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

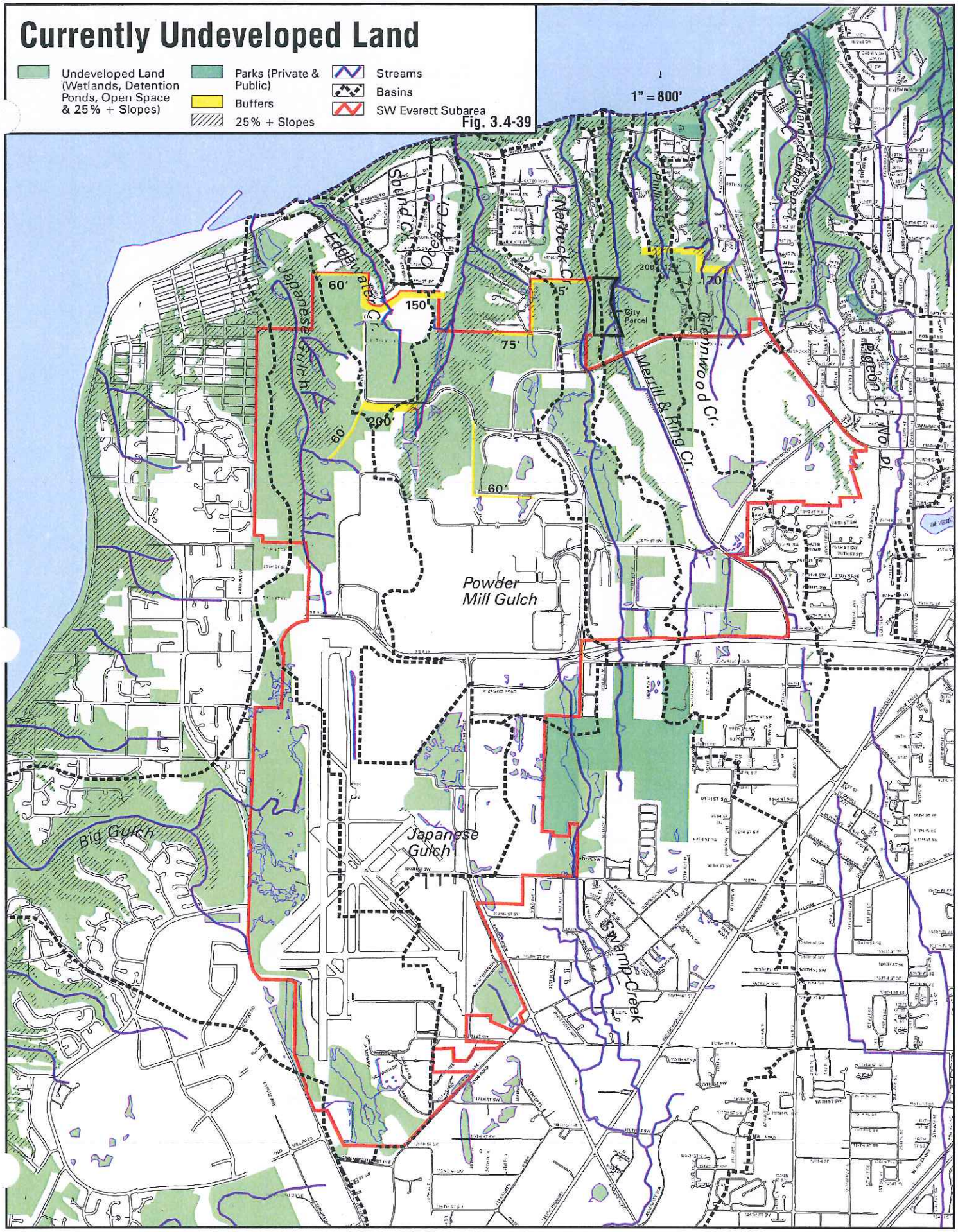
Streams

Basins

SW Everett Subarea

1" = 800'

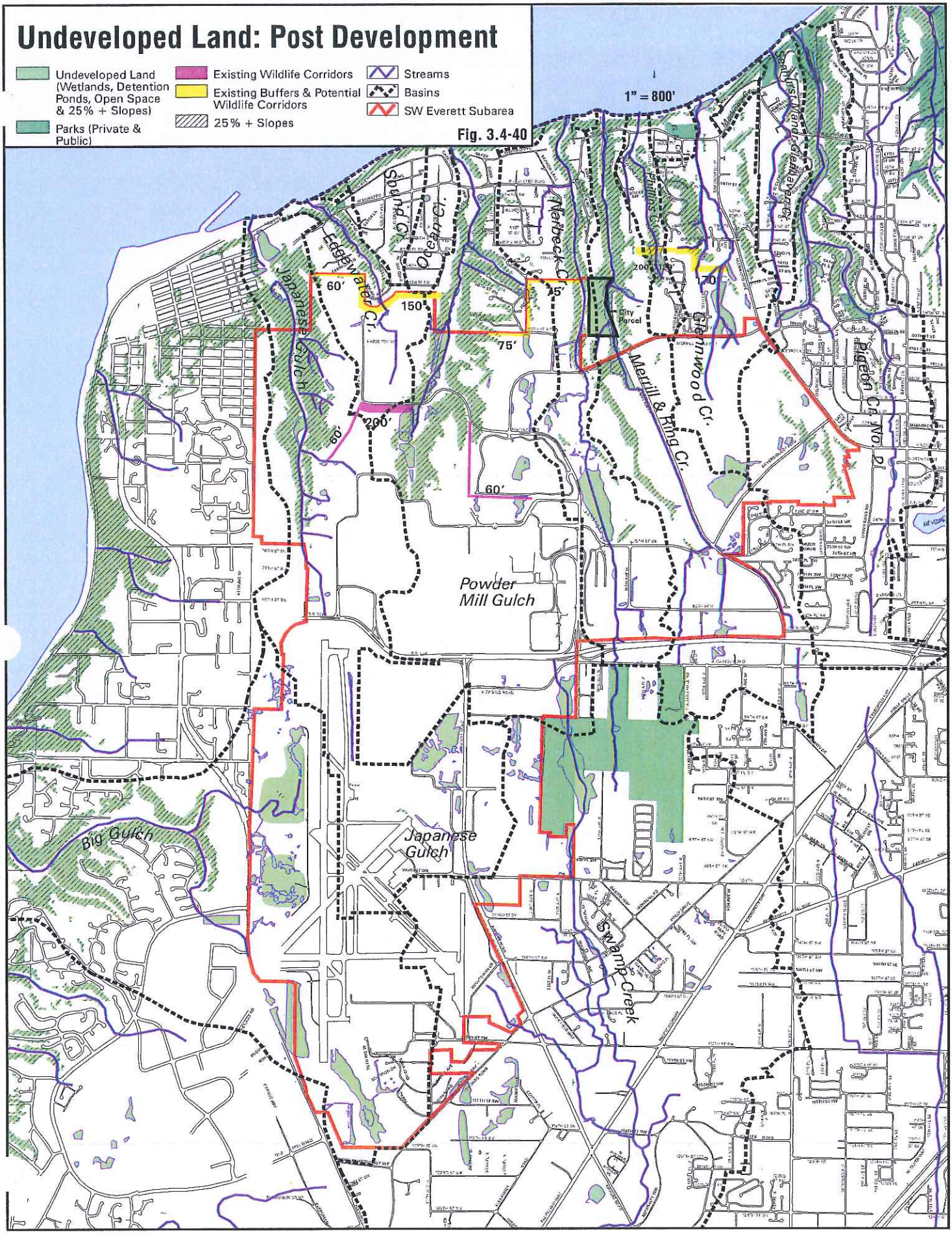
Fig. 3.4-39



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

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.