FINAL ENVIRONMENTAL ASSESSMENT

SECTION 206
ENVIRONMENTAL RESTORATION

SQUAK VALLEY PARCEL, ISSAQUAH, WASHINGTON

July 2004

US Army Corps of Engineers ®
Seattle District

Squak Valley Environmental Restoration
Issaquah, King County, Washington
Final Environmental Assessment
July 2004

Responsible Agency: The responsible agency for this project is the Seattle District, U.S. Army Corps of Engineers (Corps).

Abstract: This final environmental assessment (EA) evaluates the potential impacts of the proposed creation of two backwater channels, enhancement of an existing tributary to Issaquah Creek, and associated planting and grading at the Squak Valley parcel in Issaquah, Washington. The primary purpose of the project is to create off-channel rearing and refuge habitat for salmon and trout. Associated riparian plantings will benefit local wildlife by improving habitat value along the riparian corridor of Issaquah Creek. As a component of this project, the City of Issaquah will require several recreational features in keeping with the City's master plan. Alternatives considered in the EA include the Preferred Alternative as well as construction of a side channel and complete levee removal. All of the evaluated alternatives would allow the creek to access the floodplain to a much greater extent that currently exists, but the Preferred Alternative provides the most environmental benefits, particularly considering gains in fish habitat. The cumulative effect of the Squak Valley project will be to provide incremental enhancements of ecological functions and values in the basin, particularly regarding salmonid habitat. The proposed work is planned for the summer of 2005.

THE OFFICIAL COMMENT PERIOD ON THE DRAFT ENVIRONMENTAL ASSESSMENT CLOSED ON **SEPTEMBER 29, 2003**.

This document is available online under *Squak Valley Habitat Restoration* at:
http://www.nws.usace.army.mil/ers/doc_table.cfm

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BE: Biological Evaluation

CFR: Code of Federal Regulations

DPS: distinct population segment

EA: Environmental Assessment

EFH: Essential Fish Habitat

EO: Executive Order

ESA: Endangered Species Act

ESU: evolutionarily significant unit

FWCA: Fish and Wildlife Coordination Act

ISPG: Integrated Streambank Protection Guidelines

LWD: large woody debris

NEPA: National Environmental Policy Act

NOAA: National Oceanic and Atmospheric Administration

NMFS: National Marine Fisheries Service

NWP: Nationwide Permit

RM: river mile

USC: United States Code

USFWS: United States Fish and Wildlife Service

WDFW: Washington Department of Fish and Wildlife

WSDOT: Washington State Department of Transportation

WQC: Water Quality Certification

WRIA: Water Resource Inventory Area

1. INTRODUCTION

The United States (U.S.) Army Corps of Engineers (Corps) proposes enhance fish and wildlife habitat adjacent to Issaquah Creek near the southern city limits of Issaquah, King County, Washington. The proposed work is planned for the summer of 2005. In accordance with the National Environmental Policy Act (NEPA), this document examines the potential impacts and potentially feasible (i.e. reasonable) alternatives of the proposed project.

2. BACKGROUND

2.1. Project Location

The approximately 10-acre Squak Valley parcel (Section 3, Township 23N, Range 6E, Willamette Meridian) is located between Issaquah-Hobart Road and Issaquah Creek, just south of Southeast 96th Street within the City of Issaquah in King County, Washington (Figure 1). The parcel is owned by the City of Issaquah. A small tributary (Water Resource Inventory Area, or WRIA, Trib. 0199, also known as Kees Creek) flows along the northern edge of the property before draining into Issaquah Creek. The site lies at approximately river mile (RM) 4.6 of Issaquah Creek.

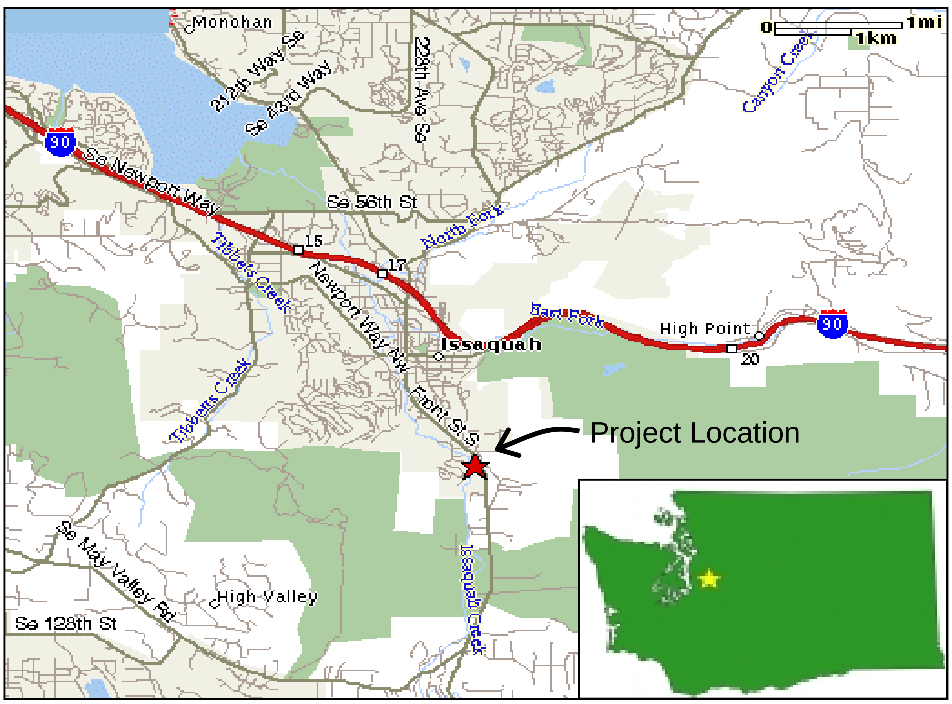

Figure 1. Project Location

2.2. Project Authority

The proposed project is authorized under Section 206 authority of the Water Resources Development Act of 1996, P.L. 104-303. This authority authorizes the Secretary of the Army to carry out aquatic ecosystem restoration and protection projects if the Secretary determines that the project will improve the quality of the environment, is in the public interest, and is cost-effective. The local sponsor for the project is the City of Issaquah.

2.3. Need and Purpose

Over the last century, the portion of Issaquah Creek within Issaquah city limits has been channelized and otherwise altered to the detriment of local fish and wildlife populations. As a result, Issaquah Creek within the City of Issaquah has few stable off-channel habitats, which are essential for full production of Chinook salmon, coho salmon and steelhead trout. A recent report (Parametrix 2002) identified lack of off-channel salmonid habitat as a limiting factor for the mainstem of Issaquah Creek. Side channels and backwater sloughs are important for Chinook salmon rearing from February through July when Chinook fry and juveniles are present in the system in greatest numbers (note that Chinook juveniles typically move away from shore and into higher velocity areas as they grow larger; Lister and Genoe 1970, Chapman and Bjornn 1969). Off-channel areas are also very important for juvenile coho salmon throughout the year as rearing and refuge habitat. Off-channel areas and wetlands help attenuate the magnitude or duration of high velocities in the main creek channel during high flows by allowing the creek to flow onto its floodplain, thereby helping to reduce scour of salmon redds in downstream areas (two Chinook salmon redds were observed in the reach of Issaquah Creek adjacent to the property in fall 1999; Martz 1999).

The proposed project is intended to create off-channel rearing and refuge habitat for fish, including salmon and trout species, along the Issaquah Creek corridor. Associated riparian plantings will benefit local wildlife by improving habitat value along the riparian corridor of Issaquah Creek.

As a component of the Squak Valley project, the City of Issaquah requires several recreational features in keeping with the City's master plan. These recreational features at the project site are designed to promote education and passive day uses such as walking and picnicking.

3. ALTERNATIVES

3.1. Preferred Alternative (Two Backwater Channels)

The Preferred Alternative consists of excavating two backwater channels (Figure 2). While isolated from the creek channel by an existing levee, two dead-end, backwater channels would be excavated. Each channel would incorporate two deeper pools, and the channels would be sloped and excavated to ensure a positive gradient to the creek channel with the pools wetted under all but the driest conditions. Once excavated, the new channels would be connected to Issaquah Creek by removing two sections of the existing levee along the creek shoreline.

The northern and southern channels would be 280 and 320 feet long, respectively, as measured along the channel bottom (i.e. the side slope at the channel end is not included). Bottom width of the channels would vary between 7 and 12 feet and the channel shorelines would be graded to slopes varying between 2:1 (horizontal to vertical) and 4:1. Bankfull width of the channel would be between 18 and 26 feet (varying due to the varying side slope gradients and channel depth). Each channel would incorporate three wetland bench areas that would be planted with native emergent sedge species.

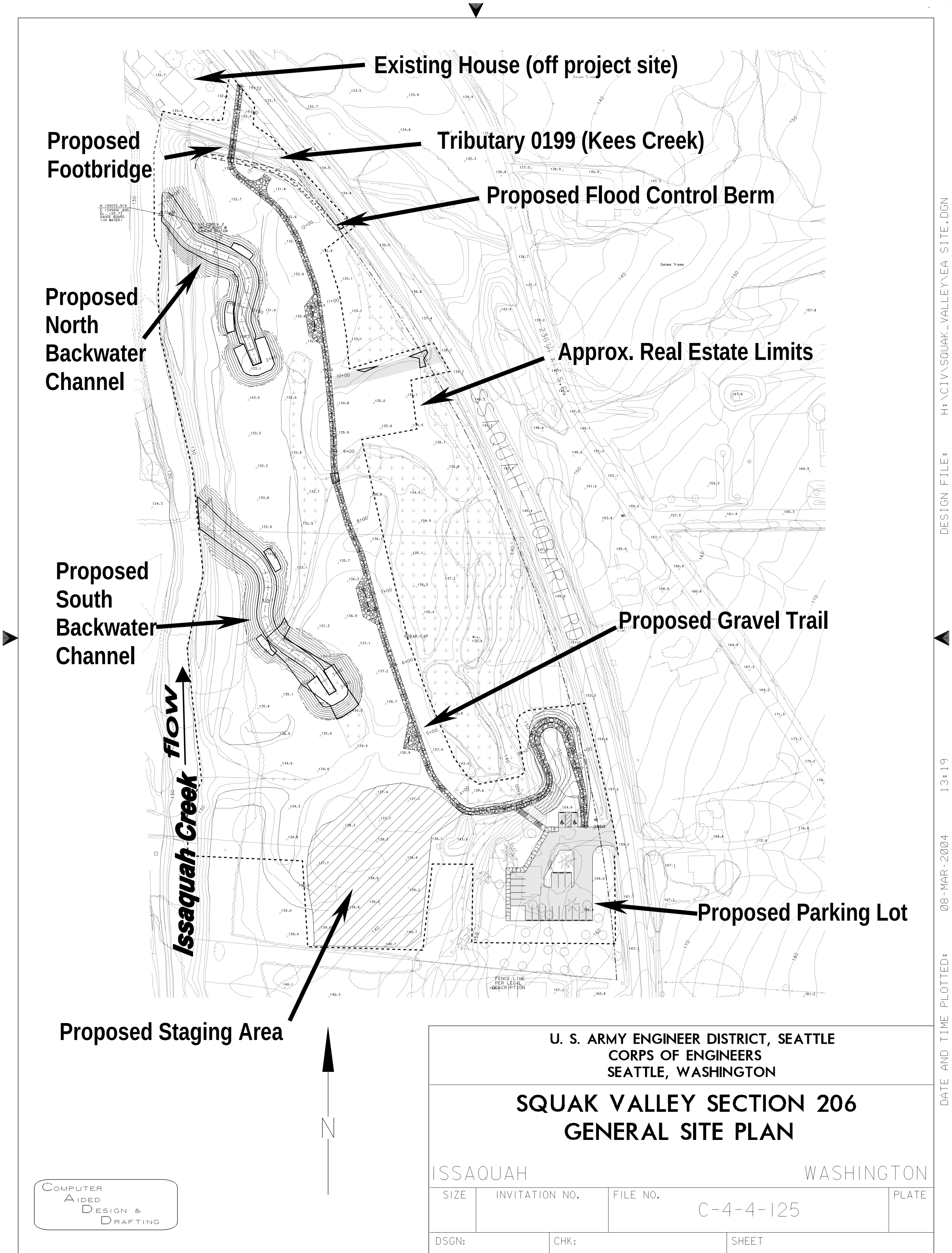

Figure 2. Preferred Alternative Layout (see Appendix A for detailed design drawings)

At least 10 pieces[1] of large woody debris (individual pieces will have an attached rootwad, a minimum diameter-breast-height of 18 inches, and a minimum length of 20 feet) would be placed along the shoreline of each channel and the areas bordering the channels would be planted with a variety of native plant species. The channel outlets include bioengineered streambank protection that incorporates a riprap toe (about 37 cubic yards of Class I riprap[2] for each outlet), native plantings, and soil lifts made with geotextile fabric. A low berm would be constructed along the Issaquah-Hobart road to contain periodic floodwaters within the project site and to protect the road and houses to the north from flooding.

Other restoration work includes enhancement of Tributary 0199 (along the southern project boundary) by grading the existing near-vertical banks to a shallower slope and planting native plant species.

Recreation features that would be constructed include a gravel trail, picnic benches, and open areas. The gravel trail would start at a small parking lot that would be constructed on a terrace at the southeastern corner of the site. The trail alignment follows the route of the construction access roads and also provides maintenance access to the site following construction. The trail crosses one narrow wetland area. This wetland crossing will consist of a gravel path that is laid at the existing ground surface, thereby providing connectivity between the backwater channels and the undisturbed wetlands east of the trail (see Section 5.6.4.2).

Construction would be accomplished with standard excavation equipment which may include dump trucks, track hoes, backhoes, small bulldozers, tractors, graders, front-end loaders, pumps, hydroseeding truck, and hand shovels and rakes. Construction is anticipated to occur during a window between April and October 2005. Work in Issaquah Creek or Tributary 0199 would be restricted to the fish window of June 15 to July 31. Vegetation would be planted in the fall following construction. Excess excavated material would be disposed on uplands at a site about ¼-mile south of the project site.

3.2. Side Channel with Two Levee Breaches

This alternative would involve construction of a side channel along Issaquah Creek by creating two openings in the existing levee and excavating an existing swale in the field to create a channel connecting the levee breaches (Figure 3). The upstream levee breach would consist of a riprap weir designed to allow flow to enter the side channel only during high water events (roughly 2 to 3 times per year). The side-channel outlet would be stabilized with bioengineered streambank protection that includes a riprap toe, native plantings, and soil lifts by geotextile fabric. A total of about 600 cubic yards of riprap (of which about 560 cubic yards would be Class III riprap) would be required for the upstream weir and the downstream bank stabilization. The lower portion of the channel would be inundated by backwater at normal winter flows. Total length of the side channel would be about 1000 feet and the bottom width would be about 10 feet.

[1] The number of pieces of large woody debris doubles the density of woody debris referenced in the NMFS Matrix of Pathways and Indicators (NMFS, 1996) for "properly functioning" systems.
[2] The maximum size of Class I riprap is 150 pounds per rock, with 50% larger than 50 pounds

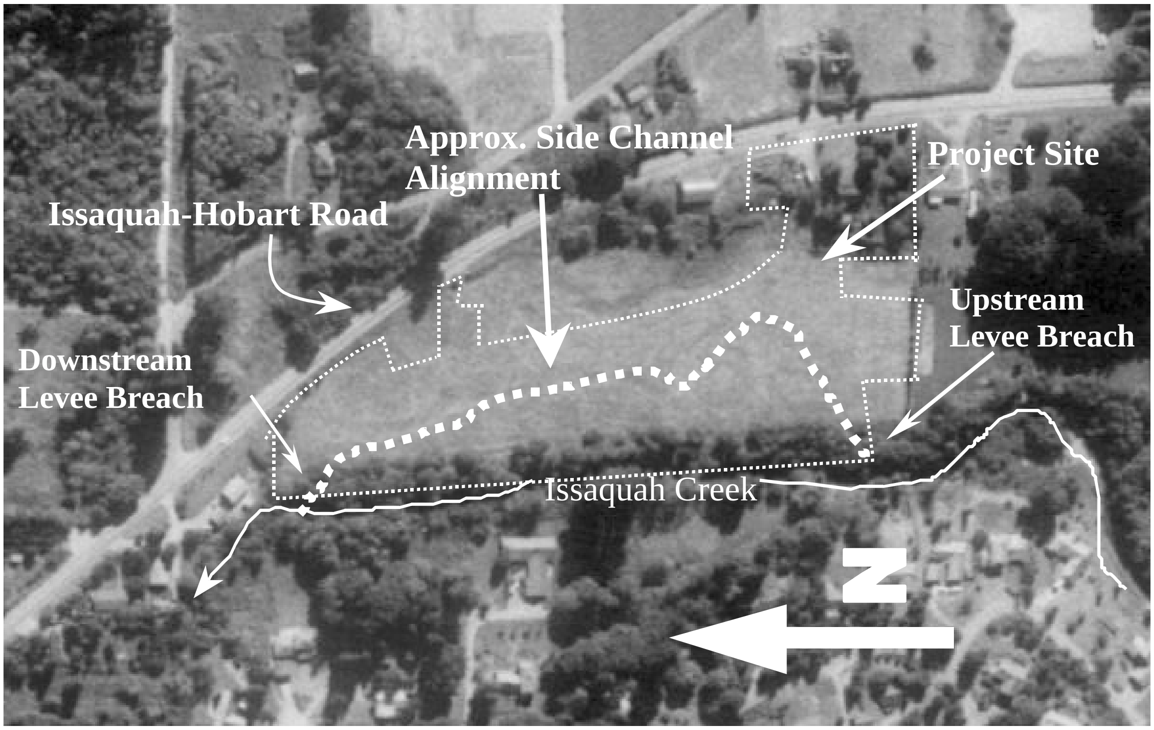

Figure 3. Conceptual Plan of Alternative with Side Channel and Two Levee Breaches

Bankfull width of the side channel would be about 26 feet. Properly-sized gravels and large woody debris would be placed in the side channel to provide refuge and rearing habitat for anadromous and resident salmonids.

In common with the Preferred Alternative (Section 3.1), riparian vegetation would be planted along the channel, a low berm would be constructed along Issaquah-Hobart Road, the side slopes of Tributary 0199 would be graded and planted, and recreational features would be incorporated into the site design. Construction equipment and techniques would be similar those described for the Preferred Alternative.

3.3. Complete Levee Removal

This alternative would remove the existing levee along the entire western property boundary along Issaquah Creek. The Issaquah-Hobart Road and houses to the north would require new protection from floods in the form of a low levee or berm located adjacent to the road. Riparian vegetation would be planted along the channel, the side slopes of Tributary 0199 would be graded and planted, and recreational features would be incorporated into the site design.

3.4. No Action

Under the "No Action Alternative," no work would be done at the Squak Valley parcel. If mowing of the field continues, the site would remain in its existing condition for the foreseeable future. If mowing ceases, the project site would likely gradually change to a mix of blackberry thicket and alder and cottonwood forest. The existing creek along the project site appears fairly stable and would likely remain that way in the absence of disturbances from falling trees, alteration of the western streambank, or upstream land-use changes.

3.5. Cost Comparison for Action Alternatives

Of the action alternatives, complete removal of the levee would be the most costly, primarily due to increased earthmoving requirements. Cost for the Preferred Alternative and the Side Channel with Two Levee Breaches would be similar.

3.6. Alternatives Considered But Not Evaluated in Detail

During the planning process, various alternatives were initially considered. As an initial screen for these planning alternatives, the Corps performed an analysis of environmental benefits to fish and wildlife habitat in relation to project cost. The alternative described below was considered, but, for the reasons stated below, will not be carried forward for further evaluation because the environmental benefits were not sufficient to justify the costs, or they entailed unacceptable environmental impacts.

3.6.1. Several Levee Breaches, No Channels

Several levee breaches along the project reach would allow higher flows to inundate the floodplain many times during the winter. Except at the levee breaches, the trees and willows on the levee would remain in place to provide creek shading and wildlife habitat. The road and houses to the north would not be protected to the current level of flood protection, so a secondary levee or berm would be constructed. As with total levee removal, fish would access the project site for short periods when high flows flood the site, but no rearing habitat would be created. Since this alternative is similar to the Preferred Alternative but provides substantially less fish habitat benefits, it was not be carried forward for further evaluation.

4. EXISTING CONDITIONS

4.1. Physical Characteristics

The Issaquah Creek Basin encompasses approximately 61 square miles (Kerwin 2001). The basin's headwaters flow from the steep slopes of Cougar, Squak, Tiger and Taylor Mountains. Elevations range from more than 3,000 feet at the peak of Tiger Mountain to near sea level at the mouth of Issaquah Creek. The basin includes Issaquah Creek and its tributaries Holder, Carey, Fifteenmile and McDonald Creeks and the North and East Forks of Issaquah Creek, as well as Tibbetts Creek.

The Squak Valley parcel occupies a floodplain terrace in a rural area in the southern part of Issaquah. The majority of the site is low lying and, in the absence of the levee along Issaquah Creek, would likely flood frequently during the winter. The southeast corner of the site consists of an upper terrace. A steeply sloped hillside leads from the upper to lower terrace.

The reach of Issaquah Creek bordering the Squak Valley parcel is straight and a consistent bankfull width of about 30 feet (E. Lewis, Corps, 2003, pers. obs.; Martz 1999). The channel is primarily a riffle/glide complex, with only one piece of large wood in the channel along the left bank in the project reach and 3 small lateral pools associated with shoreline structure or vegetation (Martz 1999). Cobbles and gravel dominate the creek substrate, with a veneer of sand along the shorelines during lower flows. Tributary 0199, a perennial stream, flows into Issaquah Creek along the northern boundary of the site.

Streambanks of both watercourses at the Squak Valley parcel appear to be stable and are likely the result of historical shoreline manipulation. Riprap bank protection along the project reach is sporadic and superseded in function by the mature bank vegetation growing on sediment deposits that overlay what little rock could be found during a survey in February, 2003 (E. Lewis, Corps). Immediately downstream of the mouth of Tributary 0199, a revetment of large rock protects the right bank. Upstream of the south boundary of the project site, a rock bulkhead stabilizes lawn along the left bank.

The proposed disposal site is located on an elevated terrace adjacent to Issaquah-Hobart Road. A residence with adjacent fields and scattered trees dominates the portion of the site that would be used for disposal. The disposal footprint is 3.6 acres of uplands. A wetland area occurs in the southwestern portion of the site and continues on the lower terrace along Issaquah Creek. No material would be placed closer than 50-feet from the edge of the wetland area.

4.2. Hydrology and Hydraulics

Issaquah Creek is one of the larger creeks in the Lake Washington watershed, with streamflows ranging from several hundred cubic feet per second (cfs) in the winter to summer lows of about 30 cfs (King County 1991). Mean flow is 134 cfs (King County 1991). Drainage area for Issaquah Creek is about 61 square miles, most of it upstream of the Squak Valley parcel (Kerwin 2001). Unit area discharges have been calculated for the basin and range from 0.06 to 0.12 cfs/acre, with a mean flow of 0.099 cfs/acre (King County 1991). This number is relatively large compared to other highly urbanized Lower Puget Sound basins that are typically in the 0.078 cfs/acre range (King County 1991). The large unit area discharge in the Issaquah Creek basin is the result of greater local precipitation, generally steeper topography, and a local geology dominated by significant amounts of bedrock and till. The 100-year flood discharge is estimated to be 3,160 cfs and the 10-year flood discharge to be 1,960 cfs (King County 1991).

4.3. Water Quality

Water quality in the basin is generally good. Although the lower reaches of the creek (generally downstream of the project area in Township 24N, Range 6E) are listed on the Washington State 303(d) list of impaired waters for elevated temperatures and fecal coliform levels (<www.ecy.wa.gov/programs/wq/links/impaired_wtrs.html>), state water quality standards designate Issaquah Creek as Class A (excellent). Localized pollution from urban sources, roads, and agricultural and forestry activities likely contribute to the 303(d) listing of Issaquah Creek.

4.4. Geology/Sediments

The soils and land types of the King County Area were formed largely in deposits of glacial drift laid down during the Vashon period of the Fraser glaciation late in the Pleistocene. The major kinds of material left by the glacier are till, recessional outwash, and pro-glacial lacustrine and outwash sediments (Snyder *et al.* 1973).

Soils on the low terrace are mapped as Puyallup fine sandy loam, a soil series typical of alluvium and natural levees adjacent to streams (Snyder *et al.* 1973). Soil borings done by the Corps in March, 2000 indicate that the soils are characterized by about a 1-foot-deep layer of sandy silts overlying 1 to 5 feet of sandier soils. Below the sandy layers, deposits of clean gravels predominate. The water table generally corresponds to the gravel layers.

Gravels characterize the creek substrate, with occasional sand bars along the creek shoreline (E. Lewis, Corps, pers. obs.). No known sources of possible sediment contamination occur at or upstream of the project site.

4.5. Natural Resources

4.5.1. Fish

Anadromous fish found in Issaquah Creek include Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), sockeye salmon (*O. nerka*), and steelhead trout (*O. mykiss*). In recent years large numbers of Chinook, coho, and sockeye salmon have returned to Issaquah Creek but only a small percentage of these salmonids have been documented upstream of the hatchery intake dam at RM 3.5. Resident fish in the creek include sculpin (*Cottus* spp.) and large numbers of cutthroat trout (*O. clarki*). There was an observation of a native char (*Salvelinus* sp.) in the creek years ago and a small native population of kokanee historically inhabited the creek.

4.5.1.1. Chinook Salmon

Issaquah Creek is one of the three major Chinook salmon spawning streams in the Lake Washington basin (the other two are the Cedar River and Bear Creek; Kerwin 2001). Chinook salmon return to Issaquah Creek from July through October, with the peak in late August through September (WDFW and WWTIT 1994). The collection of adult coho and Chinook salmon for egg propagation at the hatchery takes place during the months of September, October, and at least part of November. The collection of broodstock during this period precludes Chinook salmon and coho salmon escapement above the hatchery. During the collection period, essentially all salmonids other than Chinook salmon and coho salmon are sorted out manually and released back into Issaquah Creek upstream of the hatchery weir. During the rest of the year, approximately December through August, upstream-bound fish are allowed to pass over the hatchery weir. Therefore, any Chinook salmon returning before or after the hatchery collection period would be able to move upstream of the hatchery and spawn naturally. Primary spawning areas include the East Fork of Issaquah Creek and, due to low summer flows that can make it difficult for returning hatchery fish to reach the hatchery, the mainstem below the hatchery (WDFW and WWTIT, 1994).

The majority of naturally-spawned Chinook salmon production in the basin is likely the progeny of hatchery-spawned fish. The hatchery's production goal requires approximately 1,200 adult Chinook salmon for egg production and the escapement goal is 500 fish. In some years, the escapement goal is not met, but recent returns have been well sufficient to meet both the hatchery and escapement thresholds. Adult returns between 1994 and 2001 ranged between 1,246 and 10,451 fish. The Washington Department of Fish and Wildlife (WDFW) estimates that Issaquah Creek produced between 39,000 and 45,000 juvenile Chinook salmon in 2000.

Issaquah Creek Chinook salmon exhibit an "ocean-type" life history. In general, ocean-type fish tend to move relatively rapidly through freshwater and into coastal or estuarine rearing areas as juveniles. Like most Chinook salmon in the Lake Washington basin, Issaquah Creek Chinook salmon emigrate from their natal streams as fry from early January through March (WDFW and WWTIT 1994). Most juvenile fish then rear in Lake Washington for several months moving into Puget Sound in May and June. Recent evidence also suggests evidence that some Chinook salmon may rear in Lakes Sammamish and Washington for a year or more prior to out-migration (K. Fresh, NOAA Fisheries, pers. comm.).

4.5.1.2. Coho Salmon

Adult coho salmon return and migrate upstream from early September through late December and juvenile coho salmon migrate downstream in mid March through May in Issaquah Creek (WDFW and WWTIT, 1994). Coho salmon are also propagated at the Issaquah hatchery so there is a hatchery component and a wild component to the Issaquah Creek coho salmon population. Adult coho salmon returning to Issaquah Creek are collected during the months of September, October, and part of November. Generally the procedure has been to collect approximately 2,400 coho salmon for egg propagation and allow 1,300 to 2,400 coho salmon above the rack to spawn naturally.

Trapping of juvenile coho salmon was conducted in the spring of 2000 from March 14 through July 3 to estimate natural coho salmon production of Issaquah Creek. In 2000, WDFW estimated that Issaquah Creek produced 18,232 wild coho salmon (D. Seiler, WDFW, pers. comm.).

4.5.1.3. Sockeye Salmon

The 1992 Washington State Salmon and Steelhead Inventory (WDF *et al.* 1993) identified three distinct sockeye salmon stocks in Lake Washington, with the Issaquah Creek sockeye salmon as a part of the Sammamish Tributary Stock. Historic run sizes (1972-1990) for Issaquah Creek in particular are not available but the entire Lake Washington population had a median return of 246,913 adults, ranging from 122,964 in 1990 to 531,062 in 1988. From 1988 to 1995, the population continually declined with the lowest run on record occurring in 1995. However, in 1996, 2000, and 2002, large numbers of sockeye salmon returned, suggesting that the long-term negative escapement trend is reversing. Adult sockeye salmon return to Issaquah Creek from August to November with peak returns in September and October (WDFW and WWTIT, 1994). Juvenile sockeye salmon migrate downstream from January through April (WDFW and WWTIT, 1994).

4.5.1.4. Kokanee

Native kokanee were historically widespread throughout Lake Washington and its tributaries (Bean 1891). From 1978 to 1998, the native early-run-timing kokanee stock was found largely in Issaquah Creek and was believed to be the only remaining native stock of kokanee present in the Lake Washington Basin (Pfeifer 1995). Historically, this stock was present in at least Swamp and Bear Creeks. During the 1930's and 1940's, the Washington Department of Game took up to 10 million eggs from kokanee that were trapped in Bear Creek. An egg take of this size suggest trapping of in excess of 10,000 adults and as high as 25,000. However, the annual escapement rates into Issaquah Creek were reported to vary between one and three thousand individual spawners during the early 1970's (Berggren 1974). From 1980 through 1982, estimated kokanee escapement into Issaquah Creek ranged from approximately 400 and 1,000 fish (Pfeifer 1992). In 1983, only 10 early run kokanee were observed in Issaquah Creek.

Kokanee escapement counts conducted from 1992 through 1998 showed a continual low escapement.

The decline of the Issaquah Creek kokanee is most likely due to their spawning timing. These fish spawn in July and August, subjecting their redds to the typical low flow period that is accompanied by warm water temperatures. In addition, sockeye, Chinook, and coho salmon would potentially construct their redds in the same locations as the kokanee redds that were constructed just a few weeks earlier. Presently, the hatchery intake dam essentially blocks kokanee migration to upstream areas, including the creek reach adjacent to the Squak Valley parcel, in part due to low flows during the kokanee spawning migration (Parametrix, 2002). In 2001 and 2002, the WDFW operated a weir on Issaquah Creek to trap kokanee in July and August, but no kokanee were caught (J. Uehara, WDFW, 16 Jul. 2003 memo to Lake Sammamish Kokanee Technical Committee). This evidence suggests that early-run kokanee no longer exist in Issaquah Creek, although populations may persist in other portions of the Lake Sammamish basin.

4.5.1.5. Steelhead Trout

Steelhead trout, displaying perhaps the most diverse life history pattern of all Pacific salmonids, reside in most Puget Sound streams. Steelhead trout are divided based on the state of sexual maturity when they enter freshwater. Stream-maturing steelhead trout (also called summer steelhead trout) enter freshwater in an immature life stage, while ocean-maturing (or winter steelhead trout) enter freshwater with well-developed sexual organs (Busby *et al.* 1996). Steelhead trout in the Lake Washington basin are winter steelhead trout that spawn from February through May. Juvenile steelhead trout migrate in April and May. Much like Chinook and coho salmon, the steelhead trout population is composed of hatchery and wild fish. In 1998, fry were planted in the upper river and the Issaquah hatchery also raises steelhead trout that are released as fingerlings. In recent years, only a couple of adult steelhead trout have returned to Issaquah Creek each spring. In 2000, the juvenile sampling with a screw trap near the creek's mouth estimated that a total of 1,146 wild steelhead trout smolts migrated past the trap (D. Seiler, WDFW, pers. comm.).

4.5.1.6. Coastal Cutthroat Trout

Coastal, or anadromous cutthroat trout, are distributed in coastal watersheds along the entire Pacific Coast north of the Eel River in northern California. Coastal cutthroat trout exhibit early life history characteristics similar to coho salmon and steelhead trout whereby juveniles spend time rearing in freshwater before out-migrating as smolts (Leider 1997). Little information is available on the status of coastal cutthroat trout in Issaquah Creek. It is known that the adult cutthroat return to Issaquah creek in February through April, and the juveniles migrate downstream in February through June. Lake Washington cutthroat spawn in tributaries and appear to spend their entire life in Lake Washington rather than migrating into the Puget Sound. Over 4 years of purse-seining in Lake Union and the Chittenden Locks, thousands of sockeye salmon, coho, and Chinook salmon have been captured but only a few cutthroat have been observed (C. Ebel, Corps, pers. comm.). Trapping of out-migrating fish was conducted in the spring of 2000 from March 14 through July 3 to estimate the wild coho salmon production of Issaquah Creek. In addition to obtaining coho salmon production, information on cutthroat trout was obtained. It was estimated that 14,803 cutthroat migrated past the trap during the sample period. However, no attempts were made to adjust this number to represent the total basin production.

4.5.1.7. Bull Trout

The only likely viable bull trout subpopulation in the Lake Washington watershed is the Chester Morse Reservoir subpopulation. However, the Chester Morse Reservoir subpopulation is above an anadromous barrier and is a glacial relic population (WDFW 1998). Only two ``native char" were observed between 1989 and 1999 in the Issaquah Creek drainage and none have been observed in the Sammamish River system. It is questionable whether a viable Sammamish River-Issaquah Creek subpopulation subpopulation remains. Urbanization, road building and associated poor water quality have negatively affected habitat in the Sammamish River and Issaquah Creek drainages (USFWS 1999). There is no known spawning subpopulation resident in Lake Washington or Lake Sammamish; however, bull trout have been observed in the fish ladder viewing pool at the Chittenden Locks as recently as 1997 (F. Goetz, Corps, pers. comm.) and isolated reports of bull trout captures in or around Lake Washington occur every few years. A larger juvenile bull trout (~250 mm, 3 year old) was caught in the lower Cedar River in July of 1998 (Corps 2001).

4.5.2. Wildlife

Wildlife in the basin include over 100 species of birds, including bald eagles (*Haliaeetus leucocephalus*), barred owls (*Strix varia*), northern saw-whet owls (*Aegolius acaducus*), red-tailed hawks (*Buteo jamaicensus*), pileated woodpeckers (*Dryocopus pileatus*), and blue grouse (*Dendragapus obscurus*). In addition, dippers (*Cinclus mexicanus*) and belted kingfishers (*Ceryle alcyon*) have been observed throughout the basin. Several species of amphibians and reptiles are found in the area including the rubber boa (*Charina bottae*) and the Pacific giant salamander (*Dicamptodon ensatus*). Large mammals in the project area include black-tailed deer (*Odocoileus hemionus columbianus*), black bear (*Ursus americanus*), coyote (*Canis latrans*), bobcat (*Felis rufus*), beaver (*Castor canadensis*), river otter (*Lutra canadensis*), and the occasional elk (*Cervus elephus*). Historically, cougar (*Felis concolor*) were common in the area but presently they are known only to inhabit the North Fork Issaquah Creek basin and area of Tiger Mountain (Parametrix 2002).

4.5.3. Sensitive, Threatened and Endangered Species.

In accordance with Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended, federally funded, constructed, permitted, or licensed projects must take into consideration impacts to federally listed and proposed threatened or endangered species. Three threatened and one candidate species are potentially found in the project area (Table 1). Information on the life histories and occurrence of these species in the project area are detailed in the Biological Evaluation (BE) prepared for the Preferred Alternative. This document is briefly summarized in Section 5.6.3.

Table 1. ESA Protected Species Potentially Occurring in the Project Vicinity

Species	Listing Status	Critical Habitat
Bald Eagle *Haliaeetus leucocephalus*	Threatened	N
Coastal/Puget Sound Bull Trout *Salvelinus confluentus*	Threatened	N
Puget Sound Chinook Salmon *Oncorhynchus tshawytscha*	Threatened	N
Puget Sound/Strait of Georgia Coho Salmon *Oncorhynchus kisutch*	Candidate	N/A

4.5.4. Vegetation

The vegetation in the lower reaches of the Issaquah Creek basin is generally comprised of a mixed coniferous forest on the valley slopes and mixed deciduous forest in the valley floor.

The majority of the project site is an open field that is dominated by a variety of pasture grasses such as Kentucky bluegrass (*Poa pratens*), bentgrass (*Agrostis* sp.), fescue (*Festuca* spp.), reed canarygrass (*Phalaris arundinacea*). Giant horsetail (*Equisetum telmatiea*) occurs at the north end of the pasture. The steep slope between the field, the lower reach of Tributary 0199, the transition zone between the pasture and the levee, and the higher terrace at the southeastern corner of the property are covered with blackberry.

On the levee along the creek shoreline, a canopy of alder (*Alnus rubra*), cottonwood (*Populus trichocarpa*), big leaf maple (*Acer macrophyllum*), and some small red cedars (*Thuja plicata*) and Douglas fir (*Psuedotsuga menziesii*) characterizes the riparian area on the existing levee along the creek. The understory in the riparian area of Issaquah Creek consists of salmonberry (*Rubus spectabilis*), snowberry (*Symphoricarpos albus*), Indian plum (*Oemleria cerasiformis*), swordfern (*Polystichum munitum*), Oregon grape (*Berberis aquifolium*), and Himalayan blackberry (*Rubus discolor*). Willows (*Salix* spp.) dominate areas adjacent to Tributary 0199 near Issaquah-Hobart Road, with blackberry bushes forming a complete canopy over the tributary for most of its remaining length until its confluence with Issaquah Creek.

The proposed disposal area is primarily pasture composed of similar grasses to those found at project site. Seven conifers and 5 deciduous trees are located within the disposal area. Eleven of these trees are associated with the existing residence that would be removed prior to the project.

4.5.5. Wetlands

A wetland delineation of the Squak Valley parcel and the proposed disposal site was performed in early April, 2002 (The Watershed Company, 2002). The delineation was accomplished using the *Washington State Wetlands Identification and Delineation Manual* (Washington Dept. of Ecology, 1997). Three wetland areas each were delineated on the Squak Valley parcel and the parcel proposed for disposal of excavated material.

The largest wetland at the Squak Valley parcel, a complex of emergent and scrub-shrub communities, occupies two parallel north-south swales that are connected in the center. The eastern swale, which includes two remnant ponds, lies at the base of the steep terrace slope. Seeps from the slope feed the eastern part of the wetland. The western swale occupies a relic meander scar and is likely supported by a seasonally high water table. The other two wetlands at the project site, one emergent, one scrub-shrub, occur in small low-lying pockets that also are likely dependent on a seasonally high water table for hydrologic support.

The disposal parcel contains three wetland systems, two of which are located well outside of the proposed disposal area on the low terrace adjacent to Issaquah Creek. The third wetland system occurs on a portion of the upper terrace just west of the existing residence. This wetland is an emergent seep system that drains westward toward the creek.

4.6. Historical, Native American, and Cultural Resource Sites

None of the structures on the project site or the disposal site are eligible for the National Register of Historic Places due to a lack of significant historical associations or architectural values. No Native American or cultural resources sites occur in the project area. An archaeological survey of the project site found no evidence of prehistoric or historic-period archaeological deposits in the project area (Kent and McCroskey 2004). Native Americans do harvest salmonids from the Lake Washington-Sammamish system, including those that originate from the Issaquah Creek basin.

4.7. Hazardous Materials

Both the Squak Valley and proposed disposal site currently have single-family residences. Prior to commencement of construction of the Federal project, the City of Issaquah will remove all structures, including several underground storage tanks (gas and oil) near the residences. The houses may also contain lead paint or asbestos and both will need to be evaluated and, if necessary, abated before demolition. During demolition, outside debris will also be removed. The City of Issaquah is responsible for coordination of all study, removal, or abatement of hazardous materials prior to construction of the proposed habitat project.

4.8. Land Use

Data from 1995 indicates that more than 75 percent of the Issaquah Creek basin was forested, with the remainder in wetlands, pastures, urban (less than 10 percent), and cleared areas (Kerwin 2001). Currently, 30 percent of the basin is zoned commercial forest production, 12 percent is within the urban growth boundary, and the remaining in rural zoning (58 percent; Kerwin 2001). Over 40 percent of the basin is publicly owned (Kerwin 2001). Population increases in the basin and resultant pressure to develop rural lands are expected to continue. The population of the Issaquah Creek Basin is projected to increase by 18 percent between the year 2000 and 2020 (Kerwin 2001).

Upstream of the Squak Valley parcel, areas of pasture and low-density residential development concentrate close to the main creek channel. Within about 1 mile of the project site in either direction along Issaquah-Hobart Road, residential parcels mix with multi-family housing, public park areas, and sites used for church or commercial purposes. Downstream from the Squak Valley parcel, the City of Issaquah surrounds the creek, with a narrow riparian corridor bordered by residential and commercial development. A state fish hatchery at RM 3.0 maintains a collection weir and associated fish ladder at the hatchery and another weir at the hatchery's water intake at about RM 3.5, which is a partial barrier to upstream fish passage. Between about RM 0.6 to Lake Sammamish, the creek winds through Lake Sammamish State Park where the stream is wide, deep, and slow moving.

Both the Squak Valley parcel and the proposed disposal parcel are currently owned by the City but used for single-family residences in the existing houses. In the past, the lower terrace was likely used as a pasture or hay field, as evidenced by the barn near the house in the southeast portion of the site.

4.9. Flood Hazards

The existing levee at the Squak Valley site would be overtopped during a 50-year flood event and backwater flooding up Tributary 0199 likely occurs during more frequent high-flow events. For example, a substantial portion of the lower terrace was inundated during high winter flows in the late 1990's. The upper terraces at the park site and the proposed disposal site are well above the 500-year floodplain.

4.10. Recreation

While the City plans to develop the Squak Valley parcel and the proposed disposal area as recreational areas in the future, recreational opportunities currently associated with the parcels are extremely limited. Issaquah-Hobart Road carries a large amount of traffic, particularly during morning and evening rush hours and currently there is no public access to either site. Additionally, there is limited public access to the creek in the project vicinity. Shoreline property owners may utilize the creek corridor for recreational activities such as birdwatching and fishing.

5. EFFECTS OF THE PROJECT ALTERNATIVES

5.1. Summary of Effects of the Project Alternatives

All of the action alternatives would allow the creek to access the floodplain to a much greater extent than currently exists. Of the action alternatives, the Preferred Alternative provides the most environmental benefits, particularly considering gains in fish habitat. The side channel alternative would result in similar adverse impacts as the Preferred Alternative (see following sections for detailed discussion of potential adverse impacts of both projects), but would have less environmental benefit, particularly for fish. Over the long-term, complete levee removal could provide substantial habitat benefits in an unconstrained system. However, the location of the project site within the City of Issaquah presents undeniable constraints to the natural processes of erosion, sediment deposition, and resulting channel migration that ultimately would limit the form and functional level achieved by the levee removal alternative. For example, given enough time, the levee removal alternative could increase the chances of natural side channel formation through channel migration processes, but, without commitments from landowners of private property across the creek from the project site, it's unlikely that channel migration processes would be allowed to proceed to the degree necessary to create diverse off-channel habitat on the project site. Considering relative project costs (see Section 3.5) and environmental benefits, the Preferred Alternative maximizes ecosystem restoration benefits compared to costs and is the National Ecosystem Restoration plan. Specific effects of the project alternatives are discussed in Sections 5.2 to 5.12 below.

5.2. Physical Characteristics

5.2.1. Preferred Alternative (Two Backwater Channels)

The Preferred Alternative would change the character of the Squak Valley parcel site by creating backwater channel aquatic habitat that is currently not present at or near the site. The topography of the site would be altered with the excavation of the two backwater channels. The shoreline of Issaquah Creek would be altered with the excavation of the existing right-bank levee for the two backwater channel outlets. These outlets have been carefully designed to minimize impacts to the creek channel and shoreline by incorporating bioengineered stabilization of disturbed areas and a final geometry that will help minimize sedimentation at the channel outlet while minimizing scour and erosion in adjacent areas. At the disposal site, placement of excavated material would elevate the land surface by no more than 8 feet (see Figure A-10).

5.2.2. Side Channel with Two Levee Breaches

This alternative would result in topography similar to the Preferred Alternative, but with excavation of a contiguous side channel rather than two backwater channels. The inlet weir for the side channel would allow flows into the channel when they exceed a certain water surface elevation during high flow events. To achieve the project objectives, the weir would be constructed out of riprap and keyed into the adjacent areas, resulting in a substantial hardened structure at the head of the side channel. Bank stabilization would be required adjacent to the channel inlet and outlet to minimize the chance of channel avulsion where the new side channel would capture all or a portion of the main creek flow (see Section 5.3 for more details). Effects at the disposal site would be similar to those for the Preferred Alternative.

5.2.3. Complete Levee Removal

Removing the existing levee along the entire shoreline of the Squak Valley parcel would alter the topography of the area directly adjacent to the creek. Effects at the disposal site would be similar to those for the Preferred Alternative.

5.3. Hydrology and Hydraulics

5.3.1. Preferred Alternative (Two Backwater Channels)

The Preferred Alternative will alter the shoreline of Issaquah Creek and Tributary 0199. Timing, magnitude, and duration of flows in both waterbodies will not be adversely affected by the Preferred Alternative. At the backwater channel outlets, there is a potential for deposition of sediment as water velocities slow in the widened channel. To minimize hydraulic impacts, several large boulders will be placed on the upstream side of each outlet to minimize the change in the cross-sectional area of the creek. Additionally, disturbed shorelines areas of Issaquah Creek will be stabilized using bioengineering techniques designed to withstand the 50-year flow conditions. Tributary 0199 work will be limited to sloping the banks of the tributary to a shallower slope and will have minimal effect on its hydraulics.

The velocities in the backwater channels will be very low under most conditions since the channels are dead-end features. During flood events, water velocities will increase, but the backwater effect of overbank flooding is expected to provide a range of velocities suitable for salmonid rearing and refuge.

The backwater channels are designed to contain water under all but the driest conditions, with the water source a combination of backwater from Issaquah Creek and, during most of the year, groundwater inflow. When the water surface of the creek is at ordinary high water, the water depth at channel outlets will be approximately 3 feet, and water depth at the heads of the channels will be about 1 foot deep. The channel bottom will be between 4 and 7 feet below the existing ground surface. Test pits dug in March 2000 found a water table depth at about 4.5 feet below the existing ground, indicating that the proposed channels will intersect the water table during the spring and winter. The channel will be shallowly sloped to allow the creek to backwater past the proposed pools during all creek flows. Since the channel is sloped, the benches at the distal ends of both backwater channels will be shallowly inundated during average creek flows, allowing formation of an emergent wetland. When the water surface of the creek is at ordinary high water, the water depth at channel outlets will be approximately 3 feet, and water depth at the heads of the channels will be about 1 foot deep. Summer base flows result in a water surface less than 1 foot below ordinary high water. Compared to the ordinary high water elevation, the 2-year recurrence event is about 2 feet higher, the 10-year recurrence event is about 5 feet higher, and the 100-year recurrence event is about 6 feet higher (City of Issaquah 2002).

In the long-term, erosion and deposition will likely alter the shoreline of the creek, including areas near the backwater channel outlets. These natural processes will be allowed to proceed to the extent that they do not cause or have the likelihood to cause substantial adverse impacts to off-site areas.

5.3.2. Side Channel with Two Levee Breaches

Under this alternative, the elevation of the weir would determine how often water would flow through the side channel. When the stream was high enough to crest the weir at the head of the channel, water velocities in the side channel would be similar to the creek channel. Such high velocities would flush rearing fish out of the channel and decrease the suitability of the site as refuge for fish. Water depths in the lower half of the side-channel would be similar to those described for the Preferred Alternative, but the upper end of the side channel would be inundated only after the water elevation crests the upstream weir. If the weir were set at an elevation near ordinary high water, creek flows would be split more often, but with possible adverse impacts resulting from decrease in depth and wetted area during certain lower flow conditions. Flow splitting would be particularly adverse during the late summer when flows are low and Chinook salmon start to return to the system.

5.3.3. Complete Levee Removal

With complete levee removal, direct impacts to hydraulics and hydrology would be minimal. Over the long term, channel shifts would likely occur as a result of erosion and deposition occurring during flood events. These natural processes will be allowed to proceed to the extent that they do not cause or have the likelihood to cause substantial adverse impacts to off-site areas.

5.4. Water Quality

5.4.1. Preferred Alternative (Two Backwater Channels)

During construction, the primary potential water quality impact will be increased turbidity. To minimize impacts to water quality, the project will be constructed in accordance with the Washington Department of Ecology Stormwater Manual for Western Washington and best management practices will be applied. The limits of construction disturbance will be minimized and clearly marked prior to the start of land-disturbing activities. Silt fences will be installed as necessary to isolate construction areas from waterbodies and wetlands. Construction personnel will inspect erosion and sediment control features at least twice a week during dry weather and during and after any rain events. Any observed deficiencies would be immediately corrected. Placement of excavated material at the disposal site will provide a minimum 50-foot buffer from wetland boundaries.

To minimize potential spills and leaks of petroleum and hydraulic fluids during construction, construction equipment would be inspected daily for leaks or petroleum contamination. A spill prevention control and containment plan designed to reduce the impacts from potential spills (fuel, hydraulic fluid, etc) will be in place prior to the start of construction. No mechanized equipment will enter Issaquah Creek, Tributary 0199, or wetlands that are outside of delineated construction limits.

With the exception of the outlets for backwater channel outlets, the project will be constructed without any in-water work. Accordingly, Issaquah Creek water quality will not be impacted during the clearing/grading and excavation work elements related to channel construction. Excavation of the creek shoreline will occur after final grading of the more landward portions of the backwater channels. All in-water work will occur during the standard construction window for Issaquah Creek of June 15 to July 31 (which corresponds to the standard work window typically required by WDFW for Issaquah Creek). Turbidity will be regularly monitored during in-water construction and reports submitted to Ecology on a weekly basis or more frequently.

After construction, the primary water quality impact will likely be the potential for increased water temperature. The new backwater channels will increase the water surface area and, until trees and shrubs planted along the channels grow to provide sufficient shade, water temperatures in the backwater channels during the summer months may increase above the temperature of Issaquah Creek (although this may be moderated by input of groundwater). Adverse effects to Issaquah Creek water temperatures are unlikely since exchange between the creek and the backwater channels will likely be minimal during the summer. Within five years, planted willows will likely be large enough to provide sufficient shade to minimize temperature increases during the summer. Accordingly, while elevated water temperatures may adversely affect the water quality in the backwater channels for several summers after construction, long-term adverse effects due to elevated water temperatures in the channels are not anticipated. Adverse impacts due to increased water temperature in the creek are not anticipated.

5.4.2. Side Channel with Two Levee Breaches

This alternative would have similar impacts to the Preferred Alternative, except that the side channel would likely be flushed at least once per year during high flow events, likely during the late fall or winter.

5.4.3. Complete Levee Removal

While complete levee removal would likely have minor impacts on water quality during properly-conducted construction, removal of the riparian vegetation on the levee would allow the creek to heat more during the summer due to lack of shade. In the short-term, water temperatures in the creek would increase, further impacting a parameter for which Issaquah Creek has been listed on the Section 303(d) list of impaired waterbodies by the State of Washington. As trees grow on the shoreline, the extent of water quality impact would decrease, but adverse impacts would likely persist for at least 10 years until cottonwoods and alders achieved sizes that could provide some measure of shade to the creek channel.

5.5. Geology/Sediments

5.5.1. Preferred Alternative (Two Backwater Channels)

The Preferred Alternative will excavate about 12,000 cubic yards of material from the new backwater channels and the riparian area along a portion of Tributary 0199 (additional excavation and grading will occur for construction of the parking lot, trail, and approaches to the footbridge over Tributary 0199). In the backwater channels, the excavation will expose soils with more sand and gravel than that currently present on the existing land surface. Additional gravel will be imported to provide a gravel bottom to the backwater channel where the native substrate is gravel-poor. The shoreline substrate of Tributary 0199 will not change but will be sloped at a shallower angle than presently exists.

The project will incorporate a sedimentation monitoring plan (Appendix D) to ensure that the backwater channels remain accessible to fish. Monitoring results will be compiled and sent to interested agencies and tribes.

With a portion of the excavated material, a low berm will be constructed on uplands between Tributary 0199 and the northern backwater channel. This berm is intended to ensure that Issaquah-Hobart Road is not flooded when high creek flows inundate the project site through the side-channel outlets. This berm will raise ground elevations between 1 and 3 feet.

Remaining excavated material will be placed at the disposal site, rough-graded, and stabilized in accordance to best management practices. Although the land surface will be higher after placement of the excavated material, the substrate characteristics will be very similar to pre-disposal conditions. The City of Issaquah plans future construction of playfields at the disposal site, actions that they are pursuing separate from the proposed habitat restoration project (see Section 5.12.1).

5.5.2. Side Channel with Two Levee Breaches

This alternative would require excavation of substantially more material for the side channel; otherwise the impacts would be similar to the Preferred Alternative with the exception that, to perform as intended, the weir would require large quantities of Class III riprap[3] to be placed in the riparian zone of the creek.

5.5.3. Complete Levee Removal

Removal of the levee would likely require excavation of substantially more material than the Preferred Alternative; otherwise the impacts would be similar.

5.6. Natural Resources

5.6.1. Fish

5.6.1.1. Preferred Alternative

Coho salmon and cutthroat trout will likely utilize the new backwater channels more often and with greater abundance than other salmonid species. The channels will create low velocity habitat with abundant large woody debris that is preferred by rearing juvenile coho salmon. Cutthroat trout, particularly juvenile and small adult fish, also exploit these off-channel habitats. Rearing juvenile coho salmon prefer slack-water habitats at the margins of streams and coho salmon abundance in a stream has been linked to the number of suitable territories that are available (Larkin, 1977). Additionally, spring freshets can displace rearing coho salmon by sweeping coho salmon from their established territory, where, in most cases, the displaced fish involuntarily move to less favorable sites (Groot and Margolis, 1998). Coho salmon will also use the backwater channels as overwintering habitat, including portions of the channel that may be wetted only during the wetter parts of the year (like the wetland bench areas). The proposed backwater channels will increase the quality and quantity habitat available for rearing coho salmon juveniles while minimizing the chance of displacement from high flows.

Benefits to Chinook salmon and steelhead trout are expected as juveniles of these species utilize the channels for rearing and refuge during high-flow events during the late winter and spring. Chinook salmon, in particular, are expected to utilize the backwater channel habitat primarily in the later winter and early spring shortly after emergence when the Chinook salmon fry show preferences for habitats characterized by slow water velocities and sand and silt substrates (Lister and Genoe 1970, Chapman and Bjornn 1969, Everest and Chapman 1972). As Chinook salmon grow, they typically move to areas with larger substrates and increasing water velocities (Lister and Genoe 1970), such as the Issaquah Creek channel along the Squak Valley site. Accordingly, the diversity of flow, substrate, and depth that will be provided at the outlets of the channels will likely provide important habitat for juvenile Chinook salmon later in the spring. Sockeye salmon typically migrate from their natal stream soon after emergence and do not utilize off-channel stream habitats.

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[3] Class III riprap specifications call for rocks ranging up to 800 pounds in weight, with 50% larger than 300 pounds. For comparison, the maximum size of Class I riprap, which is proposed for toe stabilization at the backwater channel inlet of the proposed project, is 150 pounds per rock, with 50% larger than 50 pounds.

As discussed in Section 4.2, Issaquah Creek is a very "flashy" system, meaning that flows rapidly increase during storm events and then rapidly fall off once the storm passes. Currently, fish in the project vicinity, including salmonids, find little refuge from these high flow events since the Issaquah Creek channel lacks complexity and off-channel areas. The Preferred Alternative will re-connect Issaquah Creek to its floodplain at the project site and will allow resident fish to move into a low-velocity refuge area, particularly during high flow events. The backwater channels will increase diversity of habitat types in the Issaquah Creek basin and will facilitate inputs of litter and forage material from adjacent terrestrial areas, to the benefit of all resident fish species. Accordingly, the Preferred Alternative is expected to enhance survival and abundance of fish, including salmonids, in the Issaquah Creek system.

5.6.1.2. Side Channel with Two Levee Breaches

This alternative would provide rearing and refuge habitat for salmonids until the creek level rose high enough to crest the inlet weir. When flow engages the side channel, velocities in the side channel would be similar to those in the creek channel. Such high velocities would flush rearing fish out of the channel and decrease the suitability of the site as refuge for fish. Also, during such high flows, adult fish may spawn in the side channel, only to have their redds exposed when creek elevations drop below the inlet weir elevation on the receding limb of the hydrograph. Compared to the Preferred Alternative, the side channel with two levee breaches does not provide as much benefits for fish.

5.6.1.3. Complete Levee Removal

In common with the other action alternatives, removal of the entire levee would also connect the creek with its floodplain. Over decades, levee removal would provide an opportunity for the creek channel to occupy portions of the Squak Valley site, but the degree, extent, and rate of channel migration would likely be limited by actions taken by adjacent property owners to prevent encroachment of the channel onto their properties. With levee removal alone, fish would have access to the floodplain during high flows but would not utilize the site as rearing habitat since the creek channel would remain a straight run with little habitat diversity and complexity. Compared to two levee breaches proposed under the other action alternatives, little added benefit would be expected from removing the whole levee instead, while the costs and adverse impacts of complete levee removal are the highest of all alternatives (i.e. the benefits-to-cost ratio is the low).

5.6.2. Wildlife

5.6.2.1. Preferred Alternative

The Preferred Alternative will enhance wildlife habitat on the project site. Native plantings will provide forage and cover for birds, mammals, reptiles, and amphibians. The project will enhance the Issaquah Creek corridor and opportunities for movement of wildlife species along the creek. Prior to canopy closure over the back channels, waterfowl habitat will be provided. After several years, habitat will be more suitable for passerines, raptors, owls, and woodpeckers. Mammals such as raccoons, deer, otters, and coyote will continue to utilize the site, likely in greater numbers and more frequently than before the project.

The walking path along the edge of the habitat restoration area will provide easy public access to the site. However, considering the proximity to busy Issaquah-Hobart Road and the likelihood that use of the path will be sporadic, the potential for disturbance to wildlife from path users should be minimal. Additionally, plantings will buffer the backwater channels from the activities on the more accessible portions of the site.

5.6.2.2. Side Channel with Two Levee Breaches

This alternative would have similar impacts to the Preferred Alternative.

5.6.2.3. Complete Levee Removal

This alternative would not provide the habitat diversity of either the side channel or backwater channel alternatives. Until newly planted vegetation became established in 10 or more years, wildlife use and habitat would be adversely affected by removal of all of the riparian vegetation from the creek shoreline. Over decades, natural processes may work to yield benefits to wildlife habitat similar to the other action alternatives.

5.6.3. Sensitive, Threatened and Endangered Species.

Bald eagles (threatened), coastal/Puget Sound bull trout (threatened), and Puget Sound Chinook salmon (threatened) comprise the listed species that may occur in the project vicinity. The project area does not contain designated or proposed critical habitat for threatened or endangered species.

5.6.3.1. Preferred Alternative

Potential impacts of the Preferred Alternative on sensitive, threatened and endangered species are summarized below and are specifically addressed in a separate BE. The effects discussed below will be further considered through consultation with the USFWS and NOAA Fisheries in accordance with Section 7(a)(2) of the Endangered Species Act (see Section 7.2).

No bald eagle nests occur within one mile of the project or disposal site (Washington Priority Habitat and Species List Database, July 2003). Bald eagles occur near the project area only sporadically. Bald eagles are more active and abundant in areas closer to Lake Sammamish, more than four miles north of the project site. Bald eagle use of the site is most likely during the winter in association with the salmon spawning period. Construction at the site will occur during the spring and summer months, minimizing the chance of impacts to bald eagles. After construction, the habitat restoration will provide similar eagle habitat to that which currently exists. Accordingly, the Preferred Alternative is not likely to adversely affect bald eagles.

Effects on fish, including salmonids, are discussed in detail in Section 5.6.1. Construction will be planned and managed to minimize potential impacts to salmonids and other aquatic species. All in-water work will occur from June 15 to July 31, the standard WDFW work window for Issaquah Creek that is designed primarily for protection of salmonids. Bull trout are unlikely to occur in Issaquah Creek at any time of the year and particularly during the summer due to unsuitable water temperatures. Seasonal abundance of Chinook and coho salmon adults and juveniles is the lowest of the year during the standard construction window. Considering the magnitude, timing, and management of construction of the project, the likelihood of impacts to bull trout and Chinook salmon during construction is insignificant and discountable. After construction, habitat for salmonids, including Chinook salmon, coho salmon, and bull trout, will be enhanced by the creation of the backwater channel habitat. Accordingly, the project is not likely to adversely affect Puget Sound/Coastal bull trout or Puget Sound Chinook salmon. Under ESA, effect determinations are not appropriate for candidate species such as Puget Sound/Strait of Georgia coho salmon.

5.6.3.2. Side Channel with Two Levee Breaches

This alternative would have similar impacts to the Preferred Alternative, with the exception of possible additional adverse impacts resulting from de-watering of redds during the descending limb of high flow events.

5.6.3.3. Complete Levee Removal

Construction impacts of this alternative on threatened and endangered fish species would likely be less than under the other action alternatives this alternative since in-water work would not occur. Removal of all of the mature riparian vegetation on the levee could result in some adverse impacts to wintering bald eagles, although the degree of impact would be small since the area is likely utilized by eagles only sporadically.

5.6.4. Vegetation

5.6.4.1. Preferred Alternative

Extensive plantings are planned for the Preferred Alternative. As a result, vegetation over the majority of the project site would change from pasture (consisting primarily of introduced herbaceous species) to a native forest/scrub-shrub community. Existing forested areas adjacent to the construction areas would not be disturbed with the exception of the levee breaches necessary to connect the backwater channels to Issaquah Creek. Wherever possible, the levee breaches will be constructed to avoid removal of trees. The parking area at the project site will require removal of some small trees.

Along Tributary 0199, blackberries would be removed in the course of sloping the creek banks to a shallower angle, followed by planting of native riparian species. Plantings will be monitored for at least 5 years, with comparison of measured plant survival, species composition (including undesirable occurrence of invasive or exotic species), and percent cover to established performance standards. If monitoring reveals that the plantings do not meet the performance standards, contingency measures will be implemented to identify and rectify any problems such that the site meets those standards. Monitoring results will be compiled and sent to interested agencies and tribes.

At the disposal site, the existing pasture will be buried under the material excavated from the Squak Valley Park site, which will then be hydroseeded. Several trees will be removed at the disposal site near the location of the current residential structure. Conifers meeting specifications for large woody debris will be recycled for placement in the backwater channels at the habitat restoration site.

5.6.4.2. Side Channel with Two Levee Breaches

This alternative would have similar impacts to the Preferred Alternative.

5.6.4.3. Complete Levee Removal

This alternative would require complete removal of the alder, cottonwood, big leaf maple, cedar, and Douglas fir trees currently growing on the levee. After levee removal, similar species would be planted along the riparian area. Newly planted trees would begin to provide cover in about 10 years.

5.6.5. Wetlands

5.6.5.1. Preferred Alternative

Table 2 details the wetland impact and wetland creation acreages for the Preferred Alternative. The Preferred Alternative will enhance and restore the riparian habitat, including wetlands, of Issaquah Creek. Three wetland bench areas will be provided along each backwater channel (total area of all wetland benches will be 4,400 square feet or 0.10 of an acre). These wetland areas will be directly connected to the backwater channels, providing increased diversity and ecological functions to backwater channel aquatic habitat. For example, the benches will provide refuge for fish during high water events and nutrient and food input to the backwater channels. The upper reaches of the backwater channels themselves may also assume some wetland characteristics, particularly during drier periods of the year. Compared to the existing pasture wetlands, the wetland to be created by the proposed work will be more diverse and higher quality.

Wetland impacts from the proposed trail and berm are expected to be minor. The trail crossing of the wetland will consist of a gravel path that is laid at the existing ground surface, thereby providing connectivity between the backwater channels and the undisturbed wetlands east of the trail. This connection is particularly important during flood events, although maintenance access may be impeded when the trail is flooded at this location. The berm will fill 34 square feet of wetland that occupies the shallow swale along Issaquah-Hobart Road.

Table 2. Wetland Impact and Creation Acreage

	Wetland Impact (sq. ft.)	Wetland Creation (sq. ft.)
Flood Control Berm	34	
Trail/Access Road*	123	
South Backwater Channel	5,144	
Construction Access Road	*273 (temporary)*	
Construction Activities	*1,600 (temporary)*	
North Channel Sedge Benches		2,213
South Channel Sedge Benches		2,187
North Channel Wetted Area		6,987
South Channel Wetted Area		6,785
SUBTOTALS	5,301 (permanent)*	4,400 (sedge benches)
	1,873 (temporary)	13,752 (wetted area)
TOTAL	7,174 (0.16 acre)	18,152 (0.42 acre)

5.6.5.2. Side Channel with Two Levee Breaches

Although detailed calculations of wetland impact acreage has not been done for this alternative, more wetlands would be excavated for the channel as it follows the entire length of the low wetland swale on the site. The side channel length would be about 1,000 feet (compared to an aggregate length of 600 feet for the two backwater channels), but length of the regularly-wetted side channel would likely be similar to that in the Preferred Alternative. Possible wetland creation area would therefore likely be comparable to the Preferred Alternative.

5.6.5.3. Complete Levee Removal

Wetland impacts would be limited to that required to provide access to the levee. Wetland creation or enhancements would be similarly limited.

5.7. Historical, Native American, and Cultural Resource Sites

5.7.1. Preferred Alternative (Two Backwater Channels)

The Preferred Alternative will have no effect on Native American and cultural resource sites since known resources do not occur in the project area. The work would not adversely affect salmonid populations or impair fishing sites reserved by treaties for Native American use. The Washington State Office of Archaeological and Historic Preservation has reviewed information about the site and the Preferred Alternative and, in a letter dated 18 February 2004, concurred that no resources included in or eligible for inclusion on the National Register of Historic Places occur within the area of potential effect for the project.

Due to the possibility that archaeological deposits could be inadvertently encountered during construction in some areas of the project, a Corps archaeologist will conduct periodic monitoring. In the event that archaeological or historical materials are discovered during project activities, work in the immediate area will be discontinued, the area secured, and the project archaeologist contacted immediately. The project archaeologist will evaluate the find and, if necessary, contact the appropriated Tribes and the Washington Office of Archaeological and Historic Preservation to arrange for evaluation and treatment of the material.

5.7.2. Side Channel with Two Levee Breaches

This alternative would have similar impacts to the Preferred Alternative.

5.7.3. Complete Levee Removal

This alternative would have similar impacts to the Preferred Alternative.

5.8. Hazardous Materials

5.8.1. Preferred Alternative (Two Backwater Channels)

The City of Issaquah will remove all known hazardous materials from the project areas prior to commencement of the Federal project. Accordingly, hazardous materials are not expected to be encountered in or near the project area as part of the Corps project. To minimize the likelihood potential spills and leaks of petroleum and hydraulic fluids during project construction, construction equipment will be inspected daily for leaks and petroleum contamination. Additionally, a spill prevention control and containment plan designed to reduce impacts from spills (fuel, hydraulic fluid, etc.) will be in place prior to the start of construction. Finally, the project will not introduce any hazardous materials to the project areas.

5.8.2. Side Channel with Two Levee Breaches

This alternative would have similar impacts to the Preferred Alternative.

5.8.3. Complete Levee Removal

This alternative would have similar impacts to the Preferred Alternative.

5.9. Land Use

5.9.1. Preferred Alternative (Two Backwater Channels)

The Preferred Alternative will alter the land use from rural residential to public park and habitat area. The site will represent one of relatively few areas in the City of Issaquah to provide an extensive and diverse riparian area along and associated with Issaquah Creek.

5.9.2. Side Channel with Two Levee Breaches

This alternative would have similar impacts to the Preferred Alternative.

5.9.3. Complete Levee Removal

This alternative would have similar impacts to the Preferred Alternative.

5.10. Flood Hazards

5.10.1. Preferred Alternative (Two Backwater Channels)

The Preferred Alternative will remove sections of the existing levee at the project site and result in more frequent flooding of the project site. The project will not affect the water surface elevation of the 100-year flood. The proposed berm at the southern end of the project site will ensure that Issaquah-Hobart Road is not adversely affected by flooding, providing assurances to local stakeholders who may be concerned that the project will exacerbate flooding.

5.10.2. Side Channel with Two Levee Breaches

This alternative would have similar impacts to the Preferred Alternative.

5.10.3. Complete Levee Removal

This alternative would have similar impacts to the Preferred Alternative.

5.11. Recreation

5.11.1. Preferred Alternative (Two Backwater Channels)

With the inclusion of features such as a parking area, gravel path, benches, and gazebo, the Preferred Alternative will enhance recreational opportunities. Currently, public use of the project site is extremely limited, in part because the public ownership of the property is not apparent. The proposed work will provide public access to the edges of the habitat area. To minimize encroachment and disturbance to the habitat areas, the proposed trail is located at the edge of the stream buffer. Recreational opportunities will include walking and bird watching.

5.11.2. Side Channel with Two Levee Breaches

This alternative would have similar impacts to the Preferred Alternative.

5.11.3. Complete Levee Removal

This alternative would have similar impacts to the Preferred Alternative.

5.12. Cumulative Effects

The NEPA defines cumulative effects as the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions in the project vicinity, regardless of what agency (Federal or non-Federal) or person undertakes such other actions (40 CFR §1508.7).

5.12.1. Preferred Alternative (Two Backwater Channels)

At the site proposed for disposal of excavated material from the Squak Valley parcel, the City of Issaquah proposes to construct recreational facilities and ball fields. The ball field project would require grading, installation of drainage, and associated actions to create the fields and provide access to them. Work may include filling of wetlands that are presently located in the southwestern portion of the disposal site. Any discharge of fill into waters of the U.S., including wetlands, would require the City to obtain required authorizations from the Corps Regulatory Branch and state and local jurisdictions, including likely requirements for compensatory mitigation for wetland impacts. Work would be limited to the upper terrace portion, leaving the wetland complex adjacent to Issaquah Creek undisturbed. Due to the distance of the Preferred Alternative from the creek and the wetland buffer between the project and the creek, impacts to the creek are likely to be minor. Synergistic positive or negative effects from the ballfield and Squak Valley project are not expected to occur.

According to Washington State Environmental Policy Act Register http://www.ecy.wa.gov/apps/sepa/) and Corps records, a number of projects are ongoing or planned to occur along Issaquah Creek. Two projects (Issaquah Creek Bank Stabilization/Habitat Enhancement Project and Gilman Area Channel Improvement Project), both located within ¾-mile upstream of I-90 and about 3.5 stream miles downstream of the Squak Valley parcel, are planned to plant willows and place large woody debris along the shoreline. Another streambank restoration project (the Lasley Streambank Restoration Project) is planned to occur approximately 3 stream miles upstream of the Squak Valley parcel. These projects will enhance the riparian zone of Issaquah Creek and will complement the proposed work at the Squak Valley parcel.

Construction work by the Washington State Department of Transportation (WSDOT) is ongoing on a new Sunset Way interchange on I-90 adjacent to the East Fork of Issaquah Creek on the east side of the city. This work included authorization to fill wetlands and restore and enhance the creek corridor. In the summer of 2002, routine inspections by Corps Regulatory staff determined that additional unauthorized work had occurred. The unauthorized work included placement of riprap bank protection along the creek and additional wetland fill. To resolve the permit violation, the Corps is working with WSDOT to restore the creek and perform additional compensatory mitigation. Together with the proposed Squak Valley project, restoration and mitigation work that will likely be performed in conjunction with the Sunset Way interchange will help restore lost ecosystem functions and values.

The Corps is currently planning the Issaquah Fish Passage Project, a joint effort between the Washington Department of Fish and Wildlife and the U.S. Army Corps of Engineers. The project goal is to provide more efficient and effective adult and juvenile fish passage at the Issaquah Creek intake dam to improve spawning success of salmonids and reduce the mortality of juvenile and adult fish. When completed, this project would supplement the benefits expected to accrue from proposed Squak Valley project by providing for better access to the enhanced and restored off-channel habitat at Squak Valley site, as well as habitat that is available further upstream. Construction of both the proposed Squak Valley and Issaquah Fish Passage Project is planned for 2005. Coordination between the projects will ensure that concurrent construction avoids cumulative impacts to the creek and its biota.

In summary, the cumulative effect of the Squak Valley project will be to provide incremental enhancements of ecological functions and values in the basin, particularly regarding salmonid habitat.

5.12.2. Side Channel with Two Levee Breaches

This alternative would have similar cumulative impacts to the Preferred Alternative.

5.12.3. Complete Levee Removal

In the near term, removal of the levee and its riparian vegetation would adversely affect downstream habitat enhancement projects with increased water temperature during the summer months. Over the long-term, likely channel migration onto the Squak Valley parcel would be associated with impacts to adjacent properties. Owners of these properties would likely view channel encroachment unfavorably, and take action with bank protection or other erosion prevention measures to prevent loss or impairment of property use.

6. TREATY RIGHTS

In the mid-1850's, the United States entered into treaties with a number of Native American tribes in Washington. These treaties guaranteed the signatory tribes the right to "take fish at usual and accustomed grounds and stations . . . in common with all citizens of the territory" [*U.S. v. Washington*, 384 F.Supp. 312 at 332 (WDWA 1974)]. In *U.S. v. Washington*, 384 F.Supp. 312 at 343 - 344, the court also found that the Treaty tribes had the right to take up to 50 percent of the harvestable anadromous fish runs passing through those grounds, as needed to provide them with a moderate standard of living (Fair Share). Over the years, the courts have held that this right comprehends certain subsidiary rights, such as access to their "usual and accustomed" fishing grounds. More than *de minimis* impacts to access to usual and accustomed fishing area violates this treaty right [*Northwest Sea Farms v. Wynn*, F.Supp. 931 F.Supp. 1515 at 1522 (WDWA 1996)]. In *U.S. v. Washington*, 759 F.2d 1353 (9th Cir 1985) the court indicated that the obligation to prevent degradation of the fish habitat would be determined on a case-by-case basis. The Ninth Circuit has held that this right also encompasses the right to take shellfish [*U.S. v. Washington*, 135 F.3d 618 (9th Cir 1998)].

The project alternatives have been analyzed with respect to their effects on the treaty rights described above. We anticipate that:

(1) The work will not interfere with access to usual and accustomed fishing grounds or with fishing activities or shellfish harvesting;

(2) The work will not cause the degradation of fish runs and habitat; and

(3) The work will not impair the Treaty tribes' ability to meet moderate living needs.

7. ENVIRONMENTAL COMPLIANCE

The Preferred Alternative's compliance with key environmental laws, regulations, and policies is detailed below.

7.1. National Environmental Policy Act

Section 1500.1(c) and 1508.9(1) of the National Environmental Policy Act of 1969 (as amended) requires federal agencies to "provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact" on actions authorized, funded, or carried out by the federal government to insure such actions adequately address "environmental consequences, and take actions that protect, restore, and enhance the environment". This NEPA EA assessment evaluates environmental consequences from the proposed habitat project and feasible alternatives in Issaquah Creek, Squak Valley, Issaquah, Washington.

7.2. Endangered Species Act

In accordance with Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended, federally funded, constructed, permitted, or licensed projects must take into consideration impacts to federally listed or proposed threatened or endangered species. The potential effects of the Preferred Alternative and conservation measures taken to reduce those effects are summarized in Paragraph 5.6.3 and are addressed in more specificity in the BE for the project. In a letter dated 13 February 2004, the USFWS concurred with the Corps' determination that the Preferred Alternative is not likely to adversely affect bald eagles and bull trout. In a letter dated 7 June 2004, NOAA Fisheries concurred that the project is not likely to adversely affect Chinook salmon. Their concurrence is contingent on implementation of the following conservation measures outlined in the BE:

- All necessary regulatory permits and project authorizations will be secured prior to the start of project construction and all terms and conditions in these authorizations will be followed.
- In-water work would be completed between June 15 and July 31. The work window avoids sensitive periods for salmonids (the actual construction would begin in the spring to excavate the channels behind the existing levee while isolated from the creek, with removal of the levee 'plug' and work along Tributary 0199 occurring during the in-water work period.).
- Bank stabilization at the levee breaches has been reduced to the minimum necessary and incorporates design principles outlined in Washington Department of Fish and Wildlife's *Integrated Streambank Protection Guidelines* (WDFW, 2002).

- Construction impacts will be confined to the minimum area necessary to complete the project.
- Boundaries of clearing limits associated with site access and construction will be clearly marked prior to the start of work and maintained during work to clearly delimit construction limits.
- Sedimentation and erosion controls (silt fence, de-watering, hay bales, etc.) will be implemented to minimize the release of fines into the aquatic environment. A pollution and erosion control plan will be developed to prevent pollution related to construction activities. The plan will include:
    - Methods that will be used to prevent erosion and sedimentation associated with access roads, excavation, equipment and material storage sites, and staging areas;
    - A description of any hazardous products or materials that will be used, including inventory, storage, handling, and monitoring; and
    - A spill containment and control plan with notification procedures, specific clean-up and disposal instructions for products that could spill on the site, quick response containment and clean-up measures that will be available on-site, proposed methods for disposal of spilled materials, and employee training for spill containment.
- Machinery will be inspected for leaks of hydraulic fluid, fuel, and lubricants prior to entering the project area and regularly thereafter. Leaks, oil, fuel, and grease observed on the equipment must be repaired/cleaned in such a manner to ensure that no fuel, hydraulic fluids, or wash water enter Issaquah Creek or any portion of the project area.
- No heavy equipment will enter Issaquah Creek or Tributary 0199.

The Corps will also implement the sedimentation monitoring and adaptive management plan set forth in a memorandum dated April 2, 2004 (Appendix D).

7.3. Essential Fish Habitat

In accordance with the Essential Fish Habitat (EFH) requirements of the Magnuson-Stevens Fishery Conservation and Management Act, the Corps has determined that the proposed work would impact approximately 180 linear feet of Issaquah Creek streambank (90 feet for each channel outlet) and about 105 linear feet of Tributary 0199, areas which are classified as EFH utilized by Pacific salmon. We have determined that the proposed action would not adversely affect EFH for federally managed fisheries in Washington waters. In a letter dated 7 June 2004, NOAA Fisheries provided conservation recommendations for EFH purposes recommending development of a comprehensive monitoring and adaptive management plan to assess the effect of the project on the functional state of the affected reach of Issaquah Creek and floodplain habitats at all flow stages. The monitoring plan will focus on physical indicators of the functional state of the affected reach in accordance with guidelines outlines in WDFW's *Integrated Streambank Protection Guidelines* (WDFW 2002). The Corps will incorporate the EFH conservation recommendations and work with NOAA Fisheries to develop and implement the suggested monitoring and adaptive management plan.

7.4. Clean Water Act

Nationwide Permit (NWP) 27 authorizes "activities in waters of the U.S. associated with the restoration of former waters, the enhancement of degraded tidal and non-tidal wetlands and riparian areas, the creation of tidal and non-tidal wetlands and riparian areas, and the restoration and enhancement of non-tidal streams and non-tidal open water areas…." The Preferred Alternative will result in a net gain in the functions and values at the project site and in the Issaquah Creek watershed by creating native riparian areas, providing refuge and rearing habitat for fish, and re-connecting Issaquah Creek to the adjacent floodplain. The proposed work meets the conditions of NWP 27 and the discharges and methods specified in the proposed work are therefore in accordance with the Section 404(b)(1) guidelines. Accordingly, the proposed work is consistent with guidelines pursuant to Section 404(b)(1) of the Clean Water Act.

In addition, consideration has been given to the need for the work, and to such water quality standards as are appropriate and applicable by law. For NWP 27, Water Quality Certification (WQC), pursuant to Section 401 of the Clean Water Act, has been partially denied without prejudice by the State of Washington (State). This means that NWP 27 projects may be required to obtain individual WQC if they exceed certain criteria. The Corps has reviewed these criteria and determined that the proposed Squak Valley project does not require an individual WQC because the project:

(1) Will impact less than ½ of an acre of waters of the United States (see Section 5.6.5.1);

(2) Will not likely cause or contribute to an exceedance of a State water quality standard (WAC 173-201A; see Section 5.4.1) or sediment quality standard (WAC 173-204; see Sections 5.5.1 and 5.8.1);

(3) Will be constructed in accordance with the Washington Department of Ecology Stormwater Manual for Western Washington (see Section 5.4.1);

(4) Will not cause or contribute to a discharge to a waterbody on the state's list of impaired waterbodies [i.e., the 303(d) list, for which Issaquah Creek is listed for fecal coliform and temperature] and the discharge will not result in further exceedances of a specific parameter for which the waterbody is listed (see Section 5.4.1);

(5) Will incorporate structures and modifications beneficial for fish and wildlife habitat (see Sections 3.1, 5.6.1.1, and 5.6.4.1).

The U.S. Army Corps of Engineers (Corps) designed the proposed bank protection using the Washington Department of Fish and Wildlife (WDFW) Integrated Streambank Protection Guidelines. For all exposed areas except those below ordinary high water, the proposed bank protection utilizes bioengineering methods incorporating soil lifts and extensive plantings rather than riprap. The planned riprap toe protection uses the smallest possible riprap, Class I, which average less than 1 cubic foot per piece, much smaller than typically associated with riprap bank protection on larger river and lake shorelines. With the proposed design, riparian and stream habitat will be preserved and enhanced while maintaining the geometry of backwater channel outlet after construction, an important consideration to avoid sedimentation at the channel mouth that could hinder fish access to the backwater channels. The proposed bioengineered streambank will provide necessary bank stability together with high quality habitat for fish and wildlife. Accordingly, the Corps believes that the project, including the bank protection, is consistent with the provisions of NWP 27. Accordingly, WQC for the project is authorized per the WQC provisions of Nationwide Permit 27 authorization.

7.5. Coastal Zone Management Act.

The Coastal Zone Management Act of 1972, as amended, requires Federal agencies to carry out their activities in a manner which is consistent to the maximum extent practicable with the enforceable policies of the approved Washington Coastal Zone Management Program. For NWP 27 activities like the Preferred Alternative, Coastal Zone Management Consistency is subject to the same conditions as the WQC. Accordingly, the proposed work is consistent with the Washington Coastal Zone Management Program because it satisfies the conditions of the WQC for NWP 27.

7.6. Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (FWCA, 16 USC 470) requires that wildlife conservation receive equal consideration and be coordinated with other features of water resource development projects. This goal is accomplished through Corps funding of USFWS habitat surveys evaluating the likely impacts of proposed actions, which provide the basis for recommendations for avoiding or minimizing such impacts. The USFWS prepared a FWCA report, dated 31 March 2004, that endorsed the Preferred Alternative and recommended construction best management practices to minimize construction-related sedimentation, monitoring of the project for plant survival and sedimentation, and plant species for the planting plan. The Corps considered the FWCA report in the design and construction of the proposed Squak Valley project and incorporated all of its recommendations.

7.7. National Historic Preservation Act

The National Historic Preservation Act (16 USC 470) requires that the effects of proposed actions on sites, buildings, structures, or objects included or eligible for the National Register of Historic Places must be identified and evaluated. The project area does not include any sites listed in or eligible for the National Register of Historic Places. The Washington State Office of Archaeological and Historic Preservation has reviewed information about the site and the Preferred Alternative and, in a letter dated 18 February 2004, concurred that no resources included in or eligible for inclusion on the National Register of Historic Places occur within the area of potential effect for the project.

7.8. Clean Air Act

The Preferred Alternative has been analyzed for conformity applicability pursuant to regulations implementing Section 176(c) of the Clean Air Act. The proposed activities would not exceed *de minimis* levels of direct emissions of a criteria pollutant or its precursors and are exempted by 40 CFR Part 93.153. Any later indirect emissions are generally not within the Corps continuing program responsibility and generally cannot be practicably controlled by the Corps. For these reasons, a conformity determination is not required for this project.

7.9. Floodplain Management

Executive Order (EO) 11988 directs federal agencies to avoid, to the extent possible, the long and short term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative. The proposed project would open the floodplain of the project site to more frequent flooding and may help attenuate flooding further downstream (see Section 5.10.1). Further, the proposed work will not encourage or support floodplain development on the site or in other areas of the Issaquah Creek floodplain.

7.10. Protection of Wetlands

EO 11990 directs federal agencies to avoid, to the extent possible, the long and short term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative. The proposed work will require construction in wetlands, but will result in more diverse and higher quality wetlands as a result. Wetland impacts from the proposed gravel trail have been avoided to the maximum practicable extent by crossing the wetland at its narrowest point and constructing the crossing at the existing grade. See Section 5.6.5.1 for a more detailed discussion.

7.11. Environmental Justice

EO 12898 directs federal agencies to identify and address disproportionately high and adverse human health or environmental effects of agency programs and activities on minority and low-income populations. No tribal resources would be harmed. No adverse effects to minority or low-income populations would result from the implementation of the Preferred Alternative.

7.12. Recreational Fisheries

EO 12962 directs federal agencies to conserve, restore, and enhance aquatic systems to provide for increased recreational fishing opportunities nationwide. In accordance with this executive order, the proposed work will promotes restoration of the Issaquah Creek basin to support viable, healthy, and self-sustaining recreational fisheries and, in concert with the local sponsor, fosters sound aquatic conservation and restoration endeavors to benefit recreational fisheries.

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APPENDIX A

Project Drawings

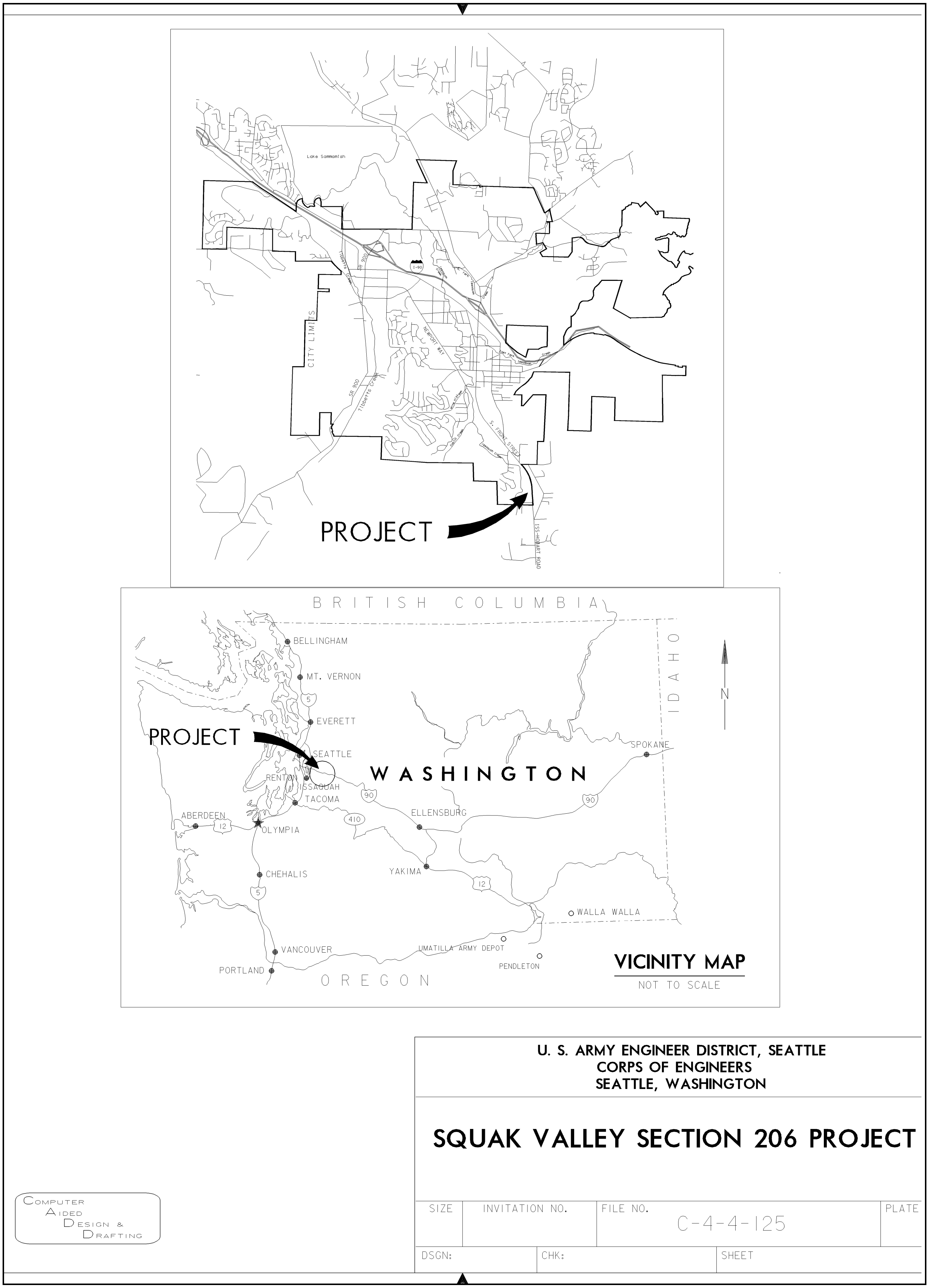


Figure A-1. Vicinity Map

TOTAL PLANT QUANTITIES FOR THE ENTIRE SITE
(TRIBUTARY 199, UPLAND PLANTINGS, AND BOTH CHANNELS)

QUANTITY	PLANT NAME	COMMON NAME	SIZE	SPACING
1069	CAREX OBNUPTA	SLOUGH SEDGE	4"	12"
1069	CAREX STIPATA	AWL-FRUITED SEDGE	4"	12"
1069	ELEOCHARIS SPP.	SPIKE RUSH	4"	12"
1069	OENANTHA SARMENTOSA	WATER PARSLEY	4"	12"
1833	SCIRPUS MICROCARPUS	BULRUSH	4"	12"
155	ACER CIRCINATUM	VINE MAPLE	3' HT.	10'
139	ACER MACROPHYLLUM	BIGLEAF MAPLE	4' HT.	12'
41	BETULA PAPYRIFERA	PAPER BIRCH	4' HT.	10'
21	CRATAEGUS DOUGLASII	DOUGLAS HAWTHORNE	3' HT.	10'
21	FRAXINUS LATIFOLIA	OREGON ASH	4' HT.	10'
21	MALUS SP.	PACIFIC CRABAPPLE	3' HT.	10'
155	PICEA SITCHENSIS	SITKA SPRUCE	3' HT.	12'
41	POPULUS TREMULOIDES	QUAKING ASPEN	3' HT.	10'
85	POPULUS TRICHOCARPA	BLACK COTTONWOOD	4' HT.	12'
139	PSEUDOTSUGA MENZIESII	DOUGLAS FIR	3' HT.	12'
21	RHAMNUS PUSHIANA	CASCARA	3' HT.	10'
480	SALIX LASIANDRA	PACIFIC WILLOW	3/4" DIA. X 2'	1.5'
480	SALIX SITCHENSIS	SITKA WILLOW	3/4" DIA. X 2'	1.5'
480	SALIX SCOULERIANA	SCOULER'S WILLOW	3/4" DIA. X 2'	1.5'
207	THUJA PLICATA	WESTERN RED CEDAR	3' HT.	12'
670	CORNUS STOLONIFERA	RED OSIER DOGWOOD	1 GAL	4'
50	CORYLUS C. CALIFORNICA	WESTERN HAZELNUT	1 GAL	6'
116	GAULTHERIA SHALLON	SALAL	1 GAL	4'
279	HOLODISCUS DISCOLOR	OCEANSPRAY	1 GAL	5'
190	LONICERA INVOLUCRATA	BLACK TWINBERRY	1 GAL	4'
325	MAHONIA AQUIFOLIUM	TALL OREGON GRAPE	1 GAL	4'
441	PHILADELPHUS LEWISII	MOCK ORANGE	1 GAL	4'
116	PHYSIOCARPUS CAPITATUS	PACIFIC NINEBARK	1 GAL	4'
279	RIBES SANGUINEUM	RED FLOWERING CURRANT	1 GAL	5'
110	ROSA GYMNOCARPA	BALD-HIP ROSE	1 GAL	4'
110	ROSA NUTKANA	NOOTKA ROSE	1 GAL	4'
110	ROSA RUGOSA	RAMANAS ROSE	1 GAL	4'
116	RUBUS SPECTABILIS	SALMONBERRY	1 GAL	4'
51	SAMBUCUS RACEMOSA	RED ELDERBERRY	1 GAL	6'
190	SPIRAEA DOUGLASII	WESTERN SPIRAEA	1 GAL	4'
441	SYMPHIOCARPUS ALBUS	SNOWBERRY	1 GAL	4'
205	VACCINUM OVATUM	EVERGREEN HUCKLEBERRY	1 GAL	3'
190	VACCINUM PARVIFOLIUM	RED HUCKLEBERRY	1 GAL	4'

GENERAL NOTES:

1. BARK MULCH SHALL BE GROUND DOUGLAS FIR OR HEMLOCK BARK. SIZE SHALL BE 1-1/2 INCH MINUS.
2. TOPSOIL SHALL BE EXISTING SURFACE SOIL STRIPPED AND STOCKPILED FOR REUSE.
3. BACKFILL SOIL FOR THE PLANTING OF THE NATIVE TREES AND SHRUBS SHALL BE EXISTING EXCAVATED SOIL, IF ACCEPTABLE. WHERE UNACCEPTABLE SOIL EXISTS, THE BACKFILL SHALL CONSIST OF EXISTING EXCAVATED SOIL MIXED WITH COMPOST (25%).
4. UPLAND SHRUB PLANTING GROUP V SHALL RECEIVE A 3" DEPTH OF "GROCO" SOIL AMENDMENT. THIS AMENDMENT SHALL BE THOROUGHLY MIXED TO A DEPTH OF 12".
5. UPLAND SHRUB PLANTING GROUP V AND PARKING AREAS NOTES SHALL BE EVENLY MULCHED/ TOP-DRESSED WITH A 4" DEPTH OF BARK MULCH.
6. GROUPS I, II, III, AND IV, FOR THE CHANNEL, GROUP II AND IV FOR TRIBUTARY 199, UPLAND GROUP V (NON-SHRUB) AND ALL DISTURBED AREAS WILL BE HYDROSEEDED. DO NOT HYDROSEED GROUP V SHRUB AREAS.
7. PLATES L-1 THRU L-3 SHOW APPROXIMATE LOCATIONS OF TREES. FINAL LOCATIONS TO BE APPROVED BY CONTRACTING OFFICER REPRESENTATIVE.
8. WILLOW PLANTINGS SHALL BE PLANTED AT 18" O.C. (2 ROWS), IMMEDIATELLY ABOVE EMERGENTS PLANTINGS AND ALONG ENTIRE LENGTH OF CHANNELS AND TRIBUTARY, BOTH SIDES. (CORNUS SHALL BE 1 GAL @ 18"O.C.)
9. EACH TREE AND SHRUB SHALL BE PIT PLANTED 2X THE DIAMETER OF THE ROOT BALL. TREES SHALL BE PLANTED IN GROUPS OF 3'S AND 5'S, SHRUBS AND CUTTINGS IN GROUPS OF 5-9, AND EMERGENTS IN GROUPS OF 15-25.
10. EACH PLANT PIT SHALL BE CONSTRUCTED WITH A WATER WELL TO PREVENT WATER FROM RUNNING AWAY FROM THE PLANT.
11. TREES SHALL BE PLACED TO COVER THE ENTIRE AREA SHOWN AT THE INDIVIDUAL SPACING GIVEN. CHANNEL SHRUBS SHALL BE PLANTED OVER THE SAME ENTIRE AREA AT THEIR RESPECTIVE SPACING. UPLAND SHRUBS SHALL BE PLANTED @ 4'O.C. IN GROUPINGS. SHRUB GROUPING AREAS SHALL BE ENTIRELY MULCHED. NO WORK IN EXISTING WETLAND AREAS.

TRIBUTARY 199 PLANT LIST

	PLANT NAME	COMMON NAME	QUANTITY
GROUP II			
NO SYMBOL	SALIX LASIANDRA	PACIFIC WILLOW	80
	SALIX SITCHENSIS	SITKA WILLOW	80
	SALIX SCOULERIANA	SCOULER'S WILLOW	80
	CORNUS STOLONIFERA	RED OSIER DOGWOOD	80
GROUP IV			
	ACER MACROPHYLLUM	BIGLEAF MAPLE	2
	CRATAEGUS DOUGLASII	DOUGLAS HAWTHORNE	3
	FRAXINUS LATIFOLIA	OREGON ASH	3
	MALUS SP.	PACIFIC CRABAPPLE	3
	PICEA SITCHENSIS	SITKA SPRUCE	8
	PSEUDOTSUGA MENZIESII	DOUGLAS FIR	2
	RHAMNUS PUSHIANA	CASCARA	3
	THUJA PLICATA	WESTERN RED CEDAR	2
	GAULTHERIA SHALLON	SALAL	16
	HOLODISCUS DISCOLOR	OCEANSPRAY	10
	PHILADELPHUS LEWISII	MOCK ORANGE	16
	PHYSIOCARPUS CAPITATUS	PACIFIC NINEBARK	16
	RIBES SANGUINEUM	RED FLOWERING CURRANT	10
	RUBUS SPECTABILIS	SALMONBERRY	16
	SAMBUCUS RACEMOSA	RED ELDERBERRY	7
	SYMPHIOCARPUS ALBUS	SNOWBERRY	16
	VACCINUM OVATUM	EVERGREEN HUCKLEBERRY	28

✳ UPLAND PLANTINGS

UPLAND PLANTING SYMBOLS SHOWN BELOW ARE FOR GRAPHIC REPRESENTATION ONLY, REFER TO ACTUAL QUANTITIES LISTED IN THE UPLAND LEGEND FOR NUMBERS TO BE PLANTED.

UPLAND SYMBOLS (TREES)

ACER MACROPHYLLUM
PICEA SITCHENSIS
CORYLUS C. CALIFORNICA
PSEUDOTSUGA MENZIESII
POPULUS TRICHOCARPA
THUJA PLICATA

UPLAND LEGEND

	PLANT NAME	COMMON NAME	QUANTITY
SEE SYMBOLS	ACER CIRCINATUM	VINE MAPLE	155
	ACER MACROPHYLLUM	BIGLEAF MAPLE	125
	PICEA SITCHENSIS	SITKA SPRUCE	135
	POPULUS TRICHOCARPA	BLACK COTTONWOOD	85
	PSEUDOTSUGA MENZIESII	DOUGLAS FIR	125
	THUJA PLICATA	WESTERN RED CEDAR	165
	CORYLUS C. CALIFORNICA	WESTERN HAZELNUT	50
	HOLODISCUS DISCOLOR	OCEANSPRAY	205
	MAHONIA AQUIFOLIUM	TALL OREGON GRAPE	325
	PHILADELPHUS LEWISII	MOCK ORANGE	325
	RIBES SANGUINEUM	RED FLOWERING CURRANT	205
	ROSA GYMNOCARPA	BALD-HIP ROSE	110
	ROSA NUTKANA	NOOTKA ROSE	110
	ROSA RUGOSA	RAMANAS ROSE	110
	SYMPHIOCARPUS ALBUS	SNOWBERRY	325
	SCIRPUS MICROCARPUS	BULRUSH	764

SHRUB QUANTITIES OVER WHAT IS NEEDED FOR AREAS SHOWN ADJACENT THE TRAIL, SHALL BE PLANTED IN SIMILAR BLOCKS THROUGHOUT UPLAND PLANTING AREAS WITH THE MAJORITY OCCURING ADJACENT THE CHANNELS.

REVISIONS

SYMBOL	ZONE	DESCRIPTION	DATE	BY

CHANNEL AREA PLANT LIST

	PLANT NAME	COMMON NAME	QUANTITY
GROUP I	CAREX OBNUPTA	SLOUGH SEDGE	1069
	CAREX STIPATA	AWL-FRUITED SEDGE	1069
	ELEOCHARIS SPP.	SPIKE RUSH	1069
	OENANTHA SARMENTOSA	WATER PARSLEY	1069
	SCIRPUS MICROCARPUS	BULRUSH	1069
GROUP II	SALIX LASIANDRA	PACIFIC WILLOW	400
NO SYMBOL SEE GENERAL NOTES	SALIX SITCHENSIS	SITKA WILLOW	400
	SALIX SCOULERIANA	SCOULER'S WILLOW	400
	CORNUS STOLONIFERA	RED OSIER DOGWOOD	400
GROUP III	BETULA PAPYRIFERA	PAPER BIRCH	41
	POPULUS TREMULOIDES	QUAKING ASPEN	41
	THUJA PLICATA	WESTERN RED CEDAR	28
	CORNUS STOLONIFERA	RED OSIER DOGWOOD	190
	LONICERA INVOLUCRATA	BLACK TWINBERRY	190
	SPIRAEA DOUGLASII	WESTERN SPIRAEA	190
	VACCINUM PARVIFOLIUM	RED HUCKLEBERRY	190
GROUP IV	ACER MACROPHYLLUM	BIGLEAF MAPLE	12
	CRATAEGUS DOUGLASII	DOUGLAS HAWTHORNE	18
	FRAXINUS LATIFOLIA	OREGON ASH	18
	MALUS SP.	PACIFIC CRABAPPLE	18
	PICEA SITCHENSIS	SITKA SPRUCE	12
	PSEUDOTSUGA MENZIESII	DOUGLAS FIR	12
	RHAMNUS PUSHIANA	CASCARA	18
	THUJA PLICATA	WESTERN RED CEDAR	12
	GAULTHERIA SHALLON	SALAL	100
	HOLODISCUS DISCOLOR	OCEANSPRAY	64
	PHILADELPHUS LEWISII	MOCK ORANGE	100
	PHYSIOCARPUS CAPITATUS	PACIFIC NINEBARK	100
	RIBES SANGUINEUM	RED FLOWERING CURRANT	64
	RUBUS SPECTABILIS	SALMONBERRY	100
	SAMBUCUS RACEMOSA	RED ELDERBERRY	44
	SYMPHIOCARPUS ALBUS	SNOWBERRY	100
	VACCINUM OVATUM	EVERGREEN HUCKLEBERRY	177

HYDROSEEDING NOTES:

HYDROSEED

HYDROSEED MIX SHALL BE AS FOLLOWS:

40% LONGFELLOW CHEWING FESCUE
30% TURF TYPE PERENNIAL RYEGRASS
10% CINDY CREEPING RED FESCUE
10% HERON HARD FESCUE
10% SHAMROCK KENTUCKY BLUEGRASS

SOW SEED AT ONE POUND PER 200 SQUARE FEET. SEED IS AVAILABLE FROM D-F MARKS CO., WOODINVILLE, WASHINGTON.

BARK MULCH ONLY

NOTE:

SOIL AMENDMENTS GROCO AND MULCH SHALL BE PURCHASED AND DELIVERED BY CITY OF ISSAQUAH. ALL CHANNEL, UPLAND, AND TRIBUTARY VEGETATION INCLUDING TREES, SHRUBS, WILLOW CUTTINGS, AND WETLAND PLANTS SHALL BE SUPPLIED AND INSTALLED BY CITY OF ISSAQUAH.

This project was designed by the Seattle District U.S. Army Corps of Engineers. The initials or signatures and registration designations of individuals appear within the specifications or on these project documents within the scope of their employment as required by ER 1110-1-8152, Professional Registration.

DATE AND TIME PLOTTED: 08-MAR-2004 08:17
DESIGN FILE: H:\CIV\SQUAK_VALLEY\ICSVLP0E.DGN

COMPUTER AIDED DESIGN & DRAFTING

REDUCED TO 50% OF FULL SIZE

U.S. ARMY ENGINEER DISTRICT, SEATTLE
CORPS OF ENGINEERS
SEATTLE, WASHINGTON

SQUAK VALLEY SECTION 206 PROJECT

PLANTING LEGEND

ISSAQUAH WASHINGTON

SIZE	INVITATION NO.	FILE NO.	DATE:	PLATE
D		C-4-4-125	17FEB04	L-1
DSGN. REID		CHK.	SHEET 13	

Figure A-2. Legend and Notes

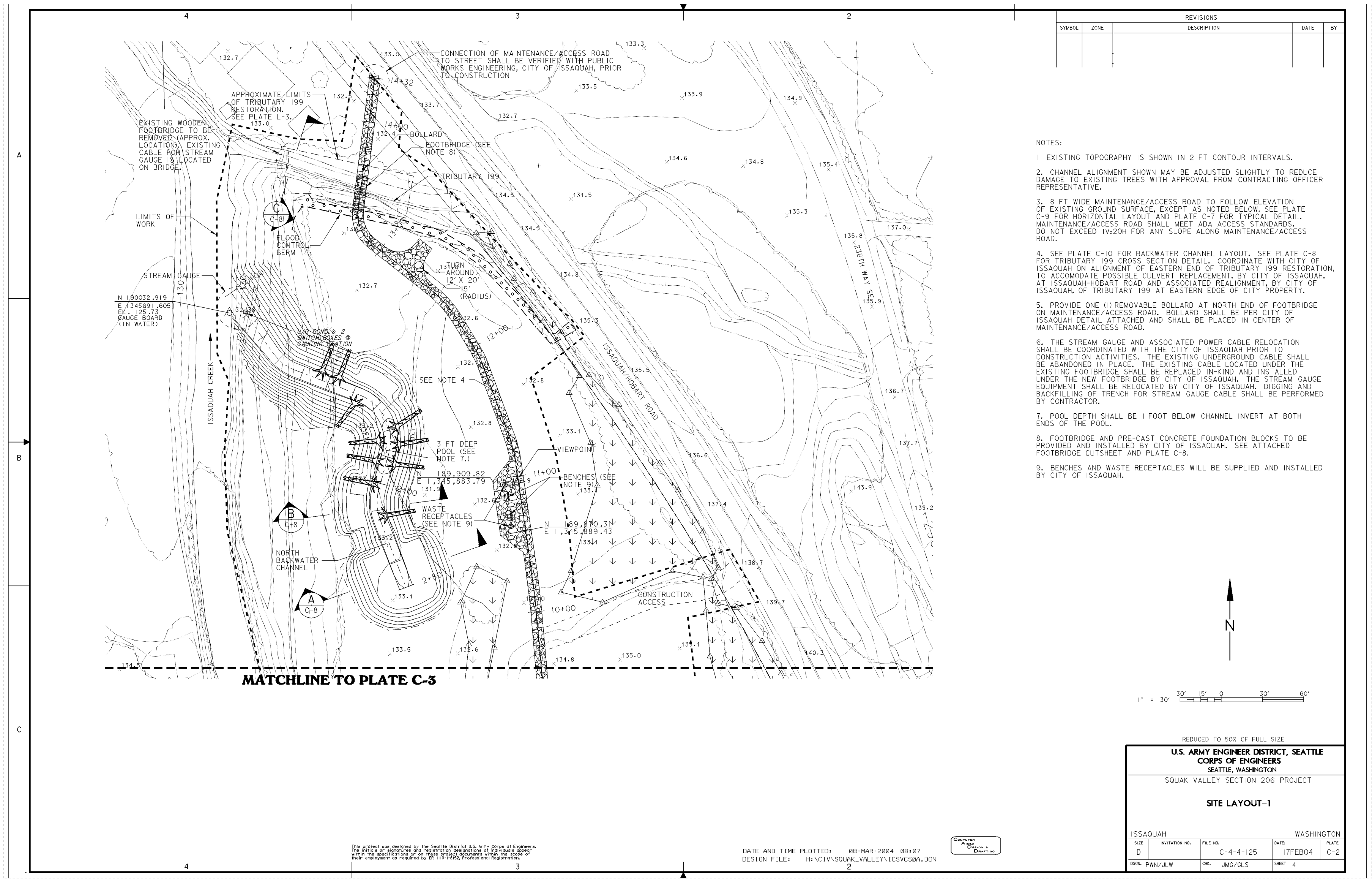


Figure A-3. Site Plan – North.

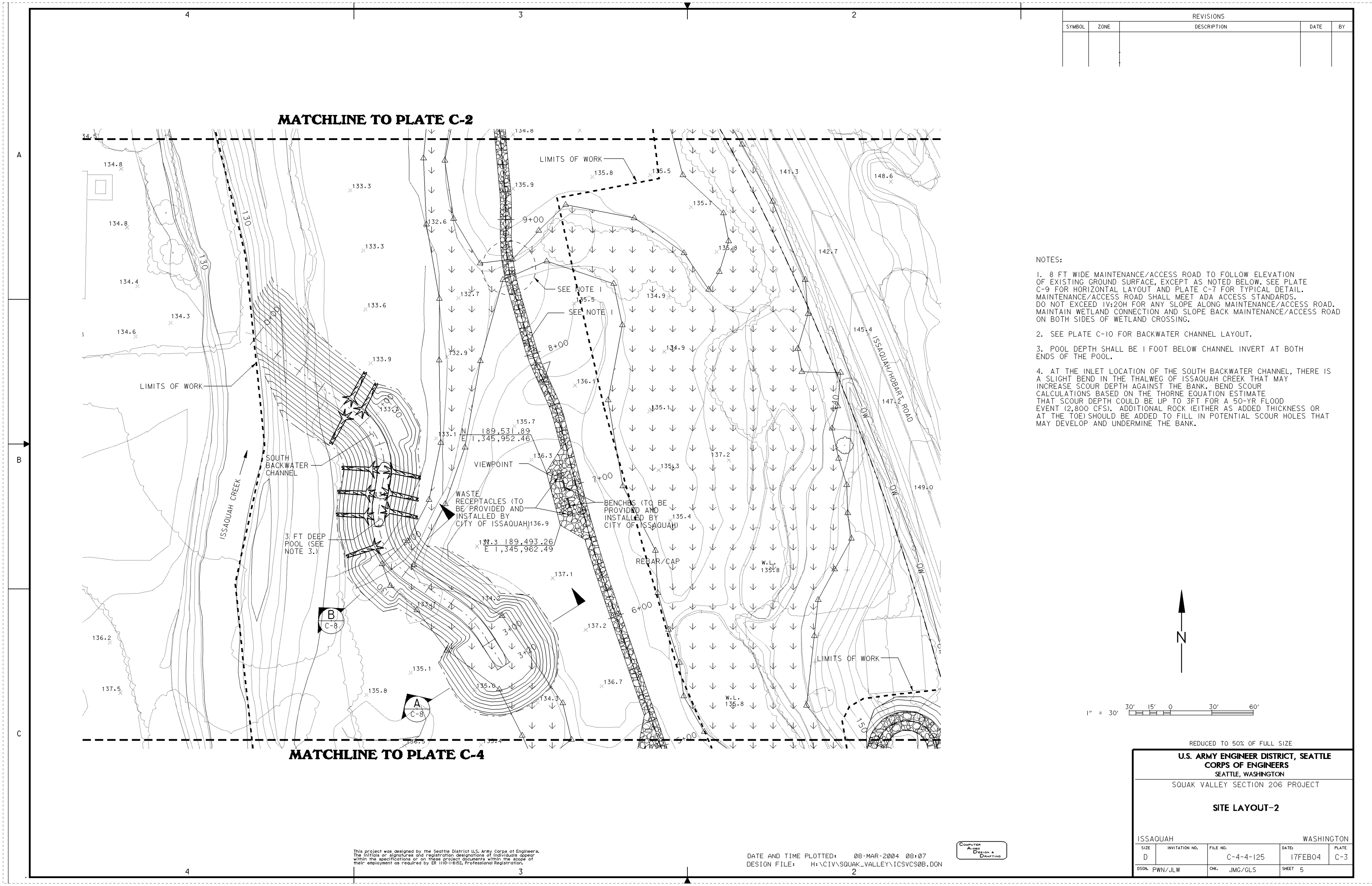


Figure A-4. Site Plan – Central.

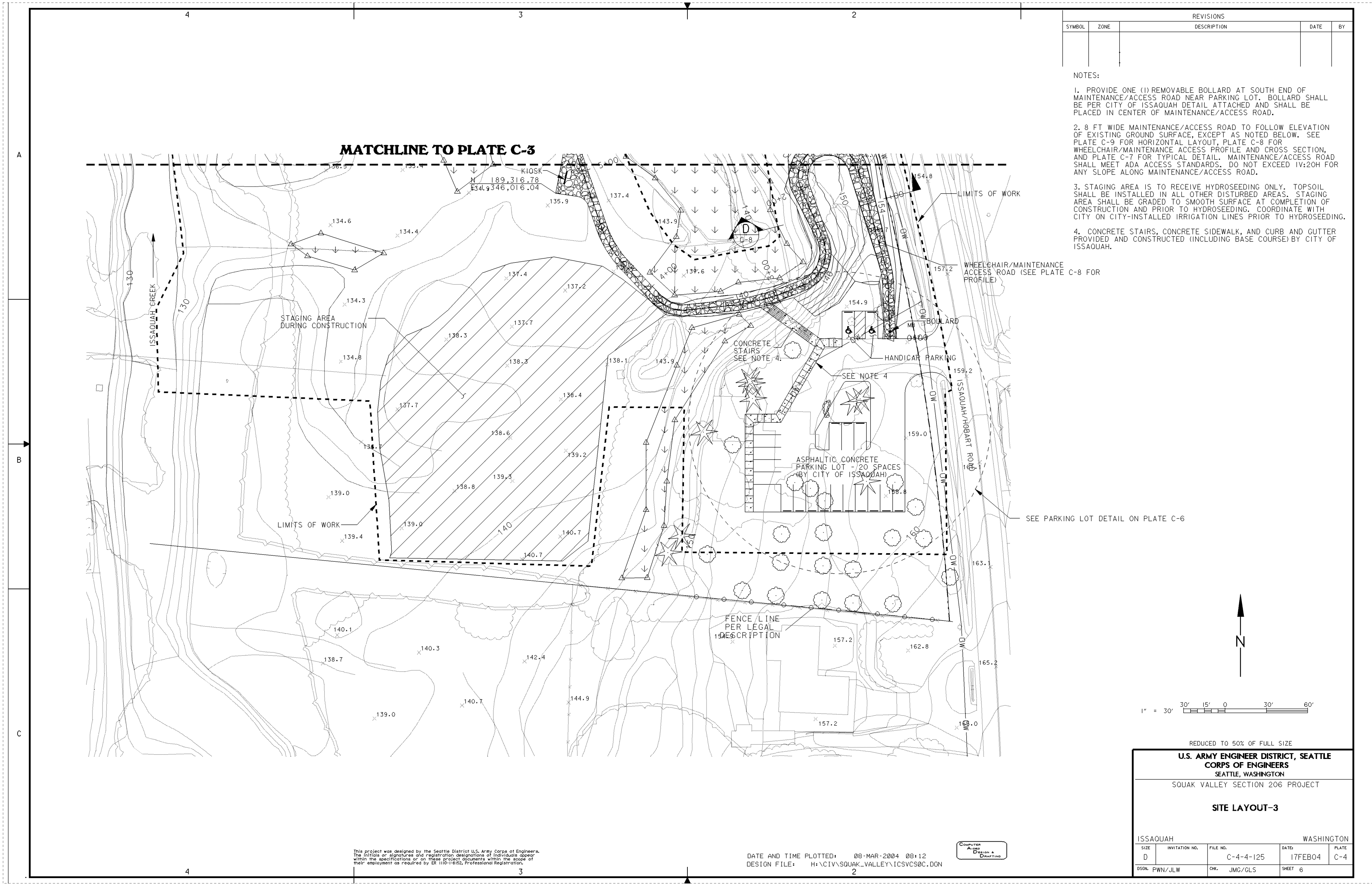


Figure A-5. Site Plan – South

Figure A-6. Disposal Site.

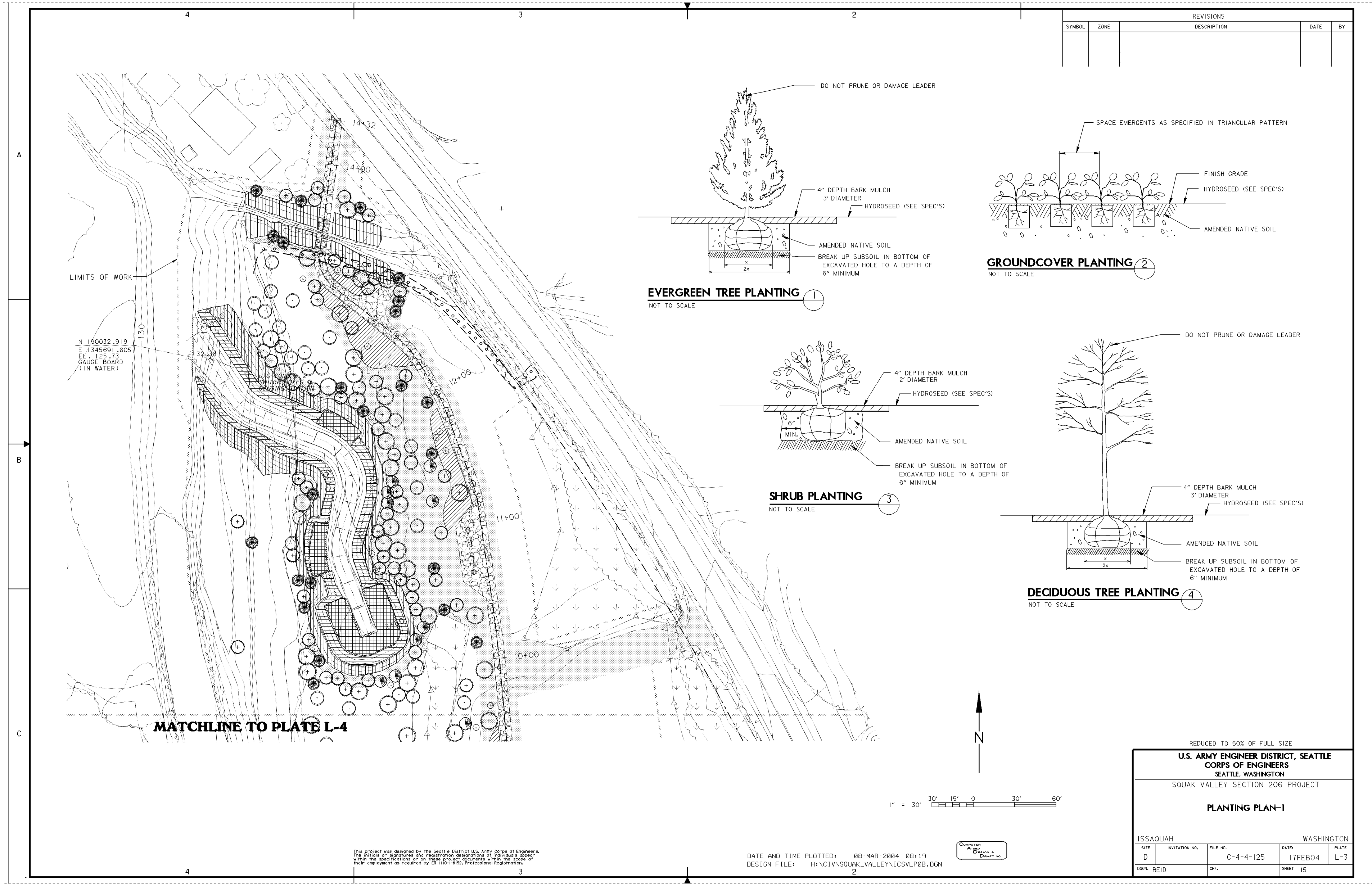


Figure A-7. Planting Plan – North.

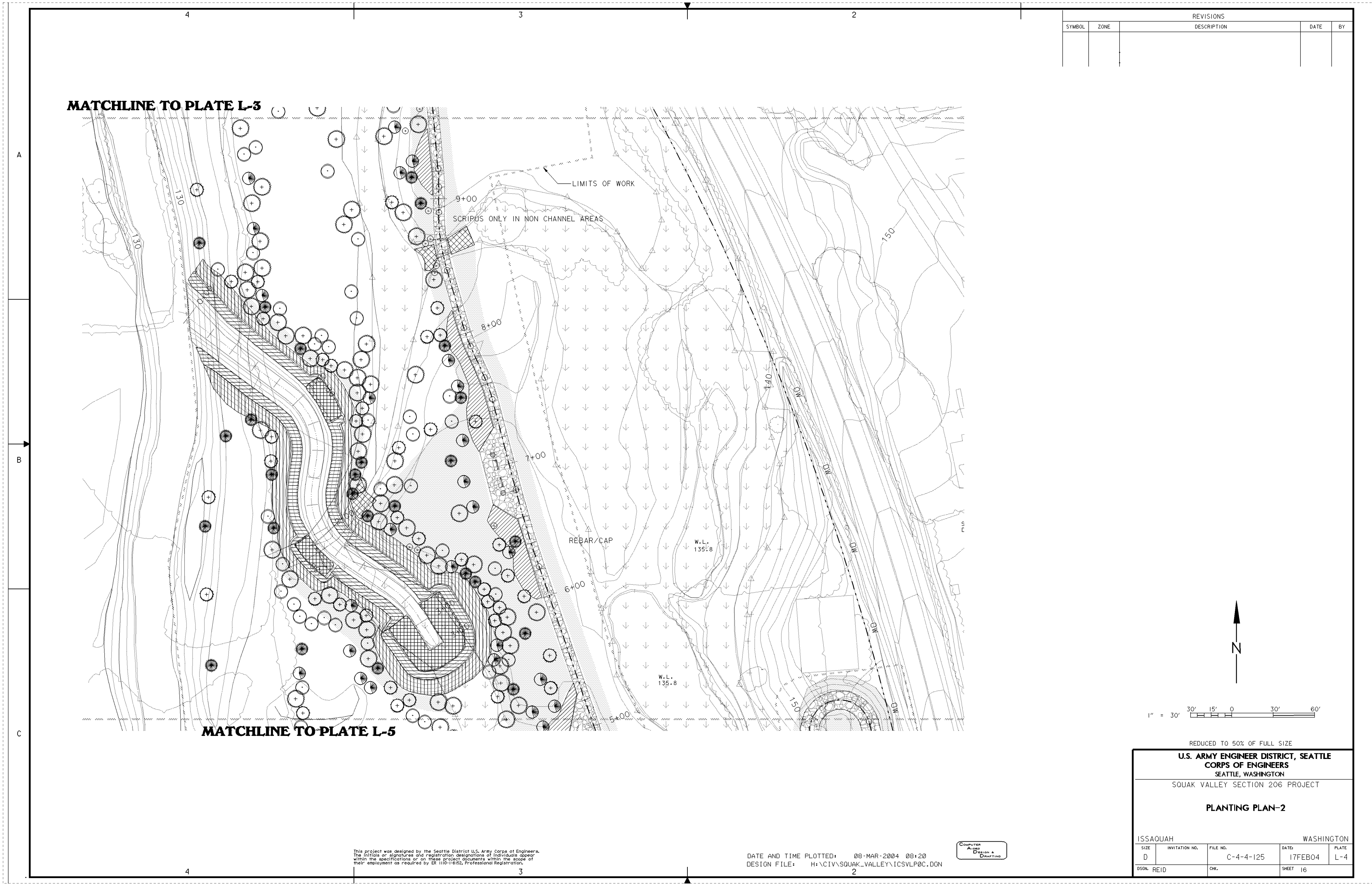


Figure A-8. Planting Plan – Central.

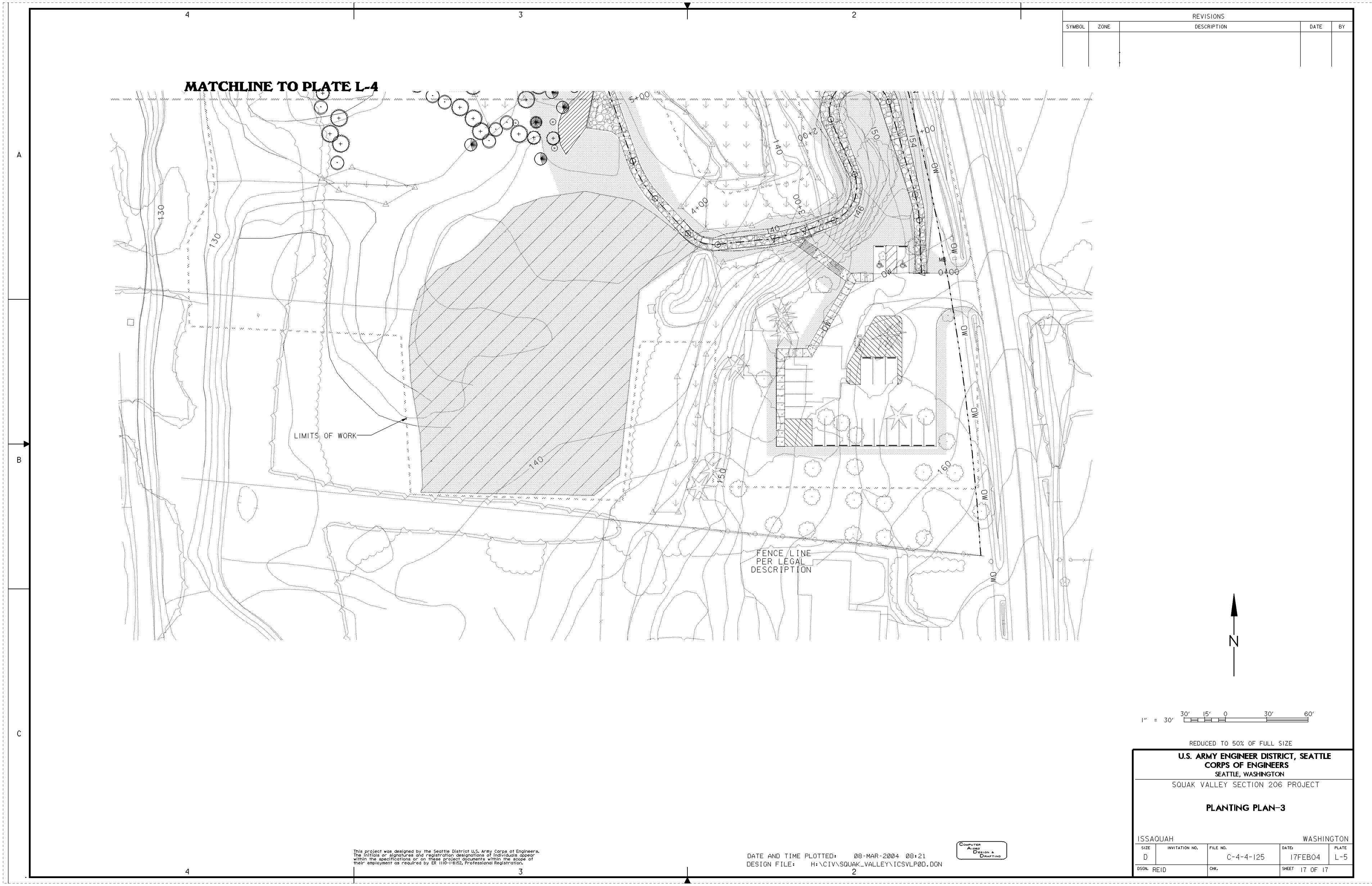


Figure A-9. Planting Plan – South.

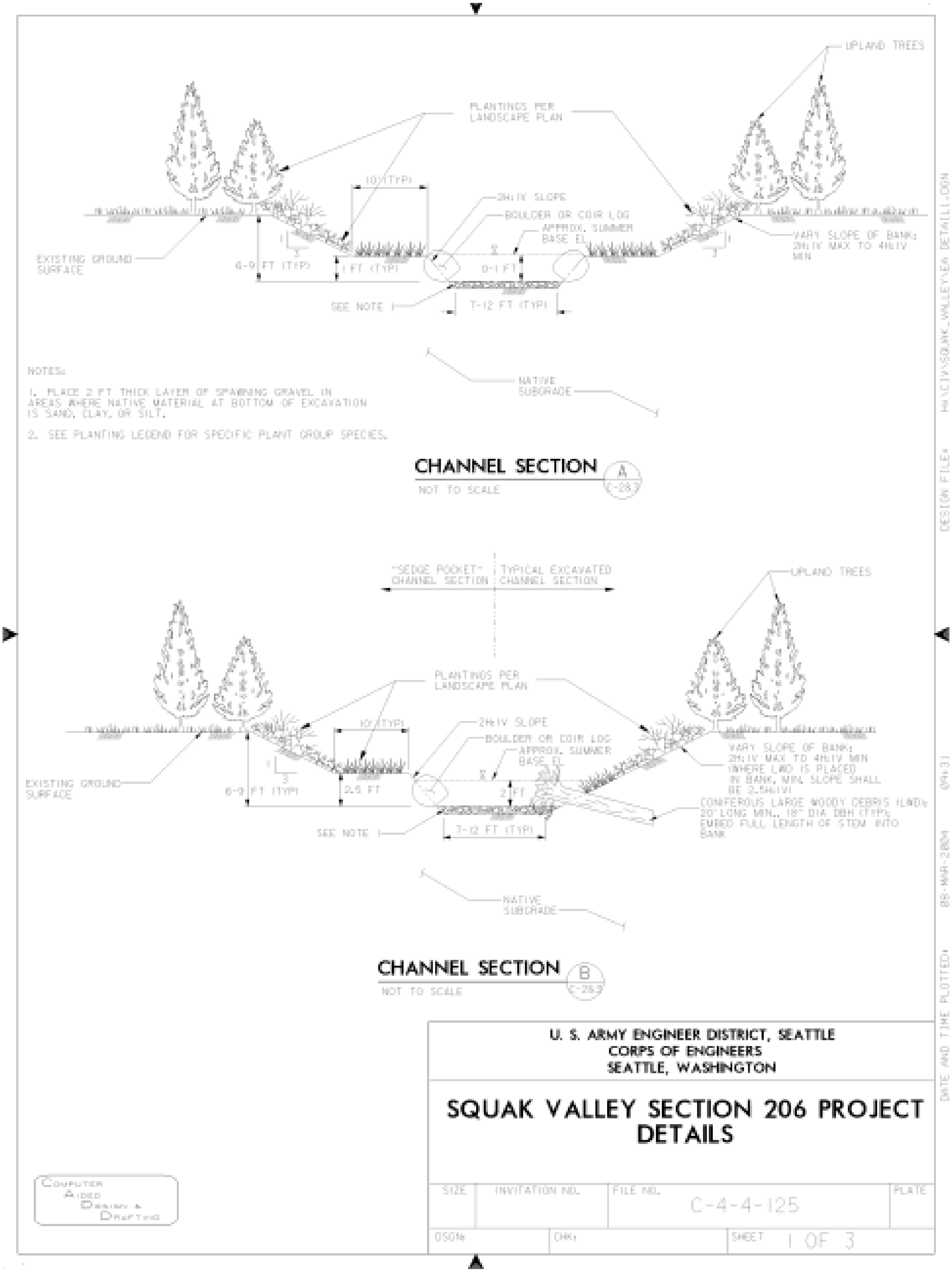


Figure A-10. Backwater Channel Cross-Section Details.

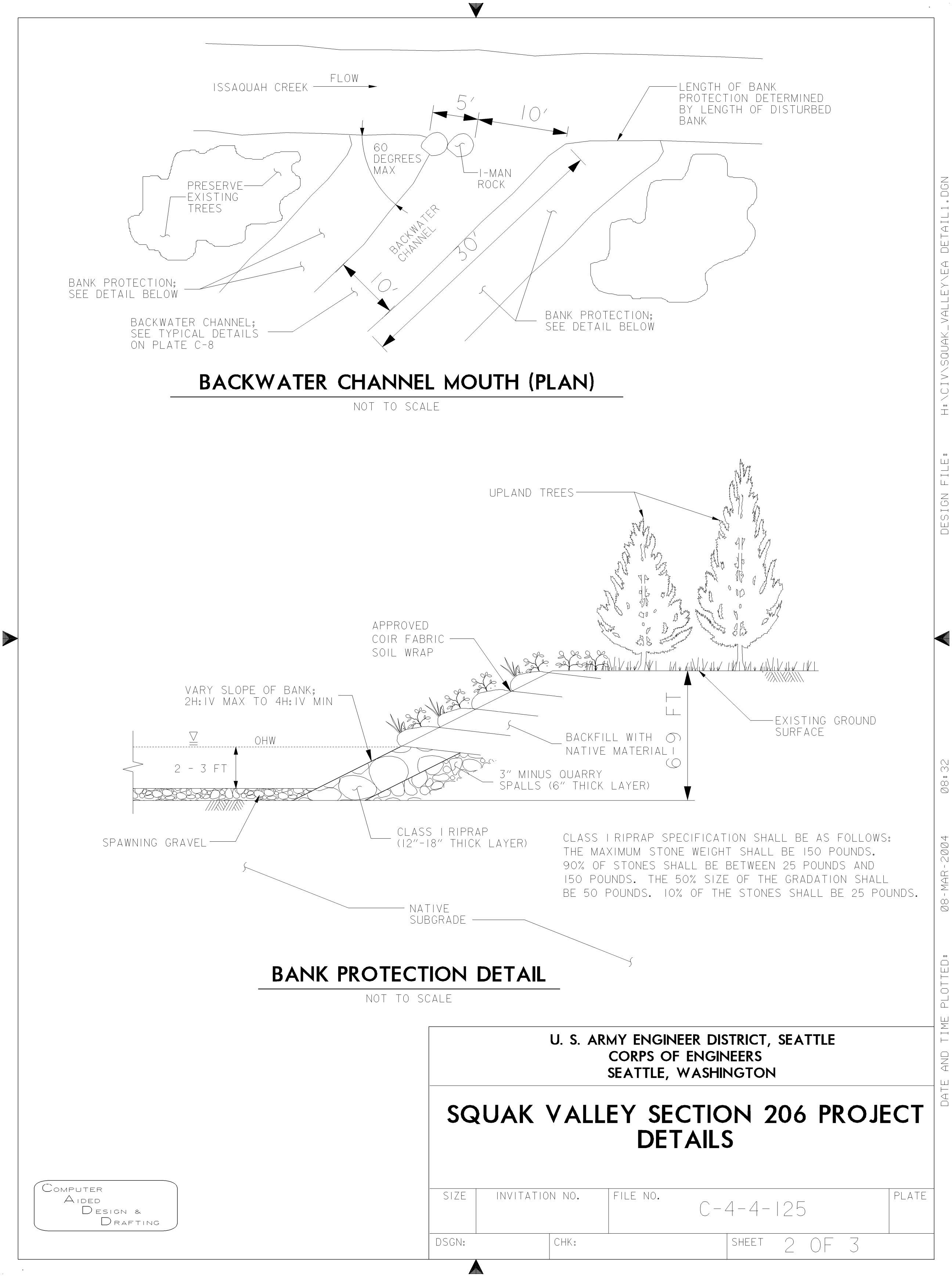


Figure A-11. Backwater Channel Inlet Details.

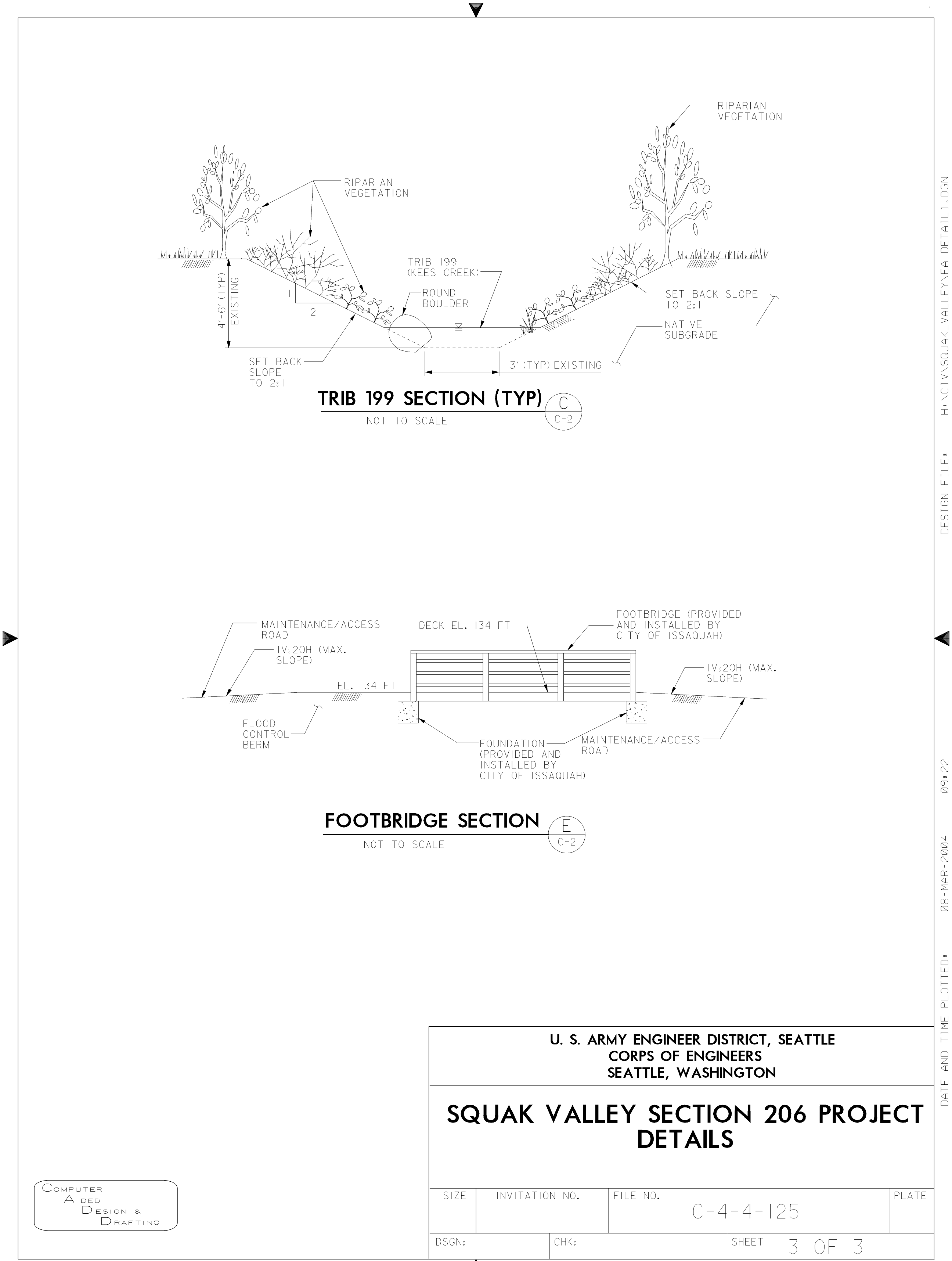


Figure A-12. Tributary 0199 (Kees Creek) Details.

APPENDIX B

Site Photographs

Figure B-1. Overview of site from southeast corner of site looking towards the northwest.

Figure B-2. Overview of site from southeast corner looking towards the southwest.

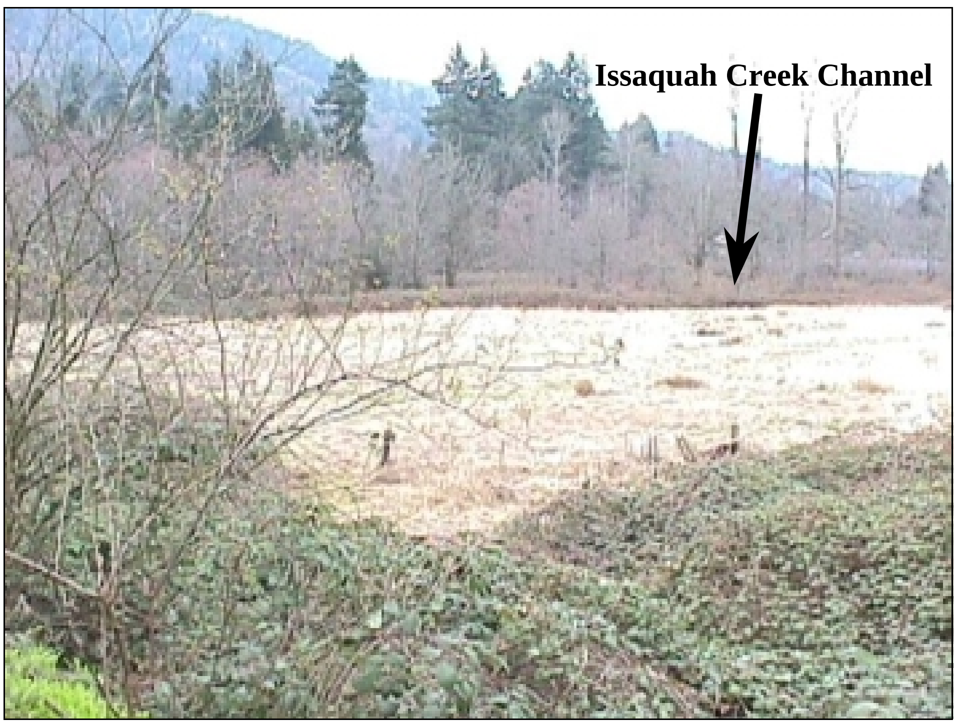


Figure B-3. Approximate Location of Upstream (Southern) Levee Breach

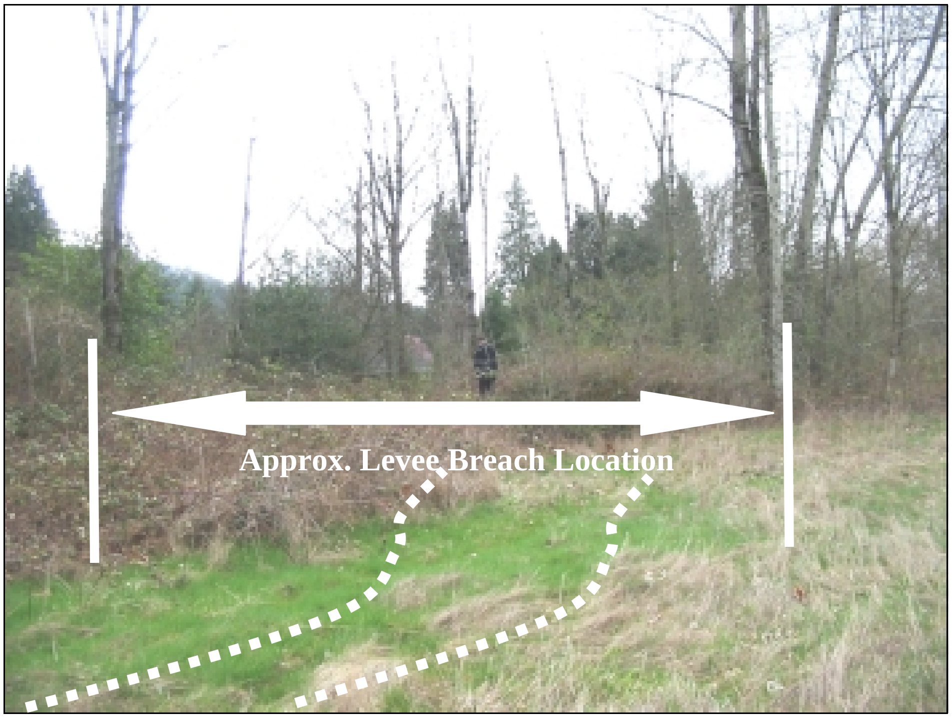


Figure B-4. Approximate Location of Downstream (Northern) Levee Breach

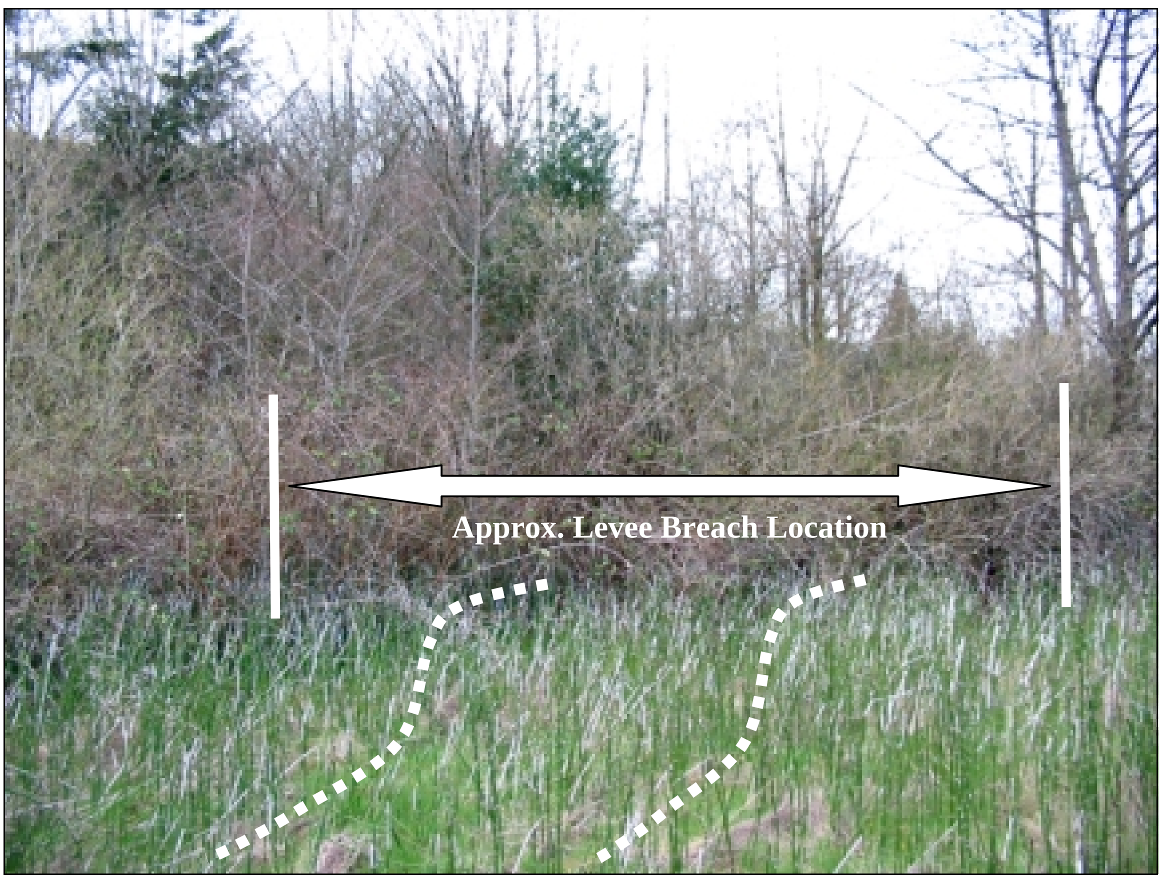


Figure B-5. Tributary 0199 in area to be graded and planted with native riparian species (looking upstream from near mouth).

Figure B-6. Downstream view of Issaquah Creek from near middle of project reach showing typical streambank and channel condition.

APPENDIX C
Corps Responses to Public and Agency Comments on the Draft Environmental Assessment
Squak Valley Environmental Restoration
Issaquah, King County, Washington

The Corps received comments on the draft environmental assessment (EA) for the proposed environmental restoration project at the Squak Valley parcel from 4 stakeholders. Specific comments and questions (*in italics*) are presented below, followed by Corps responses.

1. Washington Department of Ecology

i. In reviewing the DEA, the Corps' preferred alternative is more accurately described as "enhancing" not "restoring" channel processes and fish habitat along Issaquah Creek. Restoring Issaquah Creek would involve first understanding the channel and floodplain processes that occurred prior to manipulation, and second, recreating the conditions that supported those channel and floodplain processes.

As detailed by Section 206 of the Water Resource Development Act of 1996 (P.L. 104-303), the project falls within the general mantle of environmental restoration projects eligible for authorization. The proposed work is technically an enhancement or rehabilitation project and the final EA has been revised to reflect this distinction. It is important to note that changes to the Issaquah Creek basin caused by manipulation and development hamper or even preclude complete restoration of pre-development conditions and processes.

ii. Presumably, recreating historical channel and floodplain conditions would include removing the levee on the right bank (looking downstream), replanting the field with a variety of native shrubs and trees, and perhaps excavating the inlets to some side channels that the creek could then shape of its own accord. In doing so, overbank flooding would be restored (thereby reducing flooding), and the creek would do the majority of the work for side-channel creation and maintenance (erosion protection could be set-back as far as possible to protect the road or other infrastructure). Interestingly, I noticed the development of very productive side channel habitat along the creek where the levee was setback ~10-15 feet from the river. Normally, I would not recommend an alternative that meant removing large, mature trees. But in this situation, the impacts of removing mature trees are temporary; the impacts of leaving the levee in place (as well as installing more riprap for the proposed side channels) are permanent. Though mature woody vegetation would be removed, the long-term environmental benefits of truly restoring channel and floodplain processes (accompanied by aggressive re-planting) could likely outweigh short-term temporary disturbance associated with vegetation removal and ground disturbance. Successful replanting of cottonwood trees could provide excellent cover within 10 years.

The complete levee removal alternative could provide incrementally greater environmental benefits, over the long term, particularly if it were associated with fish habitat enhancements similar to those incorporated in the Preferred Alternative and the site was not constrained by its location in a developed portion of the basin. In the planning stages, the Corps performed a cost-benefit analysis of a range of alternatives, including complete levee removal. For ecosystem restoration projects like Squak Valley, a plan that reasonably maximizes ecosystem restoration benefits compared to costs, consistent with the Federal objective, shall be selected (as detailed in the Corps' Planning Guidance Notebook, ER 1105-2-100). In other words, ecosystem restoration projects should be based on a plan that maximizes ecosystem restoration benefits compared to costs (which is referred to in Corps planning guidance as the National Ecosystem Restoration, or NER, plan). In the case of the Squak Valley Parcel project, the Preferred Alternative provides similar environmental benefits as complete levee removal (considering both short- and long-term impacts and benefits) with substantially lower costs and adverse impacts. Accordingly, the Preferred Alternative will maximize environmental benefit to cost ratio and is therefore the NER plan.

Additionally, the potential benefits of levee removal must be considered in the context of constraints to such a process-based proposal. The location of the project site within the City of Issaquah presents undeniable constraints to the natural processes of erosion, sediment deposition, and resulting channel migration that ultimately would limit the form and functional level achieved by the levee removal alternative. The Corps and the City of Issaquah carefully designed the Preferred Alternative to provide environmental benefits while avoiding and minimizing future adverse impacts to adjacent properties and infrastructure.

iii. It is worth noting that most elements of the proposed project are viable as an enhancement effort. However, the use of riprap in the design directly conflicts with the idea and intent of restoring or enhancing fish habitat in floodplain environments. The EA states in the designs that riprap will be used from the base of the bank to the elevation of Ordinary High Water. The drawings indicate that a minimum of 30 linear feet of both channels would be riprapped with Class 1 riprap. The use of riprap is very well documented as detrimental to riverine (salmonid) environments (see reference list below, including a reference authored by the Corps of Engineers). In addition, the side channels are supposed to support wetland environments, a function that riprap does not provide.

The proposed bank protection at the channel outlets is necessary to prevent the areas that will be exposed during project construction from rapidly eroding during higher flows that occur primarily in the winter. The Corps designed the proposed stream bank protection using the Washington Department of Fish and Wildlife *Integrated Streambank Protection Guidelines* (WDFW 2002). For all exposed areas except those below Ordinary High Water, the proposed bank protection utilizes bioengineering methods incorporating soil lifts and extensive plantings rather than riprap. The planned riprap toe protection uses the smallest possible riprap, Class I, which average less than 1 cubic foot per piece, much smaller than typically associated with riprap bank protection on larger river and lake shorelines. With the proposed design, riparian and stream habitat will be preserved and enhanced while maintaining the geometry of backwater channel outlet after construction, an important consideration to avoid sedimentation at the channel mouth that could hinder fish access to the off-channel habitat. Due to steep slopes at the levee breaches, we do not intend to create wetland areas in the vicinity the channel outlets. Wetland areas will be created "upstream" of the outlets in areas currently landward of the existing levee.

iv. Accordingly, "Riprap may provide habitat for juvenile salmonids and bolster densities on reaches of stream that have been severely degraded [Issaquah Creek does not qualify as severely degraded.]. However, riprap does NOT [emphasis added] provide the intricate habitat requirements for multiple age classes or species provided by natural, vegetated banks. Streambanks with riprap have fewer undercut banks, less low-overhead cover, and are less likely than natural stream banks to contribute large woody debris to the stream…Our review further demonstrates that the practice of riprapping banks goes against current practices and philosophies of stream renaturalization and impedes future restoration work" (Schmetterling et al 2000). Why isn't the corps considering other materials for bank protection, specifically large woody debris (LWD) (without rootwads)? LWD could be placed lengthwise along the channel to protect the bank toe from erosion–the velocities of this river are not extraordinary. The use of LWD for bank protection is an absolutely viable alternative to riprap in this creek, and would provide more environmental benefit than riprap.

The proposed bank protection incorporates design features advocated by the WDFW Integrated Streambank Protection Guidelines (ISPG) publication. The proposed bioengineered streambank will provide necessary bank stability (particularly in the short-term following construction) together with high quality habitat for fish and wildlife. In general, LWD is a poor choice for toe protection since it requires substantial effort and streambank disturbance to anchor LWD so that it remains in place during the high flows. Even with anchoring, it is difficult to ensure that LWD will remain in place during flood events. If high flows were to dislodge an LWD toe, substantial erosion would likely occur at the project site, jeopardizing the proposed restoration project and off-site areas. Additionally, toe protection via LWD would function similarly to the proposed riprap toe with little environmental benefit accruing simply from substitution of wood for rock.

v. The use of riprap calls into question the suitability of approving this project under Nationwide Permit (NWP) #27, "Stream and Wetland Restoration Activities." Ecology requires your response to the issues raised regarding use of riprap before we agree with approval of this project under NWP 27.

See comments and responses 1(iii) and 1(iv) and concerning the suitability of the proposed bank protection measures.

vi. If NWP 27 is determined to be appropriate, the Corps must then demonstrate compliance with the conditions that Ecology has placed on NWP 27, or an individual 401 water quality certification is necessary. The State's conditions require assurance that the project will not cause a violation of the water quality standards, and that the project is constructed in accordance with Ecology's Stormwater Manual for Western Washington. I suggest that in order to demonstrate compliance with the water quality standards during construction, you develop and implement a water quality monitoring plan for turbidity and submit the results to Ecology on a weekly basis, or more frequently if exceedances are detected. Exceedances may result in enforcement action by Ecology.

The project will comply with all applicable laws and regulations. The Corps has reviewed the Water Quality Certification (WQC) conditions on NWP 27 and determined that the proposed work does not exceed the thresholds to require an individual WQC. See Section 7.3 for more details concerning the Corps determination that the proposed work does not require an individual

WQC. In accordance with State Water Quality standards, turbidity will be regularly monitored during in-water construction and reports submitted to Ecology on a weekly basis or more frequently.

vii. An additional condition on the NWP 27 is that the project be constructed in accordance to guidelines developed by the Washington Department of Fish and Wildlife (WDFW). I would like a written explanation of how you will meet this condition. I would prefer that the Corps obtain an advisory HPA from WDFW, or have the local sponsor (City of Issaquah) obtain an HPA from WDFW.

The City of Issaquah plans on obtaining an HPA for the project. The Corps sent a letter detailing responses to Ecology comments, including a written explanation of how the project is constructed in accordance with WDFW guidelines. The relevant section follows:

> The U.S. Army Corps of Engineers (Corps) designed the proposed bank protection using the Washington Department of Fish and Wildlife (WDFW) Integrated Streambank Protection Guidelines. For all exposed areas except those below ordinary high water, the proposed bank protection utilizes bioengineering methods incorporating soil lifts and extensive plantings rather than riprap. The planned riprap toe protection uses the smallest possible riprap, Class I, which average less than 1 cubic foot per piece, much smaller than typically associated with riprap bank protection on larger river and lake shorelines. Large woody debris (LWD), suggested as a substitute for riprap in your comments, is a poor choice for toe protection since it requires substantial effort and streambank disturbance to anchor LWD so that it remains in place during the high flows when erosion protection is most necessary. With the proposed design, riparian and stream habitat will be preserved and enhanced while maintaining the geometry of backwater channel outlet after construction, an important consideration to avoid sedimentation at the channel mouth that could hinder fish access to the backwater channels. The proposed bioengineered streambank will provide necessary bank stability together with high quality habitat for fish and wildlife. Accordingly, the Corps believes that the project, including the bank protection, is consistent with the provisions of NWP 27.

viii. What is the measurement of success of this project?

Post-construction monitoring will evaluate survival of the plantings, plant species composition, physical condition of the backwater channels, and observations of fish use. Specific metrics to quantify success have not been developed at this time. Monitoring is planned for at least 5 years. Section 5.6.4.1 has been revised to include more detailed discussion of monitoring of the plantings. Section 5.5.1 has been revised to discuss monitoring of sedimentation and, by extension, accessibility of the backwater channels to fish.

ix. Is there a long-term monitoring plan which measures water quantity, water quality, habitat, and fish use in the side channels?

See comment and response 1(viii).

x. Who is responsible for maintenance of the project over time?

Section 206(c) of the Water Resources Development Act of 1996, Public Law 104-303, as amended, provides that the Secretary of the Army shall not commence construction of any project, or separable element thereof, under the Section 206 authority, until each non-Federal sponsor has entered into a binding agreement to pay the non-Federal share of the costs of construction required by Section 206(b) and to pay 100 percent of any operation, maintenance, replacement, and rehabilitation costs with respect to the project. Accordingly, after completion of construction and the initial monitoring period, the City of Issaquah, as the non-Federal sponsor, will be responsible for project maintenance, as detailed in the project-specific project cooperation agreement between the Corps and Issaquah.

2. Washington Department of Fish and Wildlife (WDFW)

i. The third paragraph under Section 3, Page 2 states that 'at least 10 pieces of woody debris would be placed along the shoreline of each channel.' The Washington Department of Fish and Wildlife (WDFW) would like to know the source or criteria upon which this number was derived. The proposed 10 pieces of wood to be placed in the backwater channels of 280 and 320 feet long is at the lower end of published frequency ranges for naturally forested systems of the Pacific Northwest. Furthermore, the text of the draft Environmental Assessment (EA) does not indicate any size criteria or species type(s) for the large woody debris.

The Corps referred to the NMFS Matrix of Pathways and Indicators (NMFS 1996) to determine the number of pieces of wood to incorporate into the project. According to this publication, properly functioning conditions for coastal watersheds in Washington have at least 80 pieces of LWD per mile. Using this minimum threshold, about 9 pieces of LWD would be required for both channels. Realizing that the 80 pieces per mile is a minimum threshold and that the proposed backwater channels are different from mainstem creek habitat, the Corps more than doubled the number of pieces of LWD. The project drawings specify that the LWD shall be at least 20 feet long with minimum diameter breast height of 18 inches. LWD will be coniferous and the final EA provides the LWD specifications in the project description section (see Section 3.2). In addition to the 20 pieces of coniferous LWD, pieces of non-coniferous LWD may also be placed to utilize any large cottonwood, alder, or maple trees that need to be removed for project construction (such as for the levee cuts or at the disposal site).

ii. The fifth paragraph under Section 3, Page 4 states that 'Recreation features that would be constructed include a gravel trail, picnic benches, and open areas.' The WDFW questions the appropriateness of a gravel path at this location. Due to its proximity to the open backwater channels, the path could become an unwanted sediment source. In addition, as designed the path runs through a portion of the wetland. This would seem to be an avoidable impact. Has an elevated boardwalk been considered and rejected? Is so, why?

The path will be both a recreational feature and an access road for maintenance and emergencies. While a boardwalk would provide recreational access, it would not provide vehicle access required for maintenance and emergencies. During project design, the Corps and Issaquah considered bridged vehicle access to the northern portions of the site either from the south (over the wetland) or the north (over Tributary 0199), but costs and disturbance required for a bridge able to accommodate vehicles prohibited its incorporation into the final project design. The gravel path will be located outside of the habitat enhancement areas and sideboards will contain gravel to prevent erosion into adjacent areas. The path intentionally crosses the wetland at its narrowest point and at grade to maintain hydraulic connection between the eastern wetlands and the western habitat area.

iii. In the first paragraph under Section 6.2, Page 14 the draft EA states 'the outlets have been designed to minimize the change to the creek channel cross sectional area with the placement of several large boulders on the upstream side of each outlet.' The WDFW would like to know if other stabilizing options other than boulders, such as engineered wood debris jams, have been considered and rejected. Why?

The proposed boulders are not intended as stabilizing features, but rather to manage the cross-sectional area of the creek channel in the vicinity of the backwater channel outlets. During design, the Corps considered methods to manage sediment deposition at the channel outlet necessary to maintain long-term connectivity between the creek and the backwater channels. At the channel outlets, the width of the creek increases and water velocity slows, resulting in sediment deposition right at the backwater channel outlet. The boulders hydraulically constrict the channel width at the outlet so that water velocity doesn't slow at the channel mouth and sediment deposition is avoided. Additionally, scour immediately downstream of the boulders will likely maintain channel depth at the channel outlet. The Corps used boulders instead of engineered wood debris jams since boulders will provide the hydraulic conditions to maintain connectivity and provide a diverse hydraulic environment that should benefit fish, but can be placed without the anchoring or large-scale excavation that would be required to fix wood structures in the channel.

iv. The first paragraph in Section 6.2 on page 14 reads 'Additionally, disturbed shorelines areas of Issaquah Creek will be stabilized using bioengineering techniques designed to withstand the 50-year flow conditions.' WAC 220-110-050 states 'When rock or other hard materials are approved for bank protection, the following provisions shall apply: The project shall be designed and the rock installed to withstand 100-year peak flows.' WAC 220-110-050 also states 'Fish habitat components shall be installed according to an approved design to withstand 100-year peak flow.' Why was the stabilization designed for the 50-year flow condition?

In designing the Preferred Alternative to enhance fish and wildlife habitat, the Corps needed to balance short-term environmental impacts of the necessary bank stabilization with the environmental benefits of the project, and decided that the 50-year flow condition was a suitable level of protection that will likely maintain project integrity in the short-term while allowing natural channel-forming processes to shape the channel during infrequent higher flow events. Providing for more robust bank stabilization would require use of larger and more riprap that is not consistent with the goal of enhancing fish and wildlife habitat in this setting.

3. Environmental Protection Agency

i. I concur with most of the comments that the Department of Ecology provided regarding using riprap. I would suggest that other material would be better option, such as large woody debris.

Please see comment and response to comment 1(iv), from the Washington Department of Ecology.

4. Muckleshoot Indian Tribe

i. The preferred alternative to create two side channels at this site may have limited benefits compared to the alternative that would remove the entire levee (described in Section 4.2.2). Furthermore, the preferred alternative may not function as proposed and/or require maintenance that is not planned nor funded. Therefore, we recommend that the Corps reconsider this project and chose [sic] *the alternative to remove the existing levee by setting it back to the Issaquah-Hobart Road and allow Issaquah Creek to flow freely within its floodplain as the means of restoring habitat at this site. In addition to setting the existing levee back, wood should be added to this alternative to create more diverse habitat than currently exists. The affected streambanks could be planted with native vegetation that will provide stream functions in the future. This modified alternative has the best chance to be successful in the long term and provide the most benefit to salmonids in Issaquah Creek.*

The location of the project site within the City of Issaquah presents undeniable constraints to the natural processes of erosion, sediment deposition, and resulting channel migration that ultimately would limit the form and functional level achieved by the levee removal alternative. While levee removal may be suitable in a less developed setting, it is unlikely that the processes necessary to maximize the future benefits of levee removal alternatives would be allowed to shape the project site due to potential adverse impacts to nearby properties. For the Preferred Alternative, alterations to the main channel of Issaquah Creek, like placement of woody debris along the shoreline, were specifically avoided to minimize the chance for off-site impacts such as shoreline erosion on privately owned parcels opposite from the Squak Valley site. The Corps recognizes that additional actions that will provide more benefit can always be devised, but believes that the Preferred Alternative will provide crucial benefits for fish and wildlife habitat as currently designed.

ii. The EA also references a Biological Evaluation that will be completed for the project and notes that the project's effects and conservation measures are discussed in more detail in this document. We request that the Corps provide us with a copy of the Biological Evaluation prior to the initiation of consultation with the Services, so that we may review the document and provide comments, if necessary.

The rationale and conclusions of the BE have been summarized in the draft and final EA. Pursuant to Section 7 of the Endangered Species Act, we have elected not to distribute a draft of the complete BE prior to submittal to the USFWS and NOAA Fisheries. At the completion of Section 7 consultation, we will transmit a copy of the BE to the Muckleshoot Indian Tribe.

iii. The area described as Lower Issaquah Creek (section 2.3) is not defined. If should be defined by approximate location such as River Mile xxxx to River Mile xxxx, so the reader can identify the portion of the stream channel in this discussion.

The reference to lower Issaquah Creek has been changed to “the portion of Issaquah Creek within the City of Issaquah. City limits are located less than 1 mile south (upstream) of the Squak Valley parcel.

iv. [Section 2.3] *also lacks sufficient detail to support the project’s purpose and need. For example, the document notes that off-channel salmonid habitat is lacking in mainstem Issaquah Creek without identifying the exact number of side channels that exist compared to the number that would be expected for a stream of similar size. Also, a citation should be provided for the statement that side channels and backwater sloughs are especially important for Chinook rearing from February through July.*

As stated in the EA, the 2002 report on existing conditions in Issaquah Creek within the City of Issaquah (Parametrix, 2002) identified lack of off-channel salmonid habitat as a limiting factor for the mainstem of Issaquah Creek. The Parametrix report is based on a field survey of the portion of the mainstem of the creek within the Issaquah city limits. It is possible to identify off-channel habitat as a limiting factor without enumerating the exact number of side channels that currently exist or that which should exist based on reference systems. Citations for Chinook use of off-channel areas have been added.

v. Similarly, there is no evidence presented in the document to support the statement that the constructed off-channel area and wetlands will reduce water velocities thereby reducing scour. Since the proposal is not a complete side channel and will not divert flow from the mainstem, it is unclear how water velocity will be reduced in the mainstem.

The need and purpose statement explains some of the benefits of off-channel and wetland areas in relation to flood storage. Alternatives that allow more frequent flooding of the creek’s floodplain will store water that would otherwise flow immediately downstream, thereby attenuating the magnitude or duration of high flow velocities during flood events. The wording of Section 2.3 has been revised to clarify this point.

vi. Furthermore, Section 6.2 of the Environmental Assessment states, “the project may slightly affect hydraulic conditions in the vicinity of the side-channel outlets.” Thus it is unlikely that the project will reduce scour of redds in the mainstem of Issaquah Creek.

The Corps considered the potential for the proposed outlets to increase the channel cross-section, slow water velocities, and result in deposition of sediment at the mouth of the backwater channels. The referenced section of the EA has been clarified to emphasize this point in relation to placement of the boulders at the outlet to minimize deposition at the outlet.

vii. Additional information about the proposed project is needed in [Section 3]. *This information should include bankfull widths, stream channel gradients, water depth ranges from November through April and the anticipated velocities in the new channel throughout the year should be stated in addition to channel bottom widths. This information is necessary to determine the likely extent of off-channel rearing habitat for a variety of salmonids. Similarly, volume of riprap to be placed as part of the preferred alternative is neither described nor compared to other alternatives.*

Additional information about bankfull width and riprap quantities has been added to the description of the project alternatives (Section 3). Information about water depths is contained in Section 5.3.

viii. We have several comments regarding the woody debris component of the proposed project. First, the size of woody debris should be stated in Section 3, in addition to its description in the attached figures. Also, the EA fails to discuss the rationale for the number and size of wood proposed. We recommend placement of the amount and size of wood one would find in a similarly sized channel. One way to determine this is to use information in the Fish Habitat Module of the Washington Department of Natural Resources' Watershed Analysis Manual (1997; <http://www.dnr.wa.gov/forestpractices/watershedanalysis/manual/fish.pdf>). The constructed project should have number and sizes of wood that would result in a "good" rating for the appropriately sized channels.

We have added the minimum size of the proposed woody debris to the description of the Preferred Alternative. The Corps referred to the NMFS Matrix of Pathways and Indicators (NMFS 1996) to determine the number of pieces of wood to incorporate into the project. According to this publication, properly functioning conditions for coastal watersheds in Washington have at least 80 pieces of LWD per mile. Using this minimum threshold, about 9 pieces of LWD would be required for both channels. Realizing that the 80 pieces per mile is a minimum threshold and that the proposed backwater channels are different from mainstem creek habitat, the Corps more than doubled the number of pieces of LWD.

ix. Wood should be placed near the mouth to provide immediate cover for juvenile salmonids that enter the backwater channels. Placed wood should also be clumped rather than placed in isolation as shown in Figures A-3 and 4. Each piece of wood should have a rootwad and be clumped using large and small pieces to provide more habitat complexity. Additionally, Figure A-10 indicates that the full length of the wood stem is to be placed into the stream bank, with little wood actually in the channel. Since the intention is to create two backwater channels, the majority of the wood does not need to be placed in the bank for stability because there should be little potential for erosion or channel avulsion. Similarly, the backwater channels should not require riprap if they are designed correctly (Figure A-11). Wood should also be placed into Tributary 0199 (Kees Creek) to provide cover and habitat for salmonids in addition to the riparian plantings and streambank setbacks.

As discussed in comment and response 4(i), the design specifically avoids modification of the main channel of Issaquah Creek to minimize the chance for adverse off-site impacts. Accordingly, LWD will be located in the backwater channels rather than at the outlets. As shown on drawings A-3 and A-4, the woody debris will be clumped around the pools in order to maximize the habitat complexity in the area of the channel most likely to be utilized by juvenile salmonids, particularly coho salmon. Per evaluation of buoyancy and depth of floodwaters, the woody debris is buried into the bank to prevent it from floating away during flood events, with likely adverse effects downstream. As with Issaquah Creek, work in the channel of Tributary 0199 will not include placement of woody debris to avoid altering the hydraulics of the channel and minimize the chance that the habitat enhancements increase the likelihood of flooding Issaquah-Hobart Road.

x. The side channel with two levee breaches alternative should be fully analyzed (section 4.2.1) because this alternative could provide stable habitat for juvenile salmonids depending upon the quantity of wood in the channel, its configuration, or hydraulic complexity.

The environmental consequences of the side channel with levee breaches and levee removal have been fully evaluated in the final EA (Section 5).

xi. …the extent of riprap (length and volume) is not disclosed so it is not possible to compare this alternative [side channel with two levee breaches] *to any of the other alternatives. Similarly, there is no information about the water velocities in this or the other alternatives to assess the rearing habitat potential.*

The riprap quantities are described in Section 3 of the final EA. Section 5.3 discusses the potential water velocities in both the proposed backwater channels and the side-channel alternative.

xii. The alternative to remove the entire levee (section 4.2.2) overlooks the probability that setting the levee back would allow the natural processes of stream migration and meandering to more fully restore this portion of Issaquah Creek. Over the long term, this option could result in a more complex stream channel than other options, particularly if large wood was placed into mainstem Issaquah Creek in conjunction with extensive riparian plantings. The discussion that levee setback has limited benefits to fish habitat is not consistent with previous Corps projects involving levee setbacks. Furthermore, the levee setback alternative is the alternative most likely to reduce scour of redds in Issaquah Creek.

Please see the response to comment 1(ii) from the Washington Department of Ecology.

xiii. [The existing conditions] *section is missing citations throughout. For example, there is no citation to support the statement 'the reach of Issaquah Creek bordering the Squak Valley parcel is straight and a consistent width. The majority of the channel is a riffle/run complex, with only one piece of large wood in the channel along the left bank in the project reach.' Other sections such as 5.5 need citations regarding the source of information regarding numbers of salmon, egg take, escapement, viable populations, etc. Also, without specific genetic and tag data, the term "wild" salmon cannot be determined; therefore, it is more appropriate to identify these fish as naturally-spawning." Any statements regarding the extent or productivity of habitat should also have citations.*

We have added citations for the description of the existing conditions and substituted "naturally spawned" for "wild" with reference to salmon production in Issaquah Creek.

xiv. The actual percentage of the channel in a riffle/run complex should be quantified rather than qualitatively stating the majority of the channel is a riffle/run complex. Additionally, the bankfull width of the stream should be stated. Also, Section 5.1 of the EA indicates that riprap bank protection along the project reach is sporadic and superseded in function by mature bank vegetation. This sentence is unclear as to what "functions" the mature bank vegetation has superseded.

Section 4.1 has been revised to better characterize the existing conditions, including quantifying bankfull width and clarifying the discussion about mature vegetation superseding the functions of the observed riprap.

xv. It is not clear that the Corps has coordinated with the Muckleshoot Indian Tribe to substantiate the statement in this section regarding cultural site in the area. The Corps should coordinate with the Tribe to substantiate the conclusion that the project will have no effect on Native American cultural resource sites.

The Corps has sent letters to the Muckleshoot Indian Tribe to solicit their input on the presence of cultural resources and potential impacts of the Preferred Alternative. We did not receive written response from the Muckleshoot Tribe, but the Corps cultural and archaeological resource specialist has also been in contact with his counterpart at the Muckleshoot Indian Tribe. To date, the Tribe has not indicated any knowledge or concerns for the Preferred Alternative relating to cultural resources. In a letter dated 18 February 2004, the Washington State Historic Preservation Officer has concurred with the Corps' determination of no historic properties affected by the Preferred Alternative.

xvi. [Section 5.9] *notes that the existing levee is overtopped during a 50-year flood event; however the EA fails to discuss for what flood event the proposed berm (section 6.4) will prevent flooding of Issaquah-Hobart Road.*

The top of the berm will be elevation 134 and it will connect to existing high ground near Issaquah Hobart Road. The top elevation of the proposed berm corresponds to the 100-year flood elevation.

xvii. Section 6.2 should be expanded to discuss the water depths and velocities expected in the backwater channels. It is particularly important to know the backwater channel cross-sectional water velocities during the receding of high flows in Issaquah Creek, since this will be the time when water velocities are highest in the created habitats. Juvenile coho and Chinook are unlikely to rear during the winter in those portions of the water column where water velocities exceed 10 cm/s. Hillman et al. (1987) found overwintering Chinook (typically large than fry that would use the proposed channel) reared in water velocities of 0 to 12 cm/s. By looking at depth and velocity preferences for juvenile Chinook and coho, the Corps can estimate the area of usable habitat that will be created for these species, rather than imply that the entire backwater channel will be used.

Section 5.3 of the EA has been revised to clarify depths expected in the backwater channels during different flow events. Section 5.6.1 details fish use of the proposed backwater channels. Velocity in the backwater channels is difficult to quantitatively predict. During a 50-year flood event (2800 cfs), water velocity will vary from near slack in the backwater channels to average velocities of approximately 6 feet per second in the channel of Issaquah Creek, a range which will provide fish, including salmonids, with range of habitat conditions consistent with natural off-channel areas.

xviii. There may be some discrepancy between the section 6.2 and 6.3 regarding the potential for water to be pooling and heating. Section 6.2 indicates that water will be in the channels *year-round except during the driest conditions, while section 6.3 implies that the backwater channels will not be connected to the mainstem during summer.*

The backwater channels will be connected to the mainstem year-round except under the driest conditions. Section 5.3.2 states that exchange between the creek and the backwater channels will likely be minimal during the summer since turbulence, high flows, and groundwater flow will be minimal during the dry summer months, not because the backwater channels will be isolated from the creek at low flows.

xix.…note that Lister and Genoe's (1970) work occurred predominately in a mainstem river and may not apply to juvenile Chinook use of side channels or off channel habitats (Section 6.5.1). A difference reference should be used.

The Corps' literature review found numerous sources indicating that juvenile Chinook, shortly after emergence, appear to prefer areas where substrate particle size is small, velocity was low, and depth was shallow. Additional citations have been added. Also, note that Lister and Genoe's work occurred during flows of about 200 cfs, greater than those typical to Issaquah Creek, but still within the range of smaller rivers and larger streams in the Pacific Northwest.

xx. Section 6.5.3 should note that the potential impacts to coho are discussed via Essential Fish Habitat analysis elsewhere in the EA or BE.

Section 5.6.3 references the discussion of potential impacts to fish, including coho salmon, in Section 5.6.1 and notes that impacts on sensitive species, including Puget Sound/Strait of Georgia coho salmon, are specifically addressed in a separate BE.

xxi. [Section 7] *fails to discuss the potential for the City of Issaquah's proposed playfields at the sediment disposal site to adversely affect the portion of Issaquah Creek and wetlands flowing through there. The City's proposal is a reasonably foreseeable action which should be evaluated in this EA to assess cumulative impacts.*

The final EA includes a discussion of City of Issaquah's proposed development of the disposal site in the cumulative impacts section (Section 5.11.2).

xxii. The EA mentions the unauthorized work that occurred on the East Fork of Issaquah Creek as part of WSDOT's Sunset Way Interchange project and notes the need for compensatory mitigation. The EA fails to full discuss if WSDOT and the Corps intend to use this project to provide some of the required compensatory mitigation for impacts to the East Fork of Issaquah Creek. Any required compensatory mitigation should occur within the East Fork subbasin.

Habitat projects authorized by Section 206 of WRDA cannot be used as compensatory mitigation for development projects. Accordingly, the proposed Squak Valley project is not linked as compensatory mitigation with any development projects, including the WSDOT Sunset Way Interchange project. The Seattle District Regulatory Branch is handling analysis of the WSDOT actions associated with the Sunset Way Interchange, including review and approval of compensatory mitigation proposals.

xxiii. The last sentence of Section 9.1 appears to be in error because it refers to the Lincoln Park project, not this one.

The reference has been changed to correctly reference the Squak Valley project.

xxiv. The proposed channel configuration (Figures A-3, A-4, and A-10) suggests a simplified channel with few pieces of wood, few pools, and few undercut banks. All three of these features are important factors in determining the capacity of the proposed site for juvenile Chinook. Brusven et al. (1986) found that during the summer months, stream sections with simulated undercut banks contained 2.9 to 6.3 times the number of Chinook as sections lacking simulated undercut banks. Hillman et al. (1987) found that following onset of cold water temperatures, no juvenile spring Chinook were found in areas lacking undercut banks and vegetation extending below waterline. Peters et al. (1998) found that Chinook fry numbers were positively related to LWD surface area.

The project design incorporates woody debris, variable bank slopes, wetland benches, and pool construction to provide a variety of habitats suitable for salmonids and other fish. Woody debris will be clustered around the created pools to provide habitat for rearing coho and Chinook fry and juveniles. The wetland benches will provide detritus and invertebrate input to the channels and refuge habitat during flood events. At the edge of the wetland benches, boulders and coir logs will create steepened banks that provide complex habitat similar to undercut banks. As the wetland benches and riparian vegetation matures, the shoreline of the backwater channels will likely assume even more complexity, including undercut banks that would be found in naturally-occurring off-channel habitat. Based on its review of pertinent literature and coordination with stakeholders, including that provided by Muckleshoot Tribe staff during design and EA review, the Corps believes that the proposed channels will provide the habitat types and associations necessary to enhance salmonid rearing and refuge habitat at the project site. Also, note that Chinook in Issaquah Creek are not spring or stream-type fish, instead exhibiting an ocean-type life history with a summer/fall adult run timing (see Section 4.5.1.1). Accordingly, research by Hillman et al. (1987) on habits of juvenile spring Chinook may not be applicable to Issaquah Creek Chinook.

APPENDIX D

Sedimentation Monitoring Plan

CENWS-PM-PL-ER 2-Apr-04
Lewis/erl/x6922

MEMORANDUM FOR: CENWS-PM-PL\Pam Yorozu
SUBJECT: Squak Valley 206 – Details on Draft Sedimentation Monitoring and Contingency Plan

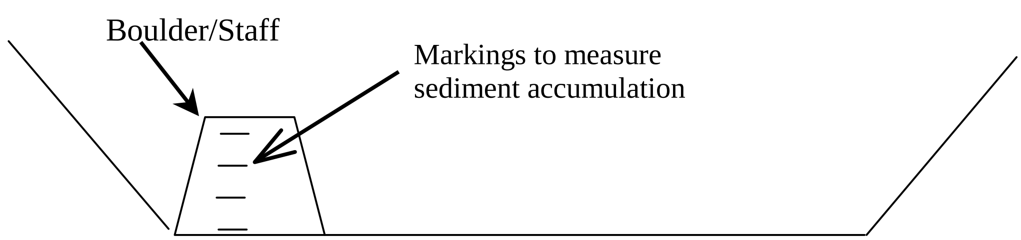
1. Reference
   A. 26-Mar-04 memo: Squak Valley Siltation Calculations and Monitoring (attached)

2. Background: Two backwater channels have been designed to provide off-channel aquatic habitat at the Squak Valley restoration site. Calculations indicate the chance for minor sediment deposition in the backwater channels over a period of 10+ years to the extent that we would have expected less than 36 cubic yards of sediment accumulation in either channel over the 14-year period from 1986-2000. If all suspended sediment were to fall out over the first third of the channels, one would expect an even accumulation of 0.137 feet (about 1.6 inches) of deposition uniformly distributed over that third of the channel. This estimate of minimal deposition provides an indication of the generally clear, low total suspended solid conditions of Issaquah Creek and indicates that sediment deposition is unlikely to adversely affect the channels or the habitat they provide.

   To address the unlikely event of higher than expected sedimentation, NOAA Fisheries has indicated that they believe an adaptive management program must be developed and implemented to ensure that any observed siltation does not adversely affect use of the backwater channels by Chinook salmon.

   The monitoring and contingency plan is not intended to ensure perpetual maintenance of as-built project condition. As with natural off-channel areas, some degree of sedimentation and erosion will likely occur as the site ages and natural processes continue to shape the riparian area. However, monitoring will detect if observed sedimentation has the potential to adversely affect Chinook salmon (such as inhibiting fish access to and egress the backwater channels, creating potential stranding areas) and contingencies will be implemented to avoid adverse impacts.

3. Monitoring Plan: To monitor sediment accumulation, the project will incorporate a staff gage in each backwater channel within 50 feet of its mouth. This staff gage could be a traditional marked gage, or could take the form of a flat-bottomed boulder with horizontal markings at specified and known intervals. Monitoring will be accomplished during the summer 1 year, 3 years, and 5 years following construction.



4. Sedimentation Standards: When flowing at summer base flow levels, Issaquah Creek is just slightly more than 2 feet deep along the Squak Valley reach. Winter base flows result in creek depths of approximately 3 feet depth. To ensure that sediment accumulation does not adversely affect fish in the Issaquah Creek ecosystem (particularly Chinook salmon), site monitoring will include observations of sediment level in relation to the staff gage.

   The following standards, as measured at any monitoring event and compared to conditions immediately after completion of construction, will determine if contingency actions may be necessary:

   - ✔ More than 12 inches of accumulated sediment is observed on a staff gage; or
   - ✔ At any point, accumulated sediment occludes more than 75% of the width of the backwater channels (as measured at ordinary high water).

5. Contingency Plan: Although available data indicate that the likelihood of adverse effects due to sediment depositions are small, if observed sediment deposition exceeds the standards described above, contingency planning will identify a solution that will be implemented. Contingencies will be part of the operations and maintenance plan that details post-construction responsibilities of the City of Issaquah (the local sponsor) and the Corps. Possible remedies include (but are not limited to):

   - ✔ Excavation of sediment to restore project conditions;
   - ✔ Modification of backwater channel inlet configuration with woody debris or boulders; or
   - ✔ Additional plantings to stabilize backwater channel sideslopes.

   As with naturally formed channels, sedimentation and erosion are expected to occur along the project reach and in the backwater channels. Accordingly, another possible contingency option would be no action if the Corps, the local sponsor, and NOAA Fisheries reach consensus that the project is not adversely affecting Chinook salmon even if the stated sedimentation standards are exceeded.

Evan Lewis
Environmental Resources Section

Distribution:
CENWS-PM-TB-HH/Reese
CENWS-EC-TB-HH/Eriksen
CENWS-EC-DB-CS/Naher
CENWS-EC-NW-ST/Parker
CENWS-EC-DB-CS/Kaiser

CENWS-EC-TB-HH 26-Mar-04
Reese/arr/x3660

MEMORANDUM FOR: CENWS-PM-PL\Pam Yorozu
SUBJECT: Squak Valley 206 – Siltation Calculations and Monitoring

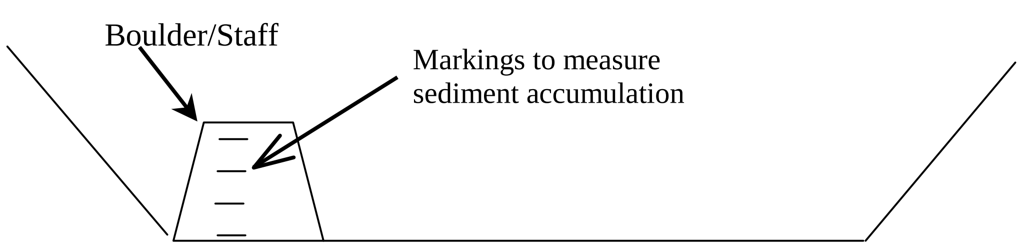
1. References
   B. Flow data
   C. Stage-Q relationship from City of Issaquah
   D. Total suspended solids (TSS) data from City of Issaquah monitoring
2. Background: Two backwater channels have been designed to provide off-channel aquatic habitat at the Squak Valley restoration site. These calculations and subsequent monitoring plan are in response to concerns regarding silt accumulation in these channels.
3. TSS data was collected by the City of Issaquah near the site on 24 occasions between May 1999 and August 2002. These data, historic flow data (1986-1999), and a stage-discharge relationship were used to estimate additional siltation from storm events into the proposed backwater channels.
4. The analysis assumes that any flow above 70 cfs may import sediments into the channels – the quantity of sediment is the mass of the sediment contained between creek stage @ 70 cfs (0.8 feet – local datum) and the stage on that given day.

Sediment vol. (cu.ft.) = [$stage_{(event)}$-$stage_{(threshold)}$](TSS_{flow})(Bankfull area)(28 L/cu.ft.)(1 lb/452592 mg)/(120 pcf)

$stage_{(event)}$: creek stage on a given day (feet)
$stage_{(threshold)}$]: creek stage at 70 cfs (feet)
TSS_{flow}: total suspended sediment (mg/L) – based on flow vs. TSS relationship
Bankfull area: the bankfull area of both backwater channels (about 40,000 sq. ft. total)
Assumptions: Density of sediment = 120 lb/cubic foot
Conversion Factors: 28 liters = 1 cubic foot
1 lb = 452,592 mg

5. Summing all incremental changes over the 14-year period of historic hydrology (1986-2000), one calculates about 68 cubic yards of total sediment accumulation the backwater channels (with about 36 cy in the southern channel and about 32 cy in the northern channel).
6. If all suspended sediment were to fall out uniformly over the first third of the channels, one would expect an accumulation of 0.137 feet (about 1.6 inches) of deposition. This is a conservative estimate since accumulation was calculated on a daily basis and some of the flow events exceeding the flow threshold of 70 cfs were multi-day events.
7. This estimate of minimal deposition provides an indication of the generally clear, low TSS conditions of Issaquah Creek. To monitor sediment deposition, 2 large flat-bottomed boulders with regular markings can be placed, 1 in each backwater channel. These boulders can then be monitored to measure sediment accumulation in the channels.

Schematic of monitoring boulder (in channel cross-section)



Amy Reese, P.E.
Hydrology and Hydraulics Section

Distribution:
CENWS-PM-PL-ER/Lewis
CENWS-EC-TB-HH/Eriksen
CENWS-EC-DB-CS/Naher
CENWS-EC-NW-ST/Parker
CENWS-EC-DB-CS/Kaiser

APPENDIX E
Required Agency Responses

1. Endangered Species Act consultation for the project has been completed. The Corps received concurrences with "may effect, not likely to adversely effect" determinations for all listed species from the U.S. Fish and Wildlife Service and NOAA Fisheries via letters dated 13 February 2004 and 7 June 2004, respectively.

2. All other environmental statutes and regulatory requirements associated with this project have been fulfilled including a cultural resources reconnaissance level survey to comply with the National Historic Preservation Act. A letter from the State Historic Preservation Officer concurred with the Corps finding of No Historic Properties Affected on 18 February 2004.