

LWSC DIFFUSER WELL PROJECT

ENVIRONMENTAL ASSESSMENT

King County, Washington

March 2008

1.0 Introduction

In accordance with the National Environmental Policy Act (NEPA), this environmental assessment (EA) examines the potential impacts of the proposed installation of a fish exclusion device on the salt water drain intake at the Locks.

The Seattle District U.S. Army Corps of Engineers (Corps) is proposing to install a fish exclusion structure adjacent to the existing upstream intake of the saltwater drain system and to automate the outlet of the saltwater drain system at the Hiram M. Chittenden Locks (Locks) on the Lake Washington Ship Canal (LWSC), in the City of Seattle, King County Washington. The Corps is proposing this project to improve adult fish passage conditions at the LWSC. This exclusion device will prevent salmon from being entrained in the system. The saltwater drain system is designed to manage saltwater intrusion above the Locks in the LWSC and also provides water for fish ladder operations. Currently, the system intake is not screened, which allows fish to enter the salt water drain system. Once they enter, they become trapped at the diffuser well. The diffuser well disperses the water flow throughout the fish ladder but precludes fish from exiting. In recent years, the Corps has attempted to rescue these trapped fish, but these rescue efforts are minimally effective and a large proportion of fish trapped in the diffuser well have died prior to or during rescue attempts.

Fish can also enter the saltwater drain system from the downstream outlet of the saltwater drain if the drain is operated at high tidal elevations. The saltwater drain outlet discharges over the spillway at tide elevation 10 feet. Adult salmon may access the saltwater drain system through outlet if the saltwater drain outlet is used during mid - or high - tides. For this reason, operation of the saltwater drain outlet is limited to use during tides less than tide elevation +6.5 feet. Operation of the saltwater drain outlet is conducted manually by Locks operations staff in coordination with Seattle District Water Management section. The change in operation relies on manual opening and closing of the outlet by the lock - wall attendants. While operating at low tide, adult salmon access to the saltwater drain is unlikely.

Both the screen and automation of the outlet are being proposed because we are confident listed species are entering the saltwater drain system from both entrances, however, we do not know which is the predominate point of entry. Therefore, to address the concern with "take" and United States Fish and Wildlife Service BiOp Reasonable and Prudent Measure (RPM) #2 "to minimize take associated with the saltwater drain system," both actions are being proposed.

2.0 Project Purpose and Need

The purpose of the proposed project is to prevent salmon from being entrained in the Locks saltwater drain system. This project is needed to prevent adult salmon from injury and mortality, including ESA listed species, resulting from entrainment in the saltwater drain system.

3.0 Project Authority

The Rivers and Harbors Act of June 25, 1910 granted the original authorities for the double-lock dam and accessory works. The Seattle District, U.S. Army Corps of Engineers (Corps) administers the on-going operations and maintenance authorities of the Locks.

4.0 Alternatives Considered

4.1 No Action

NEPA requires that EAs include an analysis of the “no action” alternative, against which the effects of “action” alternative(s) can be compared and evaluated. Under the No Action Alternative, the Corps would continue to operate the Locks with no alterations to the current operating conditions; no fish exclusion devices would be installed on the saltwater drain system, the outlet would not be automated and no additional effort would be made to exclude fish from the saltwater drain system.

The no-action alternative does not meet the project purpose and need. Without installing the fish exclusion device and automating the drain, fish will be able to access the saltwater drain system where they can be entrained and injured or killed.

4.2 Preferred Alternative

The Corps proposes to install an intake structure to prevent adult salmon from entering the saltwater drain system at the Locks. The existing intake is approximately 4 feet tall and 48 feet wide drawing water in on the vertical face. This intake is located at 50 feet of depth in mid-channel of the LWSC. The barrier will be free standing and self supporting and placed immediately upstream of the existing intake. The structure will be constructed of a steel frame supporting smaller screening material. The screened portion of the structure will be constructed of round bars with $\frac{7}{8}$ -inch spacing per National Marine Fisheries Service (NMFS) screening criteria. This spacing will prevent adult salmon from entering the intake and also discourage smaller juvenile salmon from entering water intakes. Although smaller fish including most salmon smolts will still be able to pass through the structure and the saltwater drain system as they currently do, the saltwater drain intake is at 50 feet of depth limiting use by surface oriented juvenile salmon. The preferred passage route for juvenile salmon at the Locks is through the 4 surface collection flumes which pass the majority of the fish through the project. The structure will be in place to exclude adult salmon from entering the saltwater drain from June 1 through September 30 annually.

In addition, the preferred alternative will include automating the operation of the saltwater drain outlet. To reduce the potential for adult salmon entrainment, the drain outlet will no longer be able to be opened at tidal elevations above +6.5 feet

This project is intended to be a temporary measure to exclude adult salmon from entering the saltwater drain for the next 3 years while a long term solution is developed and implemented.

5.0 Existing Environment

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 U.S. Army Corps of Engineers (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 (2.7 m). One consequence of these changes has been the development of a highly altered ecosystem, particularly for anadromous fish such as salmon. Concurrently, an urban landscape surrounding the lake developed which 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, the locks and spillway span the Salmon Bay Waterway at its narrowest point, approximately 400 feet (122 m) across. The 8-mile-long (13-km) LWSC is located entirely within the Seattle City limits.

The saltwater drain is a deepwater, gravity-fed intake that permanently conveys an average of 200 cubic feet per second (cfs) to the Locks fish ladder as fish attraction water and an average of 150 cfs to the old saltwater drain back to the Puget Sound. The water collected at the saltwater drain intake has a range of approximately 3 to 16 parts per thousand (ppt) salinity.

Water is supplied to the fish ladder year round and water is passed through the old saltwater drain when salinity levels are approaching the 1 ppt standard at the University of Washington bridge. This typically occurs in mid to late summer when the numbers of lockings is highest allowing more salinity in the LWSC. At this time we have a decrease in inflows, and a tighter water budget due to managing for flumes, lake level, and fish ladder resulting in decreasing outflows through the project which allow the salt water wedge to advance.

The intake is from 47 feet (top) to 52 feet (bottom) below the water surface due east of the large lock piernose. Velocities at or near the drain intake are estimated from 0.5 to 1.0 feet per second (feet/sec), accelerating to 5 to 8 feet/sec within the return pipe.

None of the alternatives and associated actions is expected to affect regional or local climates, geography, geology, topography, vegetation, air quality and noise, utilities and public services, land use, recreation, hazardous, toxic, and radioactive waste in the LWSC nor would these resources rise to the level of needing analysis. Therefore, these resources are not addressed in the assessment of potential impacts of the alternatives.

5.1 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 serves as the control for 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 Locks operations. Lake Union is shallow (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 thicker, and intrudes further into the system during summer when inflow decreases and lock use to accommodate boat use increases. According to the Washington state surface water quality standards (173-201A-602(54)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 °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 determine the water quality immediately upstream of the Locks.

5.2 Navigation

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 20.00 feet and elevation 22.00 feet (Corps of Engineers datum).

5.3 Biological Resources

The Lake Washington Basin supports more than 50 freshwater, marine, and anadromous fish species (Table 7-2). 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. 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.

Six anadromous salmonid species pass through the Locks and Ship Canal: Chinook salmon, coho salmon, sockeye salmon, coastal cutthroat, steelhead, and bull trout. Within the Lake Washington system, there are three stocks of chinook salmon, including a native/wild stock in the Cedar River, a native/wild stock in the north Lake Washington tributaries, and a composite stock (partially sustained by production from the Issaquah hatchery utilizing Green River stock) in Issaquah Creek. Similarly, there are both natural and Issaquah hatchery stocks of coho salmon that spawn in the Cedar River, Bear Creek, Issaquah Creek, and other tributaries.

Sockeye salmon is the most abundant salmonid in the Lake Washington system. Three stocks of sockeye spawn in the Cedar River, Issaquah/Bear Creek, and on Lake Washington beaches. The sockeye salmon are a naturally reproducing population supplemented by the release of fry from a temporary hatchery at Landsburg Dam.

The Lake Washington Basin contains one stock of steelhead. Historically steelhead spawned in the Cedar River, Issaquah Creek, Bear Creek, and the Sammamish River. However, spawning fish have recently been found only in the Cedar River.

The LWSC supports a diverse and abundant array of wildlife species. The undisturbed vegetation of Discovery Park (within 300 ft [91 m] of the LWSC) 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.

5.4 Threatened and Endangered Species

The Reference Biological Assessment for the Continued Operation and Maintenance of the Lake Washington Ship Canal King County, Washington fully documents the presence of threatened and endangered species that may occur in the vicinity of the LWSC and all associated activities, and is hereby incorporated by reference. Listed fish species and their critical habitat present include Chinook, designated Chinook critical habitat, bull trout, designated bull trout critical habitat, and steelhead.

6.0 Environmental Consequences of Proposed Action

The effects of the proposed actions are compared against the baseline conditions associated with the no-action alternative. Unless otherwise indicated in the following discussion of environmental effects, the no-action alternative will not affect water quality, navigation, or biological resources at the project site.

6.1 Water Quality

No significant adverse impacts to water quality as a result of the project are expected. The structure will simply be lowered into place and held in place by gravity, no pilings or other structures that require disturbing the LWSC sediment will be necessary for installation

6.2 Navigation

Effects to navigation will be minor and temporary. The structure installation is scheduled to occur during the annual fish ladder closure period in the last week of May or the first week of June. During installation, small lock passage will likely be closed for 2 to 3 days to allow the structure to be installed. The intake structure will be installed in an area of sufficient depth providing well over the 30 feet of depth required for navigation. The intake structure will require weekly inspection and periodic cleaning by means of divers, which will result in temporary closures of both the small lock and the large lock. These closures will be necessary to provide safe working conditions for diving operations. It is anticipated that both the small lock and large lock will be closed for up to 4 hours per week from the period of June 1 through September 30 for the next 3 years. To the maximum extent possible, the Corps will schedule the closures to avoid periods of high boat usage of the locks. The Corps will provide prior notice to the public for closures of the lock chambers.

6.3 Biological Resources

Juvenile fish passage is not expected to be affected as the existing operations, including the use of the fish passage flumes will continue. Impacts to adult passage are anticipated to be temporary and minor as a result of weekly inspection and/or cleaning.

Currently, adult salmon, including ESA listed Chinook, can be entrained in the saltwater drain system where they subsequently die. Implementation of this project will exclude fish from entering the intake to the saltwater drain system improving overall passage conditions and survival of adult salmon.

Corps safety regulations require that the flow to the intake structure be stopped while divers are in the vicinity of the intake, with the consequence that attraction flows provided by the salt water drain system to the fish ladder will be stopped during cleaning. It is anticipated that the saltwater drain system will need to be shut down for a period of 1 to 4 hours for cleaning up to once per week during the adult migration. By shutting down the attraction flows, adult passage could be slightly delayed through the fish ladder on days that cleaning are required, however surface flow will be provided to maintain fish ladder operations. The Corps does not anticipate that the temporary delay in passage will have a significant effect to adult salmonid migration as previous studies demonstrate that adult Chinook salmon spend up to 40 days holding in the vicinity of the saltwater drain intake prior to successfully migrating through the LWSC to Lake Washington. Additionally, passage via the large lock chamber will still be available during cleaning periods.

6.3.1 Threatened and Endangered Species

The Reference Biological Assessment for the Continued Operation and Maintenance of the Lake Washington Ship Canal King County, Washington fully documents the effect to threatened and endangered species that may occur in the vicinity of the LWSC and all associated activities, and is hereby incorporated by reference. The Corps has received a Biological Opinion from the United States Fish and Wildlife Service (USFWS) and this Diffuser Well Project “to minimize take associated with the saltwater drain” is included as RPM #2, therefore no further Section 7 consultation is required with the USFWS. A draft Biological Opinion from the National Marine Fisheries Service (NMFS) for the LWSC has been received and this diffuser well project is included as an RPM in this document as well. The NMFS has assured the Corps that they will issue their final BiOp, completing Section 7 consultation with the NMFS, prior to project construction this spring.

7.0 Coordination

The Corps sent a Notice of Preparation (NoP) for this EA to interested parties and solicited comments to incorporate into the document. An electronic copy of the document is available under the project title “Lake Washington Ship Canal Diffuser Well Project” on the Seattle District Document Library at:

[Http://www.nws.usace.army.mil/PublicMenu/Menu.cfm?sitename=ERS&pagename=ERS_Home](http://www.nws.usace.army.mil/PublicMenu/Menu.cfm?sitename=ERS&pagename=ERS_Home)

The Corps provided copies of the NoP, in an electronic format, to the following organizations for review and comment:

U.S. Fish and Wildlife Service (USFWS)

National Marine Fisheries Service (NMFS)
 Environmental Protection Agency
 Washington State Department of Ecology
 Washington State Department of Fish and Wildlife
 Washington State Department of Natural Resources
 The Muckleshoot Tribe
 Suquamish Tribe
 Cedar River Anadromous Fish Committee

In addition, the Corps sent the NoP to selected interested parties based on their previous participation in meetings regarding the saltwater drain issues at the LWSC. The NoP was also distributed via the appropriate Seattle District Regulatory Branch electronic distribution lists.

The NoP was circulated for 15 days between February 1, 2008 and February 16, 2008. No comments were received.

Several meetings were held with NMFS fish passage engineers and biologists to discuss the project design, NMFS fish passage criteria, and ESA coordination. The project design and ESA issues were thoroughly coordinated with the USFWS as well. The Corps held meetings with the Cedar River Anadromous Fish Committee, and with the Muckleshoot Tribe to discuss the project design, project implementation, and other project related issues.

8.0 Environmental Compliance

Table 1. Summary of the environmental compliance for the proposed action.

LAWS AND REGULATIONS RELATING TO THE PROPOSED ALTERNATIVES	ISSUES ADDRESSED	CONSISTENCY OF PREFERRED ALTERNATIVE
National Environmental Policy Act (NEPA) 42 U.S.C. 4321 et seq.	Requires all federal agencies to consider the environmental effects of their actions and to seek to minimize negative impacts.	Consistent per FONSI and EA document.
Clean Water Act (CWA) 33 U.S.C. 1251 et seq.; Sections 401 and 404	Requires federal agencies to protect waters of the United States. Disallows the placement of dredged or fill material into waters (and excavation) unless it can be demonstrated that it is the least environmentally damaging practicable alternative (Section 404). Requires federal agencies to comply with state water quality standards (Section 401).	This action does not involve a discharge of dredged or fill material into waters of the United States. Section 404 analysis or Section 401 water quality certification is not required.
Clean Air Act, 42 USC 7401 et seq.	Requires 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.	Consistent -The area is in attainment or is unclassified for all pollutants. Emissions of pollutants from the limited equipment used will be negligible.

LAWS AND REGULATIONS RELATING TO THE PROPOSED ALTERNATIVES	ISSUES ADDRESSED	CONSISTENCY OF PREFERRED ALTERNATIVE
Endangered Species Act 16 U.S.C. 1531 et seq.;	Requires federal agencies to protect listed species and consult with US Fish & Wildlife or NOAA Fisheries regarding the proposed action.	The Corps has fully coordinated this action and has received a biological opinion for this action. No further consultation is necessary.
Magnuson Fishery Conservation and Management Act	Requires Federal agencies to consult with the National Marine Fisheries Service (NMFS) regarding actions that may adversely affect Essential Fish Habitat (EFH) for Pacific coast groundfish, coastal pelagic species, and Pacific salmon.	The Corps has consulted with NMFS on EFH and received a draft reply. NMFS expects to finalize their reply prior to construction. The proposed work is consistent with this consultation.
National Historic Preservation Act 16 U.S.C. 461;	Requires federal agencies to identify and protect cultural and historic resources.	Consistent – The Corps prepared a memorandum for record that determined that the proposed action has no potential to cause effects to historic properties. No further action is necessary.
Coastal Zone Management Act (CZMA), 16 USC 1451 et seq.	Compliance with CZMA for protection of the coastal zone with concurrence of consistency with the state CZM plan from the state.	Consistent – The project is consistent with the local shorelines management plan and Washington has concurred that the project is consistent with the state CZM plan per the terms and conditions of a Nationwide Permit #7.
Executive Order 12898: Environmental Justice	Requires federal agencies to consider and address environmental justice by identifying and assessing whether agency actions may have disproportionately high and adverse human health or environmental effects on minority or low-income populations.	Consistent due to lack of adverse human health or environmental effects on minority or low-income populations in local area.

9.0 References

Hansen, L., T. Georgianna, D. Houck, J. Frodge. 1994. Lake Union data compilation and review. King County Department of Metropolitan Services. Seattle, WA.

U.S. Army Corps of Engineers (Corps). 2001. Continued Operation and Maintenance of the Lake Washington Ship Canal. Reference Biological Assessment. Seattle District, Seattle, WA.

APPENDIX A

Project Location Figures and Drawings

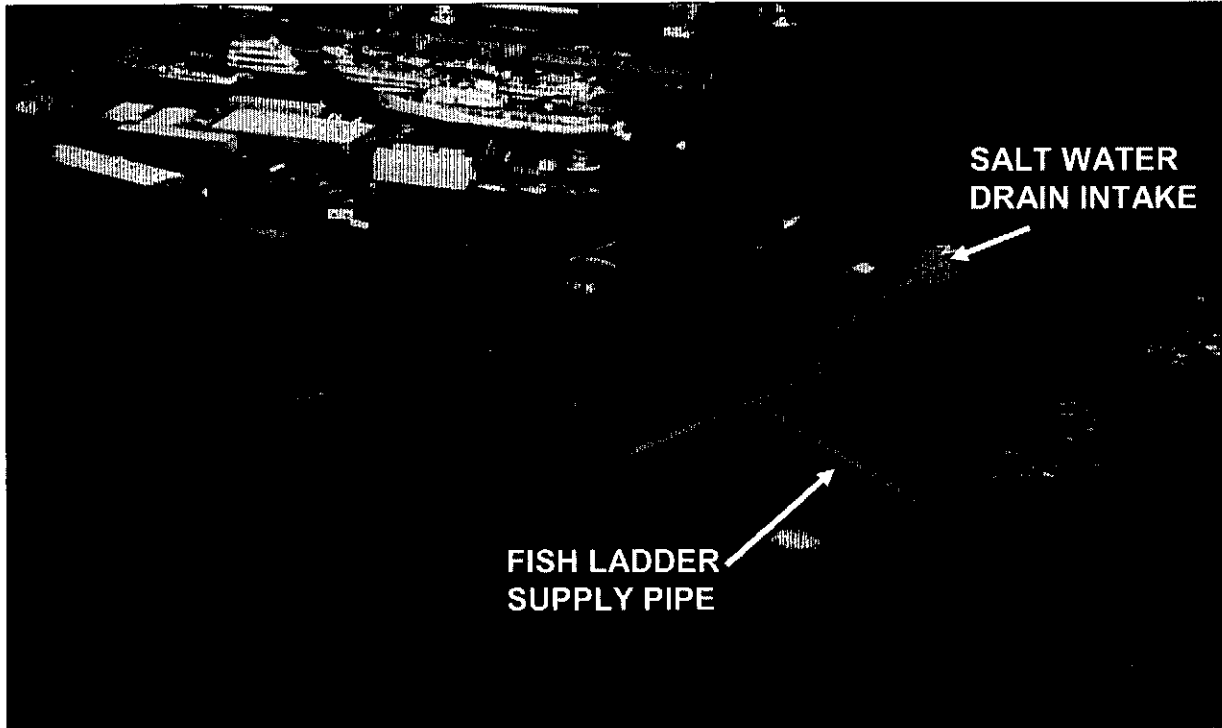


Figure 1. Project Location

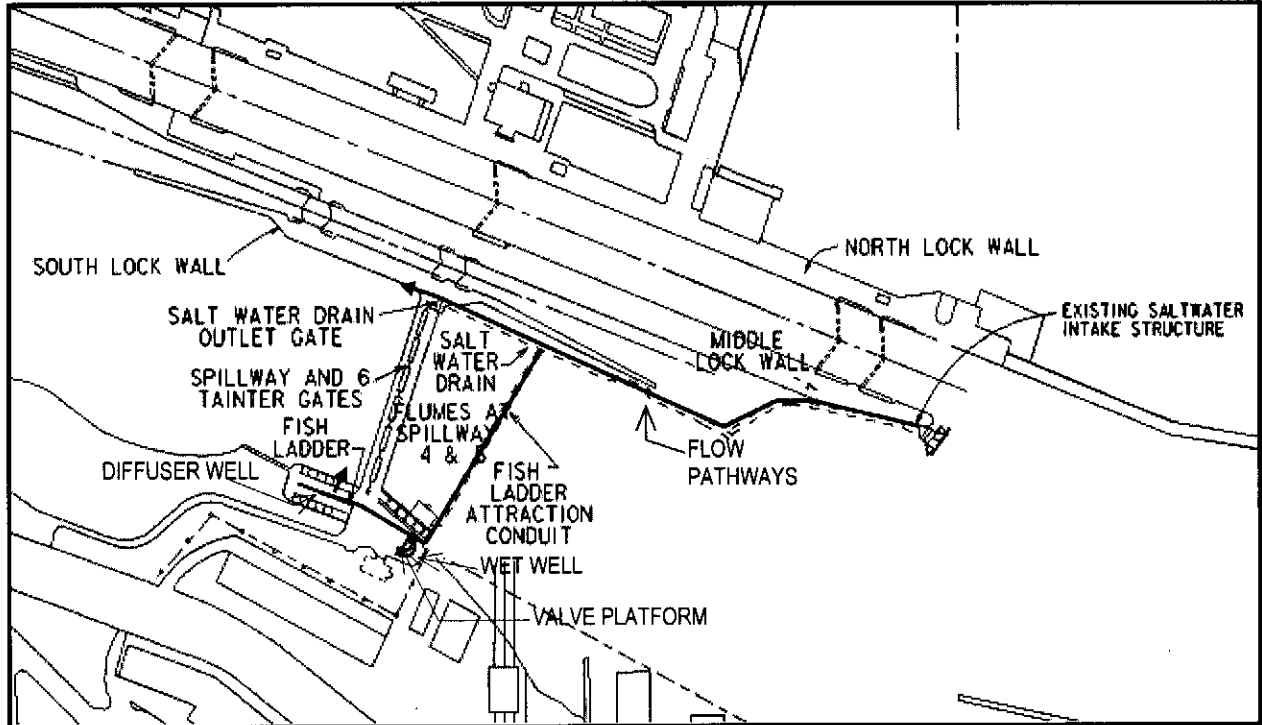


Figure 2. Project Area

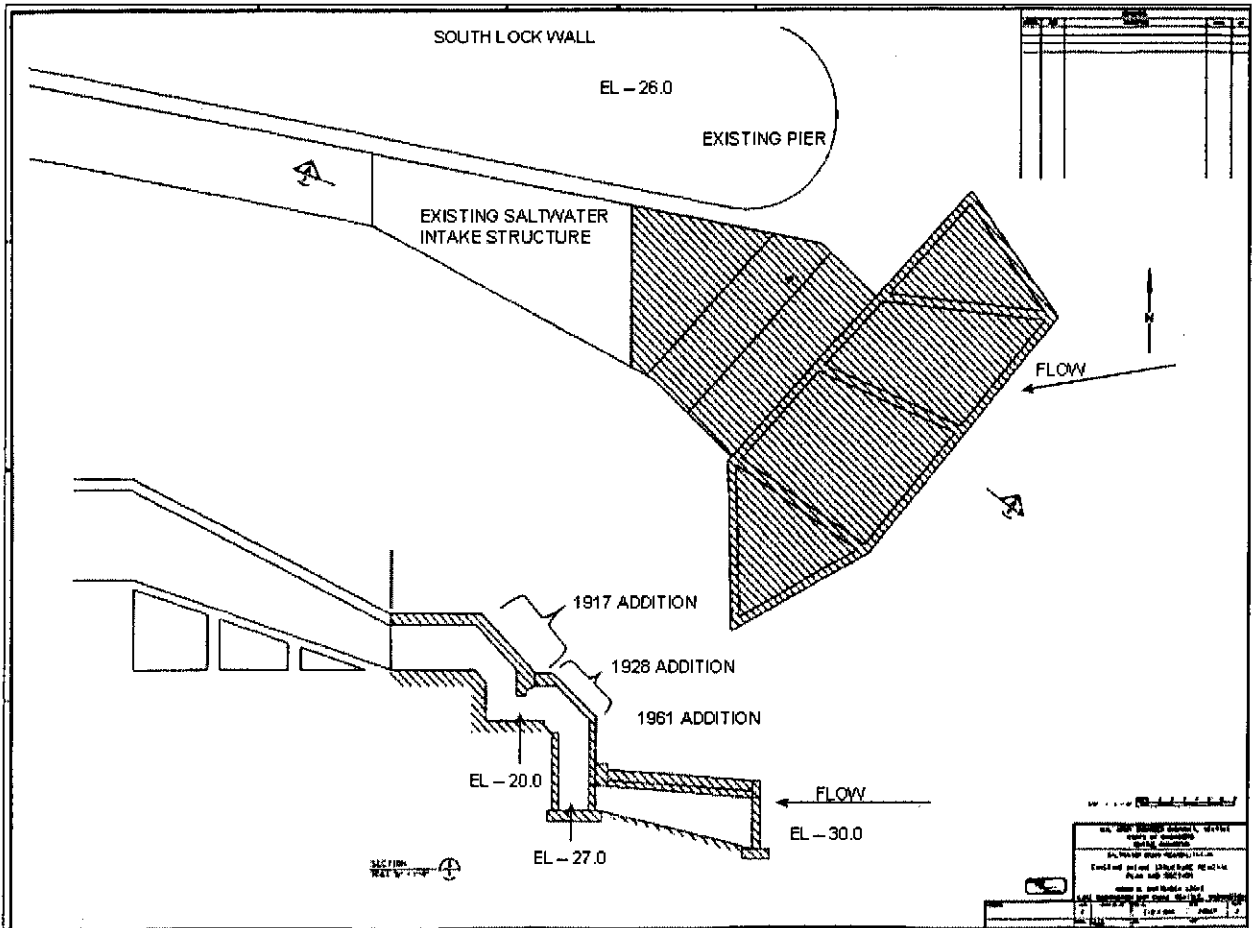


Figure 3. Existing Intake

cc with encl:
PM-PL-ER (Ebel)

EBEL/PM-PL-ER *JE 2/28/08*

LEWIS/PM-PL-ER *JE 3/4/08*

KENT/PM-PL-ER *RJK 3-7-08*

THOMASON/PM-PL *MM 3/19/08*

~~WAGNER/OD~~ *3-19-08*

NELSON/OC *MA*

~~SWANSON/PM~~ *3-24-08*

for ~~CADICAMO/DDC~~ *3-24-08*

~~MCCORMICK/DC/s~~ *MM 3/26/08*

EBEL/PM-PL-ER
(3626)

PM-PL-ER FILE

