

Final Environmental Assessment

Lake Washington Ship Canal Small Lock Monolith Repair Seattle, King County, Washington

September 2011



**US Army Corps
of Engineers®**
Seattle District

Lake Washington Ship Canal Monolith Erosion Repair

Final Environmental Assessment

September 2011

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

Abstract: This Environmental Assessment (EA) evaluates the environmental effects of the proposed repair in the Lake Washington Ship Canal (LWSC) at the Hiram M. Chittenden Locks (the Locks) downstream of the spillway in the stilling basin in Seattle, King County, Washington. The LWSC was constructed between Puget Sound and Lake Washington more than 90 years ago (between 1911 and 1916) by the Corps to provide watercraft access between Lake Washington and Puget Sound. The current configuration and water surface elevation of Lake Washington and Lake Union, and the access provided by the LWSC between the lake and Puget Sound, are the backbones on which present day Seattle and the Lake Washington ecosystem exist.

The Corps operates the LWSC to provide navigation for commercial and recreational vessels between the lake and Puget Sound and to provide passage for fish migration. The LWSC consists of the Locks and associated facilities, the Fremont Cut between Salmon Bay and Lake Union, and the Montlake Cut between Lake Union and Lake Washington. This spillway, spillway apron, and structures adjacent to the spillway are at risk of sustaining damage from scour caused by approximately 100 years of operating the spillway. The problem of scour affects structures such as the small lock wall foundation and the stilling basin apron through degradation of the exit channel. Impacts of continued scour could be failure of the small lock miter gate monolith resulting in an uncontrolled release/loss of pool or major repair of the stilling basin

For the LWSC small lock monolith and channel erosion repair project, the Corps is proposing two actions. The first action is to repair the foundation of the monolith wall and the second action is to repair the scour adjacent to the monolith in the channel below the spillway. Both of these actions are necessary to restore the structural integrity of the monolith.

The proposed project will not constitute a major Federal action significantly affecting the quality of the human environment and preparation of an environmental impact statement is not required.

This document is available online at: <http://www.nws.usace.army.mil/ers/envirdocs.html>

The public comment period was June 22, 2011 through July 13, 2011. No comments were received.

Please send questions and requests for additional information to:

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1. PROPOSAL FOR FEDERAL ACTION

The Council on Environmental Quality (CEQ) regulations, 40 CFR § 1500.1(c) and 40 CFR § 1508.9(a)(1), interpreting the National Environmental Policy Act of 1969 (as amended) (NEPA), require 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 ensure such actions adequately address “environmental consequences, and take actions that protect, restore, and enhance the environment.” This Environmental Assessment (EA) evaluates the environmental effects of proposed repairs in the Lake Washington Ship Canal (LWSC) at the Hiram M. Chittenden Locks (the Locks).

The LWSC was constructed between Puget Sound and Lake Washington more than 90 years ago (between 1911 and 1916) by the Corps to provide watercraft access between Lake Washington and Puget Sound (Figure 1). Construction of the LWSC rerouted the major rivers that fed and drained Lake Washington and lowered the lake surface elevation by about 9 feet. One consequence of these changes has been the development of a highly altered ecosystem, particularly for anadromous fish such as salmon. Concurrently, the urban landscape surrounding the lake developed, and the urban structure is now dependent on the environment created by the construction of the LWSC. The current configuration and water surface elevation of Lake Washington and Lake Union, and the access provided by the LWSC between the lake and Puget Sound, are the backbones on which present day Seattle and the Lake Washington ecosystem exist.

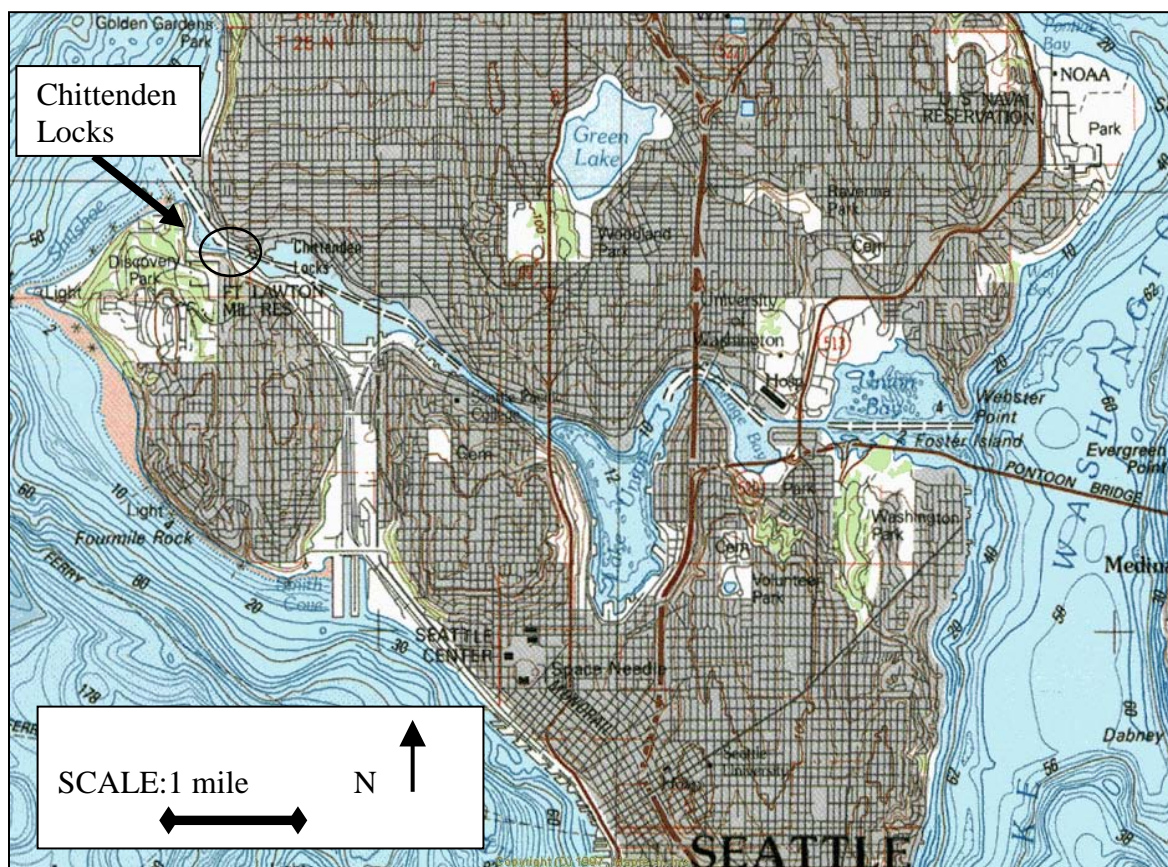


Figure 1. Project location.

The Corps operates the LWSC to provide navigation for commercial and recreational vessels between the lake and Puget Sound and to provide passage for fish migration. The LWSC consists of the Locks and associated facilities, the Fremont Cut between Salmon Bay and Lake Union, and the Montlake Cut between Lake Union and Lake Washington. Oriented northwest to southeast and located approximately 1.5 miles (2.4 km) east of Shilshole Bay, the locks and spillway span the Salmon Bay Waterway at its narrowest point, approximately 400 feet across.

This spillway, spillway apron, and structures adjacent to the spillway are at risk of sustaining damage from scour caused by approximately 100 years of operating the spillway. The problem of scour affects structures such as the small lock wall foundation and the stilling basin apron through degradation of the exit channel or stilling basin. Impacts of continued scour could be failure of the small lock miter gate monolith resulting in an uncontrolled release/loss of pool or major repair of the stilling basin.

The first major repair to address scour in the spillway occurred in 1985, when an extensive scour hole that developed under the downstream end of the apron threatened the stability of the apron. For the repair, a sheet pile wall was placed across the end of the apron and the scour hole was back filled with concrete.

In 2009, the Corps conducted a sonar survey that found an elongated scour hole on the right bank at the apron extending downstream, adjacent to the small lock river wall. A subsequent comprehensive inspection covering the small lock wall and the entire perimeter of the apron, including the sheet pile wall repair, the entire left bank from the fish ladder to the end of the sloped pavement and the area upstream of the dam indicated:

- Erosion exists under the small lock wall for approximately 120 feet downstream of the stilling basin apron. The erosion extends underneath as far as 6 feet from the river side face of the small lock wall foundation and up to 7 feet below at locations along the monolith. Erosion extends downstream under the small lock guide wall. The current bottom surface is clay with no silt.
- Scour ranging from 7 to 16 feet below the original channel elevation exists in the exit channel downstream of the apron for a distance downstream of about 250 feet (based on drawings that show the original channel bottom being level with the apron). The channel bottom on the right bank at the junction of the small lock wall foundation and the end of the apron has the largest scour hole measuring 15 feet deep, 60 feet long, and 40 feet wide (Figure 2).
- Erosion can be seen under the end of the apron sheet pile wall at the right bank nearest the small lock wall.
- A 10-foot by 10-foot area of the apron has been undermined at the downstream end of the apron on the left bank.
- Channel protection is failing on the left bank downstream of the end of the stilling basin.

- On both left and right banks just below the spillway, there are sections of the stilling basin sidewalls that have concrete apertures extending out over the apron that may result in abnormal flow patterns.

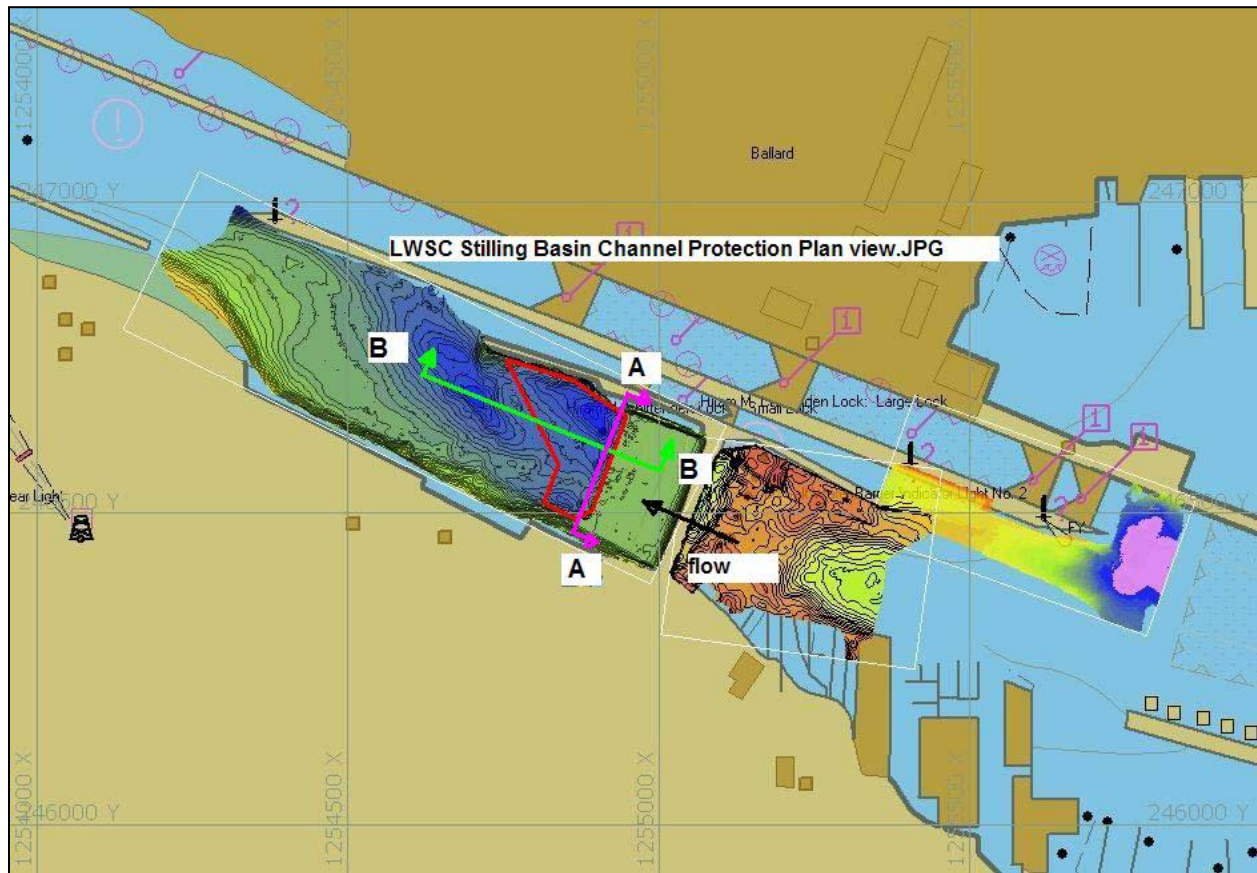


Figure 2. Location Map of LWSC Stilling Basin Repair Site.

The area inside the red lines requires channel protection to prevent erosion adjacent to the structures (monoliths, fish ladder, bulkheads) on the downstream side of the Locks. The original channel bottom elevation was the same as the apron, shown in green. The blue areas represent the deepest scour, with the darker the blue, the greater the depth and amount of scour.

For the LWSC small lock monolith and channel erosion repair project, we are proposing two actions. Figure 2 shows the location of the proposed repairs. The first action is to repair the foundation of the monolith wall and the second action is to repair the scour adjacent to the monolith in the channel below the spillway. The Corps is proposing to repair the scour underneath small lock wall (monolith) with sheet pile and concrete. To facilitate the placement of concrete under the monolith, 110 linear feet (LF) of sheet pile is required to be installed along the length of the monolith and the void between the sheet pile and monolith will be filled with approximately 100 cubic yards of concrete. The second action proposed is to prevent erosion from occurring under the new sheet pile wall repair, and to prevent additional erosion from undermining the spillway apron in the channel. To repair the scour in the channel below the spillway apron, the Corps is proposing to place riprap in the scoured areas. The Corps will place the minimum amount of riprap required to restore this area of the channel to the depth and stability that existed when the project was constructed. Approximately 1,406 cubic yards of quarry spalls, 2,830 cubic yards of class IV riprap, and 1,665 cubic yards of class II riprap will

be required to make the repairs (Figure 3). Approximately 27,000 square feet of channel bottom will be converted from clay to rock (riprap). All repairs will be conducted downstream of the Locks in Salmon Bay of the Puget Sound. The Corps would complete the work within the approved in-water construction window which combines life history patterns of bull trout and outmigrating juvenile and adult returning salmonids (October 15- February 15). Construction is expected to commence on December 1, 2011.

1.1 Location of Proposed Action

The project is located 3015 NW 54th St., Seattle, King County, Washington, at Range 3 East, Township 25 North, Section 11. The project area encompasses the width of the channel downstream of the dam for approximately 200 feet and will potentially include the shoulder of West Commodore Way and the access path from West Commodore Way to the fish ladder.

The LWSC includes the locks and all its components, the saltwater drain, the fish ladder, the smolt passage flumes, the spillway, the Fremont and Montlake Cuts, and associated structures. Water and land areas immediately adjacent to these areas that are regulated by the Corps are also considered to be part of the project. Land use in the vicinity of the LWSC is highly urbanized.

1.2 Authority

The proposed project represents operations and maintenance of the LWSC authorized by the Rivers and Harbor Acts of June 25, 1910, “Puget Sound-Lake Washington Waterway” (House Document No. 953, 60th Congress, 1st session).

The Lake Washington Ship Canal Project is operated to provide optimum conditions for navigation between Puget Sound and the freshwater lakes and bays surrounding Seattle. The authorized depth of the LWSC is 30 feet. The dam controls the outflow of fresh water from Lakes Union and Washington and maintains the upstream water level on a tightly controlled rule curve between elevation 20.0 feet and elevation 22.00feet (Corps of Engineers datum).

The project also provides regulation of lake levels and passage for anadromous fish including species listed as threatened or endangered under the Endangered Species Act (ESA) of 1973. The facilities currently allow thousands of vessels to navigate between Lake Washington and the Puget Sound annually. Hundreds of thousands of tourists visit the Locks annually as well.

1.3 Project Purpose and Need

The purpose of this project is to repair the erosion so that the small lock monolith will meet the Corps stability requirements (EM 1110-2-2100 Stability Analysis of Concrete Structures). The current condition of scour will cause a global stability failure of the small lock miter gate monolith in the event of a large earthquake resulting in an uncontrolled release/loss of pool if the upstream miter gates are not closed at the time of failure. The continued scour and erosion of foundation material will eventually lead to failure of the monolith and loss of operation of the small lock even without a seismic event, if repairs are not conducted.

2. ALTERNATIVE ACTIONS

2.1 Alternative 1 – Sheet Pile Installation to Facilitate Concrete Pouring and Restoring the Entire Area Downstream of the Spillway to the Pre-Scoured Condition.

Under Alternative 1, the Corps would restore the bathymetry of the entire spillway tailrace area to the state prior to when the scour occurred. This alternative would require the placement of approximately 18,000 cubic yards of riprap and quarry spalls and would cover approximately 81,000 square feet of the channel bottom with riprap and quarry spalls.

Alternative 1 would require the installation of 110 LF of sheet pile along the small lock miter gate monolith and guide wall and pumping approximately 100 cubic yards of concrete to stabilize the structure. The purpose of installing the sheet pile is to facilitate filling the void underneath the concrete structures with approximately 100 cubic yards of concrete. Construction materials such as rock and sheet pile will be imported to the site by barge to reduce affects to local vehicular traffic and visitors to the Locks. The Corps anticipates that concrete will also be imported to the site with barges but it may be delivered by truck. If concrete is brought in by truck, the concrete trucks could park on Commodore Way and the concrete pipeline would run down the walkway to the monolith, or it could be delivered through the project and pumped from the administration building across the large lock to the small lock monolith. All repairs will be conducted downstream of the Locks in Salmon Bay of the Puget Sound. The Corps would complete the work within the approved in-water construction window which combines life history patterns of bull trout, outmigrating juvenile, and adult returning salmonids (October 15-February 15). Construction is expected to commence on December 1, 2011. The duration of this alternative would be roughly four months.

The estimated cost of Alternative 1 is approximately \$4.4 million.

2.2 Alternative 2 – No Action

The No Action Alternative provides a basis for comparison of the effects of future conditions with and without taking the proposed Federal action. Under the no action alternative, the Corps would not take any actions to repair the scour adjacent to the small lock monolith or spillway channel. The Corps would not place riprap, install sheet pile, or address the continuing erosion of the spillway tailrace. The likely result is that the small lock monolith will become unstable and eventually resulting in the small lock being unusable. One of the primary authorizations for the LWSC project is navigation. On an annual basis, the LWSC Canal locks through the more vessels than any other Corps facility. Although the large lock may still be available, studies have indicated that closure of small lock would still adversely affect navigation by reducing the number of locks available.

Additionally the current condition of scour could cause a global stability failure of the small lock miter gate monolith in the event of a large earthquake, resulting in an uncontrolled release/loss of pool if the upstream miter gates are not closed at the time of failure. If an uncontrolled release of pool occurred this would result in significant impacts to the region. One of the primary impacts would be loss of navigation. The loss of pool would also have significant secondary impacts beyond those at the facility. For example, both the Highway 520 and Interstate 90 floating highway bridges that cross Lake Washington rely on having the water levels remain in a narrow window of operation. The Locks control the Lake Washington pool level. In addition, both the canal area and Lake Washington have a large amount of infrastructure (marinas, docks,

businesses) that relies on these tight operating ranges. An additional impact is public access. The LWSC is one of the most visited tourist attractions within the Seattle area with approximately 1 million visitors a year. In addition, many Seattle residents use the project as a transportation route to and from work or other activities. Bikers, runners, and walkers are allowed to cross the facility by using a pedestrian bridge just below the spillway gates, move onto the lock walls and then cross the lock by moving across the top of the miter gates.

2.3 Alternative 3 – Sheet Pile Installation to Facilitate Concrete Pouring and Restoring the Minimum Area Downstream of the Spillway to the Pre-Scoured Condition (Preferred Alternative)

The Corps is proposing to place rock only along the existing structures rather than filling in all of the areas of scour downstream of the spillway apron and monolith. The Corps has determined that the placement of 110 LF of sheet pile along the small lock miter gate monolith and guide wall will be required. The purpose of installing the sheet pile is to facilitate filling the void underneath the concrete structures with approximately 100 cubic yards of concrete.

Approximately 1,406 cubic yards of quarry spalls, 2,830 cubic yards of class IV riprap, and 1,665 cubic yards of class II riprap will be required to make the repairs. Approximately 27,000 square feet of channel bottom will be converted from clay to rock (riprap). This alternative requires approximately one-third times as much fill (riprap and quarry spalls) and surface area to be covered as Alternative 1. The repair is intended to restore the stability of the project to the pre-scour condition without filling all the scoured areas in the project area.

The duration of project would be roughly two months. Sheet pile installation and rock placement methods would be the same as for Alternative 1. Environmental effects of this alternative would be less than Alternative 1. Environmental effect are less than Alternative 1 due to the project requiring a shorter construction duration due to reducing the total quantity of riprap and other rock to be placed, which reduces disturbance to fish and wildlife, and transforms less channel bottom substrate from clay to riprap. The cost of Alternative 3 is estimated to be approximately \$1.5 million. Figure 3 provides drawing details of the preferred alternative.

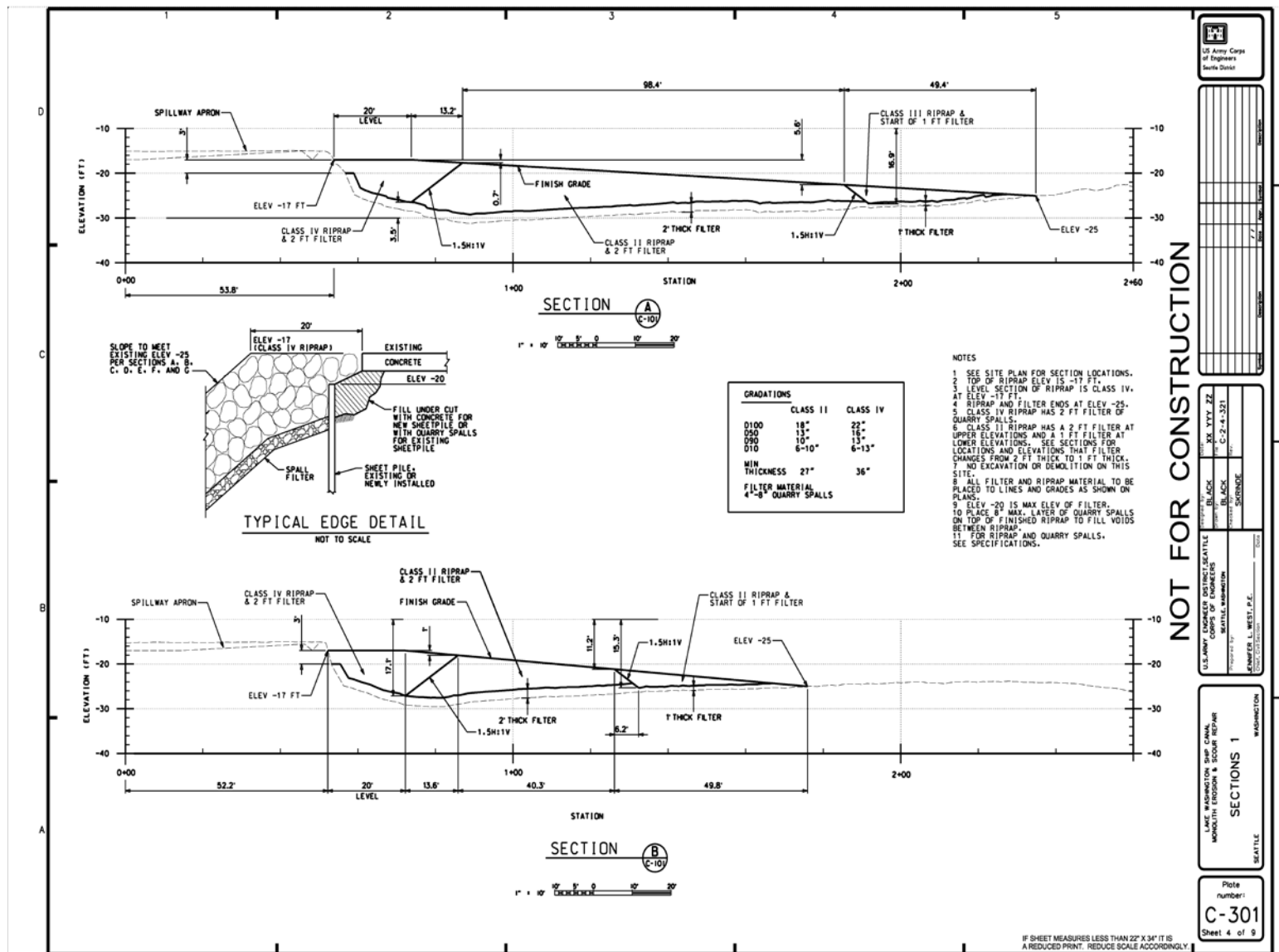


Figure 3. Cross Section showing channel scour and proposed rock placement in one section.

3. ISSUES FOR COMPARISON OF THE ALTERNATIVES

This section provides information on issues relevant to the decision process for evaluating the three alternatives. This analysis investigates the potential for activities associated with the considered alternatives to affect (either adversely or beneficially) the various issues of concern, and provides a comparative assessment of each alternative's effects to the environment. Factors for selecting the recommended plan include finding the plan that is the most cost effective and the least environmentally damaging.

3.1 Shoreline Condition, Bathymetry and Substrate

The shorelines of the bay in the project area are highly modified. The right bank consists of the vertical concrete monolith, which is being undermined by scour with a water depth of approximately 30 feet at high tide and 20 feet at low tide. The left bank is class III riprap on approximately a 2V:1H slope.

An approximately 120-foot length of the small lock monolith downstream of the stilling basin apron has been undermined from erosion. The erosion extends underneath as far as 6 feet from the river side face of the small lock wall foundation and up to 7 feet below the concrete foundation at locations along the monolith. Erosion continues downstream under the small lock guide wall. The entire spillway tailrace area was surveyed by divers to determine the scope of the scour, and to survey the existing substrate and marine resource conditions

Immediately below the spillway, a concrete apron was constructed in 1985 to reduce scour and maintain structural stability of the spillway. The apron is minus 15 feet at MLLW. The concrete apron extends from the spillway for approximately 70 feet downstream.

The channel bottom in the area downstream of the spillway and spillway apron has experienced significant scour since the installation of the apron in 1985. The operation of the spillway has resulted in vertical scour ranging from 7 to 16 feet below the original channel elevation and the channel is scoured for a distance of about 250 feet downstream of the apron. The extent of the scour is estimated based on drawings from the apron installation that show the original channel bottom being level with the apron. The channel bottom on the right bank at the junction of the small lock wall foundation and the end of apron has the largest scour hole measuring 15 feet deep, 60 feet long, and 40 feet wide.

Substrate downstream of the spillway and spillway apron is primarily hard impervious Lawton clay with a few areas of sporadically located riprap and occasional piece of concrete. The small amount of riprap located in the proposed project area is presumed to have originated from the left bank of the project area. Due to the large volume of high velocity flow during spill events, the project area does not have gravels, sand, silt, or vegetation.

To restore structural stability requirements of the monolith the void underneath the foundation will require fill.

3.1.1 Alternative 1 – Sheet Pile Installation to Facilitate Concrete Pouring and Restoring the Entire Area Downstream of the Spillway to the Pre-Scoured Condition.

Under Alternative 1, the Corps would restore the bathymetry of the entire spillway tailrace area to the state prior to when the scour occurred. This alternative would require the placement of approximately 18,000 cubic yards of riprap and quarry spalls and would cover approximately 81,000 square feet of the channel bottom with riprap and quarry spalls. This alternative requires approximately 3 times as much fill (riprap and quarry spalls) and 3 times as much surface area to be covered as the Alternative 3.

Alternative 1 would require the installation of 110 LF of sheet pile along the small lock miter gate monolith and guide wall and pumping approximately 100 cubic yards of concrete to stabilize the structure. The purpose of installing the sheet pile is to facilitate filling the void underneath the concrete structures with approximately 100 cubic yards of concrete.

3.1.2 Alternative 2 – No-Action Alternative

For the No-Action alternative, the Corps would not place riprap and quarry spalls to protect the sheet pile and concrete. Without placement of material in the scoured channel, the effect to the bathymetry and substrate of the project area is that the scour would likely continue and likely resulting in the loss of the ability to operate the small lock for navigation. This alternative does not meet the need for the project.

3.1.3 Alternative 3 – Sheet Pile Installation to Facilitate Concrete Pouring and Restoring the Minimum Area Downstream of the Spillway to the Pre-Scoured Condition

Under this alternative, the Corps would place rock only along the existing structures rather than filling in all of the areas of scour downstream of the spillway apron and monolith.

Approximately 1,406 cubic yards of quarry spalls, 2,830 cubic yards of class IV riprap, and 1,665 cubic yards of class II riprap will be placed in the tailrace. This repair is intended to restore the stability of the project to the pre-scour condition without filling all the scoured areas in the project area.

3.2 Benthic and Epibenthic Invertebrates

The composition and function of invertebrate communities are important in structuring the food web. These communities are strongly influenced by a number of factors including salinity gradients, tidal changes, substrate type, and the presence of primary producers. Invertebrates known to occur in Salmon Bay include the acorn barnacle (*Balanus glandula*), buckshot barnacle (*Cthamalus dalli*), thatched barnacle (*Semibalanus cariosus*), aggregating anemone (*Anthopleura elegantissima*), plumose anemone (*Metridium senile*), large eelgrass isopod (*Idotea rescata*), ochre sea star (*Pisaster ochraceus*), blood star (*Henricia leviuscula*), keyhole limpet (*Diodora aspera*), Sitka periwinkle (*Littorina sitkana*), checkered periwinkle (*L. scutulata*), turban snail (*Calliostoma costatum*), turret snail (*Batillaria zonalis*), the polychaete (*Capitella capitata*), mussels (*Mytilus* spp.), soft-shell clam (*Mya arenaria*), bent-nosed clam (*Macoma nasuta*), Baltic macoma clam (*Macoma balthica*), horse/gaper clams (*Tresus capax*), bivalves (*Transennella tantilla*, *Tellina* spp.), Pacific littleneck clam (*Protothaca staminea*), and the heart cockle (*Clinocardium nuttalli*), Dungeness crab (*Cancer magister*), red rock crab (*C. productus*), yellow shore crab (*Hemigrapsus oregonensis*), purple shore crab (*H. nudus*), helmet crab (*Telmessus cheiragonus*), shielded-back kelp crab (*Pugettia producta*), porcelain crab (*Petrolisthes eriomerus*), coonstripe shrimp (*Pandalus danae*), spot prawns (*P. platyceros*), ghost shrimp (*Upogebia pugettensis*), and skeleton shrimp (*Caprella californica*) (Cooney 1971, Jeffrey 1976, Simenstad *et al.* 1988, Shaw 1994). Many of these are sessile on rock and

concrete, and some are found inside the locks and filling tunnels. Such species include sea stars, barnacles and tube worms.

3.2.1 Alternative 1 – Sheet Pile Installation to Facilitate Concrete Pouring and Restoring the Entire Area Downstream of the Spillway to the Pre-Scoured Condition

It is expected that populations of the benthic community, specifically marine invertebrates that may be present in the area where riprap and quarry spalls will be placed will change dramatically. The existing area is hard clay and it will be transformed to a rocky substrate likely eliminating benthic invertebrates that inhabit clay habitat and benthos that inhabit rock habitat will colonize the area. This alternative would result in the placement of approximately 18,000 cubic yards of riprap and quarry spalls and would cover approximately 81,000 square feet of the channel bottom with riprap and quarry spalls.

3.2.2 Alternative 2 – No-Action Alternative

The No-Action alternative would not alter the benthic community.

3.2.3 Alternative 3 – Sheet Pile Installation to Facilitate Concrete Pouring and Restoring the Minimum Area Downstream of the Spillway to the Pre-Scoured Condition

It is expected that populations of the benthic community, specifically marine invertebrates that may be present in the area where riprap and quarry spalls will be placed will change dramatically. The existing area is hard clay and will be transformed to a rocky substrate likely eliminating benthic invertebrates that inhabit clay habitat and benthos that inhabit rock habitat will colonize the area. Although the riprap will change the benthic community in the area that is proposed to have riprap placed, this area (27,000 square feet) is an insignificant portion of Salmon Bay. Overall, it will likely increase the diversity of benthos in Salmon Bay.

3.3 Fish and Wildlife

The Lake Washington Basin contains more than 50 freshwater, marine, and anadromous fish species. More than 20 of these species are considered non-native and have been introduced into the system by agencies and private individuals over the last 140 years. Because the LWSC and the Locks connect the freshwater Lake Washington system with Puget Sound, a highly modified estuarine system has resulted. Several species of marine organisms exist in the lower portion of the Ship Canal up to and including the Locks. Six anadromous salmonid species pass through the Locks and Ship Canal: Chinook salmon, coho salmon, sockeye salmon, coastal cutthroat, steelhead, and bull trout. Marine fish inhabiting the area include starry flounder, shiner surfperch, striped surfperch, and Pacific herring.

Puget Sound supports a variety of marine mammals, including cetaceans (e.g., orcas, gray whales) and pinnipeds (e.g., California sea lions, harbor seals). California sea lions and harbor seals are periodically observed in the project area to feed on salmon and steelhead. Steller sea lions are only rarely sighted.

The LWSC supports a diverse and abundant array of wildlife species. The undisturbed vegetation of Discovery Park (within a quarter mile of the Locks) and other adjacent parks and hills provides patches of habitat for small mammals (shrews, moles, squirrels, and raccoons), songbirds (varied thrush, rufous-sided towhee, pileated woodpecker, and Wilson's warbler), and raptors (bald eagle, red-tailed hawk, and merlin). The proximity of these habitats to water

ensures the availability of habitat for waterfowl and other terrestrial species that are also associated with waterways (bald eagle, cormorant, osprey, and great blue heron). The interface between saltwater and freshwater creates an area where an array of species may gather. Bird species are the most abundant and easily observed throughout the LWSC. Ken Brunner (Wildlife Biologist, U.S. Army Corps of Engineers) has identified more than 100 bird species within the vicinity of the Locks.

Some marine and estuarine species migrate through the locks or live in the transition zone immediately below the locks. For example, starry flounder occur in the lower Ship Canal while shiner surfperch are found above the locks through much of the summer, and herring/smelt move above and below the locks during lockages.

3.3.1 Alternative 1 – Sheet Pile Installation to Facilitate Concrete Pouring and Restoring the Entire Area Downstream of the Spillway to the Pre-Scoured Condition

Mobile fish and wildlife species would be able to avoid the areas of rock placement and pile driving within the Salmon Bay. The LWSC is in a highly industrial area characterized by high levels of activity. Traffic, both surface vehicles and marine vessels, as well as activities associated with warehousing, berthing of vessels, loading and unloading of material, and manufacturing, are all prevalent in the LWSC area. On average, the LWSC passes 45,000 vessels each year and up to 1.3 million tourists visit the site annually. As a result, the ambient activity in both the terrestrial and marine environments is high. Due to the industrial conditions in the LWSC, fish and wildlife are assumed to be accustomed to the presence of large, noisy boat traffic. The presence of the pile driver and crane barge or excavator would be a small increment of noise and activity beyond the usual activity in the area and would endure for roughly four months.

The repair project occurs in habitats that are not suited for forage fish and no forage fish spawning habitat is known to be present in the project area. If any fish species are in the vicinity, they are expected to avoid the project site, resulting in a temporary displacement of fish from the area. Fish mortality due to the proposed action is therefore not expected. After the conclusion of the project, these species should return immediately. The area that will be transformed from clay to rock is not expected to have significant effects to fish as the area is regularly subject to large volumes of high velocity fresh water spill events and is not suitable habitat for fish. Based on a thorough review of National Marine Fisheries Service fish passage guidelines, and discussions with fish passage experts, the repairs to the channel scour will return the bathymetry of some areas to the state prior to when the scour occurred, and would not adversely affect fish passage.

The Corps will conduct stilling basin repair operations based on the fish window (October 15-February 15), which times work to avoid periods of high abundance of salmonids per life history patterns of bull trout and outmigrating juvenile salmonids. Construction is expected to commence on December 1, 2011.

3.3.2 Alternative 2 – No-Action Alternative

The No-Action alternative would not result in adverse effect to fish and wildlife.

3.3.3 Alternative 3 – Sheet Pile Installation to Facilitate Concrete Pouring and Restoring the Minimum Area Downstream of the Spillway to the Pre-Scoured Condition

The environmental effects of pile driving and rock placement for Alternative 3 would be nearly identical to the effects of Alternative 1. One notable difference is that a smaller area will be transformed from clay bottom to rock bottom with Alternative 3. The duration of noise disturbance for fish and wildlife would be shorter than Alternative 1 at approximately two months for Alternative 3 versus approximately four months for Alternative 1.

3.4 Threatened and Endangered Species

Eleven species protected by the ESA, as amended, may occur near Salmon Bay. In accordance with Section 7(a)(2) of the Act, federally funded, constructed, permitted, or licensed projects must take into consideration effects to federally listed, proposed, and candidate species. Table 1 is a list of ESA-listed species that may occur in the project vicinity.

Table 1. Protected Species Potentially Occurring in the Project Vicinity

Species	Listing Status	Critical Habitat
Puget Sound Chinook Salmon	Threatened	Designated
Coastal/Puget Sound Bull Trout	Threatened	Designated
Southern Resident Killer Whale	Endangered	Designated
Puget Sound Steelhead	Threatened	N/A
Marbled Murrelet	Threatened	Designated
Steller Sea Lion	Threatened	Designated
Yelloweye Rockfish	Threatened	N/A
Canary Rockfish	Threatened	N/A
Bocaccio	Endangered	N/A

3.4.1 Alternative 1 – Sheet Pile Installation to Facilitate Concrete Pouring and Restoring the Entire Area Downstream of the Spillway to the Pre-Scoured Condition

To satisfy the requirements of the ESA, the Corps has initiated consultation with the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) regarding the effects of the proposed action on listed species. The Corps has prepared a biological evaluation (BE) to determine the effects of the project and to propose conservation measures for species affected by the proposed action; the document was submitted to the Services in June 2011. Although a preferred alternative had not been selected at the time of submitting the consultation document, the Corps described the effects of Alternative 1 as this is the alternative with the largest quantity and longest duration of rock placement. Effects to listed species include noise disturbance, displacement due to their avoidance of the pile driver, and barges, and irritation due to turbidity. Table 2 shows the Corps' effect determinations as described in the BE. No construction would occur until consultation with the Services is complete. The document describes the Corps' analysis and determination that the proposed project is **not likely to adversely affect** the Puget Sound Chinook salmon (*Oncorhynchus tshawytscha*), Chinook salmon critical habitat, steelhead (*Oncorhynchus mykiss*), Coastal/Puget Sound bull trout (*Salvelinus confluentus*) bull trout critical habitat, and marbled murrelet (*Brachyramphus marmoratus*). The project will have **no effect** on Bocaccio (*Sebastes paucispinis*), Canary Rockfish (*Sebastes Pinniger*), Yelloweye Rockfish (*Sebastes ruberrimus*), Killer whales

(*Orcinus orca*), Killer whale critical habitat, and Steller Sea Lion (*Eumetopias jubatus*). . Table 2 provides a list of the effect determinations as well as Critical Habitat determinations.

Table 2. Summary of Effects Determinations for Alternatives 1 and 3

Species	Listing Status	Effect on species	Effect on Critical Habitat
Puget Sound Chinook Salmon	Threatened	Not likely to adversely affect	Not likely to adversely affect
Coastal/Puget Sound Bull Trout	Threatened	Not likely to adversely affect	Not likely to adversely affect
Southern Resident Killer Whale	Endangered	Not likely to adversely affect	No effect not in project area
Puget Sound steelhead	Threatened	Not likely to adversely affect	N/A
Marbled Murrelet	Threatened	Not likely to adversely affect	No effect not in project area
Steller Sea Lion	Threatened	Not likely to adversely affect	No effect not in project area
Yelloweye Rockfish	Threatened	No effect	N/A
Canary Rockfish	Threatened	No effect	N/A
Bocaccio	Endangered	No effect	N/A

Potential negative effects to protected species discussed in the BE include those associated with turbidity. The salmonid life history stages requiring the lowest suspended sediment concentration—spawning, incubation, and fry rearing—do not occur in project action area. No in-water work will occur between February 16 and October 31. This closure period corresponds to the portion of the year when Chinook and bull trout are most likely to be present in nearshore marine waters. Finally, any disruptions to benthic production resulting from any construction-related sediment discharges will be temporary and highly localized, therefore having no significant impacts on prey populations. Thus, the potential for any harm to listed fish species attributable to increased turbidity or contaminant resuspension will be low.

The generation of additional noise from the operation of heavy equipment, especially pile drivers, may also have a negative effect on any marbled murrelet and salmonids in the project area. However, short-term impacts of any sound disturbance related to construction activities are more likely to result in displacement of animals rather than injury. An acoustic harassment system has been in use in the project area for over 10 years to reduce salmon predation by sea lions. The NMFS installed this system originally in an attempt to save the dwindling Lake Washington steelhead run and continues to operate it to protect all salmon including ESA listed Chinook. The acoustic deterrent system generates 195 decibel acoustic noise 24 hours a day, 365 days a year. The vibratory pile driving is expected to produce acoustic noise ranging from approximately 165 dB to 185 dB. These numbers are based on the Compendium of Pile Driving Sound Data produced for the California Department of Transportation. The Corps does not

anticipate that the temporary lower level noise from the sheet pile installation will cause any response from killer whales or Stellar sea lions. Further, it is very likely the project will not increase noise levels in Shilshole Bay, which is the closest that killer whales are likely to approach the project area. The timing of the proposed project avoids the presence of adult returning salmon, which also avoids the presence of sea lions and harbor seals. Due to the fact that very little, if any, prey is available, the Corps determines that this is yet another factor that indicates that killer whales are unlikely to be present in the action area. Adverse effects to killer whales and Stellar sea lions are not anticipated due to the highly localized and temporary nature of the stilling basin scour repair project

3.4.2 Alternative 2 – No-Action Alternative

The No-Action alternative would have no short term effect on any threatened or endangered species. If no repairs are made, a potential effect is that the small locks will be closed, and under another potential scenario the small lock monolith will fail resulting in a loss of pool. In the later scenario, the fish ladder would become inoperable and fish passage would be adversely affected.

3.4.3 Alternative 3 – Sheet Pile Installation to Facilitate Concrete Pouring and Restoring the Minimum Area Downstream of the Spillway to the Pre-Scoured Condition

The environmental effects of Alternative 3 to ESA-listed species would be identical to effects of Alternative 1, although the duration of noise effects and potential turbidity effects to all listed species would be greatly reduced due to the reduced time required to place the smaller quantity of material.

3.5 Essential Fish Habitat

Public Law 104-267, the Sustainable Fisheries Act of 1996, amended the Magnuson-Stevens Act, which regulates fishing in U.S. waters, to establish new requirements for “Essential Fish Habitat” (EFH) descriptions in federal Fishery Management Plans (FMPs) and to require federal agencies to consult with NMFS on activities that would adversely affect EFH (PSMFC 2000). The Pacific Fishery Management Council amended the Pacific Groundfish Fishery Management Plan (PFMC 1998a), the Coastal Pelagic Species Management Plan (PFMC 1998b), and the Pacific Coast Salmon Plan (PFMC 2000) to designate waters and substrate necessary for spawning, breeding, feeding, and growth of commercially important fish species.

The marine waters of the greater Puget Sound are designated EFH for many groundfish and coastal pelagic species, and three salmon species (PSMFC 2000). The marine extent of EFH includes those waters from the nearshore and tidal submerged environments within Washington, Oregon, and California state territorial waters out to the exclusive economic zone (370.4 km) offshore between the Canadian border to the north and the Mexican border to the south. Freshwater EFH for salmon is not discussed in this document as it is not relevant to the project.

NMFS identified 83 groundfish species in the FMP (NOAA 2000) for assessment of EFH. The seven composite EFHs for groundfish include estuarine, rocky shelf, non-rocky shelf, canyon, continental shelf/basin, neritic, and oceanic habitats. The proposed project occurs exclusively over clay, bottoms in the stilling basin and at the base of the small lock monolith and therefore potential impacts would fall under the estuarine composite EFH.

Sheet pile installation and armor rock placement in the breakwater stilling basin may be a site of colonization for tolerant hard bottom species, and common invertebrate communities. These

communities are known to support a variety of organisms including a number of green and red algae species, mussels (*Mytilus* spp.), copepods, and amphipod which attract groundfish. Although monolith and stilling basin repair activities may temporarily displace groundfish that may inhabit the bottom in the immediate construction area groundfish are expected to recolonize the area quickly or move downstream 50-100 feet where clay bottom substrate is still available.

NMFS identified five coastal pelagic species (CPS) in the FMP (NOAA 2000) for assessment of EFH. EFH for coastal pelagic species is based upon a thermal range bordered within the geographic area of species occurrence at any life stage, or in areas where colonization is not precluded by environmental conditions. The specific description and identification of EFH for CPS accommodates the fact that the range of all CPS species varies widely over time in response to the temperature of the upper mixed layer of the ocean, particularly in the northern latitudes (PFMC 1998b). Adult CPS are generally not found at temperatures colder than 10°C or warmer than 26 °C and preferred temperatures and minimum spawning temperatures are typically above 13 °C. Spawning is most common in the 14 °C to 16 °C range. Habitat boundaries vary seasonally and yearly (e.g. El Niño/La Niña years). The proposed monolith repair will have no effect on water temperatures.

3.5.1 Alternative 1 – Sheet Pile Installation to Facilitate Concrete Pouring and Restoring the Entire Area Downstream of the Spillway to the Pre-Scoured Condition,

In considering salmon EFH, monolith and scour repair activities will have minimal impact to any eelgrass, and would not affect the shoreline vascular plants. The monolith repair project is not expected to affect substrate composition in any way that could cause any adverse impacts to EFH in the Action Area. Additionally, the current fish work window, which combines life history patterns of bull trout and outmigrating juvenile salmonids, is October 15 to February 15 (or as otherwise defined by USFWS or NMFS). The Corps plans to start the repair operations on November 1, 2011 or the following November. The likelihood of a juvenile salmonid occurring in the Action Area during monolith repair activities is low, so that any increases in turbidity will have similarly negligible effects. Any adult salmonid that did occur in the Action Area during repair activities would be able to avoid any areas of increased turbidity and other water quality changes. Similarly, any impacts to EFH for other pelagic species would be temporary and localized.

The proposed project will have very little, if any, effect on EFH in the Action Area. Monolith repair activities may degrade water quality on a very localized and temporary scale. Once sediment has re-settled from the repair project, substrate conditions are not likely to be measurably different from pre-project conditions. Any suspended sediment concentrations will be quickly diluted as a result of the strong flushing of Salmon Bay. Any reductions in DO levels due to monolith and scour repair activities are expected to be localized and temporary. Although monolith repair may result in localized, short-term water quality degradation, particularly with respect to dissolved oxygen and turbidity, it should not affect other water quality parameters that could cause any adverse impacts to EFH in the Action Area. Monolith repair activities within the Salmon Bay Action Area could have minimal, short-term, localized impact to EFH for salmonids, groundfish and other finfish. However, there would be no long-term adverse impacts to EFH as a result of repair activities.

3.5.2 Alternative 2 – No-Action Alternative

The No-Action alternative would have no effect on EFH.

3.5.3 Alternative 3 – Sheet Pile Installation to Facilitate Concrete Pouring and Restoring the Minimum Area Downstream of the Spillway to the Pre-Scoured Condition

Consequences to EFH for Alternative 3 would be the same as for Alternative 1, but with a period of only two months rather than approximately four months of rock placement and less substrate will be transformed from clay to rock.

3.6 Historic and Cultural Resources

The LWSC is significant to Seattle, the State of Washington and the nation as a major engineering achievement completed under government auspices which added more than 90 miles to the city's waterfront accessible to ocean-going vessels. Following decades of visionary planning and failed attempts, the project realized by the Corps in 1917 connected Puget Sound with a series of inland bodies free from tidal fluctuations and destructive marine life. The resulting freshwater harbor extending over some 25,000 acres combines with Seattle's saltwater harbor in Elliott Bay to provide navigational facilities rated among the finest of any port in the country.

The LWSC was designated to the National Register of Historic Places in 1978. Its primary components are a fixed dam and double locks and a 17-acre reservation at Salmon Bay in the Ballard District; a channel slightly more than a mile long known as the Fremont Cut, which connects the Salmon Bay Waterway to Lake Union; and a half-mile long channel known as the Montlake Cut, which in turn joins Lake Union to Lake Washington. At the Locks approximately half of the structures supporting the operation of the locks have been added since the 1940's. However, the initial complex of ten or twelve concrete accessory buildings is intact.

3.5.1 Alternative 1 – Sheet Pile Installation to Facilitate Concrete Pouring and Restoring the Entire Area Downstream of the Spillway to the Pre-Scoured Condition

Since all work will take place underwater, this alternative will not materially change the visual historic appearance of the subject property and poses no potential to affect the National Register qualities of the district.

3.5.2 Alternative 2 – No-Action Alternative

The No-Action alternative would have no effect on any cultural resources.

3.5.3 Alternative 3 – Sheet Pile Installation to Facilitate Concrete Pouring and Restoring the Minimum Area Downstream of the Spillway to the Pre-Scoured Condition

The proposed repair of placing the minimum quantity of rock needed to restore the structural stability alternative would have no potential to adversely affect cultural resources.

3.6 Water Quality

Water flows westward through the LWSC from the Montlake Cut to Lake Union through the Fremont Cut to Salmon Bay. Although Salmon Bay was historically a marine environment, it was converted to freshwater by the addition of water from Lake Union which enters Salmon Bay through the Fremont Cut. Lake Union controls water quality in the Fremont Cut. The water quality from the Fremont Cut to the Locks is a pseudo-estuarine area with salinity levels changing depending on project operations. Lake Union is shallow (no more than about 50 feet deep) and contains a seasonally fluctuating saltwater layer at the bottom. This saltwater layer intrudes into Lake Union from operation of the Chittenden Locks several miles downstream.

The saltwater layer becomes larger, and intrudes further into the system during summer when inflow decreases and boat use through the Locks increases. According to the Washington state surface water quality standards (173-210A-130(58)WAC), salinity in the Ship Canal shall not exceed one part per thousand at any point or depth along a line that transects the Ship Canal at the University Bridge which is always adhered to except during the driest of years.

During high flow periods, Lake Union completely flushes once per week causing the saltwater layer to disappear from the lake from November through April (Hansen et al., 1994). During low flow periods, flushing can be incomplete when flows are short-circuited directly from the north part of the Montlake Cut to the Ship Canal. This short-circuiting of flows, along with the saltwater layer in the lake, seems to have caused stratification in Lake Union to be stronger and longer in duration than a thermally-stratified lake.

The overall effect of the strong stratification is that available salmonid habitat is greatly reduced by high temperatures and low dissolved oxygen. During summer, the dense saltwater layer and bacterial decomposition of highly organic sediments causes the bottom of Lake Union to become anoxic. In addition, the stratified epilimnion of the lake becomes very warm. It has been suggested that warm surface water temperatures in Lake Union are increasing in duration over time; over 25 years, the number of days when surface water temperatures have exceeded 20 degrees Celsius has increased from 40 days to over 80 days (Doug Houck, King County, pers. comm.). The stratified waters of Lake Union serve as a large reservoir of warm water, which feeds directly into the Fremont Cut and drives the water quality of the Fremont Cut. The combined water from the Fremont Cut and the operations at the Locks varies the water quality immediately upstream of the Locks.

When the LWSC is not spilling water, the DO levels are the same or similar to central and northern Puget Sound. During a 5-day spill test in mid-August 2000, higher levels of DO were observed in the surface waters during the spill period, with average DO levels at 7.6 mg/l with spill and 7.0 mg/l without spill (Corps, unpublished data 2000). In 1985 when the spillway apron concrete was under construction, the Corps monitored DO, which ranged from 8.4 to 9.2 mg/L.

The pH in the Puget Sound and Pacific Ocean varies with more productive nutrient rich waters having a lower pH. The pH in the project area ranges from 8.0-8.1 (Doney 2006). The leaching of carbonates from setting/curing concrete can increase the pH of adjacent waters, particularly in freshwater environments. The magnitude of pH changes attributable to curing concrete are dependent on two factors: the amount of water-soluble "alkali" present in cement (as K₂SO₄), and volume/flow characteristics of the receiving water body. If construction is to be environmentally acceptable and cost-effective, the loss of cement through washout must be minimized. This is accomplished by using admixtures to restrict the amount of cement leaching into the water to a few grams per hundred weight of cement used (or a few grams per cubic meter of water).

3.6.1 Alternative 1 – Sheet Pile Installation to Facilitate Concrete Pouring and Restoring the Entire Area Downstream of the Spillway to the Pre-Scoured Condition

Water and sediment quality may be temporarily degraded during and immediately after monolith repair construction activities, but in the long-term existing conditions will be maintained. Pile removal and driving activities will disturb and suspend sediment, creating discoloration of the

water, reducing light penetration and visibility, and changing the chemical characteristics of the water. The size of the sediment particles and tidal currents will likely determine the duration of sediment suspension in the water column. Smaller silt and fine sand particles may remain suspended for several hours (NOAA Fisheries 2003). Sediment-bound contaminants associated with any suspended sediments may dissolve in the water column and result in impacts to water quality.

The Corps does not anticipate any effects to salinity or water temperature due to the proposed project. The proposed project will be constructed from November 1-February 15, which is a period when managing salinity and water temperature is not an issue.

During construction activities, accidental release of fuel, oil, and other contaminants may occur. The contractor will be required to submit a spill prevention control and countermeasures (SPCC) plan prior to the commencement of any construction activities. The SPCC plan will identify and recognize potential spill sources at the site, outline best management practices, delineate responsive actions in the event of a spill or release, and identify notification and reporting procedures. Implementation of the SPCC plan will minimize the effect of construction activities on the quality of surrounding waters.

The design for the sheet pile installation calls for the pile to be installed as close to the concrete monolith as possible. The Corps anticipates the pile will be within six inches from the wall, but it may be as much as 12 inches from the monolith. Both pH and turbidity will be monitored during installation and if state standards are exceeded, work will stop immediately. Construction methods will be altered to eliminate or reduce the exceeded standard or the gap between the sheet pile and monolith will be closed. The contract will specify that divers will be available to seal the gap between the sheet pile and concrete monolith if state standards are exceeded.

Several other practices to avoid and minimize sediment re-suspension and other water quality impacts during construction will be implemented. They include:

- The crane operator will place rock in a manner that minimizes turbidity in the water column as well as sediment disturbance.
- Any sediment spilled on work surfaces will be contained and disposed of.
- The contractor will retrieve any debris generated during construction with a skiff and net. Retrieval will occur at slack tide or when current velocity is low.
- Wash water resulting from wash down of equipment or work areas will be contained for proper disposal, and shall not be discharged into state waters unless authorized through a state discharge permit.
- Equipment that enters the surface water will be maintained to prevent any visible sheen from petroleum products appearing on the water.
- There will be no discharge of oil, fuels, or chemicals to surface waters, or onto land where there is a potential for reentry into surface waters.
- No cleaning solvents or chemicals used for tools or equipment cleaning will be discharged to ground or surface waters.

- The contractor will regularly check fuel hoses, oil drums, oil or fuel transfer valves, fittings, etc. for leaks, and will maintain and store materials properly to prevent spills.

Impacts to water quality are not expected to be significant because they would be short-term (during construction) and localized. No exceedences of State water quality standards are anticipated. In addition, implementation of the construction best management practices (BMPs) listed above will minimize any adverse impacts resulting from the proposed action.

3.6.2 Alternative 2 – No-Action Alternative

If no repairs to the monolith were conducted, there would be no short term impacts to water quality. Long term effects to this alternative could be significant depending on what occurs to the structure.. If the small lock is closed the large lock would need to be used more which could result in the Corps instituting reduced lockages or requiring enough vessels to be present to fill the large lock to capacity prior to conducting a lockage to conserve water and maintain the salinity requirement of the LWSC. If a miter gate failure occurred and the pool was lost resulting in the lowering the water level of the entire LWSC and both Lake Union and Lake Washington, numerous effects to water quality could occur.

3.6.3 Alternative 3 – Sheet Pile Installation to Facilitate Concrete Pouring and Restoring the Minimum Area Downstream of the Spillway to the Pre-Scoured Condition

Consequences to water quality for Alternative 3 would be the same as for Alternative 1, but with a period of only two months rather than approximately four months of rock placement.

3.7 Air Quality, Greenhouse Gas Emissions, and Noise

Air quality in the northern Puget Sound area meets the Environmental Protection Agency's (EPA) standards for all air quality parameters (EPA 2007). The EPA creates regulations as required by the Clean Air Act. Areas of the country where air pollution levels persistently exceed the national ambient air quality standards are designated as "non-attainment" areas. The EPA has set de minimis threshold levels (100 tons/year for carbon monoxide and 50 tons/year for ozone) for non-attainment areas; however, no standards are set for green house gas emissions in Washington State. In Washington, the Seattle-Tacoma area is the only designated non-attainment area; this is due to particulate matter (PM_{2.5}) levels. The proposed project is located in a mixed industrial and residential area. Immediately upstream of the project is the Ballard Interbay Northend Manufacturing Industrial area in which the City of Seattle has designated as a General Industrial zone. The proposed project area, which is downstream of the locks, is a residential area. Air quality in the project area is generally good. Motor vehicles, including boats and ships, outdoor burning, home heating, and gas-powered yard maintenance equipment are the largest source of air pollutants. Particulates, sulfur dioxide, ozone, and carbon monoxide are the pollutants of concern.

Carbon monoxide, a product of incomplete combustion, is generated by automobiles and other fuel burning activities (e.g. residential heating with wood). The highest ambient concentrations of carbon monoxide tend to occur in localized areas such as major roadways and intersections during periods of low temperatures, light winds, and stable atmospheric conditions. Ozone is a highly reactive form of oxygen created by sunlight-activated chemical reactions of nitrogen oxides and volatile organic compounds. Unlike high carbon monoxide concentrations, which tend to occur close to emission sources, ozone problems tend to be regional since ozone

precursors can be transported far from their sources. Motor vehicle engines primarily generate ozone precursors.

Sources of air pollution during the construction of this project will include the pile driver, concrete mixing truck (if utilized), crane and/or excavator, tugboat, and personal vehicles. For each project alternative, the quantity of potential air emissions was estimated using a construction emissions spreadsheet model for non-road equipment from the Sacramento Metropolitan Air Quality Management District (SMAQMD; 2008). The model accounts for emissions associated with the operation of on-road vehicles, which will transport workers to/from the site and off-road equipment, which will be used during sheet pile installation and rock placement; emissions associated with pre- and post-barge mobilization were neglected. These estimates are not intended as an exact calculation of the emissions associated with this project but rather as a means for comparison among the alternatives. Carbon monoxide (CO); reactive organic gases (ROGs), which are ozone precursors; nitrogen oxides (NO_x); particulate matter with diameters larger than 2.5 micrometers and smaller than 10 micrometers (PM₁₀); and particulate matter with diameters that are 2.5 micrometers and smaller (PM_{2.5}) were estimated using the SMAQMD model and reported in the sections below.

Regarding airborne noise, the Locks is in a highly industrial area characterized by a wide range of noise. Traffic, both surface vehicles and marine vessels, trains, as well as noise associated with warehousing, berthing of vessels, loading and unloading of material, and manufacturing, are all prevalent in the LWSC area. On average, the LWSC passes 45,000 vessels each year and up to 1.3 million tourists visit the site annually. As a result, the ambient noise conditions in both the terrestrial and marine environment are high. Permanent ambient underwater noise in the area is also high. An acoustic harassment system has been in use in the project area for over 10 years to reduce salmon predation by sea lions. The NMFS installed this system originally in an attempt to save the dwindling Lake Washington steelhead run and continues to operate it to protect all salmon including ESA listed Chinook. The acoustic deterrent system generates 195-decibel underwater noise 24 hours a day, 365 days a year.

3.7.1 Alternative 1 – Sheet Pile Installation to Facilitate Concrete Pouring and Restoring the Entire Area Downstream of the Spillway to the Pre-Scoured Condition

Air quality would meet the standards as set forth by the Washington Department of Ecology. During construction, pollutant emissions would occur due to exhaust emissions from the internal combustion engines of the equipment performing sheet pile installation and rock placement. This would last for the roughly two months of construction, although sheet pile installation is expected to require only 10 days to complete. These emissions would not exceed EPA's de minimis threshold levels (100 tons/year for carbon monoxide and 50 tons/year for ozone) or affect the implementation of Washington's Clean Air Act implementation plan; therefore, effects would be minimal. The Corps used a construction emissions spreadsheet model for non-road equipment from the Sacramento Metropolitan Air Quality Management District (SMAQMD; 2008) and used EPA data on emissions (USEPA 2011). The estimated emissions associated with this alternative are shown in the table below.

Table 3. Emissions Associated with Alternative 1 (Total for Construction Period)

Emission	CO (tons)	ROG (tons)	CO ₂ (tons)	NO _x (tons)	PM ₁₀ (tons)	PM _{2.5} (tons)
Pile Driving and Rock Placement	1.6	0.3	262.7	2.6	0.4	0.1

Noise would be intermittent at the site and would vary depending on the frequency of sheet pile installation and rock placement activities. Airborne noise levels would increase slightly above ambient while construction equipment was operating. The project is expected to require approximately 2 months to complete working 10 hours per day. Construction activities will comply with City of Seattle noise ordinance for equipment used for a public project, which specifies that work will be conducted between the hours of 7 a.m. and 10 p.m., Monday-Friday and between the hours of 9 a.m. and 10 p.m., weekends and holidays. Equipment that creates sound by impact or pulse, such as the vibratory pile driver is permitted between the hours of 8 a.m. and 5 p.m. on weekdays, and 9 a.m. to 5 p.m. on weekends and legal holidays. However, the Corps anticipates all construction activities except sheet pile installation will be conducted from 7 a.m. - 5pm Monday-Friday, and from 9 a.m.- 7 p.m. on weekends and holidays, if necessary, to further reduce noise impacts from the proposed project. Sheet pile installation would only occur during the approved hours detailed previously. Noise effects would endure for the two months (10 days of pile driving) of construction, and would remain localized to the immediate work area.

The Corps analyzed underwater noise disruption for potential effect on threatened and endangered species and marine mammals in the ESA Section 7(a) consultation document and those results are summarized in Section 3.4.1.

3.7.2 Alternative 2 – No-Action Alternative

No effects are anticipated as a result of the No-Action alternative.

3.7.3 Alternative 3 – Sheet Pile Installation to Facilitate Concrete Pouring and Restoring the Minimum Area Downstream of the Spillway to the Pre-Scoured Condition

Effects of Alternative 3 to air quality, greenhouse gas emissions, and noise would be the same as for Alternative 1, but would have a shorter duration of approximately two months instead of approximately four months. Both alternatives would produce the same amount of emissions per day but Alternative 3 requires one-third the length of time of Alternative 1 to complete, which would reduce the total emissions generated from the project. The estimated emissions associated with this alternative are shown in the table below.

Table 4. Emissions Associated with Alternative 3 (Total for Construction Period)

Emission	CO (tons)	ROG (tons)	CO ₂ (tons)	NO _x (tons)	PM10 (tons)	PM2.5 (tons)
Pile Driving and Rock Placement	0.5	0.1	87.6	0.9	0.1	0.1

3.8 Utilities and Public Services

The Locks provide a navigational passageway between Lake Washington (at a mean elevation of 21.0 feet, Corps of Engineers datum), and Shilshole Bay, the level of which is determined by tidal action. Depending on the tide, the lift provided by the locks varies from 6 to 26 feet. The structure incorporates two locks, the larger of which is 825 feet long between the upper and lower miter gates and is 80 feet in width. This lock can be divided into two smaller chambers by an intermediate miter gate. Ocean-going vessels up to 30-foot draft can be accommodated through the large lock. A saltwater barrier, hinge-mounted to the floor of the lock, is air-operated via push button controls located in the center control tower. The barrier is usually left in a raised

position to reduce the intrusion of salt water into Salmon Bay, and beyond, but is lowered to permit passage of deep-draft vessels. Salt water, which passes into Salmon Bay during lockages, settles into a saltwater basin immediately upstream of the large lock. The saltwater drain intake is located at the bottom of the saltwater settling basin, returning the salt water by gravity.

The small lock, adjacent to and south of the large lock, has a chamber 150 feet long by 30 feet wide and is used by smaller vessels with drafts up to 16 feet. Floating mooring bitts on both the south and north walls limit the usable width to 28 feet.

The Lake Washington Ship Canal Project is operated to provide optimum conditions for navigation between Puget Sound and the freshwater lakes and bays surrounding Seattle. The authorized depth of the LWSC is 30 feet. The dam controls the outflow of fresh water from Lakes Union and Washington and maintains the upstream water level on a tightly controlled rule curve between elevation 20.0 feet and elevation 22.00 feet (Corps of Engineers datum).

By providing an access between Puget Sound and Lakes Union and Washington, the project contributes to the industrial, commercial, and recreational use of the area. The project provides moorage for commercial, public, and private leisure craft, including a large fleet of commercial fishing boats free from the destructive effects of corrosion, electrolysis, marine plant growth, and barnacles. The project also provides regulation of lake levels and passage for anadromous fish including ESA listed species. The facilities currently allow thousands of vessels to navigate between Lake Washington and the Puget Sound annually. Hundreds of thousands of tourists visit the Locks annually as well.

3.8.1 Alternative 1 – Sheet Pile Installation to Facilitate Concrete Pouring and Restoring the Entire Area Downstream of the Spillway to the Pre-Scoured Condition

Impacts to navigation would be minimized as much as possible by scheduling the project construction during the period of lowest vessel traffic. The approved in water work period is November 1, 2011 through February 15, 2011. This alternative would begin December 1, 2011 and it will require approximately four months to complete. There may be temporary closures of the small lock during the construction period; however, the large lock chamber will be open and fully functional throughout the proposed project construction. A notice to mariners would be provided prior to any activity that will delay navigation for more than 4 hours. Conducting the repairs to the small lock monolith would allow the Corps to continue providing the public service of navigation.

3.8.2 Alternative 2 – No-Action Alternative

The No-Action alternative would limit navigation access to the LWSC. Continued erosion of the stilling basin could result in closure of the small lock and potentially cause an uncontrolled loss of pool, which would cause significant damage to the region.

3.8.3 Alternative 3 – Sheet Pile Installation to Facilitate Concrete Pouring and Restoring the Minimum Area Downstream of the Spillway to the Pre-Scoured Condition

Effects to utilities and public services under Alternative 3 would be the same as for Alternative 1 in that all features, facilities, and services would be preserved.

3.9 Land Use

The LWSC is surrounded by an urban landscape in which industrial, commercial, and residential activities occur.

The proposed project is located in a mixed industrial and residential area. Immediately upstream of the project is the Ballard Interbay Northend Manufacturing Industrial area in which the City of Seattle has designated as a General Industrial zone. The specific proposed project area, which is downstream of the locks, is a residential area with the land on the left bank zoned as Residential Multifamily Low Rise 3 and the right bank is zoned as Neighborhood Commercial 3. Further downstream of the project is zoned Residential Single Family.

3.9.1 Alternative 1 – Sheet Pile Installation to Facilitate Concrete Pouring and Restoring the Entire Area Downstream of the Spillway to the Pre-Scoured Condition

Alternative 1 would not cause any unique effects to land use. The area would remain to be used as it currently is, although the Corps may close access to the small lock and adjacent walkway area during a small portion of the construction activities.

3.9.2 Alternative 2 – No-Action Alternative

The No-Action alternative would limit navigation access to the LWSC. Continued erosion of the stilling basin could result in closure of the small lock and potentially cause an uncontrolled loss of pool, which would cause significant damage to the region.

3.9.3 Alternative 3 – Sheet Pile Installation to Facilitate Concrete Pouring and Restoring the Minimum Area Downstream of the Spillway to the Pre-Scoured Condition

Alternative 3 would have the same effects as Alternative 1, but with a shorter duration of only two months.

3.10 Recreation

The Locks provide a navigational passageway between Lake Washington and Shilshole Bay, and on average, the LWSC passes 45,000 vessels each year. Up to 1.3 million tourists visit the site annually to watch boats, to observe salmon in the viewing window, and to visit the historic grounds including the Carl English Gardens.

3.10.1 Alternative 1 – Sheet Pile Installation to Facilitate Concrete Pouring and Restoring the Entire Area Downstream of the Spillway to the Pre-Scoured Condition

This alternative would allow for continued project operations with continued use of the small locks transiting between Lake Washington and Shilshole Bay. Access to the Locks for vessels will not be affected. Access to specific areas at the Locks may be temporary affected. For example, pedestrians transiting across the small lock miter gate walkways could potentially experience 30-minute delays. Additionally, work safety zones will be developed which could result in areas being closed to the public during some construction activities. The project has been scheduled to avoid periods of high public use. This alternative would not have any permanent impacts to pedestrian use of the Locks

3.10.2 Alternative 2 – No-Action Alternative

In the short term, the No-Action alternative would not cause any effects to recreation. Continued erosion of the stilling basin could result in closure of the small lock and potentially cause an

uncontrolled loss of pool, which would cause significant damage to the region including recreation.

3.10. 3 Alternative 3 – Sheet Pile Installation to Facilitate Concrete Pouring and Restoring the Minimum Area Downstream of the Spillway to the Pre-Scoured Condition

Alternative 3 will have the same effects to recreation as Alternative 1.

3.12 Aesthetics

Aesthetic resources in the area include views of Salmon Bay, Commodore Park, the Carl English Gardens, and the Hiram M. Chittenden Locks Historic District however; upstream of the Locks the area is heavily industrialized and commercialized. Construction activities would be mainly out of sight of the general public; the exceptions would be those living on the hillsides overlooking the LWSC.

3.12.1 Alternative 1 – Sheet Pile Installation to Facilitate Concrete Pouring and Restoring the Entire Area Downstream of the Spillway to the Pre-Scoured Condition

Temporary impacts to aesthetics would result from the presence of the pile driving and rock placement equipment and the noise they create. However, the Corps does not anticipate that the repair activities would significantly affect the aesthetics of the area due to the industrial nature of the area. Since all work will be underwater, there would not be any permanent changes or long-term effects to the aesthetic qualities in the surrounding area resulting from the proposed alternative.

3.12.2 Alternative 2 – No-Action Alternative

No effects to aesthetics of the area are anticipated as a result of the No-Action alternative.

3.12. 3 Alternative 3 – Sheet Pile Installation to Facilitate Concrete Pouring and Restoring the Minimum Area Downstream of the Spillway to the Pre-Scoured Condition

The effects to aesthetics of the area would be the same for Alternative 3 as they are for Alternative 1.

3.13 Socioeconomic Resources

Typical socioeconomic analysis considerations include employment, population, income, economic growth, and public infrastructure. Alternatives are analyzed for their potential to affect these elements. The Corps operates the LWSC to provide navigation for commercial and recreational vessels between the lake and Puget Sound and to provide passage for fish migration. The LWSC is an important route for the movement of a great deal of commercial goods in the region.

3.12.1 Alternative 1 – Sheet Pile Installation to Facilitate Concrete Pouring and Restoring the Entire Area Downstream of the Spillway to the Pre-Scoured Condition

Alternative 1 would maintain the present capability of the LWSC. This alternative would have a minor positive effect on the socioeconomics of the region by providing work for the construction company that performs the repairs, and would meet the need for maintaining navigation. The estimated cost of Alternative 1 is approximately \$4.4 million.

3.12.2 Alternative 2 – No-Action Alternative

For the Corps to take no action toward maintaining the navigation channel would mean the project eventually would no longer be able to pass vessels via the small lock, which eventually could cause reduced recreation in the area, as well as an increased cost to companies that transport commercial goods through the LWSC. Effects of reduced vessel traffic could reduce employment, income, and hamper economic growth among the communities served by this transportation connection.

3.12.3 Alternative 3 – Sheet Pile Installation to Facilitate Concrete Pouring and Restoring the Minimum Area Downstream of the Spillway to the Pre-Scoured Condition

Alternative 3 would maintain the present capability of the LWSC. This alternative would have no effect on the socioeconomics of the region and is the least cost alternative that meets the purpose and need for the project.

4. MITIGATION

Mitigation for effects of a proposed action is evaluated as part of documentation under NEPA, such as this EA. Mitigation can take any of the following forms (Federal Register 1978):

1. Avoiding the effect altogether by not taking a certain action or parts of an action.
2. Minimizing effects by limiting the degree or magnitude of the action and its implementation.
3. Rectifying the effect by repairing, rehabilitating, or restoring the affected environment.
4. Reducing or eliminating the effect over time by preservation and maintenance operations during the life of the action.
5. Compensating for the effect by replacing or providing substitute resources or environments.

The preferred alternative includes typical Best Management Practices that would be employed to avoid and minimize any adverse effects:

- All work would occur during the standard in-water work window,
- No work would occur during the spring months when macro-algae are most susceptible to harm from increases in turbidity,
- No in-water work will occur between February 16 and October 31. This closure period corresponds to the portion of the year when Chinook and bull trout are most likely to be present in nearshore marine waters,
- All work would occur in areas previously disturbed by the navigation and fish passage project,
- Turbidity and pH would be monitored and kept within State water quality standards during construction,
- If work requires closures of the small lock, a notice to mariners would be issued.

5. COORDINATION

A Notice of Preparation of an EA and a request for a Section 401 of the Clean Water Act Certification Public Notice was provided for public comment from June 22, 2011 through July 13, 2011. No comments were received. The following agencies and entities have been contacted during the preparation of this environmental assessment:

- National Marine Fisheries Service

- U.S. Fish and Wildlife Service
- Washington Department of Fish and Wildlife
- Washington Department of Ecology
- Muckleshoot Tribe
- Suquamish Tribe

6. CUMULATIVE EFFECTS

As defined by the White House Council on Environmental Quality implementing regulations for NEPA at 40 CFR 1508.7, “cumulative impact” means “the impact on the environment which results from the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions.”

The Corps reviewed historic maps, documents, photographs, survey information, and navigation project records from 1915 to present in order to determine the types of activities that have contributed to, and continue to contribute to, cumulative effects on resources in the vicinity of the LWSC.

6.1 Historic Landscape Conditions

The idea of a canal linking Lake Washington and Puget Sound arose early in the development of the Seattle area. In 1854, Thomas Mercer mentioned the advantages of a canal connecting Lake Union and Union Bay. By 1871, First Lieutenant T.H. Handbury of the Corps reported in favor of building a canal in the region. A lock for passing logs into Lake Union from Lake Washington existed in the Montlake region in the 1880’s. In 1906, Congress authorized the construction with private capital of a canal with a single timber lock at Salmon Bay. Later, a report by Major Hiram Chittenden stated that the federal government was interested in the commercial promise of a navigable waterway and noted the indirect benefit from lowering the waters of Lake Washington to facilitate flood control and drainage of swamplands. By June 1910, Congress had appropriated \$2,275,000 for construction of the LWSC (Corps 1994).

In 1912, a public improvement district diverted the Cedar River into Lake Washington. In August 1917, the ship canal and the Hiram M. Chittenden Locks were opened. Their existence altered the movement and direction of water flow in the Lake Washington Basin. Previously, Lake Washington had been part of the Cedar/Black/White/Duwamish River Basin. Lake Washington drained into the Black River at Renton. The Black River was then joined by the Cedar River before entering the Duwamish River and finally emptying into Elliott Bay.

The opening of the locks and ship canal created a new outlet for Lake Washington. The 5,800 feet Fremont Cut joining Lake Union with Salmon Bay was completed in October 1916. The 2,500 feet Montlake Cut connecting Lake Washington and Lake Union (Union Bay to Portage Bay) was completed in May 1917. The Locks now control outflow from the entire Lake Washington Basin into Shilshole Bay in Puget Sound.

The initial opening of the Locks lowered the water level in Lake Washington from an average of 29.8 feet above mean lower low water (MLLW) of Puget Sound to the present average lake elevation of 21.0 feet, Corps datum. The 8.8 feet drop in lake elevation resulted in the dewatering of the Black River, and the Locks became the only outlet for Lake Washington. To

maintain sufficient flow for the operation of the Locks, the Cedar River was diverted to flow into Lake Washington.

6.2 Existing Conditions

The current configuration and water surface elevation of Lake Washington and Lake Union, and the access provided by the LWSC between the lake and Puget Sound, are the backbones on which present day Seattle and the Lake Washington ecosystem exist. By providing an access between Puget Sound and Lakes Union and Washington, the project contributes to the industrial, commercial, and recreational use of the area. The project provides moorage for commercial, public, and private leisure craft, including a large fleet of commercial fishing boats free from the destructive effects of corrosion, electrolysis, marine plant growth, and barnacles. The project also provides regulation of lake levels and passage for anadromous fish including ESA listed species. The facilities currently allow thousands of vessels to navigate between Lake Washington and the Puget Sound annually. Hundreds of thousands of tourists visit the Locks annually as well. The existing condition of the spillway tailrace does not meet the Corps stability of concrete structures requirements jeopardizing the continued operations of the facility.

6.3 Reasonably Foreseeable Future Actions

The LWSC has been heavily developed and industrialized. The historic estuarine habitats of Salmon Bay have been altered by previous dredging, filling, sewage and industrial discharges, and other anthropogenic activities over the past 100 years. Local municipalities are projected to continue recent growth patterns.

6.4 Incremental Effects of the Proposed Action

In the context of all that has occurred in the past and the reasonably foreseeable future actions, sheet pile installation and placement of 18,000 yards of rock covering approximately 81,000 square feet of the channel bottom rock for Alternative 1 or 6,000 cubic yards rock placed and 37,000 square feet of the channel bottom covered for Alternative 3 will not harm biological function. The proposed action will allow the continued project purposes of providing navigation, fresh water moorage, public visitation, and fish passage between Lake Washington and the Puget Sound to continue. The proposed action will restore the structural stability of the project so that it meets the Corps stability requirements enabling the Corps to continue to operate the LWSC. The proposed project also enables the Corps to continue to provide the existing services and maintain the existing water surface elevations. The proposed action will not change the function or extent of the existing navigation project. The project will not result in any changes to the human occupancy of the project area, but will allow for continued safe operation of the Locks. The Corps concludes that there will not be a significant cumulative effect associated with this action.

7. ENVIRONMENTAL COMPLIANCE

This chapter describes how the recommended plan, Alternative 3, complies with all of the pertinent environmental laws.

7.1 National Environmental Policy Act (NEPA) (42 U.S.C. § 4321 et seq.)

In accordance with the National Environmental Policy Act, Federal agencies are required to declare the potential environmental effects of their projects and to solicit public comment. The purpose of this document is to solicit public comment and fulfill the Corps of Engineers'

documentation requirements under NEPA. A public notice of the preparation of an EA and request for Section 401 of the CWA certification was prepared and sent to the public on June 22, 2011. This public notice provided a 20-day public review, which commenced on June 22, 2011 and ended on July 13, 2011. No comments were received by the Corps or the Department of Ecology. A Finding of No Significant Impact will be prepared.

7.2 Endangered Species Act of 1973, as Amended (16 U.S.C. §§ 1531-1544)

In accordance with Section 7(a)(2) of the Endangered Species Act of 1973, as amended, (16 U.S.C. §§ 1531-1544) federally funded, constructed, permitted, or licensed projects must take into consideration effects to federally listed or proposed threatened or endangered species. A Biological Evaluation (BE) was prepared and submitted to NMFS and USFWS for their concurrence with the Corps' analysis. We received concurrence from both of the Services with our determinations of effects.

7.3 Clean Water Act, as Amended (33 U.S.C. §1251 et seq.)

The Clean Water Act (33 U.S.C. § 1252 et seq.) requires Federal agencies to protect waters of the United States. The regulations implementing the Act disallows the placement of dredged or fill material into waters (and excavation) unless it can be demonstrated there are no less environmentally damaging practicable alternatives. The Corps has prepared a 404(b)(1) Consistency Evaluation that can be found in Appendix A and received a 401 Water Quality Certification from the Washington Department of Ecology, dated 18 August 2011.

7.5 Coastal Zone Management Act (16 U.S.C. §§1451-1465)

The Coastal Zone Management Act of 1972 as amended (16 U.S.C. §§ 1451-1465) requires Federal agencies to carry out their activities in a manner that is consistent to the maximum extent practicable with the enforceable policies of the approved state Coastal Zone Management Program. The Corps prepared a Coastal Zone Management Act Consistency Determination and submitted this document to the Washington Department of Ecology for their review and concurrence. The Corps received a concurrence letter from Ecology, dated 18 August 2011.

7.6 National Historic Preservation Act) (16 U.S.C. § 470 et seq.,)

The National Historic Preservation Act (16 U.S.C. § 470) requires that the effects of proposed Federal undertakings on sites, buildings structures, or objects included or eligible for the National Register of Historic Places must be identified and evaluated. The proposed project will be undertaken within the Hiram M. Chittenden Locks Historic District, a property listed in the National Register of Historic Places. However, the actions will not materially change the visual historic appearance of the subject property and poses no potential to affect the National Register qualities of the district. Therefore, no further consideration of effects under Section 106 of the National Historic Preservation Act is required.

7.7 Clean Air Act As Amended (42 U.S.C. § 7401, et seq.)

Section 176 of the Clean Air Act, 42 U S C §7506(c), prohibits Federal agencies from approving any action that does not conform to an approved state or Federal implementation plan. The Clean Air Act required states to develop plans, called State implementation plans (SIP), for eliminating or reducing the severity and number of violations of National Ambient Air Quality Standards (NAAQS) while achieving expeditious attainment of the NAAQS. The Act also requires Federal actions to conform to the appropriate SIP. An action that conforms with a SIP is defined as an action that would not: (1) cause or contribute to any new violation of any standard

in any area; (2) increase the frequency or severity of any existing violation of any standard in any area; or (3) delay timely attainment of any standard or any required interim emission reductions or other milestones in any area Air quality would meet the standards as set forth by the Washington Department of Ecology; construction of the project would not permanently affect regional air quality. During construction, reduction in air quality may occur due to exhaust emissions from the internal combustion engines of the equipment performing sheet pile installation and rock placement. This would endure for the roughly two months of construction, although sheet pile installation is expected to require only 10 days to complete. These emissions would not exceed EPA's de minimis threshold levels (100 tons/year for carbon monoxide and 50 tons/year for ozone) or affect the implementation of Washington's Clean Air Act implementation plan; therefore, effects would be minimal.

7.8 Marine Mammal Protection Act (16 U.S.C. §§ 1361-1407)

The Marine Mammal Protection Act of 1972 (16 U.S.C. §§1361-1407) restricts harassment of marine mammals. Marine mammal species that are observed in Puget Sound include harbor seal (*Phoca vitulina*), killer whale, (*Orcinus orca*), Steller sea lion (*Eumetopias jubatus*) Northern elephant seal (*Mirounga angustirostris*), California sea lion (*Zalophus californianus*), harbor porpoise (*Phocoena phocoena*), Dall's porpoise (*Phocoenoides dalli*), Minke whale (*Balaenoptera acutorostrata*), and gray whale (*Eschrichtius robustus*) (Orca Network 2011).

This project is concerned with the potential for harassment due to noise pollution. The threshold for Level B harassment of marine mammals as established by NMFS is 120 dB for non-pulsed noise, and 160 dB for pulsed noise. An acoustic harassment system has been in use in the project area for over 10 years to reduce salmon predation by sea lions. The NMFS installed this system originally in an attempt to save the dwindling Lake Washington steelhead run and continues to operate it to protect all salmon including ESA listed Chinook. The acoustic deterrent system generates 195 decibel acoustic noise 24 hours a day, 365 days a year. The vibratory pile driving is expected to produce acoustic noise ranging from approximately 165 dB to 185 dB. These numbers are based on the Compendium of Pile Driving Sound Data produced for the California Department of Transportation. The Corps does not anticipate that the temporary lower level noise from the sheet pile installation will cause any response from killer whales or Stellar sea lions. Further, it is very likely that noise levels will not increase in Shilshole Bay, which is the closest that killer whales are likely to approach the project area. The timing of the proposed project avoids the presence of adult returning salmon, which also avoids the presence of sea lions and harbor seals.

Because the level of noise generated by sheet pile installation will be lower than the ambient noise levels, the Corps does not anticipate that the temporary lower level noise from the sheet pile installation or other project elements will cause any response from killer whales or Steller sea lions and therefore is not applying for an Incidental Harassment Authorization.

7.9 Migratory Bird Treaty Act and Migratory Bird Conservation Act (16 USC 701-715)

The proposed project would be conducted in such a manner that migratory birds would not be harmed or harassed. The proposed work would be outside the nesting season for most birds. Existing flow regimes and hydrology in the LWSC would not be affected by this project.

7.10 Executive Order 12898, Environmental Justice

Executive Order 12898 directs every Federal agency to identify and address disproportionately high and adverse human health or environmental effects of agency programs and activities on minority and low-income populations. Repairing the small lock monolith would not exclude, deny benefits to, or discriminate against minority or low-income populations, nor does the project involve locating a facility that would discharge pollutants or contaminants. Therefore, the project complies with this order.

7.11 Executive Order 11990, Protection of Wetlands

This order directs Federal agencies to avoid to the extent possible the long and short-term adverse effects 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. No wetlands exist in the project area and no wetlands will be affected.

7.12 Treaty Rights

In the mid-1850s, the United States entered into treaties with nearly all of the Native American tribes in the territory that would become Washington State. 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 resolved 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* effects to access to usual and accustomed fishing area may violate this treaty right [*Northwest Sea Farms v. Wynn*, F. Supp. 931 F. Supp. 1515 at 1522 (WDWA1996)]. 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 encompasses the right to take shellfish [*U.S. v. Washington*, 135 F.3d 618 (9th Cir 1998)].

The proposed project has been analyzed with respect to its effects on the treaty rights described above. The Corps believes the following:

- (1) The work would not interfere with access to usual and accustomed fishing and gathering areas;
- (2) The work would not cause the degradation of fish runs in usual and accustomed fishing grounds or with fishing activities or shellfish harvesting and habitat; and
- (3) The work would not impair the Treaty tribes' ability to meet moderate living needs.

The project timing was developed so that it would not affect tribal fishing seasons and areas. Additionally the WDFW approved in-water work window allows work to be conducted as early as August, but to minimize potential impacts to adult coho salmon migration and tribal coho fisheries the proposed project will not be initiated until November 1 at the earliest. As the proposed project will minimize affects to fish and fishery impacts, the Corps has determined that the proposed project will not affect the treaty rights of tribes in the LWSC usual and accustomed fishing areas.

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Appendix A

Clean Water Act Section 404(b)(1) Evaluation

**CLEAN WATER ACT SECTION 404(b)(1) EVALUATION
LAKE WASHINGTON SHIP CANAL MONOLITH REPAIR
SEATTLE, WASHINGTON**

1. Introduction. The purpose of this document is to record the Corps' evaluation and findings regarding this project pursuant to Section 404 of the Clean Water Act (CWA). The following actions are covered by this document:

Installation of 110 feet of sheet pile and filling the void between the sheet pile and the existing undermined structure with 100 cubic yards of concrete

Placement of approximately 1406 cubic yards of quarry spalls, 2830 cubic yards of class IV riprap, and 1665 cubic yards of class II riprap to repair the erosion downstream of the spillway at the Hiram M. Chittenden Locks (Locks) in the Lake Washington Ship Canal (LWSC).

The information contained in this document reflects the findings of the project record. Specific sources of information included the following:

- a. Lake Washington Ship Canal Monolith Repair Biological Evaluation, dated May 2011
- b. Lake Washington Ship Canal Monolith Repair 2011 CZMA consistency statement
- c. 404(b)(1) Evaluation (see below)

This document addresses the substantive compliance issues of the Clean Water Act 404(b)(1) Guidelines [40 CFR §230.12(a)] and Public Interest Factors [33 CFR §320.4 as reference].

2. Description of Proposed Discharge.

For the LWSC small lock monolith and channel erosion repair project we are proposing two actions. The first action is to repair the foundation of the monolith wall and the second is to repair scoured out portion of substrate in the channel below the stilling basin. The Corps is proposing to repair the scour underneath small lock wall to maintain structural integrity with sheet pile and concrete. The repair to maintain stability of the small lock wall consists of the placement of 110 ft. of sheet pile along the small lock miter gate monolith and guide wall. The purpose of installing the sheet pile is to facilitate filling the void underneath the concrete structures with approximately 100 cubic yards of concrete. The sheet pile will be driven as close to the monolith as possible but due to the configuration of the equipment and to facilitate placement of the concrete, the closest that the pile can be to the wall is estimated to be 6 inches. The concrete will be pumped into the void through a tremie pipe that is placed through this 6 inch gap.

To prevent erosion from occurring under the new sheet pile wall repair and to prevent additional erosion from undermining the apron, rip-rap will be placed in the existing scoured areas to the minimum thickness and design requirements. The riprap will be sloped from the end of the concrete apron to a stable cross section at an elevation of the -25 feet contour. The downstream distance ranges from about 180 feet on the north bank adjacent to the small lock wall to approximately 80 feet on the south bank. This allows the riprap to tie in to the stable ridge diagonally across the channel at elevation -25 feet. A two foot filter blanket of 4"-8" quarry spalls will be placed on the channel bottom with riprap placed on top. Depending on the depth of scour and channel elevation, either class II or IV riprap will be placed on top of the blanket. The riprap will then have a quarry spalls blanket placed over the riprap to reduce or eliminate any voids or interstitial spaces to reduce predator habitat. The repair consists of using the minimum amount of substrate to adequately protect the structures. Approximately 1406 cubic yards of quarry spalls, 2830 cubic yards of class IV riprap, and 1665 cubic yards of class II riprap will be required to make the repairs. This repair is intended to restore the stability of the project to the pre-scour condition without filling all the scoured areas in the project area.

3. Project Purpose and Need.

The purpose of this project is to repair the erosion so that the small lock monolith will meet the Corps stability requirements (EM 1110-2-2100 Stability Analysis of Concrete Structures). The current condition of scour will cause a global stability failure of the small lock miter gate monolith in the event of a large earthquake resulting in an uncontrolled release/loss of pool if the upstream miter gates are not closed at the time of failure. The continued scour and erosion of foundation material will eventually lead to failure of the monoliths and loss of operation of the small lock.

4. Availability of Less Environmentally Damaging Practicable Alternatives to Meet the Project Purpose.

The alternatives evaluated for this project were as follows:

a. Alternative 1 – Sheet Pile Installation to Facilitate Concrete Pouring and Restoring the Entire Area Downstream of the Spillway to the Pre-Scoured Condition. Alternative 1 would require the placement of approximately 3 times as much fill (riprap and quarry spalls) as the proposed Alternative.

b. Alternative 2 – No-Action. Under the no-action alternative, the Corps would not take any actions to maintain the stability of the small lock monolith and maintain the use of the small lock. The Corps would not install sheet pile, concrete, or place rock to address the stability of the monolith or the continuing erosion of the channel.

c. Alternative 3 – Sheet Pile Installation to Facilitate Concrete Pouring and Restoring the Minimum Area Downstream of the Spillway to the Pre-Scoured Condition. The Corps is proposing to place rock only along the existing structures rather than filling in all of the areas of scour downstream of the spillway apron and monolith. The Corps has determined that the placement of 110 ft. of sheet pile along the small lock miter gate monolith and guide wall will be required. The purpose of installing the sheet pile is to facilitate filling the void underneath the concrete structures with approximately 100 cubic yards of concrete. Approximately 1406 cubic yards of quarry spalls, 2830 cubic yards of class IV riprap, and 1665 cubic yards of class II riprap will be required to make the repairs. This repair is intended to restore the stability of the project to the pre-scour condition without filling all the scoured areas in the project area.

Findings. The Corps rejected Alternative 2 because it would not meet the authorized project purpose and need. The Corps selected Alternative 3 because it is the least cost and least environmentally damaging between the two alternatives that would meet the project purpose and need.

5. Significant Degradation, Either Individually or Cumulatively, To the Aquatic Environment

a. Impacts on Ecosystem Function. The Corps has assessed potential effects from the proposed project and determined that they will be very low intensity effects in a very small area for a short duration. Effects of the work on salmonids will be reduced and/or avoided through implementation of timing restrictions. Due to these measures, effects to these important resources will not be significant either individually or cumulatively.

b. Impacts on Recreational, Aesthetic, and Economic Values. Recreational access to the Hiram M. Chittenden Locks (Locks) will not be affected. Access at the Locks may be temporarily affected. For example, pedestrians transiting across the small lock miter gate walkways could potentially experience 30 minute delays. Additionally, work safety zones will be developed which could result in areas of the Locks being closed to the public during some construction activities. The project has been scheduled to avoid periods of high public use. The project will not have any permanent impacts to pedestrian use of the Locks. Construction vehicles may temporarily disrupt local traffic on Commodore Way if concrete is supplied by land rather than by barge.

Impacts to navigation will be minimized as much as possible by scheduling the project construction during the period of lowest vessel traffic. The proposed project approved in water work period is November 1, 2011 through February 15, 2011. The Corps is proposing the project construction will begin

December 1, 2011 and it will require approximately 2 months to complete. There may be temporary closures of the small lock during the construction period, however the large lock chamber will be open and fully functional throughout the proposed project construction. A notice to mariners will be provided prior to any activity that will delay navigation for more than 4 hours.

The proposed project will ensure that vessel passage through the small lock is maintained which will maintain the economic values of the surrounding areas. In conclusion, no significant adverse effects on recreation, aesthetics, or the economy are anticipated.

Findings. The Corps has determined that there would be no significant adverse effects to aquatic ecosystem functions and values.

6. Appropriate and Practicable Measures to Minimize Potential Harm to the Aquatic Ecosystem.

a. Impact Avoidance Measures. Potential effects of the proposed work on the aquatic ecosystem will be avoided through the implementation of timing restrictions, and by avoiding unnecessary disturbance. Work will not occur during the juvenile salmon outmigration period, or during the adult salmon migration. For the protection of bull trout, steelhead, and Chinook salmon, species listed as threatened under the Endangered Species Act, no work will occur between February 16 and October 16. Only the minimum amount of fill that is required to maintain the stability and reduce erosion of critical structures will be used.

b. Impact Minimization Measures. The repair consists of using the minimum amount of substrate to adequately protect the structures. The area of rock placement is limited to only 27,000 sq. ft..

c. Compensatory Mitigation Measures. The proposed project is considered a repair to an existing project restoring a small area of scour to the original condition and function and does not require compensatory mitigation.

Findings. The Corps has determined that all appropriate and practicable measures have been taken to minimize potential harm.

8. Other Factors in the Public Interest.

a. Fish and Wildlife. The Corps has coordinated with State and Federal agencies to assure careful consideration of fish and wildlife resources. The Corps will assure full compliance with the Endangered Species Act prior to project implementation.

b. Water Quality. Public Notice PM-ER-11-2, which will be issued in June 2011, is a request for Certification under Section 401 of the Clean Water Act from the Washington Department of Ecology (Ecology). The Corps received a 401 Water Quality Certification, dated 18 August 2011 from the Washington Department of Ecology. The Corps will abide by the conditions of the State-issued Water Quality Certification to ensure compliance with State water quality standards.

c. Historic and Cultural Resources. The proposed project will be undertaken within the Hiram M. Chittenden Locks Historic District, a property listed in the National Register of Historic Places. However, the actions will not materially change the visual historic appearance of the subject property and poses no potential to affect the National Register qualities of the district. Therefore, no further consideration of effects under Section 106 of the National Historic Preservation Act is required.

d. Activities Affecting Coastal Zones. The Corps has determined that this work is consistent to the maximum extent practicable with the Coastal Zone Management Act. A concurrence letter was received from the Washington Department of Ecology, dated 18 August 2011.

e. Environmental Benefits. No substantial benefits to the environment have been identified as part of this proposed work.

f. Navigation. A minor, temporary disruption of navigation traffic may result from sheet pile operations. The pile driving equipment may require temporary closures of the small lock however the

large lock will open and fully functional during the construction activities. A notice to mariners will be issued before any impact to navigation occurs that will impede traffic more than 4 hours.

Findings. The Corps has determined that this project is within the public interest.

9. Conclusions. Based on the analyses presented in project ESA documents, the CZMA consistency statement as well as the following 404(b)(1) Evaluation and General Policies for the Evaluation of Permit Applications analysis, the Corps finds that this project complies with the substantive elements of Section 404 of the Clean Water Act and the Rivers and Harbors Act.

Potential Impacts on Physical and Chemical Characteristics (Subpart C)

1. Substrate [230.20] Immediately below the spillway a concrete apron was constructed in the 1980's to reduce scour and maintain structural stability of the spillway. The apron is -15 ft. at MLLW. The concrete apron extends from the spillway to approximately 70 feet downstream of the apron. Downstream of the apron the substrate is primarily hard impervious Lawton clay with a few areas of sporadically located rip rap and occasional piece of concrete. The small amount of rip rap located in the proposed project area is presumed to have originated from the left bank of the project area. Due to the large volume of high velocity flow during spill events the project area does not have gravels, sand, or vegetation.

The proposed project will result in the placement of rip rap on approximately 27,000 square feet (sq. ft.) of what is currently hard clay. The rip rap will be covered with quarry spalls to fill in the interstitial spaces in the rip rap to eliminate predator habitat.

2. Suspended Particulate/Turbidity [230.21] Any increases in turbidity resulting from the proposed action would be temporary, localized, and insignificant.

3. Water Quality [230.22] No significant water quality effects are anticipated. The Corps has received a Certification under Section 401 of the Clean Water Act from the Washington Department of Ecology (Ecology), dated 18 August 2011. The Corps will abide by the conditions of the State-issued Water Quality Certification to ensure compliance with State water quality standards

4. Current Patterns and Water Circulation [230.23] The discharge of nourishment materials will not obstruct flow, change the overall direction or velocity of water flow/circulation. However, the proposed project will restore the bottom contour to a smoother transition by filling in some of the scoured material. The rock placement to fill in the scoured areas below the apron may result in slightly more streaming flow in the area immediately below the spillway apron.

5. Normal Water Fluctuations [230.24] The proposed project will not impede normal tidal fluctuations..

6. Salinity Gradients [230.25] The proposed project will not divert or restrict tidal flows or affect salinity gradients (see number 5. above).

Potential Impacts on Biological Characteristics of the Aquatic Ecosystem (Subpart D)

1. Threatened and Endangered Species [230.30] Pursuant to Section 7 of the Endangered Species Act, the Corps prepared a Biological Evaluation to assess potential effects of the proposed work on species protected under the Act. This document concluded that the proposed repair work is not likely to adversely affect marbled murrelet (*Brachyramphus marmoratus*), bull trout (*Salvelinus confluentus*), Puget Sound Chinook salmon (*Oncorhynchus tshawytscha*), Puget Sound steelhead (*O. mykiss*), Steller sea lion (*Eumetopias jubatus*), and Southern Resident killer whale (*Orcinus orca*); or any critical habitat of the species listed above and would have no effect on bocaccio rockfish (*Sebastes paucispinis*), canary rockfish (*S. pinniger*), and yelloweye rockfish (*S. ruberrimus*). The Biological Evaluation was sent to the National Marine Fisheries Service and U.S. Fish and Wildlife Service on May 20, 2011.

Aquatic Food Web [230.31] The substrate is primarily hard impervious Lawton clay with a few areas of sporadically located rip rap. Due to the large volume of high velocity flow during spill events the project area does not have gravels, sand, or vegetation. As the project area is clay and lacks gravel, rock, or vegetation, and is exposed to high velocity flow, it is not suitable habitat for salmonids, forage fish, most other marine fish, most mollusks, plants, and other marine life. The only marine life identified inhabiting the area during surveys were sea stars which were presumed to be feeding on muscles attached to the upper portion of the concrete monolith. Due to the lack of habitat and marine life, the rock placement is expected to have little to no effect on all marine life except benthic invertebrates. The benthic invertebrate species that inhabit hard clay bottom in the spillway tailrace will have 27,000 sq. ft. of habitat transformed into a rock bottom, likely eliminating these invertebrates from this area. However, benthic

invertebrates that inhabit rock substrate will quickly colonize the area, resulting in an increase in benthic invertebrate diversity in the project area.

Forage fish, such as herring, surf smelt, and sand lance, will not be directly affected by the proposed action because (a) the substrate available and the high velocity flows make the habitat unsuitable for forage fish, and (b) turbidity is not expected to increase substantially above ambient conditions due to the construction methods of rock placement and the sheet pile will contain the concrete. . Indirect effects are not anticipated since no documented spawning beaches occur in the project area.

Wildlife [230.32] Noise associated with construction activities may have an effect on birds the project vicinity. The effects of any sound disturbance would likely result in displacement of bird and terrestrial animals rather than injury. Project construction operations are not expected to result in a long-term reduction in the abundance and distribution of any prey items. No breeding or nesting areas will be affected.

Marine mammals are not expected to be significantly impacted from construction noise including the noise generated by the sheet pile installation. The National Marine Fisheries Service has installed and maintained an acoustic deterrent system to reduce predation of listed Chinook salmon and steelhead from sea lions for over 10 years. This system produces sound levels greater than those generated by sheet pile installation. Due to the acoustic deterrent system marine mammals are not expected to be present and if a marine mammal is present the noise from construction activities will likely not solicit a response from marine mammals

Potential Impacts to Special Aquatic Sites (Subpart E)

- 1. Sanctuaries and Refuges [230.40]** The proposed project will not affect any designated sanctuary or refuge area.
- 2. Wetlands [230.41]** No material will not be discharged in wetland areas. No wetlands occur in the project vicinity.
- 3. Mudflats [230.42]** No mudflats occur in the project area.
- 4. Vegetated Shallows [230.43]** Extensive dive surveys have shown that no vegetation occurs in the project area.
- 5. Coral Reefs [230.44]** Not applicable.
- 6. Riffle and Pool Complexes [230.45]** Not applicable.

Potential Effects on Human Use Characteristics (Subpart F)

- 1. Municipal and Private Water Supplies [230.50]** Not applicable.
- 2. Recreational and Commercial Fisheries [230.51]** The project is not expected to affect recreational or commercial fisheries.
- 3. Water-Related Recreation [230.52]** Recreational access to the Hiram M. Chittenden Locks (Locks) will not be affected. Access at the Locks may be temporary affected. For example, pedestrians transiting across the small lock miter gate walkways could potentially experience 30 minute delays. Additionally, work safety zones will be developed which could result in areas of the Locks being closed to the public during some construction activities. The project has been scheduled to avoid periods of high public use. The project will not have any permanent impacts to pedestrian use of the Locks. Construction vehicles may temporarily disrupt local traffic on Commodore Way if concrete is supplied by land rather than by barge.

Impacts to navigation, which includes recreational vessels, will be minimized as much as possible by scheduling the project construction during the period of lowest vessel traffic. The proposed project approved in water work period is November 1, 2011 through February 15, 2011. The Corps is proposing the project construction will begin December 1, 2011 and it will require approximately 2 months to complete. There may be temporary closures of the small lock during the construction period, however the

large lock chamber will be open and fully functional throughout the proposed project construction. A notice to mariners will be provided prior to any activity that will delay navigation for more than 4 hours.

The proposed project will ensure that vessel passage through the small lock is maintained which will maintain the economic values of the surrounding areas. In conclusion, no significant adverse effects on recreation are anticipated.

4. Aesthetics [230.53] The construction equipment will temporarily alter the aesthetics of the project area. No effects to aesthetics will occur after project completion. The effect of the project on aesthetics will be discountable.

5. Parks, National and Historic Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves [230.54] Not applicable.

Evaluation and Testing (Subpart G)

1. General Evaluation of Dredged or Fill Material [230.60] The fill material will be composed of rock, steel, and concrete. The Corps has determined that the proposed discharge material is not a carrier of contaminants.

2. Chemical, Biological, and Physical Evaluation and Testing [230.61] Material does not require testing. Riprap and quarry spalls will be free of soil and obtained from a Corps approved quarry.

Action to Minimize Adverse Effects (Subpart H)

1. Actions Concerning the Location of the Discharge [230.70] The location of the discharge must be placed at the location proposed to accomplish the project purpose. If the Corps was proposing to restore the entire project area to the pre-scoured condition the discharge would be placed over a much larger area than proposed. The location and timing of the discharge has been planned to minimize effects to marine organisms.

2. Actions Concerning the Material to be Discharged [230.71] Sheet pile will contain the concrete and the Corps will monitor water quality. If exceedances are detected the Corps will revise construction activities.

3. Actions Controlling the Material after Discharge [230.72] Methods for reducing the potential for erosion, slumping, or leaching will not be employed, as the intent of the action is to introduce material into littoral transport along the project area. The material will be secured by driving the sheet pile into the substrate, the concrete will be contained by the sheet pile and the rock to be placed in the channel will be of sufficient size that water flow will not move the rip rap from the area it was placed.

4. Actions Affecting the Method of Dispersion [230.73] No material will be dispersed.

5. Actions Related to Technology [230.74] Appropriate machinery and methods of transport of the material for installation will be employed. All machinery will be properly maintained and operated.

6. Actions Affecting Plant and Animal Populations [230.75] The timing of the proposed discharge operations will minimize the potential for adverse effects to animal populations, particularly juvenile salmonids.

7. Actions Affecting Human Use [230.76] The discharge will not result in damage to aesthetically pleasing features of the aquatic landscape. The discharge will not increase incompatible human activity in remote fish and wildlife areas.

8. Other Actions [230.77] Not applicable.

General Policies for the Evaluation of Public Interest [33 CFR §320.4 for reference]

1. Public Interest Review [320.4(a)] The Corps finds these actions to be in compliance with the 404(b)(1) guidelines and not contrary to the public interest.

2. Effects on Wetlands [320.4(b)] No wetlands will be altered by the proposed repair work.

- 3. Fish and Wildlife [320.4(c)]** The Corps consulted the U.S. Fish and Wildlife Service and the National Marine Fisheries Service to ensure that direct and indirect loss and damage to fish and wildlife resources attributable to the proposed repair work will be minimized.
- 4. Water Quality [320.4(d)]** The Corps will abide by the conditions of the Section 401 Water Quality Certification for this proposed project issued by the Department of Ecology to ensure compliance with Washington water quality standards.
- 5. Historic, Cultural, Scenic, and Recreational Values [320.4(e)]** No wild and scenic rivers, historic properties, National Landmarks, National Rivers, National Wilderness Areas, National Seashores, National Recreation Areas, National Lakeshores, National Parks, National Monuments, estuarine and marine sanctuaries, or archeological resources will be adversely affected by the proposed repair work.
- 6. Effects on Limits of the Territorial Sea [320.4(f)]** The proposed repair work will not alter the coastline or baseline from which the territorial sea is measured for the purposes of the Submerged Lands Act and international law.
- 7. Consideration of Property Ownership [320.4(g)]** Not applicable.
- 8. Activities Affecting Coastal Zones [320.4(h)]** The proposed action is consistent to the maximum extent practicable with the policies and standards of the State of Washington Shoreline Management Program.
- 9. Activities in Marine Sanctuaries [320.4(i)]** Not applicable.
- 10. Other Federal, State, or Local Requirements [320.4(j)]**
The Corps has analyzed the proposed action under all applicable Federal, State, and local requirements and will document this compliance in the Environmental Assessment.
- 11. Safety of Impoundment Structures [320.4(k)]** The purpose of the project is to maintain the safety of the impoundment structures..
- 12. Floodplain Management [320.4(l)]** The proposed maintenance work will not alter any floodplain areas.
- 13. Water Supply and Conservation [320.4(m)]** Not applicable.
- 14. Energy Conservation and Development [320.4(n)]** Not applicable.
- 15. Navigation [320.4(o)]** The purpose of the proposed project is to prevent erosion from further undermining the small lock monolith and spillway apron to enable the Corps to continue operating the small lock to facilitate navigation.
- 16. Environmental Benefits [320.4(p)]** The proposed project will ensure that the small lock remains operational. If all vessels were required to use the large lock the water consumption would be greatly increased which could potentially reduce the amount of water available to operate the juvenile salmonid passage facilities.
- 17. Economics [320.4(q)]** Completion of the project will enable the Corps to continue to operate the Locks to allow navigation. The Corps finds this project is economically justified.
- 18. Mitigation [320.49(r)]** Potential effects of the repair work on salmonids will be avoided through implementation of timing restrictions. For the protection of these species, work will occur between November 1 and February 15..

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Appendix B
Concurrence Letters

Based on the information provided in and/or with your cover letter and any additional information, we have concluded that effects of the proposed action to the above-identified federally listed resources would be insignificant and/or discountable. Therefore, for the reasons identified in the enclosures to this letter, we concur with your determination that the proposed action is "not likely to adversely affect" the above-identified federally listed resources. This letter and its enclosures constitute a complete response of the U.S. Fish and Wildlife Service to your request for informal consultation.

This concludes consultation pursuant to the regulations implementing the Endangered Species Act (50 CFR 402.13). This project should be re-analyzed if new information reveals effects of the action that may affect listed species or critical habitat in a manner, or to an extent, not considered in this consultation. The project should also be re-analyzed if the action is subsequently modified in a manner that causes an effect to a listed species or critical habitat that was not considered in this consultation, and/or a new species is listed or critical habitat is designated that may be affected by this project.

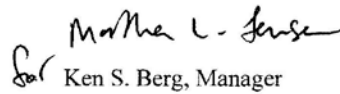
Our review and concurrence with your effect determination is based on the implementation of the project as described. It is the responsibility of the Federal action agency to ensure that projects that they authorize or carry out are in compliance with the regulatory permit and/or the ESA, respectively. If a permittee or the Federal action agency deviates from the measures outlined in a permit or project description, the Federal action agency has the obligation to reinstate consultation and comply with section 7(d).

If you have any questions about this letter or our joint responsibilities under the Endangered Species Act, please contact the consultation biologist identified below, of this office.

U.S. Fish and Wildlife Service Consultation Biologist(s):

☒ William Vogel (360 / 753-4367)

Sincerely,


Ken S. Berg, Manager
Washington Fish and Wildlife Office

Enclosures
Appendix 1 Checklist(s)

☒ WDOF, Bellevue, WA (R. Padgett)



United States Department of the Interior

FISH AND WILDLIFE SERVICE

Washington Fish and Wildlife Office
510 Desmond Dr. SE, Suite 102
Lacey, Washington 98503



In Reply Refer To:
13410-2011-1-0271

JUL - 5 2011

Evan R. Lewis, Chief Environmental Resources Branch
Seattle District, Corps of Engineers
ATTN: (Chuck Ebel)
P.O. Box 3755
Seattle, Washington 98124-3755

Dear Mr. Lewis:

Subject: Project: Lake Washington Ship Canal Monolith Repair

This is in response to your May 20, 2011, letter requesting our concurrence with your determination that the proposed action in Seattle, King County, Washington, would "not likely adversely affect" federally listed species. A photocopy from your transmittal document(s) describing the proposed action is enclosed.

Specifically, you requested informal consultation pursuant to section 7(a)(2) of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) for the federally listed species identified below (only those species that have been checked are addressed in this consultation request (See Enclosure).

- ☒ Bull trout (*Salvelinus confluentus*)
- ☒ Bull trout critical habitat
- ☒ Marbled murrelet (*Brachyramphus marmoratus*)

If you requested consultation for the bald eagle, please note that the bald eagle was removed from the Federal List of Threatened and Endangered Wildlife, effective August 8, 2007. Given that your project will be implemented after that date, consultation under section 7(a)(2) of the Endangered Species Act is not required. We have therefore not provided concurrence on your effect determination for the bald eagle.

TAKE PRIDE
IN AMERICA 

**U.S. FISH AND WILDLIFE SERVICE
WASHINGTON FISH AND WILDLIFE OFFICE**

**BULL TROUT
ENDANGERED SPECIES ACT
SECTION 7 INFORMAL CONSULTATION CONCURRENCE RATIONALE**

Project Name: Lake Washington Ship Canal Monolith Repair

DIRECT EFFECTS

1. Bull trout are not expected to be in the action area either because of the location of the action or because the action would occur during the recommended work window when bull trout are not anticipated to occur in the project area. Therefore, direct effects to bull trout from the proposed project would be discountable because of the following:

☒ The action area of the proposed project is located in or adjacent to Lake Washington, Lake Sammamish, or the Lake Washington Ship Canal, where, at the present time, bull trout occurrence is rare.

2. Bull trout may be in the action area despite the application of an in-water work window. The proposed action would occur during the following in-water work window (October 15 to February 15) when bull trout are expected to occur in low numbers. The timing restriction reduces but does not eliminate the potential for exposure of bull trout to project effects. However, direct effects of the proposed project to bull trout are expected to be insignificant because of the following:

☒ Sheet piles would only be driven using a vibratory pile driver and no proofing of the piles would be needed. This installation method is not anticipated to produce sound levels that would measurably affect bull trout. If impact pile driving does become necessary, sound levels may be elevated in a small area of the ship canal. Due to the spatial position of the monolith itself and the ship canal, elevated sound levels are not anticipated to propagate outside a portion of the ship canal west and south of the proposed action.

Additionally, turbidity will be monitored and operations modified to ensure that the concentration and duration of this exposure are not at levels that would result in a measurable effect to bull trout. Water quality will be monitored and measures put in place to minimize leakage of wet cement and thereby minimize adverse effects to water quality should any leaks in the sheet piling be detected. Therefore, the direct effects to bull trout are expected to be insignificant.

INDIRECT EFFECTS

1. Bull trout are not expected to be in the action area; therefore, indirect effects from operation of the proposed action and use of the facility after construction (if applicable) would be discountable because of the following:¹

☒ The action area of the proposed project is located in or adjacent to Lake Washington, Lake Sammamish, or the Lake Washington Ship Canal, where, at the present time, bull trout occurrence is rare.

2. Bull trout may or may not occur in the action area; however, effects to bull trout via their prey resources would be insignificant because of the following:

☒ The proposed action would not impact a documented or potential forage fish spawning area and would occur during the recommended work window for the project area (October 15 to February 15) when bull trout prey species are not likely to be affected to any appreciable degree (i.e., some fish may be affected). Therefore, effects to bull trout via reduced forage fish abundance are not expected to be measurable.

☒ Eelgrass would not be appreciably affected (e.g., by shading or physical disturbance from in- and over-water construction and structures or the use of watercraft (including but not limited to jet skis, boats, and float planes)). Eelgrass in intertidal and sub-tidal areas is important to the forage fish that bull trout feed on. Therefore, indirect effects to bull trout via effects of the proposed project to forage fish from increased over-water shading or habitat impacts are not expected to be measurable.

3. Bull trout occur in the action area; however, with regard to other indirect effects

☒ Recreational use of watercraft that would result from the proposed project would not exceed normal background sound levels in the project area. Therefore, effects are expected to be insignificant.

Consulting Biologist: William Vogel
FWS Project Biologist

Date: July 1, 2011

Concurrence approved by: M Jensen
Federal Activities Branch
Supervisor

Date: 7/5/11

¹ Many areas of Puget Sound contain high-value spawning habitat for bull trout prey resources such as surf smelt (*Hypomesus pretiosus*), sand lance (*Ammodytes hexapterus*), and Pacific herring (*Clupea harengus*). This determination may not be appropriate for projects that would have significant, long-term negative effects to bull trout prey resources.

Note: The rationale expressed in this informal section 7 concurrence rationale checklist represents our current understanding of the effects of some commonly permitted federal actions to bull trout. This document does not express all possible rationale for insignificant or discountable effects to bull trout. This document is subject to change at any time due to the collection of new information or the need to clarify our rationale. However, any future changes to this concurrence rationale document would not be expected to necessitate reinitiation on previously completed consultations. Please see the "reinitiation" paragraph of the cover letter for a discussion of reinitiation triggers.

U.S. FISH AND WILDLIFE SERVICE
WASHINGTON FISH AND WILDLIFE OFFICE

BULL TROUT CRITICAL HABITAT
ENDANGERED SPECIES ACT
SECTION 7 INFORMAL CONSULTATION CONCURRENCE RATIONALE

Project Name: Lake Washington Ship Canal Monolith Repair

The final revised rule designating bull trout critical habitat (75 FR 63898 [October 18, 2010]) identifies nine Primary Constituent Elements (PCEs) essential for the conservation of the species. This concurrence on designated bull trout critical habitat will be valid for purposes of section 7 compliance immediately upon the effective date of the final critical habitat rule, which is November 17, 2010. No additional correspondence with the Service is necessary.

BULL TROUT CRITICAL HABITAT

We have examined the anticipated effects of the proposed action on the applicable PCEs below.

- ☒ The proposed action would impact bull trout critical habitat; however, effects to the Primary Constituent Elements (PCE) applicable to the action area are expected to be insignificant based on the following rationale:

Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia.

- ☒ The proposed project site is located in marine waters. This PCE is not present in the action area for the project.

Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers.

- ☒ The proposed action would not impact the migratory corridors and/or habitats between spawning, rearing, overwintering, and/or foraging habitats via the introduction of physical, biological, or water quality barriers, including, but not limited to, high stream temperatures, suspended sediment releases, or releases of contaminants or other pollutants. Therefore, no effects to this PCE are anticipated.

An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.

- ☒ The proposed action would not impact the bull trout food base (fish and invertebrates) through a significant reduction of prey individuals, degradation of aquatic habitat for prey species, and/or removal or alteration of riparian vegetation, which provides a

source of nutrients and fallout invertebrates for the ecological community (communities) in the action area. Therefore, no effects to this PCE are anticipated.

Complex river, stream, lake, reservoir, and marine shoreline aquatic environments, and processes that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks and unembedded substrates, to provide a variety of depths, gradients, velocities, and structure.

- ☒ The proposed action would not include any activities that would increase or decrease channel complexity in the action area. No large woody debris or other habitat-forming components would be removed from the stream, and the project would have no measurable effect on any existing side channels, pools, undercut banks, embedded substrates, or other features in the action area that provide complex habitat for bull trout or their prey species. Therefore, effects to this PCE are expected to be insignificant.

Water temperatures ranging from 2 to 15 °C (36 to 59 °F), with adequate thermal refugia available for temperatures that exceed the upper end of this range.

- ☒ The proposed action would not include any activities that would directly or indirectly alter water temperature, such as the release of heated or cooled water, the extraction or addition of water, the increase or decrease of water depth, or the removal of shading vegetation. Therefore, no effects are anticipated to this PCE.

In spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival.

- ☒ The proposed project site is located in marine waters. This PCE is not present in the action area for the project.

A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, minimal flow departure from a natural hydrograph.

- ☒ The proposed project site is located in marine waters. This PCE is not present in the action area for the project.

Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.

- ☒ The proposed action may impact water quantity and/or water quality via the addition/extraction of water, introduction of contaminants or other pollutants (e.g., suspended sediments), high water temperatures, or other pathways. However, the impacts are not expected to be appreciable due to the inclusion of Best Management Practices, conservation measures, and/or other components of the project design that are expected to avoid, reduce, or compensate for the effects from these potential impacts. Therefore, effects to this PCE are expected to be insignificant.

Sufficiently low levels of occurrence of nonnative predatory (e.g., lake trout, walleye, northern pike, smallmouth bass); interbreeding (e.g., brook trout); or competing (e.g., brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.

- ☒ The proposed project site is located in marine waters. This PCE is not present in the action area for the project.

Consulting Biologist: William Vogel
FWS Project Biologist

Date: July 1, 2011

Concurrence approved by: M Jensen
Federal Activities Branch
Supervisor

Date: 7/5/11

Note: The rationale expressed in this informal section 7 concurrence rationale checklist represents our current understanding of the effects of some commonly permitted federal actions to bull trout critical habitat. This document does not express all possible rationale for insignificant or discountable effects to bull trout critical habitat. This document is subject to change at any time due to the collection of new information or the need to clarify our rationale. However, any future changes to this concurrence rationale document would not be expected to necessitate reinitiation on previously completed consultations. Please see the "reinitiation" paragraph of the cover letter for a discussion of reinitiation triggers.

**U.S. FISH AND WILDLIFE SERVICE
WASHINGTON FISH AND WILDLIFE OFFICE**

**MARBLED MURRELET AND MARBLED MURRELET CRITICAL HABITAT
ENDANGERED SPECIES ACT
SECTION 7 INFORMAL CONSULTATION CONCURRENCE RATIONALE**

Project Name: Lake Washington Ship Canal Monolith Repair

MARBLED MURRELET CRITICAL HABITAT

- ☒ The proposed project, including indirect effects, will not occur within marbled murrelet critical habitat.

DIRECT EFFECTS

Nesting Marbled Murrelets

The project will not result in the destruction or modification of suitable marbled murrelet nesting habitat and

- ☒ The proposed project is more than 0.25 mile from suitable marbled murrelet nesting habitat. Although the proposed construction will generate sounds above ambient levels via use of heavy equipment and possible use of impact pile driving, the associated sound levels are extremely unlikely to affect marbled murrelets while on the nest or in the nest stand at this distance. Therefore, the direct effects to marbled murrelets and their young while in the nest stand are expected to be discountable.

Foraging

- ☒ Marbled murrelets are not expected to forage in the action area of the proposed project. Therefore, effects to foraging marbled murrelets are expected to be discountable.
- ☒ Other: Sheet piles would only be driven using a vibratory pile driver and no proofing of the piles would be needed. This installation method is not anticipated to produce sound levels that would measurably affect marbled murrelets. If impact pile driving does become necessary, sound levels may be elevated in a small area of the ship canal. Due to the spatial position of the monolith itself and the ship canal, elevated sound levels are not anticipated to propagate outside of the ship canal west and south of the proposed action. Marbled murrelets are not likely to be present in that portion of the action area and therefore direct effects to marbled murrelets are considered discountable.

Turbidity and Other Environmental Contaminants

- ☒ The proposed project is not expected to release or introduce environmental contaminants into or adjacent to the aquatic environment. Additionally, turbidity will be monitored and operations modified to ensure that the concentration and

duration of this exposure are not at levels that would result in a measurable effect to marbled murrelets. Therefore, the direct effects to marbled murrelets are expected to be insignificant.

INDIRECT EFFECTS

Disturbance (Foraging)

- ☒ The proposed project is not anticipated to result in changes in facility operation and future maintenance. Activities associated with operation and normal maintenance of the facility were addressed in a previous consultation (FWS 1-3-02-F-0393).

Prey Resources¹

- ☒ The proposed project is not located in a documented or potential forage fish spawning area. Construction and operation of the completed action and use of the facility will not appreciably affect forage fish populations. Therefore, effects to marbled murrelets via their prey resources are considered discountable.

Contaminants

- ☒ Activities associated with operation and normal maintenance of the project were addressed in a previous consultation (FWS 1-3-02-F-0393). Therefore, effects associated with continued operation and normal maintenance are considered baseline.

Consulting Biologist: William Vogel
FWS Project Biologist

Concurrence approved by: M Jensen
Federal Activities Branch
Supervisor

Date: July 1, 2011

Date: 7/5/11

Note: The rationale expressed in this informal section 7 checklist represents our current understanding of the effects of some commonly permitted federal actions to marbled murrelet. This document does not express all possible rationale for insignificant or discountable effects to marbled murrelet. This document is subject to change at any time due to the collection of new information or the need to clarify our rationale. However, any future changes to this concurrence rationale document would not be expected to necessitate reinitiation on previously completed consultations. Please see the "reinitiation" paragraph of the cover letter for a discussion of reinitiation triggers.

¹ Many areas of Puget Sound contain high-value spawning habitat for marbled murrelet prey resources such as surf smelt (*Hypomesus pretiosus*), sand lance (*Ammodytes hexapterus*), and Pacific herring (*Clupea harengus*). This determination may not be appropriate for projects that would have significant, long-term negative effects to marbled murrelet prey resources.

1.0 INTRODUCTION

This Biological Evaluation (BE) evaluates the effects of the Seattle District U.S. Army Corps of Engineers (Corps) proposed repairs in the Lake Washington Ship Canal (LWSC) downstream of the stilling basin in Seattle, King County, Washington on species protected under the Endangered Species Act (ESA) within the project area. Such species include, but are not limited to, Puget Sound Chinook salmon, Coastal/Puget Sound bull trout, Puget Sound Steelhead, Steller sea lion, southern resident killer whale, and marbled murrelet.

2.0 PROJECT DESCRIPTION AND BACKGROUND

2.1 Background

The Lake Washington Ship Canal (LWSC) was constructed between Puget Sound and Lake Washington more than 80 years ago (between 1911 and 1916) by the Corps to provide watercraft access between Lake Washington and Puget Sound. Construction of the LWSC rerouted the major rivers that fed and drained Lake Washington and lowered the lake surface elevation by about 9 feet (ft) (2.7 m). One consequence of these changes has been the development of a highly altered ecosystem, particularly for anadromous fishes such as salmon. Concurrently, the urban landscape surrounding the lake developed, and the urban structure is now dependent on the environment created by the construction of the LWSC. The current configuration and water surface elevation of Lake Washington and Lake Union, and the access provided by the LWSC between the lake and Puget Sound, are the backbones on which present day Seattle and the Lake Washington ecosystem exist.

The Corps operates the LWSC to provide navigation for commercial and recreational vessels between the lake and Puget Sound and to provide passage for fish migration. The LWSC consists of the Hiram M. Chittenden Locks (the Locks) and associated facilities, the Fremont Cut between Salmon Bay and Lake Union, and the Montlake Cut between Lake Union and Lake Washington. Oriented northwest to southeast and located approximately 1.5 miles (2.4 km) east of Shilshole Bay, the locks and spillway span the Salmon Bay Waterway at its narrowest point, approximately 400 ft (122 m) across.

Consultation pursuant to Section 7 of the ESA was conducted beginning in 2000 for operation and maintenance of the LWSC facilities. Biological Opinions were received from the USFWS in April 2007, and from the NMFS in March 2008.

2.2 Description of Problem and Proposed Action

This spillway, spillway apron, and structures adjacent to the spillway are at risk of sustaining damage from scour caused by approximately 100 years of operating the spillway.

The problem of scour affects structures such as the small lock wall foundation and the stilling basin apron through degradation of the exit channel. Impacts of continued scour could be failure of the small lock miter gate monolith resulting in an uncontrolled release/loss of pool or major repair of the stilling basin.



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, Washington 98115

NMFS Tracking No.:
2011/02068

June 23, 2011

Evan R. Lewis
Chief, Environmental Resources Branch
Corps of Engineers, Seattle District
Post Office Box 3755
Seattle, Washington 98124-3755

Re: Endangered Species Act Section 7 Informal Consultation for the Lake
Washington Ship Canal Small Monolith Repair Project in King County, (Shell
Creek - Frontal Puget Sound 6th Field HUC 171100190203).

Dear Mr. Lewis:

This correspondence is in response to your request for consultation under the Endangered Species Act (ESA).

The Army Corps of Engineers (COE) submitted a Biological Evaluation (BE) to the National Marine Fisheries Service (NMFS), which was received on May 23, 2011. Additional information was received on June 2, 2011. The COE requested NMFS' concurrence with the following determinations: (1) "may affect, not likely to adversely affect" Puget Sound (PS) Chinook (*Oncorhynchus tshawytscha*) salmon, (2) "may affect, not likely to adversely affect" critical habitat of Puget Sound (PS) Chinook, and (2) "may affect, not likely to adversely affect" Puget Sound steelhead (*O. mykiss*).

The NMFS listed PS Chinook salmon as threatened under the ESA on March 24, 1999 (64 FR 14308). Following listing, NMFS designated critical habitat for PS Chinook salmon on September 2, 2005 (70 FR 52662). On June 11, 2007, NMFS listed the PS steelhead Distinct Population Segment (DPS) as threatened under the ESA (72 FR 26722). The NMFS conducts consultations with the COE under section 7(a)(2) of the ESA, and its implementing regulations found at 50 CFR 402.

The COE operates the Lake Washington Ship Canal (LWSC) to provide navigation for commercial and recreational vessels between the lake and Puget Sound and to provide passage for fish migration. For purposes of this consultation, this section of the LWSC consists of the Hiram M. Chittenden Locks and associated facilities which is oriented northwest to southeast and located approximately 1.5 miles (2.4 km) east of Shilshole Bay.



The locks and spillway span the Salmon Bay Waterway at its narrowest point, approximately 400 feet across.

The current facility has experienced scour problems downstream of the stilling basin and is affecting the wall foundation at the small lock and the stilling basin apron. This spillway, spillway apron, and structures adjacent to the spillway are at risk of sustaining damage from scour caused by approximately 100 years of operating the spillway.

The COE proposes to repair the foundation of the monolith wall and the scoured out portion of substrate below the stilling basin. The COE will install 110 feet of sheet pile along the monolith to facilitate filling of this void with approximately 100 cubic yards of concrete. The sheet pile will be driven as close to the monolith as possible to facilitate concrete pumping through a tremie pipe. The sheet piles will be installed with vibratory methods over a 10 hour work day, for ten days.

In order to prevent erosion from undermining the new sheet pile wall and apron, rip-rap will be sloped from the end of the concrete apron to a stable cross section, ranging from 180 feet on the north bank to approximately 80 feet on the south bank, at a -25 feet contour. The riprap will then have a quarry spalls blanket placed over the riprap to reduce or eliminate any voids or interstitial spaces that provide predator habitat. Approximately 1406 cubic yards of quarry spalls, 2830 cubic yards of class IV riprap, and 1665 cubic yards of class II riprap will be required to make the repairs. This repair is intended to restore the stability of the project to pre-scour condition.

The work will be conducted over a two month period during the in-water work window of October 15 to February 15. The actual construction is expected to occur in the December – January portion of the work window. The sheet pile installation portion of the project is expected to require 10 days to complete. The repairs will be accomplished using a crane barge and another barge supplying material. The supply barge will provide an area for concrete trucks, sheet pile, or rip rap depending on which phase of construction is being conducted.

Adult Chinook salmon migrating to the Lake Washington basin spawning grounds arrive at the Locks in mid-June. The peak time of entry through the Locks occurs in mid- to late August and the migration is generally complete by early November. Juvenile PS Chinook salmon migrate past the Locks from May to September with peak migration occurring in June. Because of the Locks, a sharp salinity gradient exists forcing both adults and juveniles to move abruptly from one salinity regime to another.

Adult steelhead begin migrating upstream through the Locks in October. Steelhead smolts migrate through the Locks rapidly from mid-June through July. A single stock of winter steelhead is found within the Lake Washington basin. The Lake Washington stock status is considered depressed because of the steep decline in numbers (18 percent annual decline) and the low population growth rate.

The aquatic action area includes the channel width of the in-water work area 300 feet downstream of the construction activities. The action area also includes upland and staging areas associated with the construction.

Species Determinations

Puget Sound Chinook Salmon
Puget Sound Steelhead

The short and long-term effects to all life stages of PS steelhead and PS Chinook salmon will be discountable. Adult migration of PS steelhead and PS Chinook salmon will be completed prior to construction. Smolt migration of PS steelhead through Lake Washington to Puget Sound occurs from mid-June through July. Seaward migration of PS Chinook salmon occurs between May and September. The construction will occur in the December – January portion of the work window when listed species are not expected to be present.

If an individual PS Chinook salmon or PS steelhead does occur in the action area during construction, effects of the action are expected to be insignificant. Any fish that may be present in the area would likely avoid the immediate vicinity of the pile driver during sheet pile installation.

Moreover, the COE is implementing vibratory pile driving techniques over a short work duration (i.e. ten days) which will significantly reduce noise impacts to aquatic species.

Because all potential adverse effects are discountable or insignificant, NMFS concurs with the COE's effect determination of "may affect, not likely to adversely affect" for PS Chinook salmon and PS steelhead.

Critical Habitat Determination

Puget Sound Chinook salmon

The action area includes designated critical habitat for PS Chinook salmon. Critical habitat consists of six Primary Constituent Elements (PCEs) for the PS Chinook Evolutionary Significant Unit (ESU). The action area contains freshwater migration corridors (PCE#3) free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.

NMFS analyzed the potential impacts of the project on this PCE and determined that the potential effects will be insignificant because the proposed project will not affect the freshwater migration corridor through the LWSC and the project action area. The project will install sheet piling to avoid potential water quality impacts relating to riprap placement behind the sheet piles. Some short-term localized turbidity may be generated during the installation of sheet piles, but these effects will not be measureable. No new

structures will be constructed during the project. The placement of sheet piles along the north bank of the channel will not affect the function of the migratory corridor within the LWSC.


Because all potential adverse effects to PS Chinook salmon critical habitat are insignificant, NMFS concurs with the COE's effect determination that the project "may affect, not likely to adversely affect" for PS Chinook critical habitat.

This concludes informal consultation pursuant to the regulations implementing the ESA, 50 CFR 402.10. The COE must re-analyze this ESA consultation if new information reveals effects of the action that may affect listed species in a way not previously considered, the action is modified in a manner that causes an effect to the listed species or critical habitat that was not previously considered, or a new species is listed, or critical habitat designated, that may be affected by the identified action. A complete administrative record of this consultation is on file at NMFS's Washington State Habitat Branch Office in Lacey, Washington. This letter of concurrence meets the applicable Data Quality Act standards for utility, integrity, and objectivity.

The COE determined that the project "would not adversely affect" habitats which have been designated as Essential Fish Habitat (EFH) for various life stages of three species of Pacific salmon. Therefore, the NMFS did not conduct an EFH analysis for this project.

If you have questions regarding either the ESA or consultation, please contact Sean Callahan of the Washington State Habitat Office at (206) 526-4744, or by electronic mail at Sean.Callahan@noaa.gov.

Sincerely,


William W. Stelle, Jr.
Regional Administrator

cc: Chuck Ebel, COE



STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

Northwest Regional Office • 3190 160th Avenue SE • Bellevue, Washington 98008-5452 • (425) 649-7000

August 18, 2011

Amanda Ogden
U.S. Army Corps of Engineers Seattle District
PO Box 3755
Seattle, WA 98124

RE: Water Quality Certification Order #8647 for U.S. Army Corps of Engineers
Reference #PM-ER-11-2, Lake Washington Ship Canal Monolith Erosion and
Scour Repair Project, Seattle, King County, Washington

Dear Ms. Ogden:

On June 24, 2011, the U.S. Army Corps of Engineers Seattle District submitted a request to the Department of Ecology (Ecology) for a Section 401 Water Quality Certification (401 Certification) under the federal Clean Water Act for the proposed Lake Washington Ship Canal Monolith Erosion and Scour Repair project.

On behalf of the State of Washington, Ecology certifies that the work described in the JARPA and the public notice complies with applicable provisions of Sections 301, 302, 303, 306 and 307 of the Clean Water Act, as amended and applicable state laws. This certification is subject to the conditions contained in the enclosed Order.

If you have any questions, please contact Rebekah Padgett at (425) 649-7129. The enclosed Order may be appealed by following the procedures described in the Order.

Sincerely,

Erik Stockdale
Northwest Regional Office
Shorelands and Environmental Assistance Program

ES:rrp:cja

Enclosure

By certified mail: 7011 0470 0003 3720 8933



cc: Laura Arber, Washington Department of Fish and Wildlife
Cindy Rathbone, Washington Department of Natural Resources
Ben Perkowski, City of Seattle
William Vogel, US Fish and Wildlife Service
Sean Callahan, NOAA Fisheries

e-cc: Joe Burcar – NWRO
Loree' Randall – HQ
Raman Iyer – NWRO
ecyrefedpermits@ecy.wa.gov

IN THE MATTER OF GRANTING A) ORDER #8647
WATER QUALITY) Corps Reference #PM-ER-11-2
CERTIFICATION TO) Lake Washington Ship Canal Monolith Erosion
U.S. Army Corps of Engineers) and Scour Repair Project; Salmon Bay, Seattle,
Seattle District) King County, Washington.
in accordance with 33 U.S.C. 1341)
(FWPCA § 401), RCW 90.48.120, RCW)
90.48.260 and Chapter 173-201A WAC)

TO: U.S. Army Corps of Engineers Seattle District
 Attn: Amanda Ogden
 PO Box 3755
 Seattle, WA 98124

On June 24, 2011, the U.S. Army Corps of Engineers, Seattle District submitted a request to the Department of Ecology (Ecology) for a Section 401 Water Quality Certification. A joint public notice regarding the request was distributed for the above-referenced project pursuant to the provisions of Chapter 173-225 WAC on June 22, 2011.

The repair proposal includes:

- Repair foundation of the small lock wall (monolith): 110 feet of sheet pile will be installed along the length of the monolith and the void between the sheet pile and monolith will be filled with approximately 100 cubic yards of concrete.
- Repair scour adjacent to the monolith: Rip rap will be placed in the scoured areas of the channel below the spillway apron to restore depth and stability to pre-scour conditions. Approximately 1,406 cubic yards of quarry spalls, 2,830 cubic yards of class IV rip rap, and 1,665 cubic yards of class II rip rap will be utilized in the repairs. Approximately 27,000 square feet of channel bottom will be converted from clay to rip rap.

The project is located downstream of the Hiram M. Chittenden Locks, on the spillway side of the small lock, 3015 NW 54th Street, Seattle, King County, Washington, Lake Washington Ship Canal, Salmon Bay, Section 11, T. 25N, R. 3E, WRIA 8.

AUTHORITIES:

In exercising authority under 33 U.S.C. § 1341, RCW 90.48.120, and RCW 90.48.260, Ecology has examined this application pursuant to the following:

1. Conformance with applicable water quality-based, technology-based, and toxic or pretreatment effluent limitations as provided under 33 U.S.C. §§ 1311, 1312, 1313, 1316, and 1317 (FWPCA §§ 301, 302, 303, 306 and 307);

2. Conformance with the state water quality standards contained in Chapter 173-201A WAC and authorized by 33 U.S.C. § 1313 and by Chapter 90.48 RCW, and with other applicable state laws; and
3. Conformance with the provision of using all known, available and reasonable methods to prevent and control pollution of state waters as required by RCW 90.48.010.

WATER QUALITY CERTIFICATION CONDITIONS:

Through issuance of this Order, Ecology certifies that it has reasonable assurance that the activity as proposed and conditioned will be conducted in a manner that will not violate applicable water quality standards and other appropriate requirements of state law. In view of the foregoing and in accordance with 33 U.S.C. § 1341, RCW 90.48.120, RCW 90.48.260 Chapter 173-200 WAC and Chapter 173-201A WAC, water quality certification is granted to the Applicant subject to the conditions within this Order.

Certification of this proposal does not authorize the Applicant to exceed applicable state water quality standards (Chapter 173-201A WAC), ground water standards (Chapter 173-200 WAC) or sediment quality standards (Chapter 173-204 WAC). Furthermore, nothing in this certification shall absolve the Applicant from liability for contamination and any subsequent cleanup of surface waters, ground waters or sediments occurring as a result of project construction or operations.

A. General Conditions:

- A1. For purposes of this Order, the term "Applicant" shall mean U.S. Army Corps of Engineers Seattle District and its agents, assignees and contractors.
- A2. For purposes of this Order, all submittals required by its conditions shall be sent to Ecology's Northwest Regional Office, Attn: 401/CZM Federal Project Manager, 3190 160th Avenue SE, Bellevue, WA 98008-5452. Any submittals shall reference Order #8647 and Corps Reference #PM-ER-11-2.
- A3. Work authorized by this Order is limited to the work described in the JARPA received by Ecology on June 24, 2011. The Applicant will be out of compliance with this Order and must reapply with an updated application if the information contained in the JARPA is voided by subsequent changes to the project not authorized by this Order.

- A4. Within 30 days of receipt of an updated JARPA, Ecology will determine if the revised project requires a new water quality certification and public notice or if a modification to this Order is required.
 - A5. Copies of this Order shall be kept on the job site and readily available for reference by Ecology personnel, the construction superintendent, construction managers and lead workers, and state and local government inspectors.
 - A6. The Applicant shall provide access to the project site and all mitigation sites upon request by Ecology personnel for site inspections, monitoring, necessary data collection, and/or to ensure that conditions of this Order are being met.
 - A7. Nothing in this Order waives Ecology's authority to issue additional orders if Ecology determines that further actions are necessary to implement the water quality laws of the state. Further, Ecology retains continuing jurisdiction to make modifications hereto through supplemental order, if additional impacts due to project construction or operation are identified (e.g., violations of water quality standards, downstream erosion, etc.), or if additional conditions are necessary to further protect water quality.
 - A8. The Applicant shall ensure that all appropriate project engineers and contractors at the project site have read and understand relevant conditions of this Order and all permits, approvals, and documents referenced in this Order. The Applicant shall provide Ecology a signed statement (see Attachment A for an example) from each project engineer and contractor that they have read and understand the conditions of this Order and the above-referenced permits, plans, documents and approvals. These statements shall be provided to Ecology before construction begins at the project or mitigation sites.
 - A9. This Order does not authorize direct, indirect, permanent, or temporary impacts to waters of the state or related aquatic resources, except as specifically provided for in conditions of this Order.
 - A10. Failure of any person or entity to comply with this Order may result in the issuance of civil penalties or other actions, whether administrative or judicial, to enforce its terms.
- B. Water Quality Conditions:**
- B1. Salmon Bay is classified as "Extraordinary Quality" and the criteria of that class apply except as specifically modified by this Order. This Order does not authorize temporary exceedances of water quality standards beyond the limits established in WAC 173-201A-210(1)(c)(i).
-

- B2. Water quality shall be sampled and monitored during "in-water construction" below the ordinary high water mark of Salmon Bay per the *USACE Water Quality Monitoring Plan for the LWSC Monolith Erosion Repair* (hereafter referred to as Plan) prepared by the Corps, received by Ecology July 12, 2011, or as modified by this Order or revised and approved by Ecology.
- B3. Detection of exceedances: Water quality standards for turbidity in "Extraordinary" waters are as follows:
- Turbidity shall not exceed 5 NTU over background conditions when the background is 50 NTU or less, or a 10 percent increase in turbidity when the background turbidity is more than 50 NTU.
 - pH must be within the range of 7.0 to 8.5 with a human-caused variation within the above range of less than 0.2 units.
- If exceedances of this standard at the point of compliance specified in WAC 173-201A-200(1)(e)(i) is detected through water quality sampling and monitoring, the Applicant shall immediately take action to stop, contain, and prevent unauthorized discharges or otherwise stop the violation and correct the problem. After such an event, the Applicant shall assess the efficacy of the site BMPs and update or improve the BMPs used at the work site in an effort to reduce or prevent recurrence of the turbidity exceedance.
- B4. Reporting: If no exceedances are detected, results of water quality sampling, as determined by the Plan, shall be forwarded to Ecology on a monthly basis in accordance to Condition A2.
- B5. Notification of exceedances: Notification of exceedances that are detected through water quality sampling shall be made to Ecology within 24 hours of occurrence. Notification shall be made with reference to Order #8647, Attn: 401/CZM Federal Project Manager, by telephone at (425) 649-7129 or (425) 649-7000, or by fax to (425) 649-7098. The Applicant shall, at a minimum, provide Ecology with the following information:
- i. A description of the nature and cause of exceedance.
 - ii. The period of non-compliance, including exact dates, duration, and times and/or the anticipated time when the Applicant will return to compliance.
 - iii. The steps taken, or to be taken, to reduce, eliminate, and prevent recurrence of the non-compliance.
 - iv. In addition, within five (5) days after notification of an exceedance, the Applicant shall submit a written report to Ecology that describes the nature of the exceedance, turbidity results and location, photographs, and any other pertinent information.
-

C. Conditions for Construction Activities:

General Conditions:

- C1. Construction stormwater, sediment, and erosion control best management practices (BMPs; e.g., filter fences, etc.) suitable to prevent exceedances of state water quality standards shall be in place before starting construction at the site.
 - C2. Sediment and erosion control measures shall be inspected and maintained prior to and during project implementation.
 - C3. All construction debris shall be properly disposed of on land so that it cannot enter a waterway or cause water quality degradation to state waters.
 - C4. Machinery and equipment used during construction shall be serviced, fueled, and maintained upland, unless otherwise approved by Ecology, in order to prevent contamination to any surface water.
 - C5. Wash water containing oils, grease, or other hazardous materials resulting from wash down of equipment or working areas shall be contained for proper disposal, and shall not be discharged into state waters or storm drains.
 - C6. Work in or near the water that may affect fish migration, spawning, or rearing shall cease immediately upon a determination by Ecology that fisheries resources may be adversely affected.
 - C7. All trash and unauthorized fill, including concrete blocks or pieces, bricks, asphalt, metal, treated wood, glass, floating debris, and paper, below the Ordinary High Water Line (OHWL) in and around the Applicant's project area shall be removed and deposited at an approved upland disposal site.
 - C8. Project activities shall be conducted to minimize siltation of the bed.
 - C9. The Applicant shall operate the barge(s) and tug in deep water so as to minimize nearshore propeller wash impacts such as suspension of sediments.
 - C10. Barges shall not be allowed to ground-out during construction.
 - C11. If cast in place, wet concrete/grout shall be prevented from entering waters of the state. Forms for any concrete/grout structure shall be constructed to prevent leaching of wet concrete/grout. Impervious materials shall be placed over any exposed concrete/grout not lined with the forms that will come in contact with state waters. Forms and impervious materials shall remain in place until the concrete/grout is cured.
-

- C12. The sheet pile shall be installed using a vibratory hammer whenever possible.
- C13. Sound attenuation methods shall be utilized for the driving or proofing of steel piles with an impact hammer below the OHWL. For impact driving of steel piles that exceed the following criteria, a bubble curtain or other Ecology-approved sound attenuation device shall be used. The specific criteria include sound pressure levels of:
- a. Greater than or equal to 206 dB (one microPascal squared per second) peak,
 - b. Greater than or equal to 187 dB (one microPascal squared per second) accumulated sound exposure level (SEL) for fish greater than or equal to 2 grams, and
 - c. Greater than or equal to 183dB (one microPascal squared per second) (SEL) for fish less than 2 grams.
- The bubble curtain shall be installed and properly functioning around the pile during all driving operations. The bubble curtain shall distribute air bubbles around 100 percent of the perimeter of the piling over the full length of the pile in the water column.
- C14. The sheet pile wall shall be located as close to the monolith as practicable.
- C15. Rock for the structure shall be composed of clean, angular material of a sufficient durability and size to prevent its being broken up or washed away by high water or wave action.
- C16. The erosion and scour repair shall use the minimum amount of substrate necessary to stabilize the structure and restore the depth.
- C17. Riprap shall be confined to the footprint illustrated in the project plans.
- C18. The bottom profile shall be constructed to the contours illustrated in the project plans.
- C19. Rip rap and quarry spalls shall be placed with a crane in order to reduce turbidity.
- C20. Wood treated with preservatives, trash, waste, or other deleterious materials shall not be burned below the OHWL. Limited burning of untreated wood or similar material may be allowed at or above the mean higher high water line.

D. Emergency/Contingency Measures:

- D1. The Applicant shall develop and implement a Spill Prevention and Containment Plan for all aspects of this project.
-

- D2. The Applicant shall have adequate and appropriate spill response materials on hand to respond to emergency release of petroleum products or any other material into waters of the state.
- D3. Fuel hoses, oil drums, oil or fuel transfer valves and fittings, etc., shall be checked regularly for drips or leaks, and shall be maintained and stored properly to prevent spills into state waters.
- D4. Any work that is out of compliance with the provisions of this Order, or conditions causing distressed or dying fish, or any discharge of oil, fuel, or chemicals into state waters, or onto land with a potential for entry into state waters, is prohibited. If these occur, the Applicant shall immediately take the following actions:
 - a. Cease operations at the location of the violation or spill.
 - b. Assess the cause of the water quality problem and take appropriate measures to correct the problem and/or prevent further environmental damage.
 - c. Notify Ecology of the failure to comply. All oil spills shall be reported immediately to Ecology's 24-Hour Spill Response Team at 1-800-258-5990, and within 24 hours of spills or other events to Ecology's 401/CZM Federal Project Manager at (425) 649-7129 or (425) 649-7000.
 - d. Submit a detailed written report to Ecology within five (5) days that describes the nature of the event, corrective action taken and/or planned, steps to be taken to prevent a recurrence, results of any samples taken, and any other pertinent information.

Compliance with this condition does not relieve the Applicant from responsibility to maintain continuous compliance with the terms and conditions of this Order or the resulting liability from failure to comply.

E. Timing Requirements

- E1. This Order expires two (2) years from the date of issuance.
 - E2. No in-water work shall occur between February 16 and July 31 of any year in which work is being conducted.
-

F. Reporting and Notification Requirement Conditions

- F1. Applicant shall provide notice to Ecology's 401/CZM Federal Project Manager:
- At least three (3) days prior to the start of each construction season.
 - Within 14 days after completion of construction for each season at the project site.

Notification, referencing Corps Reference #PM-ER-11-2, Order #8647 can take place by telephone to (425) 649-7129 or (425) 649-7000, fax to (425) 649-7098, or in writing.

- F2. If the project construction is not completed within 13 months of issuance of this Order, the Applicant shall submit per Condition A2 a written construction status report and submit status reports every 12 months until construction is complete.

YOUR RIGHT TO APPEAL

You have a right to appeal this Order to the Pollution Control Hearing Board (PCHB) within 30 days of the date of receipt of this Order. The appeal process is governed by Chapter 43.21B RCW and Chapter 371-08 WAC. "Date of receipt" is defined in RCW 43.21B.001(2).

To appeal you must do the following within 30 days of the date of receipt of this Order:

- File your appeal and a copy of this Order with the PCHB (see addresses below). Filing means actual receipt by the PCHB during regular business hours.
- Serve a copy of your appeal and this Order on Ecology in paper form - by mail or in person. (See addresses below.) E-mail is not accepted.

You must also comply with other applicable requirements in Chapter 43.21B RCW and Chapter 371-08 WAC.

ADDRESS AND LOCATION INFORMATION

Street Addresses	Mailing Addresses
Department of Ecology Attn: Appeals Processing Desk 300 Desmond Drive SE Lacey, WA 98503	Department of Ecology Attn: Appeals Processing Desk PO Box 47608 Olympia, WA 98504-7608
Pollution Control Hearings Board 1111 Israel Rd SW STE 301 Tumwater, WA 98501	Pollution Control Hearings Board PO Box 40903 Olympia, WA 98504-0903

CONTACT INFORMATION

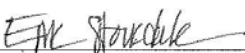
Please direct all questions about this Order to:

Rebekah Padgett
Department of Ecology
Northwest Regional Office
3190 160th Avenue SE
Bellevue, WA 98008
(425) 649-7129
Rebekah.Padgett@ecy.wa.gov

MORE INFORMATION

Pollution Control Hearings Board Website
www.eho.wa.gov/Boards_PCHB.aspx
Chapter 43.21B RCW - Environmental Hearings Office -- Pollution Control Hearings Board
<http://apps.leg.wa.gov/RCW/default.aspx?cite=43.21B>
Chapter 371-08 WAC -- Practice And Procedure
<http://apps.leg.wa.gov/WAC/default.aspx?cite=371-08>
Chapter 90.48 RCW -- Water Pollution Control
<http://apps.leg.wa.gov/RCW/default.aspx?cite=90.48>
Chapter 173-204 WAC -- Sediment Management Standards
www.ecy.wa.gov/biblio/wac173204.html
Chapter 173-200 WAC -- Water Quality Standards for Ground Waters of the State of Washington
www.ecy.wa.gov/biblio/wac173200.html
Chapter 173-201A WAC -- Water Quality Standards for Surface Waters of the State of Washington
www.ecy.wa.gov/biblio/wac173201A.html

SIGNATURE



Erik Stockdale, Unit Supervisor
Wetlands/401 Unit
Shorelands and Environmental Assistance Program
Northwest Regional Office

August 18, 2011

ATTACHMENT A

**U.S. ARMY CORPS OF ENGINEERS SEATTLE DISTRICT
LAKE WASHINGTON SHIP CANAL MONOLITH
EROSION AND SCOUR REPAIR PROJECT
Water Quality Certification Order #8647**

**Statement of Understanding of
Water Quality Certification Conditions**

I have read and understand the conditions of Order #8647 Section 401 Water Quality Certification for the U.S. Army Corps of Engineers Seattle District Lake Washington Ship Canal Monolith Erosion and Scour Repair Project. I have also read and understand all permits, plans, documents, and approvals associated with the project referenced in this Order.

Signature

Date

Title

Company



STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

Northwest Regional Office • 3190 160th Avenue SE • Bellevue, Washington 98008-5452 • (425) 649-7000

August 18, 2011

Amanda Ogden
U.S. Army Corps of Engineers Seattle District
PO Box 3755
Seattle, WA 98124

RE: **Coastal Zone Consistency for Corps Reference #PM-ER-11-2**
Lake Washington Ship Canal Monolith Erosion and Scour Repair Project, Seattle,
King County, Washington

Dear Mr. Ebel:

On June 24, 2011, U.S. Army Corps of Engineers, Seattle District (Corps) submitted a Certification of Consistency with the Washington State Coastal Zone Management Program (CZMP). Pursuant to Section 307(c)(3) of the Coastal Zone Management Act of 1972 as amended, Ecology concurs with the Corps' determination that the proposed work is consistent with Washington's CZMP.

If you have any questions regarding Ecology's consistency determination please contact Rebekah Padgett at (425) 649-7129.

YOUR RIGHT TO APPEAL

You have a right to appeal this Order to the Pollution Control Hearing Board (PCHB) within 30 days of the date of receipt of this Order. The appeal process is governed by Chapter 43.21B RCW and Chapter 371-08 WAC. "Date of receipt" is defined in RCW 43.21B.001(2).

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Amanda Ogden
August 18, 2011
Page 2 of 3

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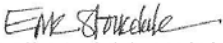
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<http://apps.leg.wa.gov/RCW/default.aspx?cite=43.21B>
Chapter 371-08 WAC - Practice And Procedure
<http://apps.leg.wa.gov/WAC/default.aspx?cite=371-08>

Sincerely,


Erik Stockdale, Unit Supervisor
Northwest Regional Office
Shorelands and Environmental Assistance Program

ES:rrp:cja

By certified mail: 7011 0470 0003 3720 8940

Amanda Ogden
August 18, 2011
Page 3 of 3

cc: Laura Arber, Washington Department of Fish and Wildlife
Cindy Rathbone, Washington Department of Natural Resources
Ben Perkowski, City of Seattle
William Vogel, US Fish and Wildlife Service
Sean Callahan, NOAA Fisheries

e-cc: Joe Burcar – NWRO
Loree' Randall – HQ
Raman Iyer – NWRO
ecyrefedpermits@ecy.wa.gov
