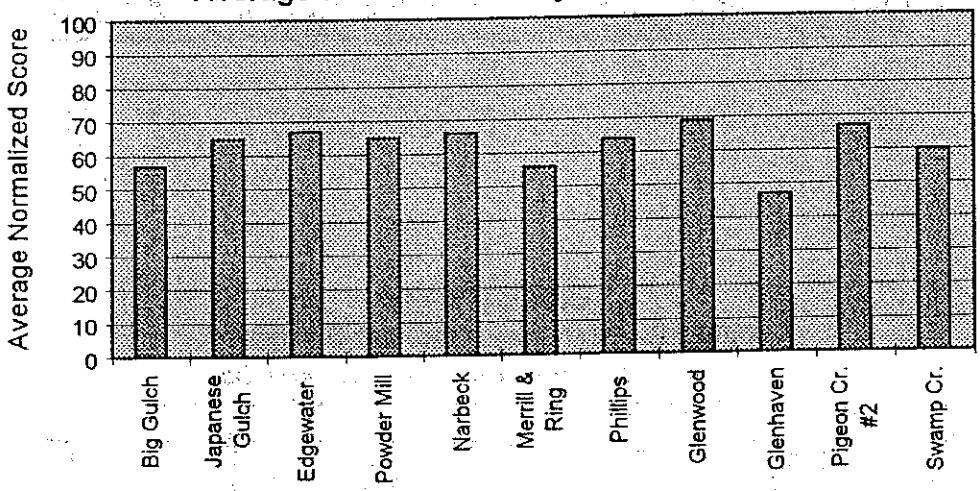
Figure 3.4-14
Water Quality Improvement Functions
Average Wetland Score by Drainage Basin



Wetlands within the Group 1 category would have restricted or bermed outlets, heavy vegetative cover and the ability to hold larger volumes of runoff for a greater period of time than other wetlands. These characteristics allow water borne sediment and associated pollutants to settle out of the water column and undergo chemical and biological transformation and uptake.

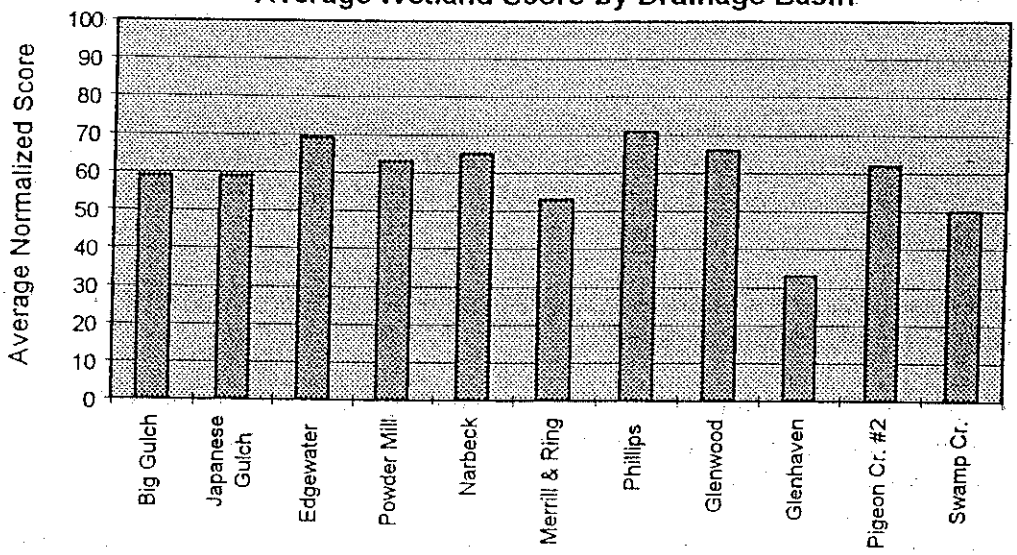
Habitat Functions. Figures 3.4-10 and 3.4-11 provide an overall depiction of the Groups 1, 2 and 3 ranked wetlands for the habitat functions, including "natural biological support" and "overall habitat functions." Figures 3.4-15 and 3.4-16 compare the scores for each of the study area basins. The natural biological support function score measures how well a wetland's foodchain works in supporting aquatic and terrestrial flora and fauna. The habitat functions score measures the ability of a wetland to provide habitat for a specific group of organisms, including birds, fish, mammals, amphibians and invertebrates. Overall, the habitat functions scores were similar to the scores for the other functions except water quality improvement which scored significantly higher.

Figure 3.4-15
Natural Biological Support Functions
Average Wetland Score by Drainage Basin



Group 1 wetlands for the natural biological support function constitute only 18% of the total number of wetlands but represent a significant portion of the total acreage of wetlands within the watershed. These Group 1 wetlands are typically larger than 5 acres with three vegetation community types, a high diversity of plant species, open water, intact native buffers, moderate to high primary productivity and organic accumulation and a variety of natural habitat features such as snags and downed woody debris in and over open water. This included very large wetlands on the Mukilteo terrace such as Narbeck Swamp (NC6), Kasch Bog and Swamp (PM18 and SC7), Boeing Lake (JG13) and South Paine Field wetlands (BG17). Also included were the riparian wetlands within the stream corridors draining northward into Puget Sound from the study area such as JG23 and 24 at the mouth of Japanese Gulch, EC3 at the mouth of Edgewater Creek, midbasin wetlands in Powder Mill Creek (PM19-21), the mouth of Merrill and Ring Creek (MR9) and midbasin wetland MR1, midbasin wetland GC8 in Glenwood Creek and the lower reach of Pigeon Creek.

Figure 3.4-16
Habitat Functions
Average Wetland Score by Drainage Basin



Group 1 wetlands for the Habitat Functions constituted 35% of the total number of wetlands within the watershed. These wetlands represented the majority of the wetland acreage within the watershed. Virtually all of the wetlands within the creek corridors north of the study area were Group 1 wetlands, in addition to most of the wetlands on the Mukilteo terrace that were Group 1 wetlands for the Natural Biological Support function. Though most of these wetlands also tended to be large (> 5 acres) with diverse habitat, many smaller wetlands were included such as those located in west Paine Field.

Cultural/Socio-economic Values. The Wetland and Buffer Functions Assessment form also included questions regarding cultural and socio-economic performance of the wetlands. The questions are actually purely value based, and relate to the value to humans for educational, recreational or commercial purposes. The questions evaluate the aesthetic value of the wetlands, opportunities for educational and recreational experiences, connection to other open spaces, presence of historical or archeological resources, and existing commercial uses of the wetlands. Evaluation of these questions was not completed for the DEIS because of lack of knowledge of ownership of wetlands outside of the SW Everett/Paine Field Subarea, as well as public access opportunities. These questions may be pursued in the future, to provide data to public decisionmakers when evaluating potential public access, educational and recreational opportunities.

While the data is currently incomplete for the overall study area, several conclusions can be drawn.

Public Access for Recreational and Educational Opportunities Within the Subarea boundaries, there is currently no known legal public access to wetlands. Wetlands located along roadways have viewing and educational opportunities, but only by viewing from the

public right-of-way. The City owns a parcel north of Seaway Blvd. in the Powder Mill Gulch basin where a wetland was created. Access to the site for educational opportunities could be pursued on this site. Paine Field is currently proposing a wetland mitigation bank adjacent to and including Narbeck Swamp (NC6). (The environmental review for the proposal is proceeding separately from this DEIS.) The proposal includes construction of public access and educational facilities on the site.

Several public parks with wetlands are located outside the Subarea, but within the study area. These include Kasch Park Bog, Harborview Park, and Walter E. Hall Park/Golf Course. In addition, Horizon Elementary School on Casino Road contains a bog which has potential for educational opportunities.

The City of Everett has a utility line running along Powder Mill Creek. Opportunities for public access along the sewer line could be pursued.

Commercial Use of Wetlands. Within the study area, there are no known commercial fisheries, or other use of wetlands for commercial purposes. However, past mining activities and development have eliminated wetlands.

Historical and Archeological Resources. Within the study area, there are no known historical or archaeological resources in wetlands.

3.4.2 DESCRIPTION OF EXISTING CONDITIONS

This section includes information from field work by Pentec Environmental and City Staff, as well as from the following documents: *Everett Growth Management Comprehensive Plan, DEIS 1994; City of Everett Water System Plan Update, November 1994;* the *Master Development Plan for the Boeing Commercial Airplane Group, 1991, DEIS; the Snohomish County Groundwater Characterization Study, 1991; Snohomish County Amended Ordinance No. 94-108- Critical Areas Ordinance;* and the *City of Everett - Port Gardner Bay Drainage Basin Plan Updates No.s 1,2,3,4,5 & 6; Snohomish County Swamp Creek Watershed Management Plan and Technical Appendices, Snohomish County Airport Master Implementation and Wetland Proposal, 1995.*

3.4.2.1 Basin Descriptions

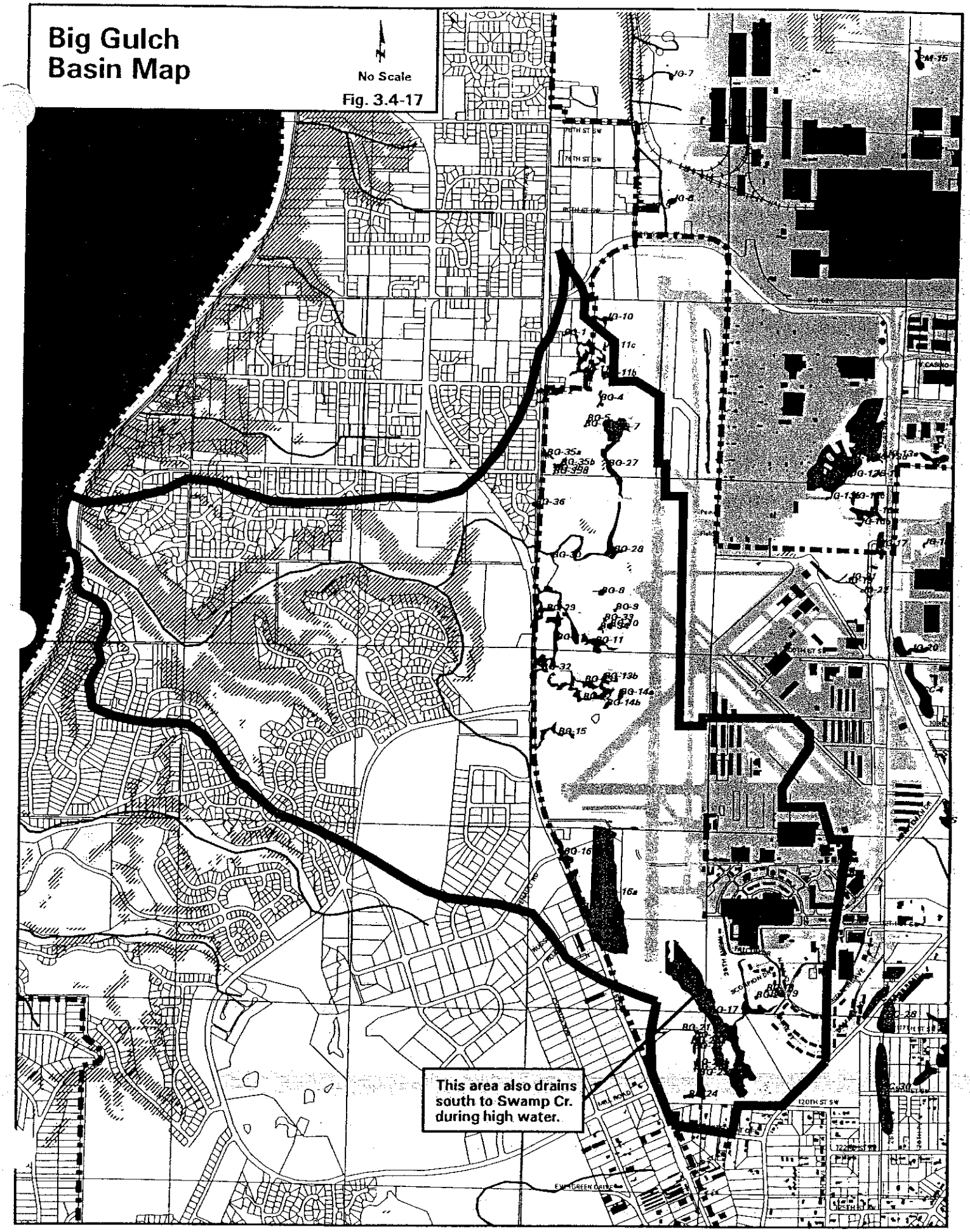
Big Gulch Basin (Figure 3.4-17)

Big Gulch Creek. Big Gulch Creek flows west from Paine Field into Puget Sound, draining an approximately 1,450-acre basin in Snohomish County and the City of Mukilteo. About half of the drainage area (750 acres) is Paine Field property. Most of the remaining land is composed of residential development on the plateau and undeveloped Snohomish County park land in the ravine of Big Gulch.

Big Gulch Basin Map

No Scale

Fig. 3.4-17



The mouth of the creek is a culvert under the Burlington Northern railroad tracks where the stream empties onto the beach. Immediately upstream of the culvert, the creek has been channelized along the perimeter of Olympus Terrace's sewer treatment plant. Beyond the channelized portion, the stream is generally in a natural system with a typical meander at the lower end and confinement within the ravine bottom in the middle and upper end. Modifications include culverts under Harbor Point Blvd. and the presence of a sewer pipe in the bottom of the channel. (KCM, 1992)

The stream buffer width requirement would be determined by Snohomish County and City of Mukilteo Ordinances. Since most of the channel is within a large Snohomish County Park, encroachment upon the stream buffer is not a major concern.

Big Gulch Creek supports small populations of coho and chum salmon, which use only the lower portion of the stream, and resident cutthroat trout, which occur from the mouth to the fork and up to Harbor Point Blvd. in the south fork. Above the fork, stream flows are intermittent. Snohomish County personnel report that residential development in the basin has depleted baseflows in the system. Formerly, flows were perennial to the top of the gulch, and cutthroat used the entire system. In the 1970s and 1980s, development filled or partially filled wetlands which provided baseflow to the stream.

The quality of fish habitat is poor, particularly in the north fork. It would be improved by increasing the size and frequency of pools, reducing peak flow rates, and reducing channel erosion.

Water quality in Big Gulch Creek has been impacted recently by releases of firefighting foam from Tramco facilities. The foam impacts fisheries by killing aquatic insects, the fish food sources, resulting in increasing competition for fish and fry for remaining food. In 1992, KCM found a significant level of nutrient loading in the south fork. The nutrients encourage the growth of algae and bacteria that result in slime visible on rocks. In 1987, the Department of Ecology also found high phosphorus concentrations in drainages from Paine Field properties that were sufficient to cause nuisance plant growths. The 1987 study found additional problems in Paine Field drainages including herbicide contamination, and elevated concentrations of mercury and cyanide, and PCBs. Paine Field has taken steps to stop herbicide contamination and has increased policing of tenants to prevent contamination.

The long term integrity of this system is a serious concern for the management of additional stream flows. As is typical of streams in watersheds undergoing development, with increasing amounts of impervious surface, Big Gulch Creek is experiencing higher peak flows and lower summer base flows. Increasingly common high peak flows have resulted in increased bank erosion and channel downcutting. The channel is cobble-bedded and is eroding through the basal till. The channel bottom is controlled by glacial lake silt and clay deposits that are somewhat resistant to erosion. Without these soils, channel erosion would progress much more quickly. Both of the tributaries above the Big Gulch fork show signs of recent bank erosion and downcutting. Further downstream, localized downcutting has occurred below storm drain outlets from residential development. To prevent acceleration of erosional processes, strict detention requirements should be applied to developments draining to this system. In addition, bioengineering efforts should be made to stabilize the channel. Efforts should be made to keep channel flows at 40 cfs or less within this basin (Sleight, 1996).

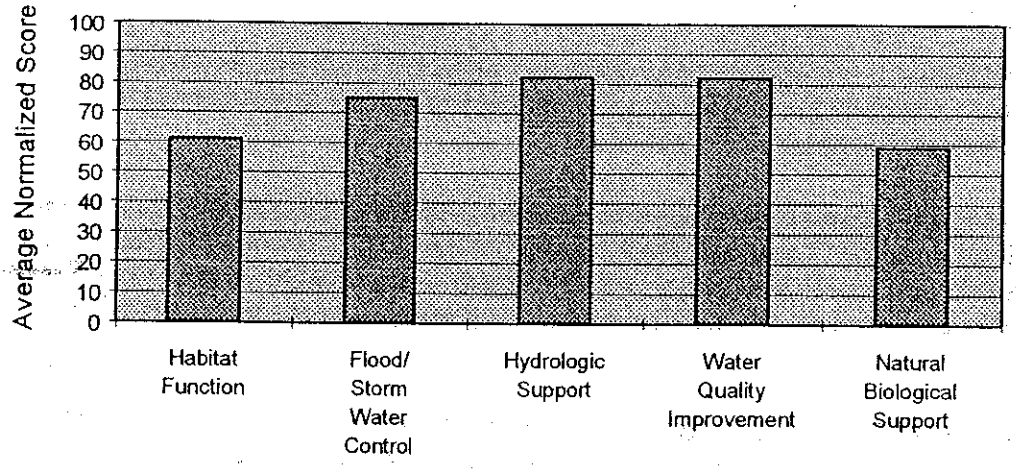
Paine Field's plans to compensate for impacts caused by relocation of its main runway include creation of 10 acres of wetlands at the headwaters of the South Fork of Big Gulch Creek on Paine Field properties (Watershed Co., 1995).

The Watershed Company and Paine Field coordinated a reconnaissance level survey to document the condition of storm drainage systems originating from residential areas in Big Gulch. Several problems were noted, ranging from channel incision and slope failure due to increased flows from development, exposed fill that was likely to wash into the creek, and discharge of stormwater onto steep slopes directly or at broken tightlines. (Watershed Co., 1995)

A 12-inch concrete bell and spigot sanitary sewer conveying sewage to the Olympic Terrace Water District treatment plant has been placed in the channel bottom of Big Gulch Creek. In some places this pipe is exposed and affects the stream morphology. In other places, where the pipe is still buried, stream scour may expose the pipe in the future. Increased channel erosion could threaten the integrity of this sanitary sewer. Buoyancy of the sewer pipe may be an issue if the channel is ever blocked via a slide in the ravine.

Big Gulch Basin Wetlands. Figure 3.4-18 shows the average wetland assessment scores for Big Gulch Basin.

Figure 3.4-18
Big Gulch Drainage Basin
Average Wetland Assessment Scores



Flood/Storm Water Control and Base Flow Support Functions. The Big Gulch basin had a large number of smaller Group 1 wetlands and one large wetland (BG17 for flood function and BG 16a,b,c for baseflow) in the upper portion of the basin. Though the average overall flood/storm water control and baseflow score (75 and 82 respectively) for Big Gulch Basin was higher than other basins in the study area (except Merrill and Ring Creek Basin), there are several wetlands where enhancement of the flood/storm water and baseflow function could occur. This includes:

- Wetlands B27- 30 located on the west side of Paine Field. These wetlands were ranked as Group 2 wetlands (BG 29 was ranked Group 1 for baseflow function). There was evidence of scouring flows through these wetlands (particularly BG28 and BG30). Because these wetlands are located within a narrow ravine, increased ponding from small check dams and flow restrictors would be possible. Increased detention of water in these areas would have significant benefits to downstream wetlands and streams.
- Wetlands BG16a,b, and c. These wetlands ranked in the lowest group for the flood and stormwater control function because of the lack of a restricted outlet. Again, there is sufficient capacity in these wetlands for the detention of additional storm and flood flows. Because these are headwater wetlands, further improvement in the storm and flood water control function would have a significant benefit to downstream wetlands and streams.

Water Quality Improvement Function. Big Gulch Basin wetlands ranked fifth overall (tied with Glenwood) in the water quality improvement scores (Figure 3.4-14). The water quality improvement function was being performed at a relatively high level for these wetlands because the majority of them were located within depressions with restricted outlets.

The Big Gulch basin had a large number of smaller Group 1 wetlands and one large wetland (BG16a) in the upper portion of the basin. However, there are opportunities for the improvement of the water quality improvement function on several Group 2 and 3 wetlands, including:

- Wetlands B27, 28, and 30 located on the west side of Paine Field. There was evidence of scouring flows through these wetlands (particularly BG28 and BG30). Because these wetlands are located within a narrow ravine, increased ponding from small check dams and flow restrictors would be possible.

- Wetlands BG16b and c. These wetlands ranked in Group 2 for the water quality improvement function because of the lack of a restricted outlet. Again, there is sufficient capacity in these wetlands for ponding of water.

- Wetlands JG11a,b,c (note these wetlands may drain to either the Big Gulch or Japanese Gulch Wetlands), and BG 1 and 2, BG21 through 24 and BG17. These wetlands ranked in Groups 2 and 3 and are characterized as having moderate to rapid runoff through them. Restriction of outlets would improve the water quality improvement function for these wetlands.

Habitat Functions. For the Natural Biological Support function only 4 wetlands ranked as Group 1 wetlands. This was due primarily to the smaller size of these wetlands, the lack of a diverse mosaic of emergent/scrub-shrub and forested vegetation classes, lack of open water and only moderate plant diversity. The clearing and disturbance in and around these wetlands during the past 20 to 30 years is primarily responsible for the lower ranking of these wetlands for this habitat function. For the Habitat Functions, 19 wetlands ranked within the Group 1 category.

Opportunities to enhance these wetlands include: creating more emergent and scrub-shrub communities through increased flooding (e.g. BG16a/b/c, BG28 and 30) planting coniferous species in buffers, and improving buffers on BG 16a,b and c. It should be noted that BG 16, known as "Aulinger Swamp," contains a sphagnum bog, which is a regionally rare wetland

type. This wetland has been highly impacted by the harvesting of the original forested wetland portion adjacent to Mukilteo Speedway, from which runoff flows into the wetland. There is virtually no buffer between the wetland and the Mukilteo Speedway. Planting of buffer along the Mukilteo Speedway, enhancing plantings and protecting the wetland from further degradation will significantly improve the performance of its habitat functions.

Japanese Gulch Basin (Figure 3.4-19)

Japanese Gulch Creek. Japanese Gulch Creek flows north from Paine Field and enters Puget Sound via a culvert under the oil tanks on the Mukilteo waterfront. It drains an approximately 1,020-acre basin. About 400 acres of the drainage area are Paine Field property. Much of the basin is undeveloped because of its steep topography. The developed area consists predominantly of industrial/commercial land uses within and adjacent to Paine Field. There is some residential development on the plateau and near the mouth of the system in the City of Mukilteo. A Burlington Northern railroad spur to the Boeing plant ascends Japanese Gulch from the waterfront in Mukilteo up to the top of the ravine near Highway 526.

The Gulch previously included a Japanese workers community with wood dwellings and a cemetery. In the 1960s, the Boeing railroad spur and associated grading activity went over the top of the cemetery and destroyed any buildings that remained. (Dilgard, 1995)

The stream channel is nearly 2 miles long with an average gradient of 5 percent. This is a relatively steep gradient compared to other streams in the Puget Sound region, but it is typical for streams draining the study area.

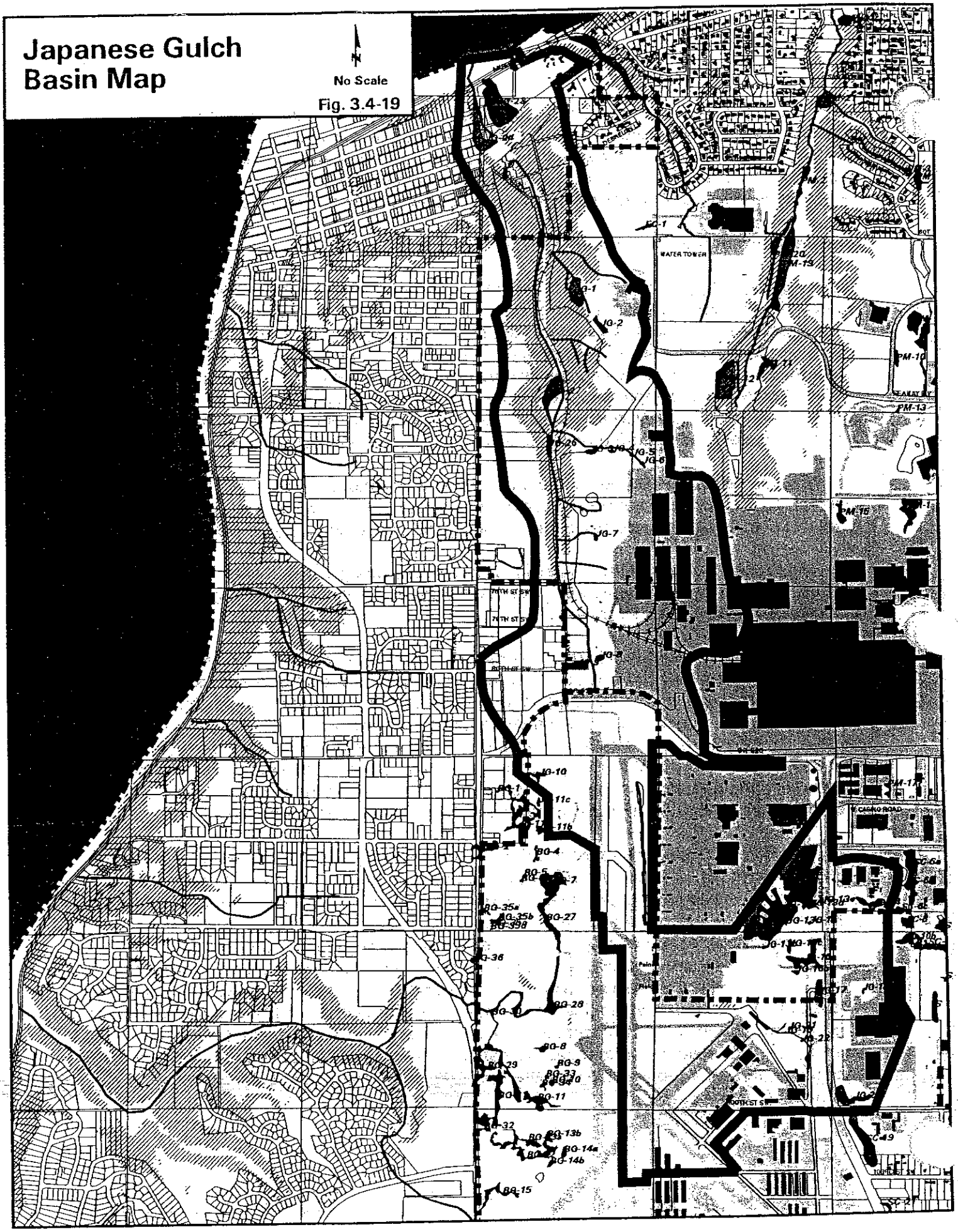
In the upper portion of the drainage basin, south of SR 526, the stream is primarily enclosed in underground storm drains. However, there are two significant surface features within the upper drainage basin: Lake Boeing and the Paine Field stormwater detention basin. Lake Boeing is a naturally occurring lake (maybe a partially mined peat bog) with a surface area of approximately 15 acres. The lake is located on Boeing property, south of SR 526, and it is used to detain storm runoff from approximately 96 acres of industrial land. The Paine Field detention pond has a surface area of approximately 18 acres, detains storm runoff from 360 acres of industrial land, and was designed to store the 100 year storm event.

Downstream of SR 526 the stream corridor is densely vegetated on both sides. Like many of the ravines in the SW Everett/Paine Field Subarea, the bottom and sides of the Japanese Gulch ravine are quite steep, with slopes up to 80 percent - well steeper than the natural angle of repose. Also downstream of SR 526, Japanese Gulch Creek has been highly modified with concrete spillways constructed approximately every 1,500 feet within the channel. The concrete spillways drop the channel approximately 20 feet with a slope of approximately 3 horizontal to one vertical. The depth of the stream flow down the spillways is less than 1 inch under dry conditions. Upstream from the 5th Street Bridge/Mukilteo Blvd., Burlington Northern has had problems with high volumes of sediment and debris moving down the system. Burlington Northern has constructed in-line sediment ponds to help control the sediment movement, but siltation problems in this reach have continued even after construction of these ponds.

Japanese Gulch Basin Map

No Scale

Fig. 3.4-19



Japanese Gulch supports an anadromous fish population (coho) and is classified as a Category I stream in accordance with the Environmentally Sensitive Areas chapter of the Everett Zoning Code. Consistent with the zoning requirements, the stream buffer width for Japanese Gulch is 100 feet. The anadramous fish population is located between the culvert on the Mukilteo waterfront and 5th Street, about 300 yards of fish habitat. This habitat was surveyed and electroshocked by KCM in March 1993 (memo from Wayne Daley to Dan Mathias, 1993). KCM's report to the City of Everett states:

> Access to this creek by returning adult salmonids is limited to a very narrow period when tides are very high and the stream flow is sufficient to remove the velocity barrier which exists at the culvert crossing under the BN tracks. A trash rack at this point further complicates adult access. In spite of the barriers to adult migration, three coho smolt and several cutthroat were shocked in the area immediately upstream of the railroad crossing. A second barrier to adult migration was found near the culvert crossing under the Boeing spur. This concrete dam appears to be a total blockage to adult migration. Industrial development and residential growth in the upper watershed together with stream blockages will limit the productivity of this stream.

Additionally, side channel and pond habitat is immediately adjacent to the main channel of the creek in wetland JG 23.

In March of 1994, the City of Everett's Utilities Division prepared the Port Gardner Bay Drainage Basin Plan Update, which included long term goals for improvement of coho habitat in the downstream reaches of Japanese Gulch. The Plan Update has not yet been adopted by City Council. Recommendations within the proposed plan included the elimination of fish migration barriers downstream of Mukilteo Blvd., and the installation of a weir or weirs to back up water. The plan also included:

- Use of on-site detention systems.
- Optimize use of an existing 45 acre-foot detention system on Paine Field property.
- On-site water quality control facilities.
- Specific recommendations for stream riparian zone protection, water quality monitoring, and enforcement.

It's not likely that the detention pond on Paine Field will be expanded due to concerns regarding attraction of waterfowl to the airport.

Japanese Gulch Basin Wetlands. Figure 3.4-20 shows the average wetland assessment scores for Japanese Gulch drainage basin.

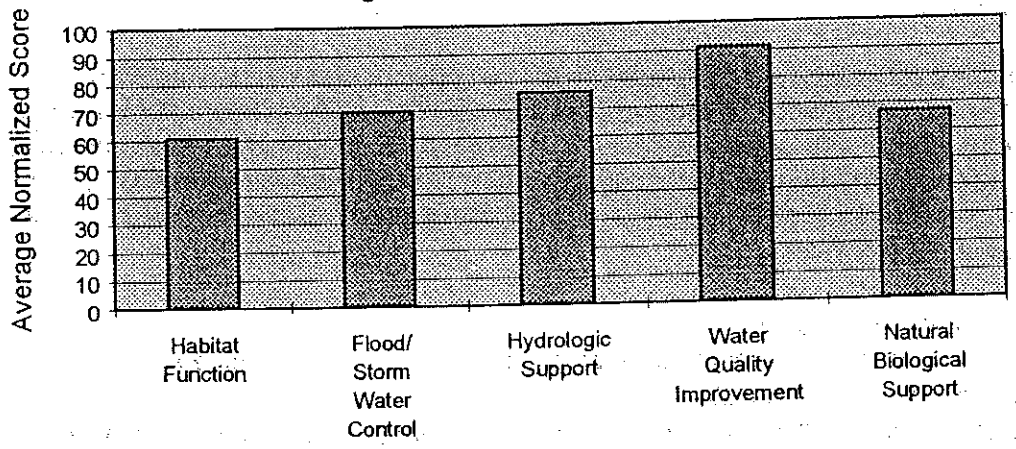
Flood/Storm Water Control and Base Flow Support Functions. Almost all of the headwater wetlands for Japanese Gulch ranked in the Group 1 category, therefore there is no need to improve the storm and flood water control function for these wetlands. The lower watershed wetlands are within a steep stream corridor and improvement of the flood and stormwater control function would be difficult and provide little improvement to the overall stormwater and flood water control function. It is important, however, that the native vegetation on the steep slopes adjoining these riparian corridors are protected because they also provide important

flood control benefits to these riparian wetlands. Without forest, the rate and volume of flows would increase which would negatively impact instream fauna, particularly Coho which are found in the lower reaches of Japanese Gulch stream.

Water Quality Improvement Function. Japanese Gulch Basin Wetlands ranked third overall in the water quality improvement scores (Figure 3.4-14). The water quality improvement function was being performed at a relatively high level for these wetlands because the majority of them were located within depressions, such as Lake Boeing (JG13), with restricted outlets that

retained a good portion of the overland flow for their sub-basin. Most of the wetlands ranked as Group 1 wetlands, with only four wetlands ranking as Group 2 wetlands. Of these four Group 2 wetlands, opportunities for enhancement of the water quality improvement function exists at JG 7 and 10 where the outlet can be restricted. Because JG27 is a slope wetland and JG26 is located on a small terrace above a stream, there is limited opportunity to improve the water quality treatment function for these wetlands.

Figure 3.4-20
Japanese Gulch Drainage Basin
Average Wetland Assessment Scores



Habitat Functions. For the Natural Biological Support function, 19% of the wetlands ranked in the Group 1 category. This included Lake Boeing (JG13 and 16) and wetlands within the lower portion of the stream corridor (JG 23,24 and 27). For the Habitat Functions, 61% of the wetlands ranked in the Group 1 category. Though highly modified, Lake Boeing provides a significant amount of waterfowl habitat relative to the rest of the basin. For both functions the Group 1 wetlands represent the majority of the wetland acreage within the basin. Opportunities for enhancement are limited to a few small wetlands (JG3, 4 and 7) and would involve creation of scrub-shrub and forested habitat and suitable buffers. A short section of Japanese Gulch stream could be enhanced immediately north of Mukilteo Boulevard by removing the concrete flume and restoring the creek channel.

Edgewater Creek Basin (Figure 3.4-21)

Edgewater Creek. Edgewater Creek drains a small and heavily developed basin of only 200 acres, a portion of which is located in the northwest corner of the SW Everett/Paine Field Subarea. The existing land uses in the Edgewater basin are primarily single family residential and open space. In the 1860's, one of the earliest county roads was constructed in the basin along portions of the stream.

The stream channel is approximately 0.5 mile long, and the stream gradient is approximately 11 percent, the steepest stream gradient in southwest Everett.

Edgewater Creek has inadequate flows to support salmonids The riparian corridor in the inner gorge below Sound Road, however, provides wildlife habitat. Upstream of Sound Avenue (within the SW Everett/Paine Field Subarea), Edgewater Creek comprises several intermittent, relatively low gradient stream channels. These intermittent channels join at a detention pond adjacent to Sound Avenue. Two culverts have been installed within the channels to accommodate an industrial development a few hundred feet upstream of Sound Avenue. Downstream of Sound Avenue, the stream corridor is in a largely undisturbed, natural condition. The stream flows through a large, vegetated corridor approximately 400 feet wide. Little intrusion into the stream corridor has occurred as a result of past urbanization, although one recent landslide and an illegal removal of trees within the stream corridor suggest that Edgewater Creek may soon be facing more frequent intrusions from adjacent land uses. Field visits in the spring of 1995 found that Edgewater Creek actively transported a large volume of sand and apparently experiences significant channel erosion during high flows.

Because Edgewater Creek may be a year-round stream downstream of Sound Avenue, it has been identified as a Category II stream downstream of Sound Avenue and a Category III stream upstream of Sound Avenue. Erosion hazard areas have been identified along the stream bed downstream of Sound Avenue.

In April 1992, City Council adopted the Port Gardner Bay Drainage Plan Update Report No. 5 as the revised Drainage Basin Plan for Edgewater Creek. The plan recommendations included upgrading of two undersized storm drains on Mukilteo Boulevard (outside of the SW Everett/Paine Field Subarea).

Edgewater Creek Basin Wetlands. See Figure 3.4-22 for the average wetland assessment scores for Edgewater Creek drainage basin.

Flood/Storm Water Control and Base Flow Support Functions. Only two wetlands, EC1 and 3, are present in this basin. EC1, a small forested depressional wetland in the upper basin, ranked as a Group 2 wetland. EC3, a riverine wetland at the mouth of Edgewater Creek, ranked as a Group 3 wetland.

The Edgewater Basin had one of the lower overall scores (63) for the flood and stormwater control function because of the lack of wetlands in the upper basin. The upper basin, therefore, would be an appropriate area to improve the storm/flood water control and baseflow function through the creation of depressional wetlands with constrained or bermed outlets.

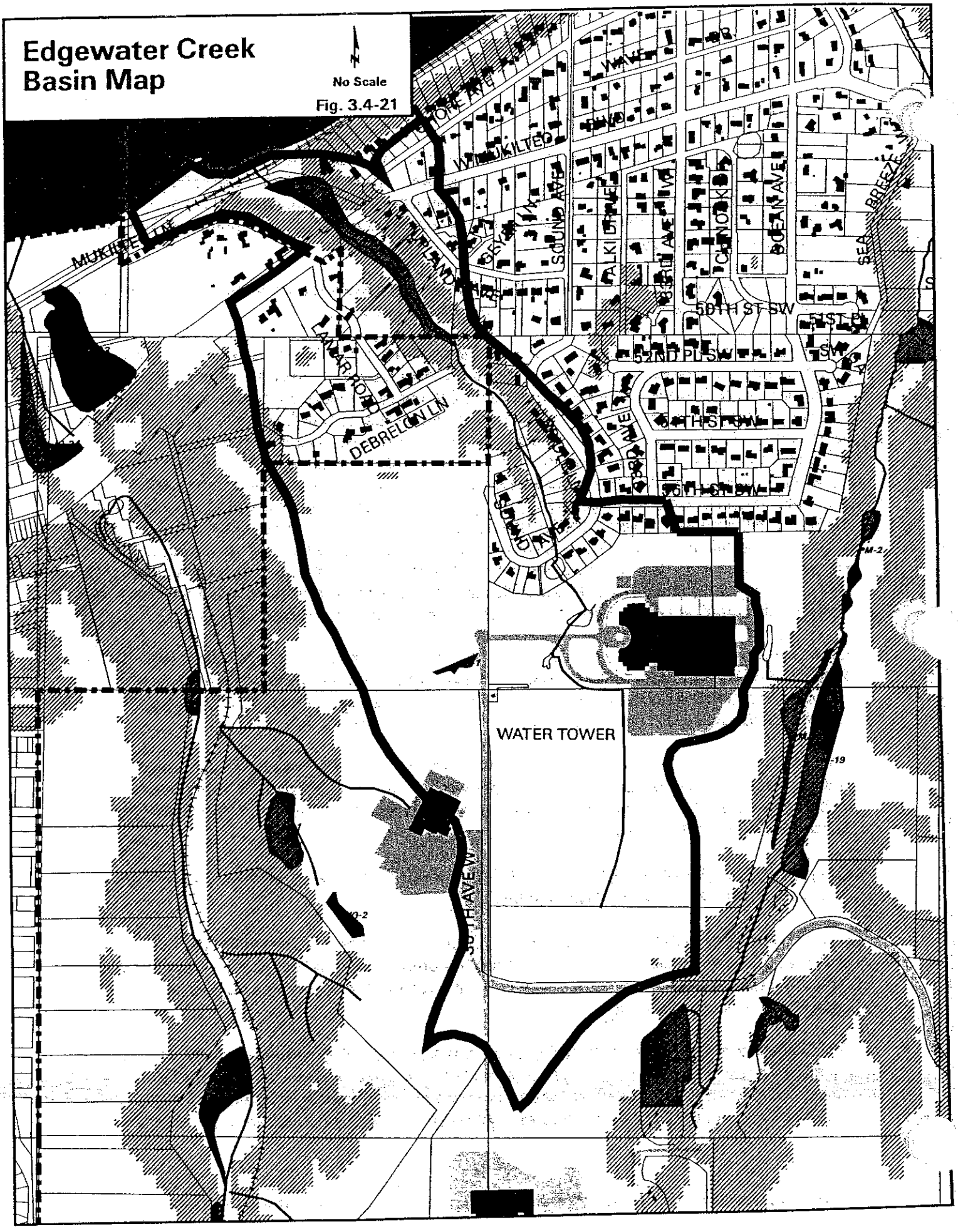
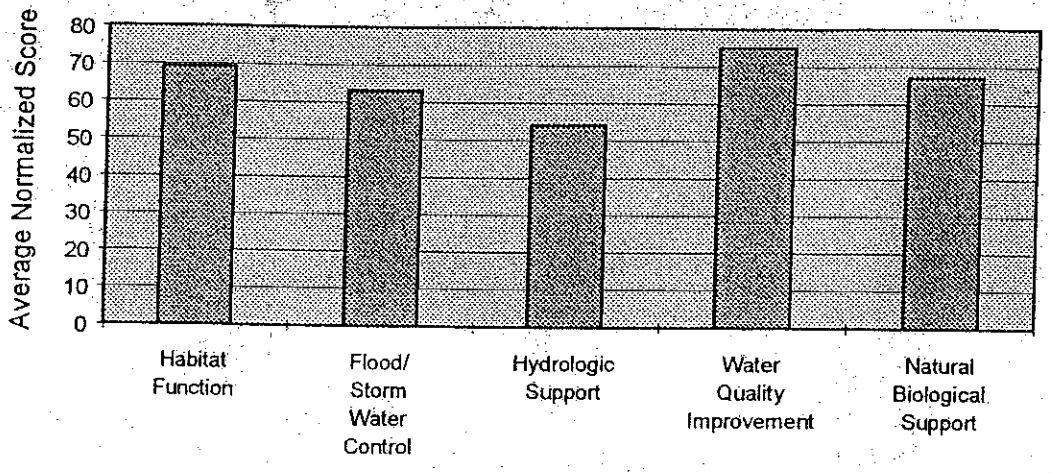

Edgewater Creek
Basin Map
No Scale
Fig. 3.4-21
WATER TOWER
50TH ST SW
52ND PL SW
DEBRELON LN
MUKILTEO BLVD
WATER TOWER

Figure 3.4-22
Edgewater Drainage Basin
Average Wetland Assessment Scores



Water Quality Improvement Function. The Edgewater Basin was the lowest ranking basin for the water quality improvement function (score of 75) due to lack of development in the upper portion of the basin (limited benefit for the function) and unconstrained outlet on the riverine wetland located in the lower portion of the basin.

Only two wetlands, EC1 and 3, are present in this basin. EC1, a small forested depressional wetland in the upper basin, ranked as a Group 2 wetland. EC3, a riverine wetland at the mouth of Edgewater Creek, also ranked as a Group 2 wetland.

The water quality improvement function for the basin could be improved by restricting the outlet of EC3 and ponding water in the lower portion of the wetland. This would have to been done in a manner that would not affect the integrity of the Burlington Northern railbed and culvert downstream of this wetland.

Habitat Functions. Of the two wetlands within this basin, the largest ranked as a Group 1 wetland for both the Natural Biological Support and Habitat Function. The habitat structure within this wetland could be enhanced through additional flooding if fish passage was not hindered and the integrity of the Burlington Northern railroad berm was not harmed.

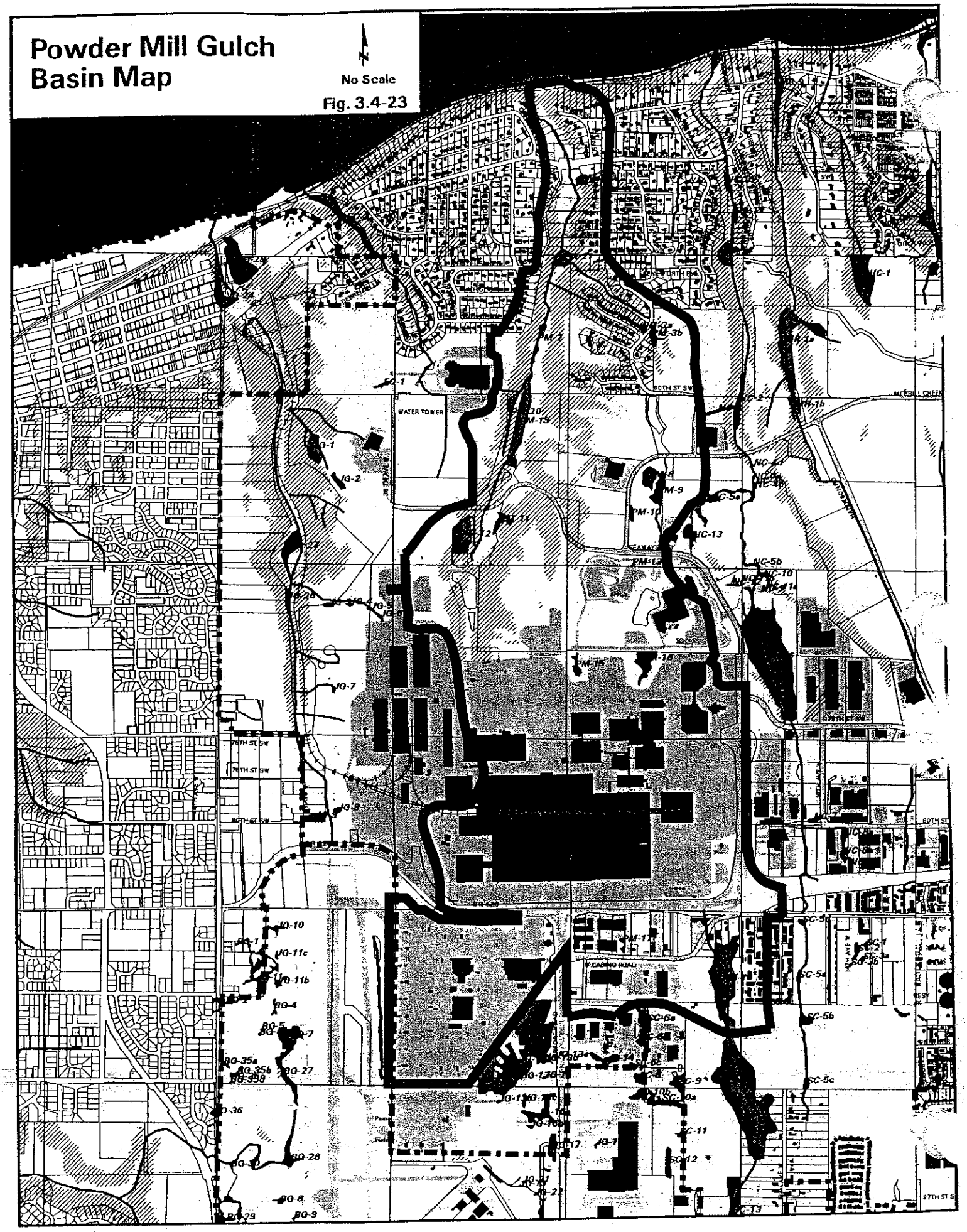
Powder Mill Gulch Basin (Figure 3.4-23)

Powder Mill Gulch Creek. Powder Mill Gulch Creek drains a 1,300-acre basin originating in the north central area of the SW Everett/Paine Field Subarea and flowing north to Port Gardner Bay in Puget Sound. This is one of the larger basins in the study area. Existing land uses vary from a predominance of open space and residential land uses in the lower drainage basin to a predominance of industrial and commercial land uses in the upper drainage basin (within the SW Everett/Paine Field Subarea). The stream corridor and inner gorge are forested and relatively undisturbed, except for the southern end, with no landslides evident on aerial

Powder Mill Gulch Basin Map

No Scale

Fig. 3.4-23



photographs. The stream's headwaters are covered by the Boeing complex, but much of the land on the ridges remains undeveloped. Past disturbances include construction of a powder mill in the gulch between Mukilteo Blvd. and Possession Sound in the early 1900s. The buildings were constructed on high pilings on the slopes in order to fit in the steep sloped ravine. There was a major office building located close to Mukilteo Blvd. on the east side of the ravine. The mill exploded in September of 1930, and many of the concrete footings still remain. (Dilgard, 1995)

The stream corridor downstream of Seaway Boulevard in the lower drainage basin is largely in a natural condition with a wide vegetative buffer along both sides of the stream. Traveling upstream of Seaway Boulevard a large created wetland and detention/water quality treatment facilities are present on the Boeing property, with the balance of the upstream area paved and the stream flow conveyed in storm drains. The detention and water quality treatment systems treat and pass collected stormwater from the Boeing and Fluke manufacturing facilities into the Powder Mill Gulch drainage basin.

The slope of the stream channel varies from approximately 3 percent upstream in the upper drainage area to approximately 9 percent downstream of Mukilteo Boulevard (lower drainage basin). The land slope along the stream corridor varies from approximately 25 percent to 50 percent upstream of Mukilteo Boulevard to 50 to 100 percent downstream of Mukilteo Boulevard.

As of 1988, nearly 50 percent of the land within the Powder Mill Gulch drainage basin was estimated by the City of Everett to be covered with impervious surfaces. The rate and volume of stormwater runoff in the drainage basin has increased dramatically over conditions that existed before the watershed was urbanized. Significant stream cutting and channel erosion have occurred in the lower reaches of the stream. Information obtained from the City of Everett's Drainage Basin Plan Update for Powder Mill Gulch (1988) describes the portion of Powder Mill Gulch that flows between Route 526 and Puget Sound as a steep, relatively straight channel, consisting of riffles and pools with channel slopes at approximately 9 percent. The channel cuts through various stratigraphic units, ranging from glacial till material consisting of silts, sands, gravels, and cobbles to dense sand and hard silt and clay deposits. Because of the presence of cobbles within the till deposits, much of the stream has developed a cobble bed. Several locations within the lower reach of the gulch appear to have unstable side slopes, as indicated by slides or cracks in the bank material or absence of significant vegetation. Most of the slopes within the reach are heavily vegetated with brush and small trees. Large woody debris, consisting of fallen trees, brush, and remains from the old Powder Mill, exists all along the channel.

Peak flow rates from the Boeing complex are partly mitigated by a series of detention ponds and biofiltration systems above Seaway Boulevard. Nevertheless, high flow rates have accelerated channel and bank erosion in this stream.

In the 1970s and 1980s, there were several reports of pollution incidents in Powder Mill Gulch. The most common report was of a strong smell of "jet fuel" emanating from the stream. Water quality had essentially been effected to the point that no life was present in Powder Mill Creek. Residents within the drainage basin expressed their concern about the channel erosion and water quality problems and potential aggravation of these problems from impending land use actions on several occasions. In response to these concerns, the Planning Commission and

City Council directed the Public Works Department to update the comprehensive drainage plan for Powder Mill Gulch and reevaluate potential solutions to the erosion and water quality problems in the drainage basin. The City's recommendation was to develop spill containment plans for the Boeing site and enhance an existing detention pond/wetland at Seaway Boulevard to improve and protect the water quality of Powder Mill Gulch. The enhancement of the detention pond and wetland was performed by Boeing in the early 1990s, and now all stormwater runoff from the facility is collected and sent through sedimentation, and detention/wetland ponds before discharge into the Powder Mill Drainage Basin. Water quality of the stormwater is monitored frequently by Boeing and compared to water quality standards stipulated in the Decision Document for the 1991 Boeing Expansion. Water quality in Powder Mill Creek has improved since Boeing's implementation of spill control plans and construction of the new facilities on the Boeing property, and benthic invertebrates are returning to the creek.

Due to past water quality problems, low summer flows, siltation, and channel erosion caused by industrial and residential development, salmonids are no longer permanent residents of Powder Mill Gulch. Though the lower reaches of Powder Mill Gulch are too steep to provide significant coho habitat, the middle reaches could provide trout habitat. This middle reach, downstream of Seaway Boulevard and upstream of Mukilteo Boulevard, contains 3,000 to 4,000 ft. of habitat physically suitable for salmonids, especially resident cutthroat trout. This section of stream has an average gradient of 3 percent, but it has qualities of a lower gradient stream due to a relative abundance of effective woody debris. If the water quality of this stream was shown to be stable, and if an adequate population of aquatic insects develops, this section of stream would be appropriate for the introduction of resident cutthroat trout.

The lower reach of this creek was surveyed and electroshocked by KCM in March 1993. KCM's report to the City of Everett (Daley, 1993) states:

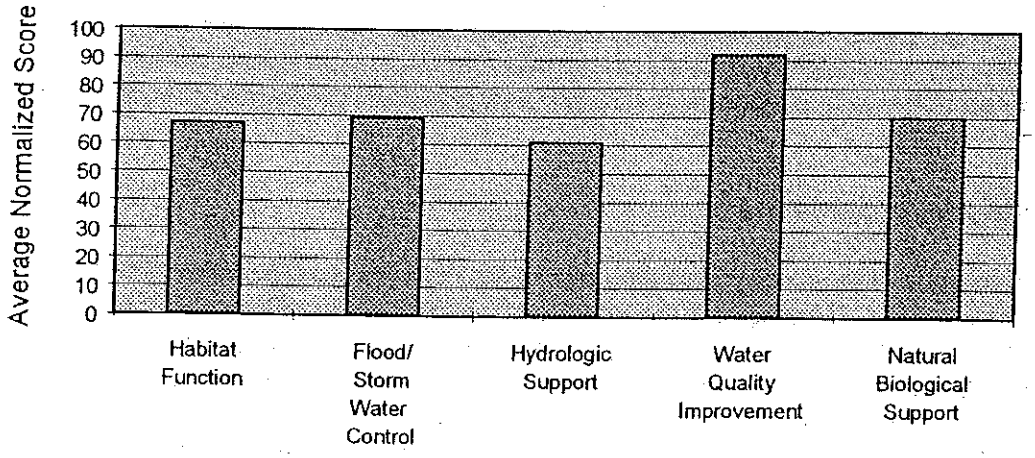
> The creek is very fast flowing at this point with a slope of approximately 6 percent. In addition there are long reaches where the stream bottom is basically clay and velocities are a potential problem for adult migration. Salmonid utilization of this system is further complicated by the release of stormwater from a large storage reservoir on the Boeing plant. There were no salmonids captured in the short reach upstream of the railroad tracks which was fished (approximately 200 feet).

During reconnaissance on June 6, 1995, a large amount of foam was present in the water.

In October of 1988, the City of Everett's City Council adopted the recommended plan from the Port Gardner Bay Drainage Basin Plan Update Report No. 1 as the Revised Powder Mill Gulch Drainage Basin Plan. The main goals of the update were to address citizen concerns about pollution and excessive channel erosion. The objective of the adopted plan was to minimize impacts of future development by creating regional detention ponds and enhancing an existing detention pond/wetland at the Boeing facility.

Powder Mill Gulch Basin Wetlands. Figure 3.4-24 shows the average wetland assessment scores for Powder Mill Gulch drainage basin.

Figure 3.4-24
Powder Mill Gulch Drainage Basin
Average Wetland Assessment Scores



Flood/Storm Water Control and Base Flow Support Functions. For the Powder Mill basin only one wetland, Kasch Swamp (PM18) ranked as a Group 1 wetland. It is located in the uppermost portion of the basin on the Mukilteo terrace, immediately south of the Boeing complex. Because the level upper portion of the basin has been essentially paved and built over, remaining wetlands are located in the ravines and riparian corridors draining northward into Port Gardner Bay. These wetlands ranked primarily as Group 2 and 3 wetlands for the flood and stormwater control function. This is an expected level of functioning for riverine wetlands because they have limited capacity to detain large volumes of water, have unconstrained outlets and do not contribute significantly to baseflows. The flood/storm water control and baseflow support function can be enhanced for PM18 by raising the elevation of the outlet culvert.

Water Quality Improvement Function. With so much of the critical upper portion of this basin developed, little opportunity exists for the creation of additional wetland areas for the purpose of improving the flood and stormwater control function. The City and Boeing should continue efforts; however, to determine if the timing of releases from Boeing's Powder Mill detention facility could be altered in order to further desynchronize downstream flows.

Powder Mill Basin ranked third for the water quality improvement function relative to the other basins in the study area. In general, the riverine wetlands ranked as Group 2 wetlands (59% of total wetlands) with the depressional wetlands ranking as Group 1 wetlands.

Because the Group 2 wetlands are riverine, enhancement of the water quality improvement function through restriction of the outlet, by berming, is limited. Opportunity for improvement of this function does exist with Kasch Swamp (PM18). The outlet for Kasch Swamp is presently below the average elevation of the swamp, resulting in a reduced ponding of water. There is sufficient depth in the swamp to allow for substantially more ponding of water in this swamp if the outlet culvert was raised in elevation.

Habitat Functions. Group 1 wetlands accounted for 35% of the total wetlands for both the Natural Biological Support and Habitat Function. This constituted wetlands within the stream corridor (PM19-22) and Kasch Swamp (PM18) in the very upper fringe of the basin. Wetlands within the middle portion of the basin (PM11,12,15 and 16) ranked in Group 2 and 3 due to impacted buffers, lack of diversity in community types and plant species. One of these wetlands (PM12) is a mitigation wetland and cannot be considered an enhancement opportunity. The remaining three wetlands can be enhanced through improved buffer plantings and creation of more extensive and diverse emergent and scrub-shrub communities.

Narbeck Creek Basin (Figure 3.4-25)

Narbeck Creek. Narbeck Creek is an approximately 450-acre drainage basin located in the north central portion of the SW Everett/Paine Field Subarea, starting at Highway 526 just east of 20th Avenue West and draining north to Port Gardner Bay. A large part of the drainage basin is contained within the SW Everett/Paine Field Subarea. In the southern, upper portion of the watershed, Narbeck Creek flows through Narbeck Swamp, an open-water wetland of about 15 acres that is home to a beaver population and a feeding area for blue heron. Downstream of Narbeck Swamp, the creek has been channelized for several hundred feet. (There is a current proposal to restore this channel.) The headwaters above Narbeck Swamp are heavily developed.

The stream corridor upstream of 75th Street SW has been substantially altered by urbanization. Approximately 25 percent of the land within the Narbeck Creek Drainage Basin is covered with impervious surface. The stream has been piped from SR 526 to an in-stream detention pond at Snohomish County PUD's operation center north of 80th Street SW. From the detention pond the stream is again piped to the 15-acre Narbeck Swamp wetland north of 75th Street SW. Downstream of Narbeck Swamp the stream corridor is largely in a natural condition with a wide vegetative buffer along both sides of the stream, with two exceptions where the stream is piped under roads (Mukilteo Boulevard and Merrill Creek Parkway).

The slope of the stream channel is approximately 3 percent for 200 feet downstream of Narbeck Swamp. The stream channel then steepens to a slope of 7 percent to the stream outlet at Port Gardner Bay (outside physical boundaries of SW Everett/Paine Field Subarea). The slope of the land adjacent to the stream corridor varies from flat (0 to 10 percent) in the upper drainage basin to 75 percent in the lower drainage basin.

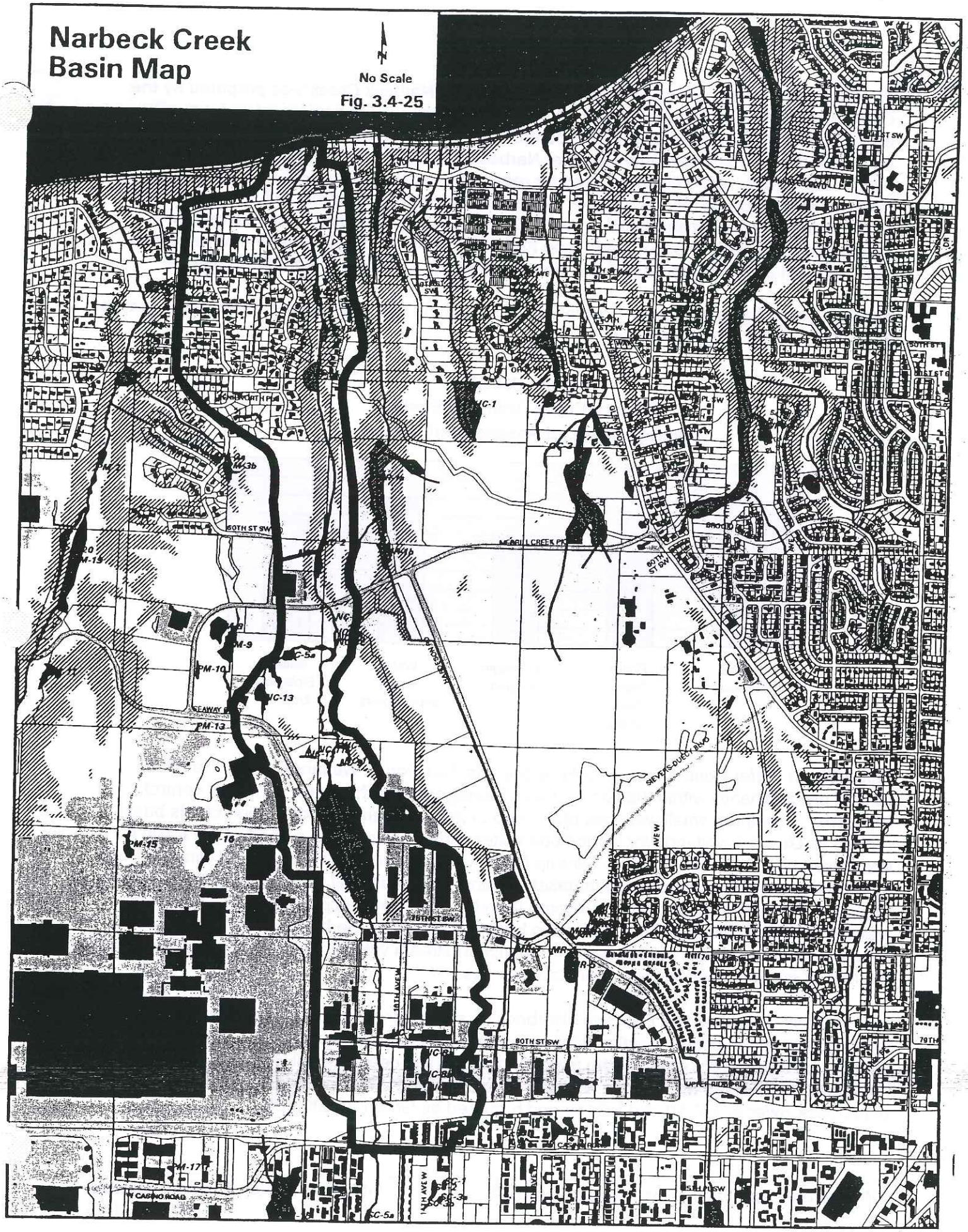
The lower third of the basin is experiencing significant problems with landslides resulting from a combination of cutting of trees for views, discharging residential runoff onto steep slopes, and the presence of a clay lens (Whidbey formation) at the base of steep slopes near the stream.

Narbeck Creek currently has no salmonids. Much of the creek goes dry in the summer, and it is unlikely that this system could support a salmonid population.

Narbeck Creek Basin Map

No Scale

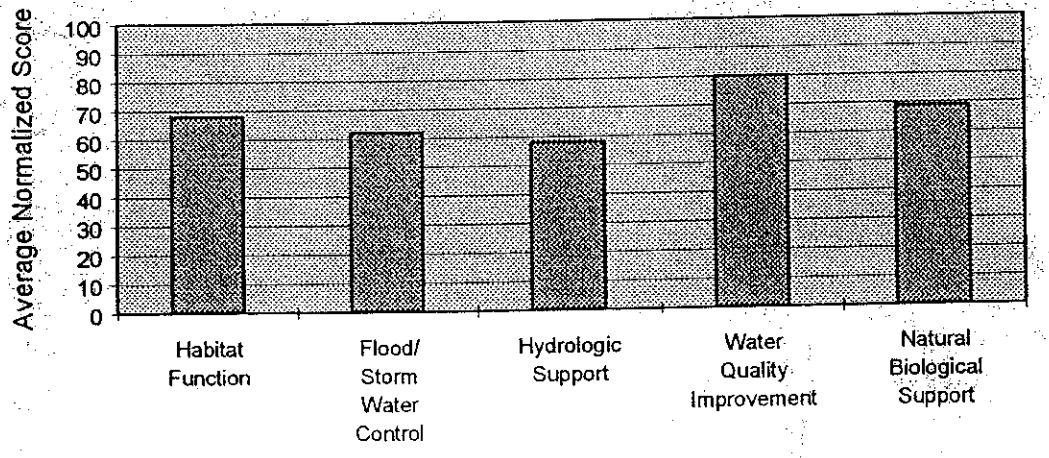
Fig. 3.4-25



The Port Gardner Bay Drainage Basin Plan Update for Narbeck Creek was prepared by the City of Everett Utilities Division in May of 1988. Goals were set to implement water quality controls, establish a stream buffer, and control the quantity of stormwater runoff in the area of the wetland. The Plan recommended that Narbeck Swamp be purchased or encumbered by a public surfacewater easement and used for regional detention. Properties upstream of Narbeck Swamp would rely on Narbeck for detention and would contribute to a fund for regional detention. Downstream of Narbeck Swamp, on-site detention would be required. This is no longer likely to occur, and Paine Field and Fluke Corporation have now developed plans (not yet approved) for expanding Narbeck Swamp as mitigation for other projects.

Narbeck Creek Basin Wetlands. Figure 3.4-26 shows the average wetland assessment scores for Narbeck Creek Drainage Basin.

Figure 3.4-26
Narbeck Creek Drainage Basin
Average Wetland Assessment Scores



Flood/Storm Water Control and Base Flow Support Functions. Wetlands within this basin ranked predominantly within the Group 2 and 3 categories for the storm and flood control functions. Only three small wetlands (8a, b and c) in the extreme upper portion of this basin ranked as Group 1 wetlands for storm/flood water control. The upper portion of the basin is dominated by the 20 acre Narbeck Swamp (NC6) which ranked as a Group 1 wetland for both the flood/storm water control and the baseflow function. Additional wetland could be created adjacent and northward of Narbeck Swamp thereby significantly improving the flood/storm water control and baseflow function for this basin. Because of the high potential for slope failure in the lower portion of this basin, reduction in stream velocity will also assist in reducing the rate of erosion along the toe of unstable slopes.

Water Quality Improvement Function. Narbeck Basin wetlands ranked sixth overall for the water quality improvement function relative to other basins in the study area. There are six Group 1 wetlands (26% of total), the majority of which are depressional wetlands. The most notable of these is the twenty acre Narbeck Swamp (NC6). Three wetlands immediately north of Narbeck Swamp, NC 10 and NC11a and b ranked as Group 3 wetlands.

The most significant potential for enhancement of the water quality improvement function exists immediately north of Narbeck Swamp. Approximately 6 acres of degraded upland and wetland is proposed for wetland creation and enhancement by Snohomish County Airport (Paine Field). Opportunities also exist with NC8a,b, and c and NC13 where restriction of the outlet would enhance the water quality improvement function.

Habitat Function. Approximately 47% of the wetlands ranked as Group 1 wetlands for both the Natural Biological Support and Habitat Function. This included Narbeck Swamp (NC6) and riverine wetlands NC5a and 13 for the Natural Biological Support function and NC14 to 17 (lower reach of Narbeck Creek) for the Habitat Functions.

Opportunity for enhancement in this basin includes: restoration and enhancement of degraded wetlands immediately north of Narbeck Swamp (e.g. from emergent to scrub-shrub and forested habitat); and elimination of the cutting of forested vegetation on slopes surrounding wetlands NC14 to 17 and replanting with native forest and scrub-shrub species.

Merrill and Ring Creek Basin (Figure 3.4-27)

Merrill and Ring Creek. Merrill and Ring Creek drains an approximately 800-acre linear basin. The upper basin, above Merrill Creek Parkway, has been heavily developed and modified. The lower basin is relatively undisturbed and undeveloped. The middle and lower basins, below Merrill Creek Parkway, feature a continuously forested inner gorge and stream corridor. Past disturbances of the stream include construction of a narrow guage railroad that extended from the bay to south of the current Everett Mall Way. A logging camp, including buildings and a cookhouse were constructed in the ravine. Much of the metal was hauled out in W.W.II. In the late 1960's a cofferdam broke on the Associated Sand and Gravel site. This flooded and changed the stream and destroyed what remained of the logging camp/railroad. (Dilgard, 1995)

The drainage basin extends from approximately Casino Road north to Port Gardner Bay. The area of the drainage basin located between Casino Road and Merrill Creek Parkway is contained within the SW Everett/Paine Field Subarea. Upstream of SR 526, the predominant land use is multi-family residential. Downstream of Merrill Creek Parkway, the predominant land uses are single family residential manufactured homes and open space. Industrial, mining, and single family land uses exist in the portion of the basin between Merrill Creek Parkway and SR 526.

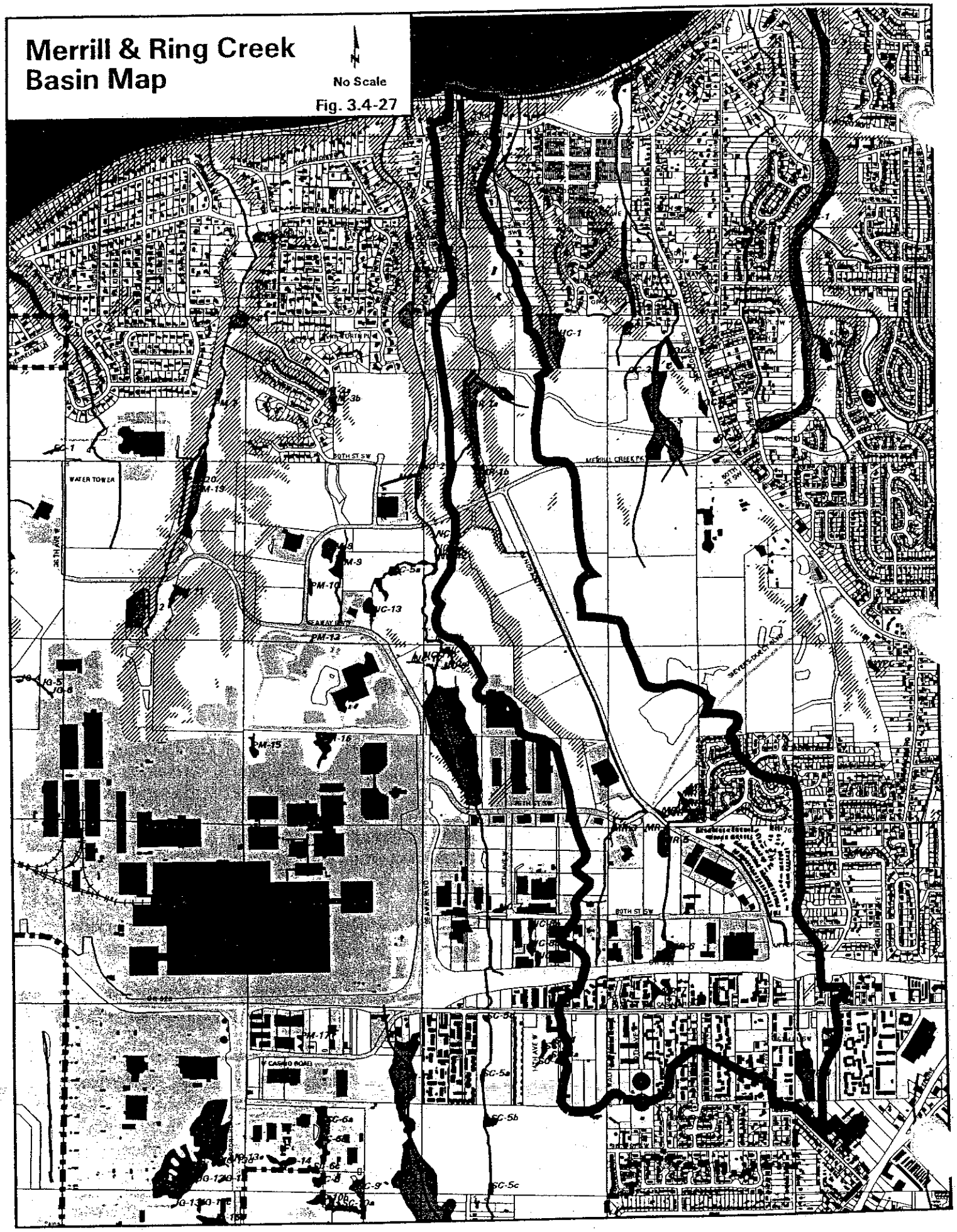
The Merrill and Ring Creek stream corridor is separated into two distinct reaches. The stream corridor downstream of Merrill Creek Parkway is densely vegetated with steep side slopes. The stream corridor is largely undisturbed, although a washwater pond blowout on the Associated Sand and Gravel site in the late 1960s still impacts the stream. The washwater pond blowout eroded the less competent surface soil and created a series of small waterfalls approximately 1,000 feet upstream of Mukilteo Boulevard.

Upstream of Merrill Creek Parkway the stream corridor has been highly disturbed. The stream has been relocated and confined into a narrow riprapped channel adjacent to Hardeson Road, and culverts have been installed at numerous stream/road crossings. The stream channel along Hardeson Road between Merrill Creek Parkway and 75th Street SW is essentially unvegetated due in large part to past mining activity adjacent to the stream.

Merrill & Ring Creek Basin Map

No Scale

Fig. 3.4-27



The stream channel is nearly three miles long. The stream gradient is an average of 4 percent; however, downstream of Merrill Creek Parkway the stream channel steepens to nearly 6 percent.

The fish habitat quality of Merrill and Ring Creek has been significantly degraded by past gravel mining in the bed and banks of the former stream channel above Merrill Creek Parkway. However, the low gradient section at the mouth of the creek does support salmonids. On June 12, 1995, Pentec personnel observed eight salmonids of unknown species in the lower 200 m of channel. Electroshocking conducted in 1981 as part of the South Everett basin planning process found coho fry in this section of Merrill and Ring Creek.

While Merrill and Ring Creek features about 600 ft. of low gradient channel below Merrill Creek Parkway that could provide habitat for small coho and chum populations, this stream will probably not support significant fish populations until sediment inputs are stabilized. Fine sediment inputs from the gravel operations and channel erosion due to increased storm flow rates has degraded the habitat in the lower sections of the stream. Salmonid use of the lower system is limited by the lack of quality spawning gravels. There is a high percentage of sand in the substrate, so flow through the gravel is sub-optimal for egg incubation.

The City's Drainage Basin Plan for Merrill and Ring Creek states that re-establishing a fishery in Merrill and Ring Creek is not a goal. However, it could become a high priority in the future if water quality efforts are successful and if fisheries enhancement efforts in other higher priority drainage basins are successful, which could free additional funds for Merrill and Ring Creek.

Merrill and Ring Creek is identified as a Category II stream downstream of Merrill Creek Parkway and a Category III stream upstream of that point. Because of salmonid usage downstream of Merrill Creek Parkway, this segment should be reclassified as a Category I stream.

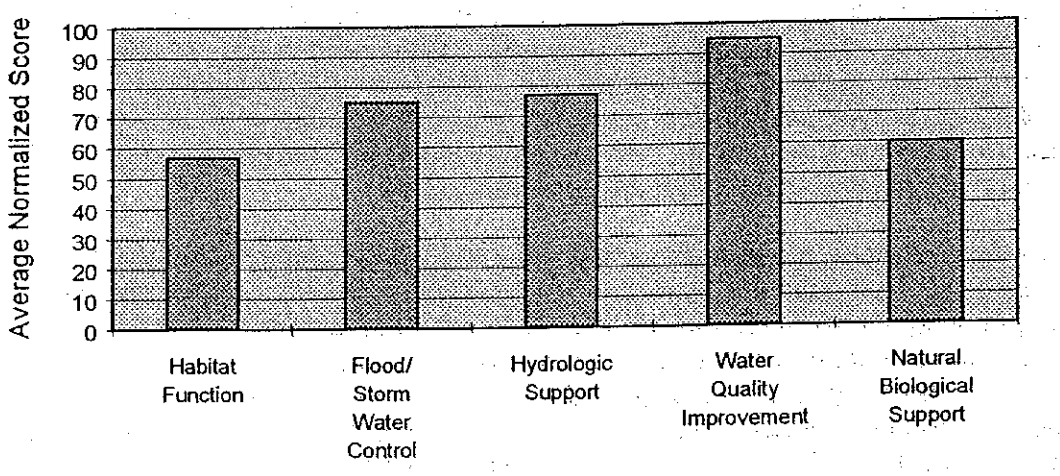
In 1992, the Everett City Council adopted the updated Merrill and Ring Creek Drainage Plan. The goals of the plan were to not only control peak stream flow but to improve the existing water quality conditions and to mitigate the impacts of future urbanization on the water quality. The adopted plan includes a combination of regional and on-site detention systems:

- The existing regional pond at Merrill Creek Parkway was to be expanded.
- A regional detention pond was to be constructed immediately south of the Westridge Mobile Home Park.
- On-site detention requirements downstream of Merrill Creek Parkway were to be based on a 5-year pre-development design storm rather than the previous 10-year criteria.
- Installation of parallel culverts at Veralene Way to decrease flooding.

The regional pond at Merrill Creek Parkway has been expanded, but the regional detention pond proposed south of Westridge Mobile Home Park and the parallel culverts have not.

Merrill and Ring Creek Basin Wetlands. Figure 3.4-28 shows the average wetland assessment scores for Merrill and Ring Creek drainage basin.

Figure 3.4-28
Merrill and Ring Creek Drainage Basin
Average Wetland Assessment Scores



Flood/Storm Water Control Function. Though this basin had one of higher overall scores for the flood and stormwater control function, all wetlands except one, ranked in the Group 2 and 3 categories. For the baseflow support function 5 wetlands (MR 1a, MR 2a, MR 6,7 and 8) ranked as Group 1. Due to past sand mining operations, the middle portion of this basin has no wetlands present with no future opportunity for the creation of additional wetlands. The upper portion of the basin has several wetlands (MR5 to 8) where the flood and stormwater control function could be improved by restricting or berming the outlets. The hydrological support function could also be improved for MR5 by restricting or berming its outlet. Wetland can also be created within a ravine north of Upper Ridge Road and adjacent to Hardeson Road by restricting its outlet into the mobile home park to the north.

Water Quality Improvement Function. The Merrill and Ring Basin Wetlands ranked first for the water quality improvement function. Group 1 wetlands (53%) were primarily small depressional wetlands in the upper watershed and the Group 2 wetlands were slope and riverine wetlands in the lower portion of the watershed.

Limited opportunity for enhancement of the water quality control function exists for the slope and riverine wetlands due to the physical difficulty in restricting water flow on slopes and in stream beds. The outlet to MR9 at the mouth of Merrill and Ring Creek could be restricted if it did not restrict fish passage or affect the integrity of the Burlington Northern railroad berm. Some enhancement opportunity does exist in the upper watershed in wetland MR8 where raising of the outlet elevation would increase ponding; there is sufficient depth in this wetland given the road berm (+6 feet) and sloping sides to allow for a water depth of 1 foot in portions of the wetland. Because the Group 1 wetlands MR5 has been ditched, there is opportunity to increase flooding by restricting the outlet and filling in the ditch running through the wetland. Further, because the Group 1 wetland MR6 is within a relatively well defined ravine, potential also exists for further restricting the outlet and ponding more water within this wetland.

Wetland can also be created within a ravine north of Upper Ridge Road and adjacent to Hardeson Road by restricting its outlet into the mobile home park to the north. This would further improve the water quality improvement function for this basin.

Habitat Functions. Group 1 wetlands for both the Natural Biological Support and Habitat functions were almost exclusively limited to the lower portion of the basin within the stream corridor (exception is MR2i and j). The upper portion of the basin, south of Merrill and Ring Way, consists of degraded Group 2 and 3 wetlands. Within the study area, this Basin was one of the lower scoring basins for these functions.

Opportunities for the improvement of the Natural Biological Support and Habitat functions include the creation of more diverse emergent, scrub-shrub and forested habitat within wetland MR5 through increased flooding. Additional wetland habitat could be created within a moderate sized area of stream habitat immediately south of Upper Ridge Road (no wetland number was assigned to this area). Enhancement opportunities also exist for the severely degraded "Dariotis" wetlands (MR7) which consist of a poor quality emergent wetland on top of compacted glacial till. This wetland could be enhanced with the importation of hydric soils (30% organics), planting of a diverse emergent, scrub-shrub and forested wetland and improved hydrology. However, this enhancement is of a low priority due to the isolation of this wetland.

Phillips Creek Basin (Figure 3.4-29)

Phillips Creek. Phillips Creek drains only about 100 acres, and it goes dry in the summer. Flows are inadequate to support salmonids. The riparian corridor is broken by houses and landscaping adjacent to the stream. Some houses appear to be built on high erosion and landslide hazard areas.

Phillips Creek Basin Wetland. Figure 3.4-30 shows the wetland assessment scores for the wetland evaluated in Phillips Creek drainage basin.

Flood/Storm Water Control Functions. This small basin has one wetland present which ranked in Group 3. Restriction on the outlet of this wetland could improve the storm and flood water control function for this wetland.

Quality Improvement Function. This small basin has one wetland present which ranked in Group 2. Restriction on the outlet of this wetland could enhance the water quality improvement function.

Habitat Functions. The one wetland for this basin ranked as a Group 2 wetland for the Natural Biological Support function and Group 1 for the Habitat function. No enhancement opportunities have been identified at this time.

Phillips Creek Basin Map

No Scale

Fig. 3.4-29

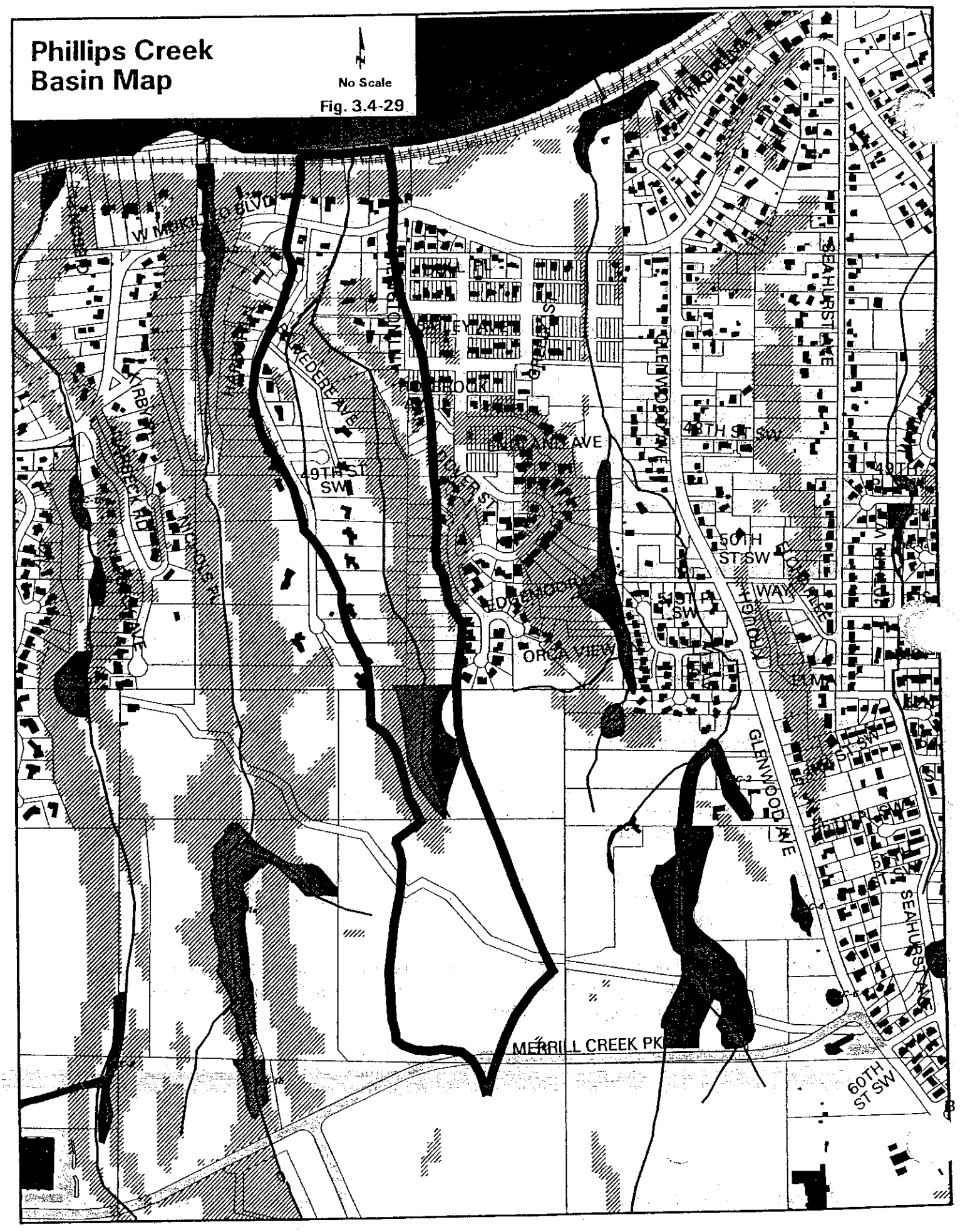
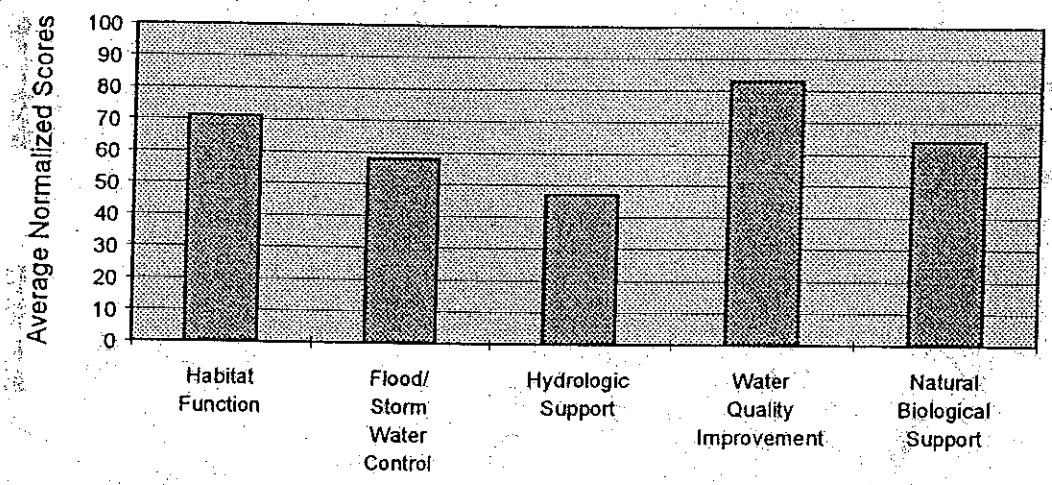


Figure 3.4-30
Phillips Creek Drainage Basin
Average Wetland Assessment Scores



Glenwood Creek Basin (Figure 3.4-31)

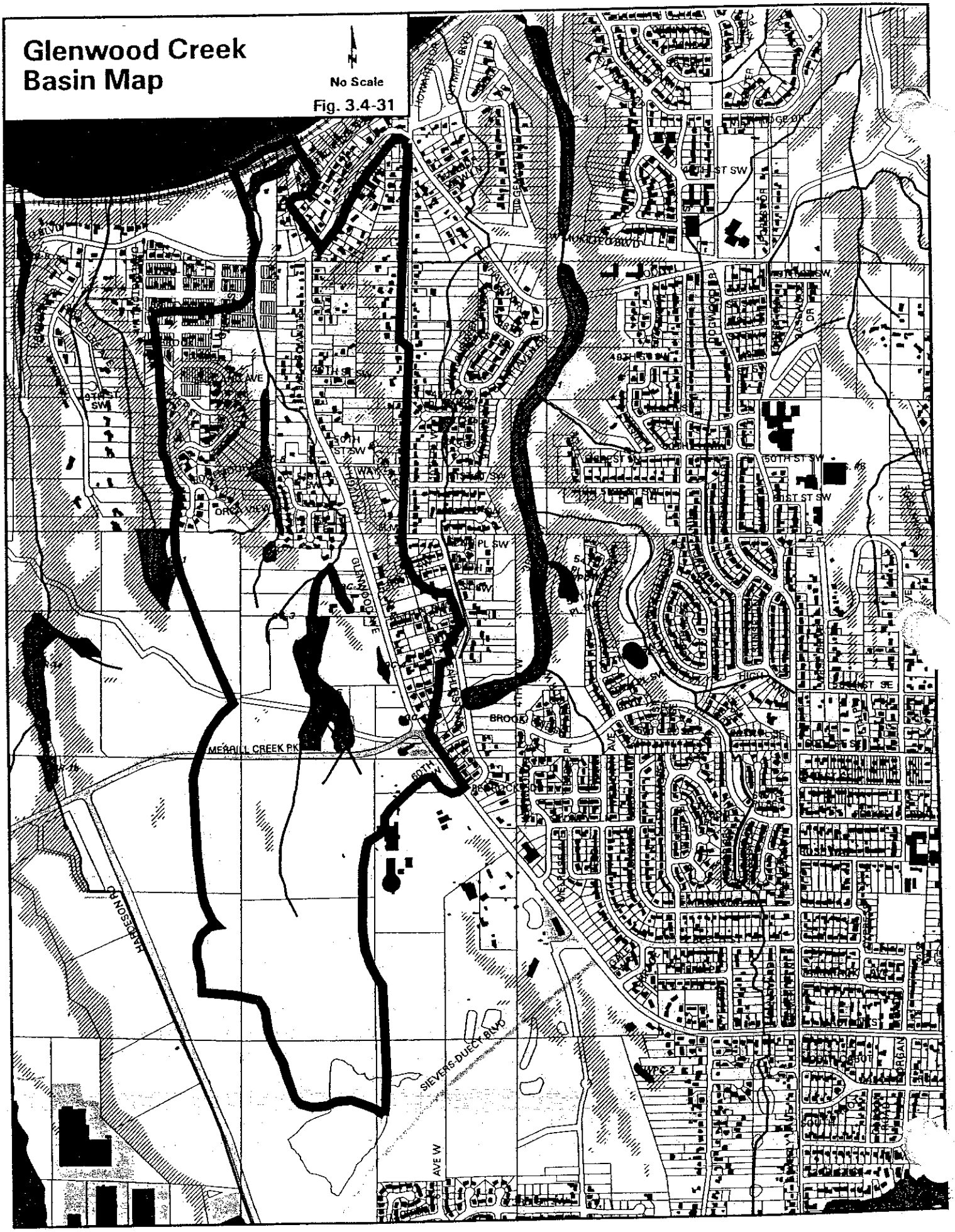
Glenwood Creek Basin. Glenwood Creek drains a 380-acre basin, a portion of which is located within the northeast corner of the SW Everett/Paine Field Subarea. Glenwood Creek consists of a main branch and an east and west fork. The west fork is approximately 0.5 mile long; it originates just downstream of Merrill Creek Parkway and flows north to join the east fork west of Glenwood at approximately 49th Street SW (just north of the physical boundaries of the SW Everett/Paine Field Subarea). Single family residential is nearly the exclusive land use in this drainage basin, with the exception of a PUD substation towards Port Gardner Bay. As of 1989, approximately 6 percent of the land within the drainage basin was covered with impervious surfaces. Past disturbances to the stream include impacts from mining and production of cement on the Associated Sand and Gravel site. In addition, Glenwood Creek was used for the first steam sawmill in the area, which was built in the 1860's. When the area was platted, Glenwood Creek was platted as a street. Fuel was stored in tanks in the area north of Harborview Park, and evidence of fuel spills is still visible. The beach at the mouth of the stream was used as a City beach, but it was eventually closed due to contamination from sewage. (Dilgard, 1996)

The Glenwood Creek basin is small but seems to provide sufficient flow to maintain fish populations. Glenwood Creek supports a trout population and features good spawning gravel and an intact riparian corridor. The stream corridors of the main branch and west fork are largely in natural, undisturbed conditions with wide vegetative buffers along both sides of the stream channels. Past urbanization has significantly altered the middle reach of the east fork stream corridor. There is a relative abundance of in-channel woody debris throughout the system. The channel is highly incised in places and seems to be reacting to the effects of storm drainage from Glenwood Avenue. Because the headwaters are relatively undeveloped, base flow losses are minimal, but development in the upper watershed could significantly affect the stream's base flows, hydrology, and geomorphology because of the small size of the basin.

Glenwood Creek Basin Map

No Scale

Fig. 3.4-31



Unlike many of the streams in this area, the riparian corridor above Mukilteo Boulevard is dominated by conifers rather than alders. However, the canopy cover is thin, and large amounts of sunlight reach the understory. Brush, including salmonberry and Himalayan blackberry, is heavy along the stream.

Glenwood Creek was surveyed and electroshocked from the railroad tracks upstream for approximately 500 ft. by KCM in March 1993. KCM's report to the City of Everett states:

> Because the stream is small, fishing was conducted in miscellaneous pools and riffles through the reach that was evaluated. The creek has excellent riparian habitat and the streambed supports the best combination of spawning gravels of all the streams entering directly into Puget Sound in this immediate vicinity. There were 9 cutthroat trout captured in the reach which was fished. This stream should be considered for fry planted coho by the Salmon in the Classroom program. The abundance of aquatic insects indicates this system will support a significant population of salmonids.

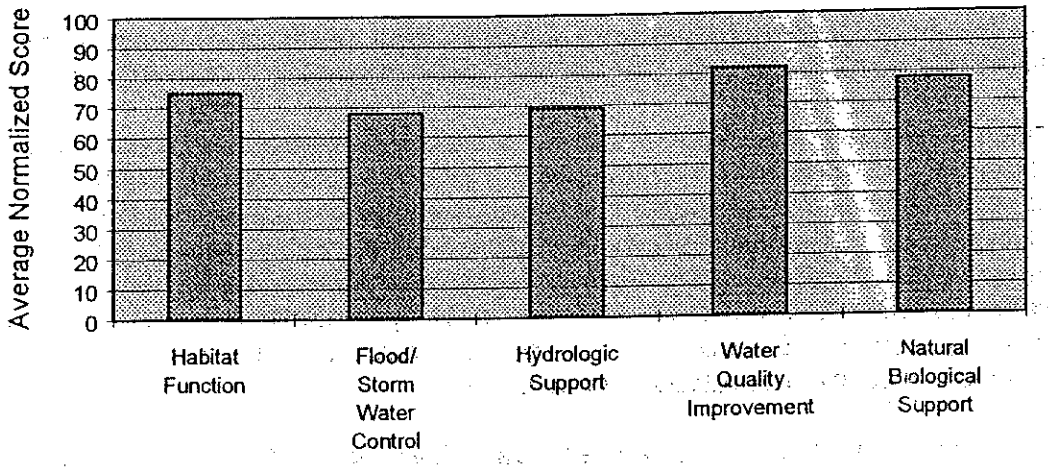
In January 1990 the Port Gardner Bay Drainage Basin Plan Update for Glenwood Creek was adopted by the Everett City Council as the revised Drainage Basin Plan. The Plan included the following goal: Ensure that urbanization in the basin does not adversely affect the existing fisheries resource or the recreational value of Glenwood Creek. This will also benefit the water quality of Puget Sound, the receiving water for the creek. Recommendations in the plan included construction of an expanded bypass drain system and an in-line underground detention system on Glenwood Avenue and on both sides of the Maple Heights Bridge. The expanded bypass drain system has been constructed, but the in-line underground detention systems have not. It is unlikely that the remaining improvements will be constructed due to cost and impacts to Harbor View Park.

Glenwood Creek Basin Wetlands. Figure 3.4-32 shows the average wetland assessment scores for the Glenwood Creek drainage basin.

Flood/Stormwater Control Function. Wetlands within this basin all ranked in the Groups 2 and 3 category for the flood/storm water control and hydrological support functions and are concentrated within the middle and lower portions of the basin. Relative to the flood/storm water control score for the other 11 study area basins, the Glenwood Basin score was ranked number 6. The upper portion of the basin is presently an active sand and gravel operation. When this mining operation is closed there will be significant opportunities to protect and improve the flood/storm water control and hydrological functions for this basin.

Water Quality Improvement Function. Wetlands within this basin ranked 5th overall for the water quality improvement function relative to the other 11 study area basins. All wetlands fell within the Group 2 category and are concentrated within the middle and lower portions of the basin. The upper portion of the basin is presently an active sand and gravel operation. When this mining operation ceases and converts to other uses it is important that the water quality improvement of downstream wetlands is protected by requiring adequate water quality treatment facilities. Because most of the wetlands in the downstream portion of the basin are slope wetlands there is little opportunity to improve their water quality improvement function through the restriction of outlet flows.

Figure 3.4-32
Glenwood Creek Drainage Basin
Average Wetland Assessment Scores



Habitat Functions. For the Natural Biological Support function, wetland GC8 within the middle stretch of Glenwood Creek ranked as a Group 1 wetland. Wetland GC8 was unique in that it was the only stream assessed that contained a relatively extensive cover of conifers. All other wetlands for this function ranked as Group 2 and 3 wetlands. For the Habitat function, essentially all wetlands ranked within the Group 1 category.

Enhancement opportunities include scrub-shrub and forested wetland and buffer plantings within wetlands GC2, 4, 5 and 7; and restoration of the stream corridor for wetland GC7. A more diverse wetland community could be created in wetland GC9 by removing fill, creating more flooded areas by raising the culvert outlet (integrity of Burlington Northern railbed has to be insured and fish passage not affected) and protect trees from cutting (all trees are presently topped).

Glenhaven Creek Basin (Figure 3.4-33)

Glenhaven Creek. Glenhaven Creek drains only about 160 acres, much of which is developed. The riparian corridor has been eliminated in places. This system cannot support a salmonid population and has limited habitat value. It primarily provides for the removal of nutrients and other pollutants input to the system by the adjoining residential development, and limited habitat for small mammals and birds. Eagles have been observed perching in trees near the wetland and ducks and Pileated woodpeckers have been observed in the area.

Glenhaven Creek Basin Wetlands. Figure 3.4-34 shows the average wetland assessment scores for wetlands in the Seahurst-Glenhaven drainage basin.

Seahurst-Glenhaven Basin Map

No Scale

Fig. 3.4-33

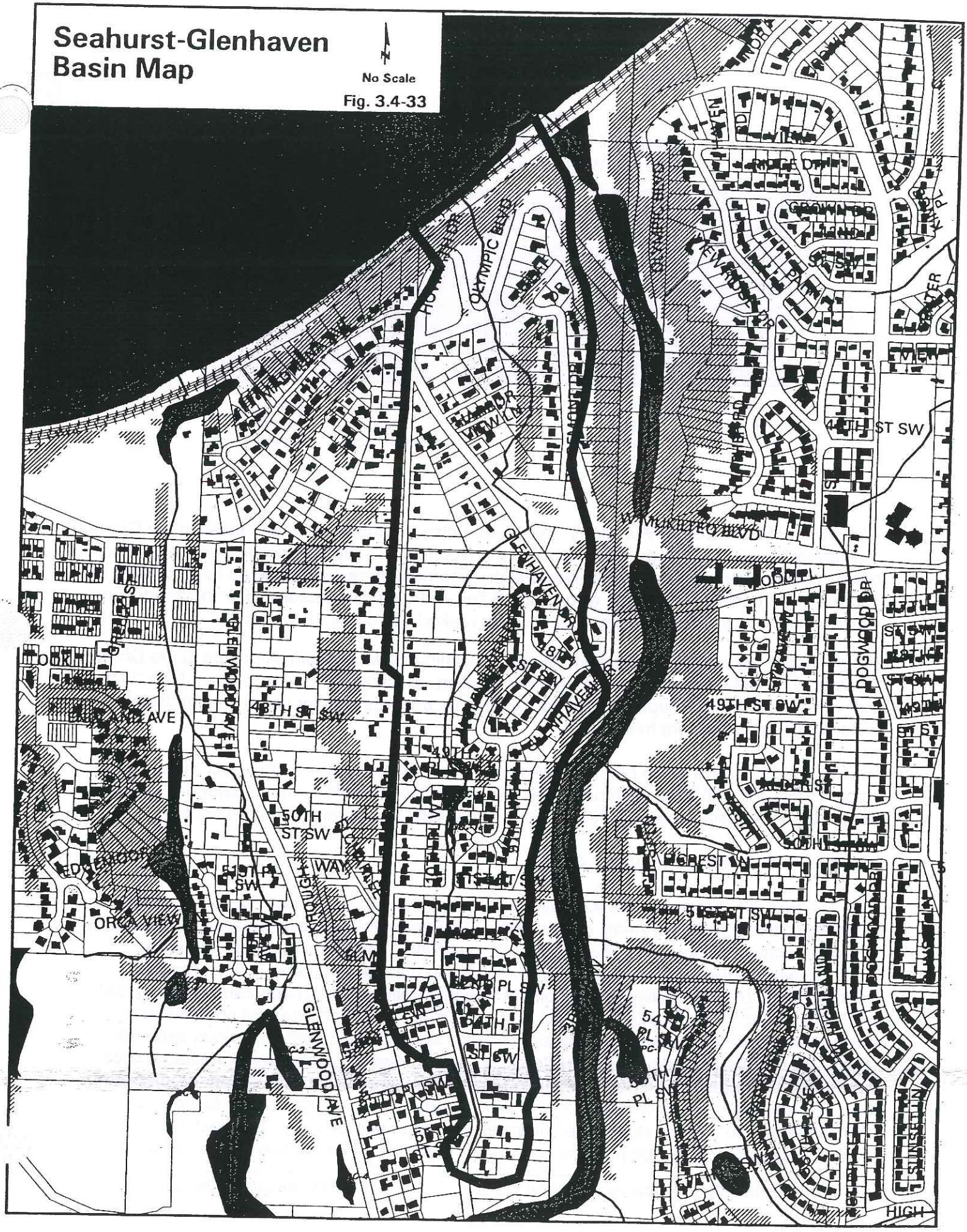
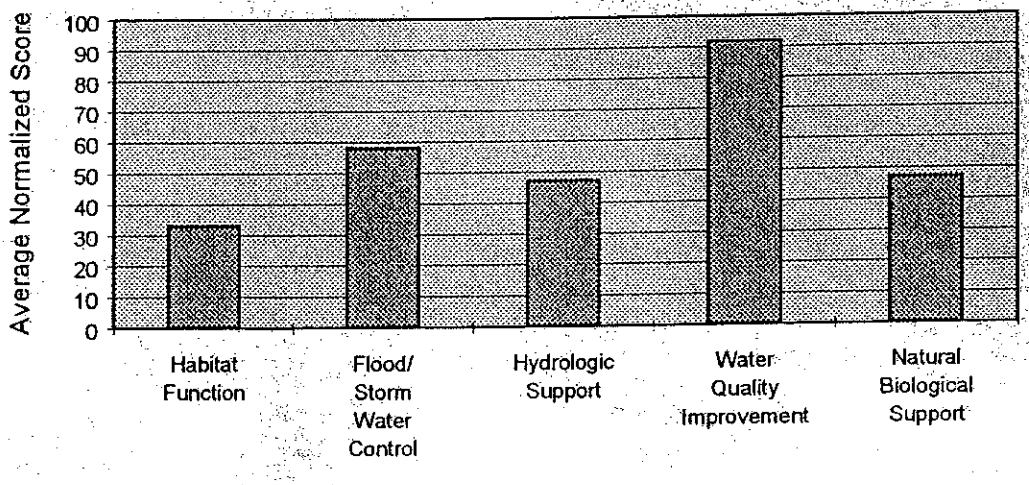


Figure 3.4-34
Seahurst-Glenhaven Drainage Basin
Average Wetland Assessment Scores



Flood/Storm Water Control Functions. Wetlands within this small basin all ranked in the Group 3 category for the flood/storm water control and hydrological support functions. Because this basin is essentially "built-out" with residential development there are little to no opportunities for improving the basin's flood/storm water control and hydrological functions. For the flood/storm water control score, the Glenhaven Creek Basin ranked last out of all the basins.

Water Quality Improvement Function. Wetlands within this small basin all ranked in the Group 1 category for the water quality improvement function. Because this basin is essentially "built-out" with residential development there are little to no opportunities for improving the basin's water quality improvement function.

Habitat Function. This basin had the lowest score for both the Natural Biological Support and Habitat functions. All three wetlands within the basin ranked in the Group 3 category for these functions. This basin is essentially built out and has little opportunity for enhancement.

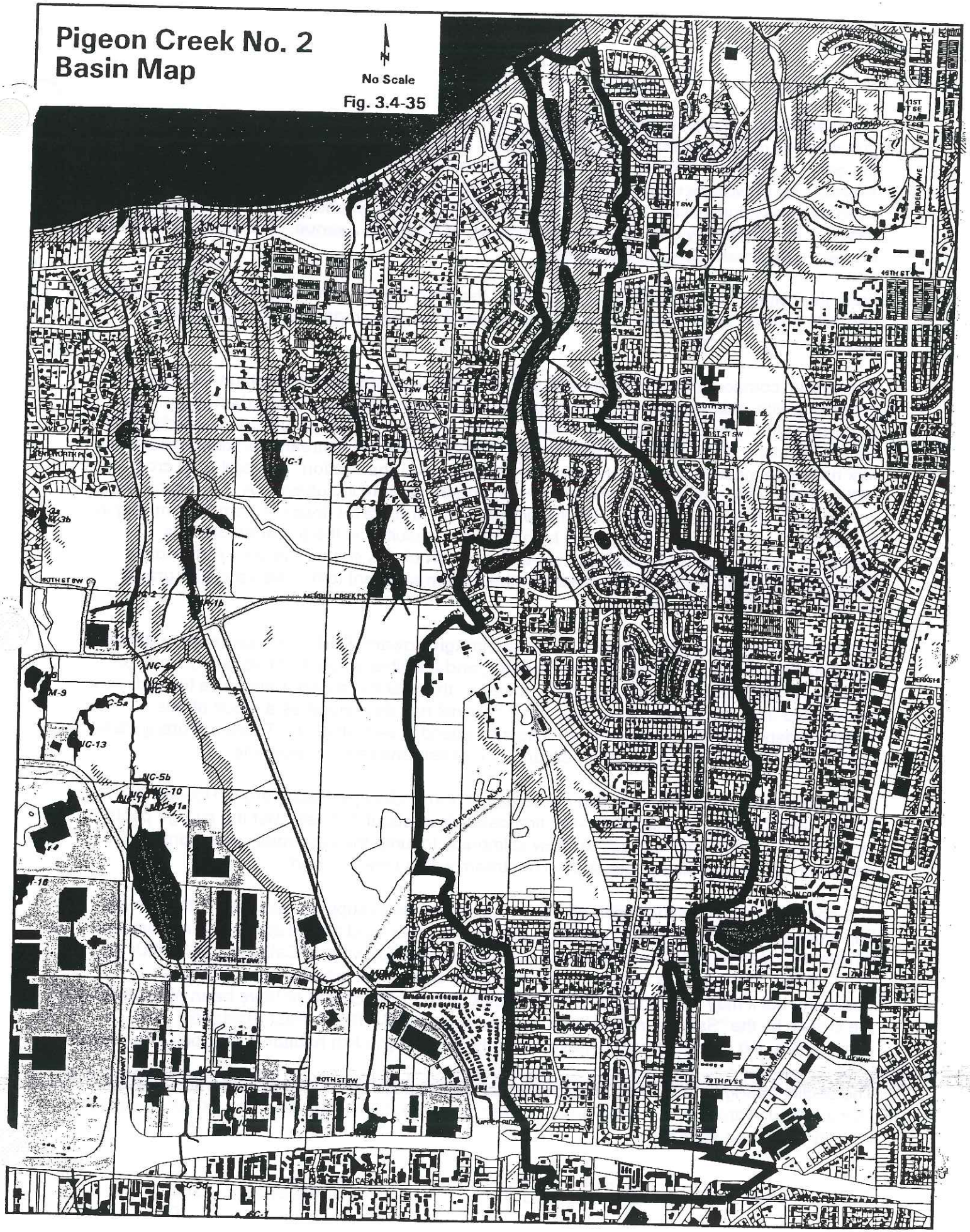
Pigeon Creek #2 Basin (Figure 3.4-35)

Pigeon Creek #2. Pigeon Creek #2 drains a 900-acre basin in southwest Everett, a portion of which flows through the northeast corner of the SW Everett/Paine Field Subarea. The majority of the drainage basin located within the SW Everett/Paine Field Subarea is developed as industrial and single family residential. Included within the industrial area is the Associated Sand & Gravel (AS&G) facility, which holds a National Pollution Discharge Elimination System (NPDES) permit. This permit allows AS&G to discharge "adequately treated contaminated stormwater runoff" to Pigeon Creek #2 and includes specific limitations on various parameters. There are two distinct forks of Pigeon Creek #2, both containing groundwater recharge sites, a preferred drainage feature not common in Everett area streams. The east fork groundwater recharge site is located west of 60th Street and Beverly Lane. All dry weather flows and approximately 1 to 2 cfs of stormwater infiltrates the soil at this location. The east fork of the creek is not located within the physical boundaries of the SW Everett/Paine Field Subarea.

Pigeon Creek No. 2 Basin Map

No Scale

Fig. 3.4-35



The west fork of Pigeon Creek #2 originates at 76th and Lower Ridge Road and flows to a groundwater recharge site at approximately 74th Street SW. A normally dry swale slopes from the groundwater recharge site and continues to a road fill at Upper Ridge Road and Glenwood Avenue. No provisions were made at the road fill to drain the normally dry swale in the event of an extreme rainfall event. The west fork "resurfaces" near Seahurst Avenue and joins the east fork approximately one half mile downstream of Seahurst Avenue. The average slope of the west fork stream channel is 3 percent.

From the confluence of the east and west fork, the main branch drains northerly approximately one mile to Port Gardner Bay. The average slope of the main branch stream channel is approximately 4 percent.

The stream corridors of the main branch and west fork are largely in natural, undisturbed conditions with wide vegetative buffers on both sides of the stream. Little urbanization has occurred in the stream corridor of the main branch and west fork probably due primarily to the very steep slope of the land adjacent to the stream channel. The stream corridor of the east fork has been modified from past land use practices and urbanization. Several road crossings of the stream channel have necessitated enclosing the stream in culverts. A combination of construction on unstable slopes, unconsolidated sand and gravel deposits from past mining in the stream bed, and downcutting from high flows has resulted in the transport of large quantities of sediment from the East Fork to the mouth of this stream system. Additionally, limited hydrocarbon deposits are present in the stream adjacent to the old sand and gravel operation at the Hannabrook site.

The lower stretch of Pigeon Creek #2 passes through Howarth Park. This segment features a low channel gradient, an intact riparian corridor, and a limited amount of habitat suitable for salmonids. Because of the low gradient, however, this reach is a deposition area for sediment transported from the upper basin. A braided channel has developed as a result of this sediment deposit and the stream and adjacent wetland is very shallow. There are many trails adjacent to the channel, and human disturbance of fish and redds is possible.

Two cascades act as barriers to fish passage just above Olympic Boulevard in Howarth Park. These cascades are not very high—the first cascade is about 3 ft. tall—but the plunge pools below them are not large enough to allow salmonids to jump the cascades. Anadromous fish habitat is therefore limited to the section of stream within Howarth Park.

The section of stream within Howarth Park should be able to support salmonids. The stream has small patches of spawning gravels, a few pools, cover, and a food supply. Cutthroat trout inhabit the creek (Dan Mathias, personal communication; Brown and Caldwell 1982; WDFW; KCM 1994). The status of salmon in this system is unclear. A single coho smolt was observed, but it may have moved into the stream from Puget Sound or have been planted in the stream by the "Salmon in the Classroom" program (KCM 1994). Past residential construction and industrial activity have severely affected the fish habitat of Pigeon Creek #2.

The section of Pigeon Creek #2 from the wetland just upstream of the railroad tracks to Olympic Boulevard was surveyed and electroshocked by KCM in March 1993. KCM's report to the City of Everett states:

The creek is suffering from major siltation problems. The wetland area prevents any adult migration (except at very high flows) due to the shallow braided condition where the silts have settled out and heavy vegetation has developed. A single coho smolt was captured in the large plunge pool at the culvert crossing under Olympic Boulevard. Because no other salmonids were captured, it is possible that the coho may have moved into the stream from Puget Sound rather than being the result of spawning activity. Although not documented, it is also possible that fry from a "Salmon in the Classroom" program may have been placed in the stream.

The City's adopted Drainage Basin Plan for Pigeon Creek #2 includes the following goals: Preserve existing fishery resource, reduce the sedimentation occurring in the lower reaches of the stream, and ensure that future urbanization does not adversely impact the fish rearing potential or passive recreational value of Pigeon Creek #2. This will also benefit the water quality of Puget Sound, the receiving water for the creek.

In January 1990, the Port Gardner Bay Drainage Basin Plan Update for Pigeon Creek #2 (Report No. 4) was adopted by the Everett City Council as the revised Drainage Basin Plan for that system. In 1992, a City report concluded that active channel incision and erosion is occurring in the east branch of Pigeon Creek #2 and downstream of the confluence of the east and west branches. As a result of this, the City is requiring a 2-year predeveloped release rate for the entire Pigeon Creek basin. A combination of regional and on-site stormwater control elements composed the adopted drainage plan:

- Three future regional detention ponds were proposed near Highland Road, Seahurst Avenue, and on Associated Sand and Gravel property.
- On-site water quality controls and non-structural solutions such as water quality monitoring were also recommended.

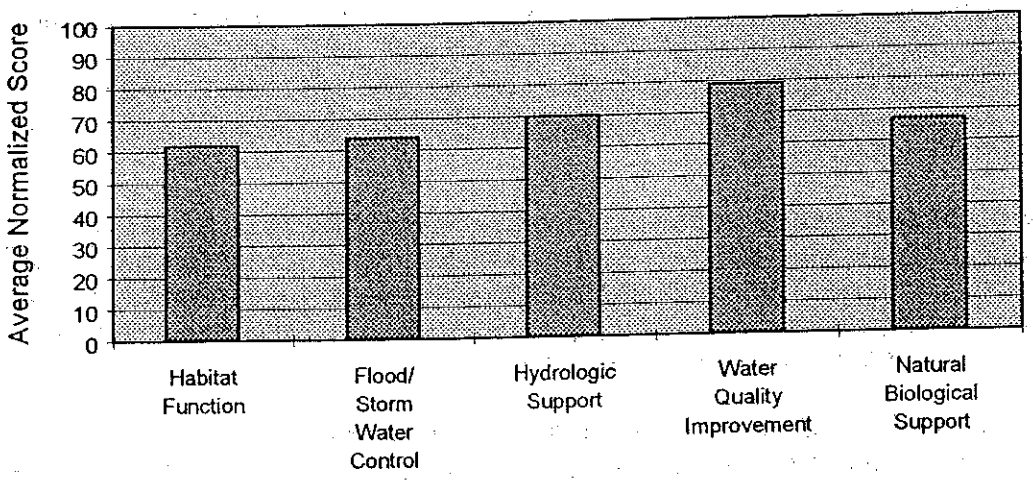
Two of the regional ponds are no longer proposed due to contamination on one site (near Highland Avenue, near Hannabrook) and impacts to wetlands on the other site (Seahurst Ave.). The remaining site on the Associated Sand and Gravel property is still feasible and could be constructed as a joint venture between the City and property owner when the property develops.

Pigeon Creek #2 Basin Wetlands. Figure 3.4-36 shows the average wetland assessment scores for the Pigeon Creek drainage basin.

Flood/Storm Water Control Functions. Wetlands within this basin ranked as Group 1 wetlands for the hydrologic support function in the upper portion of the basin and Group 2 in the lower portion of the basin. For the stormwater control function, the wetlands ranked in Group 2 for the upper basin and Group 3 for the lower portion of the basin.

Because of the excellent hydrologic support provided by upstream wetlands there is a high potential for the restoration of the degraded wetland at the mouth of Pigeon Creek 2 (due to sedimentation) and the enhancement of the fishery function. Like the Glenwood Creek Basin, the very upper portion of the Pigeon Creek basin is presently an active sand and gravel operation. When this mining operation is closed there will be significant opportunities to protect and improve the flood/storm water control and hydrological functions for this basin.

Figure 3.4-36
Pigeon Creek #2 Drainage Basin
Average Wetland Assessment Scores



Water Quality Improvement Function. Because the majority of wetlands were slope and riverine wetlands, this basin ranked 7th for the water quality control function relative to the other basins. The slope wetlands all fell within the Group 2 category for this function. For the entire basin only one wetland in the mid portion of the watershed ranked as a Group 1 wetland (EPC1).

There is limited opportunity to improve the water quality improvement function for the slope wetlands in the lower watershed due to the difficulty in controlling outlet flow. However, restoration of wetland PC2 at the mouth of Pigeon Creek #2, by removal of excess sediment, could provide for additional ponding and enhancement of the water quality improvement function.

The water quality improvement function of mitigation wetlands WPC1 and EPC1 could be substantially enhanced through the installation of better outlet structures that would result in more ponding. Both of these wetlands have suitable topography for such a modification.

Habitat Functions. For the Natural Biological Support function, only wetland PC3 located within the lower reach Pigeon Creek ranked as a Group 1 wetland. The other 5 wetlands in the basin ranked as Group 2 wetlands except for EPC1 which ranked as a Group 3 wetland. For the Habitat function, wetlands within the stream corridor of the lower reach of the basin all ranked as Group 1 wetlands. The three remaining wetlands ranked as Group 2 and 3 wetlands.

Restoration opportunities include removal of sediment from wetland PC2 located at the mouth of Pigeon Creek and creation of a diverse emergent and scrub-shrub wetland with an open water component and installation of a culvert suitable for fish passage between PC2 and PC3. Mitigation wetlands WPC1 and EPC1 require correction of outlet structures in order to improve hydrology and replanting with emergent, scrub-shrub and forested species necessary to meet

the original requirements of their mitigation plans. No enhancement measures have been identified for PC1.

Swamp Creek Basin (Figure 3.4-37)

Swamp Creek. Swamp Creek drains a basin nearly 11 miles long and 2 miles wide, encompassing an area of about 15,500 acres. Swamp Creek originates in the West Casino Road/Paine Field/Highway 99 area of south Everett and flows south for 14.7 miles before discharging to the Sammamish River in Kenmore. Swamp Creek begins in a large scrub-shrub wetland in Kasch Park south of Casino Road and east of Airport Road. Several small branches flow south from this area, and these branches come together south of 119th Street Southwest. Swamp Creek is the only creek in the SW Everett/Paine Field Subarea system that flows south and does not flow directly to Puget Sound. The SW Everett/Paine Field Subarea is located on the north and northwest boundaries of this watershed, at the convergence of West Casino Road, Paine Field, and Highway 99.

Land uses in the Swamp Creek basin have changed dramatically during the past 20 years from small farms, pasture land, and forested land to large residential developments, mobile home communities, shopping centers, and light industrial and business parks. Consequently, water is diverted directly to the drainage system rather than being intercepted by vegetation and soils. As urbanization occurs, more stormwater reaches Swamp Creek and flows through the system faster. The hydrologic regime is very "flashy," meaning that flows rise rapidly during rainstorms and fall rapidly when rain ceases. Results of Hydrological Simulation Program-Fortran (HSPF) modeling indicate that Swamp Creek has a serious potential stormwater flooding problem, particularly in lower reaches of Swamp Creek in the Kenmore area of incorporated King County. Impervious surfaces are estimated to have increased from 20 percent to 29 percent between 1985 and 1990, and in 1995 were 33%. Analysis of the HSPF modeling of Swamp Creek indicate that the hydrology of the watershed is changing as the watershed is developed. The same factors that contribute to high stormwater flow during wet periods or storm events contribute to low flow during the summer (i.e., less soil surface area available for rainwater to soak in to recharge the underlying groundwater). Swamp Creek's upper branches are all very small, low-gradient, silty streams that go dry in the summer.

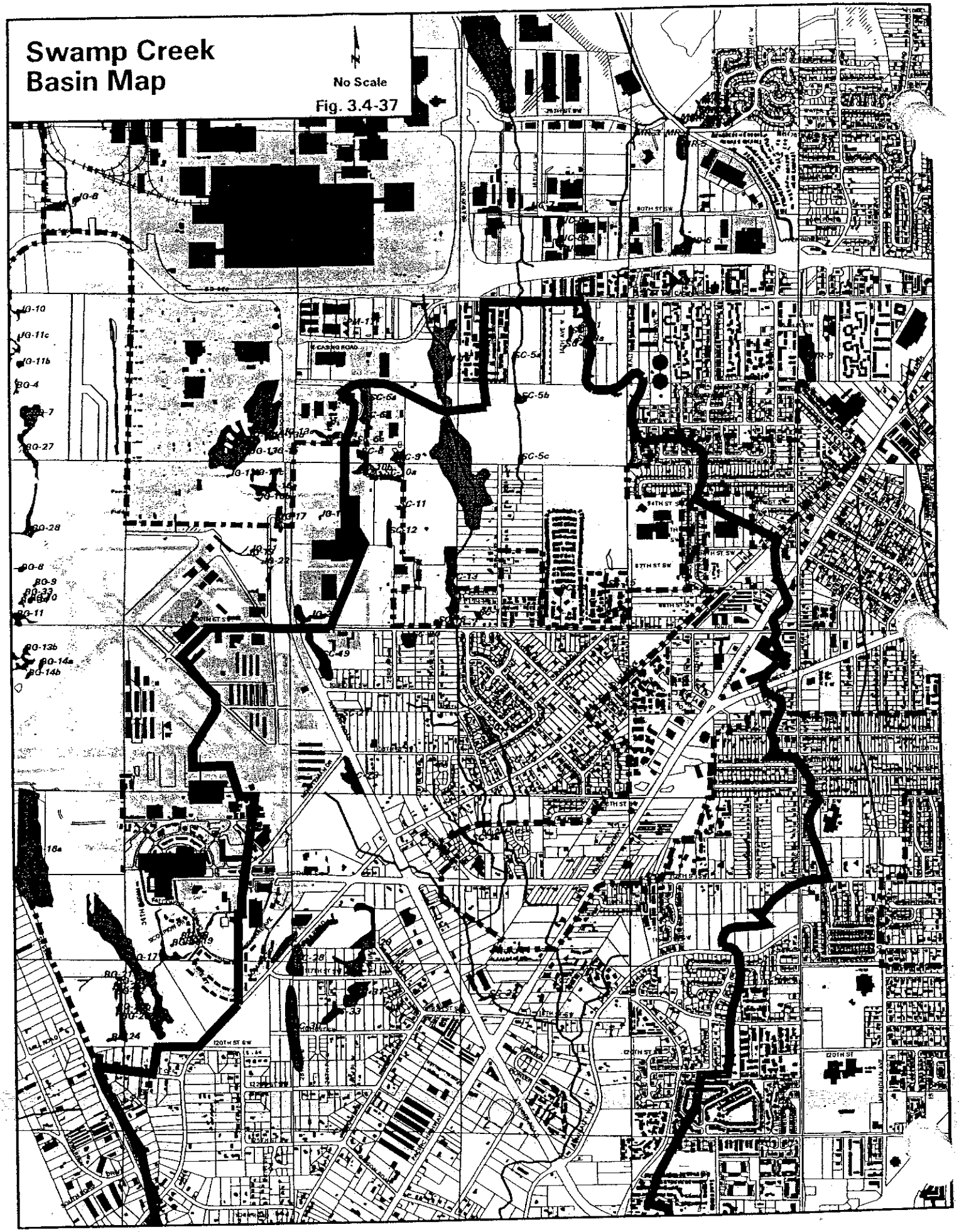
Swamp Creek is typical of Puget Sound lowland watersheds. In the gently sloping upper basin, Swamp Creek flows through a narrow valley, which gradually broadens to a flood plain almost 0.75 mile wide in the lower basin. Elevation in the headwaters is approximately 520 feet, while the elevation is about 20 feet at the confluence with the Sammamish River. The stream gradient is flat, decreasing from about 50 feet per mile in the upper basin to less than 20 feet per mile near the mouth. Scriber Creek, Little Swamp Creek, and Martha Creek are the major tributaries to Swamp Creek. Major lakes in the Swamp Creek watershed are Scriber Lake, Martha Lake, and Lake Stickney.

Between 199th Street Southwest and Airport Road, Swamp Creek flows through a several-acre open-water wetland. About 0.5 mile downstream from this wetland, Swamp Creek enters Lake Stickney. The stream segment connecting Lake Stickney with the open-water wetland upstream may flow year-round and allow year-round fish passage between these bodies of water. Water quality is a concern in this system because of the sensitivity of these small lakes

Swamp Creek Basin Map

No Scale

Fig. 3.4-37

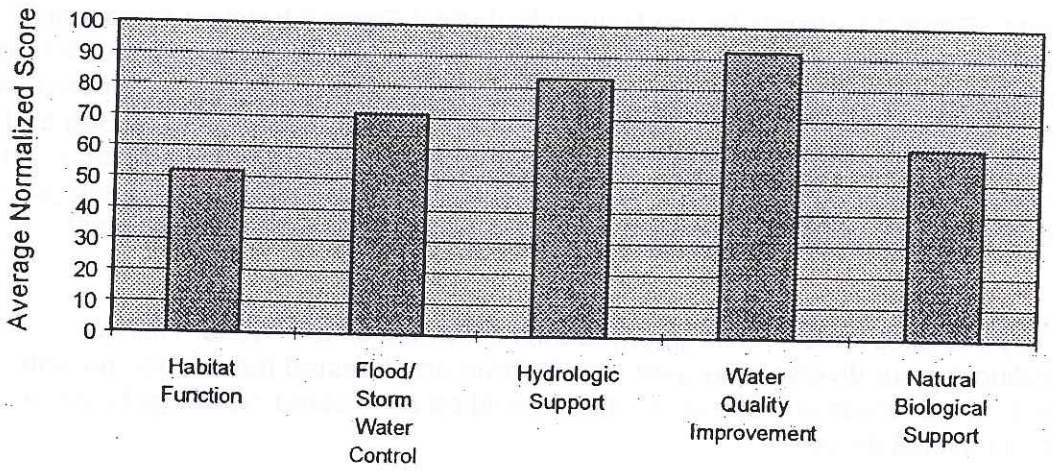


to nutrient inputs. Trash and large amounts of algae were observed in parts of the stream connecting these two water bodies.

Swamp Creek supports cutthroat trout and coho populations, but only in and downstream of Lake Stickney, which is 2.5 miles downstream of the SW Everett/Paine Field Subarea.

Swamp Creek Basin Wetlands. Figure 3.4-38 shows the average wetland assessment scores for wetlands evaluated in the Swamp Creek drainage basin.

Figure 3.4-38
Swamp Creek Drainage Basin
Average Wetland Assessment Scores



Flood/Storm Water Control and Baseflow Functions. Only a small portion of the very large Swamp Creek Basin was within the study area. Almost all of the wetlands ranked within the Group 1 category (only 4 wetlands were in Group 2 and one a Group 1) for the hydrologic support function (figure d). Relative to the other basins, Swamp Creek was one of the highest scoring wetlands for the hydrologic support function. Because the study area involves the headwaters of Swamp Creek, which is a significant fishery resource, and large areas of recreational open space are present (e.g. golf courses), there is potential to enhance the hydrologic support function for the basin. For example, it is possible that additional wetland areas could be created on the City's Walter Hall golf course as part of the overall design (e.g. as water hazard areas). Further south in the basin, high density residential and commercial development severely limit the opportunities for the restoration and creation of wetlands.

For the flood/storm water control function, the Swamp Creek Basin ranked third relative to other study area basins (figure c). The majority of the wetlands were a mix of Group 1 and 2 wetlands, with only 8 wetlands ranking as Group 3 wetlands. Again some opportunity for creating additional wetland may exist on City open space lands (e.g. Walter Hall Golf Course) which would result in an improvement of the stormwater control function for the basin. Additional wetland areas flood/storm water control function would have a very positive impact within this headwater area of the basin.

Water Quality Improvement Function. Only a small portion of the very large Swamp Creek Basin was within the study area. Over 62% of the wetlands ranked within the Group 1 category with the remaining wetlands within the Group 2 category. Relative to the other basins, Swamp Creek was one of the highest scoring basins for the water quality improvement function.

The water quality improvement function could be enhanced for Group II wetlands 5a,b,c and d and wetland SC13 by restricting the outlet and increasing flooding within the wetland. Additionally, the significant areas of recreational open space on the City's Walter Hall golf course could allow for the creation of additional wetland areas as part of the golf course overall design (e.g. as water hazard areas). Further south in the basin, high density residential and commercial development severely limit the opportunities for the restoration and creation of wetlands.

Habitat Functions. Group 1 wetlands for the Natural Biological Support function represented only 11% of the total wetlands in this basin. The Group 1 wetlands were limited to Kasch Bog (SC7) and immediately surrounding wetlands (SC9, 13 and 20). The remaining wetlands were primarily Group 3 wetlands and 5 Group 2 wetlands. For the Habitat function Kasch Bog and the adjoining SC9 and 13 ranked as Group 1 wetlands in addition to SC 29 located just south of the southern end of the study area limits. Wetlands ranking in the Group 2 and 3 category had only one to maybe two vegetation classes, highly degraded buffers and limited plant diversity.

Enhancement opportunities include enlarging wetlands SC5a,b,c on the Walter Hall golf course and creating a more diverse emergent, scrub-shrub and forested habitat portion with adequate buffers. Other areas of wetland creation should be considered on the golf course and worked into its overall design.

3.4.3 EXISTING REGULATORY FRAMEWORK

Please note that permit regulations change. Contact the appropriate agency for specific proposals.

3.4.3.1 Groundwater Regulations

While the City of Everett and other providers will supply water for industries, groundwater may be used for irrigation or industrial processes.

Snohomish County

Interim Groundwater Protection Regulations (Chapter 32.11 SCC). The Interim Groundwater Protection Regulations (SCC 32.11) require that certain land uses comply with best management practices (BMPs) and/or that hydrogeologic studies be conducted for those identified land uses which may have impacts on groundwater resources. These uses include underground storage tanks and facilities which use hazardous substances. Developments on the Paine Field properties must comply with this Ordinance as applicable.

Department of Ecology

Requirements for Obtaining New Groundwater Rights. The Washington State Department of Ecology is responsible for the allocation of groundwater rights. The following procedures are required for all potential groundwater users:

- An application must be filed with the Ground and Surface Water Section of Ecology indicating a specific amount of water requested and specific purpose.
- A public notice and comment period must occur.
- Assuming no public opposition, Ecology will issue a preliminary permit for well drilling and testing.
- Ecology will then perform a review of the investigation along with an evaluation of the following:
    - Are adequate amounts of groundwater available?
    - Will it be put to a beneficial use?
    - Is the use in the public interest?
    - Will the use be in conflict with existing uses?
- The next step in the process would be a hydrologic review performed by Ecology.
- Upon completion of a review of the hydrologic report, and a final check by Ecology, a Final Issue of Water Rights would be prepared.

In July 1995, the City of Everett approved a consulting agreement with Robinson-Noble, Inc. to conduct a groundwater feasibility study. The study will lead to a transfer of groundwater rights to irrigate key parks and golf courses in South Everett and South Snohomish County.

3.4.3.2 Stormwater, Surfacewater, Stream and Wetland Regulations

Federal Requirements: Environmental Protection Agency (EPA)

Clean Water Act. A National Pollutant Discharge Elimination System (NPDES) permit, administered by the US Environmental Protection Agency and/or Washington State Department of Ecology will be required for clearing and grading activities if the site disturbed by land alteration activities is greater than or equal to 5 acres.

A permit for stormwater discharge to creeks may or may not be required depending upon the future use of the site.

Federal Requirements: U.S. Army Corps of Engineers

Clean Water Act - Section 404. The U.S. Army Corps of Engineers (COE) regulates the excavation and discharge of fill materials into wetlands and other waters of the US. The Nationwide Permit Program was adopted by the Corps to expedite authorization of projects that are considered by the Corps to have minimal impacts on the environment. The Nationwide Permit Program covers 37 categories of minor activities, including road crossings, utility line bedding and backfill, headwaters discharges, some fill activities in isolated wetlands, and restoration of wetlands. The applicant is required to notify the Corps for some nationwide permits.

Individual permits are required for fill of wetlands not authorized under Nationwide Permits, including:

- fill in open water and wetlands adjacent to streams/rivers/lakes located below the headwaters (the point where the mean annual flow of the stream is greater than or equal to 5 cubic feet per second); and
- fill in tidal waters or adjacent wetlands.

An alternatives analysis is required for individual permits. This analysis must show that there is no less environmentally damaging practicable alternative to the proposed excavation or filling of the wetlands. The Corps can require mitigation for wetland excavation or fill.

A Water Quality Certification from the Department of Ecology is required for all Section 404 permit activities by the COE. Some certifications have been issued under nationwide permits.

Clean Water Act. The EPA issues National Pollutant Discharge Elimination System (NPDES) permits for federal facilities.

Washington State Requirements: Department of Ecology

Clean Water Act: 401 Water Quality Certification. The Clean Water Act requires certification by states that projects will not adversely affect water quality or violate state aquatic protection laws. The Department of Ecology coordinates the comments of all state natural resource agencies for required permits.

The Department of Ecology reviews the Corps nationwide permits issued under Section 404 of the Clean Water Act and either approves the permits, denies water quality certification for permits that are determined to have the potential to cause more than minimal impact to the environment, or certifies the permits with additional State conditions. Projects that fall under nationwide permits that were approved/certified by the state do not have to obtain individual Water Quality Certifications. Individual Water Quality Certifications must be obtained for projects that fall under nationwide permits that were denied, projects that cannot meet State conditions for nationwide permits, and projects that must obtain individual Corps permits.

Federal Clean Water Act and State Water Pollution Control Act (RCW 90.48). The Department of Ecology is responsible for issuing National Pollution Discharge Elimination System (NPDES) permits for non-federal projects. Any project which disturbs five acres or more of total land area during construction, and/or which will discharge stormwater to surfacewater or to a storm sewer must apply for coverage under Washington State Department of Ecology's Baseline General Permit for Stormwater Discharges Associated with Industrial Activities. The stormwater permit is meant to reduce the release of contaminants in stormwater discharges, and requires operators of industrial facilities to develop a stormwater pollution prevention plan. Constructed facilities which discharge stormwater may also have to obtain NPDES permits.

Industries required to obtain a stormwater permit include, but are not limited to:

- Heavy manufacturing facilities that fall under specific Standard Industrial Classification (SIC) codes, including lumber and wood products; paper and allied products; chemical and allied products; metal industries; and ship and boat building and repairing.
- Mining and oil and gas facilities.

- Hazardous waste treatment, storage or disposal facilities.
- Landfills, land application sites.
- Recycling facilities.
- Transportation facilities.
- Light manufacturing facilities that fall under specific SIC codes need a permit if they have industrial activity exposed to stormwater, including food products; textile products; apparel products; furniture and fixtures; paints, varnishes, lacquers, enamels, and allied products; drugs; measuring, analyzing, and controlling equipment, etc.

Water Quality Standards for Surfacewaters of the State of Washington (WAC 173-201A). The State Water Quality Standards include criteria for surfacewater characteristics such as temperature, pH, turbidity, dissolved oxygen, and fecal coliforms levels. These criteria vary based upon the classification of the surfacewaters. All of the streams in the Subarea except Swamp Creek are classified as Class A (excellent) surfacewaters. Swamp Creek and its tributaries are Class AA (extraordinary) surfacewaters. WAC 173-201A also establishes criteria for toxic substances such as ammonia, arsenic, cadmium, chromium, copper, lead, nickel and zinc. These standards are the same for all classes of surfacewaters.

The Department of Ecology is responsible for implementation and enforcement of Water Quality Standards. WAC 173-201A requires that waste discharge permits, whether NPDES permits or otherwise, shall be conditioned so the discharges authorized will meet the water quality standards. However, the Department of Ecology can issue Short Term Water Quality Modification permits which allow the criteria to be modified on a short-term basis under specific conditions.

Sediment Management Standards, WAC 173-204. Washington state sediment quality standards provide a regulatory and management goal for the quality of sediments throughout the state. The standards provide chemical concentration criteria, biological effects criteria, human health criteria, and other toxic, radioactive, biological. or deleterious substances criteria which identify surface sediments that have no adverse effects, including no acute or chronic adverse effects on biological resources and no significant health risk to humans below which no adverse effects on biological resources are predicted.

Sediment source control standards are used as a basis for controlling the effects of point and nonpoint source discharges to sediments through the National Pollutant Discharge Elimination System (NPDES) federal permit program, and state water quality management permit programs.

Washington State Requirements: Department of Fish and Wildlife (DFW)

Hydraulic Project Approvals. A Hydraulic Project Approval (HPA) from the State Department of Fish and Wildlife (WDFW) will be required for work in stream systems. An HPA is required for any activity within the ordinary high water line of state waters. Work occurring in wetlands that are located adjacent to marine bodies, streams, or lakes typically require an HPA. In addition, isolated wetlands with an open water component may also require an HPA in order for activities to occur within the ordinary high water mark. Any work that affects the waters or the aquatic beds will need an HPA. Many types of construction activities occurring in freshwater will require an HPA including the following:

- streambank protection,
- pile driving,
- conduit crossing,
- dredging,
- pond construction,
- log, log jam, or debris removal,
- installation or maintenance (of equipment) of water diversions.
- construction of bridges,
- channel change or realignment,
- culvert installation,
- gravel removal,
- placement of outfall structures,
- mineral prospecting; and

An HPA may also be required for discharge of stormwater to wetlands or streams. In the past, more stringent detention and water treatment requirements than the City would impose have been placed on projects as a condition of the HPA.

Local Requirements: City of Everett

Storm and Surface Water Management Regulations - General. The City of Everett is currently in the process of revising Public Works regulations related to storm and surface waters management. Both the existing and proposed regulations are discussed below. Existing regulations include the Design and Construction Standards and Specifications Manual, Drainage Basins Plans, Surfacewater System Ordinance, and Drainage Ordinance. The City is in the process of amending the City's Drainage Ordinance to add Minimum Technical Requirements and of creating a Stormwater Management Manual to comply with Puget Sound Water Quality Authority (PSWQA) and DOE requirements. It's anticipated that the amended Ordinance and manual will be adopted in February 1996.

In addition to these ordinances, the City has an Environmentally Sensitive Areas Ordinance which is contained in Chapter 37 of the Zoning Code.

Design and Construction Standards and Specifications (Existing). The current City of Everett Design and Construction Standards and Specifications provides requirements for land alterations, including erosion and sediment control, and also for storm and surfacewater management.

The Land Alteration chapter provides general protections and specific methods of control. This chapter also includes seasonal limitations on land alteration activities, criteria for development of temporary erosion and sediment control plans, and provisions for preservation of existing vegetation and for vegetation restoration.

The Storm and Surface Water section provides requirements for the submittal of drainage plans; specific requirements for areas containing environmentally sensitive areas; special requirements for high risk land uses such as fueling sites, auto repair and maintenance shops, car washes, etc.; and specific criteria for the selection, design, and maintenance of drainage facilities.

The options for stormwater treatment presented in the Design and Construction Standards and Specifications are, in order of preference:

1) An infiltration basin designed and constructed in accordance with City standards.
2) A wetpond designed and constructed in accordance with City standards.

3) A baffle-type oil/water separator followed by a vegetated swale, both designed and constructed in accordance with City standards.

The least preferred option is allowed only if the first two options are infeasible in the opinion of the Public Works Department.

Infiltration: The Design and Construction Standards and Specifications states the following with respect to infiltration of stormwater:

> Infiltration shall be provided for stormwater runoff quantity and/or quality control per the recommendations of drainage basin plans and/or SEPA conditions. Generally infiltration is not acceptable as the sole method of disposing of stormwater. It is an acceptable means of providing water quality enhancement [stormwater treatment] when specific soil and site criteria are met.
>
> Infiltration shall only be allowed as the major or sole method of stormwater disposal in areas of significant natural infiltration with soils classified as hydrologic Group A soils by the Soil Conservation Service. Many of these areas within the City of Everett are identified in the City's drainage basin plans.

Even when soil conditions are not conducive to large-scale infiltration of paved areas, infiltration of roof-top runoff (through the use of small, underground infiltration systems) is strongly encouraged. These smaller, more widely dispersed systems more closely approximate natural infiltration patterns. In addition, roof-top runoff is considered "clean" and does not require treatment prior to discharge to an infiltration system.

Drainage Basins Plans (Existing). The City of Everett drainage basin plans provide information and goals specific to each drainage basin within the City of Everett. In particular, goals for stream flow are developed, which in turn set specific stormwater detention standards for each drainage basin. Capitol improvements needed to achieve the goals are also identified.

The following are the current goals for stormwater quantity control identified in the most recent City of Everett Drainage Basin Plans:

	Design Storm	
Drainage Basin	Predevelopment	Post Development
Powder Mill	2	25
Pigeon Creek #2	2	25
Edgewater Creek	2	25
Glenwood Creek	2	25
Merrill and Ring	5	25
Narbeck Creek	5	25
Japanese Creek	10	25

Using the Powder Mill basin as an example, this means that when the 25 year storm falls on the developed site, sufficient detention must be provided so that the peak allowable stormwater release rate is equal to the current (undeveloped conditions) release rate from a 2 year storm.

The City does not have an adopted drainage basin plan for Swamp Creek.

Surfacewater System Ordinance, EMC 14.56 (Existing). This Ordinance prohibits the discharge of polluting matter into the surfacewater system. Violation of the Ordinance is a misdemeanor punishable by a fine not to exceed five thousand dollars per day or per occurrence.

In addition to fines, the Ordinance also gives the City the ability to require correction of an "unsafe condition" - which is defined as any condition "on public or private premises which may cause pollution or does or may impede the operation or functioning of the surfacewater system or which may cause damage thereto."

Polluting matter includes, but is not limited to: petroleum products including but not limited to oil, gasoline, grease, fuel oil, and heating oil; chemicals; paints; steam cleaning wastes; fresh concrete; washing of fresh concrete for cleaning and/or finishing purposes to expose aggregates; laundry wastes; soaps; pesticides, herbicides, or fertilizers within 25 feet of a surfacewater system; sanitary sewage including septic tank fluids; degreasers and/or solvents; antifreeze, transmission fluid, or other automotive products; animal carcasses; acids or alkalis; recreational vehicle wastes; dyes; any fluid with a pH less than 6.0 or greater than 8.5; and cooking wastes.

The surfacewater system is defined as the receiving bodies of water and the facilities within the City, both public and private, naturally existing and artificial, for storm and surfacewater drainage, conveyance, detention and storage, and any facilities or processes therein, both public and private, natural or artificial, which control the quantity or maintain or improve the quality of storm and surfacewaters or deter pollution. The surfacewater system includes, but is not limited to, streets, sidewalks and all public right-of-ways.

Water Quality Management Program. The City of Everett monitors water quality in most streams in the City. The monitoring, one component of the Surfacewater Management Program, is funded through a surfacewater assessment on utility bills, with the total city-wide budget of about $1 million. Within the Subarea, dry weather baseflow water quality data is collected for Japanese, Edgewater, Narbeck, Merrill and Ring, and Swamp Creeks. Both dry weather baseflow and storm flow water quality data is collected for Powder Mill, Glenwood and Pigeon Creek #2. The stormflow data is collected with automatic water sampling equipment. Samples are collected near the outflows of all streams within the study area into Port Gardner Bay, except that samples for Swamp Creek are collected at the outflow of a regional detention pond at 108th and Evergreen Way. Staff collects and preserves samples, and analysis of the samples is completed in a City lab. Data from the Fall of 1990 to Spring of 1992 was used for this document to summarize existing water quality in the Subarea. This data is available for review in the Planning Department.

In addition to water quality monitoring, the City has begun to sample benthic invertebrates (primarily fly larvae attached to rocks on the stream bottom) in the streams. The quantity and type (pollution tolerant or not) of benthic invertebrates living in a stream is a good indicator of the water quality in the stream. Data on these sampling efforts will be available in the future.

Drainage Ordinance, EMC 14.28 (Existing). The stated purpose of this Ordinance is "to promote sound development guidelines and construction procedures which respect and preserve the City's watercourses; to minimize water quality degradation and control sedimentation of creeks, streams, ponds, lakes, and other water bodies; to protect property owners adjacent to developing and developed land from increased runoff rates which could cause erosion of abutting property; to protect downstream owners; to preserve and enhance the suitability of waters for contact recreation and fishing; to preserve and enhance the aesthetic quality of the waters; to maintain and protect valuable groundwater resources; to minimize adverse effects of alterations in groundwater quantities, locations, and flow patterns; to ensure safety of City roads and right-of-way; and to decrease drainage related damage to public and private property."

The Drainage Ordinance applies to any developers performing clearing or logging operations in excess of five thousand square feet of area, or developing on slopes in excess of 15% projects, or obtaining a Public Works permit. A Public Works permit is required for all work within the public right-of-way and City utility easements, and for all sewer, water, and drainage improvements, including fill and excavation, parking lot construction and/or paving on private property.

The Ordinance requires:

- The development of drainage plans and the submittal of drainage calculations.
- Receiving and discharging surfacewater at the natural locations.
- Restriction of stormwater discharges to levels specified in the drainage plans.
- Provision of adequate measures for control of stormwater per the procedures manual (Design and Construction Standards and Specifications).

The City also inspects private stormwater systems on developments with on-site detention and runoff treatment facilities, including detention ponds, swales, and underground vaults through authority provided in the Drainage Ordinance. City staff can require property owners to correct violations, and property owners can be fined up to $5,000 per occurrence for clean-up costs per EMC 14.56.

Minimum Technical Requirements Ordinance and Stormwater Management Manual (Proposed). The Puget Sound Water Quality Management Plan (PSWQMP) requires that the City adopt a Minimum Technical Requirements Ordinance and a Stormwater Management Manual that is technically equivalent to the Department of Ecology's Stormwater Management Manual for the Puget Sound.

It is anticipated that a new Minimum Technical Requirements Ordinance will be approved by City Council in early 1996. This Ordinance will set forth new, minimum technical requirements for storm and surfacewater management for redevelopment and new development within the City of Everett.

The City of Everett's Stormwater Management Manual will implement the City's new Ordinance and will provide criteria for the selection, design, and construction of Best Management Practices for stormwater management, pollutant source control, and erosion and sediment control. It is anticipated that the manual will replace the land alteration and storm and surface water sections of the City of Everett Design and Construction Standards and Specifications.

General Proposed Requirements. The draft requirements of the proposed Ordinance are summarized in Table 3.4-3. The plans and requirements referenced in the table will be described in detail in the Stormwater Management Manual. Specific BMPs and their design standards will also be contained in the manual. At this time, a draft Stormwater Manual has been developed. Information from the draft manual, regarding required plans and types of BMPs, has been included in this section for reference.

Stormwater Site Plans are comprehensive reports which contain all technical information and analysis necessary to evaluate the temporary erosion and sediment control facilities, source control BMPs, and runoff control facilities required or proposed for a site. The Stormwater Site Plan must be stamped and dated by a professional civil engineer licensed in the State of Washington.

A Stormwater Site Plan will generally include the following sections:

- Project Overview
- Preliminary Conditions Summary
- Off-Site Analysis
- Proposed Erosion and Sediment Control Plan
- Proposed Drainage Plan
- Proposed Source Control Plan
- Analysis and design of all BMPs proposed and/or required.
- Special Reports and Studies
- Basin and Community Planning Areas
- Other Permits
- Miscellaneous Forms and Worksheets
- Maintenance and Operations Requirements

A Small Parcel Erosion and Sediment Control Plan will illustrate the BMPs and strategies for controlling erosion and sediment on a small parcel during construction.

A Large Parcel Erosion and Sediment Control Plan will illustrate the BMPs and strategies for controlling erosion and sediment on a construction site. It is a component of the Stormwater Site Plan, which includes the design and analysis of the erosion and sediment control BMPs.

A Drainage Plan will illustrate the BMPs and strategies for controlling runoff on a development or redevelopment site. It is a component of the Stormwater Site Plan, which includes the design and analysis of the runoff control BMPs.

Requirements for Runoff Control BMPs. Runoff control BMPs include infiltration, runoff treatment, streambank erosion control, and streambank stabilization BMPs.

- *Infiltration BMPs:* In the draft Stormwater Manual, infiltration BMPs have the highest priority for both runoff treatment and streambank erosion control, provided proper conditions exist for their use.

  Sufficient organic content to remove pollutants must be present for soils to provide runoff treatment. These soils have fairly low percolation rates that generally make them

Table 3.4-3
Draft Requirements in Minimum Technical Requirements Ordinance

Type of Development	SPESCP	SSP W/SPESCP AND DP	SSP W/LPESCP AND DP	SOURCE CONTROL	RUNOFF TREATMENT	STREAMBANK EROSION CONTROL
Individual, detached, single family residences and duplexes	X					
Creation or addition of less than 5,000 square feet of impervious surface	X					
Land disturbing activities of less than one acre	X					
Land disturbing activities of one acre or greater			X	X		X
Creation or addition of 5,000 square feet or more of impervious surface along with land disturbing activities of less than one acre		X		X		X
Creation or addition of 5,000 square feet or more of impervious surface along with land disturbing activities of one acre or greater			X	X		X
Creation or addition of 5,000 square feet or more of paved surface				X	X	X

Note:

SPESCP = Small Parcel Erosion and Sediment Control Plan
LPESCP = Large Parcel Erosion and Sediment Control Plan
SSP = Stormwater Site Plan
DP = Drainage Plan

infeasible for infiltrating the large volumes of runoff required for streambank erosion control. Coarser soils can provide streambank erosion control, but generally do not provide adequate treatment of runoff.

The use of coarser soils for infiltrating runoff is allowable to meet streambank erosion control objectives, but runoff treatment must precede discharge to these soils in order to protect groundwater quality.

- *Runoff Treatment BMPs:* Per the City's draft Minimum Technical Requirements, all projects that create 5,000 square feet or more of new pavement must provide treatment of stormwater runoff. Additional criteria apply to redevelopment projects.

  Runoff treatment BMPs are designed to reduce the concentration of pollutants in stormwater runoff. The design goal is to provide effective treatment of at least 90 percent of the runoff generated by development. To achieve this goal, runoff treatment BMPs are sized to treat the 6-month, 24-hour design storm (also referred to as the water quality design storm, or the runoff treatment design storm).

  Categories of runoff treatment BMPs include primary treatment, pretreatment, and oil/water separation. Primary treatment BMPs provide the majority of treatment. Pretreatment BMPs are used to protect certain primary treatment BMPs from suspended solids. Oil/water separation BMPs remove heavier concentrations of oil found in runoff from certain land uses. See the following page for a listing of runoff treatment BMPs.

  In general, the following land uses must provide baffle-type (API) or coalescing plate (CP) oil/water separators in addition to other runoff treatment facilities:

  Industrial machinery and equipment
  Trucks and trailer, aircraft parts and aerospace, and railroad equipment
  Log storage and sorting yards
  Airfields and aircraft maintenance
  Fleet vehicle yards
  Railroads
  Gas stations
  Retail/wholesale vehicle and equipment dealers
  Vehicle maintenance and repair
  Construction businesses (paving, heavy equipment storage and maintenance, storage of petroleum products)

- *Streambank Erosion Control BMPs:* Streambank erosion control (SBEC) BMPs are designed to prevent or control the excessive erosion that typically occurs due to increases in peak flow rates and increases in the frequency and duration of high flow conditions from urbanizing watersheds. Streambank erosion control requires attenuation of stormwater flows through the use of stormwater infiltration and/or stormwater detention.

  Streambank erosion control will most likely be required for attenuation of runoff flows when stormwater discharges are made either directly or indirectly (through a conveyance system) into a stream. Requirement of streambank erosion control is <u>not</u> proposed when there is a direct discharge to the Snohomish River, Silver Lake, or Port Gardener Bay.

Streambank Erosion Control BMPs must be designed to meet the following requirements:

- The peak discharge rate for the 2-year, 24-hour storm shall not exceed 50% of the peak runoff rate for the same storm and existing site conditions, and

- The peak stormwater discharge rates for the 10-year and 100-year, 24-hour storms shall not exceed the peak runoff rate for the same storm and existing site conditions.

(See the impact section of this DEIS for an analysis of how the new standards will affect stream flows.)

- *Streambank Stabilization Measures:* In cases where a streambank erosion problem already exists, streambank stabilization measures may be required. The selection and design of these BMPs will be made on a case-by-case basis.

- *Selection of Runoff Treatment and Streambank Erosion Control BMPs:* The order of preference for runoff treatment and streambank erosion control is shown below. A lower preference BMP may only be used if all higher preference BMPs are infeasible in the opinion of the Public Works Department.

Runoff Treatment BMPs

1. Infiltration Basin
2. Wetpond
   Constructed Wetland
3. Emergent Swale
   Grass Swale
   Sand Filtration Basin

Streambank Erosion Control BMPs

1. Infiltration Basin
2. Wetpond
   Constructed Wetland
   Extended Detention Dry Pond
   Wetvault/Tank
   Extended Detention Dry Vault/Tank

Infiltration BMPs are preferred for both runoff treatment and streambank erosion control. Before any other BMPs may be selected, it must be shown that infiltration is not feasible. The Stormwater Manual will provide detailed information regarding the feasibility of infiltration systems.

In general, where soil conditions are suitable, required setbacks can be met, and slope stability is not an issue, roof downspout infiltration systems will be required for disposal of roof-top runoff.

In general, a wetpond or constructed wetland will be required for runoff treatment if infiltration is not feasible. In some limited cases, a wetpond or constructed wetland will not be feasible. This situation is most common on redevelopment sites with existing storm systems and

extensive impervious surfaces. In these cases, a biofiltration swale or a sand filtration system may be utilized to treat stormwater runoff.

If infiltration BMPs are not feasible for streambank erosion control, any of the other detention-type BMPs listed in the table may be used instead.

Any number of factors may make one BMP preferable over another on any given site. In cases where both runoff treatment and streambank erosion control are required, a BMP that meets both objectives may be most cost-effective.

Different BMPs have different recommended drainage areas, which may affect their suitability for a particular site. On large sites, multiple facilities may be designed and constructed to avoid exceeding maximum recommended drainage areas for specific BMPS.

Environmentally Sensitive Areas (ESA) Ordinance, Chapter 37 of the Zoning Code (Existing). This Ordinance was adopted by the City per Growth Management Act requirements. It establishes regulations for the protection of environmentally sensitive areas. No development permit may be issued, no subdivision of land may be approved, nor may any use be established on any lot which contains, adjoins, or is in close proximity to an environmentally sensitive area until approvals required by this Ordinance have been granted by the City. This Ordinance applies to the following environmentally sensitive features: areas of flood hazard[5]; wetlands; streams; geologically hazardous areas; seismic hazard areas; fish and wildlife conservation areas; slopes of 25% or greater associated or in conjunction with one or more of the previously listed sensitive areas; and groundwater discharge areas.

Generally, the Ordinance requires that streams and wetlands be preserved/protected and that buffers be provided around the streams and wetlands. When a wetland or stream is known to be on-site, or may be on a site, the applicant is required to hire an expert qualified in wetlands/streams to delineate the boundary of the wetland/stream and to categorize the stream/wetland per Chapter 37 standards. The required buffer width is based upon the category of wetland/stream and ranges from 25 to 100 feet for wetlands and 10 to 100 feet for streams. Where steep slopes are adjacent to streams and wetlands, the required buffer extends 25 feet beyond the top of slope.

Some wetlands are exempt from regulation. These include:

- Category III wetlands less than 500 square feet having only one wetland class, which is not forested and which is hydrologically isolated.
- Category IV wetlands less than 8,000 square feet in area.

The Ordinance allows the modification of wetlands, streams, and their buffers in some instances, provided that mitigation is provided. Chapter 37 includes wetland and stream impact mitigation goals and preservation/alteration thresholds, and mitigation replacement ratios for wetlands that are altered. If modification of wetlands, streams or buffers are proposed, additional studies must be submitted by the wetland/stream experts. Monitoring of stream and wetland mitigation, preparation of contingency plans, and performance bonding is also required. Permanent protection of ESAs is required with permanent fencing required along the edge of the ESA, signs posted on the fence, and recording ESA covenants for

[5] There are no areas of flood hazard in the study area.

wetlands. Additional conditions may be placed on projects by the Planning Director when the proposal includes modification of wetlands, streams, or their buffers.

Local Requirements: Snohomish County

Critical Areas Ordinance (Title 32.10 SCC, Ordinance No. 94-108, as amended). This Ordinance designates critical areas by definition (including streams and wetlands) and regulates development activities in these critical areas. The Ordinance was adopted pursuant to the Growth Management Act, Chapter 16.70 RCW. Generally, the Ordinance requires that wetlands and streams be protected and that buffers be provided adjacent to these areas.

Under this Ordinance, streams are classified based on the water typing criteria in WAC 222-16-030. Stream buffers in urban areas range from 10 feet to 100 feet, depending upon the category of stream. The Ordinance defines four categories of wetlands. The wetland buffers for urban wetlands falling within these categories range from 0 to 75 feet.

Wetlands exempt from regulation include:

- non-riparian Category 2 and 3 wetlands less than 5,000 feet in size, and
- non-riparian Category 4 wetlands less than 10,000 square feet in size.

When a wetland or stream is located on a site, a study must be submitted that delineates the edge of wetlands; describes and categorizes the wetland, stream; describes observed or reported wildlife in the area; and provides a mitigation plan. Mitigation must be provided for loss of area or functional values of wetlands at a ratio of one to one. Off-site mitigation is permitted in some situations, but it must occur within the same sub-drainage basin as the project impact.

Snohomish County is under an order from the Growth Management Hearing Board to revise the Ordinance to bring it into compliance with the Growth Management Act. Revisions are expected to be adopted in May, 1996. The Board directed the County to protect Category 4 wetlands with buffers and to eliminate the prior outright exemptions for delineation and protection of critical areas.

Snohomish County Drainage Ordinance (Title 24 SCC). Snohomish County's Drainage Ordinance states that design storm peak discharge from a subject property may not be increased from conditions existing prior to the proposed development, and that surfacewater discharge rates must be maintained at or below the existing storm discharge rates.

Anadramous fish bearing streams are classified as critical areas under the Drainage Ordinance (both Swamp Creek and Japanese Creek are therefore critical areas). Developments within 200 feet of these critical areas are required to complete detailed drainage plans using standards approved by the Planning and Development Services (PDS) Director. The Department of Ecology detention standard is used by the Washington Department of Fish and Wildlife for these areas based upon an agreement between Snohomish County and the Department of Fish and Wildlife. This standard is the same as that which will be adopted by the City of Everett in their new stormwater standards:

- The peak discharge rate for the 2-year, 24-hour storm shall not exceed 50% of the peak runoff rate for the same storm and existing site conditions, and

- The peak stormwater discharge rates for the 10-year and 100-year, 24-hour storms shall not exceed the peak runoff rate for the same storm and existing site conditions.

The detention standard has been placed on projects through the County's SEPA substantive authority.

The County may add a water quality element to Title 24 later this year or as part of the Critical Areas Ordinance Amendments.

3.4.3.3 Plants and Animals Regulations

Special status species are native species that have been accorded special legal or management protection because of concern for their continued existence. There are several categories of protection at both federal and state levels, depending on the magnitude of threat to continued existence and existing knowledge of population levels.

Federal Regulations: US Fish and Wildlife Service (USFWS)

Endangered Species Act. The USFWS administers the federal Endangered Species Act (ESA). The ESA was passed in 1973 and has since been amended and reauthorized. The ESA provides a process for listing species as either threatened or endangered and methods for protecting listed species.

The ESA defines as "endangered" any plant or animal species that is in danger of extinction throughout all or a significant portion of its range. A "threatened" species is a species that is likely to become endangered in the foreseeable future. Additional species of concern are divided into four categories: 1) proposed for listing as endangered or threatened, 2) Candidate Category 1 (enough data are on file to support a listing), 3) Candidate Category 2 (information indicates proposal to list is appropriate, but current data are insufficient to support a listing), and 4) Candidate Category 3 (species that were once considered for listing but are no longer under consideration).

Washington State Regulations: Department of Natural Resources (DNR)

Natural Heritage Program. Through the Natural Heritage Program, the DNR lists native plants whose further existence in the State is of concern. Plants are listed as endangered, threatened, or sensitive[6]. DNR does not have specific regulations that apply to listed plants. Rather DNR reviews and comments on projects that may impact any listed plant under the State Environmental Policy Act (SEPA). The DNR also has developed the Natural Heritage Plan, which establishes methods of protection and priorities for listed species.

The Natural Heritage Program maintains a database of known occurrences of special status plants in Washington. The database information is not derived from systematic surveys of all

[6] "Endangered" plants are in danger of becoming extinct or extirpated in Washington within the near future if causes of decline continue. "Threatened" plants are likely to become endangered in the near future if causes of decline continue. "Sensitive" plants are declining or vulnerable and could become endangered or threatened without active management or removal of threats.

areas for special status plants; rather the data are from small surveys and data collected incidental to other field work. Thus, not all existing locations of special status plants are in the database.

No threatened, endangered, or other special status plant species are known to occur in the SW Everett/Paine Field Subarea (DNR, 1994).

Washington State Regulations: Department of Fish and Wildlife

The Washington Department of Fish and Wildlife publishes a list of Species of Special Concern (SSC) annually. This list includes native Washington species considered Endangered, Threatened, Sensitive, Candidate and Monitor[7]. Endangered, Threatened, and Sensitive species are legally established in Washington Administrative Codes. Candidate and Monitor species are established by WDFW policy. There are currently 24 Endangered, 8 Threatened, 1 Sensitive, 56 Candidate and 149 Monitor species on the SSC list.

The WDFW also publishes a Priority Habitats and Species (PHS) list. The PHS list is a catalog of habitats and species considered to be priorities for conservation and management. Priority species require protective measures for their perpetuation due to their population status, sensitivity to habitat alteration, and/or recreational, commercial, or tribal importance. Priority species include all State Endangered, Threatened, Sensitive, and Candidate species; animal aggregations considered vulnerable, and those species of recreational, commercial, or tribal importance that are also vulnerable. Priority habitats are those habitat types or elements with unique or significant value to a diverse assemblage of species.

The PHS program maintains a database of priority species and habitats in Washington. The database contains both location and use information. The PHS database information is not derived from systematic surveys of all areas for special status wildlife; rather the data are from small surveys and data collected incidental to other field work. Thus, not all existing locations of special status animals are in the database.

The only endangered species protected by State law is the Bald Eagle. If human activities threaten to alter eagle habitat near a nest or communal roosting site, a cooperative site management plan must be developed under the Washington State Bald Eagle Protection Rules (WAC 232-12-292). The management plans are prepared by the Department of Fish and Wildlife. For all species other than eagles, the Department of Fish and Wildlife comments on SEPA reviews for individual projects to recommend appropriate protection mechanisms.

Deleterious Exotic Wildlife (WAC 232-12-017). The WDFW also regulates deleterious exotic wildlife. In most cases, it is unlawful to import into the State, hold, possess, propagate, offer for sale, sell, transfer, or release live specimens of deleterious exotic wildlife. Species that are designated as deleterious exotic wildlife include walking catfish, piranha, African clawed frogs, and mute swans.

[7] "Endangered" species are in danger of extinction throughout all or a significant portion of their range in Washington. "Threatened" species are those that are likely to become endangered in Washington in the foreseeable future. "Sensitive" species are those that are vulnerable or declining and may become endangered or threatened in Washington. "Candidate" species are being reviewed for listing as endangered, threatened, or sensitive. "Monitor" species are those about which the WDFW is concerned, for a variety of reasons; therefore, the WDFW monitors their status.

Local Regulations: City of Everett

Environmentally Sensitive Areas Ordinance (Chapter 37 of the Zoning Code. The City's Environmentally Sensitive Areas Ordinance defines fish and wildlife conservation areas and requires that Habitat Management Plans be prepared for developments that may affect these areas. The required content of habitat management plans varies, depending upon the resource involved, but in general must include actions necessary to maintain and enhance the resource present. Fish and Wildlife conservation areas include:

- Habitats of Primary Association: A critical component(s) of the habitats of federally or state listed endangered, threatened, candidate, sensitive, priority and monitored wildlife or plant species, which, if altered, may reduce the likelihood that the species will maintain and reproduce over the long term. These include winter ranges, migration ranges, breeding sites, nesting sites, regular large concentrations, communal roosts, roosting sites, staging areas, and priority habitats listed by the Washington State Department of Wildlife.
- Riparian Corridors
- Continuous Vegetative Corridors Linking Watersheds
- Significant Biological Areas: Those within the study area include plant associations of infrequent occurrence, Bomarc Bog (Kasch Park bog), yew groves, Narbeck Swamp.

Local Regulations: Snohomish County

Critical Areas Regulations (Chapter 32.10 SCC, Ordinance 94-108 as amended). The County's Critical Areas Regulations define "fish and wildlife habitat"[8] as streams and wetlands regulated under the Ordinance, areas with which critical species listed as endangered or threatened under federal law have a primary association, and saltwater-related habitat. The Ordinance requires that habitat management plans be prepared for areas with which critical species listed as endangered or threatened under federal laws have a primary association and for saltwater-related habitat. It is intended that the buffers to the streams and wetlands assist in providing a riparian conservation area for the various species.

3.4.4 IMPACTS OF DEVELOPMENT

The SW Everett/Paine Field Subarea and the surrounding study area are expected to experience continued and intensified urbanization under any of the growth projections. Zoning will accommodate both heavy and light industrial development within the SW Everett/Paine Field Subarea. Increased development will continue to affect vegetation, streams, wetlands, and wildlife. Urbanization can result in the following:

- Removal of upland vegetation, and resulting increase in storm runoff volumes and decrease in base flows in streams.
- Physical encroachment into streams, wetlands, priority habitats, and their buffers.

[8] This language will be amended to read "fish and wildlife habitat conservation areas" per the Growth Management Hearings Board decision.

- Increased impervious area and resulting increase in storm runoff volumes and decrease in base flows.
- Alteration of hydrologic regimes in individual wetlands, streams and subbasin drainages.
- Soil erosion during and after land clearing.
- Increased silt and nutrient loading in streams and wetlands.
- Alteration of stream courses.
- Decreased water quality from leaking sewage systems, and from surface flow off roads and industrial areas into streams and wetlands.
- Increasing isolation and fragmentation of wildlife habitat, reduction in wildlife present, and the increasing presence of species adaptable to "urban" settings.

3.4.4.1 Stormwater Impacts to Streams from Development

Increased impervious surfaces from developments (buildings, paving, etc.) result in increases in stormwater runoff volumes and stream flows. The City's current Drainage Ordinance and Drainage Basin Plans require that developments provide on-site infiltration and/or detention of stormwater as discussed in the section on existing regulations (Section 3.4.3.2). Peak stormwater flows and volumes at buildout of the Subarea will change over that forecast in the Drainage Basin Plans due to:

- new information regarding the feasibility of regional detention facilities proposed in the Drainage Basin Plans, and
- requirements to adopt new State standards for stormwater detention. (These standards are also discussed in Section 3.4.3.2.)

The Public Works Department modeled the impacts of buildout development in the Subarea on stormwater flows and volumes based upon use of the new State standards for detention. The EPA's Stormwater Management Model (SWMM) was used for modeling purposes. The model uses information on storm events provided by the National Weather Service and was calibrated to existing stream flows in the early 1980s as part of the City's drainage basins study. Table 3.4-4 shows existing conditions for the 2 year and 10 year design storms and conditions at buildout in the Subarea for the 2 year and 10 year design storms. Theoretically, two year storms occur once every 2 years and ten year storms occur once every 10 years, so 2 year storms occur much more frequently than 10 year storms.

In general, the model shows that stream peak flows at buildout will decrease in a 2 year storm and slightly increase or stay the same in a 10 year storm. An exception is Merrill and Ring Creek where peak flows will increase in a 2 year storm and significantly increase in a 10 year storm. This is due to increased overflows at a regional detention pond at Merrill Creek Parkway from increased stormwater volumes in the study area. Flows will also significantly increase in Edgewater, due to increased overflows from a regional detention facility located north of the study area.

Table 3.4-4
Existing Stormwater Conditions & Stormwater Conditions at Buildout in the Subarea Based upon Use of New Stormwater Standards [1, 2]

	2 Year Design Storm-Existing			2 Year Design Storm at Buildout in the Subarea		
Stream	Peak Flow (CFS)	Peak Stream Velocity (FPS)	Run-Off Volume (Ac-Ft)	Peak Flow (CFS)	Peak Stream Velocity (FPS)	Run-Off Volume (Ac-Ft)
Japanese	40.0	7.5	5.1	29.0	7.0	24.2
Edgewater	6.5	4.1	2.0	5.5	4.0	7.1
Powder Mill	60.6	9.4	73.1	54.6	9.2	99.7
Narbeck	15.4	6.4	14.3	10.7	5.7	23.1
Merrill-Ring	5.0	2.9	6.9	13.0	3.9	13.2
Glenwood	13.5	3.9	3.4	12.3	3.7	6.6
Pigeon Creek #2	43.0	6.7	15.1	39.0	6.7	22.5
Swamp Creek	56.9	4.5	36.5	52.0	4.4	47.0

	10 Year Design Storm-Existing			10 Year Design Storm at Buildout in the Subarea		
Stream	Peak Flow (CFS)	Peak Stream Velocity (FPS)	Run-Off Volume (Ac-Ft)	Peak Flow (CFS)	Peak Stream Velocity (FPS)	Run-Off Volume (Ac-Ft)
Japanese	62.6	8.5	48.4	69.1	8.6	101.8
Edgewater	22.0	6.1	5.2	39.3	7.3	17.2
Powder Mill	88.5	10.6	110.6	88.5	10.6	143.9
Narbeck	37.3	9.2	22.7	37.3	9.2	36.7
Merrill-Ring	24.0	5.0	8.5	61.0	6.7	32.5
Glenwood	34.7	6.2	7.4	34.7	6.2	23.1
Pigeon Creek #2	64.0	6.9	29.6	64.0	6.9	45.0
Swamp Creek	137.5	5.3	57.4	137.5	5.3	74.0

1. The results of the model refer to conditions at the mouth of the stream where it enters Port Gardner Bay, except for Swamp Creek. Swamp Creek results are for stream conditions at 119th St. SW near Hwy 99.

2. Assumptions used in modeling included: Taking out ESAs and using 86% impervious surface in the remaining industrial/commercial areas. No increase in impervious surface was assumed for areas outside the subarea; and only existing regional detention facilities were assumed.

Run-off volumes will increase significantly for both the 2 year and 10 year storms due to the increase in impervious surfaces. The required on-site detention facilities provided with development will hold the increased run-off and release it over a period of time. So while peak flows may decrease or stay the same, the duration of the flow will be much longer.

Erosion of the streams in the study area due to stormwater flows occurred prior to urbanization due to the soil types and naturally steep gradients, and will continue to occur after development of the Subarea. Table 3.4-5 provides information on the non-erodible flow criteria for the streams, which is the flow below which erosion of the stream channel and bank should not occur. Note that the non-erodible flow criteria was exceeded in most streams approximately every 5 years prior to urbanization, so erosion was a naturally occurring event. The last column of Table 3.4-5 summarizes whether or not the non-erodible flow criteria will be exceeded in a 2 year storm. Although the non-erodible flow criteria may be exceeded in a 2 year storm, it is important to note that flows in a 2 year storm at buildout will generally be less than in an existing 2 year storm.

Column 6 of Table 3.4-5 provides the peak stormwater flows projected in the City's Drainage Basins Plans from buildout of the entire drainage basins, including the areas outside of the Subarea, based upon use of current detention standards. Some of the Drainage Basin Plans included the construction of regional detention ponds or other facilities to mitigate stormwater impacts, and the flows shown assume that these facilities have been constructed. A discussion of those facilities is included in column 6. Some of the proposed facilities have been constructed, and some are unlikely to ever be constructed - mainly due to high costs or impacts to wetlands.

Column 7 of Table 3.4-5 provides the peak stormwater flows projected based upon use of the new state stormwater standards (same information as Table 3.4-4). Modeling assumed that only existing regional detention facilities were constructed. When regional detention facilities have not yet been constructed and are still feasible, they are identified in column 6. Construction of regional facilities will mitigate impacts of development beyond that projected in the stormwater model results for buildout.

Regional facilities that have not yet been constructed and are still planned include:

- Regional detention pond located south of Westridge Mobile Home Park. (Merrill and Ring Creek)
- Parallel culverts at Veralene Way to decrease flooding. This will allow more stormwater to pass through the area, so may result in a slight increase in flows. (Merrill and Ring Creek)
- Regional detention pond on the Associated Sand and Gravel property. (Pigeon Creek #2)

It is important to note that the Drainage Basin Plan for Pigeon Creek #2 assumes that all of the flows for the west branch of Pigeon Creek #2 will continue to be fully infiltrated on the groundwater recharge area of Associated Sand and Gravel's property located south of Sievers Duecy Blvd. This will likely impact the amount of developable area on that site beyond what is shown on the environmentally sensitive areas maps.

Table 3.4-5
Summary of Stormwater Flow Information for Streams in the Study Area

Stream	Non-Erodible Flow Criteria[1]	Frequency the Non-Erodible Flow Criteria was exceeded Pre-urbanization	Existing Peak Flows in cubic feet per second (cfs)	Current Detention Criteria (Design Storm Standards)[2]	Stream Peak Flows Resulting from Buildout of Entire Basins, Including Areas Within and Outside the Subarea Based on Current Detention Standards and Regional Detention Facilities Identified in Drainage Basin Plans. These are Stormwater Model Results from the City's Drainage Basin Plans. Assumptions used in the model included: • Taking out ESAs, and assuming high impervious surfaces for remaining area - about 90% for industrial uses, 50% for multiple family properties. • Detention standards shown in column 4 (current detention criteria). • Regional detention facilities proposed in the Plans are constructed. Note that where regional detention facilities were included in the adopted plan, the facilities and status of the facilities is described.	Peak Flow Results from Stormwater Model Runs Using New State Standards for Detention.[3] (From Table 3.4-4) Assumptions included: • Taking out ESAs and using 86% impervious surface for the remaining land in the Subarea. No increase in impervious surface was assumed for areas outside the subarea. • Only existing regional detention facilities were assumed.	Theoretical Change in Existing Stream Peak Flows Resulting From Buildout in the Subarea Based on Using the New State Standard for Detention[4] (See Table 3.4-4 for existing peak flows.)
Swamp Creek	unknown	unknown	2 year: 56.9 10 yr: 137.5	10/25[5]	The City does not have an adopted drainage basin plan for Swamp Creek, as it was outside the City limits when the Drainage Basin Plans were originally completed in 1982. No new regional detention ponds are proposed in the basin.	2 year: 52.0 cfs 10 year: 137.5 cfs	Decrease in flows in 2 year storm, flows stay the same in 10 year storm
Japanese Gulch Creek	16 cfs[6]	once every 5 years	2 year: 40 10 yr: 62.6	10/25	Draft Update to Drainage Basin Plan - has not been adopted, but included the following alternatives. Alt 1: On-site detention only & 10/25 standard 2 year: 59 cfs 10 year: 98 cfs Alt 2: New State Standards for detention. Change operation of Paine Field detention pond to restrict peak outflow to 9 cfs (increase detention). (The pond is also a wetland mitigation area, so flows would not be restricted during the early growing season to protect wetland vegetation.) This will likely not occur due to the potential for open water detention areas to attract nuisance birds to the airport. 2 year: 16 cfs 10 year: 62 cfs	2 year: 29 cfs 10 year: 69.1 cfs Erodible flow criteria will occur approximately every year, but less often than currently occurring.	Decreasing flows in 2 year storm (the most frequent storm), increasing flows for 5, 10, and 25 year storm.
Edgewater Creek	8 cfs	once every 5 years	2 year: 6.5 10 yr: 22.	2/25	No regional detention ponds proposed, since any pond would have to be in riparian corridor. Plan includes replacement of 2 undersized storm drains on Mukilteo Blvd. 2 year: 10 cfs 10 year: 23 cfs	2 year: 5.5 cfs 10 year: 39.3 cfs Erodible flow criteria will not be exceeded in a 2 year storm, but will be exceeded in a 10 year storm.	Decreasing flows in 2 year storm, increasing flows for 5, 10, and 25 year storms.
Powder Mill Creek	17.6 cfs	once every 5 years, with significant erosion occurring once every 10 years.	2 year: 60.6 10 yr: 88.5	2/25	The adopted plan included 3 regional detention ponds, one of which has been constructed (north of Merrill Creek Parkway on Seaway Center). The other 2 regional detention ponds will likely not be built: These were to have been located on Boeing property, and at the south end of the basin near Kasch Park bog. 2 year: 50 cfs 10 year: 69 cfs	2 year: 54.6 cfs 10 year: 88.5 cfs Erodible flow criteria will be exceeded in a 2 year storm.	Decreasing flows in 2 year storm, flows stay the same in 10 year storm.

[1] Estimated by Brown and Caldwell Engineers for City of Everett 1982 Drainage Basin Plans.
[2] Predevelopment/Post development. E.g. for Japanese Gulch, when the 25 year storm falls on the developed site, sufficient detention must be provided so that the peak stormwater release rate is equal to the current (undeveloped conditions) release rate from a 10 year storm.
[3] Standard will be the same for all basins: The peak discharge rate for a 2 year, 24 hour storm shall not exceed 50% of the peak runoff rate for the same storm and existing site conditions and the peak discharge rates for the 10 and 100 year, 24 hour storms shall not exceed the peak runoff rate for the same storm and existing site conditions. Theoretically this standard will reduce storm flows in a 2 year storm for all basins in the City. However, for some sites such as forested areas and infiltration areas, there is no runoff in a 2 year storm, and therefore a standard that uses 50% of an existing discharge of 0 will not increase detention over a standard that uses 100% of the current 2 year storm (those basins with a current detention criteria of 2/25). See Section 3.4.3.2 for additional information regarding stormwater detention standards.
[4] See Table 3.4-2 for additional details regarding existing peak flows and projected peak flows.
[5] However most of the recent projects in Swamp Creek basin have had to obtain an HPA, and the new state standards have been required for these projects by the Department of Fish and Wildlife.
[6] To eliminate spawning bed scour in the lower reaches, stream flow velocities need to be 6 feet per second (FPS) or less. Stream flow in the lower reaches of Japanese Gulch will need to be controlled to 16 cfs or less to keep the stream velocity to 6 FPS or less.

Stream	Non-Erodible Flow Criteria[1]	Frequency the Non-Erodible Flow Criteria was exceeded Pre-urbanization	Existing Peak Flows in cubic feet per second (cfs)	Current Detention Criteria (Design Storm Standards)[2]	**Stream Peak Flows Resulting from Buildout of Entire Basins, Including Areas Within and Outside the Subarea Based on Current Detention Standards and Regional Detention Facilities Identified in Drainage Basin Plans.** These are Stormwater Model Results from the City's Drainage Basin Plans. Assumptions used in the model included: • Taking out ESAs, and assuming high impervious surfaces for remaining area - about 90% for industrial uses, 50% for multiple family properties. • Detention standards shown in column 4 (current detention criteria) • Regional detention facilities proposed in the Plans are constructed. Note that where regional detention facilities were included in the adopted plan, the facilities and status of the facilities is described.	**Peak Flow Results from Stormwater Model Runs Using New State Standards for Detention.[3]** (From Table 3.4-4) Assumptions included: • Taking out ESAs and using 86% impervious surface for the remaining land in the Subarea. No increase in impervious surface was assumed for areas outside the subarea. • Only existing regional detention facilities were assumed.	**Theoretical Change in Existing Stream Peak Flows Resulting From Buildout in the Subarea Based on Using the New State Standard for Detention[4]** (See Table 3.4-4 for existing peak flows.)
Narbeck Creek	4.8 cfs	Pre-urbanization flows were 2 cfs for 2 year storm and 58 cfs for 25 year storm.	2 year: 15.4 10 yr: 37.3	5/25	The adopted plan included the use of Narbeck Swamp for regional detention. This is not likely to happen now, since raising water levels would impact the wetland, and Paine Field is currently proposing the use of Narbeck Swamp and adjacent areas for a wetland mitigation bank. 2 year: 17 cfs 10 year: 36 cfs An alternative which was not adopted included on-site detention only. Peak flows modeled for that alternative were: 2 year: 34 cfs 10 year: 65 cfs	2 year: 10.7 cfs 10 year: 37.3 cfs Erodible flow criteria will be exceeded in a 2 year storm.	Decreasing flows in 2 year storm, flows stay the same in 10 year storm.
Merrill and Ring Creek	20 cfs	once every 5 years	2 year: 5.0 10 yr: 24.0	5/25	The adopted plan included construction of a regional pond south of Westridge Mobile Home Park, which has not yet been completed; and expansion of the regional pond at Merrill Creek Parkway, which has been completed. The plan also included installation of parallel culverts at Veralene Way, which have not been constructed. The parallel culverts will decrease flooding and will increase flows slightly because water will no longer be backing up. 2 year: 25 cfs 10 year: 66 cfs	2 year: 13 cfs 10 year: 61 cfs Flows will be lower than shown if the regional pond south of Westridge Mobile Home Park is constructed. Flows may increase slightly if the parallel culverts at Veralene Way are constructed. Erodible flow criteria will not be exceeded in a 2 year storm.	Increasing flows in both the 2 year and 10 year storms.
Glenwood Creek	16 cfs	once every 5 years	2 year: 13.5 10 yr: 34.7	2/25	The adopted plan includes an expanded bypass storm drain system, which has been completed; and in-line underground detention on Glenwood Ave., which has not yet been completed. The plan also included in-line underground detention on both sides of the Maple Heights Bridge in Harborview Park. This will likely not be constructed due to the high cost and impacts to the park. 2 year: 3.0 cfs 10 year: 11.6 cfs	2 year: 12.3 cfs 10 year: 34.7 cfs Erodible flow criteria will not be exceeded in a 2 year storm.	Slight decrease in flows in 2 year storm, flows stay the same in 10 year storm.
Pigeon Creek #2	18 cfs	once every 5 to 10 years	2 year: 43.0 10 yr: 64.0	2/25	The adopted plan included 3 regional ponds. Two of the ponds are no longer proposed due to contamination on one site (near Highland Ave. by Hannabrook), and wetland impacts on the other site (near Seahurst Ave.). The third pond is proposed on Associated Sand and Gravel property and could be constructed as a joint venture with the city when the property develops. The adopted Drainage Basin Plan includes preservation of a groundwater recharge site on Associated Sand and Gravel property located south of Sievers Duecy Blvd. 2 year: 12 cfs 10 year: 27 cfs	2 year: 39 cfs 10 year: 64 cfs Note: While this analysis did not include the reduction in flows from a potential regional detention pond on Associated Sand and Gravel property, it did include the assumption that the flows for the west branch of Pigeon Creek No. 2 continue to fully infiltrate on Associated property south of Sievers Duecy Blvd. Flows will be lower than shown if the regional pond is constructed. Erodible flow criteria will be exceeded in a 2 year storm.	Decrease in flows in 2 year storm, flows stay the same in 10 year storm.

3.4.4.2 Impacts of Development on Vegetation and Wildlife

The major impacts on vegetation and wildlife of implementing the GMA Comprehensive Plan will be the loss of natural vegetation and upland habitat and the fragmentation and isolation of the remaining riparian, hillslope, and wetland habitat. The current GMA Comprehensive Plan and the SW Everett/Paine Field Subarea Plan call for development of all buildable land in the SW Everett/Paine Field Subarea, which includes all land that is not designated environmentally sensitive. The steep-sloped ravines associated with the streams in the study area will provide the main areas of remaining wildlife habitat, and will become more important to wildlife as surrounding areas are developed. In addition, a block of habitat will remain on the west side of Paine Field, and corridors will remain along Narbeck Creek, Swamp Creek, and Glenwood Creek. Figure 3.4-39 (which is a repeat of Figure 3.4-4) shows the areas that are currently undeveloped. Figure 3.4-40 shows the areas that are expected to remain undeveloped at buildout.

As the Subarea develops, habitat will become more and more isolated. The portion of Big Gulch inside the Subarea is generally isolated from the rest of Big Gulch by SR 525/the Mukilteo Speedway. As traffic increases and Paine Field Blvd. is constructed, this area will become more isolated. Because of major roadways surrounding the Paine Field area and other existing development, little opportunity exists to connect Big Gulch habitats to Japanese Gulch or Swamp Creek.

Outside of the major ravines, few, if any, corridors will be left that are a minimum of 300 feet wide. This will likely result in disruptions to the movement between drainage basins of larger mammals such as deer. Deer may use developed areas adjacent to remaining corridors more often, such as roads and landscaped areas. This will result in more frequent conflicts for animals and humans.

The already low proportion of upland conifer forest will decrease further as development proceeds in the uplands where conifers are more numerous. Further loss of conifers will decrease the diversity of available habitats. Moreover, removal of upland conifer forest may limit conifer recruitment in the hardwood-dominated preserved areas. This could result in the loss of coniferous and mixed deciduous/coniferous habitat in the future.

Removal of large areas of forest adjacent to environmentally sensitive areas (ESAs) can result in damage to trees in the ESAs. Damage can result from compaction around roots, placing fill material over roots, and cutting roots. In addition, the remaining trees will be subject to greater forces from wind. These impacts will result in additional tree loss and blowdowns within the ESAs.

Species that may be particularly sensitive to reduction and fragmentation of forested area include neotropical birds. These are long distance insectivorous migrants that winter primarily in the New World tropics, and include flycatchers and warblers. Conversely, short-distance migrants that have adapted to survival in edge habitats (i.e., jays, house wrens, robins, starlings, blackbirds and towhees) and permanent resident species tend to maintain their populations following reduction in habitat from development. (Adams and Dove, 1989)[15]

[15] Martin-Yanny (1992) found no significant correlations between migrants or resident bird richness with percent watershed urbanization. She hypothesized that this may be due to the fact that some of the more urbanized watersheds in the study were associated with large wetland areas.

Currently Undeveloped Land

Undeveloped Land (Wetlands, Detention Ponds, Open Space & 25% + Slopes)

Parks (Private & Public)

Buffers

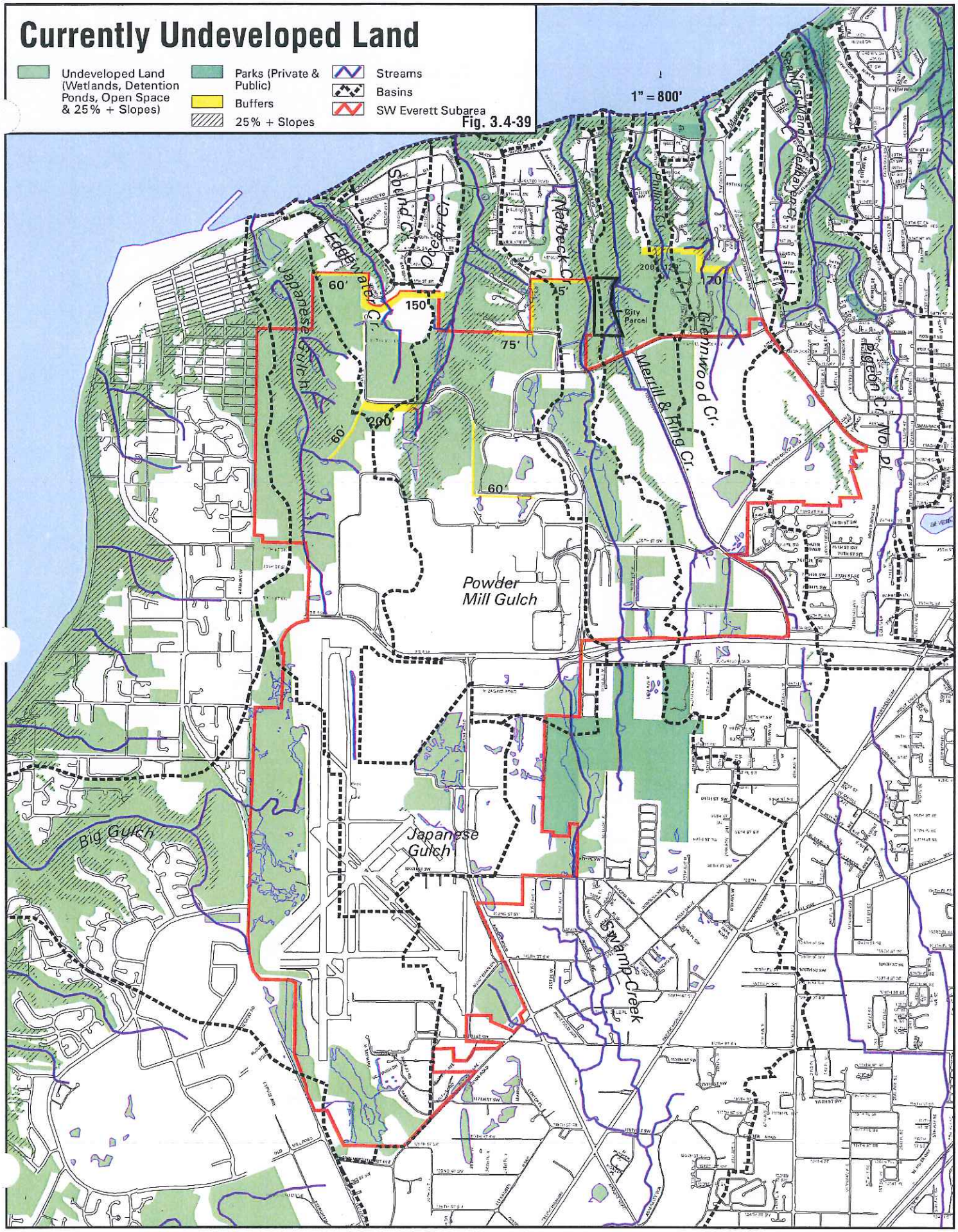
25% + Slopes

Streams

Basins

SW Everett Subarea

Fig. 3.4-39

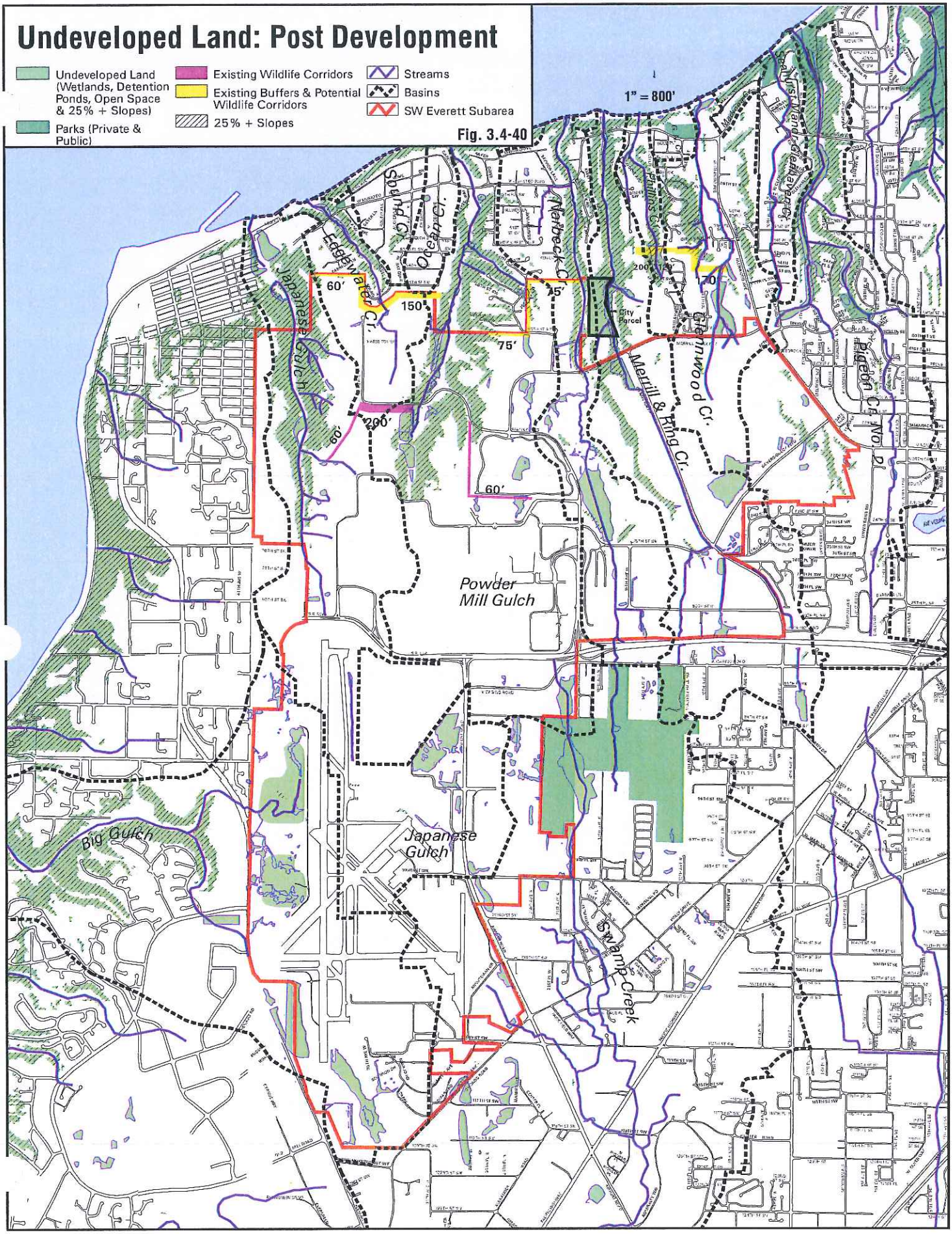


Undeveloped Land: Post Development

- Undeveloped Land (Wetlands, Detention Ponds, Open Space & 25% + Slopes)
- Parks (Private & Public)
- Existing Wildlife Corridors
- Existing Buffers & Potential Wildlife Corridors
- 25% + Slopes
- Streams
- Basins
- SW Everett Subarea

1" = 800'

Fig. 3.4-40



A study of King County wetlands concluded that all bird species that were closely tied to conifers for feeding or nesting (winter wrens, golden-crowned kinglets, western flycatchers, hermit thrushes and Wilson's warblers) declined with urbanization. (Martin-Yanny, 1992)

Disturbance due to construction favors the introduction and spread of exotic invasive species. The species of most concern are Scot's broom and English ivy (*Hedera helix*), which decrease native plant diversity through competition in shrublands and forests, respectively. This reduces available forage for deer and smaller herbivores and reduces nesting and foraging sites for shrub and understory birds.

A study of wetlands in King County found that ground nesting birds (winter wrens, hermit and Swainson's thrushes and Wilson's warblers) declined with increasing urbanization. Increased human activity, reduced buffers, and increased predation from species such as cats, rats, squirrels, opossums, foxes, coyotes and raccoons may be to blame. Ground nesting species typically associated with edge habits were found to increase with urbanization. These species commonly nest in nettles (*Urtica* dioica) and blackberry plants (*Rubus sp.*), which deter predation and humans. (Martin-Yanny, 1992)

Roads built to serve the new industrial areas in the SW Everett/Paine Field Subarea may also contribute to impacts on wildlife. Roads are a significant barrier to the movement of less mobile wildlife species such as dispersing amphibians. Migration from breeding areas in wetlands to upland forests is especially important to the rough-skinned newt (*Taricha granulosa*) and the western (boreal) toad (*Bufo boreas*). The western toad appears to have declined significantly in developed areas. On occasion, hundreds of toadlets dispersing from breeding ponds have been stranded and have died between the curbs in suburban roads that were too tall for them to climb. Even large, mobile animals such as deer tend to avoid habitat within several hundred yards of busy roads. Increased traffic volumes and longer traffic periods on existing roads that bisect corridors and habitat patches will lead to increased roadkill and decreased value as cover.

Fences constructed around developments will also limit the movement of wildlife.

As habitat becomes reduced and more isolated, wildlife will become more stressed and decrease within the study area. More frequent contact may occur with wildlife and humans and pets. Wildlife will be impacted by domestic animals such as cats and dogs. For example, deer tend to avoid dogs and may not use wildlife corridors adjacent to residential areas if dogs are present. Wildlife can also be attracted to residential areas. For example coyotes find it easier to forage in residential areas, where pets and other food sources are readily available. Other wildlife may be attracted by pet food and fruits and vegetables grown in residential areas. Opossum, raccoon and gray squirrels can become nuisances. Steps that can be taken by homeowners to reduce nuisance animals include keeping pets and pet food indoors, keeping overhanging vegetation away from houses, not planting vegetation that will attract deer, and not feeding deer. Information on trapping raccoons, opossum and squirrels is available from the Washington Department of Fish and Wildlife. Deer will not be trapped by the Department of Fish and Wildlife and feeding stations will not be established.

It is difficult to estimate the amount of land needed for specific wildlife. One estimates of the amount of land needed for a deer's home range is 320 to 640 acres. However, the amount of

habitat needed is highly dependent upon the quality of habitat for forage and cover, and the distance between areas providing forage and cover. (Stine, 1996)

3.4.4.3 Impacts of Development on Streams, Fish, and Fish Habitat

Salmonids live in streams with cool summer flows, pools for resting, vegetative cover, healthy populations of aquatic insects, gravel for spawning, and clean waters with high concentrations of dissolved oxygen and low concentrations of toxins. Development can alter each of these variables in a direction that reduces the salmonid productivity of streams. The specific stream habitat concerns associated with development of the SW Everett/Paine Field Subarea are peak flow increases, base flow reductions, channel and streambank erosion, landsliding within the inner gorges, loss of riparian forest, and water quality degradation.

From available data, it appears that the limiting factor for maintaining fisheries in the study area will be high stream flows, rather than water quality. (Jacobson. 1996 and Zimmerman, 1996)

All of the streams in the study area are sensitive to peak flow increases and base flow reductions caused by land development. Development decreases infiltration of rainwater by constructing impervious surfaces and compacting soils. Reduced infiltration increases peak flows during storms, as water flows off impervious surfaces and enters creeks within minutes of an event. It also decreases groundwater recharge and reduces summer base flows. Base flow reduction reduces summer fish habitat when upper reaches become shallow or intermittent. For example, the upper reaches of Big Gulch have changed from perennial to seasonal flow following rapid residential development within the Big Gulch Basin (Randy Sleight, Snohomish County personnel, pers. comm.).

Higher peak flow rates and longer durations of storm flows caused by conversion of forest cover to landscaped and impervious surfaces increases channel and bank erosion rates. The increased rate and duration of storm flow increases entrainment and transport of the channel sediments.

Building, clearing and landscaping within stream gorges can cause surface erosion and landsliding to occur. This will introduce large amounts of sediment. Sediment can fill pools and permeate spawning gravels, reducing their suitability for incubating eggs. Pools and clean spawning gravel are both scarce in the streams in the study area. Since pool and spawning gravel abundance currently limits fish populations, further damage to these resources can be expected to cause direct losses of fish.

Temporary sediment production during construction away from stream gorges is also a critical concern for long term maintenance of fish habitat. While the production of sediment during construction is temporary, the effects in the stream channels can be long-term. Sediment delivered to the channel from erosion of bare soils and sheet flow off construction sites can fill permanently pools, deteriorate the quality of spawning gravels, and interfere with fish respiration.

Most of the streams in the study area currently have good quality forested riparian corridors. These corridors provide food, shade, cover, woody debris, and improved water quality for fish.

Encroachment into or elimination of these forested riparian corridors will reduce these functions and degrade the quality of fish habitat.

Development of the SW Everett/Paine Field Subarea may increase the frequency of accidental chemical spills and the pollutant loadings from road and parking lot runoff. Chemical spills reaching the stream systems could cause fish kills, and excessive loadings from paved surfaces could affect the aquatic insect population on which fish depend. Any time there is a fire at a facility that has fire suppressant systems using firefighting foam or a fire where the foam is used by firefighters (airport runways, etc.), it is expected that the foam will be released into streams and kill aquatic insects. Fire fighting foam is used in fire suppressant systems by Boeing, as well as Tramco and is present where fueling occurs, so is used at Paine Field and Boeing.

3.4.4.4 Impacts of Development on Wetlands

Wetlands will be affected both directly and indirectly by development within the SW Everett/Paine Field Subarea. Grading and filling of wetlands is the most obvious direct impact; however, even unfilled wetlands will be affected by changes in hydrology. Fluctuations in depth, frequency, and duration of inundation result in harmful species composition changes (e.g., invasive species established) because most plants have very specific ranges of tolerance to hydrologic regimes (Taylor, 1994). Hydrologic changes within a basin can result from increased impervious area, altered surface drainage patterns, reduced flood storage, and blocked drainage (Horner and Reinelt, 1993 & Taylor, 1994). Changes in hydrologic regime can stem from activities as minor as construction of a single family residence without proper drainage design. Physical alteration of wetlands and their buffers (clearing of understory, dumping of debris) is also common when adjacent areas are landscaped.

Other potential impacts are the introduction of invasive species of plants and animals and loss of key species upon which other species depend. Altering hydrology, changing water quality, or introducing invasive species is likely to reduce the presence of sensitive species over time (Cooke and Azous 1994). The Puget Sound Wetlands and Stormwater Management Research Program study found high water level fluctuations had a significant impact on wetland vegetation. Wetlands with hydrologic regimes that have a high water level fluctuation during the early growing season, especially those wetlands that also become dry during the later growing period, are optimal for invasive weedy plant species. Less common species tended to grow in areas with lower water level fluctuation. Increasing duration of storm events can also be a significant factor in reducing wetland plant diversity. (Horner et al.).

DOE #8

The Puget Sound Wetlands and Stormwater Management Research Program study found no relationship between the total or average plant richness based on wetland size. The same dominant plant species were found in many wetlands. However, unusual and rare species were often found in only one wetland. 19% of the total plant species found were found in only one wetland. Regulations that allow small wetlands to be filled may result in elimination of unusual or rare species.

The Puget Sound Wetlands and Stormwater Management Research Program study found that distribution of amphibians was unrelated to wetland characteristics of size, vegetation classes,

presence of vertebrate predators and water permanents. However, reduced richness of terrestrial breeding amphibian species was found in wetlands with high water level fluctuation, specifically wetlands with water level fluctuations exceeding 20 cm. This is likely the result of wet buffer conditions. Terrestrial breeders are more frequently found in cool, flat stands, with well drained soils that are not extremely wet and tend to avoid soaked or flooded sites. Flooded habitats may also have less large downed woody material, litter and other organic material that provide food, cover and oviposition sites. Isolated wetlands in the most urbanized watersheds had the least number of amphibian species. However, even the smallest wetland studied had some species. (Horner, et al.)

DOE #8

The Puget Sound Wetlands and Stormwater Management Research Program developed guidelines for wetlands and stormwater management to minimize impacts on vegetation, amphibians, etc. The recommendations are that the frequency of water levels greater than 15 cm. above pre-development levels be limited to an annual average of six or less per year and that the durations of water levels greater than 15 cm. above or below pre-development levels be limited to less than 72 hours. However, the study states that it will be difficult for urbanizing jurisdictions to meet such standards in all areas, and it is not likely to happen if detention is the primary management tool (which is the case in most of the Subarea). The guidelines also state that mean annual water level fluctuation is likely (75% of cases measured) to be >30 cm, and somewhat likely (50% of cases measured) to be 50 cm or higher if the total impervious surface in the watershed is >40%. (Horner et al.) Existing and potential impervious surface area was calculated for drainage basins in the SW Everett/Paine Field Subarea. For the portions of the drainage basins within the Subarea, existing impervious surfaces range from 3% of total area in Glenwood Creek basin to 60% in Powder Mill Gulch Basin. Future impervious surfaces are expected to exceed 80% for the portions of some drainage basins within the Subarea. Based on the impervious surface calculations, many wetlands in the Subarea will be impacted by high water level fluctuations, and increases in the frequency and duration of high or low water levels.

Intentional diversion of stormwater into wetlands for the purpose of water quality improvement or stormwater detention affects both the hydrology and the chemistry of the wetland receiving the water. Stormwater diversion affects water chemistry by introducing toxins such as oil and other organics washed off streets and industrial areas or by diluting the natural chemistry of the wetland. Bogs are particularly sensitive to changes in natural water chemistry. Sphagnum bogs develop unique acid chemistry that favors the success of bog specialists—such as sphagnum moss (*Sphagnum spp.*), orchids, and carnivorous plants—over other species. Low pH and dissolved oxygen inhibit decomposition, so bogs are naturally very low in nutrients. When the nutrient load and pH are increased by stormwater diversion, acid-intolerant, nutrient-loving plants flourish at the expense of bog specialists.

3.4.5 POTENTIAL MEASURES TO REDUCE THE IMPACTS OF DEVELOPMENT

3.4.5.1 General Mitigation Measures

There are several opportunities for mitigating development impacts both on-site and off-site. Resource surveys are important tools for identifying resources in need of protection as well as appropriate locations for off-site mitigation. On-site mitigation activities include impact avoidance, coordination of location and timing of construction activities, and planning for revegetation and landscaping. Off-site mitigation opportunities include improving performance of stream and wetland functions, reestablishing salmonid populations in restored streams, increasing native plant diversity, and improving the quality and function of riparian and wildlife corridors.

1. All development must comply with the federal, state, and local regulations in effect at time of application for permits, except that some zoning code standards may not apply to vested projects (projects with previous approvals). All applicable permits must be obtained. These requirements include, but are not limited to the following:
   - A National Pollutant Discharge Elimination System (NPDES) permit, administered by the US Environmental Protection Agency and/or Washington State Department of Ecology will be required for clearing and grading activities if the site disturbed by land alteration activities is greater than or equal to 5 acres.
   - Any project proposing fill or alteration of wetlands must contact the US Army Corps of Engineers to determine if a permit is required. All applicable permits must be obtained.
   - A Water Quality Certification must be obtained from the Department of Ecology for projects that fall under nationwide permits that were denied, projects that cannot meet State conditions for nationwide permits, and projects that must obtain individual Corps permits must obtain an individual Water Quality Certification.
   - A Hydraulic Project Approval may be required from the State Department of Fish and Wildlife for work in streams or for discharge of stormwater to wetlands or streams.
   - All projects within the City of Everett must comply with the Stormwater Standards in effect at time of application for permits including the Design and Construction Standards and Specifications, the Drainage Basins Plans, Surfacewater System Ordinance, Drainage Ordinance and/or Minimum Technical Requirements Ordinance and Stormwater Management Manual.
   - All projects within the City of Everett that have wetlands, streams, steep slopes, and/or fish and wildlife conservation areas on or adjacent to the site must comply with Chapter 37 of the City's Zoning Code, Environmentally Sensitive Areas (ESAs).
   - All projects on Paine Field properties must comply with Snohomish County's Critical Areas Ordinance.
   - All projects on Paine Field properties must comply with Snohomish County's Drainage Ordinance.

2. Seasonal limitations should be placed on land alteration activities on sites containing or in proximity to environmentally sensitive areas. Land alteration activities are defined in the City's Design and Construction Standards and Specifications as clearing, grubbing, excavation, filling, grading and stockpiling. Determination of the exact seasonal limitation

period requires site specific information generally not available until the project's design stage. However, land alteration activities on these sites will normally be restricted to the period between April 1 and October 1.

3. Best Management Practices (BMPs) should be developed and followed for all work through streams & wetlands. These best management practices could include:
   - Work should be done in the dry season whenever possible (June 15 to September 15).
   - Minimize the width of the corridor through the wetland or stream.
   - Construction staging areas should be located outside of environmentally sensitive areas and their buffers.
   - Work shall be done so as to minimize turbidity, erosion, and other water quality impacts.
   - Proper erosion and sediment control measures shall be followed to prevent sediments from entering creeks or wetlands. Measures should include, but are not limited to placing plywood or metal sheets across the area where equipment will operate or mulching the wetland areas where equipment will operate. Wood chips placed atop a flexible mat help to prevent compaction. The wood chips and mat should be removed following construction. In addition, silt fences and hay bales should be placed between construction areas and all adjacent wetlands and streams.
   - All erosion control structures shall be inspected regularly to ensure they are maintained in working order.
   - If the corridor needs to be dewatered to do the work, the water should be pumped to a sedimentation pond where all solids can settle or an area where it can sheet flow before being discharged back to the wetland. Turbidity levels in associated wetlands and streams shall not be increased by the return flows of the water.
   - Any excavation materials must be placed in an upland area during construction. Wetland soils must be in separate piles from upland soils. After construction, wetland soils should be returned to the wetland and upland soils placed in upland areas. At a minimum, the top 18 inches of topsoils from wetland areas shall be stored separately from the rest of the soils and replaced as the top layer of fill in the wetlands following construction. Care must be taken not to make "dams" from compacted fill that would alter any subsurface flow.
   - After construction the site must be returned to its original grades. Care must be taken to not drain wetlands or alter water flows.
   - If a pipe is being trenched through the area, it should be bedded in native materials or cut off collars should be provided to prevent the pipe from dewatering the wetland.
   - When operating machinery in or near water, extreme care shall be taken to prevent any petroleum products, cement, chemicals, or other toxic or deleterious materials from entering the water. If a spill does occur, stop work immediately and contact Ecology's Spill Response Section.
   - Equipment maintenance should not occur in or adjacent to wetlands and streams.
   - If wetland plant species are not invasive, they should be removed prior to construction and placed aside in a shady damp location, such as under wet burlap sacks. Following construction they should be replaced in the wetland area.
   - Revegetation: If revegetation is required, it should be planted immediately following recontouring of the site. Native species compatible with preconstruction vegetation patterns shall be used for revegetation. Degraded emergent sites, such as Reed canary grass fields, shall be replanted with species that are representative of a higher

quality emergent, scrub-shrub or forested wetland. If revegetation is required, monitoring should occur once a year for a minimum of two years.

4. Utility purveyors in Snohomish County have elected to utilize the Department of Ecology BMPs to minimize construction impacts to streams and wetlands as part of their consensus work with the County in redrafting the Critical Areas Ordinance.

5. Natural drainage patterns regarding proportion of stormwater runoff to sub-basins must be maintained.

6. All collected surfacewater exiting the subject property must be conveyed to the nearest established, stable drainage course by pipe or by an approved swale in a manner that will not result in erosion or flooding. Sufficient downstream information and analysis must be provided to enable the City to determine that this requirement is being met. Private easements will be required if conveyance must occur across private property. Any encroachment into environmentally sensitive areas will require submittal of additional information and a restoration plan.

7. Pre-construction conferences should be held with the Planning Department, Public Works Inspector and site development manager on sites containing environmentally sensitive areas in order to ensure that all development standards are understood.

8. On sites where wetlands, streams and/or buffer mitigation is required, the City/County should require that a report be submitted by the wetland/stream expert following construction stating that the construction was completed per plans.

9. A permanent fence should be constructed along the entire edge of any environmentally sensitive area buffer. The design of the fence should be split rail, or an alternative approved by the Planning Department prior to issuance of permits. ESA signs should be placed at approximately 50 foot intervals along the fence. Signs are available from the Planning and Community Development Department.

3.4.5.2 Mitigating Impacts of Development on Vegetation and Wildlife

1. Vegetation surveys can identify potentially valuable plant resources, from rare or uncommon species to communities of high local diversity and pockets of undisturbed native vegetation. The results of such a survey can be used to identify areas that may be better devoted to parks or conservation easements than to development. Because of the limited extent of coniferous and mixed forest habitat, upland habitats that include significant conifers are among priority areas identified for reduced impact.

2. Exotic invasive species should be controlled. English ivy (*Hedera helix*) should not be planted in the Subarea. Properties should be maintained to eliminate Scot's broom.

3. Project design can be used to minimize impacts on site. For example, laydown, staging, and parking areas may be located in existing disturbed areas rather than in adjacent established vegetation. Protection of existing vegetation on site will reduce erosion as well as protect plant and wildlife. Where protection is not practical, disturbed areas should be revegetated as soon after disturbance as possible. A variety of native species can be

planted to increase local diversity and provide attractive wildlife habitat while countering erosion. Plants with noted habitat or food value for wildlife should be selected wherever possible. A list of recommended species is included in Appendix 3.4.6.

4. Water use efficiency is another advantage of landscaping with native plants. Reduced irrigation means reduced likelihood of erosion, siltation, and landsliding resulting from the development, reduced impacts to local hydrology, reduced maintenance costs, and enhanced water availability for other consumptive uses.

5. Conifer trees should be retained whenever feasible. In addition, snags should be retained to support populations of cavity nesting species, such as woodpeckers. (Martin-Yanny, 1992)

6. Where development occurs adjacent to environmentally sensitive areas, an analysis of hazardous trees in the environmentally sensitive area should be completed by a professional arborist prior to issuance of occupancy permits. Any trees that are hazardous (i.e., are diseased or damaged and have the potential to fall on development) should be removed. Where possible, the trunks of these trees should be left for snags. For each tree cut, up to three coniferous trees should be planted.

7. Three level vegetation (groundcover, shrubs and trees) is needed for wildlife. Diversity of buffer habitat should be ensured through the planting of later successional forested stages of vegetation (e.g. Western red cedar, Douglas fir, and Western hemlock) where needed and appropriate. Western red cedar and Western hemlock should only be planted in established alder forest.

8. Offsite improvement projects may be considered to mitigate development impacts. For example, shade-tolerant conifers like Western hemlock, Western red cedar, and Sitka spruce can be planted in the understory of existing deciduous forests to augment the development of mixed and coniferous forest. Other off-site improvements could include removal of exotic vegetation (particularly Himalayan blackberry, Scot's broom, and English ivy) and replanting of native species. Reforestation in areas that can serve as wildlife movement corridors could improve wildlife populations as well as plant communities. In areas where significant improvements have been made, it might be prudent to consider permanent protection from future development.

9. Wildlife surveys can identify areas of significant wildlife habitat. Of particular importance are current and potential nesting habitat of valued wildlife, including bald eagles and other raptors, great blue herons, and sensitive species like pond-breeding amphibians. Where appropriate, construction planning could take the breeding seasons of significant wildlife species into account. Surveys can help identify existing movement corridors as well as areas where new movement corridors, developed as part of mitigation activities, would be most effective.

10. The most important means of protecting wildlife and habitat lies in protecting identified priority habitats, including wetlands, riparian areas, and corridors. The City's Zoning Code requires that a habitat management plan be prepared for development proposed on/or adjacent to a habitat of primary association, which includes priority habitats listed by the Washington State Department of Wildlife, as well as habitats of federally or state listed

endangered, threatened, candidate, sensitive, priority, and monitored wildlife or plant species, which, if altered, may reduce the likelihood that the species will maintain and reproduce over the long term.

11. Wetland mitigation plantings should be designed to simulate Pacific NW native plant communities in terms of composition, cover-abundance, and structure.

12. When enhancing, restoring, or creating wetland, stream, steep slope and buffer areas, sufficient shrub or woody debris cover should be maintained and planted in and adjacent to environmentally sensitive areas to conceal nests from terrestrial predators and thereby insure the survival of ground nesting bird species. For example, downed logs which provide quality nesting habitat for winter wrens should be maintained and fast growing shrubs (i.e. red-osier dogwood) should be planted to provide added concealment of ground nests from predators. In addition, to minimize entrance of predators and humans into wetlands, "barrier" species such as native roses (*Rosa sp.*) could be planted in buffers. (Martin-Yanny, 1992)

13. Total bird abundance and richness (number of species present) in wetlands was found to increase significantly with wetland size. Therefore, when feasible, wetland creation projects should occur adjacent to existing wetlands or be connected by natural corridors to neighboring habitat.

14. The City's Zoning Code requires that perimeter landscaping be provided around most sites, that landscaping of the parking lot be provided, and in some cases that interior landscaping be provided. These areas could be vegetated with native plant species adapted to the Puget Sound area. A wide mix of native species should be planted to increase plant species diversity.

15. No development is permitted on the portion of Boeing site with major yew grove per the Boeing expansion decision document. Any future development of the area is subject to additional SEPA analysis of impacts on yew trees and groves.

16. The DNR Natural Heritage Program was contacted for known records of endangered, threatened, and sensitive plants and unique plant communities in the project area. As no thorough, systematic botanical surveys have been conducted of the area, unknown populations of unique or special status plants may exist in the SW Everett/Paine Field Subarea. If an endangered plant or wildlife species is found on a site prior to or during development, the developer must comply with all applicable federal, state, and local regulations, including preparation of habitat management plans.

17. Although eagles are not currently known to be nesting in the Subarea, they do nest in the study area. Eagles sometimes move nest locations within their territories, and more eagles are nesting in urban areas, often at sites that appear to be extremely marginal (Milner, 1996). Potential nesting sites do occur and will continue to occur within the ravines and in other forested areas within the Subarea. The City's Environmentally Sensitive Areas Ordinance requires that trees within the ravines and other environmentally sensitive areas be protected in most cases. (In the past, the Planning Director has allowed trees in environmentally sensitive areas to be cut in emergency situations, such as where they pose a hazard to structures, and for construction of required utilities.) If a nest does occur

on or adjacent to a development proposal, the owner currently has to work with the Washington Department of Fish and Wildlife before they can obtain a permit from the City. The City could work with the Department of Fish and Wildlife to incorporate an eagle management plan in the adopted Subarea Plan. This would expedite permitting if an eagles nest is found near a proposed development. The plan could be similar to the following "generic" plan that was developed for Eliza Island:

Bald Eagle Management Plan

a. Between February 1 and July 15, there will be no external construction or land clearing within 660 feet of a viable nest site. If the nest site is determined to be inactive by the WDFW in April, construction or land clearing may begin on May 1.

b. On any lot between 400 and 660 feet of a viable nest site, no conifer greater than six feet tall will be taken, provided that such conifers may be cleared for a building site and path and an area within 25 feet of the building site. Conifers may only be removed for drainfields if no reasonable alternative exists.

c. On any lot 400 feet or greater from a viable nest site, a minimum of 50% of the pre-construction or clearing stand with stems/acre and size glasses representative of the conifer stand greater than 6 feet tall must remain. In addition, on any shoreline lot, a minimum of 3 conifers greater than 18 inches d.b.h. must remain within 75 feet landward of the survey staking line on the plat map. Pruning of branches for view is acceptable if not more than 30% of the live crown is removed.

d. Any landowner objecting to the above conditions can negotiate an individual site management plan with the WDFW. Any construction or land clearing within 400 feet of a viable nest site will also require an individual bald eagle management plan with the WDFW. The WDFW will provide locations of viable and active nest sites to Whatcom County and the Eliza Island Beach Club by May 1 annually.

Definitions

a. Active Nest. Any nest with eagles actively nesting as determined by the presence of an adult in incubating posture, eggs, or young.

b. Viable Nest Site. Any nest site (tree(s)) which has/does contained(s) a nest in the past and is likely to have actively nesting eagles in the future as determined by the WDFW. This will include recently active nest sites including those which recently lost nests but still have nest branch structure capable of supporting a nest.

c. D.B.H. Diameter at breast height. The diameter of the tree 4.5 feet above the ground.

18. No removal of vegetation should be permitted in wildlife corridors, except as approved by the Planning Director and as needed to provide construction of utilities and/or access to properties. Any cleared areas shall be replanted with native vegetation with the intent to establish coniferous forest, except that utility corridors shall be established with native shrubs and groundcover. In addition, corridors that are narrow or sparsely vegetated should provide additional plantings of native vegetation.

19. The City could allow limited clearing of sites for marketing purposes prior to application for development permits. Clearing should be limited to areas outside of environmentally sensitive areas, and buffers for these areas shall be doubled until such time as a development is proposed on the site. Clearing should not be permitted in any area designated as buffer and/or wildlife corridors, and should not occur within 300 feet of a residential area. Clearing should not remove coniferous trees. Erosion control measures should be installed as appropriate to the site and amount of work. A clearing plan should be submitted to the City Planning and Public Works Departments for their approval, and temporary detention ponds should be provided for any clearing as required by the Public Works Department.

20. Because the area is generally built out, few opportunities exist to establish east-west wildlife corridors between basins in the residential areas to the north of the Subarea.

21. The buffers between industrial developments and the residential areas and buffers separating residential areas (see Figure 3.4-40) could be designated as wildlife corridors[16] as well as buffers. Plantings in selected buffers could be enhanced to provide additional cover and food sources for wildlife.

22. Developments that are eliminating existing wildlife habitat, particularly forested habitat, could be required to enhance remaining wildlife corridors in other portions of the study area, or to contribute to a fund to purchase land to create wider wildlife corridors in the study area, or to secure the east-west connection across the Bhend property.

23. Fences should not be permitted where they would limit wildlife movement through environmentally sensitive areas corridors.

24. Other communities have provided corridors for wildlife under busy roadways to connect areas of wildlife habitat.

25. The City could consider revising the Environmentally Sensitive Areas Ordinance to allow reductions in wetland replacement ratios when improvements to other wetland functions such as wildlife habitat are provided, as long as a minimum of 1:1 replacement of wetland impacts (area) occurs. For example, rather than providing a 3:1 replacement for filled wetlands, a development could provide a larger buffer of coniferous forest than required by the Zoning Code.

[16] Defined as "continuous vegetative corridors linking watersheds" in the City's Environmentally Sensitive Areas Ordinance.

3.4.5.3 Mitigating Impacts on Streams, Fish, and Fish Habitat

1. There are a variety of on-site mitigation measures that can be used to reduce impacts on streams and fish habitat. These measures include:
   - stormwater volume and rate control using infiltration ponds and retention/detention;
   - stormwater quality treatment using infiltration basin, wetponds and constructed wetlands, emergent swales, grass swales, sand filtration basins;
   - streambank erosion control measures such as extended detention dry ponds, wetvaults, and extended detention dry vaults;
   - on-site erosion and sediment control;
   - spill response planning; and
   - protection of riparian buffers and erosion and landslide hazard areas.

2. Off-site mitigation measures include:
   - restoration of stream channels;
   - retrofitting of problem stormwater outfalls;
   - improvement of anadromous fish access to streams; and
   - enhancement of stream habitat.

3. Impacts on peak flows can be mitigated by engineered stormwater detention and infiltration. Stormwater detention facilities collect water from developed areas and release it at a rate slower than that at which it enters the collection system. The excess of inflow over outflow is temporarily stored in a pond or vault and is typically released over a few hours or a few days.

4. Due to the construction of new impervious surfaces, stormwater volumes will increase significantly. Base flow reductions can only be mitigated by the use of infiltration systems for collected stormwater. Infiltration systems will be required whenever feasible. This study area, however, has few areas of soils suitable for large scale infiltration. These areas should be identified and should be considered for development as a means of improving overall infiltration in the study area. The Associated Sand and Gravel property located south of Sievers-Duecy Blvd. is one area where stormwater is currently being infiltrated. This study assumes that infiltration will continue to occur on that site.

5. The City should consider revising the Environmentally Sensitive Areas Ordinance to allow reductions in wetland replacement ratios when improvements to other wetland functions such as groundwater support and stormwater control are provided, as long as a minimum of 1:1 replacement of wetland impacts (area) occurs.

6. Effective on-site erosion and sediment control is critical for construction occurring in any basin draining to a fish-bearing stream or lake.

7. The riparian habitats associated with study area streams are generally in good condition, although the proportion of conifers is low. Riparian corridors have been an important factor in maintaining the ecological values of these streams in the face of large hydrologic changes from development. The riparian corridors currently include the entire inner gorges of many streams. Because most activities within most areas of the gorges are prohibited by the landslide and erosion hazard requirements of the Environmentally

Sensitive Areas Ordinance (the side slopes are in excess of 25 percent), the resulting riparian buffer is beyond the buffer requirement for the streams. Functional riparian corridors should be delineated and protected in places where the ESA restrictions do not sufficiently protect the corridor functions.

8. Assisting the conversion of riparian zones from deciduous to coniferous or mixed forest is likely to improve the long-term fish and terrestrial habitat of these streams. While riparian corridors are currently providing needed ecological functions, most of these stands are dominated by red alder. Red alder is a relatively short-lived species, and alder snags and logs decay relatively rapidly. A forest stand including conifers would have a longer lived canopy and would provide longer-lasting woody debris to the channels. Natural regeneration of conifers within the riparian corridors is slow, and silvicultural treatments designed to encourage forest succession to conifers would eventually enhance wildlife habitat and stream conditions.

9. Many streams, such as Narbeck, are experiencing significant local erosion problems as a result of poorly designed stormwater outfalls from residential development. Identification and correction of these problem outfalls is an inexpensive means of significantly improving habitat in these streams. Some outfalls can be routed to dispersal pipes laid on contour with rip-rap to disperse energy. Others can be improved simply by taking the pipe all the way to the channel rather than discharging at the top of the steep erodible gorge. Problem outfalls should be inventoried, and a retrofit program should be implemented.

10. Fish access to the Puget Sound streams bearing or potentially bearing anadromous fish, including Big Gulch, Japanese Gulch, Merrill and Ring Creek, Glenwood Creek, Powder Mill Gulch, and Pigeon Creek #2, should be evaluated and improved where appropriate.

11. Recommend/encourage developers to provide understructure parking or parking structures to reduce the amount of impervious surface and pollutants in stormwater runoff. (Under current market conditions this isn't likely to occur.)

12. Storm detention facilities are not permitted in riparian corridors or their buffers.

13. Many of the roads constructed in the Subarea in the past, as well as past developments have not included water quality treatment of stormwater runoff such as wetponds or vegetated swales. All pollutants emitted in these areas wash directly into the stormwater system and streams. The City's existing and proposed stormwater manuals include standards for retrofitting stormwater treatment facilities on sites where expansion or renovation is occurring. As widening or other reconstruction of roads is proposed in the Subarea, the City and County should evaluate the possibility of adding stormwater treatment facilities to treat road runoff, and retrofit the systems when feasible. (This is often difficult since stormwater treatment was not considered in the design of existing facilities, and stormwater often discharges at many points along a roadway.) The City and County should also continue to monitor the feasibility of new technologies for underground water quality treatment.

3.4.5.4 Wetlands

1. With respect to wetlands, the goals of the GMA are to have no net loss of wetland resources or wetland functions in the short-term and to have a net gain of wetland resources and functions in the long-term. In order to achieve these goals, the City has defined the following hierarchy:
   (1) Avoid impacts by not taking the destructive action.
   (2) Minimize impacts by limiting the magnitude of the disturbance to wetland habitats by utilizing appropriate technology.
   (3) Rectify the impact by rehabilitating or restoring the affected areas.
   (4) Reduce or eliminate the impact over time by prevention and maintenance during the life of the disturbing activity.
   (5) Compensate the impact by replacing, enhancing, or creating wetland areas.
   (6) Monitor impacts and take corrective measures.

2. Mitigating measures include avoiding impacts in areas where habitats are rare, sensitive, or critical for key species of wildlife. Avoidance is perhaps most important in bogs and in forested wetlands. Minimizing disturbance of wetlands that are habitats for sensitive species, are regionally rare habitats, or perform functions that are needed or limited in a drainage is preferred. Surfacewater storage is a function that is limited in the southern half of the SW Everett/Paine Field Subarea. Preservation of wetlands with good storage capacity (such as Narbeck Swamp) is therefore a priority. Preservation or enhancement of wetlands is important in the industrial areas where pollution and large amounts of impervious surface are a problem. This is especially true because of normally limited on-site stormwater storage, flood attenuation, and water quality improvement in industrial areas.

3. Mitigation for impacts to wetlands usually requires more area than the original wetland. This is due to the time it takes for the mitigation area to provide the same functions as the impacted wetland, and the historical failure of mitigation wetlands to provide the same functions as the impacted wetland. The City's Environmentally Sensitive Areas regulations require replacement ratios ranging from 6:1 for Category 1 wetlands to 1.25: 1 for Category 4 wetlands.

4. The wetland mapping completed for the Subarea Plan is not sufficient for purposes of project review. At the time development is proposed on a site containing wetlands, a wetland delineation and study must be completed by a biologist with expertise in wetlands in compliance with Chapter 37 of the Zoning Code. The wetland must be retained and buffers must be provided per the requirements of Chapter 37. In some cases the applicant may propose modification of the wetland with mitigation, or buffer width reduction. If modification of the wetland or buffer is proposed, additional studies must be completed and the alterations must be approved by the Planning Director using Review Process IIB (property owners within 300 feet are notified and have an opportunity to appeal the decision).

5. Wetlands can change over time and incomplete wetland assessment data is available on some wetlands. When a project is proposed on a specific site, the wetland assessment(s) for the site should be updated/completed.

6. Based on the wetland assessments, the following general mitigation requirements are recommended for wetlands in the Subarea (see Table 3.4-6 for listing of specific wetland recommendations):
   - The flood/storm water control, baseflow support and water quality improvement functions should be protected and maintained on or immediately offsite.
   - The habitat functions should be protected and maintained onsite or immediately offsite for Group 1 wetlands greater than 1 acre, or wetlands of any Group that:
     a. are located within a riparian or wildlife corridor;
     b. drain into an adjacent Group 1 wetland (such as Narbeck or Kasch Swamps) or regionally rare wetland types such as Aulinger Swamp or Kasch Bog.
   - Mitigation for impacts to habitat functions for wetlands not meeting the above requirements, may be provided out of basin.
   - Enhance the flood/storm water and baseflow functions for wetlands located on the Mukilteo plateau in order to improve the habitat functions of downstream wetlands.

   The basis for these recommendations is that the maintenance of stormwater/floodwater control and baseflow functions and water quality control functions, especially in upper watershed wetlands within developed areas, is critical to the maintenance of the habitat functions of downstream wetlands. Some of the upper watershed wetlands are isolated and located several thousands of feet from adjoining wetlands, wildlife corridors and riparian corridors and have, therefore, limited importance to wildlife and low performance of habitat functions. In these circumstances, it is appropriate to move the habitat function to a larger offsite or out of basin wetland ecosystem that has a higher potential to provide significant gains in the habitat function.

7. Table 3.4-6 provides a summary of potential wetland mitigations by basin. When wetland mitigation is required on a specific site, these measures should be considered.

8. Natural wetlands should not be used for detention of stormwater. In addition, stormwater detention is generally not allowed in wetlands created for mitigation. However, with certain types of mitigation wetlands, a restricted outlet and fluctuating water table is a desired and designed feature of the wetland. Detention of clean or treated stormwater may be permissible under these circumstances.

9. The City could consider revising the Environmentally Sensitive Areas Ordinance to allow reductions in wetland replacement ratios when improvements to other wetland functions such as groundwater support and stormwater control are provided, as long as a minimum of 1:1 replacement of wetland impacts (area) occurs.

10. Development of the site must not adversely affect the hydrology of wetlands on or adjacent to the site. The quantity and rate of water entering the wetlands must be determined for current conditions. Under developed conditions a similar rate and quality of roof drainage or treated runoff must continue to be discharged to the wetland(s). Prior to application for building permits and plan review by the Public Works Department, a characterization of the hydrology of the wetland(s) on or adjacent to this project that may be affected by the development of this site must be submitted to and approved by the Planning and Public Works Departments.

Table 3.4-6
Summary of Potential Wetland Mitigations by Basin

Basin	Potential for Enhancement of Hydrological Support, Flood/Storm Water Control Functions	Potential for Enhancement of Water Quality Control Functions	Potential for Enhancement of Habitat Functions
Big Gulch Basin	Yes - Create check dams to pond water for B27-30 and BG16a,b,c	Yes - Measures recommended for previous function should be implemented	Yes but limited - Scrub/Shrub enhancement on BG 16a,b,c (also buffer plantings) and BG28,30 and coniferous plantings on BG28, 30
Japanese Gulch Basin	Little potential on existing wetlands - already performing at high level	Little potential - Restrict outlet for JG 7 and 10	Yes but limited mainly to replanting the riparian buffer along the middle and lower reaches of Japanese Gulch Creek.
Edgewater Creek	Yes - enhancement and creation of this function in the upper watershed	Yes - restrict outlet of EC3	Yes - habitat structure for EC3 would be improved through additional flooding recommended under water quality control function.
Powder Mill Gulch	Limited because of extent of development in upper basin. Increase height of outlet on PM18 to increase flood and stormwater control	Limited because of extent of development. Increase height of outlet on PM18	Limited - enhance habitat in PM 11, 15, and 16 through coniferous and scrub/shrub plantings and addtional buffer plantings.
Narbeck Creek	Yes - Create and enhance wetland north of Narbeck Swamp (NC6)	Yes - Create and enhance wetland north of Narbeck Swamp (NC6)	Yes - Create and enhance wetland north of Narbeck Swamp (NC6). Control cutting of forested slopes in Narbeck Creek and replant with more diverse coniferous species. Other wetlands in the upper watershed such as 7 and 8a,b,c have limited biological significance.
Merrill and Ring Creek	Yes - restrict or berm the outlets of MR5 to 8. Create wetland within ravine north of Upper Ridge Road and adjacent to Hardeson Road by restricting outlet.	Yes - Same recommendations as for the Flood/Storm water control function. Also consider restricting outlet of MR9 (without affecting fish passage).	Limited - most of the degraded wetlands in the upper watershed (MR2 to 8) are isolated and have limited biological significance.
Phillips Creek Basin	Yes - restrict outlet of PHC1	Yes - restrict outlet of PHC1	None identified
Glenwood Creek Basin	Yes - Infiltration function presently occuring in Associated Sand and Gravel operation must be maintained when operation closes in future.	Yes - Water quality treatment function provided by infiltration at sand and gravel operation must be maintained in order to protect high performing downstream wetland functions. Increase flooding in GC9 (without affecting fish passage).	Yes - Enhance GC2,4,5, and 7 with scrub/shrub, forested and buffer plantings. Create more diverse wetland habitat structure in GC9 by removing fill.
Glennhaven Creek Basin	Little Potential	Little Potential	Little Potential
Pigeon Creek #2	Yes - Maintain infiltration function provided by Assoicated Sand and Gravel operation in upper watershed. Remove sediment from PC2 and restrict outlet without affecting fish passage.	Yes - Maintain infiltration function provided by Associated Sand and Gravel in upper watershed. Remove sediment from PC2 and restrict outlet. Restrict outlets on WPC1 and EPC1.	Yes - Create more diverse emergent, scrub/shrub and forested wetland by restoring PC2 (remove sediment, create open water).
Swamp Creek	Yes - Create and enhance wetland on Walter Hall Golf Course including wetlands SC5a,b,c,d and restrict outlet of SC13.	Yes - Implement previous recommendations for Flood/Storm Water Control Functions.	Limited Potential - The wetlands that are not directly on Swamp Creek and less than 1 acres, are isolated, wetlands with limited biological significance.

11. Discharge of water to wetlands should mimic natural discharges as much as is feasible. Point source discharges should not be created where they do not naturally occur. Techniques that result in dispersed discharge, such as dispersion trenches or buried perforated pipe located at wetland buffer edges, can be used to mimic naturally occurring sheet flow into wetlands.

12. All trash located in the preserved wetlands, streams, and their associated buffers must be removed.

13. Wetland monitoring shall occur per the standards in the City's Administrative Guidelines for the Identification and Evaluation of Wetlands and Streams.

14. A biologist should be on site during all construction activities involving the use of heavy equipment adjacent to environmentally sensitive areas. The biologist should have authority to impose a stop work order immediately if the biologist determines that work activities violate buffer and setback requirements.

15. Monitoring of water quality of stormwater runoff to wetlands should be provided to verify assumptions for pollutant loadings in wetlands.

3.4.5.5 Water Quality Requirements

1. Developments with hazardous wastes on-site must comply with all applicable state and federal storage requirements. (See Section 3.6 of this DEIS)

2. Staging areas for vehicle maintenance activities during construction must be specified. These areas must be well away from all drainage courses.

3. Developers could be required to provide educational signs to communicate the importance of water quality, to benefit both the environment and the public.

4. The use of fertilizers, herbicides, and pesticides could be minimized by using low-maintenance native plants for landscaping.

5. Application of fungicides, herbicides, insecticides, and fertilizers could be prohibited from January through April when soils are frequently saturated and storm events generate substantial runoff.

6. All sites containing fuel tanks must comply with the requirements listed in Section 3.6 of this DEIS, including secondary containment equal to at least 110% of the capacity of the fuel tanks.

7. All storm drains must be stenciled with substantially the following language: "Dump No Waste, Drains to (Stream/Wetland/Groundwater." This reminder is typically spray-painted on to the ground adjacent to the catch basin with the use of a stencil. The treatment needs to be repeated, approximately annually, when the paint wears off. The developer/owner may either perform the stenciling, or give permission for volunteer groups to enter onto the property and perform the stenciling.

8. During construction activities, all spills must be contained and removed in such manner as to prevent their entering the waters and soils of the state. Cleanup of spills should take precedence over other work on-site.

9. Developments could be required to perform periodic water quality sampling for toxic substances which may contribute to groundwater and surfacewater contamination.

10. Any new airplane fueling stations should:
    - Minimize the potential for aviation fuel spills to enter the stormwater drainage system, by implementing source control options such as the following. The detailed design shall be reviewed and approved by the Responsible Official.
    - install new coalescing plate separator to serve surface runoff from new fueling stalls;
    - install a stormwater cut-off trench by the airplane wing fueling ports for new fueling stalls; and
    - install piping valving and an automated control system to divert dry weather runoff to a holding tank for periodic pump-out.

    Alternatively undertake a technical analysis and develop a plan that provides equal or better protection of the surfacewaters.

11. In addition to new airplane fueling stations, the following measures should be implemented after review by the Responsible Official:
    - Provide an ongoing employee training program to minimize the number of accidental fuel spill incidences.
    - Provide a spill control plan to control spills when they occur.

12. Vehicle Washing Areas: A specially designated area will be required for washing of cars or fleet vehicles. The washing area must be hydrologically isolated from the rest of the site, be covered, and wash water from the area must drain to the sanitary sewer after being routed through a baffle-type oil/water separator designed to city standards. Signs must be posted on the site limiting car and fleet vehicle washing to the designated area only. A note stating that car and fleet washing is only permissible in the designated area must be included on the storm drainage plans. (This standard may be in the City's new Stormwater Manual.)

13. Airplane Washing Areas: Paine Field should continue to look for solutions to water quality degradation caused by washing and de-icing airplanes on the runway.

14. Sites that use firefighting foam (AFFF) should construct containment systems for an acceptable ratio of potentially released foam and solution. The solution could then be metered out at a rate that would not impact wastewater treatment plants or aquatic insects.

15. Stormwater drainage systems should be maintained to ensure proper functioning, including vegetation harvesting and cleaning of sumps, to avoid infiltration of contaminants to subsurface water. Maintenance must occur per the standards in the City's Design and Construction Standards and Specifications and/or the new stormwater standards manual when adopted.

16. Turbidity sampling could be required for all projects in the construction phase. (The City currently does turbidity testing on City projects, but testing has generally not been required for private projects. Turbidity testing was required during construction of one residential plat. The equipment to do turbidity testing costs approximately $1,000 - $2,000. There is no additional cost to test samples.)

17. On sites with a previous history of water quality violations, an analysis of water quality impacts will be required at time of application for any expansions. The City may require additional measures more stringent than contained in the City's Stormwater Manual and Design and Construction Standards and Specifications or measures specifically tailored to address the particular site's impacts.

3.4.5.6 Groundwater

1. Hydrogeologic studies could be required for any project that may impact groundwater aquifers. Recommendations of the studies should be implemented as part of the development.

2. Measures could be imposed at the design stage of future developments to mitigate groundwater impacts in areas where local hydrogeologic conditions are conducive to such mitigation. The results of ongoing subsurface evaluations should be considered in the final designs of developments, such that predevelopment recharge to perched groundwater system is maintained.

3. Require storage of all hazardous materials to comply with all applicable spill control requirements and Department of Ecology requirements. (See Section 3.6 of this DEIS)

4. Future development should incorporate facilities and procedures for the safe handling and effective monitoring of toxic or hazardous materials, which include spill entrapment, training, and special handling, thus, reducing the potential for release of hazardous or toxic materials to the groundwater system.

5. New fuel tanks must be installed per the Washington State Department of Ecology's Underground Storage Tank Management Program. (See Section 3.6 of this DEIS)

6. Stormwater drainage systems should be maintained to ensure proper functioning, including vegetation harvesting and cleaning of sumps, to avoid infiltration of contaminants to subsurface water.

3.4.5.7 Specific Mitigation Measures for Study Area Basins

Big Gulch Basin Mitigation

1. This system is experiencing severe erosion and sedimentation problems as a result of high storm flows. Creation or enlargement of regional detention facilities should be considered, and infiltration should be pursued wherever possible to improve base flow conditions in Big Gulch. In addition, there is little or no detention on the west side of Paine Field, which is

causing significant erosion and scouring in the upper watershed. Additional detention should be provided on Paine Field properties.

2. Because of the existing and worsening erosion problem in Big Gulch, new developments should control not only the peak flow rates of their runoff, but also the duration of all sediment-moving flows. Such detention facilities can be designed with a continuous hydrologic model that allows durational analysis, or a surrogate design-event methodology can be used. King County has developed a surrogate methodology for designing duration-control facilities using either the Santa Barbara Urban Hydrograph (SBUH) or the Soil Conservation Service (SCS) event methodologies. This methodology, called the Streat Protection Standard, focuses control on the more frequent storm events. Facilities are designed with the following maximum release rates for three design storms:

Design Event	Maximum Release Rate
2-year developed condition storm	One-half the 2-year pre-developed peak rate
10-year developed condition storm	2-year pre-developed peak rate
Largest storm of regulatory concern	Pre-developed peak rate - largest storm of concern

3. Outfalls to Big Gulch Creek and its tributaries should extend all the way to the channel elevation and include energy dissipation structures. The storm drainage problems identified in the report *Storm Drainage Impacts to Big Gulch Creek, Snohomish County, Washington* should be further evaluated and solutions implemented by Snohomish County, the City of Mukilteo, Olympus Terrace Sewer District, and volunteers from Saltwater Anglers and Stilly-Snohomish Fisheries Enhancement Task Force.

4. The regional detention pond (Sector 7) located west of Paine Field Blvd. in the south fork of Big Gulch could be expanded. (Sleight, 1996)

5. Stream habitat would be improved by increasing the number and size of pools and by importing clean spawning gravels. Anadromous fish access should be evaluated and improved, if appropriate.

6. Aulinger Swamp contains a significant Class I bog. Bogs are very sensitive to water quality changes caused by increased inflow. Aulinger Swamp should be protected from increased flow and should not be used for stormwater detention, infiltration, or water quality improvement efforts.

Japanese Gulch Basin Mitigation

1. Anadromous fish access should be evaluated and improved by retrofitting the Burlington Northern culvert in the lower reach, removing the concrete flume, and restoring the stream channel.

2. The City should complete the update of the City's Drainage Basin Plan for Japanese Gulch.

3. The Port Gardner Bay Drainage Basin plan calls for optimizing use of the existing 45 acre-foot detention system on Paine Field property.

4. The riparian vegetation immediately adjacent to the stream north of Mukilteo Blvd should be restored.

Edgewater Creek Basin Mitigation

1. The April 1992 Port Gardner Bay Drainage Plan Update Report No. 5 calls for upgrading two undersized storm drains on Mukilteo Boulevard and modifying other drainage structures to provide peak flow mitigation.

Powder Mill Gulch Basin Mitigation

1. Powder Mill Gulch Creek may be an appropriate site for reintroduction of resident cutthroat trout. If the water quality of this stream remains stable, and if an adequate population of aquatic insects develops, the reach between Seaway Boulevard and Mukilteo Boulevard would be appropriate for the introduction of resident cutthroat trout. (Rearing of salmonids in this reach, as done in Piper Creek, should also be considered.) However, restoration or creation of salmonid habitat below Mukilteo Boulevard would be difficult and is not recommended. The culvert under Mukilteo Boulevard acts as a physical barrier to migration; the stream below this culvert is quite steep. The culverts passing under the Burlington Northern Railroad tracks also bar salmonid migration.

2. Peak flow rates from the Boeing complex are partly mitigated by a series of detention ponds and biofiltration systems above Seaway Boulevard. Nevertheless, high flow rates have accelerated channel and bank erosion in this stream. Creation of regional detention facilities or better regulation of outflow from the Boeing detention facility might reduce channel erosion rates in Powder Mill Gulch.

3. In addition, there are several visible examples of poorly designed residential stormwater outfalls in the channel that cause severe local channel and bank erosion. Redesign of these stormwater outfalls would improve channel conditions, reduce erosion, and reduce sediment loads.

Narbeck Creek Basin Mitigation

1. There is potential for enlarging the Narbeck Swamp wetland and restoring disturbed areas of Narbeck Swamp. Paine Field and the Fluke Corporation are planning to make these improvements to Narbeck Swamp as mitigation for other development projects.

2. Cleared hillsides and creek habitat in the lower third of the drainage could be restored to stop landslides.

3. Residential runoff should be routed away from slopes or tightlined to the bottom of the slope.

Merrill and Ring Creek Basin Mitigation

1. The habitat within the lower section of Merrill and Ring Creek would be improved by the addition of woody debris to the channel to create large pools. Habitat would also be improved by importing scarce spawning gravels to this reach. In addition, anadromous fish access should be evaluated and improved, if appropriate.

2. Like Big Gulch, Merrill and Ring Creek suffers from channel erosion due to increased storm flow rates from urbanization. Enlarging regional detention facilities to provide additional control of high flows would improve the habitat potential of this stream.

3. A regional detention facility could be constructed south of Westridge Mobile Home Park as proposed in the April 1992 Port Gardner Bay Drainage Plan Update Report No. 5.

Phillips Creek Basin Mitigation

No basin specific mitigation recommendations.

Glenwood Creek Basin Mitigation

1. Glenwood Creek suffers from channel erosion due to increased flows from urbanization. Diversion of storm runoff from Glenwood Avenue out of the stream and directly to Puget Sound would improve the channel conditions of Glenwood Creek. The City of Everett has already expanded the bypass drain system, and further improvement may not be necessary.

2. If the headwaters continue to be protected, Glenwood Creek is likely to maintain its trout population. Mitigation credit could be provided for the purchase and long term protection of headwater areas.

Glenhaven Creek Basin Mitigation

No basin specific mitigation recommendations.

Pigeon Creek #2 Basin Mitigation

1. KCM (KCM #2) has developed habitat improvement recommendations for Pigeon Creek #2 within Howarth Park. These recommendations call for stream restoration including creating a more sinuous channel and more pool habitat within the park as well as bank revegetation in specific locations. These improvements, along with initial stocking of salmonids and improvement of access, could create a small salmonid fishery in this stream.

2. Creation of a regional detention pond on Associated Sand & Gravel property would reduce peak flow rates and channel erosion in Pigeon Creek #2.

Swamp Creek Basin Mitigation

1. The large bog/shrub/forested wetland in east Kasch Park should be protected from stormwater inputs, which will degrade the bog by raising pH and the nutrient level.

2. The Swamp Creek Drainage Basin Plan has many specific recommendations for water quality improvement, stream channel and wetland enhancement and restoration projects. These actions would be implemented by Snohomish County and other governmental agencies, rather than developers. Implementing these recommendations would improve water quality, flooding and habitat conditions downstream. Following are some of the recommendations that assume participation or support by Everett:

Administrative Actions

- Increased construction inspection and plan review.
- Staff workshops.
- Formation of an emergency pollutant response network.

Finance

- Provide wetland retention incentives, such as property tax relief, increased densities for upland portions of site, acquisition of wetlands, etc.

Interagency/Governmental Coordination

- Support Snohomish County's efforts to implement a plan for deterrence of illegal waste disposal in the watershed.
- Superfund site coordination.

Land Acquisition

- Participate in the cost of an inventory of important riparian corridors/wetlands throughout the Swamp Creek watershed, and in the protection of identified parcels through acquisition or other means.

Producing Alternative Analysis

Golf course drainage into the tributary from Walter E. Hall golf course may contain fertilizers, pesticides, and herbicides that can negatively impact water quality. The City should meet with golf course owners to discuss management plan and objectives, and conduct a field reconnaissance and monitoring effort to characterize golf course drainage.