Union Slough 1135 Restoration Project

Everett, Washington

Ecosystem Restoration Report/Environmental Assessment

January 2002

U. S. Army Corps of Engineers

Seattle District

SECTION 1:EXECUTIVE SUMMARY

1.1 Authority and Jurisdiction

This Project Modification Report is submitted under authority of Section 1135 of the Water Resources Development Act of 1986 (Public Law 99-662), as amended, and is in accordance with EC 1105-2-214, Project Modifications for Improvement of the Environment and Aquatic Ecosystem Restoration (dated September 1997). The City of Everett, by letter dated July 21, 1998 requested Federal assistance in restoring 100 acres land on Smith Island alongside Union Slough adversely affected by the Everett Harbor Snohomish River Navigation project completed in 1963.

1.2 Project Background

The authorized federal navigation project was adopted 25 June 1910 and modified by subsequent Acts, provided for dredging of the Snohomish River and adjacent sloughs, the construction and rehabilitation of training and spur dikes, and the construction of a settling basin. The project was completed on 8 April 1963. The fish and wildlife habitat in the Snohomish estuary, including Union Slough, has been significantly degraded as a result of the modifications the navigation channel. An estimated 75 percent of the wetlands in the lower Snohomish Basin have been altered due to local flood control, agricultural conversion and to a lesser extent filling. Union Slough is almost entirely diked. The areas behind the levees are predominantly freshwater wetlands dominated by reed canary grass, and agricultural fields providing no access for fish. In recent years the farms behind the levees have ceased to operate and the land has passed into public ownership. In two other locations on Union Slough, the levees have been breached to re-create habitat areas, and one location has been preserved as a fresh water wetland.

1.3 Proposed Plan

The proposed plan consists of construction of a new set-back levee, filling the old borrow ditches, and breaching the old levee in three locations. Bridges to maintain the existing public-access trail will span the levee breaches. The entire site will flood and drain completely twice a day with the tide.

The project site covers approximately 93 acres. The project was formulated as a whole. However, the local sponsor dedicates 50 acres of the project to mitigation for other work. Therefore, the Corps is cost-sharing approximately 46 acres of the project, and the local sponsor is funding 50 acres. The cost share is determined by a line across the project (see Appendix A, Real Estate Map), with the sponsor paying 100% of the construction costs north of the line, and the Corps cost-sharing south of the line.

SECTION 2:BACKGROUND

2.1 Project Authority

This Project Modification Report is submitted under authority of Section 1135 of the Water Resources Development Act of 1986 (Public Law 99-662), as amended, and is in accordance with EC 1105-2-214, Project Modifications for Improvement of the Environment and Aquatic Ecosystem Restoration (dated September 1997). The City of Everett, by letter dated July 21, 1998 requested Federal assistance in restoring 100 acres land on Smith Island alongside Union Slough adversely affected by the Everett Harbor Snohomish River Navigation project completed in 1963.

2.2 Study Purpose and Scope

This report is a final response to the Section 1135 study authority and addresses the need for and desirability of undertaking a plan to restore river and tidal influence to 100 acres of the Snohomish River estuary that have been affected by the Corps navigation project. The goal of this project is to create/restore critical salmon rearing habitat, while maintaining flood protection to the City's sewage treatment facility. The proposed project is located adjacent to the Union Slough sub-channel of the Snohomish River in the City of Everett, on Smith Island, in Snohomish County, Washington.

2.3 Project History

The authorized federal navigation project was adopted 25 June 1910 and modified by subsequent Acts, provided for dredging of the Snohomish River and adjacent sloughs, the construction and rehabilitation of approximately 20,000 linear feet of training and spur dikes, and the construction of a 1,000,000 cubic yard settling basin. The project was completed on 8 April 1963. The southerly 3,250 feet of training dike was rehabilitated in 1974 under the maintenance program.

The fish and wildlife habitat in the Snohomish estuary, including Union Slough, has been significantly degraded as a result of the modifications the navigation channel and adjacent urban development. The Snohomish estuary is one of Puget Sound's largest estuaries, and numerous waterfowl and anadromous fish are dependent on this area for critical portions of their life histories. An estimated 75 percent of the wetlands in the lower Snohomish Basin have been altered due to local flood control, agricultural conversion and to a lesser extent filling.

Union Slough is almost entirely diked. The areas behind the levees are predominantly freshwater wetlands dominated by reed canary grass, and agricultural fields providing no access for fish. The levees along Union Slough between the upper entrance from the Snohomish River have a variety of vegetation ranging from a good mix of deciduous species to areas dominated by blackberry providing limited benefit for aquatic species.

2.4 Resource Problems

The existing dike structures in the Union Slough area have created a system of disconnected habitats. The lands behind the existing dikes provide habitat for a variety of invertebrate, amphibian, and vegetation species. These habitats produce an important food source to a variety of predators, however, the great majority of the bio-mass and organic nutrients inside the dikes cannot be transported out of the area due to blockages. With the dikes in place, there is no hydraulic connectivity between these habitats and the river and estuarine environment. The lack of bio-mass and nutrient transport to the river and estuary has become an ecosystem limiting factor.

The Union Slough dike created a blockage that limited the creation of subsidiary and blind channels. With the main portions of the slough and tidal influence removed, there is little or no scour action to form and maintain channels. These channels are crucial for the transport of detritus both into and out of the diked area as well as providing access into the area for salmonids.

2.5 Prior Studies and Reports

As with almost any river basin in the Puget Sound region, the Snohomish River has had a wide variety of studies that have documented the ecosystem function, process, and limiting factors. A few specific studies were used to provide a strong foundation for the Corps analysis. The main reports are as follows with additional references being listed at the conclusion of this report:

- Snohomish Estuary Wetland Integration Plan (SEWIP), City of Everett, EPA, PSWQA, and Wash. St. Dept. of Ecology, April 1997.

- Drainage District 6 Restoration Plan, Snohomish County Public Works, December 1996.

- Spencer Island Wetland Restoration and Enhancement Report, Curtis Tanner, U.S. Fish and Wildlife Service, April 1993

- Biological Status of Fish and Invertebrate Assemblages in a Breached-Dike Wetland Site at Spencer Island, Washington. Fisheries Research Institute, June 1998.

- Fish Assemblages and Juvenile Salmonid Diets at a Breached-Dike Wetland Site, Spencer Island, Washington, Jeff Cordell, Mark Stamey, Curtis Tanner, and Kevin Aitkin, 2001.

- Wetland Mitigation Plan City of Everett Water Pollution Control Facility Dike Maintenance and Mitigation Project Site. Prepared by Jones and Stokes for the City of Everett Public Works, December 8, 2000.

2.6 Expected Success

The expected success of the project will come through reconnecting portions of the wildlife area to tidal inundation and periodic flooding to re-establish inter-tidal marsh and shrub communities. The project will create the physical connectivity and nutrient export that has been lost for 40 years.

The project will not jeopardize flood control projects in the Snohomish estuary. Addition off channel storage will be available during flood events, although the decrease in flood levels is insignificant.

SECTION 3:PLANNING AND OBJECTIVES

The goal of this project is to restore natural habitat forming processes to create a dynamic and self-maintaining environment that is hospitable to fish and wildlife. The levee along Union Slough will be replaced and breached, in order to:

1. Create and maintain tidal inundation in estuarine habitat;

2. Maintain existing level of flood protection; and

3. Maintain existing public access

3.1 General Criteria

The following general criteria have been established for and met by the Union Slough 1135 project. These criteria were established by examination of Federal, state, and local regulations and policy and by working with the local sponsor to understand their needs and requirements:

- The solution is multi-objective and environmentally feasible with long-term benefits.

- The proposed work is compatible with other ongoing efforts by Federal, state, and local agencies.

- The proposed work will protect public health, safety, and well-being.

The project team analyses benefits and costs in accordance with Corps regulations,

3.2 Technical Criteria

Basic technical criteria are the fundamental engineering and scientific principals that govern a project of this nature. There are special criteria that need to be addressed for this specific project. These criteria represent special circumstances that relate specifically to this project due to location, existing conditions, and special land use practices of the project area. Other than the basic standards of engineering and scientific standards, the following technical criteria have been established by the Corps, the project sponsor, and involved agencies for the Union Slough Section 1135 Restoration Project:

- The site must completely fill and flush in each tidal cycle. Breaches must be placed and sized so that the entire site is tidally influenced.

- The new levee must be constructed at the “10+2” elevation. This elevation is two feet higher than the flood stage for the ten-year event.

- The new levees must be adequately protected from erosion.

- The pedestrian trail must be placed back in operation after the project is constructed.

- The City must have maintenance access to the entire pedestrian trail.

3.3 Environmental and Social Criteria

Environmental and social criteria were established by the local sponsor in coordination with Federal, state, local, and tribal officials. The criteria here represent the results of much coordination, negotiation, and compromise. The criteria are meant to provide sound guidance for the creation of project alternatives and selecting an implementable plan.

- Revert current fresh water wetlands habitat to tidal wetlands habitat.

- Maintain shore access required by the City's shoreline permit.

SECTION 4:EXISTING CONDITIONS

4.1 General

To summarize aquatic conditions of the Snohomish River/Union Slough as a whole, this area lacks large woody debris, exhibits higher water temperatures than historic levels, has an unacceptable level of chemical contamination, lacks off-channel fish habitat, exhibits low pool frequency and quality, exhibits a modified peak/base flows, and increased drainage network, and lacks floodplain connectivity. Other factors associated with aquatic habitats are considered to be functioning adequately.

4.1.1 Geology

Soils on the area are classified as predominately Puget silty clay loam with isolated areas of Mukilteo muck, Snohomish silt loam, and Terric Medisaprists by the Soil Conservation Service (USDA 1983). Upper subsurface materials on the site consist of very soft to soft silty clay, silt, and organic silt with peat layers to depth of 15-25 feet below the surface. The silty soils are underlain by fine sand with silty sand, silty layers, and scattered peat lenses. Dense sand and gravel occurs at depths of approximately 125 feet.

According to the Soil Conservation Service classifications, Puget silty clay loam is a very deep, artificially drained soil formed in alluvium. Permeability is slow and susceptibility to erosion is low to moderate for all four soil units (types) occurring on the site.

4.1.2 Climate

In the Snohomish estuary the weather is typically maritime. Air masses originating in the Pacific Ocean dominate the weather patterns. This usually means a mild, wet winter temperature ranges from 35° to 50° F and dryer summer. Very little rain falls during the months of July, August and September, and temperature ranges from 55° to 85° F. Annual precipitation is about 40 inches.

4.1.3 Hydrology.

The Snohomish Estuary is approximately 9 miles long and 3 to 4.5 miles broad at its widest point, encompassing six major islands within its 19.5 square miles. The Estuary is at the mouth of the Snohomish River and is the second largest Puget Sound watershed, consisting of 1, 780 square miles of land and water. Two main tributaries to the Snohomish River, the Skykomish and Snoqualmie, converge at Monroe, Washington, 23 miles upstream from the mouth of the river.

The Snohomish River runs from Monroe to the Estuary at a gradient of 1 ft/mile. The lower portion of the Snohomish River basin is flood protected with a series of levees built and maintained by independent diking and drainage districts.

The average annual runoff is 7,090,000 acre-ft. with an average annual flow of 9,951 cfs measured at Monroe in 1985 (Snohomish Study Team, 1980, and Williams et al., 1985). The maximum discharge for the Snohomish River was measured as 186,000 cfs during the flood of 1990 (Pentec, 1992).

The project site is bordered on the east by Union Slough. The site is protected from flooding by a dike system bordering the river and slough. Surface water on the site is limited to a series of open drainage ditches lying adjacent to the oxidation ponds, aerated lagoons, and dikes, and to several scattered open water shallow intermittent potholes. Based on field surveys carried out on site in the 1980s, the drainage ditches do not appear to be connected to the Snohomish River or Union Slough.

4.1.4 Water Quality

Generally the water quality has been good in the lower Snohomish River and it is rated by the state as class A. With this in mind there are some water quality criteria that are of some concern in the lower river related to fecal coliform and dissolved oxygen.

Historic water quality data for the Snohomish River are available for Snohomish (river mile [RH] 12.7) and the Snohomish River at Highway 99 (RM 1.3) downstream from the Everett Treatment Plant outfall. The water quality of the Snohomish River was evaluated by the Washington Department of Ecology in a February, 1982 report entitled, "Quality of the Snohomish River/Estuary and Possible Impacts of a Proposed Bewlett-Packard Manufacturing Plant." The report indicates that fecal coliform and copper concentrations in the river above the treatment plant outfall are above EPA water quality criteria but that the copper levels are caused primarily by natural factors (DOE 1982).

During 1981, DOE characterized water quality conditions of the Snohomish River upstream and downstream from the entrance of the Everett Treatment Plant outfall. The study showed State Class A standards for fecal coliform were occasionally exceeded at all upstream stations and with slightly elevated coliform levels at downstream stations. Nutrients levels were slightly higher and metal concentrations were within Class A standards.

The City of Everett wastewater facility has generally provided good treatment and performance; however, there are a number of operational factors that occasionally affect effluent quality. While the facilities perform well, effluent water quality exceeds the 30 mg/l BODS NPDES limits during the warm months. Additionally, the 55 m9/1 suspended solids values are also occasionally exceeded.

Salinity in Union Slough at the 4th Street bridge ranged from 3 ppt at the surface to 8 ppt at a depth of 2 meters during high tide event in September 1992. By comparison, salinity at Steamboat Slough was measured to be 8.2 ppt at a depth of 5 meters during a high tide in late summer.

4.1.5 Air Quality

Air quality in the Puget Sound region has been in attainment with state and federal air quality regulations during the 1990s (PSAPCA 1996). There are occasional complaints from local residents about odors coming from the sewage treatment plant.

4.1.6 Noise

The project site is rural in character but bordered by urban activities. Background noise at the site is dominated by traffic noise coming from nearby I-5. In addition, the physical plant of the sewage treatment plant contributes to the background noise in the area.

4.2 Natural Resources

4.2.1 Vegetation

The majority of the site is covered with wetlands. Vegetation types are covered in this sections but additional information can be found in the wetland section.

There is an extensive area or mature alder forest with shrub understory near the dike along Union Slough. Although elderberry *is* the most dominant shrub in the understory, salmonberry, blackberry, rose, willow, and snowberry are also common. A deep ditch runs the full length of the area and the dominant herbaceous species along the banks of this ditch are skunk cabbage, swordfern, and woodfern. Higher up the banks of the dike, nettles occur amongst the salmonberry and other shrub species. Alder is the only tree species present in the canopy except along the edges where Sitka spruce and tall willows can be found. In recent years the vegetation along Union Slough has been cleared for levee maintenance purposes. In general invasives such as blackberries have grown in these areas greatly reducing their value for fish and wildlife.

Scattered throughout the area to the east of the existing lagoons patches of alder occur. Most appear to be younger than the alder along the dike. However, growing conditions may not be as optimum so some may be the same age. Shrubs occur in patches which, depending on the species, appears to be responding to the soil moisture in the area. Generally, the drainage ditches have will have young alder, and some blackberry. The wetter patches are nearly pure hardhack with a few willows. Drier areas have a highly diverse species composition where roses, red osier dogwood, snowberry, salmonberry, bittercherry, and the ever present blackberries can all be seen. Under these shrubs, where there is sufficient light, grasses, sedges, soft rush, and creeping buttercup can be found. Access to these areas is often difficult because of the large areas of blackberry.

Emergent wetland areas in the project area are dominated by reed canary grass, *Phalaris sp.*. Other plants found in the habitat type are *Lysichiton americanum* (skunk cabbage), *Carex deweyana* (Dewey's sedge), *Carex obnupta* (slough sedge), *Typha latifolia* (common cattail), *Sparganium spp.* (burreed), *Athyrium felix-femina* (lady fern), *Alisma plantago-aquatica* (broadleaf water plantain), *Oenanthe sarmentosa* (water

parsley), *Veronica spp.(speedwell), Iris pseudacorus* (yellow iris), *Tolmiea menziesii* (piggyback plant), *Juncus ensifolius* (dagger-Ieaf rush), *Impatiens noli-tangere* (yellow touch-me-not), *EJeocharis spp* (spikerush), *Glyceria spp.* (mannagrass), *Urtica dioica* (stinging nettle), *Solanum dulcamara* (bittersweet nightshade).

4.2.2 Fisheries

An inventory of salmon and steelhead stock status (WDFW and Western Washington Treaty Indian Tribes 1994, also known as the SASSI Report) did not judge any Snohomish River watershed stocks to be "critical" but did suggest that all of the river's stocks of native chinook for which adequate abundance information was available (all but one) are "depressed". (The SASS! report defines a critical stock as one experiencing production levels that are so low that permanent damage to the stock is likely or has already occurred and a depressed stock as one that has production below expected levels based on available habitat and natural variations in survival rates, but above the level where permanent damage to the stock is likely.)

The Estuary supports runs of seven salmonids: coho *(Oncorhynchus kisutch),* chum *(Oncorhynchus keta),* pink *(Oncorhynchus gorbuscha),* chinook *(Oncorhynchus tshawytscha),* sea-run cutthroat *(Oncorhynchus c/arkl),* steelhead *(Oncorhynchus mykiss),* and Dolly Varden *(Sa/ve/inus ma/ma).* All of these species are important in recreational fisheries, and five are important commercial and Native American fisheries. All species spawn in freshwater upstream of the Estuary. Spawning varies from August and September for pink and Chinook salmon to May through June for steelhead and cutthroat trout.

Upstream migration of adult salmonids occurs every month of the year, mostly in August through March. Migrating salmon pass through all of the Estuary , most fish moving quickly to upstream holding and spawning areas. By the time adult salmon and steelhead enter the Estuary, most have stopped active feeding. The smaller adult sea-run cutthroat trout and Dolly Varden, however, actively feed in the lower river channels and shorelines throughout the Estuary where favorable habitats are found.

Downstream smolt migration occurs mainly in the spring and early summer. Estuarine habitats provide a transition zone where juvenile salmonids physiologically adapt from fresh to salt water environments. The Estuary also provides habitats for feeding and refuge from predation. In many cases, the growth rates for juvenile salmonids in estuaries may be the highest in their life histories. In addition, the Estuary is an important source of primary production for the food chain that supports salmonids, as well as other species.

The extent of estuarine wetland use by juvenile salmonids for feeding and refuge varies among the species. Pink salmon smolts tend to move quickly through the Estuary , concentrating along the shorelines and feeding on small crustaceans and insects. Upon entering the more marine environment of the lower Snohomish River channel, the delta flats, and Port Gardner Bay, pink smolts continue to feed along shorelines, moving rapidly into offshore waters as they grow.

In contrast, chum salmon smolts may remain in the Estuary up to four or five weeks before entering Port Gardner Bay, moving in and out of wetlands with the tide and feeding extensively on copepods and insects.

Snohomish Estuary wetlands provide insect and crustacean prey for chinook salmon smolts as they migrate through the Estuary, often moving into the wetlands on the flood tides. Chinook salmon residency times within lower riverine and estuarine environments range from six to 189 days.

Coho salmon are typically considered one of least shoreline-associated species of juvenile Pacific salmon; however, individual residency times for yearling coho smolts within estuarine habitats may range from 6 to 40 days. Coho pre-smolts were found using the marsh on Mid- Ebey Island for up to six weeks in a recent study. Coho smolts in the main channels feed on small freshwater crustaceans and insects.

Sea-run cutthroat trout, steelhead trout, and Dolly Varden are present in the Estuary and Port Gardner Bay in lesser numbers than the Pacific Salmon. Relatively little is known regarding their residence periods and habitat utilization of estuarine areas for these salmonids.

Peamouth chub *(Mylocheifus caurinus),* the second most abundant non-salmonid Estuary species, is also widely distributed throughout the Estuary .This species spawns on a gravel or rubble substrate and adults are frequently found in off-channel areas. Also widely distributed in the study area, the Pacific staghorn sculpin *(Leptocottus armatus)* is the third most abundant non-salmonid species in the Estuary .Prickly sculpin *(Cottus asper)* is relatively abundant in lower estuary. Three-spined sticklebacks *(Gasterosteus aculeatus)* are also found in the lower estuary.

4.2.3 Wildlife

The Snohomish Estuary is important as wildlife habitat on several geographic scales. Estuary habitats function locally as a corridor/refuge within the lower Snohomish River watershed for small mammals, herptiles, and invertebrates and function regionally in the extended Snohomish River basin for medium and large mammals and birds. The Estuary links urban and rural open space from the Puget Sound lowlands to the Cascade Crest. Estuary wetland habitats also function regionally, nationally and internationally as a stop-over and wintering area in the Pacific Flyway for migratory waterfowl, including ducks, geese, and swans; and neotropical migrants, such as certain passerines and raptors. Diking District 6 within the Estuary has been recognized as an a important area for restoration in the Washington State Component of the North American Waterfowl Management Plan.

Compared to other Puget Sound estuaries, the Snohomish Estuary is one of the most diverse in habitat types and wildlife species (Carroll personal commuication with Rick Huey, 1996). Key aquatic habitats include: subtidal unvegetated and vegetated (eel grass); intertidal mudflat and eel grass; salt and brackish marsh; and fresh water emergent, scrub/shrub and forested wetlands and riparian habitats. Forest fringe habitats

of spruce and alder on and adjacent to the dikes provide important migration habitat for mammals and birds and have considerable fish value where overhanging riparian vegetation is present. Seasonally flooded agricultural lands in association with the Estuary provide waterfowl and shorebird feeding and refuge habitat (Zeigler personal communication, 1996).

A variety of rare and uncommon species is present in addition to large numbers and diversity of common species. During the field inventory process for SEWIP (May through October 1994), 63 species of birds, 15 species of mammals, and four species of herptiles were observed in the Estuary. During a 1978 to 1980 U.S. Fish and Wildlife study of the Estuary, a total of 116 species of migratory and resident birds was identified (Zeigler, 1996).

Prior to the advent of extensive diking, which occurred between 1895 and 1911, habitats within the Snohomish River Estuary included salt marshes, cattail marshes, oxbow ponds, and extensive spruce swamp forests (COE 1979). There was likely a greater /numeric and geographic distribution of waterbirds, such as ducks, grebes, wading birds (sandpipers, herons, and rails), blackbirds, and possibly more woodpeckers and other forest birds than exists today. Smith Island contained up to 30 percent of the estuary's salt marsh acreage prior to 1911 (COE 1979). Following dike building, draining, and conversion to agricultural uses, many of the above referenced species were likely reduced in number and probably could have been replaced by other species, such as sparrows and songbirds. Habitat richness was also likely reduced through drainage of marshes and swamps and clearing of forests for pasturelands.

The adjacent oxidation ponds and Spencer Island support a wide variety of wintering waterfowl. Although not considered natural waterfowl habitat, the oxidation ponds are of value to waterfowl and other wildlife species. The lagoons are considered one of the best waterfowl birding areas in Snohomish County. Eighteen waterfowl species use the lagoon for resting, feeding, and/or breeding.

In general, the birds were observed to utilize the interspersed grass, alder/shrub, and shrub vegetation. Although a number of species followed expected habitat affinities, swallows were mainly observed flying over grass and rush vegetation; seed eating birds, such as goldfinch, were seen foraging in grasses and wetland species, such as yellowthroat and marsh wrens, were observed in the soft rush/reed canary grass or in nearby shrubs.

Experienced birders report a number of shorebirds use the area, and that while the site is too small to support large populations, a good variety of species moves through on a seasonal basis (D. Paulson, Mlodinow pers. com.).

During the field survey conducted in June, 1984, few mammals were seen or identified by sign. Grass clippings, runways, and holes indicated the likely presence of field mice (probably Townsend meadow mouse and/or long-tailed meadow mouse). Black- tailed deer tracks and pellets were found in grass, rush, and shrub types and mole mounds and coyote scat in open areas.

Small mammals, such as Pacific jumping mice, deer mice, vagrant shrews, and muskrats, could occur on the site. Other than the mammals likely to utilize the site include raccoon, mink, and weasel.

4.3 Threatened and Endangered Species

The U.S. Fish and Wildlife Service, and the National Marine Fisheries Service have indicated that the following endangered, threatened, or candidate species might occur in the project area:

- bald eagle *(Haliaeetus leucocephalus)* Threatened
- Puget Sound chinook salmon *(Oncorhynchus tshawytscha)* Threatened
- bull trout *(Salvelimls confluentus)* Threatened
- Puget Sound/Strait of Georgia coho salmon (0. *kisutch)* Candidate

4.3.1 BALD EAGLE

Washington's marine coastline and lowland river basins provide a rich habitat available to both resident and migrant bald eagles. Bald eagles were listed as a threatened species on March 11, 1967 under the Endangered Species Preservation Act of 1966. This designation later carried over into the Endangered Species Act of 1973 with the eagle recently being proposed for delisting (Federal Register, 1999).

The Snohomish River, as part of Northwest Washington's river system, provide habitat for some of the highest wintering bald eagle concentrations in the contiguous United States. Wintering eagles arrive during late October to November and forage almost exclusively on spawned-out salmon carcasses for roughly a three-month period. Bald Eagles will shift river systems based on the availability of food and will congregate with other eagles to roost communally at night near these foraging areas.

In Washington, eagle breeding territories are located predominantly in coniferous, uneven-aged stands with old-growth components. Territory size and configuration are influenced by a variety of habitat characteristics such as, available perches, distance to forage habitat, and quality of forage habitat. Courtship and nest building begin between January and Feburary with egg-laying occurring sometime in March or early April. Eaglets hatch in mid-April or early May.

The nearest known nest site is over 1.0 mile northeast of the project. Bald eagles tend to concentrate near water and may forage along the Snohomish River and Union Slough, although there are no records of regular use of the area.

4.3.2 Puget Sound Chinook

The Snohomish River stocks of chinook salmon belong to the Puget Sound chinook salmon evolutionarily significant unit (ESU), which was designated Threatened

on 24 March 1999. The Snohomish River watershed supports four stocks of chinook salmon: summer and fall Snohomish stocks, the Wallace River summer stock, and the Bridal Veil Creek fall stock. The Snohomish summer and fall chinook are both native stocks, status "depressed," with July to August run timing; the summer stock spawns in September, and the fall stock spawns from late September to October. The Wallace River stock is a hatchery stock, status "healthy," also with July to August run timing and September to October spawning. The Bridal Veil Creek stock is a very small native stock (status unknown) that spawns primarily in October. Collectively, the Snohomish chinook stocks showed a definite decline for the period 1978 to 1991, but the population has since shown a steady increase, with a 1998 return of 6,304 fish, exceeding the escapement goal of 5,250 fish. This recovery is attributed to conservative harvest programs.

4.3.3 Bull Trout

The Coastal/Puget Sound distinct population segment (DPS) bull trout, which was listed as threatened in November 1999, is composed of 35 subpopulations from 26 river basins. Sixteen subpopulations occur in eight river basins in the Puget Sound Analysis Area (this does not include Hood Canal or Strait of Juan de Fuca).

Historically, bull trout occurred throughout the Puget Sound region. Bull trout have been extirpated from many of the large rivers within their historic range, but they persist in isolated populations of headwater streams. The decline of the Coastal/Puget Sound bull trout DPS has been attributed to habitat degradation, dams, diversion, and interaction with non-native fishes, and the DPS is also likely affected in many areas by poor water quality.

Within the Snohomish River watershed, bull trout are known to spawn in the North Fork Skykomish River and lower East Fork Foss River. These are treated as a single native stock, but there is some evidence of genetic differentiation between the two populations. Anadromous, fluvial, and resident forms are all present within the watershed and likely interbreed. Adult anadromous fish enter the river between late May and early July, usually spawning in October, in response to late season drops in water temperature to values below 8 °C. Juveniles of the anadromous form of bull trout migrate through the estuary to the ocean. The Snohomish River stock is classified as "healthy".

4.3.4 Coho Salmon

The Snohomish River watershed supports four stocks of coho salmon: the Snohomish stock, the Skykomish stock, the South Fork Skykomish stock, and the Snoqualmie stock. The Snohomish, Skykomish, and Snoqualmie are all mixed stocks; and the South Fork Skykomish is a hatchery stock. In 1992, the Snohomish stock had "depressed" status, and the others had "healthy" status with evidence of long-term population stability. Currently, the Snohomish River coho stocks are extremely healthy; the escapement goal of 70,000 fish was greatly exceeded in 1998 (escapement 150,000) and escapement in all years since 1992 has exceeded 50,000. WDFW currently regards the population as habitat-limited. All stocks enter the river in September and October, spawning in areas well upstream of the action area from late October through January.

The lowest-elevation spawning habitat is used by the Snohomish stock, which spawns in Snohomish River tributaries in lands primarily managed for agriculture or industrial forestry. This stock is affected by impaired habitat including diking, industrial pollution, and an absence of in-stream woody debris or woody debris recruitment. These stocks belong to the Puget Sound/Strait of Georgia coho salmon evolutionarily significant unit (ESU), which has been designated a candidate for listing under the Endangered Species Act, although listing has been found to be "not warranted for this ESU".

The life histories and potential impacts of the proposed project to these species is identified in the Biological Evaluation found in appendix ___.

4.4 Cultural Resources

A check of the State Archaeological Site Database found two known prehistoric sites approximately 1 mile from the project area. A field reconnaissance was attempted on May 22, 2001. However, the presence of heavy vegetation and high water table (even standing water on surface in areas) prevented visual examination of the site.

4.5 Socio-Economic Resources

4.5.1 Land Use

The majority of Smith Island is in agricultural use. The south end of Smith Island is dominated by the Sewage Treatment Plant. The project area lies within the city of Everett and is zoned for the Sewage Treatment Plant. West of the Sewage Treatment Plant is I-5 , the Snohomish River and urban parts of the city of Everett. To the east of the project area is Spencer Island which is a regional recreation area.

4.5.2 Demographics

The site is part of the city of Everett Sewage Treatment Plant and does not have any permanent residents. Smith Island has few residents and adjacent Spencer Island is devoted to recreation with no permanent residents. Across the river to the west is the highly urbanized sections of the city of Everett.

4.5.3 Environmental Justice

Executive Order 12989, Environmental Justice in Minority Populations and Low Income Populations asks that each Federal agency make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States. No residents live on or adjacent to the project site.

4.6 Aesthetics/Recreational Resources

4.6.1 Recreation

The Union Slough dike has a regional trail located on top of the dike. This trail was mandated by the Shoreline Management Act and allows for access by the public to Union Slough. The oxidation ponds, the adjacent project area, and Spencer Island are a major destination for area bird watchers. The primary access to the Spencer Island Wildlife Area is through the south end of the project area on 4th Street. While hunting is restricted in the project area, it is allowed on the north half of Spencer Island.

4.7 Hazardous and Toxic Wastes

A preliminary assessment screening was performed onsite on November 29, 2001. No evidence was uncovered to indicate that hazardous substance activity had taken place on the site.

4.8 Wetland Resources

Before diking occurred, Smith Island was a tidally influenced estuarine habitat. Survey notes from the original land survey of the area conducted in 1869 provide a general description of the Snohomish Estuary which reads as follows:

> Township No 29. N.R. 5 E. Will. Mer. General Description
>
> The upland in this Township is densely covered with a superior quality offir and cedar timber. The soil is first class clay.
>
> Along the bank of the river and Slough, there is a strip of land from one to four chains in width that is covered with an excellent quality of spruce which is in great demand for ship knees. Near the mouth of the river and on Smith's Island there are about two thousand acres of tide prairie covered with fine grass. The remainder of the Tp. (township) between the various sloughs and river is covered with willow, alder and swamp Dogwood. Underbrush Rose briers. The Slough and river are navigable through the entire township for steamers. Ebey's and Steamboat Sloughs having an average depth of 12 feet. The swamp and tide prairies are susceptible of drainage and will make agricultural lands unsurpassed by any in the county . May 31st. 1869

Diking in the early part of this century resulted in a conversion of these estuarine wetland areas into palustrine wetland areas. A delineation was done by the city of Everett in June of 1999.

The project area currently contains 38 acres of wetlands. The breakdown is listed in table 4-1

TABLE 4-1 Wetland Acreage in Project Area

WETLAND TYPE	ACREAGE
Palustarine Emergent	16.7
Palustarine Scrub Shrub	13.1
Palustarine Forest	7.8

Vegetation characteristics are described in the vegetation section. The soils found in the area are hydric soils. Soils information is found in the geology section.

SECTION 5:PLAN FORMULATION

5.1 Problem Identification

As a result of local flood control efforts, agricultural conversion and dredging and filling for navigation, an estimated 75 percent of the wetlands in the lower Snohomish Basin have been impacted. The formation of dikes from the disposal of dredge sediments from the federal navigation project, resulted in the separation of the Snohomish River channel from Union Slough. This has resulted in disconnecting critical salmon habitat from tidal and riverine influence and reducing the overall productivity of the slough. The goal of this project is to create/restore critical salmon rearing habitat, while maintaining flood protection to the City's sewage treatment facility. By removing blockages to Union Slough habitat caused by diking, the project will restore tidal inundation, water circulation and anadromous fish access to estuarine habitat of the past. Benefits from this project will result from providing significantly more rearing habitat for Chinook, Coho, Pink, and Chum salmon along Union Slough. In addition to the benefits to salmon, Bull Trout, Steelhead, Bald Eagles, Peregrine Falcons, Great Blue Heron, and other birds and mammals will also benefit from the project.

Benefits were calculated based on additional habitat created. Since all alternatives being examined would result in the tidal inundation of the project area and create estuarine wetland conditions, a different metric was needed to assess which alternative would maximize habitat for rearing salmonids. Based on existing literature, the metrics to be used for evaluation were determined to be additional tidal channel being created, and riparian edge habitat being enhanced.

5.2 Alternatives

Seven individual alternatives were developed for the project, which could be combined to form distinct alternatives. The options, and very brief descriptions, are listed below.

Union Slough Alternative Alternatives:

5.2.1 Alternative O: No Action.

- No construction
- Site remains a disconnected freshwater wetland
- All habitat along Union Slough remains as is.

5.2.2 Alternative A: 2 Breaches.

- Construct new set-back levees around the south, west and north sides of the project site, and along the east side along the Rhodes property line.

- Breach the old levee in two locations.

- Construct bridges across the two breach locations. The pedestrian access is a requirement of an existing shoreline permit for the nearby waste water treatment plant owned by the City of Everett.

- The lengths of the two breaches reduce the quantity of habitat along the slough.

- The borrow ditches divert the tidal energy, minimizing dendritic channel creation in the interior of the project site.

- The entire site is subject to tidal flow, and is reconnected to the riverine ecosystem.

5.2.3 Alternative B: 3 Breaches.

Alternative B is identical to Alternative A, except that the old levee would be breached in three locations, and bridges would be built cross all three breaches.

5.2.4 Alternative C: Remove the entire levee.

Alternative C is identical to alternatives A and B except that the old levee would be removed instead of being breached. In order to maintain the waterfront access, a raised walkway would be install along the entire length of excavated levee.

5.2.5 Alternative D: Fill the borrow ditches (with 2 breaches).

Alternative D consists of filling in the old borrow ditches. The borrow ditches were the source of material for the construction of the existing levee, and run the length of the old levee. Alternative D can not be considered on its own, and can only be considered in combination with Alternative A.

5.2.6 Alternative E: Fill the borrow ditches (with 3 levees).

Alternative E is identical to Alternative D, except that it can only be combined with alternative B. Alternative E is considered separately from Alternative D because there is less ditch to fill behind three breaches as opposed to behind two breaches, so there is a cost consideration.

5.2.7 Alternative F: Purchase the Rhodes property.

Alternative F represents the purchase of a neighboring farm property that allows for a reduced length of levee. Alternative F can be combined with any of the other alternatives.

Alternatives	Label:
No Action	O
2 Breaches	A
3 Breaches	B
Remove entire levee	C
Fill borrow ditches w/2 breaches	D
Fill borrow ditches w/3 breaches	E
Purchase Rhodes property	F

See Paragraph 5.6 for a discussion on dependency alternatives and non-combinability alternatives.

5.3 Evaluation of alternatives

The alternatives were evaluated based on linear feet of water edge habitat (benefit) and construction cost (cost). The benefits for the alternatives were based on projected dendritic channel creation and enhanced riparian areas. The projections were based primarily on the channels created in the functionally identical project on Spencer Island, on the other side of Union Slough, and the know benefits of re-establishing riparian buffers along existing sloughs. The Spencer Island project has a large breach and a small breach, and also demonstrates the effect of the borrow ditches on the creation of the small dendritic channels. The costs for the alternatives was determined by preparing a 10% level engineering design and by preparing a construction cost estimate from the designs. An incremental cost and cost effectiveness computer model was used to evaluate each alternative and combination of alternatives to help select the recommended plan.

5.4 Habitat Benefits

Benefit-Cost evaluation is an integral part of most civil works Corps of Engineers projects. For traditional Corps project purposes such as navigation and flood control, benefits and costs are quantified in monetary terms. Because both costs and benefits are quantified in dollar terms an easy comparison can be made to determine the optimal project. The economic rule used to determine the optimal project, is that alternative that has the greatest net benefits (benefits minus costs). Quantifying environmental benefits in monetary terms is much more difficult and controversial. Recognizing this difficulty, the Corps does not perform a traditional benefit cost evaluation for restoration projects.

However, because costs and benefits are an important consideration in determining whether a particular restoration project merits investment and to identify the optimal level of investment an alternative tool is used in place of the traditional benefit-cost evaluation. This tool is a cost-effective and incremental cost evaluation (CE/ICA). Although this approach does not result in a strict decision criteria, it is useful to assess project alternatives. Under this approach, potential project benefits are quantified, but not typically in monetary terms. The quantified benefit is measured using non-dollar quantified outputs which differ depending on the type of restoration project being considered. Examples might include habitat units or a habitat index. It is important to recognize that the selected measure typically can't include all components of ecosystem restoration and should be viewed as a proxy for the project benefits. Under the CE/ICA the benefits or project outputs are quantified for each of the alternatives and combination of alternatives and then compared to their costs. Alternatives which are not cost effective (i.e. either have a lower output and higher cost or a higher cost and lower output compared to another alternative) are eliminated. Of the remaining alternatives, the relationship between changes in costs and changes in outputs are then evaluated. From this analysis, increases in the incremental cost per incremental output are identified and any significant changes between alternatives are identified and help determine the recommended alternative(s). This evaluation procedure should be viewed as a tool to identify the most effective and efficient project alternative(s) and help in the selection of the recommended alternative(s).

5.6 Evaluation of Benefits and Costs Using Cost Effectiveness and Incremental Cost Analysis

(A) Cost Effectiveness and Incremental Cost Evaluation.

The economic evaluation of environmental restoration projects consists of determining the most cost effective alternative or combination of alternatives that will help solve the identified problem(s). The Institute For Water Resources (IWR) cost effectiveness/incremental cost computer model was used to assist in evaluating the project alternatives, determining the most cost effective alternatives and in helping select the recommended alternative. This model uses project costs and expected environmental outputs (benefits) to analyze each alternative and combination of alternatives. As discussed in Section 5.4, project outputs have been quantified based on additional lineal feet of habitat created by each alternative or combination of alternatives. In addition, total project first costs associated with each alternative and converted to average annual costs were also used in the analysis. Annual maintenance costs and any rehabilitation costs over the expected 50 year life of the project are expected to be the same across the alternatives. The following table compares the outputs and costs associated with each alternative

The costs shown in table 5-2 include construction costs as well as average annual costs and were based upon preliminary 10 percent level of design assumptions. Benefits are based on additional lineal feet of habitat created.

Table 5-2. Costs and Benefits (Outputs) of Alternatives

Alternative	Total Project Cost Oct. 2000 P&C	Average Annual Cost	Total Output (Lineal Feet of Added Habitat)
Alt. #1 No Action	**$0**	**$0**	**0**
Alt. # 2 (A)	**$5,186,000**	**$358,000**	**8,813**
Alt. # 3 (B)	**$5,302,000**	**$366,000**	**8,721**
Alt. #4 (C)	**$7,680,000**	**$530,000**	**6,638**
Alt. #6 (D)	**$108,000**	**$8,000**	**1,380**
Alt. #7 (E)	**$80,000**	**$6,000**	**1,937**
Alt. #8 (F)	**($988,000)**	**($68,000)**	**635**

As shown above, alternative F has a negative cost. It is also dependent on either alternative A, B, or C and when it is combined it reduces the cost of each of those alternatives by $988,000. Alternative F involves the purchase of the Rhodes property and the construction of a short extension of the northern levee across that property to the slough. The extension eliminates the need for the much longer north-south levee along the property line, and the cost savings is much greater than the cost of the property. Therefore, alternative F represents cost savings, rather than expense. At the same time, Alternative F adds area and benefits to the project.

The first step in the cost-effectiveness and incremental cost analysis model is to build combinations of alternatives. In order to accurately determine the actual number of possible combinations, dependency and non-combinability of alternatives were identified. Dependency alternatives consist of alternative D dependent on alternative A; E dependent on B; and F dependent on either A, B or C. Non-combinability shows that neither A, B or C can be combined with each other plus A can not be combined with E; B with D; C with D or E and D with E. These combinations are then sorted by increasing output. Given the above criteria, the above seven alternatives can be combined to create 11 different project alternatives. These combinations, listed in increasing order of outputs, are shown in table 5-3.

Table 5-3. Least Cost Alternatives for Increasing Output Levels

	Alternative	Total Project Cost Oct. 2000 P&C ($1,000)	Output Measured in Additional Lineal Feet of Habitat
1	No Action	**0**	**0**
2	C	**$530**	**6,638**
3	C,F	**$462**	**7,273**
4	B	**$366**	**8,721**
5	A	**$358**	**8,813**
6	B,F	**$298**	**9,356**
7	A,F	**$290**	**9,448**
8	A,D	**$366**	**10,193**
9	B,E	**$372**	**10,658**
10	A,D,F	**$298**	**10,828**
11	B,E,F	**$304**	**11,293**

The next step in the process is to eliminate all alternatives which are not cost efficient. That is, if an alternative costs more than another and has a lower output, it is not economically efficient and is eliminated. For example, as shown in table 5-3, alternative A,F has a lower cost and greater output than all of the alternatives shown above it (Alternatives 2-5). As a result, none of those alternative are cost effective and were eliminated from further analysis. In addition, alternative A,D,F has a lower cost and higher output than either alternative A,D (alternative 8) or B,E (alternative 9). As a result, these two alternatives are not cost efficient and were eliminated from further analysis. This analysis leaves three cost efficient alternatives which are alternatives A,F; A,D,F; and B,E,F.

The following step is to compute the average cost per unit of output for each alternative. The alternatives with levels of output lower than the alternative with the lowest average cost are dropped from further analysis. As shown below in table 5-4, the alternative with the lowest average cost is B,E,F and all other alternatives have a higher average cost and lower outputs and were dropped from further analysis.

As a result, only one alternative remains from the average cost analysis and is therefore, the only “best buy” alternative and hence alternative B,E,F is the recommended alternative for this project.

Table 5-4. Average Cost of All Plan Combinations (Ordered by Output)

	Alternative	Total Project Cost Oct. 2000 P&C ($1,000)	Output Measured in Additional Lineal Feet of Habitat	Average Cost Per Feet of Habitat
1	No Action	**0**		**N/A**
2	A,F	**$290**	**9,448**	**$.0307**
3	A,D,F	**$298**	**10,828**	**$.0275**
4	B,E,F	**$304**	**11,293**	**$.0269**

SECTION 6:RECOMMENDED PLAN

6.1 Description

The recommended plan (known as "BEF") will include the construction of the new setback levee around the entire site. The levee will be built in two construction seasons to accommodate settling. After the new levee is completed, the old levee will be breached in three places, and bridges will be built over the three breaches. Each of the breaches will be 180' long at the top, with 3:1 side slopes at the edges of the breaches. The bottom of each breach will slope down into Union Slough, and will be low enough to permit complete draining of the site.

6.2 Operation and Maintenance

Once the project is completed, the only maintenance that is anticipated is keeping the new levee clear of large growth, in accordance with Corps of Engineers guidelines for maintenance of flood control levees. Maintenance of the trail along the old levee and maintenance of the bridges over the breaches is not required for the success of the project. No maintenance is foreseen in the interior of the project. Similar projects elsewhere have not needed maintenance to establish superior habitat conditions in the tidal areas.

6.3 Monitoring

The Corps will adopt a monitoring plan similar to that proposed by the city of Everett for their adjacent restoration area. Reference the mitigation plan prepared by Jones and Stokes for the City of Everett (Dec. 2000).

6.4 Cost sharing

The project site covers approximately 93 acres. The project was formulated as a whole. However, the local sponsor dedicates 50 acres of the project to mitigation for other work. Therefore, the Corps is cost-sharing approximately 46 acres of the project, and the local sponsor is funding 50 acres. The cost share is determined by a line across the project, with the sponsor paying 100% of the construction costs north of the line, and the Corps cost-sharing south of the line.

SECTION 7:ENVIRONMENTAL IMPACTS OF SELECTED PLAN

7.1 General

Geology. The over all site geology is not anticipated to change as a result of the project. There will be some regrading of the project area due to the filling in of drainage features and the connecting of low spots. Once tidal exchange has been restored, sedimentation will occur in the marsh area as is found in other tidally influenced areas of the estuary.

Climate. There is no anticipated change to climate as a result of the project.

Hydrology. Hydrology will be effected in a beneficial way as a result of this project. One of the stated purposes of this project is an attempt to restore some of the historic hydrologic regime. Breaching the levee will result in tidal interchange being restored to the project area. Restoring the tidal process will also result in the formation of dendritic channels.

Water Quality. Short term impacts are expected from construction activities. Water quality parameters will be affected, primarily turbidity. The majority of the construction will be accomplished inside the existing Union Slough Levee. Sediment impacts can be reduced through the employment of best management practices (BMPs). BMPs include the use of silt screens, hay bails, monitoring of construction vehicles, extra precaution when fueling, as well as the late June through September timing of construction. Only after all the levee work and grading has been completed, and the site has had a period to allow for the settling of loose material and reestablishment of vegetation, will the dike be breached and the bridges constructed. It is anticipated that even while the breach work will be accomplished in the dry during the low point of the tidal cycle, there will be some increase in turbidity levels due to tidal action working over newly disturbed ground. This release will be short term and rapidly dissipate as the loose material is moved by tidal action.

Long term changes in water quality are expected to improve due the reintroduction of tidal flushing to the project area. There could be a slight decrease in water temperatures in Union Slough due the reestablishment of significant riparian cover along the slough.

Air Quality. There will be some minor short term impacts to air quality due to the use of construction equipment (such as excavators, dump trucks, and bulldozers). Slight elevation of carbon dioxide and particulates levels are expected in the immediate construction area. This is not expected to be of any significance as the construction area is large and open.

Noise. There will be some minor short term noise impacts due to the use of construction equipment (60-76 dBA at 200 feet, as generated by excavators, dump

trucks, and bulldozers). Again, this is not expected to be of any significance due to the construction area is large and open. Very few dwellings are located near the construction area, and there is already significant background noise from I-5 and the STP.

7.2 Natural Resources

Vegetation. Based on existing site topography as compared to other intertidal habitats near the project area, it is anticipated that the site will support estuarine wetland plant species. The exact species composition can not be accurately predicted at this time. Vegetation communities at sites immediately downstream are typically of brackish marsh systems; projections based on these data suggest that the site will develop large areas of Lyngby's sedge (Carex lyngbyei) (Jones and Stokes 2000). However, data from the Spencer Island site, immediately upstream of the project area, suggest the development of a freshwater tidal vegetation community, characterized by plants such as wapato (Sagittaria latifolia) and water plantain (Alisma plantago-aquatica) (Tanner et al. in revision; L. Tear and J. Rubey pers. com.). What does seem clear from previous studies is that the Union Slough restoration site will likely undergo a period of rapid transition, and that it may by at least 10 years before the vegetation community composition begins to stabilize. Factors such as salinity, soil characteristics, tidal hydrology, herbivory, invasive species, and topography will have interrelated effects in establishing the restoration trajectory for the plant community, and other aspects of the physical and biological habitat.

Restoration of tidal action and the ending of vegetation maintenance on the Union Slough levee will result in an increase of 11,000 lineal feet of new dendritic channel and restored riparian habitat being created.

It is also hoped the that the restoration of tidal influence and increased salinity will result in a major decrease in the amount of reed canary grass found in the site. There is a possibility that purple loose strife (Lythrum salicaria) will establish on the fringe of the marsh as has occurred on Spencer Island. The establishment of the new plant community should be monitored to identify the possible introduction of invasives and implement control mechanisms.

Fisheries.

Experience from similar restoration project supports the premise that the Union Slough project will have important benefits for fishery resources. Studies from the Spencer Island restoration project, located less than 1 mile upstream from the proposed project, documents these benefits.

Chum (Oncorhynchus. keta), chinook (0: tshawytscha), and coho (0. kisutch) salmon were all observed to regularly access the restored intertidal habitats of Spencer Island. In the most recent sampling effort, eleven species of fish were captured; chum dominated the overall catch numerically (399 chum of 644 fish. total). Analysis of stomach contents from chum sampled at Spencer Island showed diets dominated by chironomids (larvae, pupae and emergent adults). These results are similar to results from

other natural and restored wetland sites in the region (Cordell et al. 2001). Restored habitats on Spencer Island were observed to be producing quantities of chironomids comparable to reference sites (Tanner et al. in revision). While fewer chinook and coho juvenile individuals were sampled on Spencer Island, similar results were observed, with evidence that they are acquiring prey resources species typical for their species' use of estuarine habitats in the region. Furthermore, for all three species sampled, stomachs were relatively full, typically ~4 on a scale of 1 (empty) to 6 (full) (Cordell et al. 2001).

The importance of estuarine habitats to bull trout (Salvelinus confluentllS) is less documented; However, evidence from the Skagit River watershed suggests that some of the rearing fish take up residence in estuarine portions of the system for much of their rearing (a year or more). The smolts leave the system in the spring and begin re-entering the system beginning in August and extending through October or early November as sub-adult fish to over winter (C. Kraemer, pers. com.). In addition to these potential direct benefits to bull trout, estuaries likely provide indirect benefits by supporting important prey species. Limited studies indicate that while in the marine environment, char (i.e. bull trout) feed on Pacific herring (Clupea harengus pallasi), Pacific sand lance (Ammodytes hexapteros), pink salmon smolts (Oncorhynchus gorbuscha), and chum salmon smolts (0. keta) (Kraemer unpublished).

Finally, it is important to note that, in addition to the benefits to fishery resources described above, short term adverse impacts may also result from construction activities. It is probable that there will be release of sediment from the project. Some existing riparian vegetation may be damaged. The design report identifies a number of measures that are being included in the project to limit these impacts. These include completing the majority of earth moving operations behind the existing dike system, installation of temporary erosion and sedimentation control measures, and isolation of in-water construction of dike breaches with sheet pile "cutoff walls". It is possible that other appropriate best management practices maybe identified during §7 Endangered Species Act consultation for listed salmonids.

Wildlife.

It is anticipated that the restored habitats will provide benefits for waterfowl and shorebirds. This assertion is likely accurate, at least in part, though the benefits are less clear and more complicated than is the case for fishery resources. To date, dike breach restoration projects in Puget Sound have not received consistent monitoring for objectives related to wildlife. For shorebirds, there is some anecdotal evidence that this type of project will provide direct habitat benefits. In the case of Spencer Island, while not quantitatively assessed, observations do include regular use of the unvegetated mudflats by dowitcher *(Limnodromus* sp.) (C. Tanner pers. com.). Experienced birders report a number of shorebirds use the area at low tides, and that while the site is too small to support large populations, a good variety of species moves through on a seasonal basis (D. Paulson, pers. com.).

A literature review currently being prepared on the subject of waterfowl relationships with estuarine and diked area habitats has found mixed results. Certain

species, such as those that can be classified as dabbling ducks, derive benefit from diked palustrine wetland habitats. Other species, including some dabblers, utilize estuarine habitats for a variety of life history requirements. The author concludes that there is a "lack of any kind of quantitative avifaunal monitoring for waterfowl or other waterbirds (Quifionez in prep).

7.3 Effects on Endangered Species

Potential impacts to threatened and endangered species is covered in the Biological Evaluation submitted to the Fish and Wildlife and National Marine Fisheries Services for review. The BE is included in appendix ___. The BE determined that the proposed project would be not likely to adversely effect bald eagle, Puget Sound chinook salmon, and bull trout.

7.4 Effects on Cultural Resources

Implementation of the preferred alternative will not affect any known prehistoric or historic properties potentially eligible for the National Register. As there is at least the possibility of encountering small buried sites or "wet site" features with exceptional preservation, during construction it is recommended that monitoring be conducted by professional archaeologists.

It is also recommended that Seattle District staff archaeologists be present during any geomorphic testing prior to construction. If any inadvertent discoveries of archaeological materials are made during construction or testing, all activities in the immediate area of such a find will cease until it can be assessed, and the State Historic Preservation Officer informed.

7.5 Effects on Socio-Economic Resources

Land Use. The overall land use of the project area will not change. The area will remain undeveloped and function as fish and wildlife habitat. Current recreational uses, such as bird watching and running, will still occur.

Demographics. The project as proposed is not expected to change the demographics in the area surrounding the project. No households or businesses will be impacted by project construction.

Environmental Justice. This project is expected to comply with Executive Order 12989, Environmental Justice in Minority Populations and Low Income Populations. The project location is remote and the residents of this area and the Puget Sound region will have an opportunity to enjoy the natural amenities of this habitat restoration project.

7.6 Effects on Aesthetics and Recreation

Recreation. The construction of the project will result in a temporary disruption of access to the wildlife viewing and waterfowl hunting areas on Spencer Island, as well as the shoreline trail along Union Slough. In the long term the temporary closure of the

main access route to Spencer Island will be restored. Over the long term the project will not result in a change in non-consumptive uses of the project area since the shoreline trail will be replaced in the same alignment. The companion City of Everett project to the north will actually result in an extension of the trail and possible increase in non-consumptive uses.

7.7 Toxic and Hazardous Materials

Future project activity does have the potential to introduce chemical contamination at the site. Best management practices should be implemented to avoid fuel or hydraulic spills associated with the use and storage of construction equipment on the site. In addition, appropriate storm water and erosion controls should be used to avoid and minimize impacts to water quality during construction.

7.8 Wetland Impacts

It is expected that there will be several changes in the wetlands in the project area. The majority of the changes will be beneficial in nature but there are a few impacts to wetlands that can be anticipated. There will be a loss of 2.5 acres of wetlands in the project area due to construction of new levees to protect the oxidation ponds. This loss of wetland acreage will offset by an increase in the functions and values of the estuarine wetlands restored by breaching the levees.

As a result of restoring the natural hydrology to the project area, the restoration action will provide many improvements to the functions (such as nutrient export, flood storage, fish and wildlife) of the wetlands of the site. An examination of the Snohomish Estuary Wetland Integration Plan (SEWIP, 1997) indicates that the project area is currently functioning in the 26-50 range for fish and wildlife attributes. If we use South Spencer Island as a surrogate we see that after a dike breach the wetland area could be expected to function at the 76-100 level for fish and wildlife habitat. Likewise, water quality functions could be expected to rise from the current 26-50 range to the 51-75 range as seen on South Spencer Island. Although previously stated there will be some minor impacts due to filling for creation of new levees, the overall change in the site will be beneficial. The improvements of this project in respect to functions gained greatly outweigh the impacts and are “self mitigating” for the purposes of this project.

7.9 Cumulative Impacts

Researchers analyzing historic maps for the Snohomish River estuary estimate that there were once 39 km2 (9636 ac) of estuarine wetland habitat. Diking and other activities have reduced this by nearly 75%, to current estimates of 10km2 (2471 ac). The proposed project would return some 93 acres, or 1.3% of the estimated loss. While this net gain may seem small in comparison to historic loss, when taken together with other completed and or planned restoration projects in the estuary (ie. Spencer Island, 56 ac; Qwuloolt, 390 ac; Diking District Six, 233 ac; City of Marysville, 14 ac; Port of Everett Union Slough, 19 ac) over 11% of this loss may be restored in the near future.

SECTION 8:COST ESTIMATE AND SCHEDULE

8.1 Project Cost Estimate

A detailed cost estimate is included in the Engineering Appendix. The fully funded implementation cost is $2,780,000. The federal share of the construction is estimated to be $1,935,000, so a Value Engineering study is not required. Including the feasibility study, the fully funded project cost is $3,130,000. Due to the multi-year nature of the construction, the cost estimator included annual escalation in the estimate. The cost estimator did not prepare an estimate that did not include escalation. Therefore, the only available estimate is the fully funded estimate, and the fully funded project cost is used in this report as the total project cost.

The fully funded project cost is $3,130,000. The non-federal sponsor's share is $783,000. The LERRD is estimated at $130,000, and the local cash share is estimated at $653,000.

8.2 Design and Construction Schedule

The project schedule is for a brief P&S phase beginning in February 2002, and a construction phase beginning in March 2002. Because the project is already permitted, and the feasibility design is sufficient for the work to be accomplished in 2002, the P&S phase will be used only to award the design contract for the bridges. The Corps will construct the levees in two phases, in 2002 and 2003, and will construct the bridges in 2003 and open the breaches in 2004. The only fish window concern will be for the breach opening.

8.3 Non-Federal Responsibilities

The non-federal sponsor (the City of Everett) is responsible or the operation and maintenance requirements, as described above. Additionally, the City will provide all necessary lands, easements and rights of way (LERRD) for construction and operation/maintenance of the project in perpetuity. All LERRD that the City provides will be credited towards the overall 25% local share of the implementation costs.

8.4 Real Estate

8.4.1 Background

The City of Everett, Washington is the Non Federal Sponsor (NFS) for this project and currently owns land required to support the project as shown in the real estate drawing included in Exhibit A of Appendix A. However, Diking Improvement District No. 5 (District) has an easement interest (granted in the 1920's by the former owner of record) for the dikes that will be breached in three places. The NFS is in the process of extinguishing the District's easement within the Section 1135 Project and betterment areas, and will take over operation and maintenance of the dike in these areas. There are no existing federal lands within the proposed project footprint.

In support of construction, and subsequent operation and maintain of the proposed project, the NFS must own or control a sufficient area and interest in approximately 41.90 acres fee. An additional 0.30 of an acre needed for the project is below the Union Slough Mean High Water (MHW) elevation, and in navigable waters. During the period of construction, the proposed project will require a 4.3-acre temporary work area easement, including approximately 4.1 acres above MHW. An additional 0.20 acres below the MHW is in navigable waters. The temporary work area easement will be required for a 3-year construction period and is located staging adjacent to 4th Street SE, access from 12 Street NE. Table I below is a summary of the lands, easements and right-of-way (LER) and values by type of estate.

TABLE I - CREDITABLE LER SUMMARY

ESTATE	ACREAGE	ESTIMATED VALUE
Fee	41.60	$117,000
Temporary Work Area Easement (3-years)	4.10	$ 4,000
TOTALS	**45.70**	**$121,000**

8.4.2 Estates

All lands required to support the proposed project are standard estates. The fee and temporary work area easement estates are defined ER 405-1-12, Chapter 5, Change 7 of 8 Feb 1979.

8.4.3 Navigational Servitude

The proposed project is a modification to the Everett Harbor Snohomish River Navigation Project completed in 1963. The Corps of Engineers (COE) Regulatory Branch considers Union Slough as navigable. Navigational servitude is being exercised on the lands below MHW for the proposed project. This area is not included as part of the NFS's creditable lands, easements, and rights-of-way.

8.4.4 Public Law 91-646 and Acquisition

8.4.4.1 Assessment of NFS Land Acquisition Experience

The NFS has been advised of Public Law 91-646, as amended. The NFS has land acquisition experience and is fully capable of acquiring any lands necessary for the project. The NFS real estate acquisition capabilities were assessed and are the results are summarized in Appendix A , Exhibit B.

8.4.4.2 Zoning

There are no zoning ordinances proposed in lieu of or to facilitate acquisition in connection with this project.

8.4.4.3 Relocation Benefits

No relocation assistance benefits are anticipated to be required for the implementation of the project. There are no landowners or businesses that will temporarily or permanently be displaced under the proposed project.

8.4.4.4 Mineral Interests

When the NFS acquired the project lands in the 1950's through a "Governor's Deed", it was common practice for the state to segregate the mineral interests. There are no past, or current mining activities in the vicinity of the project, and future mining is not anticipated. The NFS has been advised to clear, or subordinate the mineral interests, and if not possible, to perform a risk analysis regarding the segregated mineral interests within the project footprint. This issue will be reevaluated during the next project phase.

8.4.4.5 Investigation of Contaminants

The district conducted a "Preliminary Assessment Screening "(PAS) for this project. The City of Everett has owned the land since 1959. Prior to 1959, the land was privately owned and used for agricultural production. There is no known or suspected presence of hazardous and/or toxic waste contamination within the project area. See paragraph 4.7 Hazardous and Toxic Wastes of this report for further details and discussion of the HTW investigation and results.

8.4.4.6 Landowners Views and Public Opposition

The COE is not aware of any public opposition to this project.

8.4.4.7 Utility and Facility Relocations

No facility or utility relocations are anticipated for this project.

8.4.5 Special Value Considerations

Since the NFS already owns the lands for the proposed project, LER credit will be based on Federal appraisal principles for determining market value for crediting purposes. Land below MHW is not part of the NFS creditable LER.

8.4.6 Real Estate Cost Estimate

The NFS's total LER cost is estimated to be $165,000, see Table II below. This estimate includes NFS costs such as title, survey and appraisal, and negotiation costs; clearing third party interests, recording fees; and legal fees. Federal review and assistance costs, including those costs associated with providing the NFS with LER requirements, review of acquisitions and crediting appraisals, coordination meetings,

review of right-of-way documents, legal support, and crediting activities are estimated to be $12,000.

TABLE II TOTAL NFS LER COSTS

Lands and Damages	$121,000
Non-Federal Sponsor's Acquisition Costs	$ 22,000
Subtotal NFS Costs	$143,000
Contingency @ 15%	$ 22,000
TOTAL NFS LER COSTS	$165,000

8.4.7 Betterments

This area immediately north of the proposed Section 1135 Restoration Project is not part of the proposed cost-share project, however, the City plans on restoring that area at same time the Corp's constructs the Section 1135 Project. See area identified as "Betterment" in Appendix A, Exhibit A. Currently the plan is for the Corps to include the restoration work in the betterment area with the Section 1135 contract work. The NFS must demonstrate that it owns and controls a sufficient interest in the lands for the betterment area prior to the Corps advertising for construction. The NFS will also need to provide 100% of the estimated costs of constructing this area in advance of the Corps performing the work.

8.4.8 Certification Requirements

Before advertisement for construction, the NFS must demonstrate that it owns a sufficient area and interest in all the lands the Corps has identified as necessary for the project construction contract. The NFS must also provide the Government with authorization for entry to all lands, including the betterment area, for the proposed project. Authorization for entry will be by providing the Corps with a Certification of Lands and Authorization for Entry and Attorney's Certificate as presented in Exhibit C of Appendix A. See paragraph 8.2 for the project design and construction schedule.

SECTION 9:COORDINATION AND LOCAL SUPPORT

9.1 Compliance with Environmental Statutes

Law/Regulation	Status of Compliance
NEPA	This document is draft NEPA documentation.
SEPA	NEPA document will be prepared to allow sponsor to adopt NEPA documentation per SEPA.
Clean Water Act, Section 404	Project falls under the nationwide 27 permit process. Public review under 404 and completion of review will occur during review of the feasibility plan. Project is designed to be consistent with 404.
Clean Water Act, Section 401	401 Certification will be obtained following the 404 public notice, all requirements of permit will be complied with.
Clean Water Act, Section 402	A stormwater pollution prevention plan will be prepared for the stormwater discharge permit during plans and specs.
Endangered Species Act	ESA coordination is on going. A draft Biological Evaluation is attached; no adverse impact is expected to any listed or candidate species. Informal consultation is expected. The BE has been submitted to NMFS and USFWS
Fish and Wildlife Coordination Act	Final Coordination Act Report is attached. USFWS supports this project.
National Historic Preservation Act	State Historic Preservation Officer coordination is ongoing.
Executive Order 11988, Floodplain Management	Project will not encourage further development in the floodplain.
Executive Order 11990, Protection of Wetlands	Project will provide for restoration of any wetland impacts.

Law/Regulation	Status of Compliance
Shoreline Management Act	Because the project is following the Nationwide 27 permit guidelines, and the sponsor has obtained an HPA and Shoreline exemption, no Shoreline permit has to be obtained by the local sponsor. Project is designed to be consistent with these regulations.
Coastal Zone Management Act	The project is following the Nationwide 27 permit process. Consistency with CZMA and SMA has already been granted for this nationwide permit. Project is designed to be consistent with these regulations.
Clean Air Act	Coordination with local air pollution control agency (Puget Sound Air Pollution Control Authority) is ongoing. Project construction will have minor impact on air quality; no other impacts expected.
Washington Hydraulic Code	Local sponsor has obtained an HPA, project is designed to enhance fish habitat. WDFW supports and sponsors this project.
Indian Treaty Rights/Trust Responsibility	Coordination is ongoing, project is designed to enhance fish habitat.

9.2 Public and Agency Coordination

The Corps has coordinated with the Washington State Department of Fish and Wildlife and has received an advisory HPA for the project. The Fish and Wildlife Service has issued a final Fish and Wildlife Coordination Act Report (Appendix __) for this project. Corps staff have also met with Washington State Department of Ecology on January 4, 2002 to discuss requirements for the 401 Water Quality Certification.

SECTION 10: CONCLUSIONS AND RECOMMENDATIONS

10.1 Conclusions

This study has included an examination of all practicable alternatives for meeting the study objective of restoring tidal influence to the project site adjacent to Union Slough in Everett, Washington, for fisheries and wildlife. Alternative BEF is the most effective alternative that also meets the sponsor's needs. The plan provides significant fish and wildlife benefits at a reasonable construction and O&M cost. The plan does not impair the original Federal project at this site for navigation, and is consistent with national policy, statutes, and administrative directives. The plan has been reviewed in light of overall public interest, which includes the views of the local sponsor and interested agencies. The District has concluded that the City of Everett is capable of meeting their financial obligations and that the total public interest would be served by implementation of the recommended plan.

10.2 Recommendations

I recommend that the proposed work be authorized and funding allotment of $1,935,000 be made available to complete construction. The proposed work would be improvements for fishery and wildlife restoration for the designated area of Union Slough in Everett, Washington, as generally described in this report, with such modifications by the Chief of Engineers as may be advisable to meet provisions of Section 1135 of the 1996 Water Resources Development Act, as amended. Authorization is subject to cost sharing and financing arrangements with the local sponsor, the City of Everett, and is based o the cost sharing and financing requirements as contained in Public Law, 99-662, as amended. Prior to construction, and during Plans and Specifications stage, the local sponsor will: provide all lands easements, and rights of way necessary for the project; hold and save the Unites States free from damages due to the construction or operation and maintenance of the project; and operate and maintain the project after construction.

Date:_____ _____

Colonel Ralph H. Graves
Colonel, Corps of Engineers
District Engineer

APPENDIX A. REAL ESTATE DOCUMENTS

APPENDIX B. FWCA REPORT/ HPA

APPENDIX C. ENDANGERED SPECIES CONCURRENCES

APPENDIX D. FONSI

APPENDIX E. 404 PUBLIC NOTICE

APPENDIX F. ENGINEERING DESIGN AND COST ESTIMATE