# BIOLOGICAL ASSESSMENT REFERENCE

# WASHINGTON STATE FERRIES CAPITAL, REPAIR, AND MAINTENANCE PROJECTS

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| | |
|---|---|
| ACZA | ammoniacal copper zinc arsenate |
| ADA | Americans with Disabilities Act |
| AWPA | American Wood Preservers' Association |
| BA | Biological Assessment |
| BMP | best management practice |
| BO | Biological Opinion |
| CFS | cubic feet per second |
| Corps | U.S. Army Corps of Engineers |
| CDF | Cumulative Density Function |
| CFR | Code of Federal Regulations |
| CSL | Cleanup Screening Level |
| CSO | combined sewer outfall |
| CWT | coded wire tag |
| dB | decibel |
| dBA | weighted in-air noise rating for human receptors, decibels |
| $dB_{PEAK}$ | peak pressure, instantaneous maximum or minimum overpressure observed during each impact pulse, decibels |
| $dB_{RMS}$ | RMS (root mean square), square root of energy divided by impulse duration, decibels |
| DBT | dibutyltin |
| DIDSON | Dual-frequency Identification Sonar |
| DO | dissolved oxygen |
| DPS | distinct population segment |
| Ecology | Washington State Department of Ecology |
| EFH | Essential Fish Habitat |
| EPA | U.S. Environmental Protection Agency |
| ESA | Endangered Species Act |
| ESU | Evolutionary Significant Unit |
| FHWA | Federal Highway Administration |
| FMO | foraging, migration, and overwintering |
| FTA | Federal Transit Administration |
| HPA | Hydraulic Project Approval |
| HPAH | high-molecular-weight polycyclic aromatic hydrocarbon |

| | |
|---|---|
| H:V | horizontal to vertical |
| kHz | kilohertz |
| $LC_{50}$ | 96-hour median lethal concentration |
| LID | Low Impact Development |
| LPAH | low-molecular-weight polycyclic aromatic hydrocarbon |
| LTAA | Likely to Adversely Affect |
| mg/kg | milligrams per kilogram |
| mg/L | milligrams per liter |
| MHHW | mean higher high water |
| MLLW | mean lower low water |
| MM | minimization measure |
| mm | millimeter |
| MMPA | Marine Mammal Protection Act |
| mph | miles per hour |
| MRC | Marine Resource Consultants |
| NLTAA | Not Likely to Adversely Affect |
| NMFS | National Marine Fisheries Service |
| NOAA | National Oceanic and Atmospheric Administration |
| NPDES | National Pollutant Discharge Elimination System |
| NTU | nephelometric turbidity unit |
| OHW | Ordinary High Water |
| PAH | polycyclic aromatic hydrocarbon |
| PAR | photosynthetically active radiation |
| PBB | polybrominated diphenyl biphenyl |
| PBDE | polybrominated diphenyl ether |
| PCB | polychlorinated biphenol |
| PCE | Primary Constituent Element |
| PCP | polychlorinated paraffins |
| PCN | polychlorinated naphthalenes |
| PCT | polychlorinated terphenyl |
| PEM | palustrine emergent |
| PFO | perfluro-octane sulfonate |
| PHS | Priority Habitats and Species |

| | |
|---|---|
| PNNL | Pacific Northwest National Laboratory |
| POF | palustrine forested |
| POW | palustrine open water |
| ppb | parts per billion |
| PSAMP | Puget Sound Ambient Monitoring Program |
| PSDDA | Puget Sound Dredged Disposal Analysis |
| PSLM | Practical Spreading Loss Model |
| PSS | palustrine scrub shrub |
| PSU | Primary Sampling Units |
| RCW | Regional Code of Washington |
| RMS | Root Mean Square |
| SEL | Sound Exposure Level |
| SMS | Sediment Management Standards |
| SPCC | Spill Prevention, Control, and Countermeasures |
| SPL | sound pressure level |
| SQS | Sediment Quality Standards |
| SR | State Route |
| SSDP | Shoreline Substantial Development Permit |
| TBT | tributyltin |
| TNAP | Temporary Noise Attenuation Pile |
| TSS | total suspended solids |
| µg/L | micrograms per liter |
| µg/kg | micrograms per kilogram |
| µPa | micropascal |
| UHMW | Ultra-high molecular weight |
| USFS | U.S. Forest Service |
| USFWS | U.S. Fish and Wildlife Service |
| WAC | Washington Administrative Code |
| WDFW | Washington Department of Fish and Wildlife |
| WQC | Water Quality Criteria |
| WSDOT | Washington State Department of Transportation |
| WSF | Washington State Ferries |

# EXECUTIVE SUMMARY

The purpose of this Biological Assessment Reference (BAR) is to streamline preparation of BAs in support of Washington State Ferries' (WSF's) capital and preservation (i.e., maintenance and repair) programs. It describes common terms used in the WSF system, the most commonly used construction methods and potential effects on listed species from those methods. It also identifies baseline conditions and species distributions at each WSF facility. This document provides background to be used on project-specific or programmatic consultations. To initiate Endangered Species Act (ESA) consultation, WSF will submit a *WSF Capital, Repair, and Maintenance Projects BAR Project Form* (Project Form) (Appendix A) to the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) that contains specific information needed to complete ESA consultations for each project.

The BAR has been written to comply with the Federal Highway Administration (FHWA), U.S. Army Corps of Engineers (Corps), and WSF standards. Both the USFWS and NMFS have been provided a copy of this document for their use during ESA consultations on WSF projects.

The benefits of this BAR include reducing the amount of redundant or standard written material generated for the ESA consultation process, reducing the time and costs associated with producing individual stand-alone BAs for each project, and reducing the amount of paperwork reviewed by the federal action agency, USFWS and NMFS, allowing each agency to focus on project-specific information.

## 1 INTRODUCTION

The Washington State Department of Transportation (WSDOT) Washington State Ferry (WSF) system operates and maintains 19 ferry terminals and one maintenance facility; all of which are located in either Puget Sound or the San Juan Islands. WSF sails to a 20th terminal in Sidney, British Columbia (BC), that is operated by BC Ferries. Since its creation in 1951, WSF has become the largest ferry system in the United States, operating 23 vessels on 10 routes with over 500 sailings each day. Over 24 million passengers ride WSF ferries each year. Approximately 10 million of these are car/driver passengers and over 14 million are walk-on passengers. Figure 1-1 shows the WSF routes.


**Figure 1-1**
**WSF Routes**

Ridership of WSF ferries has grown 22 percent over the last decade and is projected to grow more than 30 percent by 2040. By 2040, WSF anticipates it will spend approximately $1.8 billion to preserve WSF terminals, and its capital/terminal improvement program will spend over $700 million, which will include major construction at the Seattle and Fauntleroy terminals. Regular, reliable and safe service on WSF routes depends on adequate preservation of the existing terminals and terminal improvements. Table 1.1 shows the 2017 annual ridership by route for each terminal.

**Table 1-1**
**Annual Ridership by Route**

| Route | Annual Ridership (millions) (2020) |
|---|---|
| Seattle/Bainbridge | 2.6 |
| Seattle/Bremerton | 0.9 |
| Fauntleroy/Vashon/Southworth | 1.9 |
| Tahlequah/Point Defiance | 0.7 |
| Edmonds/Kingston | 2.9 |
| Mukilteo/Clinton | 3.1 |
| Port Townsend/Coupeville | 0.5 |
| Anacortes/San Juans* | 1.4 |

*includes all Anacortes/San Juan routes and inter-island routes

## 1.1 The ESA Consultation Process

Section 7(a)(1) of the Endangered Species Act (ESA) of 1973, as amended, (16 U.S.C. 1531 et seq.) requires federal agencies to protect endangered and threatened species. Section 7(a) (2) requires federal action agencies to conduct ESA consultations to ensure that any action authorized, funded, or carried out by a federal agency will not jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitats.

Nearly all WSF projects have a federal nexus resulting from either receipt of federal money from the Federal Highway Administration (FHWA) or the Federal Transit Administration (FTA), or through issuance of a federal permit from the U.S. Army Corps of Engineers (Corps) or other federal agency. The lead federal agency, either through funding or issuing a permit for a project, is referred to as the federal action agency.

The federal action agency may initiate either formal or informal consultation with the National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service (USFWS), collectively called the "Services." The Corps and FHWA have granted WSDOT nonfederal designee status, which allows WSDOT to initiate informal consultation directly with the Services. The lead federal agency is responsible for initiating ESA consultation with the Services for formal consultations. Formal consultations are those where an analysis of the project determines that the project is Likely to Adversely Affect (LTAA) a listed species. Informal consultations are those where an analysis determines the project is Not Likely to Adversely Affect (NLTAA) listed species.

For species that are proposed for ESA listing, formal ESA conferencing is required for federal actions likely to jeopardize the continued existence of proposed species or adversely modify proposed critical habitat. The lead federal agency may request a formal conference for a project that warrants a conditional effects determination of LTAA for proposed species or critical habitat. WSF or the lead federal agency may request informal conference for projects when a species listing is imminent and the effects analysis concludes that a provisional NLTAA is appropriate. This Biological Assessment Reference (BAR) will be updated with information on species that are listed or proposed for listing, critical habitat that is designated or proposed for designation, baseline conditions, and effects analysis on an annual basis, as individual projects go through consultation, or as species and critical habitat listings change.

## 1.2 Essential Fish Habitat

The Magnuson-Stevens Act, as amended by the Sustainable Fisheries Act of 1996, requires that federal agencies consult with NMFS on activities that may adversely affect Essential Fish Habitat (EFH). This BAR includes a discussion of EFH in the project areas for each facility including groundfish, coastal pelagic, and salmon species. The analysis includes avoidance and minimization measures (MMs) that are generally incorporated into WSF project design and construction.

## 1.3 Biological Assessment Reference

### 1.3.1 Purpose

In the last decade of ESA consultations, WSF has submitted dozens of BAs that contain nearly identical information and analysis of WSF projects. Regardless of the size of the project, in-water construction methods are similar among most marine construction projects, and include activities such as pile driving, pile removal, and building of facility components such as wingwalls and dolphins.

The purpose of this BAR is to streamline the preparation of BAs in support of WSF's capital and preservation programs. It describes common terms used in the WSF system, the most commonly used construction methods, and potential effects on listed species from those methods. It also provides baseline conditions at each facility. For individual projects, WSF will submit a WSF Capital, Repair, and Maintenance Projects BAR Project Form (Project Form) that contains specific information needed to complete ESA consultation for that project (see Appendix A).

The benefits of this BAR include reducing the amount of written material generated for the ESA consultation process, reducing the time and costs associated with producing individual BAs for each project, and reducing the amount of paperwork reviewed by the federal action agency and the Services.

### 1.3.2 Contents

Chapters in this BAR are summarized below:

- Chapter 2 includes a detailed discussion of standard WSF marine construction methods and the MMs employed to protect water quality and marine life.
- Chapter 3 details potential effects to listed threatened and endangered species and critical habitats from various construction activities (such as turbidity and noise).
- Chapter 4 provides current environmental baseline information specific to each WSF location including chemical, physical, and biological indicators and also provides the distribution of ESA-listed species and critical habitat.
- Chapter 5 contains references for this BAR.

- Appendix A is a blank Project Form that will be submitted for individual projects.
- Appendix B provides a discussion of ESA-listed species biology.
- Appendix C describes EFH that occurs at WSF facilities.

A typical project-level WSF BA contains the following information based on the proposed action:

- Project description and schedule
- Construction methods and MMs
- Action area
- Environmental baseline in the action area
- Species occurrence and distribution in the action area
- Effects of project construction on species and critical habitat including direct and indirect effects
- Effects determinations
- Discussion of interrelated/interdependent actions
- Cumulative effects (if formal consultation)
- EFH effects analysis

Table 1-2 compares the contents of a typical project-level WSF BA, the information included in this BAR, and the contents of the Project Form that will be provided to the lead federal agency or the Services for each project.

**Table 1-2**
**Comparison of Information in the BAR**

| Typical Project-level WSF BA Contents | BAR Contents | Project Form Contents |
|---|---|---|
| Project description and schedule | | X |
| Construction methods and MMs | X | |
| Action area | | X |
| Environmental baseline | X | X[1] |
| Species occurrence and distribution in the action area | X | |
| Effects of project construction on species and critical habitat | X | |
| Effects determinations | | X |
| Interrelated/interdependent actions | | X |
| Cumulative effects (if formal consultation) | | X |
| Species lists | | X |
| EFH Effects Analysis | | X |

1 The baseline information in the BAR covers only the immediate terminal areas and therefore may need to be expanded on the project form depending on the extent of the action area

### 1.3.3 ESA-Listed Species Included in this Analysis

NMFS and USFWS species lists were reviewed to identify ESA-listed species that may occur near WSF facilities. In this review, it was determined that the presence of terrestrial species, insects, and certain other listed species in the action areas is extremely unlikely; therefore, they are not further addressed in the BAR.

Species addressed in the BAR are listed in Table 1-3, and further described in Chapter 4. WSF will update and modify (if necessary) the species list, as individual projects go through consultation, or as species listings change. These species include fish, bird, and marine mammal species that could occur in the action areas during construction. The presence (or lack of presence) of each list species is discussed in the terminal specific sections of the BAR.

**Table 1-3**
**ESA-listed Species/Critical Habitat Addressed in the BAR**

| Species/Habitat | Status | Agency |
|---|---|---|
| Killer whale (*Orcinus orca*) | Endangered (Southern Resident DPS) | NMFS |
| Killer whale critical habitat | Designated (Southern Resident DPS) | NMFS |
| Humpback whale *(Megaptera novaeangliae*) | Endangered | NMFS |
| Puget Sound Chinook salmon (*Oncorhynchus tshawytscha*) | Threatened (Puget Sound ESU) | NMFS |
| Puget Sound Chinook salmon critical habitat | Designated (Puget Sound ESU) | NMFS |
| Hood Canal summer chum salmon[1] *(O. keta)* | Threatened (Hood Canal ESU) | NMFS |
| Hood Canal summer chum salmon critical habitat[1] | Designated (Hood Canal ESU) | NMFS |
| Steelhead *(O. mykiss)* | Threatened (Puget Sound DPS) | NMFS |
| Steelhead critical habitat[2] | Designated (Puget Sound DPS) | NMFS |
| Bocaccio (*Sebastes paucispinis*) | Endangered (Georgia Basin DPS) | NMFS |
| Yelloweye rockfish (*Sebastes ruberrimus*) | Threatened (Georgia Basin DPS) | NMFS |
| Rockfish critical habitat | Designated (Georgia Basin DPS) | NMFS |
| North American green sturgeon (*Acipenser medirostris*) | Threatened (Southern DPS) | NMFS |
| North American green sturgeon critical habitat[2] | Designated (Southern DPS) | NMFS |
| Pacific eulachon (*Thaleichthys pacificus*) | Threatened (Southern DPS) | NMFS |
| Pacific eulachon critical habitat[2] | Designated (Southern DPS) | NMFS |
| Marbled murrelet *(Brachyramphus marmoratus)* | Threatened | USFWS |
| Marbled murrelet critical habitat[2] | Designated[1] | USFWS |
| Bull trout *(Salvelinus confluentus)* | Threatened (Coastal-Puget Sound DPS) | USFWS |
| Bull trout critical habitat[3] | Designated (Coastal-Puget Sound DPS) | USFWS |

**Notes:**
ESU - Evolutionary Significant Unit
DPS - Distinct Population Segment
[1]Port Townsend terminal only
[2]Not present at any WSF terminal/facility
[3]Clinton, Mukilteo, Edmonds, Seattle, Fauntleroy and Point Defiance terminals only

### *1.3.4 Biological Assessment Reference Development History*

The concept of a BAR was developed in coordination with the USFWS, NMFS, FHWA, and the Corps. WSF initially presented the BAR concept at the June 23, 2008, pre-BA meeting in Lacey, Washington, to the Services and FHWA. A draft final revision of the June 2009 BAR was presented at the July 21, 2011, pre-BA meeting. The BAR was revised in 2012, 2014, 2019 and 2022.

## 1.4 Use of the Biological Assessment Reference

For individual WSF projects, WSF will submit a Project Form to the lead federal agency (if formal) or directly to the Services (if nonfederal designee status applies) to initiate the ESA consultation process. The Project Form (included in Appendix A) will include the following additional information, which is described in further detail below:

1. Project description and schedule
2. Project action area
3. Updated species or habitat information
4. Current species list
5. Effects determinations for species and critical habitat
6. EFH effects analysis

### *1.4.1 Project Description and Schedule*

The project description will include an overview of the proposed project, schedule, and any proposed offsetting measures. The project description will provide a detailed discussion of all proposed project activities and will rely on this BAR to provide specific detailed construction methods such as pile driving and building typical WSF structures. The discussion will contain project-specific information including, but not limited to:

- Location and size of project structures including number and diameter of piles to be installed and removed, type of piles/materials to be used, construction equipment needed, and any necessary temporary structures.

- Proposed upland work including a description of new impervious surfaces, proposed stormwater treatment, and a stormwater analysis based on the most recent WSDOT/FHWA interim stormwater guidance or latest agreed-upon stormwater guidance.
- Construction schedule and project timing.
- Unusual construction techniques not discussed in the BAR and any associated MMs.
- Project drawings and photos (if available).

### 1.4.2 Project Action Area

The project action area will be based on specific construction activities. In the case of in-water work, the action area will likely be based on noise generated by pile installation, but could be based on other construction activities that generate turbidity or other disturbance of aquatic or terrestrial species.

### 1.4.3 Environmental Baseline

WSF will review the environmental baseline information provided in the BAR and expand it if necessary based on the extent of the action area for individual projects.

### 1.4.4 Updates to Species or Habitat Information

WSF will review Washington Department of Fish and Wildlife (WDFW) Priority Habitats and Species (PHS) maps, and consult with resource agencies and/or tribal biologists to identify whether new information on listed species is available. Any new species information will be included in the Project Form and added to the BAR during revision cycles.

### 1.4.5 Effects Determinations for Species and Critical Habitat

An effects determination for listed or proposed species will be included. Direct and indirect effects such as noise and turbidity are described in this BAR and will be identified on the Project Form. Interrelated and interdependent actions and cumulative effects (if formal) will be described in the Project Form. This section will also identify whether informal or formal consultation and/or conferencing is being requested.

#### 1.4.6 EFH Effects Analysis

A brief analysis of effects to EFH will be included, which will identify EFH in the action area, effects, and any MMs not described in this BAR.

### 1.5 Maintaining the Biological Assessment Reference

The 2019 version of the BAR will be an on-line document, available at the WSDOT ESO web page. This will allow the BAR to be a "living document" that will be revised as new information becomes available. Updates to the document will be necessary when, for example, new information becomes available for each terminal, construction methodologies change, the species listing statuses change, or critical habitat designations change. (listings, de-listings, new critical habitat designations). WSF will consult with WDFW or other resource agencies and/or tribes during preparation of individual Project Forms to ensure that the most current information is provided to the Services.

# 2 CONSTRUCTION METHODS AND MINIMIZATION MEASURES

This section describes types of marine demolition, installation, and reconstruction methods, followed by a description of WSF structures, their functions, repair requirements, and MMs common to these construction methods. The figures presented in this chapter do not represent a specific terminal; rather, they are representations of typical WSF structures.

## 2.1 Construction Practices and Descriptions

### *2.1.1 Pile Removal, Repair, and Installation*

Most ferry structures are pile-supported, including dolphins, wingwalls, towers, bridge seats, and trestles. Therefore, repair or replacement of these structures typically involves removal of timber and steel pilings, installation of steel or concrete pilings, or repair of existing timber or steel piles.

Sections 2.1.1.1 through 2.1.1.8 describe the construction methods used for pile removal and installation, pile materials, rock anchors, micropiles, drilled shafts, and pile repair for pile-supported structures. Three methods of pile removal are described: vibratory extraction, direct pull, and clamshell removal. Two methods of pile installation are described: impact and vibratory hammer. The methods of timber or steel pile repair include pile stubbing, steel collar, pile encapsulation, welding, or installation of H-piles.

#### 2.1.1.1 *Pile Removal*

*Vibratory Extraction*

Vibratory extraction is a common method for removing both steel and timber piling. A vibratory hammer is a large mechanical device mostly constructed of steel (weighing 5 to 16 tons) with a hydraulic or electric power source, that is suspended from a crane by a cable and positioned on the top of a pile. As the pile is vibrated, the surrounding soil vibrates, reducing the resistance between the pile and the sediments. The pile is then unseated from the sediments by engaging the hammer and slowly lifting up on the hammer with the aid of the crane. Once unseated, the hammer is disengaged, and the crane will continue to raise the hammer and pull the pile from the sediment. When the pile is released from the sediment, it is pulled from the water and placed on a barge. Figure 2-1 shows a timber pile being removed with a vibratory hammer.

**Figure 2-1**
**Vibratory Hammer Removing a Timber Pile**

Sediments attached to the outside of the pile fall back to the seafloor in a short period of time (from several seconds to minutes to a few hours, depending on the sediment type, currents, and weather conditions). The piling are loaded on to the barge or into a container and disposed of off-site in accordance with Washington Administrative Code (WAC) 173-304 and the MMs in Section 2.3.

*Direct Pull and Clamshell Removal*

Timber pilings are particularly prone to breaking at the mudline due to damage from marine borers and vessel impacts, but must be removed because they can interfere with installation of new steel piling, causing construction delays and added risk to construction workers. In some cases, removal with a vibratory hammer is not possible because the pile will break apart from the force of the clamp and the vibration. Broken or damaged piles may be removed by wrapping the piles with a cable or chain and pulling them directly from the sediment with a crane (Figure 2-2).

**Figure 2-2**
**Direct Pull of Timber Piles**

If the piles break between the waterline and the mudline, pile stubs are then removed with a clamshell bucket. A clamshell bucket is a hinged steel apparatus that operates like a set of steel jaws. The bucket is lowered from a crane and the jaws grasp the pile stub as the crane pulls up (Figure 2-3). The broken piling and stubs are loaded onto the barge for off-site disposal.

In some cases (depending on access, location, etc.), timber piles may be cut below the mudline and the resulting hole backfilled with clean sediment.

**Figure 2-3**
**Removal of a Broken Pile with a Clamshell Bucket**

#### 2.1.1.2 *Pile Installation*

##### *Impact Hammer Method*

Impact hammers are used to install plastic/steel core, wood, concrete, or steel piles. An impact hammer is a steel device that works like a piston. Impact hammers are usually large, though small impact hammers are used to install small diameter plastic/steel core piles. Impact hammers have guides (called a lead) that hold the hammer in alignment with the pile while a heavy piston moves up and down, striking the top of the pile, and drives it into the substrate from the downward force of the hammer on the top of the pile.

To drive the pile, the pile is first moved into position and set in the proper location using a choker cable or vibratory hammer. Once the pile is set in place, pile installation with an impact hammer can take less than 15 minutes under good conditions, to over an hour under poor conditions (such as glacial till and bedrock, or exceptionally loose material in which the pile repeatedly moves out of position). Figure 2-4 shows a pile being driven with an impact hammer.

**Figure 2-4**
**Impact Hammer Driving a Steel Pile**

When driving concrete piles, poor soil conditions (such as glacial till) can damage the piles because they are not as strong as steel. There are two methods to help advance a concrete pile in poor soil: jetting and the use of a stinger. Jetting refers to water being forced with a compressor through a pre-cast passage in the pile (a "jet-pipe"). The water flows out the end of the pile, helping to loosen soil so the pile can advance with less damage. Jetting is typically done only when harder soils (such as glacial till) are encountered. A concrete pile is driven through softer soils without jetting, then the jetting begins only when the glacial till layer is reached. In this case, the tip of the pile may be 30 to 40 feet below ground surface before jetting begins, so there is typically no turbidity on the surface of the soil or in the water column during jetting. A stinger is an H-pile that is precast into the tip of the concrete pile. The steel stinger breaks through glacial till, helping to advance the pile.

#### *Vibratory Hammer Method*

The vibratory hammer method is a common technique used in steel pile installation where the type of sediment allows this method to be used. This process begins by placing a choker around the pile and lifting it into vertical position with the crane. The pile will then be lowered into position and set in place at the mudline. The pile will be held steady while the vibratory hammer installs the pile to the required tip elevation (Figure 2-5). For some load-bearing structures such as towers, wingwalls, and trestles, the vibratory hammer can only install piles until they reach a certain level of resistance. To meet certain design criteria and ensure proper functioning of the structure, piles (steel, timber, and concrete) sometimes must be "proofed" by striking them with an impact hammer. During the proofing process, an observer records the distance the pile is embedded with each impact hammer blow. Data collected during this process is then sent to the Project Engineer for review to ensure the pile will meet the load-bearing design criteria.

Timber and concrete piles cannot be installed with a vibratory hammer and must be impact driven.

**Figure 2-5**
**Vibratory Hammer Installing a Steel Pile**

### 2.1.1.3 *Pile Materials*

When new structures are installed, the pile material is steel or concrete. When repairs to existing timber structures are needed, design criteria often require the replacement of timber with timber rather than steel or concrete. Creosote and ammoniacal copper zinc arsenate (ACZA) are the only approved marine wood treatment options that meet design specifications. ACZA is the best available, EPA-approved technology for protection of wood from marine borers in the marine environment today, and is the treatment option currently used by WSF. Existing timber dolphins are sometimes reinforced with 13-inch plastic/steel core piles. The outer layer of plastic acts as a rub face so that when a ferry rubs against the dolphin, the ferry and the dolphin are not damaged.

#### 2.1.1.4 *Rock Anchors*

Several WSF facilities occur on bedrock with very little sediment overlay. These facilities include Shaw Island, Orcas Island, Lopez Island, and Friday Harbor terminals. For this reason, traditional pile driving methods may not be sufficient for securing new steel structures in place. In these situations, rock anchors may be used to ensure piles meet the engineering criteria, primarily uplift resistance, required for structural loads and safe operations. The following steps are required for installation of rock anchors:

- For freestanding structures like dolphins where the area cannot be accessed via land, a small rock drill rig is mounted on an existing structure, or on a temporary, pile-supported platform that is constructed around the pile.
- Each pile is installed with a vibratory hammer or impact hammer and driven in the standard manner until the tip reaches bedrock. Design criteria typically require the pile to be embedded at least 1 inch into sediment before hitting bedrock.
- A smaller steel pipe casing is placed down the center of the steel pile with its tip at the surface of the bedrock and is cast in place with concrete.
- The drill is placed in the smaller steel pipe casing, and augers a 6-inch-diameter hole into bedrock.
- Steel dowels up to 1.75 inches in diameter (Figure 2-6), or a strand cluster of up to 4 inches in diameter, will be inserted into the hole to the required depth.
- The steel strands are tensioned to the required load and locked off. The casing is then filled with grout (for both dowel and strand methods).
- If site conditions allow, sandbags are placed around the base of the pile to prevent grout from leaking and coming into contact with surface water.

**Figure 2-6**
**Steel Strand Cluster Method of Rock Anchor Installation**

A typical rock anchor is shown in Figure 2-7. Drill cuttings are captured at the drill rig so they do not reach surface waters. Concrete and grouting is contained within the pile and casing, and also will not reach surface waters.

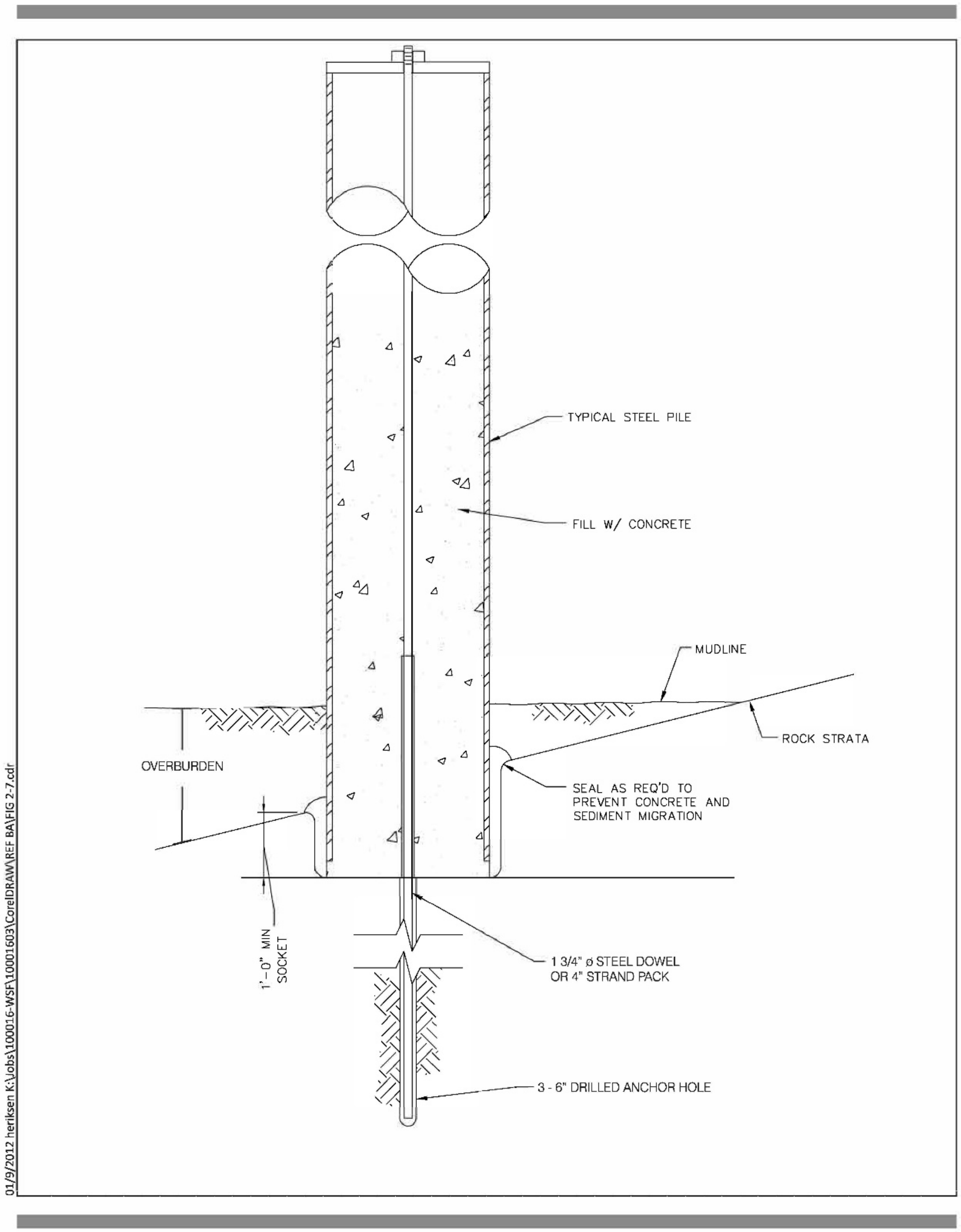



**Figure 2-7**
**Typical Rock Anchor Detail**

### 2.1.1.5 *Micropiles*

In some situations, micropiles can also be used at facilities located on bedrock as an alternative to rock anchors. Micropiles are relatively small in diameter (8 to 12 inches) and are not as strong as piles installed with rock anchors; therefore, their use is limited to situations with lower structural capacity requirements. Micropiles are steel piling with a serrated edge (Figure 2-8) that are drilled 2 to 3 feet into the rock rather than being installed with hammer. The pile is drilled from small equipment located on the trestle. The resulting soil and rock fragments are flushed out to the center of the pile with compressed air and contained for upland disposal. After the pile is cleaned of drill cuttings, the center of the pile is filled with grout. The micropile is then attached to the deck above with bolts and other fasteners.

**Figure 2-8**
**Serrated Edge of a Micropile**

### 2.1.1.6 *Drilled Shafts*

Drilled shafts are needed to support hydraulic cylinders used in overhead loading and transfer spans, and to support structures installed in deep water and/or thick layers of soft sediments. To create a drilled shaft, a steel casing approximately 6 to 10 feet in diameter is driven into the substrate using a vibratory hammer (Figure

2-9), and the material inside the casing is excavated using an auger or a clamshell dredge (Figure 2-10). Augering is done within the casing such that no suspended sediments are released to the surface waters. Auger tailings are removed from the hole by mechanical means and disposed of upland.

The casing will be dewatered after augering. If required, a concrete seal at the base of the casing will be poured to prevent water from entering the casing from below, but depending on the till layer, the casing may not have any groundwater seeping into the drilled shaft. Any additional water will be pumped out of the casing. All water removed from the casing is run through a filter to comply with any issued water quality certification before returning to Puget Sound, or is pumped into a Baker tank for proper disposal. Sediments are disposed of upland.

During excavation, a bentonite or synthetic polymer slurry is sometimes added to stabilize the walls of the shaft. When the shaft is of the desired depth, rebar reinforcement is placed in the shaft (Figure 2-11) and concrete is poured with a small-diameter flexible hose called a tremie. The concrete displaces any slurry that was previously added and a vacuum hose is used to remove the slurry from the top of the concrete (Figure 2-12).


**Figure 2-9**
**Vibratory Installation of Drilled Shaft Casing**


**Figure 2-10**
**Auger Excavation of Drilled Shaft**

**Figure 2-11**
**Rebar Reinforcement of Drilled Shaft**

**Figure 2-12**
**Vacuuming of Slurry from Drilled Shaft**

#### 2.1.1.7 *Pile Repair*

Although WSF prefers to install new piling to make repairs, a process called pile stubbing is sometimes used to repair timber piles. Pile stubbing is the only known feasible option when piling under a trestle or dock require repair and when cutting a hole and installing piling through the dock is not feasible (e.g., buildings on top of the dock preclude installing piling through an existing dock).

##### *Pile Stubbing*

Pile stubbing is a process in which an existing, damaged length of pile above the ground line is removed and replaced with a new length of ACZA-treated timber pile. This process does not involve pile driving. Pile stubbing is often done at elevations that are exposed at low tide. The process for pile stub repairs in the dry involves cutting and removing a damaged timber pile between the ground line and the underside of the pile cap (Figure 2-13). The remaining portion of the pile is inspected for structural integrity. A 1-inch-diameter, 2-foot-long galvanized steel pin is installed in the center of the pile, extending 1 foot from each side of the joint. A new section of pile is then inserted between the cut section of pile that is still embedded in the sediments and the underside of the structure the pile is supporting (Figure 2-14). The pile surfaces are then cleaned of marine organisms. The form must extend 30 inches below and above the joint of the two timber piles, often requiring the excavation of small amounts of sediment around the base of the pile. The sediment can be excavated with a backhoe, hand tools, shovels, or a siphon. When the process is complete, the sand is returned to its original location and the form, which extends above the high tide elevation, is removed.

**Figure 2-13**
**Pile Stubbing: Removing a Damaged Section of Pile**

**Figure 2-14**
**Pile Stubbing: Setting New Pile Section in Place**

Steel reinforcement is placed inside the form and concrete is then pumped into the form to fill the void between the form and the pile. Concrete is poured through a tremie. The mouth of the tremie hose is placed at the bottom of the form to prevent splashing or accidental spillage of concrete. Sandbags placed around the base of the form prevent seepage of concrete into the water.

An effort is made to complete certain tasks at the same time, in sequence. For example, workers will attempt to replace pile segments on as many piles as possible in a single low tide event, and at least one tidal cycle may occur before additional steps (such as placing concrete) are completed.

WSF performs pile stub repairs in the dry whenever possible, as it is a more cost-effective operation than performing the work in water with divers. However, when a pile is located in deeper water such that the repair cannot be performed in the dry, WSF will take additional steps to protect the marine environment. Commercial divers use a hand-held siphon to excavate the area around the base of the pile for the form to reach below the splice. The form is made long enough for the top to extend above the high tide level and is not removed until the concrete is cured, in order to prevent premature contact with marine water.

#### *Steel Collar*

Another method of timber pile repair is a steel collar used in place of a cast concrete collar. The steel collar encases the pile and extends at least 1 foot beyond the joint in both directions. The collar is bolted together around the pile (Figure 2-15). As with the concrete collar, a galvanized steel pin is first installed inside the pile to reinforce the pile at the joint. The primary difference between this and pile stubbing is this method does not use concrete, rebar, or forms that require removal. However, use of the steel collar method is limited because it is difficult to achieve a tight, sealed connection between the old and new sections of pile if the old pile is warped or deteriorated. If the section of pile stub remaining in the ground is in poor condition, the cast concrete collar must be used.

**Figure 2-15**
**Pile Stubbing: Steel Collar Method**

*Pile Encapsulation*

There are different methods of pile encapsulation, but in general, encapsulation refers to the process of encasing piling in concrete. Encapsulation is used when a pile is damaged, but still retains some load bearing capacity. Damaged wood piles can be repaired by encasing them in concrete using either a steel form or a fabric form called a "seaform." The seaform method is currently the only soft form that will not leach concrete mix through the fabric.

Using the seaform method, piling to be encased are first cleaned of any loosely adhering marine organisms. Reinforcing steel is then installed around the pile prior to installation of the fabric form. All wires and rod ends are turned in toward the pile to avoid damage to the fabric form. A custom fabricated jacket is then installed around the entire pile. The top and bottom ends of the jacket are cinched with wire cables to prevent concrete leaks. Concrete is then pumped into the fabric form through a suitable hose extending down to the lowest point of the jacket. As the form is slowly filled with concrete, hydraulic pressure forces the entrained seawater within the fabric form out through an overflow valve. The valve is fitted with a filter that prevents suspended solids from discharging into surrounding waters. The valve is permanently closed once the form has been filled with concrete. The typical method for seaform installation is shown in Figure 2-16.

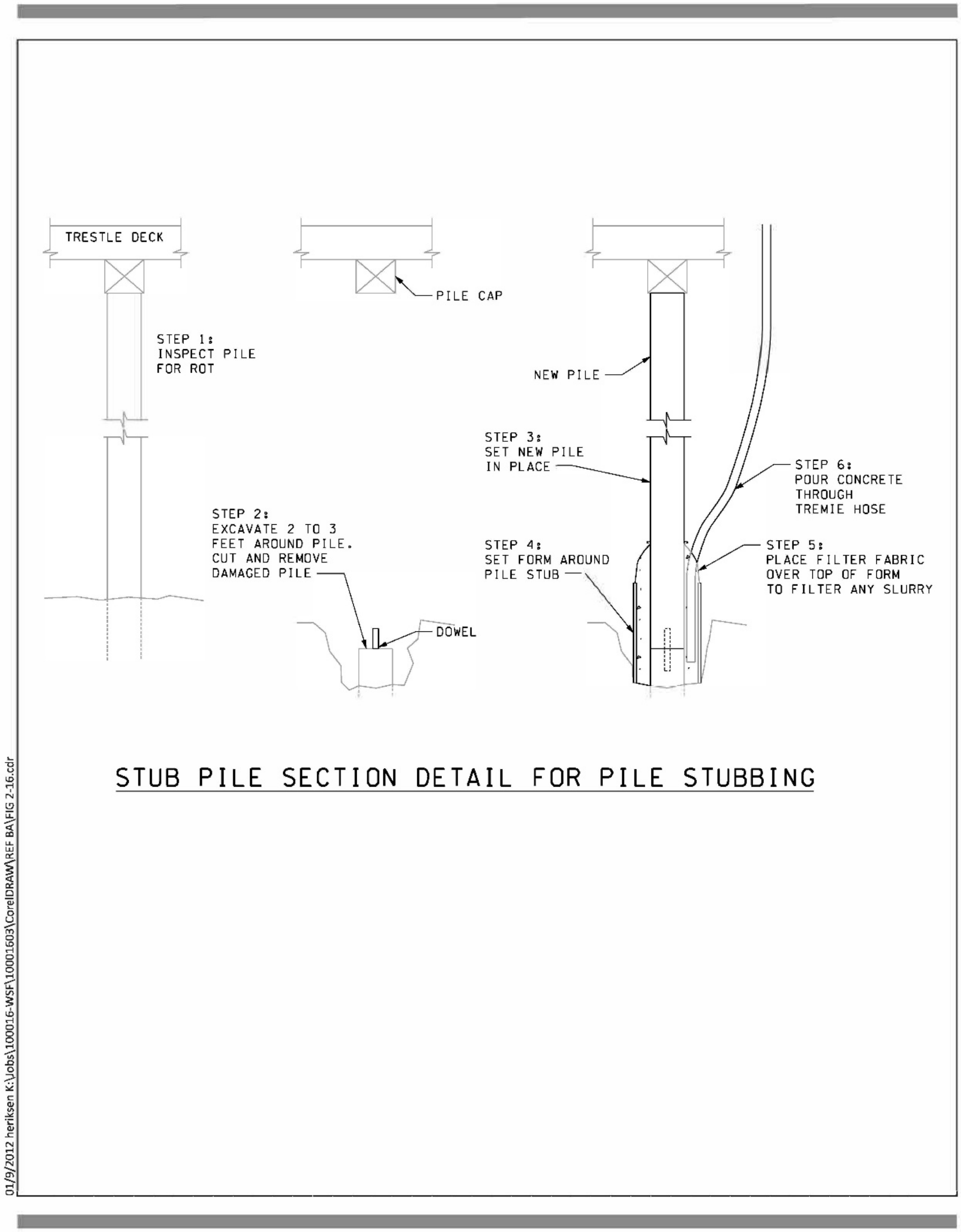



**Figure 2-16**
**Pile Stubbing Using a Sea Form**

Pile encapsulation with a steel form works much like the pile stubbing method described above. A concrete plug is poured in the bottom of the form and allowed to cure. Once cured, seawater is pumped from the pile and contained so as not to enter surface waters. Concrete is then poured inside the form. The concrete pouring is stopped once the concrete reaches a level below the top of the pile to prevent concrete spillage. Encapsulation with a steel form is shown in Figures 2-17 through 2-19. In these figures, the encapsulation is being done in the dry. When done in water, work is performed from a skiff by commercial divers.

**Figure 2-17**
**Pile Prepared for Encapsulation**

**Figure 2-18**
**Installing the Form**

**Figure 2-19**
**Completed Pile Encapsulation**

#### *H-Pile Installation*

In some cases where a timber pile is failing, it may be very difficult to remove and directly replace that pile (e.g. under a trestle with many piles close together). In this case, repair will occur by driving an H-pile through the deck of the trestle, in the approximate location of the failing timber pile. A cap will then be placed over the H-pile and timber pile, effectively connecting the two and providing support for the structure (Figure 2-20).

**Figure 2-20**
**Completed H-Pile**

### 2.1.1.8 *Steel Pile Repair*

The use of steel piles in structures has been introduced over the last decade, and breakage of steel piles is rare. However, when damaged, steel piling can be repaired in several ways depending on the severity of the damage and the location of the pile. If the pile is damaged above the water line, the pile may be cut off and a new pile section welded on (Figures 2-21 and 2-22). If the damage is below the water line, WSF will evaluate whether the pile can be removed with a vibratory hammer. If the pile is pinched, bent, or otherwise damaged, removing the pile may not be feasible because the vibratory hammer may break the pile during removal. In this rare case, the pile will be cut off at the mudline and abandoned. The approximate location of the abandoned pile can be documented in as-built drawings.

**Figure 2-21**
**Bent Steel Pile in Need of Repair**

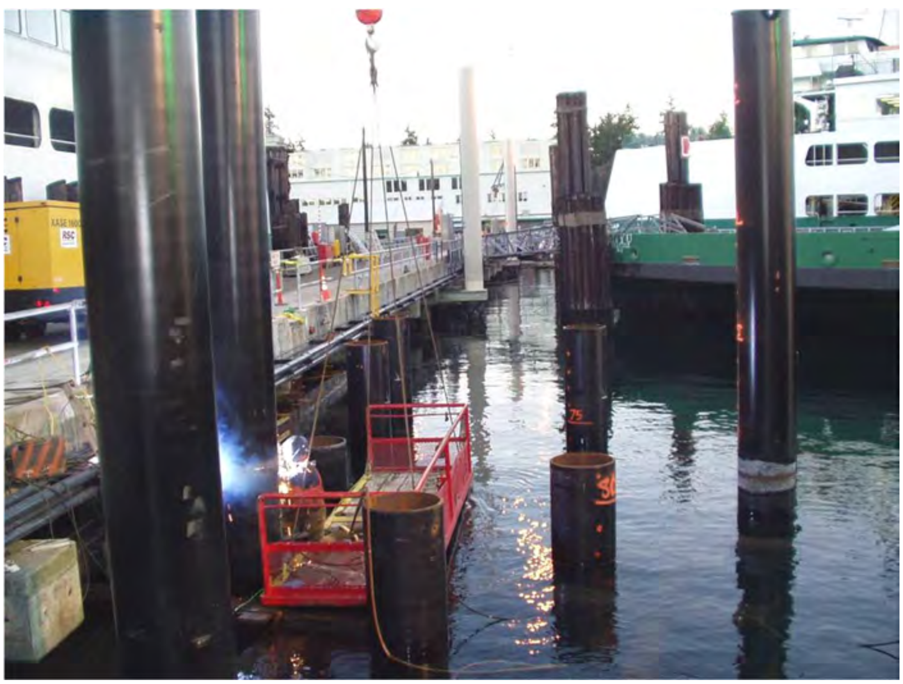


**Figure 2-22**
**Welding New Pile Section**

Steel piles can also be repaired by encasing them in concrete. The process is very similar to the process for timber pile encapsulation, described in Section 2.1.1.7. Marine growth is removed and a form is fitted around the pile. When steel piles are encased in concrete, the form is extended to the top of the pile. The form is then filled with concrete. A plug is poured in the base of the form and allowed to cure. Once cured, seawater inside the form is pumped from the pile and contained so as not to enter surface waters. The concrete is then poured inside the form. Pouring is stopped before the concrete reaches the top of the pile to prevent concrete spillage.

### *2.1.2 Dredging*

Maintenance dredging at the ferry terminals is rarely required. Dredging may be required for new slips or to prepare an existing slip to receive a larger class vessel or in rare cases if a slip becomes silted in. Dredging is usually done with a clamshell dredge deployed from a barge. Alternatively, the dredge may be deployed from land or the trestle structure. Prior to dredging, sediments are tested to determine if they can be reused, disposed of at a designated open water disposal site, or need to be disposed of upland.

## 2.2 WSF Structures, Functions, Repairs, and Installation

The components of a typical ferry terminal, from offshore to onshore, include dolphins, wingwalls, towers and headframe, transfer span with apron, bridge seat, trestle, pedestrian overhead loading, and bulkhead and terminal building (Figures 2-23 and 2-24).


**Figure 2-23**
**Typical Ferry Terminal, Aerial View**

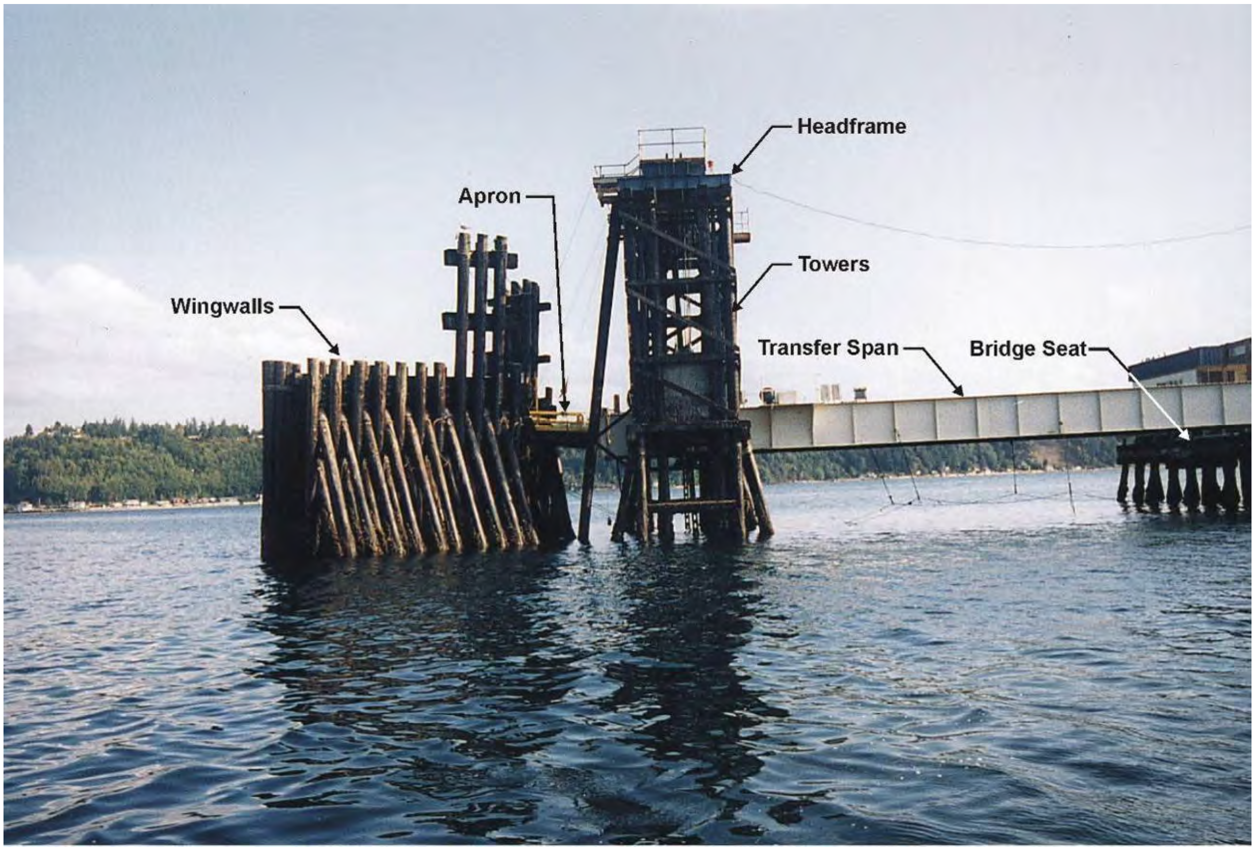



**Figure 2-24**
**Typical Timber Ferry Terminal**

Dolphins and wingwalls are structures that aid in the docking and mooring of ferries and function to protect the structures behind them such as the towers, bridge seat, overhead loading, and trestle. Dolphin and wingwall structures protect passengers and terminal structures by absorbing high levels of energy, and these structures will collapse when significantly overloaded under extreme conditions. Dolphin and wingwall structures continually absorb the forces of ferry landings and departures and must withstand even greater impact during inclement weather and at heavily used terminals. Dolphin and wingwall structures are outfitted with different types of wearing and fendering materials (i.e., rubber or polyethylene) that can be easily replaced, and extend the life of these structures. Because dolphins and wingwalls are continually subject to extreme energy-absorbing demands, they require regular preservation and repair work. Failure to maintain these structures as scheduled or required may lead to catastrophic harm to the vessels, passengers, crew, and property, and closure of facilities.

These terminal structures have historically been built of creosote-treated timber, but WSF is systematically replacing timber pile structures with steel or concrete pile structures when they need to be repaired or replaced, and as funding for projects allows. New facilities will be built with steel or concrete materials. Structural repairs vary from replacing one pile to replacement of entire structures. Sometimes it is necessary to make repairs to timber structures (particularly dolphins, towers, and wingwalls) by adding steel piles or new ACZA treated timber piles to shore up the timber structures. Usually only a few steel piles are needed to provide additional support. These structures are generally found at depths greater than -15 feet mean lower low water (MLLW).

Most dolphins and wingwalls are fixed-pile structures, meaning they are driven into the seabed; however, a few floating dolphins and floating wingwalls are in use. These floating structures, attached to the seabed by steel chains attached to steel or concrete anchors, are being replaced with fixed structures where possible as they are damaged and as funding allows, because during high storm/wind events, some floating structures flip over, and they do not withstand vessel impacts as well as fixed structures. However, in some locations such as Lopez Island and Mukilteo, floating structures are required because geological conditions such as bedrock do not allow for pile driving, and because the water is too deep for traditional fixed-pile structures.

Sections 2.2.1 through 2.2.9 describe each component of the system; its function; and common repair, maintenance, and preservation activities performed.

### 2.2.1 Dolphins

#### 2.2.1.1 *Function*

Dolphins are structures located offshore used to guide the ferry into the terminal and hold it in place while docked or berthed (Figure 2-25). Ferry captains use the dolphins to deflect misaligned vessels back into position during arrival and departure. Newly constructed dolphins have a life expectancy of 50 years. Existing timber dolphins have a life expectancy of 25 to 30 years.


**Figure 2-25**
**Vessel in Berth Using Dolphins to Maintain Position**

#### 2.2.1.2 *Design*

Dolphins are typically placed in several different locations for ferry approach, and their positions vary by terminal location and orientation, type of vessels used, and environmental conditions. The dolphin located farthest offshore is referred to as the outer dolphin and is the largest of the dolphins. The next closest dolphin to shore is called the intermediate dolphin and is slightly smaller, and the dolphin closest to shore is called the inner dolphin and is the smallest of the three. Dolphins occur in a variety of water depths. In general, inner dolphins occur in water depths from -25 to -35 feet MLLW, intermediate dolphins occur between -25 to -45 feet MLLW, and outer dolphins occur between -30 to -55 feet MLLW. Not all terminals currently have inner, intermediate, and outer dolphins in place, depending on terminal age, class of vessel servicing the terminal, environmental conditions, and budget allocation.

### *Temporary Dolphins*

During repairs and construction within the ferry slip, the use of temporary dolphins is sometimes necessary to allow vessel operations to continue during the repair and to protect the damaged structure and the workers. The six- to eight-pile temporary dolphins are typically placed in front of the construction area for the duration of the construction activity and are removed when construction is complete (Figure 2-26).

### *Fixed Timber Pile Dolphin*

There are standard timber dolphin sizes (35-pile, 70-pile, and 100-pile dolphins), though dolphin sizes vary with site and conditions. Timber dolphins are typically lashed in two places with multiple wraps of galvanized wire rope stapled to each outside pile on each wrap (Figure 2-26). Timber dolphins are commonly faced with high-density plastic (called ultra-high molecular weight [UHMW] polyethylene) to prevent wearing of the timber piling (Figure 2-27). Timber dolphins are no longer the preferred method of design and will be replaced over time by steel pile dolphins (described later) through preservation and improvement projects.

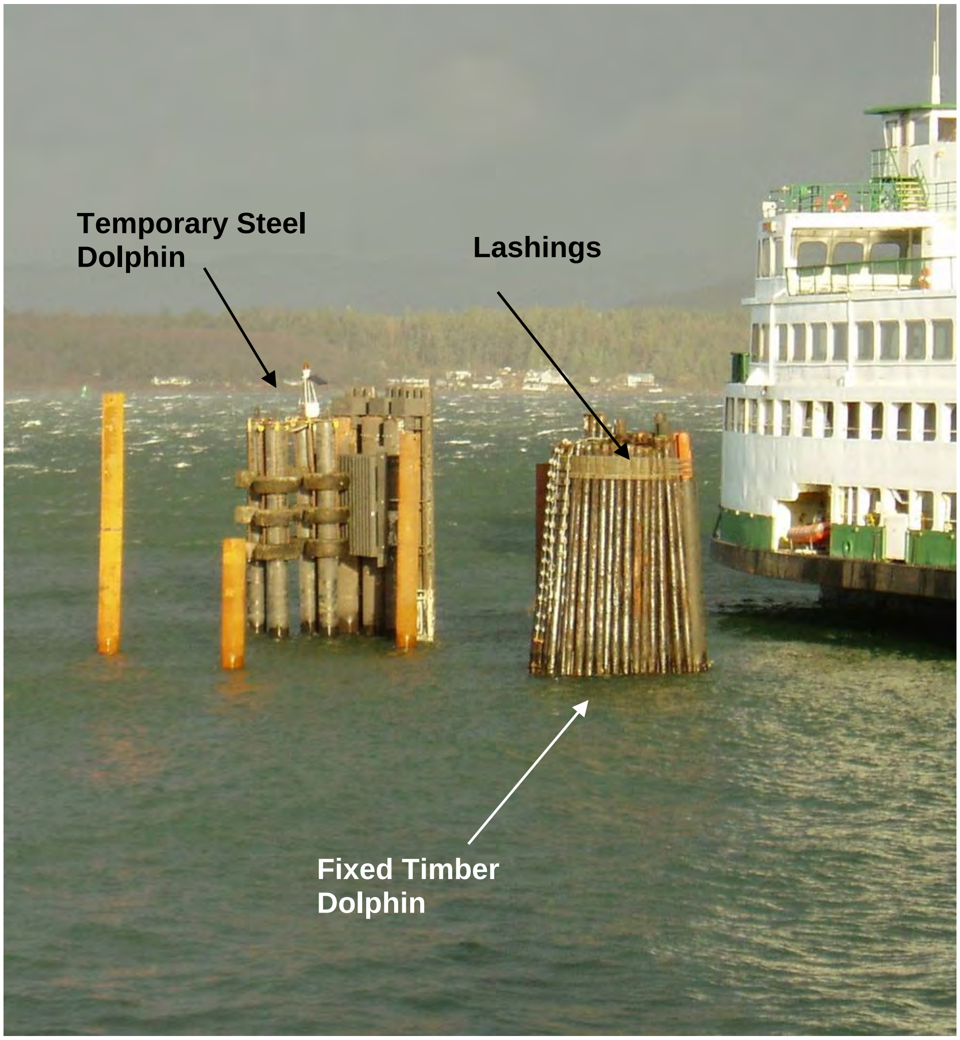



**Figure 2-26**
**Temporary Steel Dolphin and Fixed Timber Dolphin Structures**


**Figure 2-27**
**Plastic Face Piling on a Fixed Timber Dolphin**

#### *Floating Dolphin*

Floating dolphins are structures that float on steel or polyethylene tanks or on concrete pontoons (see Figures 2-28 and 2-30). Horizontal cap timbers are attached to the floating tanks, creating a floating platform on which 12-inch by 14-inch vertical timbers are erected to form a wall that absorbs the forces of incoming vessels. If concrete pontoons are used, the timbers are erected on steel frames bolted to the pontoons without any cap timbers.

The vertical timbers are faced with 6- by 12-inch timbers that make up the wearing surface, or rub face, of the dolphin. The rub face is usually covered with UHMW polyethylene sheets to reduce the abrasion from repeated vessel contact. The wall is braced with 12- by 12-inch timbers tied to the cap timbers or concrete on the non-impact side of the platform. The rub face of the dolphin is not submerged.

Anchor chains are attached at the corners of the floating dolphin, and in some cases, on the sides of the platform. They run out at an angle to the seabed and are connected to concrete or steel anchors that position the dolphin to absorb the energy of berthing vessels, and to prevent it from moving.

Anchors are installed by lowering them to the seafloor, from a workboat or tug, and dragging them until the anchor fluke penetrates the seafloor and develops the required holding capacity. The drag distance is a function of the soil type, factors of safety, and the length of the anchor fluke, and it may take one or two runs to set each anchor (see Figure 2-29).

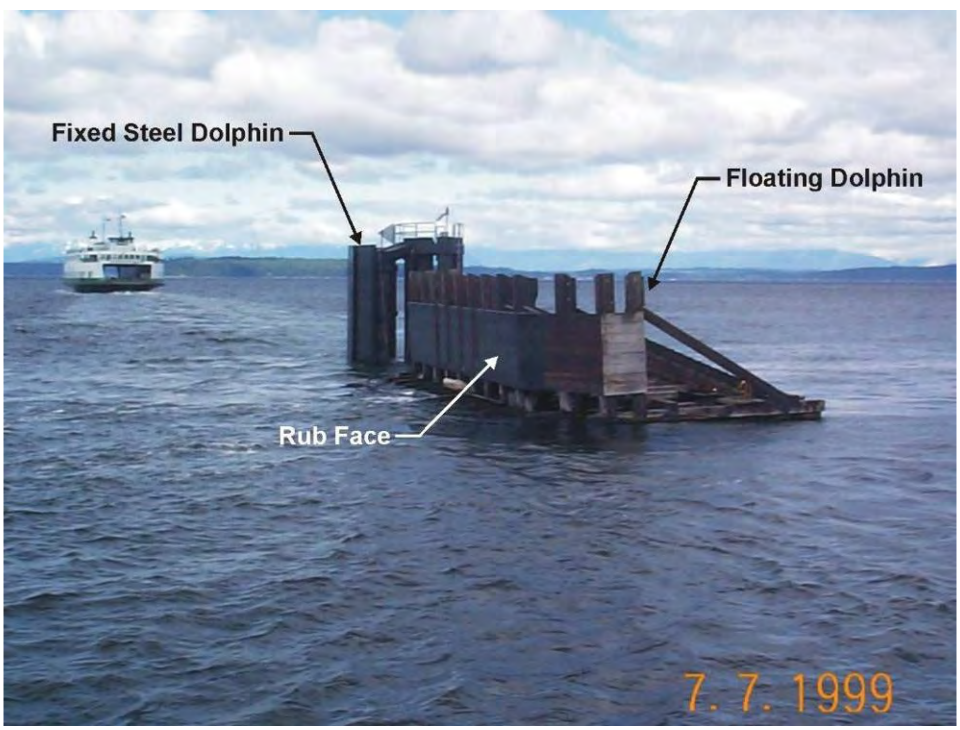



**Figure 2-28**
**Floating Dolphin and Fixed Steel Pile Dolphin**

**Figure 2-29**
**Installation of Floating Dolphin Anchors**

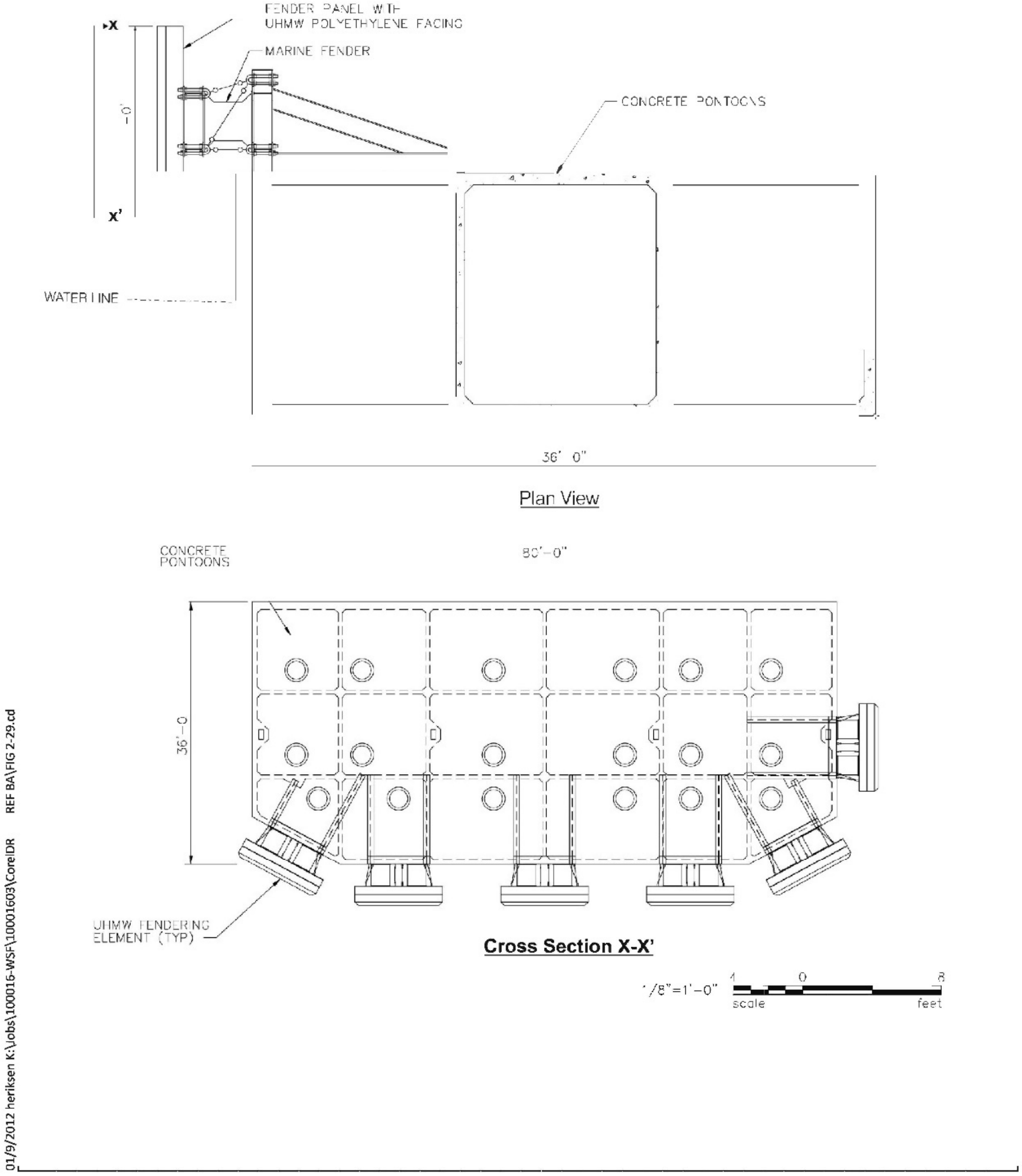


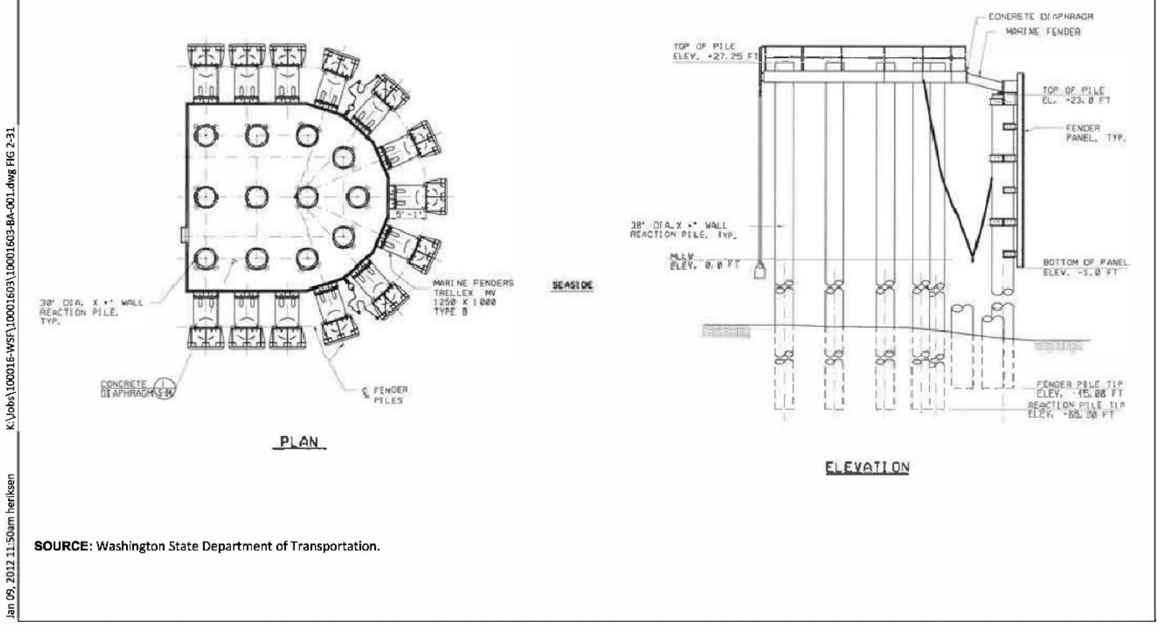

**Figure 2-30**
**Typical Floating Dolphin**

### *Steel Dolphin*

The size of steel dolphins varies with their distance from shore, depth, location, intended energy demand, and class of vessel service provided. Figure 2-31 shows a typical steel dolphin design. Outer dolphins are subject to the greatest demands, and typically contain up to 15 to 25 steel piling, although double-sided dolphins (serving two slips) contain about 30 piling (Figure 2-32). Intermediate dolphins typically contain about 12 to 15 piling, and inner dolphins generally contain about seven to 10 piling.

Though there are varieties of steel dolphin configurations in use, the materials and general design have evolved into the structure shown in Figures 2-31 and 2-32.


**Figure 2-31**
**Typical Steel Dolphin**




**SOURCE:** Washington State Department of Transportation.

**Figure 2-32**
**Typical Double-Sided Steel Dolphin**

The dolphin discussed here is a 13-pile design that would typically be used as an intermediate dolphin. New steel dolphins are constructed of two groups of steel pipe piling driven plumb (straight up). The back group (called reaction piling) is constructed of seven to nine piling driven deep enough to provide stability. The embedment is determined by sediment conditions, but is typically around 35 feet. They are driven in a configuration spaced approximately 4 to 8 feet apart. This set of piling is joined at the top with tube steel or a reinforced concrete diaphragm. The front group includes four to five piling embedded approximately 20 feet. They are spaced 9 feet from the nearest reaction piling and are connected to the diaphragm by rubber marine fenders. The wearing face of the dolphin has a fender panel made of steel and plastic attached to the front fender piling.

#### 2.2.1.3 *Repairs and Replacement of Dolphins*

Timber dolphins are most frequently repaired by driving steel or ACZA-treated timber piling behind or in front of the existing dolphin to reinforce the structure. Another repair involves removing broken piling and driving recycled plastic piling with a steel core (called face piling) in front of the dolphin and lashing them in place with cable. A repair of this kind would typically take 3 days. If a timber dolphin cannot be repaired, it is removed and replaced.

### *2.2.2 Wingwalls and Wing-dolphins*

#### 2.2.2.1 *Function*

Wingwalls protect the towers and transfer span from direct vessel impact and help guide and hold the vessel in position (see Figures 2-23 and 2-24). Typical wingwalls receive 12 to 40 vessel landings per day. Most wingwalls are fixed-pile structures (Figure 2-33), but some float on anchored concrete pontoons. They are positioned at an angle at the seaward end of the facility to catch the ferry and hold it in place. Wingwalls typically occur in water depths between -25 and -40 feet MLLW. The innermost section of the wingwall is called the throat (Figure 2-34). During vessel landings, the ferry remains under power to maintain its position during loading and unloading. During loading and unloading, most of the pressure from the vessel lies directly on the throat of the wingwall. This section of the wingwall typically requires regular preservation and repair work due to the heavy loads imposed on it.

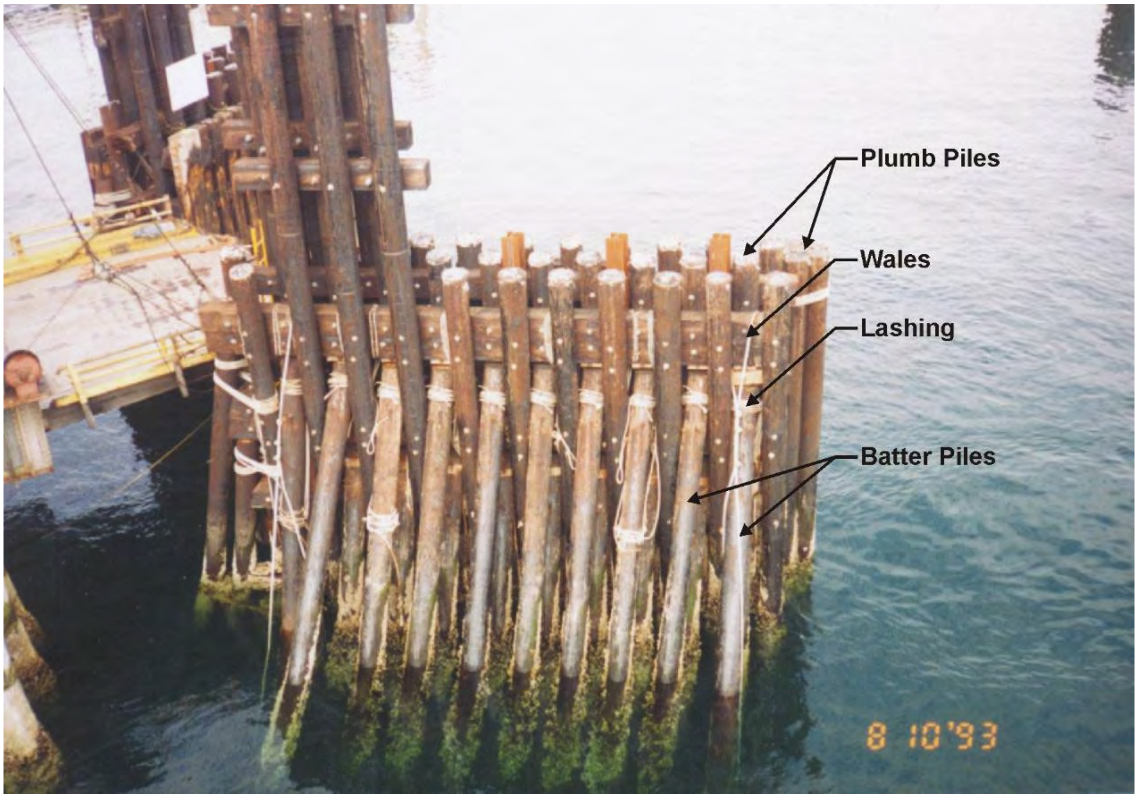



**Figure 2-33**
**Typical Timber Wingwall—Back Side of the Structure**


**Figure 2-34**
**Wingwall Face**

Another wingwall structure is called a wing-dolphin. Wing-dolphins are dolphins located where wingwalls usually are in relation to the transfer span and towers. They perform the same function as wingwalls, but are not designed to withstand normal vessel operations. They are configured as linear dolphins, not walls, and are used at tie-up slip locations and at Lopez Island. Terminals currently with wing-dolphins include the Eagle Harbor Marine Maintenance Facility, Vashon, and Port Townsend tie-up slips, and the Anacortes second tie-up slip.

### 2.2.2.2 *Design*

#### *Timber Wingwall*

A typical timber wingwall contains 75 to 100 piling driven in four rows: the first three rows are plumb, and the back row is driven at an angle (batter) (see Figure 2-33). The rows of piling are connected by 12- by 12-inch timber wales bolted horizontally to the piling. Wales are also lashed to timber piling for additional strength. The front of the wingwall is protected by 26-foot-long vertical rubbing timbers that provide a wearing surface for the vessel. In many cases, steel H-piling have been added to timber wingwalls over time to strengthen the structure as it weakens under heavy use. The average usable life span of a timber wingwall is 15 years.

#### *Steel Wingwall*

Steel wingwalls (Figure 2-35) contain fewer piling than timber wingwalls, usually 13 to 15 per structure. Steel wingwalls are designed similarly to timber wingwalls in that they contain two rows of plumb piling and one row of batter piling or a third row of plumb piling. A rubber fender between the first and second rows of plumb piling absorbs much of the energy and returns the front row to its original vertical position after an impact. The second row of plumb piling is driven deeper into the sediment and braced with batter piling to minimize movement of the structure. Both pile rows are welded together with horizontal I-beams to which rubbing timbers are attached (Figure 2-35). They are designed for a 25-year life span.

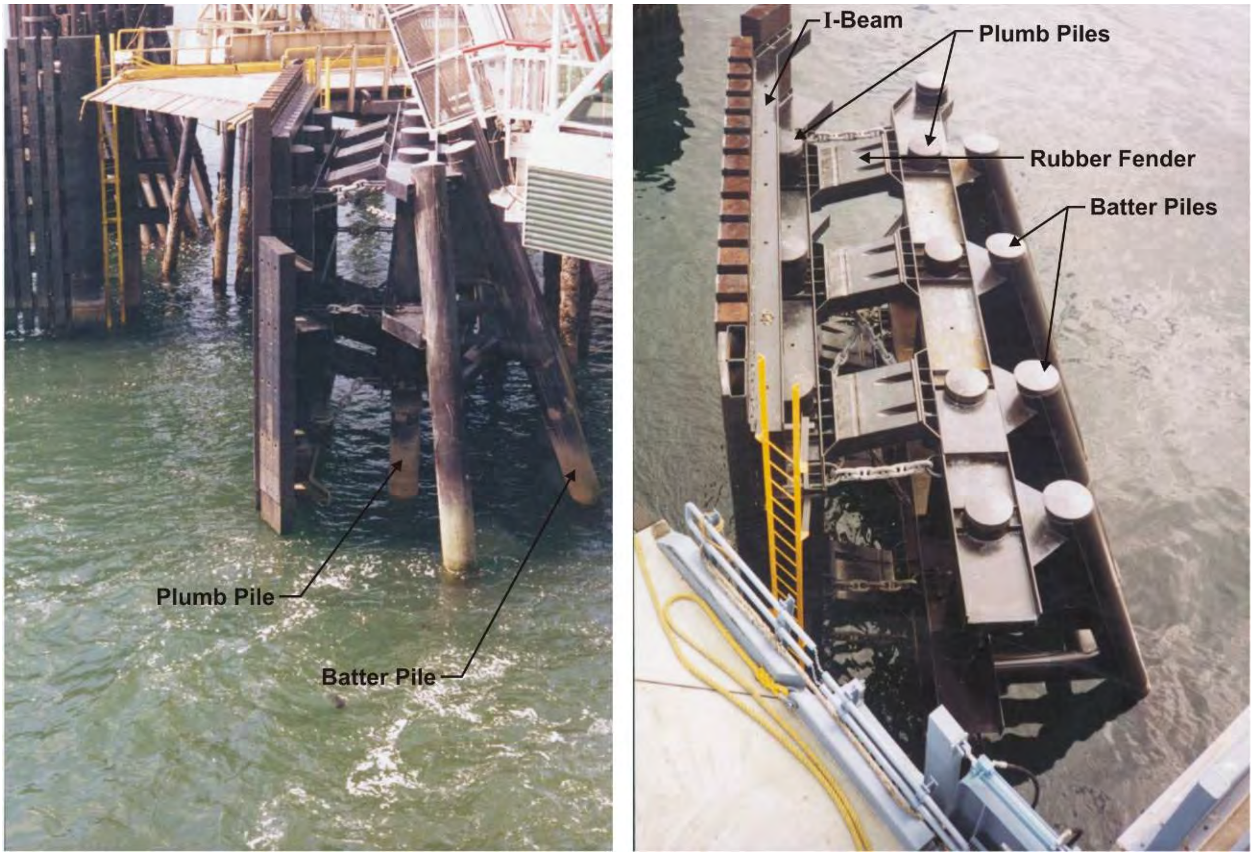



**Figure 2-35**
**Typical Steel Wingwalls (Side and Top Views)**

2.2.2.3 *Wingwall Removal, Repair, and Installation*

Wingwalls can be replaced by different methods, depending on the severity of damage to piling being removed and the limits of operational closures. If the timber piling comprising the wingwall are in good condition, the wingwall can be dismantled and the piling can be removed with a vibratory extractor, but this process is very time-consuming and results in extended closures of the facility. Another method of removing piling is cutting the piles below the rub face and lifting the entire rub face onto the barge in one piece. The piles can then be removed using the vibratory, direct pull, or clamshell method depending on the condition of the piles. In the event that a large number of piling associated with a wingwall are in poor condition or are broken at the mudline, or if reducing facility closure time is critical, wingwalls can be pulled over using a crane or a tug boat and removed. Using this method, the entire wall will come out in one piece. A clamshell bucket may then be used to remove broken pile stubs (see Figure 2-3).

The decision to choose one removal method over another is contingent upon several factors, including pile condition, tides, and the length of facility closure time. To dismantle the wingwalls and pull piles individually takes approximately 7 days. To remove them in one piece, it takes approximately 2 to 3 days per wingwall. Length of time for each method must be taken into consideration if the slip is closed to operations.

Each replacement steel wingwall is installed by driving steel piling to the required depth, then cutting it off at the desired length. To ensure that the piling are installed in the correct position, a temporary template is often used to guide the piling into place (Figure 2-36).


**Figure 2-36**
**Template Used During Steel Wingwall Installation**

The template consists of four to six temporary steel piling that support a steel template with holes through which the permanent piling are driven. In some instances, several temporary H-piling may be driven in front of the construction area to protect work crews and equipment from incoming vessels if repair work is being conducted while the slip is in operation. Once the piling are driven through the template, a prefabricated wingwall frame is set on top of the piling and fastened (Figure 2-37).

**Figure 2-37**
**Crane Installing Steel Wingwall Frame**

### *2.2.3 Towers and Headframe*

#### 2.2.3.1 *Function*

Some towers and headframes operate like a drawbridge and contain a counterweight-and-cable system that supports the offshore end of the transfer span, allowing for its raising and lowering to meet the car deck of the ferry at all tide elevations. Towers and headframes are constructed of timber and/or steel, both with the same general configuration (see Figure 2-24). Towers are typically placed in water depths ranging from -20 to -40 feet MLLW.

WSF is currently installing an alternate tower design as a new standard for all WSF facilities. The design is a system called an H-span, which uses hydraulic cylinders to move the transfer span up and down instead of the existing system of cables and counterweights (Figure 2-38).

**Figure 2-38**
**Compression Cylinder Tower System**

2.2.3.2 *Design*

*Cable-Counterweight System*

Both steel and timber towers stand approximately 40 to 45 feet above MLLW for structural support and clearance. Steel towers consist of a group of plumb and batter piling capped with concrete. A steel headframe sits on the concrete cap. Timber headframes are continuous piling that extend to the top of the tower.

The steel or timber piling are tied together with framing to create a rigid structure to support the headframe. The headframe is constructed of horizontal beams that span the distance between the towers. The counterweight cables are attached to, and run across, the headframe in a rigging system that supports the offshore end of the transfer span and allows it to raise and lower to meet the vessel vehicle deck.

*Hydraulic System*

The hydraulic system (H-span) uses compression to raise and lower the transfer span. The cylinder hydraulic tower structure is primarily composed of two 5- to 6-foot-diameter steel casings mounted on a concrete plug installed with the drilled shaft method (see Section 2.1.1.6). Figure 2-38 shows a compression cylinder tower system.

#### 2.2.3.3 *Repairs and Replacements to the Towers and Headframe*

If a timber tower pile is damaged, it can be repaired by replacing sections of the damaged pile, if possible (see Section 2.1.1.7). A more typical repair includes adding steel piling to shore up or provide lateral support for the tower. Timbers, 12 inches by 12 inches or larger, are usually bolted on the outside of each tower. Steel or timber piling are then driven at an angle to the tower and attached to the 12-inch by 12-inch timber with a steel collar. Depending on the location and function of the piling, repair may consist of concrete encasement. If a steel tower pile is damaged, additional piling is installed to shore up the tower or the pile is removed and replaced. If a steel pile cannot be repaired, it is removed and replaced with a new pile. Total in-water work, including pile driving, takes approximately 2 days per pile (about 3 hours of in-water work).

### 2.2.4 Transfer Span/Apron

#### 2.2.4.1 *Function*

The typical transfer span is a steel girder bridge structure approximately 90 feet long and 24 feet wide that carries two lanes of traffic between the trestle and the ferry (see Figures 2-23 and 2-24). The transfer span rests entirely above water. The transfer span is seated at the onshore end on the bridge seat and suspended at the offshore end from the tower headframe or H-span. The transfer span is raised or lowered by machinery housed in the tower, or by hydraulic lifts. The transfer span ends beyond the headframe in a 15-foot-long lipped apron that adjusts hydraulically or by cables up or down to accommodate minor changes in elevation as vehicles cross from the transfer span onto the ferry deck.

#### 2.2.4.2 *Design*

The transfer span is constructed of steel or timber stringers running the length of the span tied into floor beams, and end beams running perpendicular to the stringers. The lift beam is wider than the span itself and is attached to the headframe system. The span is decked with a variety of materials including timber laminates, concrete, or steel, and is covered with a wearing surface, typically asphalt. Older timber transfer spans used creosote-treated timber laminated decking beneath an asphalt cap.

The apron is hinged to the offshore end of the span. The apron is raised or lowered with a hydraulic cylinder and lever arm, or a similar cable system. There are smaller, hinged steel flaps called apron lips that connect to the end of the apron. The apron lips provide stability during loading and unloading as the vessel moves in the water. The apron lips are attached to the apron by bolts that allow them to swing freely within a limited range.

#### 2.2.4.3 *Removal, Replacement, and Installation of the Transfer Span and Apron*

The transfer span and apron occur above mean higher high water (MHHW), but repair and replacement work typically occurs from a derrick on the water. The transfer span and apron are unsupported structures spanning between the bridge seat and the tower structures. The transfer span and apron are typically lifted off the supporting structures with a derrick and removed from the site (see Figure 2-39).


**Figure 2-39**
**Removal of a Transfer Span**

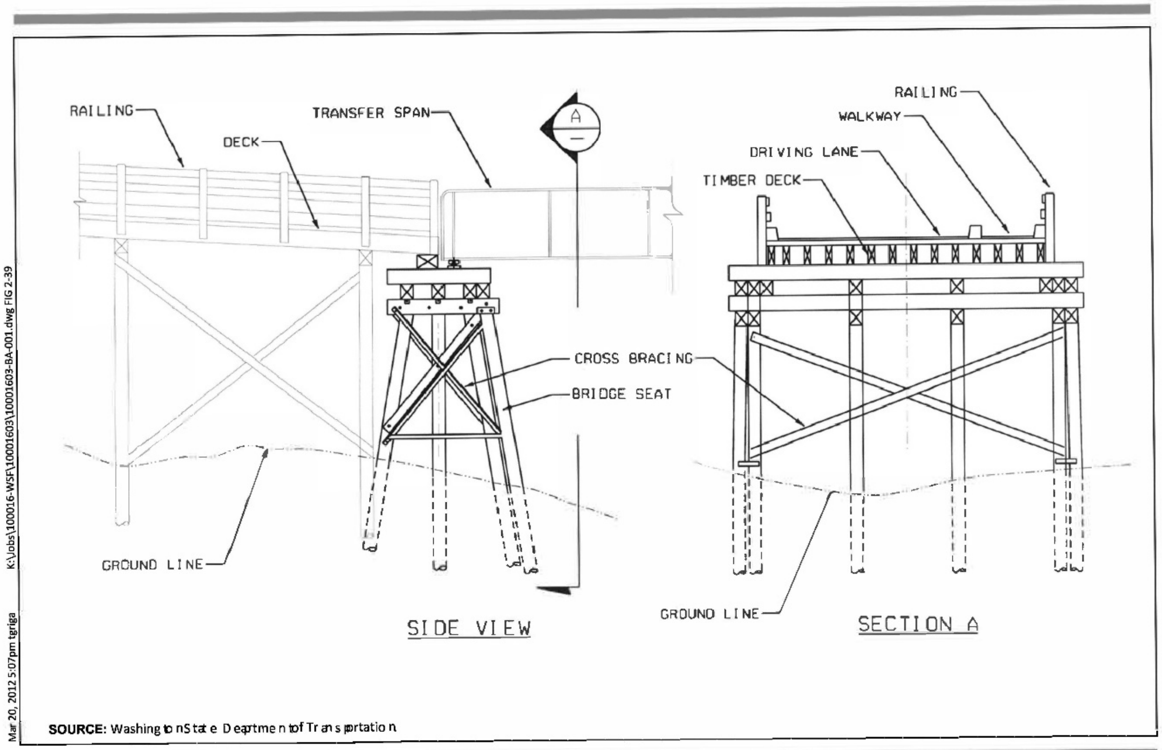
The refurbished or replacement transfer spans and aprons are brought to the construction site on a barge. Each component is then lifted into place with the crane and set into position. Work to weld, bolt, and fasten these structures is generally conducted from the trestle.

### *2.2.5 Bridge Seat*

#### 2.2.5.1 *Function*

The bridge seat is a pile and cap structure that supports the fixed end of the transfer span and provides a pivot point for the transfer span to be raised and lowered. Bridge seats generally occur in water depths of -10 to -35 feet MLLW.

The bridge seat is typically constructed of two clusters of four piling tied together with a concrete cap and beam. Older facilities were built with multiple timber pile caps and beams (Figure 2-40).




**SOURCE:** Washington State Department of Transportation

**Figure 2-40**
**Typical Timber Bridge Seat**

#### 2.2.5.2 *Repairs or Replacements*

Bridge seat piling can be repaired in several ways, depending on the severity of damage to the structure. The structure can be supported by driving additional piling beneath or next to the structure to stabilize it. Most bridge seats can be supported with as few as two to four additional steel piles. However, in rare cases where access is difficult or impossible, up to eight additional steel piles may be required to support a bridge seat. A more complex repair involves detaching the entire transfer span and removing it from the site, and removing the old piling and driving new piling. A cast-in-place or pre-cast concrete cap is installed to connect the steel piling. Cast in place structures require the use of forms to contain the concrete until it cures. Forms are sealed with rubber or foam to ensure no uncured concrete escapes (Figure 2-41).


**Figure 2-41**
**Forms Used for a Cast-in-place Concrete Pile Cap**

After the piling are driven, the bridge seat is reassembled and the transfer span is put back in place. This requires that the ferry slip be closed and results in operational interruptions. Alternatively, a new bridge seat can be built with the transfer span in place during most of the construction to minimize closure time. However, this requires short-term closures and potential operational interruptions.

#### 2.2.5.3 *Installation*

Installation of a new bridge seat is accomplished in the same way a new trestle is installed (see Section 2.2.6.3).

### *2.2.6 Trestle*

#### 2.2.6.1 *Function*

A trestle is a fixed-pile structure that carries passenger and vehicle traffic from shore to the transfer span (see Figures 2-23 and 2-24). The trestle may be relatively short in an area with a steep beach, or long in gently sloping areas. Trestle widths vary by ferry terminal.

#### 2.2.6.2 *Design*

The trestle is constructed of a series of rows of piling that, when connected by a common cap, are called "bents" (see Figure 2-42). The bents provide support for the vertical load. The term "bent" includes the pile cap and all the piles that support it. Timber trestles are supported by the cross-bracing installed between the bents or by batter piling (Figure 2-42). The distance between the bents (and therefore the total number of piling required for the trestle) is determined by the load that the structure is expected to support, and the pile and pile cap capacity. The bents are linked at the top by stringers running from cap to cap for the length of the trestle. Older stringers are generally creosote-treated wood, and newer trestles are built with reinforced concrete stringers (Figure 2-42). The stringers are topped with one of a variety of decking materials; the decking is typically covered with asphalt.


**Figure 2-42**
**Under a Timber and Concrete Trestle**

### 2.2.6.3 *Repairs or Replacements to the Trestle*

Piling replacement under an existing trestle is not a simple project. There are several methods of replacing a pile under a trestle. One method involves lifting the decking, removing the damaged pile and driving a new one in the same location, or driving a new pile adjacent to the damaged pile and removing the damaged pile entirely if possible, or cutting it off below the mudline and capping it with clean material. To install a pile through the decking, an approximately 2-foot-square piece of decking is removed and the pile is driven through the hole. However, because the pile supports a timber (usually) pile cap, the new pile must be driven at a slight angle and bent back to slip underneath to support the pile cap. The decking is then replaced. Micropiles, described in Section 2.1.1.5, may be used to replace timber piles.

Other methods used to repair trestle piles are pile stubbing and pile encapsulation, which are described in Section 2.1.1. Stub-pile repair and pile encapsulation are done when structures on the trestle, such as buildings, or dock architecture prohibit installing piling through the existing trestle.

Eventually timber trestles deteriorate to such a point that they can no longer be repaired and must be replaced. Trestle replacement starts with demolition of the old trestle including removal of the decking and old piles. This can be done from a derrick or sometimes with machinery working directly on the trestle or on shore (Figure 2-43).

**Figure 2-43**
**Removal of Timber Decking**

Old decking and piles are stored on a barge or in a truck and disposed of off site. Once demolition is complete, new piles are installed using the methods described in Section 2.1.1.2. The new piles are then fitted with concrete caps (Figure 2-44).

**Figure 2-44**
**Concrete Pile Cap**

Deck panels are placed on top of the caps once the caps have cured. The concrete caps and deck panels may be cast in place (Figure 2-45) or pre cast (Figure 2-46).

**Figure 2-45**
**Pouring Concrete for Cast-in-place Deck Panels**

**Figure 2-46**
**Pre-cast Concrete Deck Panels**

### 2.2.7 Overhead Loading

Overhead loading facilities are pile-supported structures with an enclosed walkway above (Figure 2-47). Of the 19 WSF terminals, six currently have overhead loading facilities: Anacortes, Bainbridge Island, Bremerton, Edmonds, Kingston, and Seattle. The overhead loading facilities at Anacortes, Edmonds, Kingston, Bremerton, and Seattle are constructed of steel. The elevated walkway to the overhead loading structure at Bainbridge Island is constructed of timber. The transfer span at the end of the walkway is steel and the support structures are steel and concrete.

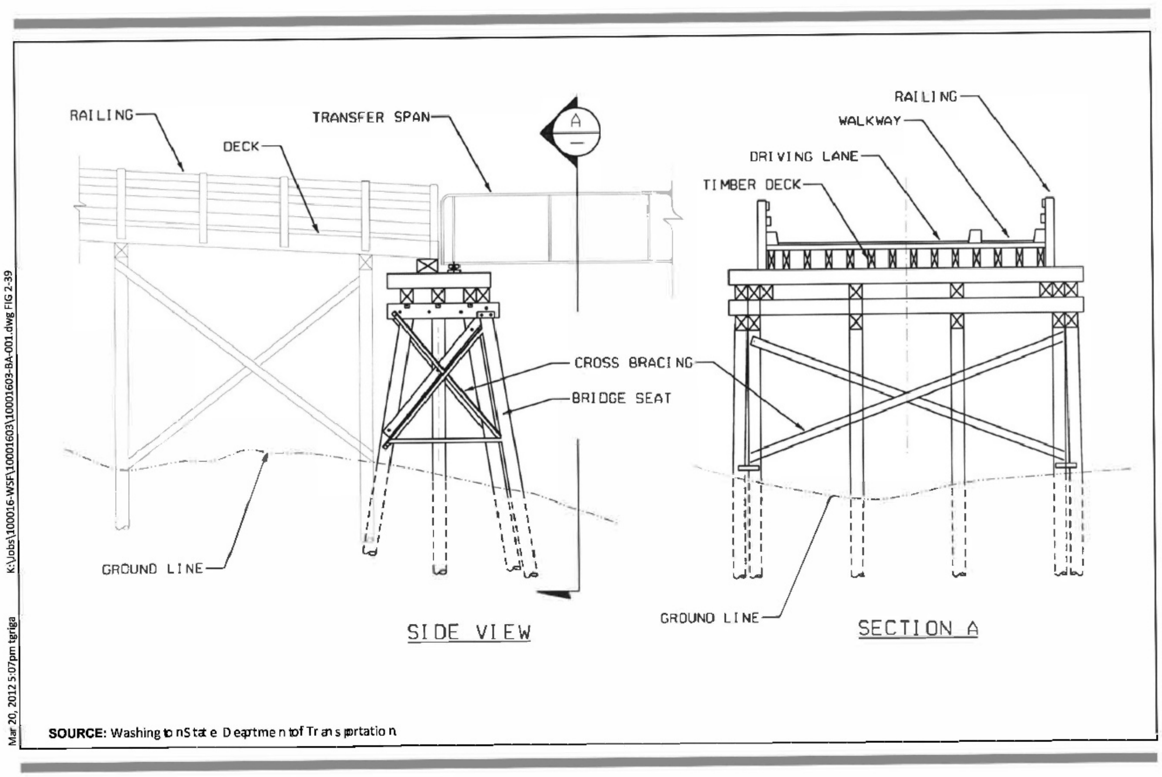



**Figure 2-47**
**Typical Overhead Loading**

#### 2.2.7.1 *Function*

Overhead loading structures provide direct pedestrian access to the passenger levels of the vessel. These structures separate pedestrians from vehicular traffic, and allow simultaneous loading of pedestrians and vehicles to improve safety and decrease loading time.

#### 2.2.7.2 *Design*

Overhead loading facilities have a fixed walkway leading from the shore to a moveable transfer span, loading cab, and gangway apron. The gangway apron is connected to a cab. The apron and cab act much like a transfer span—the unit is hinged on one end and raises and lowers with the tides to meet the upper deck of the vessel. The apron is raised and lowered with a hydraulic or chain lifting system connected to the cab. The elevation of the walkway is determined by the height of the passenger deck level of the vessel servicing the route, and shoreline elevation. The walkway is designed to meet Americans with Disabilities Act (ADA) requirements. Typically, an overhead loading facility is about 20 feet higher than a trestle.

The fixed portion of the timber overhead loading facility at Bainbridge Island is designed much like a timber trestle. It is supported by rows of timber piling and timber cross-bracing. Steel overhead loading facilities, such as those at Kingston and Edmonds, are constructed of three to four 60-inch-diameter piling that support a covered walkway. The seaward end of the cab is supported by either a tower system or by a supercolumn (108 inches in diameter) containing an internal hydraulic system. Both of these systems allow the end of the passenger overhead loading structure to elevate or lower to meet the deck of the ferry vessel at any tide elevation. The hydraulic system in the supercolumn is protected by a two-piece fiberglass shroud, which is bolted onto the supercolumn (Figure 2-48).

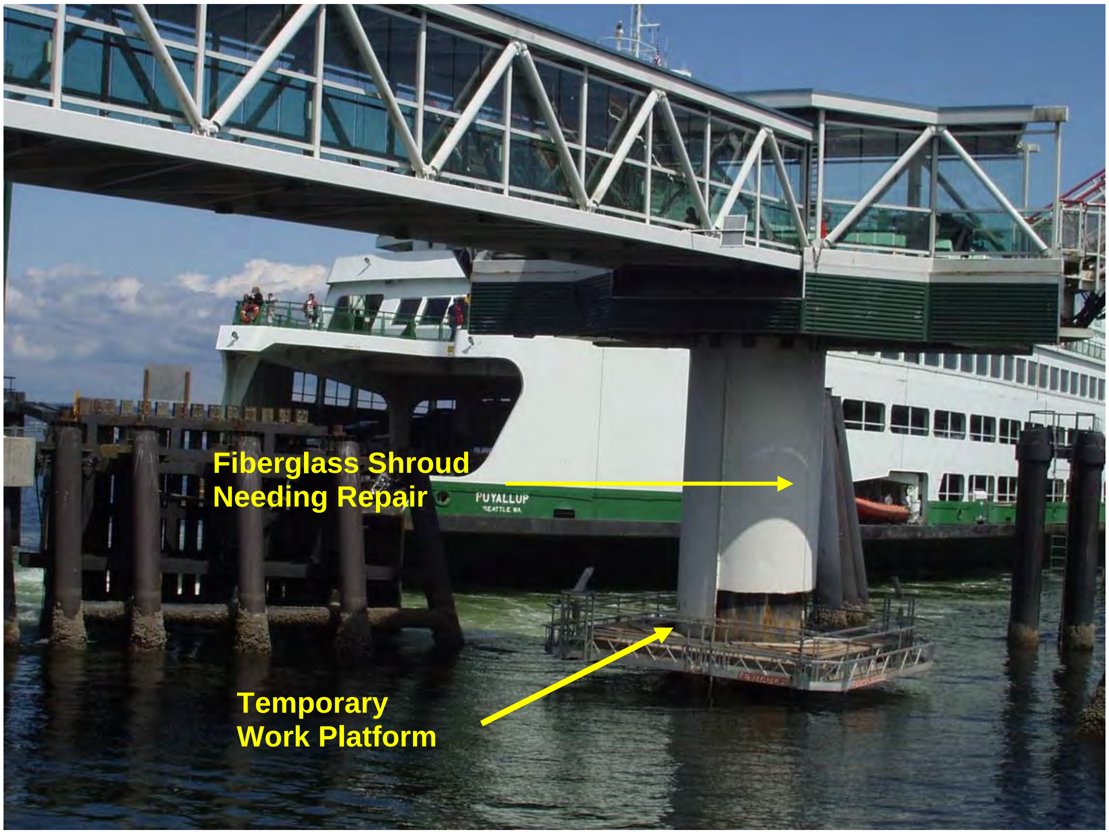



**Figure 2-48**
**Supercolumn Supporting Overhead Loading Structure at the Kingston Terminal**

### 2.2.7.3 *Repair*

In-water repairs to overhead loading facilities include pile repair and/or installing additional piling to shore up the structure and replacement of cross bracing. Repairs to the tower system or hydraulics and protective fiberglass shroud (see Figure 2-48) of a supercolumn are typically completed using a derrick with an overhead crane.

### 2.2.7.4 *Installation*

New overhead loading facilities are hydraulically supported and the pedestrian transfer span can be raised and lowered to accommodate the tides and meet ADA requirements. The hydraulic supercolumn supports the entire overwater structure. The supercolumn is installed in the same way as hydraulic transfer spans, with a drilled shaft foundation. Temporary pile supports may be needed to construct the walkway structure until it is completed and can be supported by the supercolumn.

### 2.2.8 Bulkheads

#### 2.2.8.1 *Function*

WSF bulkheads are constructed of timber, steel sheet pile, riprap, or concrete walls and are located beneath the trestle, acting as retaining walls to protect the shoreward connection between the trestle and land. Many of the bulkheads at WSF terminals occur above MHHW. These bulkheads must remain free of debris that can cause damage to pile structures during high wind and wave action.

#### 2.2.8.2 *Design*

Bulkheads are designed in a number of ways. Bulkheads commonly consist of sheet piling driven into the ground or H-beam piling driven into the ground with either timber or pre-cast concrete in between the piling, riprap, or lagging (horizontal timber members in between vertical supports) (Figure 2-49). Large bulkheads or those constructed in poor soil conditions may require installation of piles or small diameter (36-inch) drilled shafts. Some bulkheads require support components, referred to as tie-backs, which extend shoreward from the bulkhead to provide additional support to the structure. Construction of concrete bulkheads usually requires trenching to install either pre-cast concrete panels (constructed off site and brought in for installation) or cast-in-place concrete lagging (concrete poured on site). To prevent erosion, riprap has been installed in front of many WSF bulkheads.


**Figure 2-49**
**Timber and Steel Bulkheads**

#### 2.2.8.3 *Repairs or Replacements to Bulkheads*

Sheet pile bulkheads are susceptible to rust. A temporary repair method is to weld replacement steel sheet metal over the rust holes and backfill any voids caused by loss of soil through the holes. Whenever possible, the work is performed from the upland area using land based equipment. Work performed from the waterside is usually performed at low tide or from a floating work platform. A more permanent repair method is to replace the bulkhead. Depending on the type of bulkhead, replacement may require impact driving or vibratory installation of H-piles or hollow steel piles, driving of sheet pile, or installation of concrete panels.

Timber bulkheads can be replaced or repaired by removing and replacing lagging with new pieces of timber. This work is also performed at low tide.

### 2.2.9 Temporary Structures

Two types of temporary structures are described in this section: structures required to provide passenger-only service or other service during scheduled construction that results in the temporary closure of a facility, and structures that are installed under urgent or emergency situations.

#### 2.2.9.1 *Structures to Provide Limited Service*

Closure of facilities is occasionally required during larger replacement projects such as removal of transfer spans, construction of towers, and construction of wingwalls. In these instances, WSF is responsible for providing some level of service to the public during closures. In the event of a complete shutdown of vessel operations, WSF typically provides passenger-only service between existing WSF terminals or other nearby facilities. To provide service, ADA-accessible floats and ramps may be used. The longest closure of a WSF facility to date has been 3 weeks, and passenger-only service was provided for the duration of the closure. Temporary structures used to provide interim service are removed shortly after service is resumed.

#### 2.2.9.2 *Structures to Maintain Regular Service*

Structures such as towers, wingwalls, and (most frequently) dolphins are prone to catastrophic damage from hard landings caused by weather conditions or malfunctioning equipment on a vessel. In these instances, WSF may need to install a temporary structure to maintain vessel operations while a permanent structure can be designed, materials procured, money reallocated, and normal contracting procedures completed. Temporary structures are most often dolphins, and are generally a cluster of steel or ACZA-treated timber piles. Temporary structures generally contain fewer than 25 piles and sometimes as few as six piles. Under these situations, WSF aims to complete the permanent repair as quickly as possible, but due to factors such as budget constraints, availability of materials, availability of labor to engineer the structures, and limited construction windows, temporary structures may not be replaced for up to 2 years.

#### 2.2.9.3 *Structures to Maintain Operation During Construction*

Temporary structures such as transfer spans and towers may be needed to maintain operation during construction at terminals. The nature of these structures is project-dependent and the construction methods are the same as for similar permanent structures.

#### 2.2.9.4 *Structures Used for Construction*

Temporary work platforms are occasionally used to allow access to construction areas, or to guide placement of new structures (see Figure 2-50). Examples of these structures include the temporary work platforms used for installation of rock anchors on Lopez Island and the platform used to guide the placement of a replacement dolphin on Bainbridge Island.

The installation of work platforms often requires placement of temporary piles for support (Figure 2-51).

**Figure 2-50**
**Temporary Work Platform**

**Figure 2-51**
**Work Platform Supported by Temporary Steel Piles**

### 2.3 Minimization Measures

The following MMs will be employed during all construction at WSF facilities. General MMs used for all construction practices are presented in Section 2.3.1, followed by specific MMs for individual activities in Sections 2.3.2 through 2.3.5. Some of these MMs apply to several different activities and are listed multiple times in these sections.

These MMs have been developed and are routinely used by WSF during repair, replacement, and maintenance activities at WSF terminals. The MMs are intended to avoid and minimize potential effects to ESA-listed species and designated critical habitat.

The language in each MM is included in the Contract Plans and Specifications for specific projects and must be agreed upon by the contractor prior to any construction activities.

Upon signing the contract, it becomes a legal agreement between the contractor and WSF. Failure to follow the prescribed MMs is a contract violation.

WSF policy and construction administration practice is to have a WSF inspector on site during construction. The role of the inspector is to ensure contract compliance. The inspector and the contractor each have a copy of the Contract Plans and Specifications on site and are aware of all requirements. The inspector is also trained in environmental provisions and compliance.

### 2.3.1 General Minimization Measures for All Construction Activities

All WSF construction is performed in accordance with the current WSDOT Standard Specifications for Road, Bridge, and Municipal Construction. Special Provisions contained in preservation and repair contracts are used in conjunction with, and supersede, any conflicting provisions of the Standard Specifications.

WSF activities are subject to federal, state, and local permit conditions. WSF uses the best guidance available (e.g., best management practices [BMPs] and MMs) to accomplish the necessary work while avoiding and minimizing environmental effects to the greatest extent possible.

WSF policy and construction administration is to have at least one WSF inspector on site during construction. The role of the inspector will be to ensure contract and permit compliance. The inspector and contractor each will have a copy of the Contract Plans and Specifications on site and will be aware of all permit requirements. In addition, depending on the specific project, environmental staff may be present for monitoring and compliance.

WSF must comply with all Washington State Department of Ecology (Ecology) water quality regulations. General and specific conditions to protect water quality that apply to the project shall be reviewed with all contractors prior to the start of the project, and kept on the job site at all times during construction.

Timing restrictions are used to avoid in-water work when ESA-listed species are most likely to be present. Work windows are typically imposed by the Corps and/or Services if data indicates that listed species are present in the area, and by WDFW if forage fish spawning is known to occur near the terminals.
The contractor will be advised that eelgrass (*Zostera marina* L.) beds are protected under local, state, and federal law. When work will occur near eelgrass beds, WSF will provide plan sheets showing eelgrass boundaries to the contractor. The contractor shall exercise extreme caution when working in the area indicated on the plans as "Eelgrass Beds." The contractor shall adhere to the following restrictions during the life of the contract. The contractor shall not:

1. Place derrick spuds or anchors in the area designated as "Eelgrass."
2. Shade the eelgrass beds for a period of time greater than 3 consecutive days during the growing season (generally March through September).
3. Allow debris or any type of fuel, solvent, or lubricant in the water.
4. Perform activities that could cause significant levels of sediment to cover the eelgrass beds.
5. Conduct activities that may cause scouring of sediments within the eelgrass beds or other types of sediment transfer out of or into the eelgrass beds.

Any damage to eelgrass beds or substrates supporting eelgrass beds that results from a contractor's operations will be repaired at the contractor's expense.

WSF will obtain Hydraulic Project Approval (HPA) from WDFW and a Shoreline Substantial Development Permit (SSDP) or Permit Exemption from the local jurisdiction for in-water projects and the contractor will follow the conditions of these permits. HPA and SSDP or Permit Exemption requirements will be listed in the contract specifications for the contractor to agree to prior to construction and the HPA will be attached to the contract such that conditions of the HPA and SSDP are made part of the contract.

Additional general MMs for all activities described in this document include:

- The contractor shall be responsible for the preparation of a Spill Prevention, Control, and Countermeasures (SPCC) Plan to be used for the duration of the project. The plan shall be submitted to the project engineer prior to the commencement of any construction activities. A copy of the SPCC Plan with any updates will be maintained at the work site by the contractor.

- The SPCC Plan shall identify construction planning elements, and recognize potential spill sources at the site. The SPCC shall outline BMPs, responsive actions in the event of a spill or release, and notification and reporting procedures. The SPCC shall also outline contractor management elements such as personnel responsibilities, project site security, site inspections, and training.
- The SPCC will outline what measures shall be taken by the contractor to prevent the release or spread of hazardous materials, either found on site and encountered during construction but not identified in contract documents, or any hazardous materials that the contractor stores, uses, or generates on the construction site during construction activities. These items include, but are not limited to, gasoline, oils, and chemicals. Hazardous materials are defined in Regional Code of Washington (RCW) 70.105.010 under "hazardous substance."
- The contractor shall maintain, at the job site, the applicable spill response equipment and material designated in the SPCC Plan.

• No petroleum products, fresh cement, lime, concrete, chemicals, or other toxic or deleterious materials shall be allowed to enter surface waters.
• WSF will comply with water quality restrictions imposed by Ecology (Chapter 173-201A WAC), which specify a mixing zone beyond which water quality standards cannot be exceeded. Compliance with Ecology's standards is intended to ensure that fish and aquatic life are being protected to the extent feasible and practicable.
• If beach access is required, use of equipment on the beach area shall be held to a minimum and confined to designated access corridors that minimize foot traffic on the upper beach.
• Barge operations shall be restricted to tide elevations adequate to prevent grounding of the barge.

- Wash water resulting from washdown of equipment or work areas shall 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 shall be maintained to prevent any visible sheen from petroleum products appearing on the water.
- There shall 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 shall be discharged to ground or surface waters.
- The contractor shall regularly check fuel hoses, oil drums, oil or fuel transfer valves, fittings, etc. for leaks, and shall maintain and store materials properly to prevent spills.
- Projects and associated construction activities will be designed so potential effects to species and habitat are avoided and minimized.

### 2.3.2 Pile Removal and Demolition of Structures

MMs to be employed during pile removal and demolition of structures include:

- A containment boom surrounding the work area will be used during creosote-treated pile removal to contain and collect any floating debris and sheen, provided that the boom does not interfere with vessel operations. The boom will remain in place until all oily material and floating debris have been collected and all sheens have dissipated. The contractor will also retrieve any debris generated during construction, which will be properly disposed of at an approved upland location.
- The contractor will have oil-absorbent materials on site to be used in the event of a spill if any oil product is observed in the water.
- All creosote-treated material, pile stubs, and associated sediments will be disposed of by the contractor in a landfill that meets the liner and leachate standards of the Minimum Functional Standards, Chapter 173-304 WAC. The contractor will provide receipts of disposal to the WSF project engineer.
- Removed piles, stubs, and associated sediments (if any) shall be contained on a barge. If piles are placed directly on the barge and not in a container, the storage

area shall consist of a row of hay or straw bales, filter fabric, or similar BMP placed around the perimeter of the barge.

- Excess or waste materials will not be disposed of or abandoned waterward of Ordinary High Water (OHW) or allowed to enter waters of the state, as per WAC 220-110-070. Waste materials will be disposed of in a landfill. Hazardous waste and treated wood waste will be disposed of by the contractor in a landfill that meets the liner and leachate standards of the Minimum Functional Standards, Chapter 173-304 WAC.
- Piling that break or are already broken below the waterline will be removed with a clamshell bucket. To minimize disturbance to bottom sediments and splintering of piling, the contractor will use the minimum size bucket required to pull out piling based on pile depth and substrate. The clamshell bucket will be emptied of piling and debris on a contained barge before it is lowered into the water. If the bucket contains only sediment, the bucket will remain closed, be lowered to the mudline, and opened to redeposit the sediment.
- Demolition and construction materials shall not be stored where high tides, wave action, or upland runoff can cause materials to enter surface waters.

### 2.3.3 Pile Installation, Pile Repair, and Installation of Structures

MMs to be employed during pile installation, pile repair, and installation of structures include:

- The vibratory hammer method will be used to the extent possible to drive steel piles to minimize noise levels.
- A bubble curtain or other noise attenuation device will be employed during impact installation or proofing of steel piles unless the piles are driven in the dry.
- WSF will comply with water quality restrictions imposed by Ecology (Chapter 173-201A WAC), which specifies a mixing zone beyond which water quality standards cannot be exceeded. Compliance with Ecology’s standards is intended to ensure that fish and aquatic life are protected to the extent feasible and practical.
- Creosote-treated timber piling shall be replaced with non-creosote-treated piling.
- The contractor will be required to ensure that wet concrete does not come in contact with marine waters. Forms for any concrete structure will be constructed

to prevent leaching of wet concrete. Forms will remain in place until concrete is cured.

- The tube used to fill steel pilings with concrete or to grout rock anchors will be placed toward the bottom of the piling to prevent splashing and concrete overflow.
- During grouting of rock anchors, the bottom of the pile will be sealed by the sediment it has been driven into or, if the sediment layer is too thin, by plastic and sandbags to ensure no concrete escapes from the base of the pile.
- For installation of drilled shafts, sediments and slurry will be completely contained within the casing during construction. The sediments removed will be contained for upland disposal, as will the drilling slurry.
- The contractor will be required to retrieve any floating debris generated during construction. Any debris in the containment boom will be removed by the end of the work day or when the boom is removed, whichever occurs first. Retrieved debris will be disposed of at an upland disposal site.
- Whenever activities that generate sawdust, drill tailings, or wood chips from treated timbers are conducted, tarps or other containment material shall be used to prevent debris from entering the water. If tarps cannot be used (because of the location or type of structure), a containment boom will be placed around the work area to capture debris and cuttings.
- Excess or waste materials will not be disposed of or abandoned waterward of OHW or allowed to enter waters of the state.
- Water inside the form used for pile repairs will be drained to the water elevation outside the form before concrete is poured.
- Steel, plastic/steel, concrete, or ACZA-treated wood piling will be used. No creosote-treated timber piling will be used.
- ACZA-treated wood will be treated using the April 3, 2012 version of the BMPs for the Use of Treated Wood in Aquatic and Wetland Environments; Western Wood Preservers Institute.
- All piling, lumber, and other materials treated with preservatives shall be sufficiently cured to minimize leaching into the water or sediment.
- Hand tools or a siphon dredge will be used to excavate around piles to be replaced.

### 2.3.4 Temporary Structures

MMs to be employed during installation of temporary structures include:

- Temporary structures associated with facility closures during construction will be removed before the contractor demobilizes from the site.
- Temporary structures installed to maintain existing service to the facility will be replaced with the permanent structure within 2 years of installation.
- If temporary floats are installed to provide passenger-only service in areas adjacent to eelgrass beds, floats will be designed to avoid shading of eelgrass beds, or will be installed in water depths of at least -20 feet MLLW to prevent scouring of eelgrass beds.
- WSF will develop operational criteria for temporary vessels providing passenger-only service, including maximum horsepower ratings, propeller diameters, and propeller depth to centerline thresholds that the provider of the passenger-only service must meet to operate at temporary passenger-only facilities, to prevent scouring of the seabed.

### 2.3.5 Dredging

MMs to be employed during dredging include:

- Dredged material will be contained with BMPs such as ecology blocks, filter fabric, and/or straw bales and disposed of in an approved in-water disposal site or upland location, or reused if reuse has been approved.
- WSF will comply with water quality restrictions imposed by Ecology (Chapter 173-201A WAC), which specifies a mixing zone beyond which water quality standards cannot be exceeded. Compliance with Ecology's standards is intended to ensure that fish and aquatic life are protected to the extent feasible and practical.
- Dredging will be done at a slow and controlled pace to minimize turbidity.

# 3 SPECIES EFFECTS ANALYSIS

Effects to species are project-specific; however, certain effects are predictably associated with different types of work. The purpose of this section is to describe the effects of construction activities on listed species, and provide necessary analysis for making effects determinations on a project-by-project basis. Table 3-1 outlines the nature and severity of potential effects that could occur from certain types of construction. The life histories and other information on these species are described in Appendix B.

Effects to listed fish species are expected to be similar and are therefore grouped together in Section 3.1. Additional species specific information is provided where appropriate. Effects to listed marine mammal and bird species discussed separately.

## 3.1 Listed Fish Species Effects

Potential effects to fish are similar, therefore this section addresses all listed species. Studies of Chinook are more common, which is reflected in the discussion below. Rockfish presence is depth specific, so is discussed separately at the end of this section.

### *3.1.1 In-water Noise*

NMFS has set underwater noise injury and disturbance thresholds for fish as shown in Table 3-2. Impact pile driving of steel and concrete piles can produce sound that exceeds injury and disturbance levels. Impact driving of timber piles, and vibratory driving/removal of all types of piles do not exceed injury levels, but can exceed disturbance levels.

The ESA listed species effect determinations for any individual project will depend on a combination of factors including site-specific sediment conditions, use of attenuation devices, duration of exposure, and shoreline configuration that may limit sound propagation (for example, an enclosed bay as opposed to an open shoreline). For a full discussion of in-water noise, pile driving and removal noise data, and impact pile driving attenuation data, see Section 7.2 of the WSDOT Biological Assessment Manual (WSDOT 2019a).

**Table 3-1**
**Effects Associated with Project Activities**

| Type of Work | Associated Effects | | | |
|---|---|---|---|---|
| | Noise | Turbidity | Change in Overwater/Benthic Coverage | Other Potential Effects |
| Pile repair | | Short-term, localized turbidity may occur | | Metal leaching (from ACZA-treated wood) |
| Impact pile driving | Potential for injury and disturbance effects for fish, murrelet and marine mammals. | Short-term, localized turbidity may occur | If benthic footprint increased, may result in lower productivity and/or altered predator-prey relationships.<br>If decreased, may result in increased benthic productivity<br>. | |
| Vibratory pile driving and removal | Potential for disturbance effects for fish and murrelet. Potential injury and disturbance effects for marine mammals. | Short-term, localized turbidity may occur | If benthic footprint increased, may result in lower productivity and/or altered predator-prey relationships. If decreased, may result in increased benthic productivity. | Resuspension of contaminants[1] |
| Rock anchors | Potential for underwater noise above ambient levels but below the behavioral effects threshold | | | Elevated pH if concrete grouting is used |
| Cast-in-place concrete | | | | Elevated pH |
| Dredging | | Short-term turbidity with significant plume possible; severity depends partly on sediment conditions | | Temporary loss of benthic productivity |
| New or replacement structures | Noise associated with pile driving; can reach injury or disturbance thresholds underwater and in air | Short-term, localized, turbidity associated with pile removal and/or installation | If overwater/benthic footprint increased, may result in lower benthic productivity and/or altered predator-prey relationships. If decreased, may result in increased benthic productivity<br>Some water temperature effects possible with large changes | |
| Shoreline armoring | | Short-term, localized turbidity, especially if excavation is part of the work | May increase shoreline productivity if bulkhead is removed or modified | Elevated pH if concrete is used |

**Table 3-2**
**Fish Sound Injury and Disturbance Threshold**

| | Pulse |
|---|---|
| Single Strike Injury (fish of all sizes) | 206 $dB_{PEAK}$ |
| Cumulative Sound Injury | -- |
| <2 grams | 183 $dB_{SEL}$ |
| ≥2 grams | 187 $dB_{SEL}$ |
| Disturbance | 150 $dB_{RMS}$ |

**Source:** Fisheries Hydroacoustic Working Group 2008

### *3.1.2 Temporary Turbidity*

Work involving sediment disturbance, including pile removal and installation, dredging, and other in-water activities, has the potential to cause turbidity. The potential effects of increased turbidity on salmonids have been investigated in a number of dredging studies (Servizi and Martens 1987 and 1992; Emmet et al. 1988; Noggle 1978; Simenstad 1988; Redding et al. 1987; Mortensen et al. 1976; Berg and Northcote 1985). Dredging activities would generate much greater turbidity than pile removal activities because smaller amounts of material are removed during pile removal activities. Pile removal activities disturb far less sediment and have less potential impact on water quality than dredging.

The most important factor in resistance to turbidity effects is the availability of "turbidity refugia," areas of clear water outside the turbidity plume that are accessible to fish (Bash et al. 2001). All the WSF terminals are in areas of open water large enough to provide turbidity refugia outside the affected area.

Very little data exists regarding sediment plumes and turbidity caused by pile removal. Roni and Weitkamp (1996) monitored water quality parameters during a pier replacement project in Manchester, Washington. The study measured water quality before, during, and after pile removal, dredging, and pile replacement. Construction activities occurred from mid-February 1991 to March 1993. The study found that construction activity at the site had "little or no effect on DO (dissolved oxygen), water temperature, and salinity." Turbidity (measured in nephelometric turbidity unit [NTU]) at all depths nearest the construction activity was typically less than 1 NTU higher than stations farther from the construction area throughout construction. Only during dredging in 1991 did turbidity exceed background levels by more than 1 NTU.

In September 2004, water quality monitoring conducted at the Friday Harbor Ferry Terminal during three pile removal events of creosote-treated structures showed turbidity levels did not exceed 1 NTU over background conditions and were generally less than 0.5 NTU over background levels. In October 2005, water quality monitoring conducted at the Eagle Harbor Maintenance Facility during four pile removal events of creosote and steel piles showed turbidity levels did not exceed 0.2 NTU over background levels (WSF 2005a). In December 2005, water quality monitoring conducted during 28 pile removal events of steel piles at the Friday Harbor Ferry Terminal showed turbidity levels did not exceed 0.61 NTU over background levels (WSF 2005b).

The U.S. Environmental Protection Agency (EPA) indicates that turbidity is localized around piling to about a 25-foot radius during pile installation. Because there is so little information available on turbidity and pile removal and installation, studies on the effects to fish from suspended sediments from dredging are summarized for this discussion. Turbidity from dredging greatly exceeds turbidity levels measured during pile removal because dredging involves the removal and disturbance of greater amounts of sediment than pile removal.

There are several mechanisms by which suspended sediment can affect juvenile salmonids, including direct mortality, gill tissue damage, physiological stress, and behavioral effects. Each is discussed in Sections 3.1.2.1 through 3.1.2.4.

#### 3.1.2.1 *Direct Mortality*

Direct mortality from extremely high levels of suspended sediment has been demonstrated at concentrations far exceeding those caused by typical dredging operations. Laboratory studies have consistently found that the 96-hour median lethal concentration ($LC_{50}$) for juvenile salmonids occurs at levels above 6,000 milligrams per liter (mg/L) (Stober et al. 1981; Salo et al. 1980; LeGore and DesVoigne

1973). However, typical samples collected adjacent to dredge sites (within approximately 150 feet) contain suspended sediment concentrations between 50 and 150 mg/L (Havis 1988; Salo et al. 1979; Palermo et al. 1990). Based on an evaluation of seven clamshell dredge operations, LaSalle (1988) determined that suspended sediment levels of 700 mg/L and 1,100 mg/L at the surface and bottom, respectively, would represent the upper limit concentration expected adjacent to the dredge source (within approximately 300 feet). Concentrations of this magnitude could occur at sites with fine silt or clay substrates. Much lower concentrations (50 to 150 mg/L at 150 feet) are expected at sites with coarser sediment. Because direct mortality occurs at turbidity levels that far exceed typical dredging operations, and because levels of suspended sediment from dredging far exceed levels generated by pile removal and installation, direct mortality from suspended sediment is not expected to occur during pile removal or installation activities.

#### 3.1.2.2 *Gill Tissue Damage*

Studies also indicate that suspended sediment concentrations occurring near dredging activity will not cause gill damage in salmonids. Servizi and Martens (1992) found that gill damage was absent in underyearling coho salmon exposed to concentrations of suspended sediments lower than 3,143 mg/L. Redding et al. (1987) also found that the appearance of gill tissue was similar for control fish and those exposed to high, medium, and low concentrations of suspended topsoil, ash, and clay. Based on the results of these studies, juvenile and sub-adult salmonids, if any are present, are not expected to experience gill tissue damage even if exposed to the upper limit of suspended sediment concentrations expected during dredging, and therefore, are not expected to experience gill tissue damage from suspended sediment caused by pile removal or installation activities.

There is some evidence that fish may be more susceptible to gill tissue damage during the summer months when protective mucous secretions are generally lower (Bash et al. 2001).

#### 3.1.2.3 *Physiological Stress*

Suspended sediments have been shown to cause stress in salmonids, but at concentrations higher than those typically caused by dredging. Under-yearling coho salmon exposed to suspended sediment concentrations above 2,000 mg/L were physiologically stressed, as indicated by elevated blood plasma cortisol levels (Redding et al. 1987). Exposure to approximately 500 mg/L of suspended sediment for 2 to 8 consecutive days also caused stress, but to a much lesser degree (Redding et al. 1987; Servizi and Martens 1987). At 150 to 200 mg/L of glacial till, no significant difference in blood plasma glucose concentrations were observed. These results indicate that upper limit suspended sediment conditions near dredging activity (700 to 1,100 mg/L) can cause stress in juveniles if exposure continues for an extended period of time. Continued exposure is unlikely, however, due to the tendency for unconfined salmonids to avoid areas with elevated suspended sediment concentrations (Salo et al. 1980). Typical sediment plumes (50-150 mg/L) caused by dredging do not create suspended sediment concentrations high enough to cause stress in juvenile salmonids. Therefore, it is concluded that the even lower concentrations of suspended sediment caused by pile removal and other in-water activities will not have physiological impacts on salmonids in the project area.

#### 3.1.2.4 *Behavioral Effects*

Behavioral responses to elevated levels of suspended sediment include feeding disruption and changes in migratory behavior (Servizi 1988; Martin et al. 1977). Several studies indicate that salmonid foraging behavior is impaired by high levels of suspended sediment (Bisson and Bilby 1982; Berg and Northcote 1985). Redding et al. (1987) demonstrated that yearling coho and steelhead exposed to high levels (2,000 to 3,000 mg/L) of suspended sediment did not rise to the surface to feed. Yearling coho and steelhead exposed to lower levels (400 to 600 mg/L); however, actively fed at the surface throughout the experiment. In these instances, the thresholds at which feeding effectiveness was impaired greatly exceeded the upper limit of expected suspended solids during dredging. Pile installation is expected to result in even lower levels of sediment suspension.

Adult migration could also be subject to disruption from suspended sediment. Adult salmonids are not closely associated with the shoreline and are less vulnerable to adverse impacts should they avoid turbid conditions. Whitman et al. (1982) used volcanic ash from the eruption of Mount St. Helens to recreate highly turbid conditions faced by returning adult salmon. This study showed that, despite very high levels of ash, adult male Chinook salmon were still able to detect natal waters through olfaction even when subjected to 7 days of total suspended sediment levels of 650 mg/L. Since suspended sediment levels are not expected to reach those of dredging, migratory or feeding disruptions are not likely to occur from pile removal or installation activities.

### 3.1.3 Change in Overwater Coverage

The effects of overwater structures on outmigrating juvenile salmonids are not well understood. Some literature suggests that overwater structures have the potential to affect juvenile salmonids through habitat changes, increased predation, and disruption of migration patterns (Nightengale and Simenstad 2001). These issues have been studied to varying degrees but have not yielded conclusive results. Sections 3.1.3.1 through 3.1.3.3 discuss the potential effects of additional overwater cover, including migration disruption, the potential for increased predation, and primary and epibenthic productivity.

#### 3.1.3.1 *Migration Disruption*

Juvenile salmonids are reliant on shallow water nearshore habitats for food and refuge. Recent studies suggest that the movement of juvenile salmonids is affected by sharp shadows and dark/light interfaces cast by overwater structures (Nightengale and Simenstad 2001; NOAA Fisheries 2004; USFWS 2004a; Southard et al. 2006). Studies have shown that juvenile salmonids may follow the edge of a shadow along piers, rather than pass under the pier. A 2005 study conducted by Pacific Northwest National Laboratory (PNNL) at 10 WSF ferry terminals found it to be probable that overwater structures are temporary impediments to juvenile salmonid movement during specific times of day (depending on light level, sun angle, and cloud cover) or under specific environmental conditions (depending on current magnitude and direction, and tidal stage). The study also found that "juvenile chum remained on the light side of a dark/light shadow line when the decrease in light level was approximately 85% over a shore horizontal distance (e.g., five meters)" (Southard et al. 2006). However, another study conducted by PNNL at the existing Mukilteo Ferry Terminal found that "salmon fry moved freely under the relatively narrow, shaded portion of the Mukilteo Ferry Terminal where mean light levels in water were reduced by over 97%" (Williams et al. 2003). The observers concluded that "during the day, fry moved freely under the relatively narrow (33 feet wide), shaded portion of the ferry terminal and did not appear to be inhibited by the differences in light levels detected here…the terminal structure did not appear to act as barriers to fry movement at this location…" (Williams et al. 2003).

A 2008-2009 WSDOT sponsored research study by the University of Washington School of Aquatic and Fishery Sciences/Batelle Marine Science Laboratory on the effectiveness of under dock lighting as mitigation for shading was carried out at the Port Townsend Ferry Terminal. This study found that juvenile salmon seldom swam underneath the terminal but instead stayed 2 to 5 meters away from the dock, even in the afternoon when the shadow line moved underneath the dock. In addition to avoiding the dock's shading, juvenile salmon also appeared to avoid the overwater structure itself. Shoals of juvenile salmon observed in this study did not swim under the dock during daylight hours even when the shadow line moved some distance beneath the terminal. The study concluded that there is a high probability that small juvenile pink salmon experience more than 9 hours of migration delay per dock encounter, during high tides, on a sunny day. Unfortunately, there are no data to allow generalization of this finding to other overwater structures and other salmon species. Artificial light was used to mitigate the dock shadow edge, and the study concluded fish were more likely to come closer to the dock edge. This raises the possibility that a properly designed lighting system may allow for fish passage under the dock (Ono et al. 2010).

Bull trout enter Puget Sound at a later stage of development than most salmonids and are not as dependent on the shoreline environment (Goetz 2004). Therefore, bull trout migration may be less affected by nearshore overwater coverage.

### 3.1.3.2 *Potential for Increased Predation*

Studies have suggested that migrating salmonids may not pass under an overwater structure and may be forced to move farther offshore where they may become more susceptible to predation from birds, mammals, and fish. However, no conclusive evidence has been found to suggest that marine overwater structures contribute to increased predation on juvenile salmonids. According to Simenstad et. al. (1999), "despite considerable speculation about the effects of overwater structures increasing predation on juvenile salmonids, evidence supporting this contention scientifically is uncertain at best."

Williams et al. (2003) conducted bird/mammal surveys at six north-central Puget Sound WSF terminals and paired reference sites between April 1 and May 10, 2002. In addition, intensive surveys for potential predators of juvenile salmonids were conducted at the Mukilteo Ferry Terminal and reference sites in May 2002. The studies included SCUBA transects (benthic predatory fishes), snorkel transects (pelagic fishes), bird and marine mammal predatory surveys, salmon fry abundance surveys, documentation of nearshore fish assemblages during all diel phases using boat-deployed beach seines, collection of live potential fish predators and stomach content analysis, documentation of light measurements, and the use of Dual-frequency Identification Sonar (DIDSON) to document potential predators associated with the water column and terminals at night. According to Williams et al. 2003:

> Observational surveys at six locations suggest that potential salmon predators were statistically more abundant at WSF terminals with unmodified shorelines. Piscivorous birds were observed more often than expected at ferry sites as compared with reference sites. However, large aggregations of piscivorous birds were not observed at WSF terminals during any survey. Predatory fish surveys, which were conducted only at the Mukilteo ferry terminal and paired reference sites, produced similar findings…We found no evidence that avian or marine mammal predators consumed more juvenile salmon near WSF terminals along shorelines without overwater structures…our analysis of fish diets at the Mukilteo ferry terminal provides one piece of conclusive evidence that juvenile salmon were observed in the diet of a single staghorn sculpin collected at the reference site; these salmon were undigested and likely consumed in the bag of the beach seine. Our interpretation of the abundance, distribution patterns, and diets of potential predators suggest that juvenile salmon did not experience biologically

significant levels of predation near the ferry terminals studied during the spring of 2002.

The body of available research on the effects of overwater structure related to predation is inconclusive. Each project must be evaluated, considering the water depth where overwater structure is being added, the estimated light penetration under the structure, and any other available information.

#### 3.1.3.3 *Primary and Epibenthic Productivity*

A research report by Haas et al. (2002) studied the relationship between the large overwater structures associated with ferry terminals and abundance of epibenthic prey species. Although results were variable, the differences in epibenthic assemblages indicated negative effects from the terminals. The results demonstrated that significant differences in epibenthic assemblages do exist around the ferry terminals. Adjusted in-water photosynthetically active radiation (PAR) was generally close to zero under the existing structure at Bainbridge Island. Substrate composition for all three terminals studied (Bainbridge Island, Clinton, and Southworth) was noticeably different around the terminal structures, with higher gravel, shell, and cobble proportions as compared to sand, the dominant component. This was attributed to a combination of sea star foraging on piling and in substrate and the decomposition of shells from large numbers of bivalves in the sediments under and near the terminals. The Haas et al. (2002) study suggested that propeller wash may contribute to differences in epibenthic productivity at Bainbridge Island.

The Haas et al. (2002) study concluded that ferry terminal structures induce decreases or changes in epibenthos density, diversity, and assemblage composition, but attributed it to a combination of four interacting factors rather than to overwater coverage alone:

1. Direct disturbance and/or removal by regular vessel disturbance
2. Reduced benthic vegetation or compromised benthic vegetation function due to shading and physical disturbance
3. Physical habitat alterations (e.g., altered grain-size distribution from propeller wash or piling effects)

4. Biological habitat alterations (e.g., increased shell hash from sea star foraging and reduced eelgrass density due to benthic macrofauna disturbance)

The dominant factors will vary by project and should be discussed at the project level. A significant change in the configuration of an overwater structure could cause changes in local currents and sediment transport; this would need to be identified and evaluated at the individual project level.

### 3.1.4 Creosote Exposure and Effects

WSF is systematically replacing creosote-treated timber structures with steel or concrete. This is resulting in a reduction in polycyclic aromatic hydrocarbon (PAH) exposure in Puget Sound. The amount any one project contributes to this effort depends on the number of piles or board feet of timber removed from the aquatic environment. Removal of creosote-treated timber results in a reduction in long-term chronic exposure to fish and aquatic life. Removal of creosote-treated piles may result in a short-term increase in PAH exposure during removal activities, which is discussed below.

Existing creosote-treated piles are a source of hydrocarbon contamination to marine sediments in the form of PAHs. Concerns have been raised about the potential for resuspension of contaminants during removal of creosote-treated piles. As with all potentially toxic chemicals, the risk is a function of exposure, which can be highly variable and subject to modifying factors in the natural environment.

The bioavailable fraction of non-polar organic chemicals (i.e., PAHs) is a function of the sediment chemistry, including the amount and type of organic carbon, and the nature of the source material. Resident benthic species can come in contact with sediment-associated PAHs through three primary pathways: 1) through ingestion of sediment in their diet; 2) through direct contact, ingestion, and ventilation of interstitial water in the benthic mixed layer; and 3) through direct contact with contaminated sediment. This can lead to direct effects, primarily from non-polar narcosis (disruption of cellular function resulting in disorientation), as well as bioaccumulation in some benthic invertebrates.

The primary exposure pathway for PAHs in most vertebrate species is through the food chain. Marine fish that prey on benthic infauna can be exposed to PAHs via the dietary pathway (USFWS 2004a). The effects of ingesting PAHs accumulated in prey species includes the following, as noted in the Edmonds Crossing Biological Opinion (BO) (USFWS 2004a):

> Vertebrate organisms are able to quickly metabolize some of the lighter PAH compounds and readily excrete a percent of the hydrophobic parent compound along with the polar water-soluble metabolites (James et al. 1991; McElroy et al. 1991) which can be passed on to consuming marine fish. While PAHs do not bioaccumulate in vertebrates, some of the heavier, more carcinogenic PAH compounds and metabolites may persist and are known to cause sub-lethal effects to fish exposed in laboratory studies (NTP 1999) and field studies (Moore and Myers 1994; Myers et al. 1998a and 1998b; O'Neill et al. 1998).

Exposure to PAHs in juvenile salmon has been linked to immunosuppression and increased disease susceptibility (Arkoosh et al. 1998). However, Palm et al (2003) concluded that their controlled laboratory experiments suggest that dietary exposure to an environmentally relevant mixture of PAH compounds does not alter the immunocompetence or growth of juvenile Chinook salmon. Other effects of exposure to PAHs have been described in the Edmonds Crossing BO (USFWS 2004a):

> The general mode of effect associated with acute exposure to PAHs is non-polar narcosis (van Brummelen et al. 1998). Other major effects include biochemical activation/adduct formation (carcinogenesis), phototoxicity (acute and chronic exposure), and disturbance of hormone regulation. The role of PAHs in endocrine disruption is not well documented. Immunotoxicity as a mode of PAH toxicity has been investigated (Varanasi et al. 1993, Karrow et al. 1999). PAHs have induced tumors in laboratory animals exposed by inhalation and ingestion (Germain et al. 1993). The presence of hepatic (liver) tumors in English sole (Parophrys vetulus), a benthic marine fish, has been linked to PAH contamination in sediments collected from industrialized areas around Puget Sound (Johnson 2002, Meyers et al. 1990, Stein et al. 1990, Krahn et al. 1986).

#### 3.1.4.1 *Fate and Transport of PAHs from Pile Removal*

There are two mechanisms by which pile removal can reintroduce PAH contamination. The first route of contamination is through the water column as piles are being extracted. The second route of contamination is through the settling of resuspended PAHs on the surface sediments as residuals. PAHs are heavier than water and can sink to the bottom floor. Though undetectable in the water column, marine species could be directly or indirectly exposed to creosote through the food chain (USFWS 2004a).

At some terminal sites, the presence of crabs and shellfish and an accumulation of years of barnacles (*Balanus glandula*) attaching themselves to the dock piles, dying, and sloughing off to the bottom has created a thick layer of shell hash on the bottom. Theoretically, this shell hash will be pulled by the natural vacuum that is created during pile extraction and will further bury the contaminated sediment. The suction pulling the shell hash in the hole could counteract much of the sediment plume entering the water column during extraction. This natural cap should form a layer that may help isolate the contaminated sediment from the marine environment.

Field studies from dredging operations indicate that remobilization of PAHs from pile removal is not expected to affect salmonids that might be in the surrounding areas. A summary of the mechanisms by which contaminants could be mobilized and become bioavailable during an activity that disturbs bottom sediments and the frequency with which this has been observed during various dredging events is provided below. The dredging information comes from a literature review documenting the effects of resuspended sediments due to dredging operations (Anchor 2003b). It is expected that dredging activities lead to a larger amount of resuspended sediments and disturbance to the sediments than pile pulling and driving; therefore, this information is conservative for this application.

Non-polar organic compounds, like PAHs, are heavier than water and are not likely to dissolve in the water column. Organic compound contaminants become mobilized during dredging in the following ways: 1) through the release of porewater containing dissolved chemicals; 2) by desorption from sediment particles; and 3) through loss of particulate bound contaminants (Averett et al. 1999 *cited in* Anchor 2003a). Once mobilized, organic compound contaminants may become bioavailable as dissolved and particulate bound forms. The dissolved fraction available can be predicted using equilibrium partitioning modeling (EPA 2003). The dissolved form of chemicals can be toxic or can contribute to bioaccumulation of chemicals in an organism's tissue.

Theoretically, the releases of non-polar organic contaminants (including PAHs) can occur during dredging of contaminated sediments and increase water column concentrations above ambient levels. However, field studies show that PAH releases were small in comparison to the dilution from the receiving waters and that there were minimal changes in water quality, even when heavily contaminated sediments were dredged (Ludwing and Sherrard 1988; Brannon 1978; both *cited in* Anchor 2003a). Additional studies indicate that the concentrations of PAHs measured in the water column during dredging operations have been minimal and, in many instances, below detection limits. For example, dredge monitoring at the Port of Los Angeles showed PAH concentrations in the water column were four to six orders of magnitude lower than the concentrations measured in the sediments (MBC 2001a-f; all *cited in* Anchor 2003a).

Overall, the studies included in the literature review did not find a significant increase in concentration of organic compounds in the water column from suspended sediment resulting from dredging activities. Pile removal activities are generally less disruptive to bottom sediment than dredging. Sediments disturbed by pile removal will be suspended for only a short duration before particles settle out. Because of this, it is expected that pile removal would cause even less of an increase in contaminants dissolved in the water column than dredging.

The long-term benefit of removing creosote-treated wood from the aquatic environment is greater than the short-term impacts of removal. The short-term impacts generally result in an effect determination of "may affect, not likely to adversely affect," unless individual project conditions make a different effect determination appropriate.

### 3.1.5 ACZA Exposure and Effects

Research has shown that ACZA presents a far smaller relative hazard than creosote in the marine environment. While piling over 40 years of age still contain diffusible amounts of creosote that migrate from the piling to the environment, ACZA leaching lasts only up to a few weeks. The shorter leaching period is due in part to the pressure treatment and washing process that ACZA treated pilings must go through before being installed in marine environments. The leaching period may be slightly longer in overwater structures that are not constantly exposed to the water column. After several weeks, the metal compounds fuse to the wood and leaching no longer occurs (Poston 2001).

During the short leaching period, ACZA treated timbers may be a source of trace metals (primarily copper) to the aquatic environment by leaching into the water column and surrounding sediments.

The primary effect to salmonids of increased copper concentrations in water is olfactory disruption (Brooks 2004). Salmonids depend on olfaction to determine their migration route and to find food. A relationship between olfactory inhibition and diminished alarm response to predators has also been established (Sandahl et al. 2007). Chronic effects to salmonids occur when copper concentrations rise above the level the fish are acclimated to. These effects are detectable at levels of 2.0 μg/L above the acclimated level (Sandahl et al. 2007). Salmonids recover from these chronic effects when concentrations are lowered.

However, when ACZA piles are installed, increases in sediment metal concentrations are generally limited to within 10 feet or less of small treated wood structures in both marine and freshwater habitats. This can result in the food chain being exposed to copper, but not at potentially toxic levels (Poston 2001). In addition, the overwhelming conclusion of studies (Poston 2001) indicates that the effect from the use of ACZA treated wood can be greatly minimized if the wood is treated properly. As presented in Poston 2001, the reviewed studies and model results applied to projects to predict environmental responses to ACZA treated wood indicate the following:

- The use of treated wood in projects with less than 100 piling and in areas with normal tidal flushing does not produce metal concentrations that exceed Washington State's regulatory levels (measured in parts per billion [ppb]).

- The use of treated wood is unlikely to result in detectable increases in dissolved copper in water. The predicted amounts are a few tens of parts per trillion and are a thousand times less than the several ppb increase that might cause effects in even the most sensitive species.
- Models indicate that loss rates decline exponentially with time and reach background levels within 1 week after installation. Model results indicate that if water and sediment concentrations of copper are maintained below federal and state water and sediment quality standards, zinc or arsenic will not reach levels of concern and will be below the thresholds associated with stress or disease.
- Metal accumulation associated with ACZA-treated wood structures is relatively minor in most settings. Metal accumulation is limited spatially (within 10 feet or less of the structure), has not been associated with significant biological effects, and is not high enough to pose ecological risks in moderate to well-mixed waterbodies.
- Impacts of metals in sediments are localized and tests have shown that the sediment concentrations are lower than state Water Quality Criteria (WQC) by a factor of 22 within 2 centimeters of the pile and lower than the Sediment Quality Standards (SQS) by a factor of up to 26 within 30 centimeters of a pile. These concentrations decrease rapidly with time and reach background levels within 2 weeks.
- Metal losses reach low values in less than 2 weeks, losses are very small after 1 or 2 weeks, and ACZA and other treated wood provide excellent protection in most aquatic environments.
- Leaching rates are not sufficiently high to pose ecological risks in mixed waterbodies, and the duration of biological effects appears to be attenuated within several months of construction.
- No adverse biological impacts were reported in the studies reviewed. The most probable route of exposure to contaminants is through consumption of contaminated prey if a species is feeding in low flow areas adjacent to treated wood structures.

Further information on listed fish species can be found in Appendix B.

### 3.1.6 Prey Species

Prey species for all listed fish are discussed in Appendix B. Effects to prey species are expected to be similar to effects to listed fish species.

For WSF projects, any adverse effects to prey species occur during project construction and are short term. Given the large numbers of prey species in Puget Sound, the short term nature of effects, and extensive MMs to protect prey species during construction, WSF projects are not expected to have measurable effects on the distribution or abundance of listed fish prey species.

### 3.1.7 Rockfish Species

Bocaccio and yelloweye rockfish adults are found in deep water, usually more than 150 feet deep, and are very unlikely to occur within the immediate project areas because of ferry facility shallower depths (64 ft. MLLW maximum depth). Larvae and juveniles are found in the water column closer to the surface.

Adults are unlikely to be affected by localized temporary turbidity because of the distance from the terminal areas to very deep water where adults are found. Pelagic juveniles could be affected by turbidity, but the turbidity associated with WSF projects is localized, affecting a small area that could be avoided by juvenile rockfish.

## 3.2 Killer Whale (*Orcinus orca*)

For WSF projects, underwater noise, water quality effects, and adverse effects on the whales' food supply (i.e., potential direct effects to salmonids) have the most potential to affect killer whales. Further information on killer whales can be found in Appendix B.

### 3.2.1 Noise

For cetaceans, sound is perhaps the most critical sensory pathway of information. Killer whales communicate with each other over short and long distances with a variety of clicks, chirps, squeaks, and whistles. They also use echolocation to find prey and to navigate. Killer whales are mid-frequency cetaceans, with hearing in the range of 150 Hz to 20 kHz (Southall et al. 2007). Natural and anthropogenic sounds have the potential to impact the use of biologically important acoustic signals by killer whales (NOAA 2008). Long-term impacts from noise pollution would not likely show up as noticeable behavioral changes in habitat use, but rather as sensory damage or a gradual reduction in population health (Whale Museum 2005).

For most free-ranging cetaceans, behavioral responses are difficult to observe, and interpretation of observed results is limited by uncertainty as to what does and does not constitute a response (Southall et al. 2007; NOAA 2008). Additionally, precise measurements of received noise exposure and other relevant variables can be difficult to obtain. Only a few disturbance studies have been undertaken that estimate received sound levels, and only a very small number have measured received levels at the subject. Thus, behavioral reactions to acoustic exposure in cetaceans are generally more variable, context-dependent, and less predictable than effects of noise exposure on hearing or physiology (Southall et al. 2007).

The majority of the research on underwater noise impacts to killer whales is associated with vessel and navy sonar disturbances and does not address impacts from pile driving. The NMFS 2004 Status Review of Killer Whales released in December 2004 and the WDFW status report released in March 2004 indicate that the threshold levels at which underwater noise becomes harmful to killer whales are unknown (Krahn et al. 2004). There are several short-term and long-term effects that have been hypothesized and untested, including impaired foraging efficiency due to noise and its potential effects on movements of prey, as well as harmful physiological conditions, energetic expenditures, and temporary hearing threshold shifts due to chronic stress from noise (Krahn et al. 2004).

NMFS has implemented Technical Guidance for assessing the potential impacts of sound on marine mammals (NMFS 2018). All projects with pile driving or removal are required to use this guidance when assessing potential impacts. For a full discussion of in-water noise, pile driving and removal noise data, and impact pile driving attenuation data, see Section 7.2 of the WSDOT Biological Assessment Manual (WSDOT 2019a).

### 3.2.2 Water Quality

Short-term turbidity can result from in-water work. Turbidity was not raised as an issue in the proposed or final listings for Southern Resident killer whales, nor is it mentioned in the Recovery Plan for Southern Resident Killer Whales (NMFS 2008a). In addition, WSF must comply with state water quality standards that limit the extent of turbidity to the immediate project area and killer whales are not expected to come close to WSF facilities during construction. Therefore, turbidity is not expected to affect Southern Resident killer whales in any significant way.

Existing creosote-treated piles are a source of hydrocarbon contamination to marine sediments in the form of PAHs. Long-term water quality improvements in the Puget Sound will result from WSF's systematic replacement of creosote-treated timber structures with steel and concrete. Because killer whales are at the top of the food chain and have a long life expectancy, bioaccumulation of toxins is of high concern (NMFS 2008a). Removal of creosote from the aquatic environment has a beneficial effect on Southern Resident killer whales.

The NMFS (2008a) Recovery Plan lists the classes of environmental contaminants that are of concern to killer whales. They are:

- Organochlorines (polychlorinated biphenols [PCBs], pesticides, dioxins, and furans)
- Polybrominated diphenyl ethers/biphenyls (PBDEs/PBBs), used as flame retardants
- PAHs, from fuel combustion and other sources
- Other chemical compounds including perfluorinated compounds, polychlorinated paraffins (PCPs), polychlorinated naphthalenes (PCNs), polychlorinated terphenyls (PCTs), tributyltin/dibutyltin (TBT/DBT), perfluro-octane sulfonate (PFOs), endocrine disruptors (e.g., synthetic estrogens, steroids, and some pesticides), pharmaceuticals, and personal care products (e.g., diagnostic agents and cosmetics)
- Toxic elements—most importantly, mercury, cadmium, and lead

### 3.2.3 Prey Species

Chinook salmon is the dominant component of the Southern Resident killer whales' summer diet, while steelhead and a wider variety of species are used for forage in other seasons (Hanson et al. 2010). For most WSF projects, any adverse effects to salmonids occur during project construction and are short term.

Given the large numbers of salmonids in Puget Sound, the short term nature of effects to salmonids, and extensive MMs to protect salmonids during construction, WSF projects are not expected to have measurable effects on the distribution or abundance of potential killer whale prey species.

### 3.2.4 Passage Conditions

WSF terminal structures are located at the shoreline and extend a few hundred feet (to a maximum of approximately 800 feet) into the water. Water depths at the outer limit of the terminals range from 40 to 100 feet. Most WSF projects involve repair or replacement to existing facilities. In the event of a project that introduces new passage barriers, that project will be evaluated to determine effects to passage conditions.

If the underwater injury or disturbance thresholds from impact or vibratory pile driving for killer whales are exceeded within designated critical habitat, then passage conditions may be impeded. Areas with water less than 20 feet deep relative to the extreme high water mark are not included in the critical habitat designation (Federal Register 2006).

## 3.3 Humpback Whale (*Megaptera novaeangliae*)

For WSF projects, underwater noise, water quality effects, and adverse effects on the whales' food supply (especially herring) have the most potential to affect humpback whales. Further information can be found in Appendix B.

### 3.3.1 Noise

For cetaceans, sound is perhaps the most critical sensory pathway of information. Humpback whales sing long, complex songs lasting 10 to 20 minutes. Humpbacks are also thought to communicate with gestures involving tail and flipper slapping

(American Cetacean Society 2009). Humpback whales are low-frequency cetaceans, with hearing in the range of 7 Hz to 22 kHz (Southall et al. 2007). It is not known whether humpback whales that tolerate chronic noise exposure undergo stress or are otherwise deleteriously affected (NPS 2009).

NMFS has implemented Technical Guidance for assessing the potential impacts of sound on marine mammals (NMFS 2018). All projects with pile driving or removal are required to use this guidance when assessing potential impacts. For a full discussion of in-water noise, pile driving and removal noise data, and impact pile driving attenuation data, see Section 7.2 of the WSDOT Biological Assessment Manual (WSDOT 2019a).

### 3.3.2 Water Quality

Humpback whales are affected by the same bioaccumulating toxins described for Southern Resident killer whales in Section 3.2.2. WSF's systematic removal of creosote-treated wood from all its terminals is consistent with regional creosote removal efforts and will contribute to long-term water quality improvements.

### 3.3.3 Prey Species

The most significant prey item for humpback whales in Puget Sound is herring (American Cetacean Society 2009). A large herring holding area exists in the south Sound near the southern tip of Vashon Island (WDFW 2005c). WSF repair and maintenance activities would not affect this holding area. Herring spawn on macroalgae, mainly eelgrass and kelp (WDFW 2005c). Most of the work at WSF terminals is in deeper water, away from suitable spawning substrate.

## 3.4 Marbled Murrelet (*Brachyramphus marmoratus*)

Potential effects on marbled murrelets are primarily related to noise from construction, specifically from pile driving activities, and physical disturbance during foraging. Of all WSF facilities, murrelet sightings are most common at Port Townsend, Coupeville, Anacortes, Mukilteo and the San Juan Island terminals (PSAMP and WDFW 1994). Further information on marbled murrelet can be found in Appendix B.

### *3.4.1 Noise*

Because murrelets are diving sea birds, both in-air and underwater noise effects must be considered.

#### 3.4.1.1 *In-air Noise Potential Effects on Foraging*

Marbled murrelets can be affected by project noise, most notably impact driving of steel piles. In-air noise measurements are often recorded in dBA using the A-frequency weighing scale. The A-weighted rating of noise is used because it relates to human interpretation of noise. Peak sound emitted from a source is called Lmax. Sound levels averaged during a measured period of time are referred to as Leq.

All WSF terminals experience regular human activity to some extent; therefore, murrelets in those areas are expected to be somewhat acclimated to the normal activity levels. Noise studies were conducted at several WSF terminals to determine in-air noise from vessel operation in January 2005. Based on the noise data from the Bremerton Ferry Terminal, which is situated in a semi-urban area, in-air noise from ferry operations had approximate Lmax recordings of 65.5 dBA for arrival, 72.5 dBA during unloading of vehicles, 67.5 dBA during loading of vehicles, and 67.5 dBA during departure. From arrival to the next departure, noise recordings ranged from a low of 56 dBA during departure to a high of 72.5 dBA during unloading. Ambient noise recordings ranged from approximately 54 to 61 dBA at the terminal (McMullen Associates, Inc. 2005).

According to the Mukilteo test pile project noise results, a marbled murrelet on the surface of the water 300 feet from the pile driving location would experience noise levels within the Lmax range of 93.4 to 99.3 dBA (WSF 2007a).
USFW evaluated the effects of sound-related disturbance in the terrestrial environment and determined that murrelets could be adversely affected by sounds higher than 92 dBA (USFW 2003). USFW considers 92 dBA to be a disturbance threshold guideline, not criteria, for the foraging marbled murrelet (Fisheries Hydroacoustic Working Group 2008). There are no known studies or data available on the likely response of murrelets (or other alcids) to in-air sound in the marine environment. For projects in the marine environment, it is assumed that murrelet

response to above-ambient sounds on the water would be similar to those expected in the terrestrial environment (USFW 2010b).

In 2013, USFW implemented in-air masking thresholds for impact driving of steel piles, and in some cases for impact driving of concrete piles (Table 3-4). Monitoring of the appropriate masking zone takes place during the April 1-September 23 nesting season, to reduce disturbance of foraging murrelet pair communication. Shutdown of pile driving is implemented when a murrelet approaches the zone to prevent masking effects.

**Table 3-3**
**Murrelet In-Air Masking Masking Zones**

| | Meters |
|---|---|
| Piles < 36-inch | 42 |
| Piles ≥ 36-inch | 168 |

Source: WSDOT 2019a.

#### 3.4.1.2 *In-air Noise Potential Effects on Suitable Nesting Habitat*

Construction and pile driving noise can have disturbance effects on occupied murrelet nests. According to USFW guidance (WSDOT 2014b):

- If marbled murrelet suitable habitat is present within 328 feet, then construction noise from heavy equipment or pile driving (within 368 feet) could result in behavioral disruption and harassment.
- If suitable habitat is present farther than 328 feet, but within 0.25 miles (1,320 feet), then murrelet may be disturbed by construction noise.
- If suitable habitat is present farther than 0.25 miles (1,320 feet), no effect to murrelet is expected from construction noise.

A WSF biologist has reviewed habitat conditions near all WSF facilities, using a combination of Google Maps, GIS orthophotos, the USFW habitat suitability index (WSDOT 2019a), and site visits. Suitable murrelet habitat is present farther than 328 feet, but within 0.25 miles of the Anacortes, Coupeville, Lopez and Shaw terminals (Table 3-5) (Figures 3-1/3-2/3-3/3-4). Therefore, there is potential to disturb marbled murrelet if the suitable habitat is occupied.

However, there is considerable disturbance from ferry vessel noise and other activities near this suitable habitat. Table 3-4 notes the number of planned vessel trips for Fiscal Year 2017-2018 (July 2017-June 2018), and the number of trips during the April 1 – September 23 nesting season when murrelet may be occupying suitable habitat (WSDOT 2018a). Table 3-4 also provides the nearest documented murrelet nesting (WSDOT 2018b), and prey presence (WSDOT 2018c). Additional disturbance factors present at the four terminals with suitable habitat are listed after each Figure (3-1/3-2/3-3/3-4).

**Table 3-4**
**Marbled Murrelet Disturbance/Habitat/Nesting/Prey**

| Facility | WSF Vessel Trips FY 2017/2018 | WSF Vessel Nesting Season Trips FY 2017/2018 | Suitable Habitat Present within 0.25 miles | Nearest Documented Nesting (miles/direction) | Documented Prey Species Spawning Presence |
|---|---|---|---|---|---|
| Anacortes | 5,430 | 3,010 | **Yes** | 39 SW | **Surf Smelt** |
| Bainbridge | 16,520 | 8,290 | | 27 W | **Surf Smelt** |
| Bremerton | 10,900 | 5,465 | | 22 NW | |
| Clinton | 13,400 | 6,798 | | 29 SW | **Surf Smelt** |
| Coupeville | 4,465 | 2,596 | **Yes** | 21 SW | |
| Eagle Harbor | N/A* | N/A* | | 27 W | |
| Edmonds | 8,605 | 4,315 | | 34 SW | |
| Fauntleroy | 14,040 | 7,080 | | 34 SW | **Sand Lance** |
| Friday Harbor | 4,920 | 2,570 | | 38 S | |
| Kingston | 8,605 | 4,315 | | 42 SW | |
| Lopez | 5,980 | 2,910 | **Yes** | 42 SW | **Surf Smelt** |
| Mukilteo | 13,400 | 6,798 | | 27 NE | **Sand Lance** |
| Orcas | 4,990 | 2,650 | | 42 SW | |
| Point Defiance | 6,985 | 3,505 | | 37 NW | |
| Port Townsend | 4,465 | 2,596 | | 15 SW | **Surf Smelt** |
| Seattle | 27,420 | 13,755 | | 35 NW | |
| Shaw | 4,900 | 2,540 | **Yes** | 42 SW | |
| Southworth | 8,560 | 4,325 | | 29 NW | **Surf Smelt** |
| Tahlequah | 6,985 | 3,505 | | 35 NW | |
| Vashon | 18,200 | 9,260 | | 31 NW | **Surf Smelt** |

*Infrequent ferry vessel traffic – only when repair or maintenance required

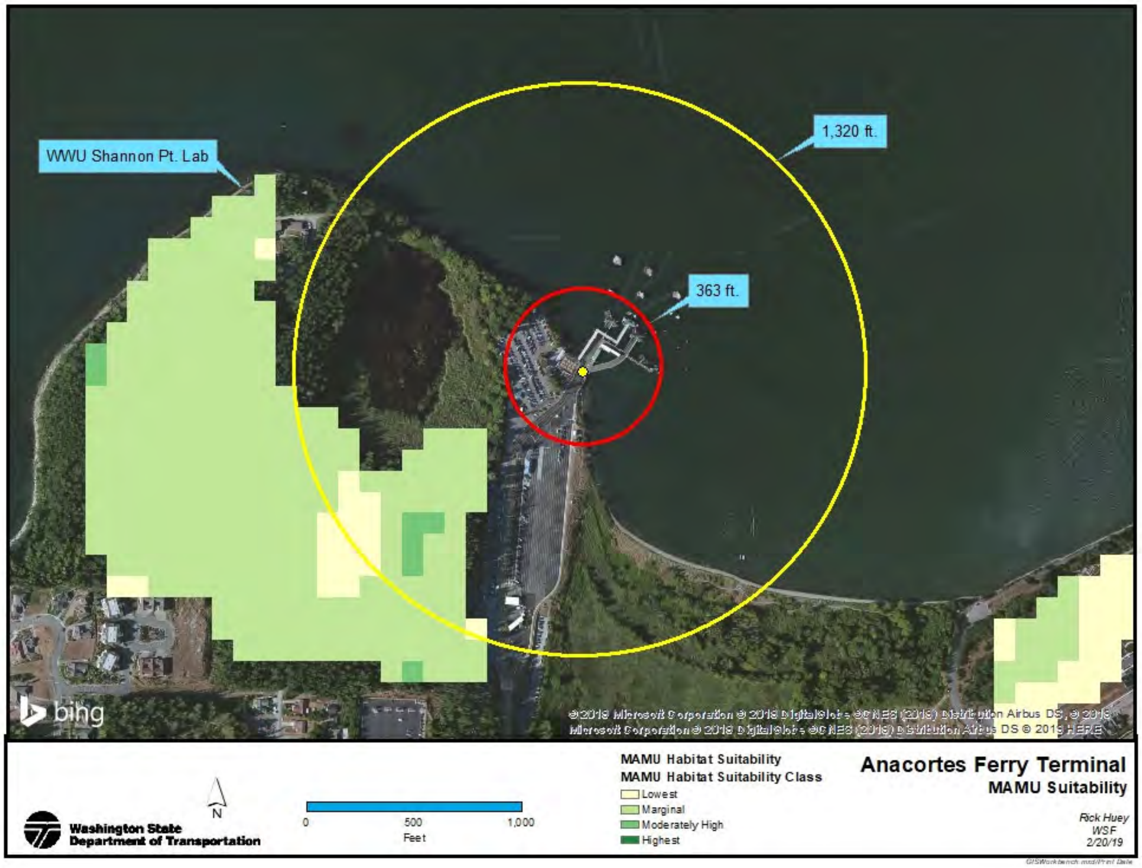



**Figure 3-1**
**Anacortes MAMU Suitability and Potential In-air Disturbance Zone**

### 3.4.1.3 *Anacortes Murrelet Disturbance Factors:*

- ✓ The WSF upper parking lot is open for Spring/Summer use mid-May to mid-September. This lot is closer to suitable habitat, and vehicle traffic and pedestrian use generates increased noise; especially during the April 1-Sept. 23 nesting season.
- ✓ The adjacent neighborhood and the WWU Shannon Point Marine Lab are present near suitable habitat; and vehicle, pedestrian and homeowner power tool use generates increased noise.
- ✓ An informal trail system is present within suitable habitat, which increases the chance for disturbance, especially during the April 1-Sept. 23 nesting season.

- ✓ Corvid presence in the area increases predation risk, making this habitat less suitable for murrelet use.

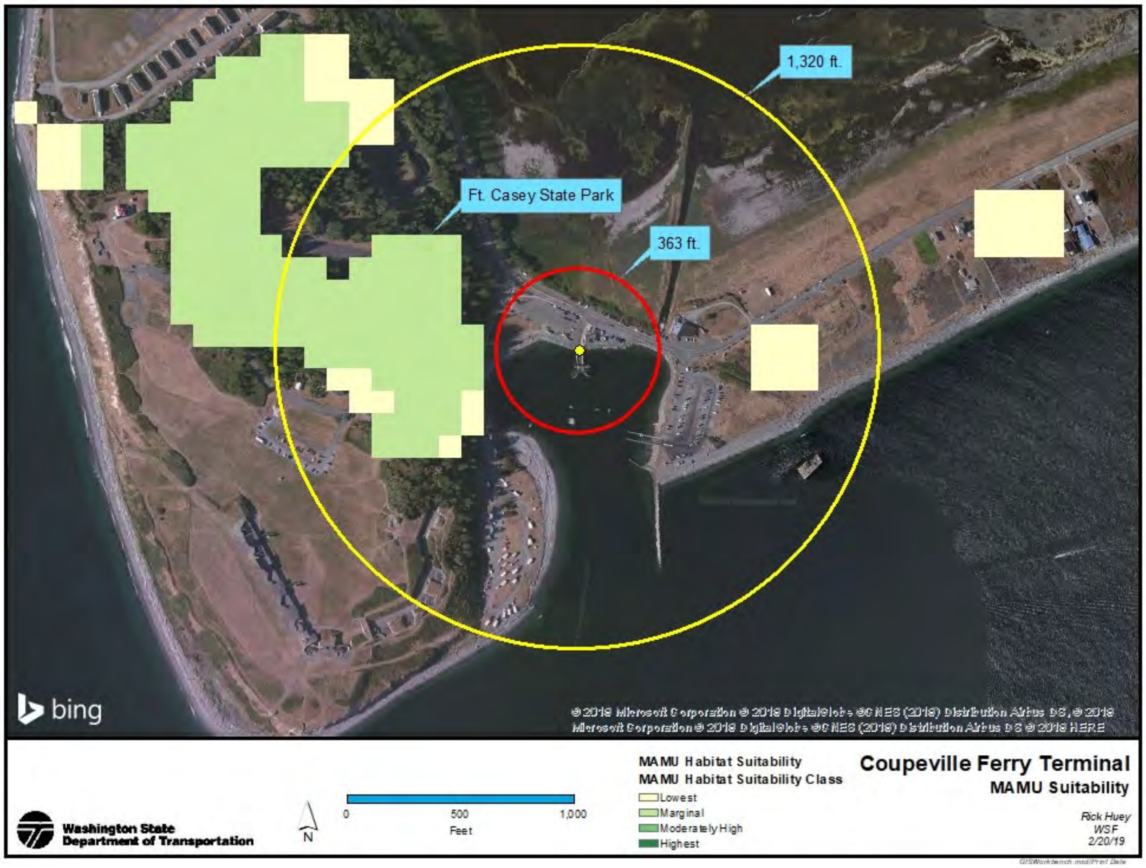



**Figure 3-2**
**Coupeville MAMU Suitability and Potential In-air Disturbance Zone**

### 3.4.1.4 *Coupeville Murrelet Disturbance Factors:*

- ✓ Suitable habitat near the terminal is within Ft. Casey State Park, which is disturbed by campers, vehicles and pedestrians; especially during the April 1-Sept. 23 nesting season.
- ✓ Corvid presence in the area increases predation risk, making this habitat less suitable for murrelet use.

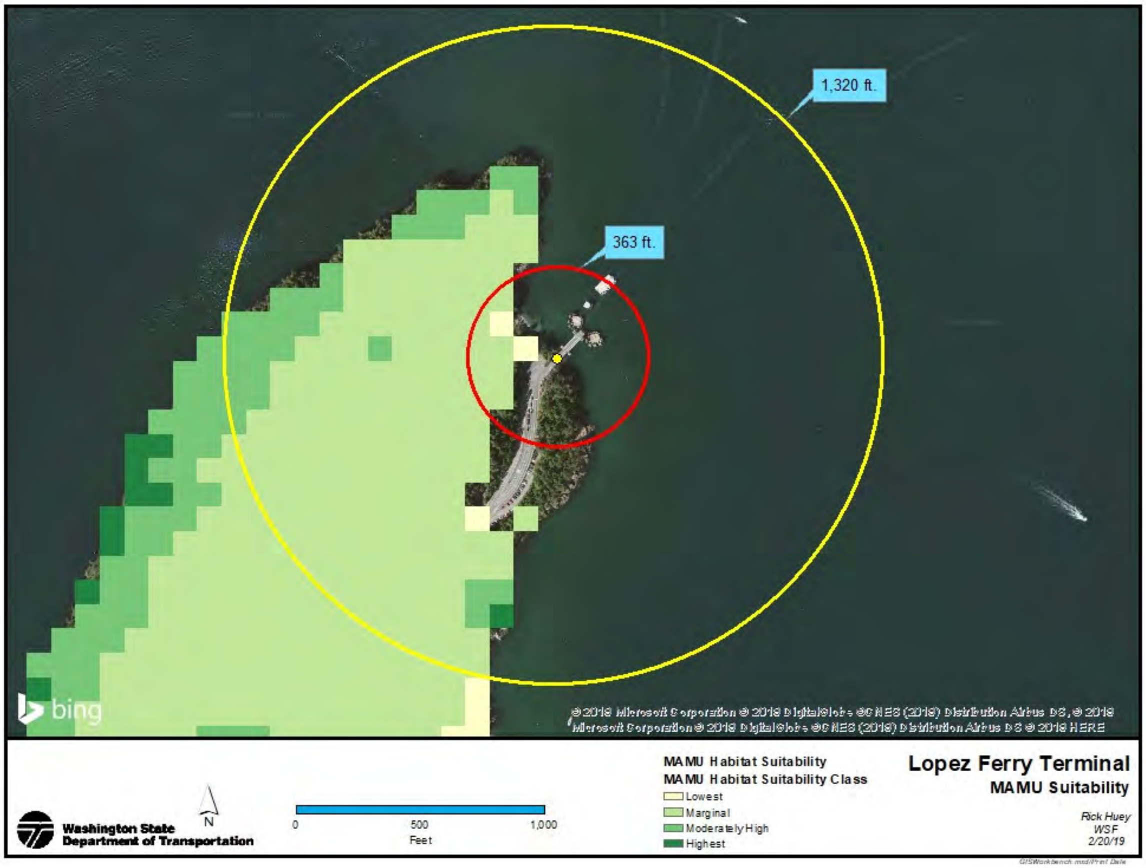



**Figure 3-3**
**Lopez MAMU Suitability and Potential In-air Disturbance Zone**

### 3.4.1.5 *Lopez Murrelet Disturbance Factors:*

- ✓ Suitable habitat near the terminal is within the San Juan Co. Land Bank's Upright Head Preserve, which includes a trail system that has heavier day hiker use during the April 1-Sept. 23 nesting season.

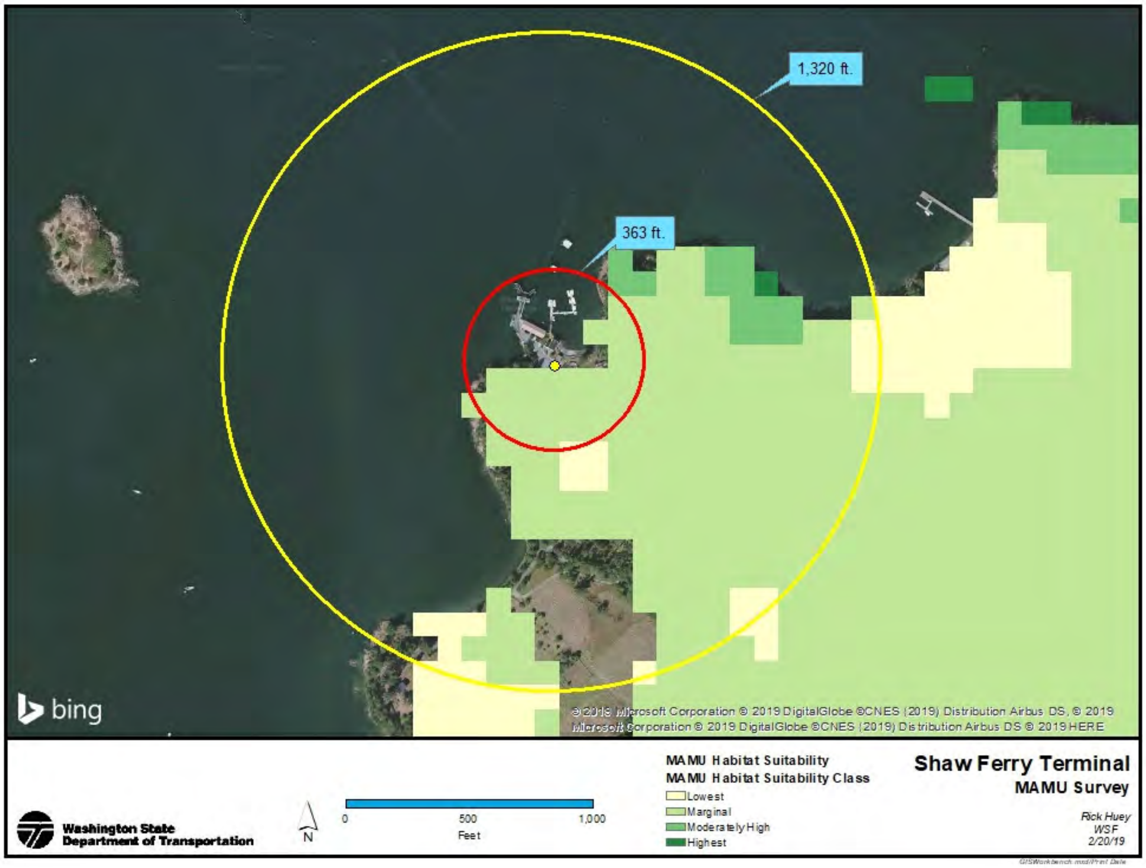



**Figure 3-4**
**Shaw MAMU Suitability and Potential In-air Disturbance Zone**

3.4.1.6 *Shaw Murrelet Disturbance Factors:*

- ✓ A marina and private properties are adjacent to suitable habitat, which increases the likelihood of disturbance.
- ✓ An informal trail system is present within suitable habitat, which increases the chance for disturbance, especially during the April 1-Sept. 23 nesting season.

#### 3.4.1.7 *Underwater Noise*

Physical harm and behavioral modifications could result from elevated underwater SPLs caused by impact installation of steel piles. Pile driving noise, particularly during impact hammer installation, could temporarily disrupt or displace foraging murrelets, or cause direct harm via elevated SPLs, particularly if a murrelet was foraging underwater during impact pile installation (USFWS 2003).

USFWS has set thresholds for physical injury and a disturbance guideline (Table 3-5). No injury or disturbance thresholds for vibratory pile driving are set by USFWS.

**Table 3-5**
**Murrelet Undewater Sound Injury and Disturbance Threshold**

| | Pulse |
|---|---|
| Barotrauma | 208 $dB_{SEL}$ |
| Auditory Injury | 203 $dB_{SEL}$ |
| Disturbance | 150 $dB_{RMS}$ |

Source: WSDOT 2019a.

For a full discussion of in-water noise, pile driving and removal noise data, and impact pile driving attenuation data, see Section 7.2 of the WSDOT Biological Assessment Manual (WSDOT 2019a).

#### 3.4.1.8 *Potential Physical Disturbance of Foraging Murrelet*

Foraging murrelet near WSF terminals may be disturbed by frequent ferry vessel arrivals and departures. Table 3-5 (above) notes the number of planned vessel trips for Fiscal Year 2017-2018 (July 2017-June 2018) that may disturb foraging murrelet. Table 3-5 also notes the number of trips during the April-September 23 nesting season, when murrelet may be foraging to feed new chicks (WSDOT 2018a). Table 3-5 also provides documented prey presence (WSDOT 2018c).

### *3.4.2 Prey Species*

Marbled murrelet feed on fish, small crustaceans, and invertebrates. Murrelets prefer to forage near kelp beds and at stream mouths, and feed on a variety of prey including sand lance, Pacific herring, and northern anchovy. For WSF projects, any adverse effects to prey species occur during project construction and are short term. Given the large numbers of prey species in Puget Sound, the short term nature of effects to salmonids, and extensive MMs to protect prey species during construction, WSF projects are not expected to have measurable effects on the distribution or abundance of potential murrelet prey species.

# 4 TERMINAL SPECIFIC INFORMATION

This chapter provides a summary of the baseline information and distribution of ESA-listed species and critical habitat at each terminal. The chapter begins with three tables summarizing the chemical, physical, and biological indicators for the 19 ferry terminals and one ferry maintenance facility. The chapter is then organized alphabetically by ferry terminal, with more detailed descriptions of the environmental baseline followed by the ESA-listed species and critical habitat distributions for each terminal.

# ANACORTES

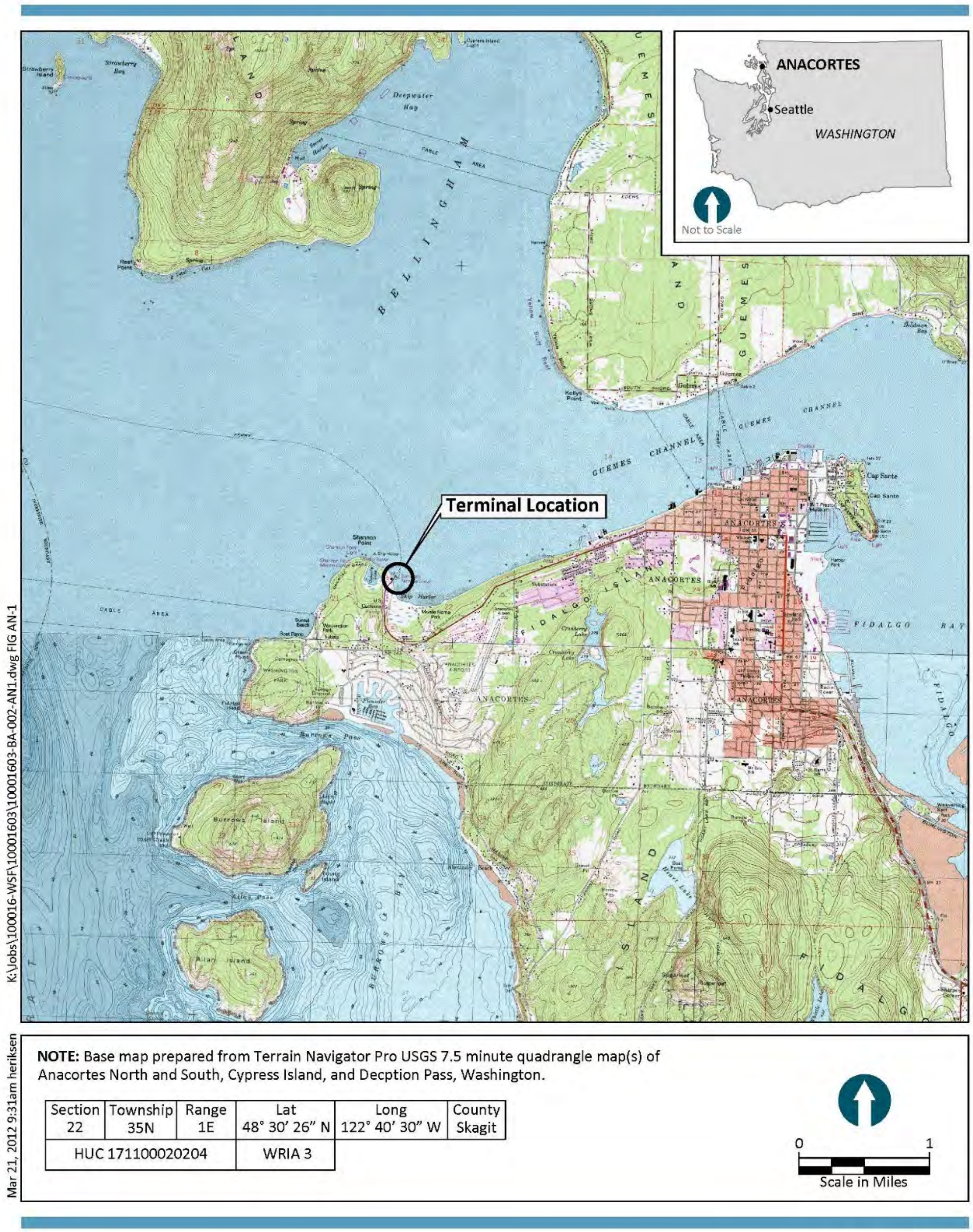



**Figure AN-1**
Anacortes Ferry Terminal Vicinity Map
WSF Biological Assessment Reference
Anacortes, Washington

**Figure AN-1**
**Anacortes Ferry Terminal Vicinity Map**

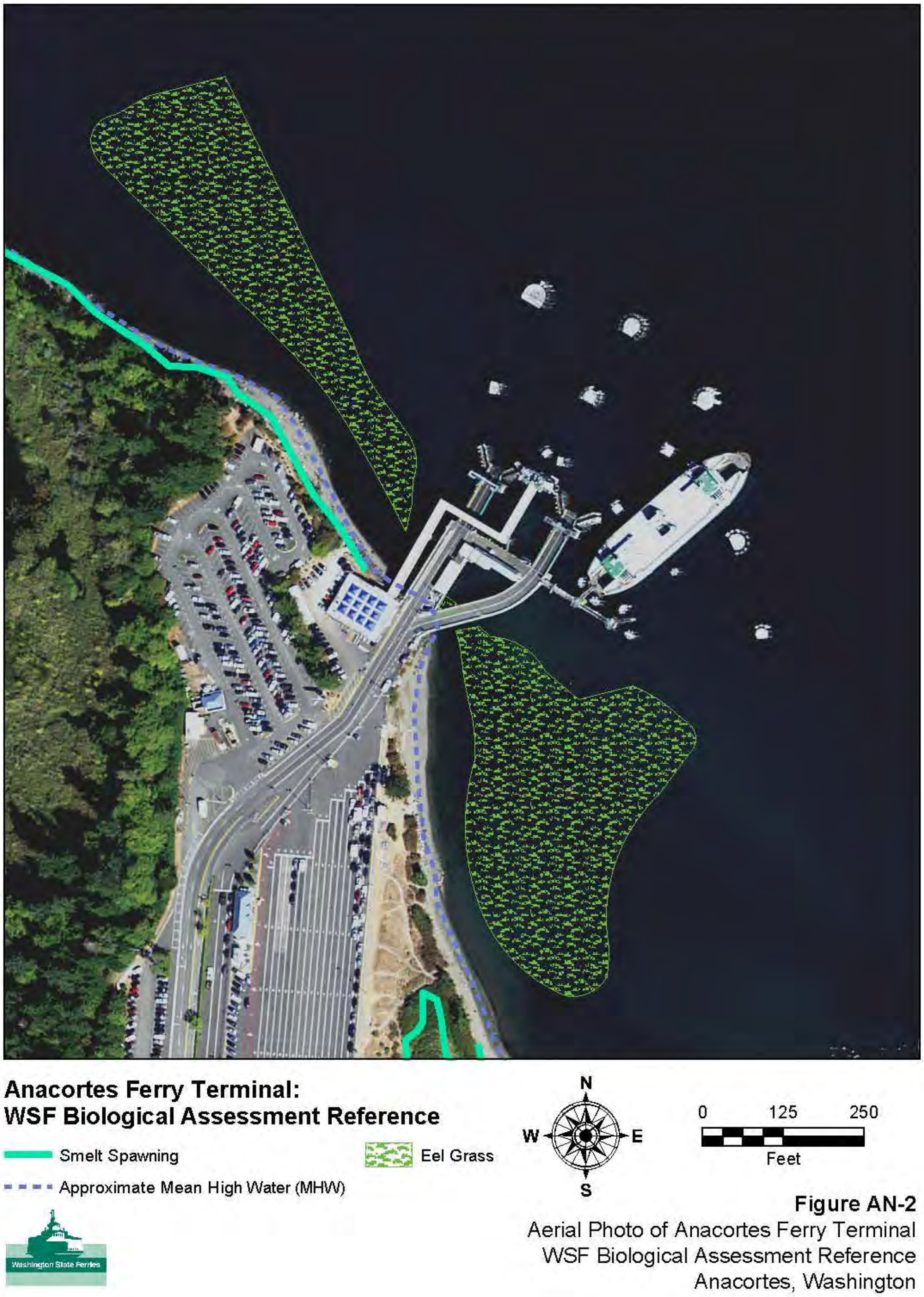



**Figure AN-2**
**Aerial Photo of Anacortes Ferry Terminal**

## 4.1 Anacortes

The Anacortes Ferry Terminal is located in the city of Anacortes, on Fidalgo Island, adjacent to Guemes Channel (see Figures AN-1 and AN-2).

The Anacortes Ferry Terminal provides service to the San Juan Island terminals (Lopez, Shaw, Orcas, and Friday Harbor), and to Sidney B.C. There are three routes that originate from this terminal: Anacortes to Friday Harbor with stops at Orcas, Shaw, and Lopez; inter-island between Friday Harbor, Orcas, Shaw, and Lopez; and international from Anacortes and Friday Harbor to Sidney B.C.

Features of the terminal include a terminal building, four pay parking lots, 15 vehicle holding lanes that accommodate up to 450 vehicles, and overhead passenger loading facilities. The terminal has four slips: main, auxiliary, and two tie-up slips. Steel wingwalls are present in the main and auxiliary slips, a timber half-wing wingwall in Tie-up Slip 1, and a timber wingwall in Tie-up Slip 2. Twenty dolphins are associated with the terminal, fourteen steel and six wood.

### *4.1.1 Anacortes Environmental Baseline*

#### 4.1.1.1 *Physical Indicators*

*Substrate and Slope*

Near the terminal, shorelines contain relatively steep, rocky shorelines punctuated by sandy/cobble/gravel beaches (see Figures AN-3 and AN-4). The adjacent Shannon Point Bluff is eroding and is a source of sediment to Guemes Channel, and Ship Harbor is considered a pro-graded beach.

At the ferry terminal, substrates below MLLW are primarily sand and silt, with larger areas of shell fragments in offshore areas. Substrates above MLLW are a mix of gravel, cobble, and sand. Some riprap and hardened shoreline occurs at the bulkhead under the trestle and adjacent to the terminal.

**Figure AN-3**
**Shoreline Area to the West of the Anacortes Ferry Terminal**

**Figure AN-4**
**Shoreline Area to the East of the Anacortes Ferry Terminal**

The slope is relatively flat above -7.5 feet MLLW and then transitions to a steeper slope. Offshore depths of terminal structures are: head of main slip (-31.4 feet MLLW), auxiliary slip (-36.0 feet MLLW), tie-up slip #3 (-26.4 feet MLLW), and tie-up slip #4 (-21.8 feet MLLW). Maximum depth for fixed dolphins is -45.0 feet MLLW.

*Salt/Freshwater Mixing*

Near the terminal, there is one small stream that drains into Guemes Channel from Cranberry Lake, approximately 1.5 miles east of the terminal. There are no intermittent or perennial streams located adjacent to the ferry terminal, and no large river systems drain in the area.

There is a palustrine open water (POW) wetland (Cannery Lake) west of the ferry terminal and a POW, palustrine emergent (PEM), palustrine scrub shrub (PSS), and palustrine forested (POF) wetland (Ship Harbor) east of the ferry terminal (see Figure AN-2). These wetlands do not have a direct connection to Guemes Channel. It is possible, depending on tides and groundwater levels, that there is a subsurface connection between the Ship Harbor wetland and Guemes Channel.

*Flows and Currents*

Strong currents and tidal mixing within the area are influenced by the open marine waters surrounding the ferry terminal and winds and tides. A review of predicted currents between 2006 and 2008 indicates a high of -4.10 knots at a maximum ebb to 2.12 knots at maximum flood.

#### 4.1.1.2 *Chemical Indicators*

*Water Quality*

The marine waters of Guemes Channel near the ferry terminal are designated "Extraordinary" for aquatic life use. No water quality parameters of concern were identified at the current terminal location (Ecology 2018). The water quality of adjacent receiving wetland waterbodies is unknown.

*Sediment Quality*

Anacortes is an urbanized area with industrial, commercial, and recreational uses along the waterfront. It is expected that sediments contain low levels of pollutants associated with urban runoff. At the ferry terminal, there are no known sources of industrial contamination or hazardous waste.

#### 4.1.1.3 *Biological Indicators*

*Shoreline Vegetation*

Shoreline vegetation at the ferry terminal is generally absent. Existing vegetation consists predominately of shrubs and herbaceous vegetation. Much of this vegetation consists of invasive or non-native vegetation such as Himalayan blackberry (*Rubus discolor)* and Scotch broom *(Cytisus scoparius)* (see Figures AN-5 and AN-6).

**Figure AN-5**
**Marine Riparian Vegetation**

**Figure AN-6**
**Buffer Vegetation Between Holding Lanes and Ship Harbor Wetland**

Based on a review of aerial photographs, outside of the immediate terminal area it appears that a large portion of the shoreline within the area contains coniferous and deciduous tree and shrub vegetation.

### *Macroalgae and Eelgrass*

Eelgrass and biological resources surveys were conducted in 1996 and 2003. The extent of the eelgrass bed in the area has changed since the 1996 survey. The seaward extent of the eelgrass bed has shifted inshore by 30 to 60 feet. Observations of a berm that ends just offshore of the current eelgrass bed suggest substrate movement and changes in bathymetry since the 1996 survey. The inside margin of the eelgrass bed was of a very similar configuration to that observed in 1996. In addition, the outside margin of the eelgrass bed in the area to the east of the existing tie-up slip was similar to that observed in 1996. Eelgrass is present from 0 feet MLLW to about -15 feet MLLW (see Figure AN-2). Maximum eelgrass densities range from 57.2 to 102.8 shoots per square meter.

Much of the eelgrass observed during the survey of transects had extensive *Smithora naiadum* growth on the blades. Dominant macroalgae consists of *Ulva* sp. *Enteromorpha* sp. was often found, but generally covered less than 5 percent of the quadrat area surveyed. *Sarcodiothec*a sp., *Gracilaria* sp., and *Polysiphonia* sp. occur in the area located directly next to the existing auxiliary slip trestle. Sugar wrack (*Laminaria saccharina*) occurs as well as rockweed (*Fucus gardneri*), *Chondracanthus* sp., *Desmarestia* sp., and bull kelp (*Nereocystis leutkeana*).

### *Epibenthos, Macrofauna, Fish, and Marine Mammals*

Substrates at the ferry terminal are expected to support epibenthic production. Several invertebrates were observed during dive surveys in 1996 and 2003. Species observed include barnacles, limpets (*Diodora aspera*), anemones (*Cnidaria sp.*), sea stars (*Pisaster ochraceus*), perch, sculpin (*Cottus*), hermit crab (*Pagarus sp.*), sand lance (*Ammodytes hexapterus*), red rock crab (*Cancer productus*), graceful crab (*Cancer gracilis*), Dungeness crab (*Cancer magister*), and starry flounder (*Platichthys stellatus*).

In addition to species observed at the ferry terminal, marine mammals that could occur near the terminal include harbor seals (*Phoca vitulina*), harbor porpoises

(*Phocoena phocoena*), Steller sea lion (*Eumetopias jubatus),* and California sea lions (*Salophus californianus*). Offshore, Dall's porpoise (*Phocoenoides dalli*), gray whales, minke whales, and killer whales (*Esrichtichus robustus, Baleanoptera acutorostrata, and Orcinus orca*, respectively) have been observed. Humpback whales (*Megaptera novaeangliae)* have been sighted rarely since the early 1900s; however, sightings have increased since the early 1990s (Falcone et al. 2005).

*Forage Fish*

Documented surf smelt (*Hypomesus pretiosus*) spawning is present (see Figure AN-2), extending approximately 184 feet to the northwest and 406 feet to the southeast WSDOT 2018a). There is no documented herring, herring holding areas, or sand lance spawning at the terminal.

### 4.1.2 Anacortes Species Distributions

#### 4.1.2.1 *Puget Sound Chinook Salmon (Oncorhynchus tshawytscha)*

No Chinook salmon-bearing streams are located near the Anacortes Ferry Terminal. However, major rivers that support Chinook salmon in this area of Puget Sound include the Skagit River (approximately 20 shoreline miles south), Nooksack River (approximately 22 shoreline miles north), and Stillaguamish River (approximately 30 shoreline miles south). Chinook salmon may also be present from rivers and streams in central and southern Puget Sound (WDFW 2007a).

*Adult and Sub-adult Chinook*

Migrating sub-adult and adult Chinook salmon have free access to the entire marine portion of the Anacortes Ferry Terminal area. These fish could be present near the ferry terminal year-round, but are likely to be more abundant in mid to late summer as they prepare to migrate to their natal rivers to spawn.

*Juvenile Chinook*

Recent information on anticipated juvenile Chinook utilization in the nearshore habitats of the ferry terminal area consists of research conducted in Skagit Bay and Bellingham Bay. Skagit Bay is located approximately 15 miles south of the ferry terminal and Bellingham Bay is located approximately 12 miles north of the ferry terminal. Given the close proximity of the these research areas to major salmon producing rivers (Skagit and Nooksack Rivers), juvenile Chinook densities in the research areas are likely to be higher than those anticipated at the ferry terminal.

However, both study areas provide data on the timing of juvenile Chinook occurrence in the nearshore. Eight years of beach seine data in Skagit Bay indicates that wild sub-yearling Chinook are most abundant along the shoreline between May and July, and then tail off in August (Beamer 2004). Wild sub-yearling Chinook were captured infrequently in Skagit Bay during beach seining efforts in September and October. A nearly identical pattern was observed in Bellingham Bay (Ballenger 1996) where monthly sampling continued through December. The Bellingham Bay research captured two juvenile Chinook in 14 sets in September and no juvenile Chinook were captured between October and December.

Similarly, tow-net sampling in deeper portions of the nearshore reveals a consistent downward trend in Chinook abundance in Skagit Bay between June and October (Rice et al. 2001). Tow-net sampling in Bellingham Bay also documented a summer peak and few juvenile Chinook captured in October (Beamer et al. 2003). No tow-net sampling was conducted in Bellingham Bay during September. In comparison to the beach seine results, juvenile Chinook presence in the Skagit Bay tow-net samples persisted later in the year (Rice et al. 2001). This observation supports the assumption that juvenile Chinook captured in the tow-net are fish that have moved offshore from the immediate shoreline area and are getting closer to beginning their marine migrations. Most of the juvenile Chinook caught from September to November were larger than those captured between February and July (over 110 millimeters).

#### 4.1.2.2 *Puget Sound Chinook Salmon Critical Habitat*

The Anacortes Ferry Terminal lies within Chinook Zone 3 (Federal Register 2005a). Eelgrass beds in close proximity to the ferry terminal may be used by juvenile Chinook for rearing (Anchor 2004a).

The Primary Constituent Elements (PCEs) provided in the ferry terminal area, and their existing conditions, are listed in Table AN-2. PCEs relevant to the terminal area are numbered per Federal Register 2005a.

**Table AN-1**
**Existing Conditions of Chinook Salmon PCEs at the Anacortes Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 5) Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels. | **Obstructions**<br>In-water ferry terminal structures include overhead loading, the trestles, the main and auxiliary slips, two tie-up slips, and dolphins. The existing ferry terminal may affect fish passage in the nearshore.<br><br>**Water Quality and Forage**<br>The marine waters of Guemes Channel near the ferry terminal are designated "Extraordinary" for aquatic life use. Impaired waters listings in the terminal area do not identify any water quality parameters of concern (Ecology 2018).<br>The existing stormwater system at the ferry terminal site consists of two drainage areas. Approximately 25.7 acres drains through four outfalls to the Ship Harbor wetland; and 18.4 acres drains through five outfalls to Guemes Channel (note: one outfall to Guemes Channel drains to the Ship Harbor wetland seasonally in winter). The Ship Harbor wetland is likely to drain to Guemes Channel when the wetland stage is high via subsurface flow. A biofiltration swale is directly upgradient of one of the outfalls that drains directly to Guemes Channel (Ship Harbor seasonally), providing basic treatment for approximately 6 acres of impervious surfaces from the upper parking lot. There is no other treatment for stormwater runoff.<br><br>Existing creosote treated piles may leach PAHs into the water column, degrading water quality in the terminal vicinity.<br><br>Overwater coverage from the existing ferry terminal structures may reduce the production of aquatic invertebrates that are prey species to salmon. Substrates in the area are expected to support epibenthic production.<br><br>Sand lance spawning occurs 400 feet southeast of the terminal. Documented surf smelt spawning at the terminal extending approximately 184 feet to the northwest and 406 feet to the southeast.<br><br>**Natural Cover**<br>Shoreline vegetation is generally absent. A 2003 dive survey identified submerged aquatic vegetation including eelgrass, which occurs north and south of the ferry terminal. Much of the eelgrass observed during the survey of transects had extensive *Smithora naiadum* growth on the blades. Dominant macroalgae consists of *Ulva* sp*.* *Enteromorpha* sp. was often found, but generally covered less than 5 percent of the quadrat area surveyed. *Sarcodiotheca* sp., *Gracilaria* sp., and *Polysiphonia* sp. were found along each transect in the area located directly next to the existing auxiliary slip trestle. Sugar wrack was observed in the area, as well as *Fucus gardneri* (rockweed), *Chondracanthus* sp*., Desmarestia* sp*.,* and *Nereocystis leutkeana* (bull kelp) (Anchor 2004a).<br><br>There is no large overhanging wood vegetation. The existing conditions consist of sand and silt below MLLW, with shell fragments in offshore areas; and gravel, cobble, and sand above MLLW within the defined area of critical habitat (Anchor 2004a). Some riprap and hardened shoreline are adjacent to the ferry terminal. Side channels do not occur in the ferry terminal area. |
| 6) Offshore areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation. | The marine waters of Ship Harbor and the portion of Guemes Channel near the ferry terminal are designated "Extraordinary" for aquatic life use per WAC 173-201(a). Impaired waters listings in the terminal areado not identify any water quality parameters of concern (Ecology 2018).<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Offshore areas provide habitat for forage fish. |

#### 4.1.2.3 *Puget Sound Steelhead (Oncorhynchus mykiss)*

There are no natal streams in the area of the Anacortes Ferry Terminal that support Puget Sound steelhead.  However, major river systems that support winter and summer steelhead include the Samish River (approximately 15 shoreline miles northeast), Nooksack River (approximately 22 shoreline miles north), Skagit River (approximately 20 shoreline miles south), Stillaguamish River (approximately 30 shoreline miles south), and Snohomish River (approximately 50 shoreline miles south).  Steelhead may also be present from rivers and streams in Hood Canal and southern Puget Sound (WDFW 2007a).

Available data from tow-net sampling (deeper nearshore) and beach seine sampling (shallow nearshore) efforts around Puget Sound have reported the capture of few steelhead.  In tow-net sampling in north and south Puget Sound, NMFS captured a total of 18 steelhead (Rice, unpublished data).  The total sampling effort data was not available, but the mean steelhead catch ranged from 0 to 0.2 per net in north Puget Sound and 0.1 to 0.8 per net in south Puget Sound.

Beach seine sampling in Bellingham Bay (north Puget Sound) also captured few steelhead (Lummi Nation, unpublished data).  The Bellingham Bay research reported the capture of two juvenile steelhead salmon in 336 sets between February 14 and December 1, 2003.  The steelhead were captured in the eastern portion of Bellingham Bay near the Taylor Avenue Dock on June 12 and June 25, 2003.

##### *4.1.2.3.1 Puget Sound Steelhead Critical Habitat*

The Anacortes Ferry Terminal does not fall within designated steelhead critical habitat (Federal Register 2016a).

#### 4.1.2.4 *Humpback Whale (Megaptera novaeangliae)*

Humpback whales may be present near the Anacortes ferry terminal.  Critical habitat has not been designated for humpback whales.  Sightings data will be summarized in each project BA.  The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.1.2.5 *Southern Resident Killer Whale (Orcinus orca)*

Southern Resident Killer Whale (SRKW) may be present near the Anacortes ferry terminal. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.1.2.6 *Southern Resident Killer Whale Critical Habitat*

The Anacortes Ferry Terminal area lies within designated critical habitat (Area 1 – Core Sumer Area). Areas with water less than 20 feet deep relative to the extreme high water mark are not included in the critical habitat designation (Federal Register 2006).

The PCEs provided in the terminal area, and their existing conditions, are listed in Table AN-3. PCEs relevant to the terminal area are numbered per Federal Register 2006.

**Table AN-2**
**Existing Conditions of Southern Resident Killer Whale PCEs at the Anacortes Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 1) Water quality to support growth and development | The marine waters of Guemes Channel are designated “Extraordinary” for aquatic life use. Impaired waters listings in the terminal areado not identify any water quality parameters of concern (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal site consists of two drainage areas. Approximately 25.7 acres drains through four outfalls to the Ship Harbor wetland; and 18.4 acres drains through five outfalls to Guemes Channel (note: one outfall to Guemes Channel drains to the Ship Harbor wetland seasonally in winter). The Ship Harbor wetland is likely to drain to Guemes Channel when the wetland stage is high via subsurface flow. A biofiltration swale is directly upgradient of one of the outfalls that drains directly to Guemes Channel (Ship Harbor seasonally), providing basic treatment for approximately 6 acres of impervious surfaces from the upper parking lot. There is no other treatment for stormwater runoff.<br><br>Existing creosote treated piles may leach PAHs into the water column, degrading water quality in the terminal vicinity. |
| 2) Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth | Salmonids are the primary prey of SRKW, and may be present near the terminal. Further information on prey can be found in the Puget Sound Chinook section, and Appendix B – Species Biology. |
| 3) Passage conditions to allow for migration, resting, and foraging | Existing structures that occur below -20 feet in critical habitat include a segment of overhead loading and the trestles, the main and auxiliary slips, two tie-up slips, and dolphins. It is unlikely that the presence of these structures affects passage conditions because killer whales can pass freely offshore of the ferry terminal. |

#### 4.1.2.7 *Bull Trout (Salvelinus confluentus)*

There are no natal streams in the area of the Anacortes Ferry Terminal that support bull trout (WDFW 2007a).

The aquatic portions of the ferry terminal are within marine foraging, migration, and overwintering (FMO) habitat. While bull trout have not been documented in the ferry terminal area, suitable FMO habitat is present. Eleven bull trout were captured during a beach seine in the Swinomish Channel in June 2001 (Yates 2001, cited in Goetz et al. 2004). In August 1976, one bull trout was captured in a tow net in Padilla Bay (Miller et al. 1977, cited in Goetz et al. 2004). Therefore, it is expected that the ferry terminal area would be used by anadromous adult and sub-adult bull trout for foraging, migration, and overwintering (USFWS 2004b). Within the ferry terminal area, it is expected that individual bull trout from the Lower Skagit River (approximately 20 shoreline miles south), Stillaguamish River (approximately 30 shoreline miles south), Nooksack River (approximately 22 shoreline miles north), and Snohomish River (approximately 50 shoreline miles south) core areas are most likely to be present (Chan 2005). Bull trout may also be present from rivers and streams in Hood Canal and southern Puget Sound (WDFW 2007a).

#### 4.1.2.8 *Bull Trout Critical Habitat*

The Anacortes Ferry Terminal does not fall within designated bull trout critical habitat (Federal Register 2010a).

#### 4.1.2.9 *Green Sturgeon (Acipenser medirostris)*

There are no natal streams in the area of the Anacortes Ferry Terminal that support green sturgeon.

Observations of green sturgeon in Puget Sound are much less common compared to the coastal Washington estuaries and bays such as Willapa Bay, Grays Harbor, and the Lower Columbia River estuary (Federal Register 2018). In addition, Puget Sound does not appear to be part of the coastal migratory corridor that Southern DPS fish use to reach overwintering grounds north of Vancouver Island (Federal Register 2018).

NMFS reviewed green sturgeon acoustic detection data from 2002-2019 in Puget Sound and the Strait of Juan de Fuca. From 2002-2008, 350 tagged green sturgeon were at large (67% from the threatened southern DPS). During this time, 17 were detected in Puget Sound (4 from the southern DPS). After 2008, none were detected in central or southern Puget Sound, though 400 were at large (83% southern DPS). From 2013-2018, six (one from the southern DPS) were detected in Admiralty Inlet (northern Puget Sound).

From 2004-2019, 210 green sturgeon were detected in the Strait of Juan de Fuca (71% southern DPS). This indicates that the strait is used as a corridor, with green sturgeon residing at detection sites for short periods as they pass through from open ocean. Few of these fish were detected afterwards in Admiralty Inlet, suggesting

that most of the tagged population move northward into the Strait of Georgia after transiting the strait. Data indicates conclusively that green sturgeon from the southern DPS occur in Puget Sound and Admiralty inlet, but at low rates compared to Strait of Juan de Fuca presence. This confirms earlier findings that Puget Sound is of lower conservation value to southern DPS green sturgeon. However, it is noted that the tagged population is a small fraction of the whole green sturgeon population, and that conditions need to be optimum for acoustic detection to occur (Moser, et. al. 2021).

#### 4.1.2.10 *Green Sturgeon Critical Habitat*

The Anacortes Ferry Terminal does not fall within designated green sturgeon critical habitat (Federal Register 2018).

#### 4.1.2.11 *Marbled Murrelet (Brachyramphus marmoratus)*

The Anacortes terminal area provides suitable marbled murrelet marine foraging habitat.

Documented surf smelt (prey species) spawning is present (see Figure AN-2), extending approximately 183 ft. NW and 414 ft. S of the terminal (WSDOT 2018a).

WDFW surveys conducted from 2001 to 2012 show a density of 1-3 murrelet per square kilometer in the terminal area (WDFW 2016). The nearest documented marbled murrelet nesting site is located 39 miles SW of the terminal (WSDOT 2018b).

The Northwest Forest Plan Marbled Murrelet Effectiveness Monitoring Program (2012) identified habitat suitability throughout the range of the species, and ranked it as Zero, Low, Marginal, Moderately High and Highest. The Anacortes murrelet habitat suitability within the pile driving/heavy equipment zone of potential effect (0.25 miles), ranges from Zero to Moderately High (WSDOT 2019b).
Five acres of contiguous coniferous forest that may offer nesting opportunity is present within the pile driving/heavy equipment zone of potential effect (0.25 miles) (WSDOT 2014/2018c). The 0.25 mile Zone of potential effect is discussed in Section 3.4.

Ferry traffic creates regular disturbance in the immediate terminal area. From July 2017 to June 2018, there were approximately 5,430 scheduled arrivals and departures from the terminal. During the nesting season (April 1-September 23), when foraging murrelet are more active, there were approximately 3,010 scheduled arrivals and departures (WSDOT 2018d).

Individual marbled murrelets were identified on the water near the terminal (once at 20 meters, twice at 50 meters, and once at 1 kilometer) on four separate days in January and February 2007 during construction of a dolphin replacement project at the terminal (WSF 2007b). A total of five murrelets were seen during the monitoring.

Anecdotal evidence from bird watchers located in Washington Park (facing Rosario Strait) indicate that marbled murrelets are likely in the area year round (Teachout, personal communication 2004).

#### 4.1.2.12 *Marbled Murrelet Critical Habitat*

No marbled murrelet critical habitat has been designated near the terminal (USFWS 1996).

#### 4.1.2.13 *Rockfish Species*

*Bocaccio*

Bocaccio are rarely caught in north Puget Sound and only sparse records exist for the Strait of Georgia (Federal Register 2010b). Because larvae are widely dispersed, it is possible that bocaccio juveniles could be found near the Anacortes Ferry Terminal at any time of year. Adult bocaccio generally move to very deep water. The water near the Anacortes Ferry Terminal remains shallow (less than 30 feet deep) throughout Guemes Channel.

*Yelloweye Rockfish*

Yelloweye rockfish are more closely aligned with rocky, high-relief substrates than with very deep water (Federal Register 2010b). The Guemes Channel is shallow, with muddy substrates. Yelloweye rockfish would be expected to reside in the nearby rocky substrata of the San Juan Islands and the Strait of Georgia, but not in the Guemes Channel.

#### 4.1.2.14 *Rockfish Species Critical Habitat*

The Anacortes Ferry Terminal is within rockfish nearshore critical habitat (less than or equal to 98 feet in depth) (Federal Register 2014). The physical and biological features (PBFs) (Federal Register 2014) essential to the conservation of juvenile Bocaccio rockfish are listed in Table AN-3. PBFs relevant to the terminal area are numbered per the CFR (Federal Register 2014). These PBFs are specific to nearshore environments, where only juvenile Bocaccio rockfish could be found. Deepwater (> 98 feet in depth) PBFs exist for adult Bocaccio, and adult and juvenile yelloweye rockfish; however, this habitat is not present at the Anacortes Ferry Terminal and will not be discussed here.

**Table AN-3**
**Existing Conditions of Rockfish PBFs at the Anacortes Ferry Terminal**

| PBFs | Existing Conditions |
|---|---|
| 1) Quantity, quality, and availability of prey species to support individual growth, survivial, reproduction, and feeding opportunities. | The marine waters of Guemes Channel near the ferry terminal are designated “Extraordinary” for aquatic life use. Impaired waters listings in the terminal area do not identify any water quality parameters of concern (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal site consists of two drainage areas. Approximately 25.7 acres drains through four outfalls to the Ship Harbor wetland; and 18.4 acres drains through five outfalls to Guemes Channel (note: one outfall to Guemes Channel drains to the Ship Harbor wetland seasonally in winter). The Ship Harbor wetland is likely to drain to Guemes Channel when the wetland stage is high via subsurface flow. A biofiltration swale is directly upgradient of one of the outfalls that drains directly to Guemes Channel (Ship Harbor seasonally), providing basic treatment for approximately 6 acres of impervious surfaces from the upper parking lot. There is no other treatment for stormwater runoff.<br><br>Existing creosote treated piles may leach PAHs into the water column, degrading water quality in the terminal vicinity.<br><br>Overwater coverage from the existing ferry terminal structures may reduce the production of aquatic invertebrates that are prey species to rockfish. Substrates in the area are expected to support epibenthic production.<br><br>Sand lance spawning occurs 400 feet southeast of the terminal. Documented surf smelt spawning at the terminal extending approximately 184 feet to the northwest and 406 feet to the southeast. |
| 2) Water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities. | Substrates support epibenthic production. Surf smelt spawn approximately 0.75 mile north of the terminal.<br><br>Dominant macroalgae in the area is eelgrass (*Zostera marina* L.) and benthic macroalgae (*Ulva* spp., *Laminaria* sp.).<br><br>There is no large overhanging wood vegetation present to provide a food base from terrestrial organisms. The existing conditions consist of sand and silt below MLLW, with shell fragments in offshore areas and gravel, cobble, and sand above MLLW within the defined area of critical habitat. Some riprap and hardened shoreline are adjacent to the ferry terminal. |

#### 4.1.2.15 *Pacific Eulachon (Thaleichthys pacificus)*

The Anacortes Ferry Terminal is approximately 45 shoreline miles from the Fraser River, a confirmed spawning river. Eulachon use the Strait of Juan de Fuca as a migration corridor, so it is possible that eulachon might be present at the Anacortes Ferry Terminal.

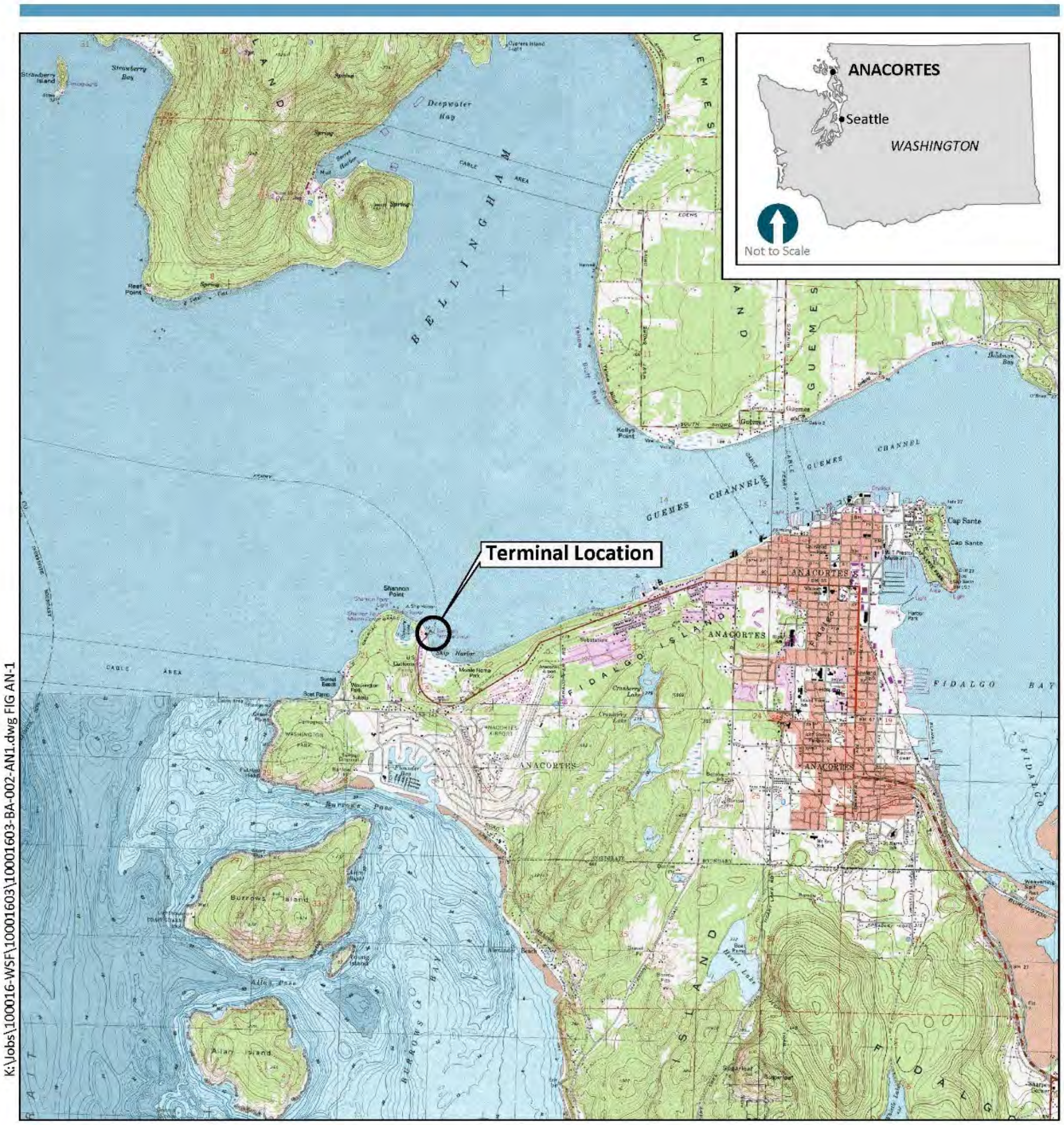
A monthly bottom trawl study was funded by Fisheries and Oceans Canada's National Rotational Survey Fund from October 2017 to June 2018 to sample Eulachon in three regional strata in Juan de Fuca Strait and the Strait of Georgia. The goal of this study was to gain insights into the biology, distribution, and migration timing of Eulachon to the Fraser River by observing their spatial and temporal occurrence and biological condition over a wide survey region and over a series of months. Eulachon catch per unit effort (CPUE), size distributions, sex ratios, and maturity observations varied over time and space, as did the occurrence of stomach contents and presence/absence of teeth. Highest catches of Eulachon occurred in Juan de Fuca and lowest near the Fraser River. Mean catch rates at sites near the Fraser River plume corresponded with expected peak spawning periods in the Fraser River. The sex ratio of Eulachon sampled throughout the study region in all months was approximately 1:1 although most samples in the Strait of Georgia in May and June were female. The presence of Eulachon with maturing gonads increased in frequency from west to east in January to April before sharply decreasing throughout the survey region in May and June. Stomach contents and teeth decreased in frequency with proximity to the Fraser River.

Trends in CPUE, fish length, presence of teeth, and stomach contents demonstrate that Juan de Fuca Strait likely provides an important year-round marine habitat for Eulachon feeding and growth as well as being a migration corridor to and from the west coast of Vancouver Island, which offers a large range of additional Eulachon habitat for foraging, growth habitat and mixing of stocks (Dealy et. al., 2019).

#### 4.1.2.16 *Pacific Eulachon Critical Habitat*

No Pacific eulachon critical habitat has been designated near the Anacortes Ferry Terminal (Federal Register 2011).

# BAINBRIDGE ISLAND




K:\Jobs\100016-WSF\10001603\10001603-BA-002-AN1.dwg FIG AN-1

Mar 21, 2012 9:31am heriksen

**NOTE:** Base map prepared from Terrain Navigator Pro USGS 7.5 minute quadrangle map(s) of Anacortes North and South, Cypress Island, and Decption Pass, Washington.

| Section | Township | Range | Lat | Long | County |
|---|---|---|---|---|---|
| 22 | 35N | 1E | 48° 30' 26" N | 122° 40' 30" W | Skagit |
| HUC 171100020204 | | | WRIA 3 | | |

0 1
Scale in Miles

**Figure AN-1**
Anacortes Ferry Terminal Vicinity Map
WSF Biological Assessment Reference
Anacortes, Washington

**Figure BA-1**
**Bainbridge Island Ferry Terminal Vicinity Map**


**Figure BA-2**
**Aerial Photo of Bainbridge Ferry Terminal**

## 4.2 Bainbridge Island Ferry Terminal

The Bainbridge Island Ferry Terminal is located in the city of Bainbridge Island (formerly Winslow), on the shoreline of Eagle Harbor (see Figures BA-1 and BA-2).

The Bainbridge Ferry Terminal provides service to the Seattle Ferry Terminal (Colman Dock).

Features of the terminal include a terminal building, paid parking lots, 14 vehicle holding lanes that accommodate up to 212 vehicles, and overhead passenger loading facilities. The terminal has three slips that include a main, auxiliary, and tie-up slips. Steel wingwalls are present in the main and auxiliary slips and one 5-pile wingwall is present in the tie-up slip. Seven steel dolphins are associated with the terminal, four in the main slip, two in the auxiliary slip, and one in the tie-up slip.

### *4.2.1 Bainbridge Environmental Baseline*

#### 4.2.1.1 *Physical Indicators*

*Substrate and Slope*

The shoreline in the area is generally developed. Some riprap exists east of the ferry terminal. Low, steep bluffs rise behind the terminal on both sides. See Figures BA-3 and BA-4.

Substrate in the area is gently sloping sand, gravel, and shell in the intertidal areas, and drops off steeply toward the end of the terminal entrance. The high intertidal zones are characterized by cobble and gravel-sized sediment, and the mid- to low-intertidal areas are characterized by silt and sand (EPA 1989). Offshore depths of terminal structures are: head of main slip (-29.9 feet MLLW), auxiliary slip (-31.6 feet MLLW), and tie-up slip (-28.8 feet MLLW). Maximum depth for fixed dolphins is -40.4 feet MLLW, and the floating dolphin is -40.0 feet MLLW.

**Figure BA-3**
**Beach Area on South Side of Bainbridge Island Ferry Terminal**

**Figure BA-4**
**Beach Area on North Side of Bainbridge Island Ferry Terminal**

*Salt/Freshwater Mixing*

While several small streams drain into Eagle Harbor, there are no significant freshwater flows. A narrow ravine about 0.5 mile long drains into the harbor approximately 0.25 mile west of the ferry terminal.

*Flows and Currents*

Incoming tides circulate west along the northern shore of Eagle Harbor and exit east along the center line of the bay. Tidal currents near the ferry terminal tend to follow an east-west direction to approximately -35 feet MLLW. Beyond -35 feet MLLW, currents tend to form a circular pattern during flood tides (EPA 1989).

#### 4.2.1.2 *Chemical Indicators*

*Water Quality*

The marine waters of Eagle Harbor near the ferry terminal are designated "Extraordinary" for aquatic life use. Impaired waters listings in the terminal area (Eagle Harbor) include organics and metals (tissue-22 parameters) (Ecology 2018).

*Sediment Quality*

Impaired sediment quality listings in the terminal area (Eagle Harbor) include organics and metals (32 parameters) (Ecology 2018).

#### 4.2.1.3 *Biological Indicators*

*Shoreline Vegetation*

Above MHHW, there is a strip about 100 feet wide of shrubs, some trees, and non-native and invasive English ivy and Himalayan blackberry between the beach and the paved ferry terminal holding area. Low but steep bluffs rise behind and on both sides of the terminal.

*Macroalgae and Eelgrass*

The most common algal species in the vicinity of the facility include *Ulva* sp. and diatoms. While there are no eelgrass or kelp *(Laminaria* sp.) communities in the area near the terminal, both are present at the mouth of Eagle Harbor near Wing Point, approximately 0.75 miles away.

*Epibenthos, Macrofauna, Fish, and Marine Mammals*

Based on sediment characteristics, substrates are expected to support epibenthic production. Macrofauna observed during a 1996 dive survey include horse clams (*Tresus* sp. *Indet* and *T. capax*), shrimp (*Pandalus danae*), anemones (*Anthozoa* sp. *Indet* and *Metridium giganteum*), and sea cucumbers (*Parastichopus californicus*). Geoduck clams (*Panopea abrupta*) were also recorded during the dive survey (Parametrix 1996).

Large moon snails (*Polinices lewisii*) were abundant under the existing trestles. Fish species commonly found in Eagle Harbor include English sole, rock sole (*Lepidopsetta bilineata*), C-O sole (*Pleuronichthys coenosus*), shiner perch (*Cymatogaster aggregata*), and ratfish. Geoduck and hardshell clam beds are located outside the mouth of Eagle Harbor, over 0.5 mile from the ferry terminal. River otters (*Lontra Canadensis*) are regularly sighted under the Eagle Harbor Maintenance Facility.

*Forage Fish*

Documented surf smelt spawning is present (see Figure BA-2), extending approximately 661 feet to the southwest and 660 feet to the northeast (WSDOT 2018a). There is no documented herring, herring holding areas, or sand lance spawning at the terminal.

### 4.2.2 Bainbridge Species Distributions

#### 4.2.2.1 *Puget Sound Chinook Salmon (Oncorhynchus tshawytscha)*

No Chinook salmon bearing streams are located near the Bainbridge Island Ferry Terminal. The closest major rivers that support Chinook salmon are the Lake Washington/Cedar River system (approximately 6 miles northeast, shoreline distance), Duwamish/Green River (approximately 7 miles southeast, shoreline distance), and the Puyallup River (approximately 27 miles southeast, shoreline distance) (WDFW 2007a). Chinook may also be present from rivers and streams in southern Puget Sound (WDFW 2007a). Smaller drainages are discussed below.

*Adult and Sub-adult Chinook*

Adult Puget Sound Chinook salmon destined for Sinclair Inlet and other west-central Puget Sound tributaries probably migrate through Eagle Harbor in late summer and early fall as they return from the ocean to natal streams and rivers (NMFS 2005).

Sub-adult Chinook have access to the terminal area and may be found there at any time of year. Sub-adults have spent a winter in the marine environment and are not closely oriented to the shoreline like juveniles.

### *Juvenile Chinook*

Eagle Harbor provides habitat for multiple populations of Chinook salmon that are natal to streams elsewhere in Puget Sound. Use of this habitat necessitates crossing an open, deep water channel away from the protection of the nearshore environment. In Eagle Harbor, juvenile Chinook salmon have been found between April and August, with peak catches in May and June (NMFS 2005).

Between 2002 and 2004, juvenile Chinook salmon were sampled in beach seines set by the City of Bainbridge Island and the Suquamish Tribe in Eagle Harbor and along the eastern shoreline of Bainbridge Island, approximately 1.5 miles from Eagle Harbor (NMFS 2005). In Eagle Harbor, juvenile Chinook salmon were found between April and August, with peak catches in May and June (Table BA-1). Along the eastern shoreline of Bainbridge Island, juvenile Chinook salmon were found between June and September, with peak catches in June and August (Table BA-2). Mean size in April, May, and possibly September for all three years and both sampling locations was influenced by the small sample size and may not be reflective of the true size distribution (BA-3). However, between June and possibly September, mean size increased from 99 to 137 millimeters (mm) fork length, with standard deviations ranging from 6 mm to 25 mm.

**Table BA-1**
**Total Number of Juvenile Chinook Captured in Beach Seine Sampling in Eagle Harbor**

| | Year | | |
|---|---|---|---|
| **Month** | **2002** | **2003** | **2004** |
| January | | | 0 |
| February | | | |
| March | | | 0 (2 sets) |
| April | | | 1 |
| May | | 5 (2 sets) | 1 |
| June | 4 | 0 | 0 |
| July | | 0 | |
| August | | | 4 |
| September | | 0 | |
| October | | | 0 |
| November | | 0 | |
| December | | 0 (2 sets) | 0 |

**Source:** NMFS 2005
**Note:** One set per month unless otherwise indicated. Empty cells indicate that zero sets were conducted.

**Table BA-2**
**Total Number of Juvenile Chinook Captured at a Beach Seine Sampling Station along Eastern Shoreline of Bainbridge Island**

| Month | Year | | |
|---|---|---|---|
| | 2002 | 2003 | 2004 |
| January | | | 0 |
| February | | | 0 |
| March | | | 0 (2 sets) |
| April | | 0 | 0 (2 sets) |
| May | | 0 (2 sets) | 0 (2 sets) |
| June | 6 | 8 (2 sets) | 1 (3 sets) |
| July | 3 (3 sets) | 4 (3 sets) | 1 |
| August | 4 | 2 (2 sets) | 8 (2 sets) |
| September | 0 (2 sets) | 0 | 4 (2 sets) |
| October | | 0 | 0 |
| November | | 0 | 0 |
| December | | 0 | 0 |

**Source:** NMFS 2005
**Note:** One set per month unless otherwise indicated. Empty cells indicate that zero sets were conducted.

**Table BA-3**
**Forklengths of Juvenile Chinook Captured in Beach Seine Sampling in or near Eagle Harbor**

| Month | Sample Size | Mean ± St. Dev. (mm) |
|---|---|---|
| January | 0 | |
| February | 0 | |
| March | 0 | |
| April | 1 | 58 |
| May | 6 | 121 ± 21 |
| June | 19 | 99 ± 17 |
| July | 8 | 118 ± 25 |
| August | 18 | 126 ± 18 |
| September | 4 | 137 ± 6 |
| October | 0 | |
| November | 0 | |
| December | 0 | |

**Source:** NMFS 2005
**Note:** Data from all 3 years and all sampling locations combined per month

Near Colvos Passage (southwest of the ferry terminal) and in the Sinclair Inlet drainages, there are several small streams that support Chinook salmon. Curley Creek, which drains Long Lake and is a tributary to Yukon Harbor, is the nearest stream with Chinook (approximately 8 miles southwest, shoreline distance). A tributary to Sinclair Inlet, Gorst Creek (approximately 19 miles, shoreline distance) supports both summer and fall-run Chinook salmon (Williams et al. 1975). Chinook salmon spawning in Gorst Creek has increased in recent years, due in part to a reduction in the fishing effort in the area. Most of these fish are believed to be returns from hatchery Chinook salmon released from the Gorst Creek rearing ponds. An escapement of over 17,000 Chinook salmon to the Inlet (fishery harvests plus stream escapement) in 2002 was the largest on record, with over 10,000 adult Chinook salmon in Gorst Creek. Returns to the stream in the previous 3 years averaged about 2,400 adult Chinook salmon. An outmigrant trap recently installed at River Kilometer 1.4 on Gorst Creek (upstream of the hatchery) captured 1,352 juvenile Chinook salmon in 2001 and 324 juvenile Chinook salmon in 2002. Another tributary to Sinclair Inlet, Blackjack Creek (approximately 17.0 miles shoreline distance), supports Chinook salmon (WDFW 2006c).

#### 4.2.2.2 *Puget Sound Chinook Salmon Critical Habitat*

The Bainbridge Island Ferry Terminal lies within Chinook Zone 14 (70 FR 52630). While there are no streams that support Chinook salmon in Eagle Harbor, there are eelgrass beds at the mouth of Eagle Harbor near Wing Point that may be used by juvenile Chinook for rearing (Ash 2001). Use of critical habitat in Eagle Harbor necessitates crossing an open, deep water channel away from the protection of the nearshore environment.

The PCEs provided in the ferry terminal area, and their existing conditions, are listed in Table BA-4. PCEs relevant to the terminal area are numbered per the CFR (70 FR 5263070 FR 52630).

**Table BA-4**
**Existing Conditions of Chinook Salmon PCEs at the Bainbridge Island Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 5) Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels. | **Obstructions**<br>In-water ferry terminal structures include the trestles, the main and auxiliary slips, one tie-up slip, and dolphins. The existing ferry terminal may affect fish passage in the nearshore.<br><br>**Water Quality and Forage**<br>The marine waters of Eagle Harbor are designated “Extraordinary” for aquatic life use. Impaired waters listings for Eagle Harbor include organics and metals (tissue – 22 parameters; sediment – 32 parameters) (Ecology 2018).<br>The existing stormwater system at the ferry terminal site consists of four drainage networks of catch basins that drain to Eagle Harbor. The largest system drains the holding lanes and toll booth approach lanes and consists of five catch basins. These catch basins discharge into a stormwater vault containing Kri-Star stormwater filters that provide secondary level treatment before discharging to Eagle Harbor A second drainage network drains a portion of the entrance and exit lanes approaching the trestle and discharges under the existing concrete trestle. The other two smaller networks drain parking lots and discharge on the vegetated bank north of the ferry terminal building. None of the runoff from these areas is treated.<br><br>Existing creosote treated piles may leach PAHs into the water column, degrading water quality in the terminal vicinity.<br><br>Overwater coverage from existing ferry terminal structures may reduce the production of aquatic invertebrates that are prey species to salmon. Based on sediment characteristics, substrates are expected to support epibenthic production.<br><br>Surf smelt spawn year-round in Eagle Harbor.<br><br>**Natural Cover**<br>The marine waters of Eagle Harbor are designated “Extraordinary” for aquatic life use. Impaired waters listings for Eagle Harbor include organics and metals (tissue – 22 parameters; sediment – 32 parameters) (Ecology 2018).<br><br>The shoreline at the ferry terminal consists of riprap to the east. Existing conditions consist of a gently sloping bottom with cobble and gravel in the high intertidal zone; and sand, silt, gravel, and shell in the intertidal area within the defined area of critical habitat. Wood and steel debris is common under the ferry terminal. The bottom drops off steeply toward the wingwalls and dolphins (EPA 1989). Side channels do not occur in the ferry terminal area. |
| 6) Offshore areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation. | The marine waters of Eagle Harbor are designated “Extraordinary” for aquatic life use per WAC 173-201(a). Ecology’s 2012 303 (d) water quality parameters of concern for Eagle Harbor include copper and bacteria (water) and organics and metals (tissue-23 parameters).<br><br>Existing creosote treated piles may leach PAHs into the water column, degrading water quality in the terminal vicinity.<br><br>Offshore areas provide habitat for forage fish. |

#### 4.2.2.3 *Puget Sound Steelhead (Oncorhynchus mykiss)*

There are no natal streams in the area of the Bainbridge Island Ferry Terminal that support Puget Sound steelhead. However, major river systems that support winter steelhead include the Lake Washington system (approximately 6 miles northeast, shoreline distance), Duwamish/Green (approximately 7 miles southeast, shoreline distance) and the Puyallup (approximately 27 miles southeast, shoreline distance). The Duwamish/Green River also supports a run of summer steelhead. Steelhead may also be present from rivers and streams in southern Puget Sound (WDFW 2007a).

In addition, winter steelhead are present in Curley Creek just west of the Southworth Ferry Terminal in Yukon Harbor (approximately 8 shoreline miles southwest), Shingle Mill Creek on Vashon Island (approximately 10 shoreline miles southwest), Blackjack Creek (approximately 13 shoreline miles southwest), Ross Creek (approximately 14 shoreline miles southwest), Anderson Creek (approximately 15 shoreline miles southwest), and Gorst Creek (approximately 16 shoreline miles southwest)—all tributaries to Sinclair Inlet; and Chico Creek (approximately 15 shoreline miles northwest), Barker Creek (approximately 17 shoreline miles northwest), Strawberry Creek (approximately 17 shoreline miles northwest), and Clear Creek (approximately 18 shoreline miles northwest)—all tributaries to Dyes Inlet (WDFW 2007a).

Available data from tow net sampling (deeper nearshore) and beach seine sampling (shallow nearshore) efforts around Puget Sound have reported the capture of few steelhead. In tow net sampling in north and south Puget Sound, NMFS captured a total of 18 steelhead (Rice, unpublished data). The total sampling effort data was not available, but the mean steelhead catch ranged from 0 to 0.2 per net in north Puget Sound and 0.1 to 0.8 per net in south Puget Sound.

During 2001 and 2002, beach seining conducted in central Puget Sound by King County Department of Natural Resources captured only nine steelhead out of a total of approximately 34,000 juvenile salmonids. All the steelhead were caught between May and August and ranged in size from 141 to 462 mm with a mean size of 258 mm (Brennan et al. 2004). Also during 2001 and 2002, beach seining, tow netting, and purse seining were conducted by WDFW in Sinclair Inlet. This sampling effort focused on beach seining, which occurred monthly from April to October in 2001 and from mid-February to September in 2002. Tow netting was conducted monthly from May to August in 2002 only and purse seining was limited to only 2 days in July of 2002. The sampling effort resulted in the capture of four steelhead out of a total of 21,500 salmonids. Despite the larger effort given to beach seining, of the four steelhead, only one was caught in the beach seine and the remaining three were caught in deeper water with the tow net and purse seine (Fresh et al. 2006).

Steelhead were infrequently captured in a 2002-2004 beach seine study around Bainbridge Island. The study consisted of 271 beach seine sets conducted between April and September 2002 and between April 2003 and December 2004. Three steelhead were captured in the study; one was captured in May and two were captured in September. The steelhead were 179, 280, and 300 mm in total length. One of the three steelhead had been fin clipped, indicating it was of hatchery origin (City of Bainbridge Island, Suquamish Tribe, and WDFW 2005). During 2001 and 2002, beach seining conducted in central Puget Sound by King County Department of Natural Resources captured only nine steelhead out of a total of approximately 34,000 juvenile salmonids. All the steelhead were caught between May and August and ranged in size from 141 to 462 mm with a mean size of 258 mm (Brennan et al. 2004).

#### 4.2.2.4 *Puget Sound Steelhead Critical Habitat*

The Bainbridge Island Ferry Terminal does not fall within designated steelhead critical habitat (Federal Register 2016a).

#### 4.2.2.5 *Humpback Whale (Megaptera novaeangliae)*

Humpback whales may be present near the Bainbridge Island ferry terminal. Critical habitat has not been designated for humpback whales. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.2.2.6 *Southern Resident Killer Whale (Orcinus orca)*

Southern Resident Killer Whale (SRKW) may be present near the Bainbridge Island ferry terminal. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.2.2.7 *Southern Resident Killer Whale Critical Habitat*

The Bainbridge Island Ferry Terminal lies within Area 2 – Puget Sound considered to be used by killer whales for fall feeding. Areas with water less than 20 feet deep relative to the extreme high water mark are not included in the critical habitat designation (Federal Register 2006).

The PCEs provided in the ferry terminal area, and their existing conditions, are listed in Table BA-5. PCEs relevant to the terminal area are numbered per the CFR (Federal Register 2006).

**Table BA-5**
**Existing Conditions of Southern Resident Killer Whale PCEs at the Bainbridge Island Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 1) Water quality to support growth and development | The marine waters of Eagle Harbor are designated “Extraordinary” for aquatic life use. Impaired waters listings in the terminal area include organics and metals (tissue-22 parameters; sediment – 32 parameters) (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal site consists of four drainage networks of catch basins that drain to Eagle Harbor. The largest system drains the holding lanes and toll booth approach lanes and consists of five catch basins. These catch basins discharge into a storm water vault containing Kri-Star storm water filters that provide secondary level treatment before discharging to Eagle Harbor. A second drainage network drains a portion of the entrance and exit lanes approaching the trestle and discharges under the existing concrete trestle. The other two smaller networks drain parking lots and discharge on the vegetated bank north of the ferry terminal building. None of the runoff from these areas is treated.<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity. |
| 2) Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth | Salmonids are the primary prey of SRKW, and may be present near the terminal. Further information on prey can be found in the Puget Sound Chinook section, and Appendix B – Species Biology. |
| 3) Passage conditions to allow for migration, resting, and foraging | Existing structures that occur below -20 feet in critical habitat include a segment of the overhead loading and trestles; the main, auxiliary, and tie-up slips; and dolphins. It is unlikely that the presence of these structures affects passage conditions because killer whales have not been observed in Eagle Harbor. |

#### 4.2.2.8 *Bull Trout (Salvelinus confluentus)*

There are no natal streams in the area of the Bainbridge Island Ferry Terminal that support bull trout. It is unlikely that anadromous bull trout would enter Eagle Harbor (WDFW 2007a).

The aquatic portions of the ferry terminal are within marine FMO habitat. Suitable FMO habitat is present, and bull trout are thought to occur throughout south, central, and northern Puget Sound. Therefore, it is expected that the ferry terminal area would be used by anadromous adult and sub-adult bull trout for foraging, migration, and overwintering (USFWS 2004b). Within the ferry terminal area, it is expected that individual bull trout from the Lake Washington/Cedar River system (approximately 6 miles northeast, shoreline distance), Duwamish/Green River (approximately 7 miles southeast, shoreline distance), and the Puyallup River (approximately 27 miles southeast, shoreline distance) core areas are most likely to be present. Bull trout may also be present from rivers and streams in southern Puget Sound (WDFW 2007a).

In August 2005, an acoustic tag was detected off the northeast point of Bainbridge Island. The tag code corresponded to a bull trout tagged 2 years earlier in the north Swinomish Channel. The fish was only detected once and therefore there is some uncertainty with the finding (Goetz 2007). No other historic or current references indicate the occurrence of bull trout (or Dolly Varden) on the west side of Puget Sound, main basin, or Kitsap Peninsula. Char are infrequent migrants across deep inlets, such as the main basin (Goetz et al. 2004).

#### 4.2.2.9 *Bull Trout Critical Habitat*

The Bainbridge Island Ferry Terminal does not fall within designated bull trout critical habitat (Federal Register 2010a).

#### 4.2.2.10 *Green Sturgeon (Acipenser medirostris)*

There are no natal streams in the area of Eagle Harbor that support green sturgeon.

Two confirmed Southern DPS green sturgeon were detected in Puget Sound in 2006, but the extent to which green sturgeon from the Southern DPS use Puget Sound is uncertain (Federal Register 2018). Observations of green sturgeon in Puget Sound are much less common compared to the coastal Washington estuaries and bays such as Willapa Bay, Grays Harbor, and the Lower Columbia River estuary (Federal Register 2018).

NMFS reviewed green sturgeon acoustic detection data from 2002-2019 in Puget Sound and the Strait of Juan de Fuca. From 2002-2008, 350 tagged green sturgeon were at large (67% from the threatened southern DPS). During this time, 17 were detected in Puget Sound (4 from the southern DPS). After 2008, none were detected in central or southern Puget Sound, though 400 were at large (83% southern DPS). From 2013-2018, six (one from the southern DPS) were detected in Admiralty Inlet (northern Puget Sound).

From 2004-2019, 210 green sturgeon were detected in the Strait of Juan de Fuca (71% southern DPS). This indicates that the strait is used as a corridor, with green sturgeon residing at detection sites for short periods as they pass through from open ocean. Few of these fish were detected afterwards in Admiralty Inlet, suggesting that most of the tagged population move northward into the Strait of Georgia after transiting the strait. Data indicates conclusively that green sturgeon from the southern DPS occur in Puget Sound and Admiralty inlet, but at low rates compared to Strait of Juan de Fuca presence. This confirms earlier findings that Puget Sound is of lower conservation value to southern DPS green sturgeon. However, it is noted that the tagged population is a small fraction of the whole green sturgeon population, and that conditions need to be optimum for acoustic detection to occur (Moser, et. al. 2021).

#### 4.2.2.11 *Green Sturgeon Critical Habitat*

Eagle Harbor does not fall within designated green sturgeon critical habitat (Federal Register 2018).

#### 4.2.2.12 *Marbled Murrelet (Brachyramphus marmoratus)*

The Bainbridge terminal area provides suitable marbled murrelet marine foraging habitat.

Documented surf smelt (prey species) spawning is present (see Figure BA-2), extending approximately 629 ft. N and 625 ft. S of the terminal (WSDOT 2018a).

WDFW surveys conducted from 2001 to 2012 show a density of less than 1 bird per square kilometer in the terminal area (WDFW 2016). The nearest documented marbled murrelet nesting site is located 27 miles W of the terminal (WSDOT 2018b).

The Northwest Forest Plan Marbled Murrelet Effectiveness Monitoring Program (2012) identified habitat suitability throughout the range of the species, and ranked it as Zero, Low, Marginal, Moderately High and Highest. The Bainbridge murrelet habitat suitability within the pile driving/heavy equipment zone of potential effect (0.25 miles) is Zero (WSDOT 2019b).

Five acres of contiguous forest that may offer nesting opportunity is present within the pile driving/heavy equipment zone of potential effect (0.25 miles) (WSDOT 2014/2018c). A WSF Biologist visited the terminal area on 12/13/18. Although there were 5 acres of contiguous forest, it was less than the required 60% coniferous. Therefore, the forest does not offer appropriate nesting opportunity (WSDOT 2018f).

Ferry traffic creates regular disturbance in the immediate terminal area. From July 2017 to June 2018, there were approximately 16,520 scheduled arrivals and departures from the terminal. During the nesting season (April 1-September 23), when foraging murrelet are more active, there were approximately 8,290 scheduled arrivals and departures (WSDOT 2018d).

#### 4.2.2.13 *Marbled Murrelet Critical Habitat*

No marbled murrelet critical habitat has been designated near theterminal (USFW 1996).

#### 4.2.2.14 *Rockfish Species*

*Bocaccio*

Bocaccio are rarely caught in north Puget Sound and only sparse records exist for the Strait of Georgia (Federal Register 2010b). Because larvae are widely dispersed, it is possible that bocaccio juveniles could be found near the Bainbridge Island Ferry Terminal at any time of year. Adult bocaccio generally move to very deep water. The water near the Bainbridge Island Ferry Terminal reaches a maximum of 70 feet deep near the harbor mouth (NMFS 2009).

*Yelloweye Rockfish*

Yelloweye rockfish are more closely aligned with rocky, high-relief substrates than with very deep water (Federal Register 2010b). Eagle Harbor is relatively shallow, but does not have the rocky substrata required by adult yelloweye rockfish.

#### 4.2.2.15 *Rockfish Species Critical Habitat*

The Bainbridge Island Ferry Terminal is within rockfish nearshore critical habitat (less than or equal to 98 feet in depth) (Federal Register 2014). The physical and biological features (PBFs) (Federal Register 2014) essential to the conservation of juvenile Bocaccio rockfish are listed in Table BA-6. PBFs relevant to the terminal area are numbered per the CFR (Federal Register 2014). These PBFs are specific to nearshore environments, where only juvenile Bocaccio rockfish could be found. Deepwater (> 98 feet in depth) PBFs exist for adult Bocaccio, and adult and juvenile yelloweye rockfish; however, this habitat is not present at the Bainbridge Island Ferry Terminal and will not be discussed here.

**Table BA-6**
**Existing Conditions of Rockfish PBFs at the Bainbridge Island Ferry Terminal**

| PBFs | Existing Conditions |
|---|---|
| 1) Quantity, quality, and availability of prey species to support individual growth, survivial, reproduction, and feeding opportunities. | The marine waters of Eagle Harbor are designated “Extraordinary” for aquatic life use. Impaired waters listings for Eagle Harbor include organics and metals (tissue – 22 parameters; sediment – 32 parameters) (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal site consists of four drainage networks of catch basins that drain to Eagle Harbor. The largest system drains the holding lanes and toll booth approach lanes and consists of five catch basins. These catch basins discharge into a stormwater vault containing Kri-Star stormwater filters that provide secondary level treatment before discharging to Eagle Harbor A second drainage network drains a portion of the entrance and exit lanes approaching the trestle and discharges under the existing concrete trestle. The other two smaller networks drain parking lots and discharge on the vegetated bank north of the ferry terminal building. None of the runoff from these areas is treated.<br><br>Existing creosote treated piles may leach PAHs into the water column, degrading water quality in the terminal vicinity.<br><br>Overwater coverage from existing ferry terminal structures may reduce the production of aquatic invertebrates that are prey species to salmon. Based on sediment characteristics, substrates are expected to support epibenthic production.<br><br>Surf smelt spawn year-round in Eagle Harbor. |
| 2) Water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities. | The most common macroalgae species under the ferry terminal are *Ulva* sp. and diatoms. While there are no eelgrass or kelp communities in the area near the terminal, both are present at the mouth of Eagle Harbor near Wing Point, approximately 0.75 miles away. The upper shoreline in the area is relatively flat and is characterized by trees, shrubs, and some residential clearing. Low but steep bluffs rise behind and on both sides of the ferry terminal (Anchor 2005a).<br><br>The shoreline at the ferry terminal consists of riprap to the east. Existing conditions consist of a gently sloping bottom with cobble and gravel in the high intertidal zone; and sand, silt, gravel, and shell in the intertidal area within the defined area of critical habitat. Wood and steel debris is common under the ferry terminal. The bottom drops off steeply toward the wingwalls and dolphins (EPA 1989). Side channels do not occur in the ferry terminal area. |

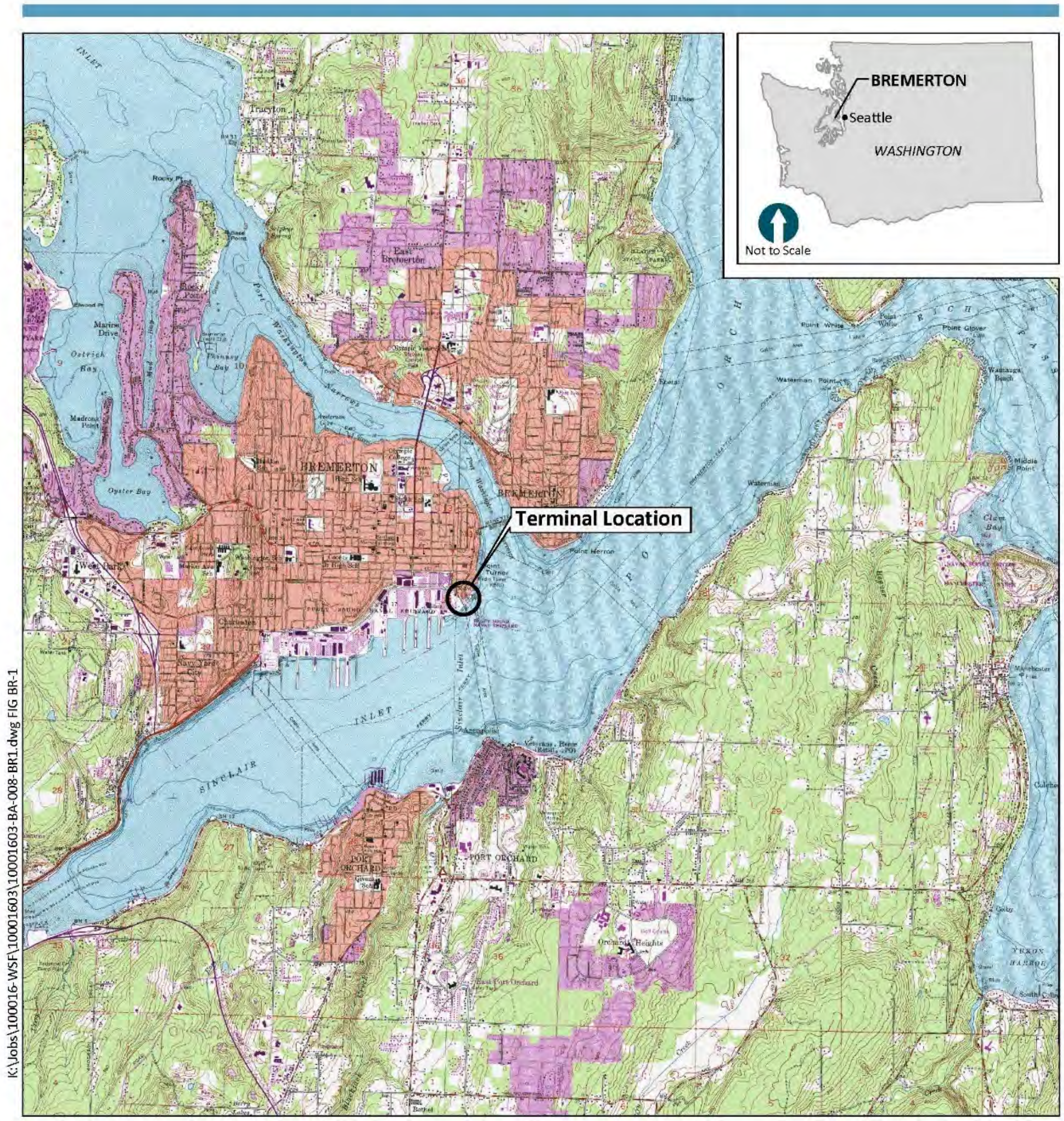
#### 4.2.2.16 *Pacific Eulachon (Thaleichthys pacificus)*

The Bainbridge Island Ferry Terminal is distant from any of the known eulachon spawning rivers. It is highly unlikely that eulachon will be present at the Bainbridge Ferry Terminal.

#### 4.2.2.17 *Pacific Eulachon Critical Habitat*

No Pacific eulachon critical habitat has been designated near the Bainbridge Island Ferry Terminal (FEDERAL REGISTER 2011).

# BREMERTON




**NOTE:** Base map prepared from Terrain Navigator Pro USGS 7.5 minute quadrangle map(s) of Bremerton East and West, Washington.

| Section | Township | Range | Lat | Long | County |
|---|---|---|---|---|---|
| 24 | 24N | 1E | 47º 33′ 44″ N | 122º 37′ 23″ W | Kitsap |
| HUC 171100190103 | | | WRIA 15 | | |

0 1 Scale in Miles

**Figure BR-1**
Bremerton Ferry Terminal Vicinity Map
WSF Biological Assessment Reference
Bremerton, Washington

**Figure BR-1**
**Bremerton Ferry Terminal Vicinity Map**


**Figure BR-2**
**Aerial Photo of Bremerton Ferry Terminal**

## 4.3 Bremerton Ferry Terminal

The Bremerton Ferry Terminal is located in the city of Bremerton, east of the Navy shipyard. Bremerton is on the shoreline of Sinclair Inlet, south of Bainbridge Island (see Figures BR-1 and BR-2).

The Bremerton Ferry Terminal provides service to the Seattle Ferry Terminal (Colman Dock).

Features of the terminal include a terminal building, 13 vehicle holding lanes that accommodate up to 230 vehicles, and overhead passenger loading facilities. No paid parking is available at the Bremerton Ferry Terminal. The terminal has main and auxiliary slips. Steel wingwalls are present in the main and auxiliary slips. Six steel dolphins are associated with the terminal, three in the main slip and three in the auxiliary slip. Two timber dolphins are also associated with the terminal, one each in the main and auxiliary slips.

### *4.3.1 Bremerton Environmental Baseline*

#### 4.3.1.1 *Physical Indicators*

*Substrate and Slope*

Substrates in Sinclair Inlet are comprised of gravel, sand, mud/clay, and shell hash. Some woody debris and garbage (i.e., bottles, tires, and cable) are present. The shoreline is heavily armored with riprap (see Figures BR-3 and BR-4). Offshore depths of terminal structures are: head of main slip (-29.9 feet MLLW), auxiliary slip (-31.6 feet MLLW), and tie-up slip (-28.8 feet MLLW). Maximum depth for fixed dolphins is -40.4 feet MLLW.

**Figure BR-3**
**Shoreline Area to the West of the Bremerton Ferry Terminal**

**Figure BR-4**
**Shoreline Area to the East of the Bremerton Ferry Terminal**

*Salt/Freshwater Mixing*

There are no streams, creeks, or rivers in the vicinity of the ferry terminal that drain into Sinclair Inlet.

*Flows and Currents*

Currents passing through Port Washington Narrows can reach as high as 4 knots. As the mouth of the Narrows opens in the vicinity of the ferry terminal, maximum currents slow to 2 knots.

#### 4.3.1.2 *Chemical Indicators*

*Water Quality*

The marine waters of Sinclair Inlet near the ferry terminal are designated "Excellent" for aquatic life use. The impaired waters listings in the terminal area include dissolved oxygen, and temperature (water), and arsenic (tissue) (Ecology 2018).

*Sediment Quality*

The terminal is east of the Puget Sound Naval Shipyard Superfund Site. Sediments contaminated with PCBs and mercury were dredged and placed in a confined aquatic disposal site in 2004. Monitoring indicates that post-clean up goals for PCBs are not being met, and additional remedial actions are being developed.

Impaired sediment quality listings in the terminal area (Sinclair Inlet) include organics and metals (22 parameters) (Ecology 2018).

#### 4.3.1.3 *Biological Indicators*

*Shoreline Vegetation*

The shoreline is heavily armored with bulkheads and riprap, and there is no shoreline vegetation at the terminal. Minimal riparian buffer vegetation occurs north of the ferry terminal (see Figure BR-2).

*Macroalgae and Eelgrass*

No significant macroalgae occurs in the vicinity of the ferry terminal. Recorded macroalgae includes red algae (*Iridaea cordata*) and gracilaria (*Gracilaria pacifica*). No eelgrass occurs in the vicinity of the ferry terminal.

Epibenthos, Macrofauna, Fish, and Marine Mammals

The lack of nearshore intertidal habitat combined with the heavily armored shoreline are not expected to support significant epibenthic production. Macrofauna occurring in the vicinity of the ferry terminal include sea pens, anemones, rock crab, shrimp, sea cucumber, sea stars, and few geoduck. Intertidal hardshell clams occur in the Port Washington Narrows. Harbor seals, harbor porpoise, and killer whales occur near the area, and gray whales have been sighted in the Port Washington Narrows over the years.

*Forage Fish*

There is no documented forage fish spawning present in the terminal area (WSDOT 2018a). A herring pre-spawn holding area is located approximately 4,000 feet east of the terminal.

### 4.3.2 Bremerton Species Distributions

#### 4.3.2.1 *Puget Sound Chinook Salmon (Oncorhynchus tshawytscha)*

No Chinook salmon-bearing streams are located near the Bremerton Ferry Terminal. The nearest Chinook salmon-bearing streams are Blackjack Creek (approximately 1 shoreline mile south) and Gorst Creek (approximately 4 shoreline miles southwest), both located in Sinclair Inlet; and Chico Creek (approximately 6 shoreline miles northwest), Barker Creek (approximately 6 shoreline miles north), and Clear Creek (approximately 7 shoreline miles north), all located in Dyes Inlet (WDFW 2007a). Chinook may also be present from rivers and streams in southern Puget Sound (WDFW 2007a).

*Adult and Sub-adult Chinook*

Adult Chinook salmon may be found near the terminal at any time of year, but are most abundant in the late summer and fall when returning from the ocean to their natal streams.

Sub-adult Chinook have access to the terminal area and may be found there at any time of year. Sub-adults have spent a winter in the marine environment and are not closely oriented to the shoreline like juveniles.

*Juvenile Chinook*

In 2001/2002, WDFW conducted a field study of juvenile salmon use of Sinclair Inlet, focusing on sub-yearling Chinook salmon. Study goals included assessing juvenile Chinook use of nearshore and offshore habitat, determining residence time of hatchery salmonids, and evaluating salmonids diet, along with predator and competitor diet.

In both years, 21 sites were sampled in three study areas to track spatial and temporal patterns of fish distribution in beach seine surveys from February through

September. Most of the analyses were based on a limited number of regularly sampled sites; eight in 2001 and 13 in 2002. In 2002, additional beach seining was done to recapture juvenile Chinook salmon marked with florescent pigment in order to estimate their residence time in Sinclair Inlet. A tow net (or a two-boat surface trawl) was used to sample the upper 3 meters of the water column of study sites within Sinclair Inlet in 2002 only. Tow net samples were collected monthly from May to August 2002 during day and night hours along both shorelines and offshore. Table BR-1 provides juvenile Chinook catch numbers for the months when sampling occurred in 2002. The report (WDFW 2006c) did not provide similar data for 2001.

**Table BR-1**
**Total Number of Juvenile Chinook Captured in Sinclair Inlet in 2002**

| Month | Number Captured |
|---|---|
| February | 0 |
| March | 0 |
| April | 0 |
| May | 2,964 |
| June | 2,325 |
| July | 1,431 |
| August | 208 |
| September | 26 |

**Source:** WDFW 2006c

A major source of both naturally produced and hatchery Chinook salmon in the study area was Gorst Creek, at the terminus of Sinclair Inlet. In addition, juvenile Chinook salmon originated from a large number of sources outside the study area. In general, about 10 percent of the juvenile Chinook salmon collected each year and in each habitat type (nearshore and offshore) were unmarked sub-yearlings and possibly the progeny of naturally spawning fish. There was little difference in patterns of distribution, abundance, and size of hatchery origin and naturally spawning fish, suggesting: 1) hatchery and naturally spawning fish behave similarly; or 2) most fish assumed to be naturally spawning were unmarked hatchery fish.

The findings of this study indicate that Sinclair Inlet is used by three major groups of juvenile Chinook salmon:

- The first group consists of hatchery origin fish released into Gorst Creek, typically in late May through the end of June. The fish disperse throughout the Inlet (appearing to use both inshore and offshore habitats), with most of the fish rapidly leaving the Inlet.

- Second, hatchery fish from sources outside the Inlet migrate into Sinclair Inlet. This group is present from July to September. It is possible that some of these fish may reside for an extended period of time in Sinclair Inlet.
- Third, naturally spawning Chinook salmon use the Inlet. These fish could be naturally spawning fish from Gorst Creek or nearby local systems or move into the Inlet from other river systems. The only way to identify wild fish was by a lack of marks or tags identifying them as hatchery fish. Differences in distribution, growth patterns, or diet composition between hatchery and naturally spawning Chinook were not detected. It is possible that unmarked fish are of hatchery origin. However, this may be due to the unmarked hatchery component of the naturally spawning group or the low numbers captured of naturally spawning fish overall. Alternatively, the two groups may behave similarly during their early life history in Sinclair Inlet.

Juvenile Chinook salmon are present in Sinclair Inlet littoral habitats from early spring through early fall, at a minimum. Sinclair Inlet shorelines are host to juvenile Chinook salmon from throughout Puget Sound during late spring and summer months, and likely include both hatchery and natural origin fish (WDFW 2006c).

#### 4.3.2.2 *Puget Sound Chinook Salmon Critical Habitat*

The Bremerton Ferry Terminal lies within Chinook Zone 14 (70 FR 52630). The PCEs provided in the ferry terminal area, and their existing conditions, are listed in Table BR-2. PCEs relevant to the terminal area are numbered per the CFR (70 FR 52630).

**Table BR-2**
**Existing Conditions of Chinook Salmon PCEs at the Bremerton Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 5) Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels. | **Obstructions**<br>In-water structures include overhead loading, the trestles, the main and auxiliary slips, and dolphins. The existing ferry terminal may affect fish passage in the nearshore.<br><br>**Water Quality and Forage**<br>The marine waters of Sinclair Inlet near the ferry terminal are designated "Excellent" for aquatic life use. The impaired waters listings in the terminal area include dissolved oxygen, and temperature (water), arsenic (tissue), and organics and metals (sediment – 22 parameters) (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal site consists of the holding area and dock. The holding area is drained by a series of catch basins, area drains, and drop pipes that lead to a 30-inch storm drain pipe. Treatment is provided by a sedimentation/oil vault before discharging to Sinclair Inlet. The treatment system is maintained by the City of Bremerton. The dock area is drained by area drains and drop pipes that discharge untreated stormwater directly to Sinclair Inlet.<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>The lack of nearshore intertidal habitat, combined with the heavily armored shoreline, make it unlikely that the area supports significant epibenthic production.<br><br>Surf smelt spawn approximately 0.25 mile north of the terminal.<br><br>**Natural Cover**<br>There is no shoreline vegetation at the terminal. Sparse riparian vegetation exists north of the terminal. No significant macroalgae occurs in the vicinity of the terminal, and there is no eelgrass at the terminal. The existing conditions consist of large rock within the defined area of critical habitat. Side channels do not occur in the ferry terminal area. |
| 6) Offshore areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation. | The marine waters of Sinclair Inlet are designated "Excellent" for aquatic life use. The impaired waters listings in the terminal area include dissolved oxygen and temperature (water), arsenic (tissue), and organics and metals (sediment – 22 parameters) (Ecology 2018)<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Offshore areas provide habitat for forage fish. |

#### 4.3.2.3 *Puget Sound Steelhead (Oncorhynchus mykiss)*

Natal streams in the area of the Bremerton Ferry Terminal that support Puget Sound steelhead include Blackjack Creek (approximately 1 shoreline mile south), Ross Creek (approximately 2 shoreline miles southwest), Anderson Creek (approximately 4 shoreline miles southwest), and Gorst Creek (approximately 4 shoreline miles southwest), all located in Sinclair Inlet; and Chico Creek (approximately 6 shoreline miles northwest), Barker Creek (approximately 6 shoreline miles north), Strawberry

Creek (approximately 6.8 shoreline miles north), and Clear Creek (approximately 7 shoreline miles north), all located in Dyes Inlet (WDFW 2007a).

Major river systems in this area of Puget Sound that support winter steelhead include the Lake Washington/Cedar River system (approximately 16 miles northeast, shoreline distance), Duwamish/Green River (approximately 14 miles southeast, shoreline distance), and the Puyallup River (approximately 31 miles southeast, shoreline distance). The Duwamish/Green River also supports a run of summer steelhead.

Available data from tow-net sampling (deeper nearshore) and beach seine sampling (shallow nearshore) efforts around Puget Sound have reported the capture of few steelhead. In tow-net sampling in north and south Puget Sound, NMFS captured a total of 18 steelhead (Rice, unpublished data). The total sampling effort data was not available, but the mean steelhead catch ranged from 0 to 0.2 per net in north Puget Sound and 0.1 to 0.8 per net in south Puget Sound.

During 2001 and 2002, beach seining conducted in central Puget Sound by King County Department of Natural Resources captured only nine steelhead out of a total of approximately 34,000 juvenile salmonids. All the steelhead were caught between May and August and ranged in size from 141 to 462 mm with a mean size of 258 mm (Brennan et al. 2004). Also during 2001 and 2002, beach seining, tow netting, and purse seining were conducted by WDFW in Sinclair Inlet. This sampling effort focused on beach seining, which occurred monthly from April to October in 2001 and from mid-February to September in 2002. Tow netting was conducted monthly from May to August in 2002 only and purse seining was limited to only 2 days in July of 2002. The sampling effort resulted in the capture of four steelhead out of a total of 21,500 salmonids. Despite the larger effort given to beach seining, of the four steelhead, only one was caught in the beach seine and the remaining three were caught in deeper water with the tow net and purse seine (Fresh et al. 2006).

Steelhead were also infrequently captured in a beach seine study around Bainbridge Island (City of Bainbridge Island, Suquamish Tribe, and WDFW 2005). The study consisted of 271 beach seine sets conducted between April and September 2002 and between April 2003 and December 2004. Three steelhead were captured in the study: one was captured in May and two were captured in September. The steelhead were 179, 280, and 300 mm in total length. One of the three steelhead had been fin clipped, indicating it was of hatchery origin.

#### 4.3.2.4 *Puget Sound Steelhead Critical Habitat*

The Bremerton Ferry Terminal does not fall within designated steelhead critical habitat (Federal Register 2016a).

#### 4.3.2.5 *Humpback Whale (Megaptera novaeangliae)*

Humpback whales may be present near the Bremerton ferry terminal. Critical habitat has not been designated for humpback whales. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.3.2.6 *Southern Resident Killer Whale (Orcinus orca)*

Southern Resident Killer Whale (SRKW) may be present near the Bremerton ferry terminal. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.3.2.7 *Southern Resident Killer Whale Critical Habitat*

The Bremerton Ferry Terminal lies within Area 2 – Puget Sound, considered to be used by killer whales for fall feeding. Areas with water less than 20 feet deep relative to the extreme high water mark are not included in the critical habitat designation (Federal Register 2006).

The PCEs provided in the ferry terminal area, and their existing conditions, are listed in Table BR-3. PCEs relevant to the terminal area are numbered per the CFR (Federal Register 2006).

**Table BR-3**
**Existing Conditions of Southern Resident Killer Whale PCEs at the Bremerton Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 1) Water quality to support growth and development | The marine waters of Sinclair Inlet are designated "Excellent" for aquatic life use. The impaired waters listings in the terminal area include dissolved oxygen and temperature (water), arsenic (tissue), and organics and metals (sediment – 22 parameters) (Ecology 2018)<br><br>The existing stormwater system at the ferry terminal site consists of the holding area and dock. The holding area is drained by a series of catch basins, area drains, and drop pipes that lead to a 30-inch storm drain pipe. Treatment is provided by a sedimentation/oil vault before discharging to Sinclair Inlet. The treatment system is maintained by the City of Bremerton. The dock area is drained by area drains and drop pipes that discharge untreated stormwater directly to Sinclair Inlet.<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity. |
| 2) Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth | Salmonids are the primary prey of SRKW, and may be present near the terminal. Further information on prey can be found in the Puget Sound Chinook section, and Appendix B – Species Biology. |
| 3) Passage conditions to allow for migration, resting, and foraging | Existing structures that occur below -20 feet in critical habitat include a segment of the overhead loading and trestles, the main and auxiliary slips, and dolphins. |

#### 4.3.2.8 *Bull Trout (Salvelinus confluentus)*

There are no natal streams in the area of the Bremerton Ferry Terminal that support bull trout (WDFW 2007a).

The aquatic portions of the ferry terminal are within marine FMO habitat. While bull trout have not been documented in the ferry terminal area, suitable FMO habitat is present, and bull trout are thought to occur throughout south, central, and northern Puget Sound. Therefore, it is expected that the ferry terminal area would be used by anadromous adult and sub-adult bull trout for foraging, migration, and overwintering (USFWS 2004b). Within the ferry terminal area, it is possible that individual bull trout from the Lake Washington/Cedar River system (approximately 16 miles northeast, shoreline distance), the Duwamish/Green River (approximately 14 miles east, shoreline distance) and the Puyallup River (approximately 31 miles southeast shoreline distance) could be present (WDFW 2007a).

During 2001 and 2002, beach seining, tow netting, and purse seining was conducted by WDFW to determine juvenile salmon use of Sinclair Inlet. This sampling effort focused on beach seining, which occurred monthly from April to October in 2001 and from mid-February to early September in 2002. Tow netting was conducted monthly from May to August in 2002 only and purse seining was limited to only 2 days in July of 2002. No bull trout were captured during this 2-year sampling effort. In August 2005, an acoustic tag was detected off the northeast point of Bainbridge Island. The tag code corresponded to a bull trout tagged 2 years earlier in the north Swinomish Channel. The fish was only detected once and therefore there is some uncertainty with the finding (Goetz 2007). No other historic or current references indicate the occurrence of bull trout (or Dolly Varden) on the west side of Puget Sound, main basin, or Kitsap Peninsula. Char are infrequent migrants across deep inlets, such as the main basin, and observations of bull trout suggest they frequent shoreline areas (Goetz et al. 2004).

#### 4.3.2.9 *Bull Trout Critical Habitat*

The Bremerton Ferry Terminal does not fall within designated bull trout critical habitat (Federal Register 2010a).

#### 4.3.2.10 *Green Sturgeon (Acipenser medirostris)*

There are no natal streams in the area of the Bremerton Ferry Terminal that support green sturgeon.

Observations of green sturgeon in Puget Sound are much less common compared to the coastal Washington estuaries and bays such as Willapa Bay, Grays Harbor, and the Lower Columbia River estuary (Federal Register 2018). In addition, Puget Sound does not appear to be part of the coastal migratory corridor that Southern DPS fish use to reach overwintering grounds north of Vancouver Island (Federal Register 2018).

NMFS reviewed green sturgeon acoustic detection data from 2002-2019 in Puget Sound and the Strait of Juan de Fuca. From 2002-2008, 350 tagged green sturgeon were at large (67% from the threatened southern DPS). During this time, 17 were detected in Puget Sound (4 from the southern DPS). After 2008, none were detected

in central or southern Puget Sound, though 400 were at large (83% southern DPS). From 2013-2018, six (one from the southern DPS) were detected in Admiralty Inlet (northern Puget Sound).

From 2004-2019, 210 green sturgeon were detected in the Strait of Juan de Fuca (71% southern DPS). This indicates that the strait is used as a corridor, with green sturgeon residing at detection sites for short periods as they pass through from open ocean. Few of these fish were detected afterwards in Admiralty Inlet, suggesting that most of the tagged population move northward into the Strait of Georgia after transiting the strait. Data indicates conclusively that green sturgeon from the southern DPS occur in Puget Sound and Admiralty inlet, but at low rates compared to Strait of Juan de Fuca presence. This confirms earlier findings that Puget Sound is of lower conservation value to southern DPS green sturgeon. However, it is noted that the tagged population is a small fraction of the whole green sturgeon population, and that conditions need to be optimum for acoustic detection to occur (Moser, et. al. 2021).

#### 4.3.2.11 *Green Sturgeon Critical Habitat*

The Bremerton Ferry Terminal does not fall within designated green sturgeon critical habitat (Federal Register 2009).

#### 4.3.2.12 *Marbled Murrelet (Brachyramphus marmoratus)*

The Bremerton terminal area provides suitable marbled murrelet marine foraging habitat.

There is no documented forage fish spawning present at the terminal (WSDOT 2018ac).

WDFW surveys conducted from 2001 to 2012 show a density of less than 1 bird per square kilometer in the terminal area (WDFW 2016). The nearest documented marbled murrelet nesting site is located 22 miles NW of the terminal (WSDOT 2018b).

The Northwest Forest Plan Marbled Murrelet Effectiveness Monitoring Program (2012) identified habitat suitability throughout the range of the species, and ranked it as Zero, Low, Marginal, Moderately High and Highest. The Bremerton murrelet habitat suitability within the pile driving/heavy equipment zone of potential effect (0.25 miles) is Zero (WSDOT 2019b). There are no coniferous forest that may offer nesting opportunity within the pile driving/heavy equipment zone of potential effect (0.25 miles) (WSDOT 2014/2018c).

Ferry traffic creates regular disturbance in the immediate terminal area. From July 2017 to June 2018, there were approximately 10,900 scheduled arrivals and departures from the terminal. During the nesting season (April 1-September 23), when foraging murrelet are more active, there were approximately 5,465 scheduled arrivals and departures (WSDOT 2018d).

In preparation for a WSDOT project to rehabilitate the Manette Bridge in Bremerton, ten at-sea surveys for marbled murrelet and marine mammals were completed by the U.S. Department of Agriculture Pacific Research Station in Sinclair Inlet between July 2006 and January 2007 (at 2-4 week intervals). No marbled murrelet were observed during these surveys (USDA 2007).

#### 4.3.2.13 *Marbled Murrelet Critical Habitat*

No marbled murrelet critical habitat has been designated near the terminal (USFWS 1996).

#### 4.3.2.14 *Rockfish Species*

*Bocaccio*

Bocaccio are rarely caught in north Puget Sound and only sparse records exist for the Strait of Georgia (Federal Register 2010b). Because larvae are widely dispersed, it is possible that bocaccio juveniles could be found near the Bremerton Ferry Terminal at any time of year. Adult bocaccio generally move to very deep water. The Sinclair Inlet reaches depths of over 100 feet within 3 miles to the northeast of the terminal (NMFS 2009). It is possible that adult bocaccio could be found in these deeper waters.

*Yelloweye Rockfish*

Yelloweye rockfish are more closely aligned with rocky, high-relief substrates than with very deep water (Federal Register 2010b). Substrates near the terminal are generally sandy. Rocky substrates such as those favored by yelloweye rockfish are not found in Sinclair Inlet.

#### 4.3.2.15 *Rockfish Species Critical Habitat*

The Bremerton Ferry Terminal is within rockfish nearshore critical habitat (less than or equal to 98 feet in depth) (Federal Register 2014). The physical and biological features (PBFs) (Federal Register 2014) essential to the conservation of juvenile Bocaccio rockfish are listed in Table BR-4. PBFs relevant to the terminal area are numbered per the CFR (Federal Register 2014). These PBFs are specific to nearshore environments, where only juvenile Bocaccio rockfish could be found. Deepwater (> 98 feet in depth) PBFs exist for adult Bocaccio, and adult and juvenile yelloweye rockfish; however, this habitat is not present at the Anacortes Ferry Terminal and will not be discussed here.

#### 4.3.2.1 *Pacific Eulachon (Thaleichthys pacificus)*

The Bremerton Ferry Terminal is distant from any of the known eulachon spawning rivers. It is highly unlikely that eulachon will be present at the Bremerton Ferry Terminal.

#### 4.3.2.2 *Pacific Eulachon Critical Habitat*

No Pacific eulachon critical habitat has been designated near the Bremerton Ferry Terminal (FEDERAL REGISTER 2011).

**Table BR-4**
**Existing Conditions of Rockfish PBFs at the Bremerton Ferry Terminal**

| PBFs | Existing Conditions |
| --- | --- |
| 1) Quantity, quality, and availability of prey species to support individual growth, survivial, reproduction, and feeding opportunities. | The marine waters of Guemes Channel near the ferry terminal are designated “Extraordinary” for aquatic life use. Impaired waters listings in the terminal area do not identify any water quality parameters of concern (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal site consists of two drainage areas. Approximately 25.7 acres drains through four outfalls to the Ship Harbor wetland; and 18.4 acres drains through five outfalls to Guemes Channel (note: one outfall to Guemes Channel drains to the Ship Harbor wetland seasonally in winter). The Ship Harbor wetland is likely to drain to Guemes Channel when the wetland stage is high via subsurface flow. A biofiltration swale is directly upgradient of one of the outfalls that drains directly to Guemes Channel (Ship Harbor seasonally), providing basic treatment for approximately 6 acres of impervious surfaces from the upper parking lot. There is no other treatment for stormwater runoff.<br><br>Existing creosote treated piles may leach PAHs into the water column, degrading water quality in the terminal vicinity.<br><br>Overwater coverage from the existing ferry terminal structures may reduce the production of aquatic invertebrates that are prey species to rockfish. Substrates in the area are expected to support epibenthic production.<br><br>Sand lance spawning occurs 400 feet southeast of the terminal. Documented surf smelt spawning at the terminal extending approximately 184 feet to the northwest and 406 feet to the southeast. |
| 2) Water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities. | There is no shoreline vegetation at the terminal. Sparse riparian vegetation exists north of the terminal. No significant macroalgae occurs in the vicinity of the terminal, and there is no eelgrass at the terminal. The existing conditions consist of large rock within the defined area of critical habitat. Side channels do not occur in the ferry terminal area. |

# CLINTON


**Figure CL-1**
Clinton Ferry Terminal Vicinity Map
WSF Biological Assessment Reference
Clinton, Washington

## Figure CL-1
## Clinton Ferry Terminal Vicinity Map

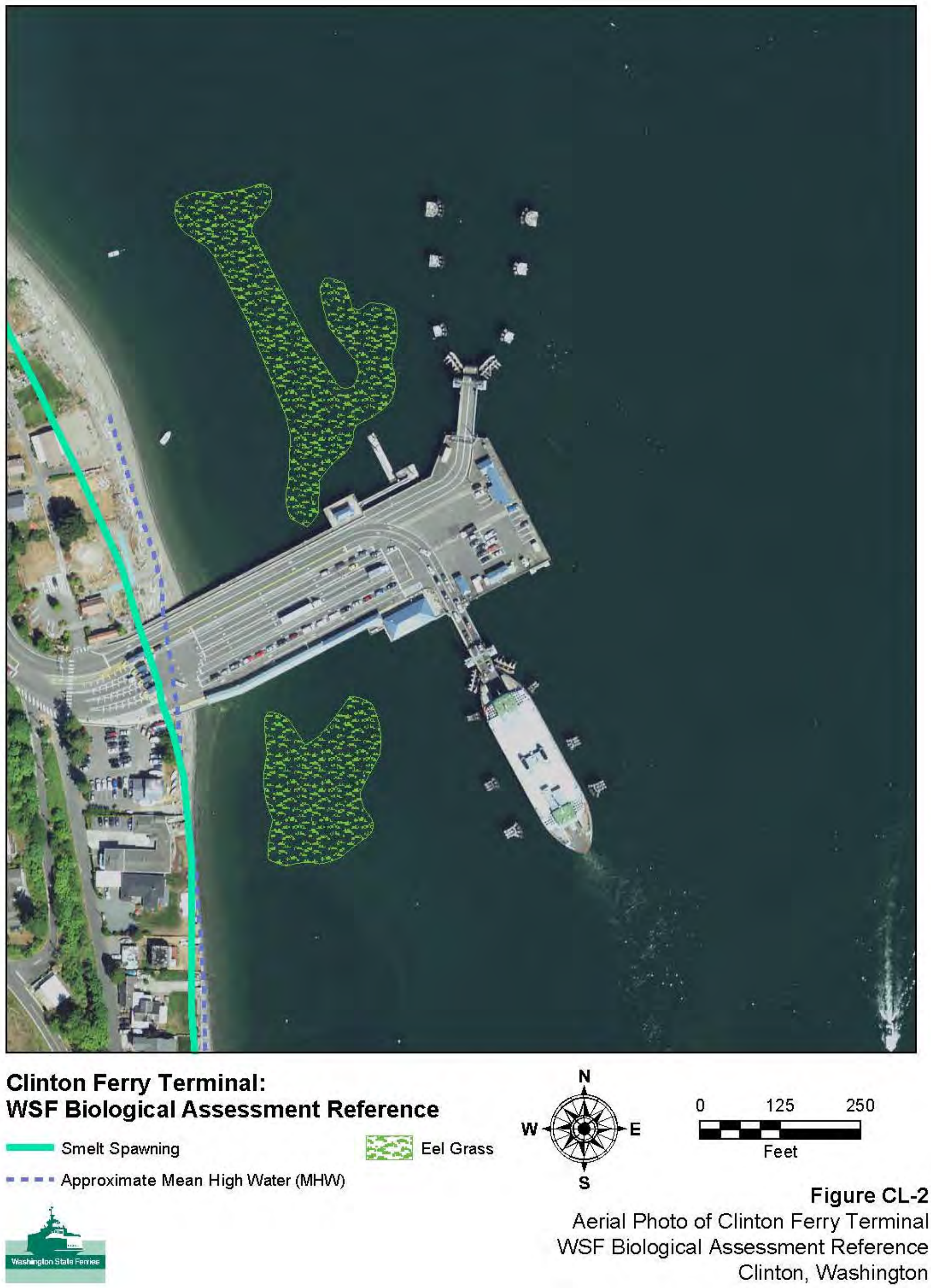



**Figure CL-2**
**Aerial Photo of Clinton Ferry Terminal**

## 4.4 Clinton Ferry Terminal

The Clinton Ferry Terminal is one of two WSF terminals on Whidbey Island. Clinton is close to the southern tip of the island, on the eastern side facing Possession Sound (see Figures CL-1 and CL-2).

The Clinton Ferry Terminal provides service to the Mukilteo Ferry.

Features of the terminal include a terminal building, 10 vehicle holding lanes that accommodate up to 190 vehicles, an upper parking lot, and roadside holding. The terminal has main and auxiliary slips. Steel wingwalls are present in both the main slip and auxiliary slip. Twelve steel dolphins are associated with the terminal, six in the main slip and six in the auxiliary slip.

### *4.4.1 Clinton Environmental Baseline*

#### 4.4.1.1 *Physical Indicators*

*Substrate and Slope*

A small sandy beach with low bank waterfront exists north of the terminal. South of the terminal, the beach is moderately sloping coarse sand to approximately MLLW. See Figures CL-3 and CL-4. The terminal exists in a portion of beach that is somewhat steeper than areas within 0.5 mile north and 0.5 mile south of the terminal.

**Figure CL-3**
**Shoreline Area to the North of the Clinton Ferry Terminal**

**Figure CL-4**
**Shoreline Area to the South of the Clinton Ferry Terminal**

Seaward of MLLW, the beach slope decreases, and substrates consists of medium to fine sands, wood, and shell debris. Offshore depths of terminal structures are: head of main slip (-34.0 feet MLLW) and auxiliary slip (-33.1 feet MLLW). Maximum depth for fixed dolphins is -40.8 feet MLLW.

*Salt/Freshwater Mixing*

A few small streams near and north and south of the terminal drain into Possession Sound but are not likely to contribute much freshwater. The location of one of these outfalls is shown on Figure CL-2.

*Flows and Currents*

Currents in Possession Sound are considered weak and variable.

#### 4.4.1.2 *Chemical Indicators*

*Water Quality*

The marine waters of Possession Sound are designated “Excellent” for for aquatic life use. No water quality parameters of concern were identified at the current terminal location (Ecology 2018).

#### *Sediment Quality*

No sediment quality data is available in the immediate terminal area (Ecology 2018).

### 4.4.1.3 *Biological Indicators*

#### *Shoreline Vegetation*

There is very little to no shoreline riparian vegetation in the vicinity of the ferry terminal. Extensive residential development exists to the north and south of the terminal and the adjacent uplands. The shoreline to the south of the terminal has an extensive length of bulkheads and hardened shoreline.

#### *Macroalgae and Eelgrass*

Dominant macroalgae in the area is green algae and kelp (*Ulva* spp.) and benthic diatoms. *Ulva* is found between MLLW and -12 feet MLLW, and *Laminaria* typically occurs at depths greater than -10 feet MLLW. Eelgrass is abundant and is primarily distributed from MLLW to -10 feet MLLW (see Figure CL-2). Redevelopment of the Clinton Ferry Terminal in the late 1990s resulted in a large scale mitigation action that included transplanting eelgrass, monitoring associated epibenthic assemblages, and installation of rubble mounds and collars on piling to support invertebrates, kelp, and fish. Glass blocks were also installed in the pedestrian walkway to increase light penetration.

#### *Epibenthos, Macrofauna, Fish, and Marine Mammals*

Epibenthic assemblages occur at and in the vicinity of the ferry terminal. Dive surveys identified 12 fish and 17 macroinvertebrate taxa. Sea stars, Dungeness crab, red rock crab, and bivalves were among the invertebrates observed. The WDFW PHS maps (WDFW 2006b) identify subtidal geoduck beds offshore from the ferry terminal and nearshore and offshore areas supporting Dungeness crab and pandalid shrimp. Fish species included various rock fish, flatfish, perch, and sculpins. An unnamed stream south of the terminal supports coho salmon. Killer whale, sea lion, harbor seal, and harbor porpoise may occur in Possession Sound.

*Forage Fish*

Documented surf smelt spawning  is present at the terminal (see Figure CL-2), extending approximately 180 feet to the south and 837 feet to the north.  There is no documented herring, herring holding areas, or sand lance spawning at the terminal (WSDOT 2018a).

### 4.4.2 Clinton Species Distributions

#### 4.4.2.1 *Puget Sound Chinook Salmon (Oncorhynchus tshawytscha)*

No Chinook salmon-bearing streams are located near the Clinton Ferry Terminal. However, major rivers that support Chinook salmon in this area of Puget Sound include the Snohomish River (approximately 8 miles northeast), Stillaguamish River (approximately 25 shoreline miles north), Skagit River (approximately 30 shoreline miles north), Lake Washington/Cedar River system (approximately 10 shoreline miles southeast), and the Duwamish/Green River (approximately 16 shoreline miles southeast) (WDFW 2007a).  Chinook may also be present from rivers and streams in southern Puget Sound (WDFW 2007a).

*Adult and Subadult Chinook*

Migrating sub-adult and adult Chinook salmon have free access to the entire marine portion of the ferry terminal area.  These fish could be present near the ferry terminal year-round, but are likely to be more abundant in mid to late summer as they prepare to migrate to their natal rivers to spawn.

*Juvenile Chinook*

Beach seines conducted from April through September of 2001 and 2002 in the southeastern Whidbey Basin showed juvenile Puget Sound Chinook salmon first entered the area in late April with numbers peaking in early May.  A second smaller pulse occurred in late July with numbers steadily tapered off through August and September.  The average fork length was approximately 80 mm for those juvenile Chinook caught in May and 110 mm for those caught in late August (Duffy et al. 2005).

In February and August of 2005, Washington Trout crews surveyed the nearshore waters of Admiralty Inlet on Whidbey Island for juvenile salmonid presence.  From

February through August, crews sampled 10 sites that represent the range of habitats available to juvenile salmon as they migrate along the western shore of Whidbey Island from natal rivers to the Pacific Ocean. Two types of beach seines were employed. A large net beach seine, 120 feet long and 12 feet deep, was used at deep water sites and open beaches, while a small net, 80 feet long and 6 feet deep, was used to sample shallow sites with more complex habitat structure. Figure CL-5 shows the sampling sites.

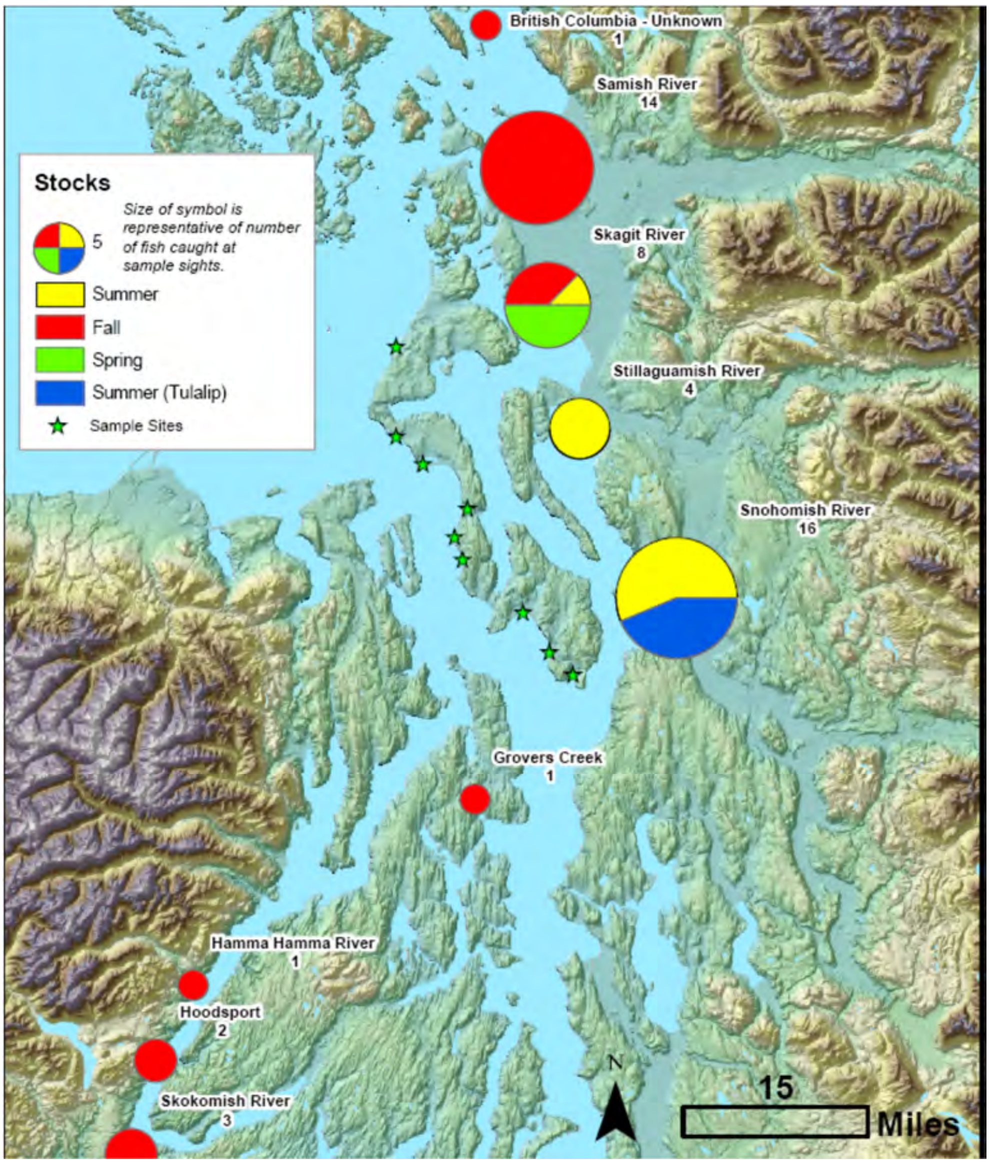



**Figure CL-5**
**Stock and River of Origin for all 50 Coded-wire Tagged Juvenile Chinook Recovered Along the West Coast of Whidbey Island (February through August 2005)**
Source: Wild Fish Conservancy 2007

Figure CL-6 shows the catch per unit of effort for juvenile salmon at all sites, across the entire field season using the large net, while Figure CL-7 shows the catch per unit effort for juvenile salmon at all sites, across the entire field season using the small net. Overall, chum salmon were the most common juvenile salmon caught, while coho salmon were the least common. The Cultus Bay sampling sites are nearest to the Clinton Ferry Terminal. One Chinook salmon was caught in the Cultus Bay Channel with the large beach seine (see Figure CL-6).

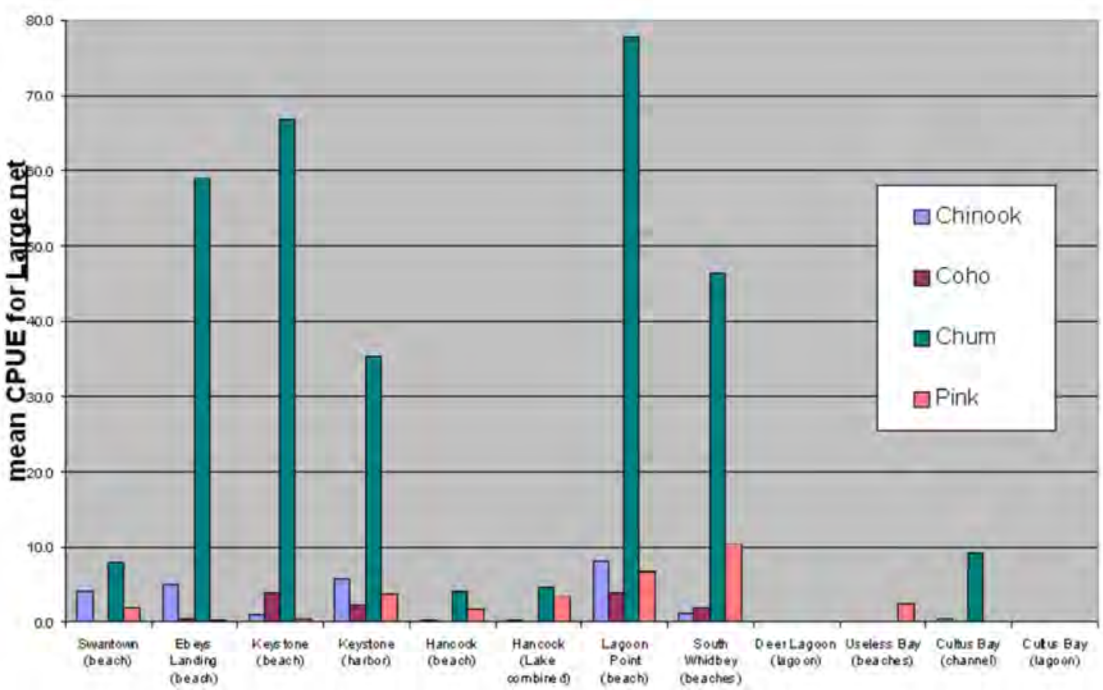



**Figure CL-6**
**Total Catch per Unit Effort for all Juvenile Salmon at all Sites, Across the Sampling Season (February to August) Using the Large Beach Seine**
Source: Wild Fish Conservancy 2007

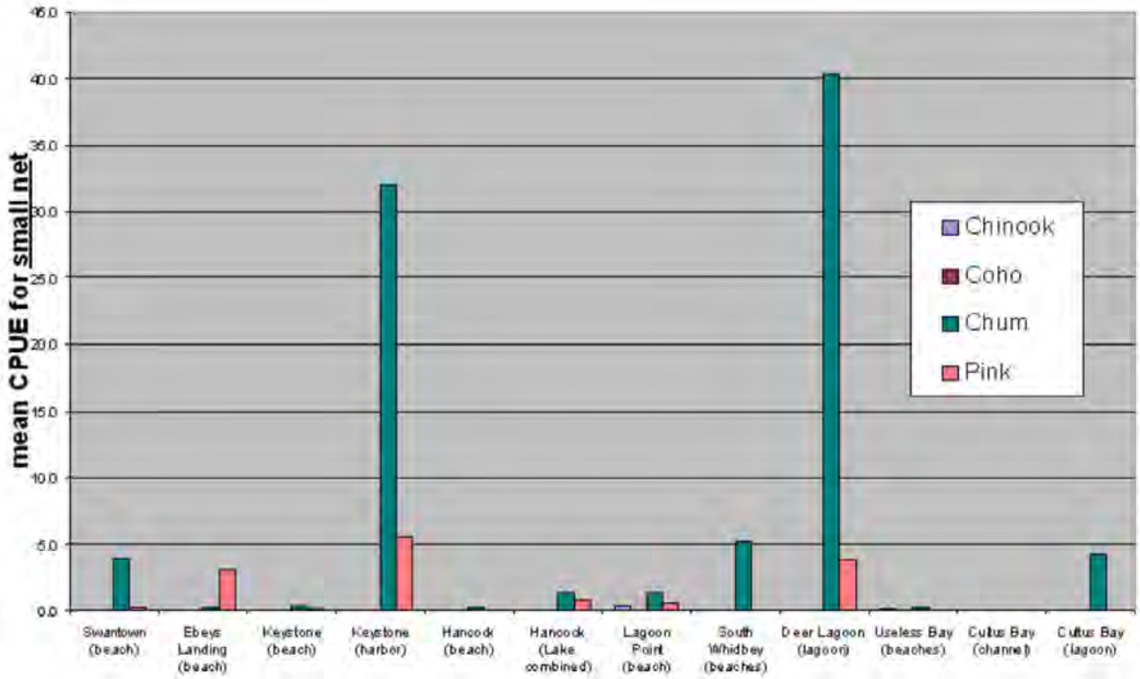



**Figure CL-7**
**Total Catch per Unit Effort for all Juvenile Salmon at all Sites, Across the Sampling Season (February to August) Using the Small Beach Seine**
Source: Wild Fish Conservancy 2007

Approximately 8 percent of the juvenile Chinook caught during the monitoring season were marked with coded wire tags (CWTs). These tags identify the stock and river of origin for tagged fish, usually hatchery salmon. Figure CL-5 shows the stock and river of origin for the 50 juvenile Chinook sampled with recovered CWTs. Eleven percent of the recovered CWT fish were from rivers draining into the Hood Canal Watershed, indicating that these fish crossed Admiralty Inlet to utilize habitats along Whidbey Island's western shore. Twenty-eight percent of the recovered CWT fish were from the three rivers draining into the Whidbey Basin: the Skagit, Stillaguamish, and Snohomish River systems. One of the recovered fish had a British Columbia tag; however, the stock and river of origin have not been determined for this fish. Fourteen percent of the recovered fish were from the Samish River, which drains into north Puget Sound.

None of the recovered CWT fish were from south Puget Sound river basins, such as the Puyallup or Nisqually. This could be a result of small sample sizes, hatchery release timing, sample timing, or could indicate that juvenile Chinook from these basins are not occupying habitats on the western shore of Whidbey Island in the same abundances as fish from the Hood Canal, Whidbey Basin, and north Puget Sound (Wild Fish Conservancy 2007).

#### 4.4.2.2 *Puget Sound Chinook Salmon Critical Habitat*

The Clinton Ferry Terminal lies within Chinook Zone 5 (70 FR 52630). While there are no streams that support Chinook salmon near the ferry terminal, there are eelgrass beds in close proximity that may be used by juvenile Chinook for rearing (Thom et al. 1995). The PCEs provided in the ferry terminal area, and their existing conditions, are listed in Table CL-1. PCEs relevant to the terminal area are numbered per the CFR (70 FR 52630).

#### 4.4.2.3 *Puget Sound Steelhead (Oncorhynchus mykiss)*

There are no natal streams in the area of the Clinton Ferry Terminal that support Puget Sound steelhead. However, major river systems that support winter and summer steelhead include the Snohomish River (approximately 8 miles northeast), Samish River (approximately 15 shoreline miles northeast), Stillaguamish River (approximately 25 shoreline miles north), Skagit River (approximately 30 shoreline miles north), and the Duwamish/Green River (approximately 16 shoreline miles southeast). The Lake Washington/Cedar River system (approximately 20 shoreline miles south) supports winter steelhead only. In addition, numerous small streams in the Sinclair/Dyes Inlets (see Bainbridge Island Ferry Terminal, Section 4.2, for more information), and southern Puget Sound rivers and streams support winter steelhead (WDFW 2007a).

Available data from tow-net sampling (deeper nearshore) and beach seine sampling (shallow nearshore) efforts around Puget Sound have reported the capture of few steelhead. In tow-net sampling in north and south Puget Sound, NMFS captured a total of 18 steelhead (Rice, unpublished data). The total sampling effort data was not available, but the mean steelhead catch ranged from 0 to 0.2 per net in north Puget Sound and 0.1 to 0.8 per net in south Puget Sound.

**Table CL-1**
**Existing Conditions of Chinook Salmon PCEs at the Clinton Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 5) Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels. | **Obstructions**<br>In-water structures include trestles, main and auxiliary slips, and dolphins. The existing ferry terminal may affect fish passage in the nearshore.<br><br>**Water Quality and Forage**<br>The marine waters of Possession Sound near the ferry terminal are designated "Excellent" for aquatic life use. No water quality parameters of concern were identified at the current terminal location (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of four drainage areas that drain to Possession Sound. Two of the areas include treatment. The first drainage area drains the toll booth area, and consists of four catch basins that flow through an oil/water separator (inspected annually), and discharge through a shared 32-inch outfall to the south of the trestle. A fifth catch basin managed by WSDOT is connected upgradient of this drainage area, and shares the same outfall.<br><br>The second drainage area drains the holding lanes on the trestle and the area around the terminal building. The holding lane drainage consists of two trench drains that run most of the length of the trestle. The terminal building drainage consists of two shallow trench drains. All of the trench drains flow through the oil/water separator and discharge through the 32-inch outfall.<br><br>The third drainage area drains the end of the trestle, and consists of five catch basins, two located at the entrance to the auxiliary transfer span, and three more to the southwest that drain the remainder of the main trestle. All five catch basins are fitted with stormwater filter units (inspected annually), and each discharges directly to surface water.<br><br>The fourth drainage area consists of the transfer spans (typically 90 feet long by 24 feet wide that carry traffic between the trestle and ferry), which discharge by sheet-flow directly to surface water.<br><br>The Clinton Ferry Terminal no longer has creosote treated piles, therefore leaching of PAHs from piles has been eliminated at this terminal.<br><br>Overwater coverage from the existing ferry terminal structures may reduce the production of aquatic invertebrates that are prey species to salmon. Epibenthic assemblages occur at and in the vicinity of the ferry terminal.<br><br>Surf smelt spawn at the terminal, and sand lance and surf smelt spawning occur 0.75 mile north of the terminal.<br><br>**Natural Cover**<br>There is little to no shoreline vegetation in the vicinity of the terminal. Dominant macroalgae in the area is eelgrass (*Zostera marina* L.) and benthic macroalgae (*Ulva* spp., *Laminaria* sp.). Eelgrass is primarily distributed from MLLW to -10 feet MLLW. *Ulva* is also found between MLLW and -10 feet MLLW, and *Laminaria* typically occurs at depths greater than -10 feet MLLW (Thom et al. 1995). There is no large overhanging wood vegetation. The existing conditions consist of sand and silt below MLLW, with shell fragments in offshore areas, and gravel, cobble, and sand above MLLW within the defined area of critical habitat. Some riprap and hardened shoreline are adjacent to the ferry terminal. Side channels do not occur in the ferry terminal area. |
| 6) Offshore areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation. | The marine waters of Possession Sound near the ferry terminal are designated "Excellent" for aquatic life use. No water quality parameters of concern were identified at the current terminal location (Ecology 2018).<br><br>Clinton no longer has creosote treated piles, therefore leaching of PAHs from piles has been eliminated at this terminal.<br><br>Offshore areas provide habitat for forage fish. |

During 2001 and 2002, beach seining conducted in central Puget Sound by King County Department of Natural Resources captured only nine steelhead out of a total of approximately 34,000 juvenile salmonids. All the steelhead were caught between May and August and ranged in size from 141 to 462 mm with a mean size of 258 mm (Brennan et al. 2004). Beach seine sampling in Bellingham Bay (north Puget Sound) also captured few steelhead (Lummi Nation, unpublished data). The Bellingham Bay research reported the capture of two juvenile steelhead salmon in 336 sets between February 14 and December 1, 2003. The steelhead were captured in the eastern portion of Bellingham Bay near the Taylor Avenue Dock on June 12 and June 25, 2003.

#### 4.4.2.4 *Puget Sound Steelhead Critical Habitat*

The Clinton Ferry Terminal does not fall within designated steelhead critical habitat (Federal Register 2016a).

#### 4.4.2.5 *Humpback Whale (Megaptera novaeangliae)*

Humpback whales may be present near the Clinton ferry terminal. Critical habitat has not been designated for humpback whales. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.4.2.6 *Southern Resident Killer Whale (Orcinus orca)*

Southern Resident Killer Whale (SRKW) may be present near the Clinton ferry terminal. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### *4.4.2.7 Southern Resident Killer Whale Critical Habitat*

The Clinton Ferry Terminal lies within Area 2 – Puget Sound considered to be used by killer whales for fall feeding. Areas with water less than 20 feet deep relative to the extreme high water mark are not included in the critical habitat designation (Federal Register 2006).

The PCEs provided in the ferry terminal area, and their existing conditions, are listed in Table CL-2. PCEs relevant to the terminal area are numbered per the CFR (Federal Register 2006).

**Table CL-2**
**Existing Conditions of Southern Resident Killer Whale PCEs at the Clinton Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 1) Water quality to support growth and development | The marine waters of Possession Sound near the ferry terminal are designated "Excellent" for aquatic life use. No water quality parameters of concern were identified at the current terminal location (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of four drainage areas that drain to Possession Sound. Two of the areas include treatment.<br><br>The first drainage area drains the toll booth area, and consists of four catch basins that flow through an oil/water separator (inspected annually), and discharge through a shared 32-inch outfall to the south of the trestle. A fifth catch basin managed by WSDOT is connected upgradient of this drainage area, and shares the same outfall.<br><br>The second drainage area drains the holding lanes on the trestle and the area around the terminal building. The holding lane drainage consists of two trench drains that run most of the length of the trestle. The terminal building drainage consists of two shallow trench drains. All of the trench drains flow through the oil/water separator and discharge through the 32-inch outfall.<br><br>The third drainage area drains the end of the trestle, and consists of five catch basins, two located at the entrance to the auxiliary transfer span, and three more to the southwest that drain the remainder of the main trestle. All five catch basins are fitted with stormwater filter units (inspected annually), and each discharges directly to surface water.<br><br>The fourth drainage area consists of the transfer spans (typically 90 feet long by 24 feet wide that carry traffic between the trestle and ferry), which discharge by sheet-flow directly to surface water.<br><br>The Clinton Ferry Terminal no longer has creosote treated piles, therefore leaching of PAHs from piles has been eliminated at this terminal. |
| 2) Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth | Salmonids are they primary prey of SRKW, and may be present near the terminal. Further information on prey can be found in the Puget Sound Chinook section, and Appendix B – Species Biology. |
| 3) Passage conditions to allow for migration, resting, and foraging | Existing structures that occur below -20 feet in critical habitat include the trestles, main and auxiliary slips, and dolphins. |

4.4.2.8

#### 4.4.2.9 *Bull Trout (Salvelinus confluentus)*

There are no natal streams in the area of the Clinton Ferry Terminal that support bull trout (WDFW 2007a).

The aquatic portions of the ferry terminal are within marine FMO habitat and bull trout are thought to occur throughout south, central, and northern Puget Sound. Therefore, it is expected that the ferry terminal area would be used by anadromous adult and sub-adult bull trout for foraging, migration, and overwintering (USFWS 2004b). Within the ferry terminal area, it is expected that individual bull trout from the Snohomish River (approximately 8 miles northeast), Stillaguamish River (approximately 25 shoreline miles north), Skagit River (approximately 30 shoreline miles north), Lake Washington/Cedar River system (approximately 10 shoreline miles southeast), and the Duwamish/Green River (approximately 16 shoreline miles southeast) are most likely to be present (WDFW 2007a). Bull trout may also be present from rivers and streams in Hood Canal and southern Puget Sound (WDFW 2007a).

Preliminary study results indicate that subadult and adult bull trout first enter the lower Snohomish estuary and marine nearshore by early to mid-April. Presence in the estuary occurs through mid-summer, after which the bull trout begin moving back to freshwater (Goetz et al. 2004). Bull trout were observed in the lower estuary or marine nearshore the first week of August 2003 (Pentec 2004). This is consistent with bull trout monitoring conducted from late summer through winter 2001 in the Snohomish River. Sampling weekly, no bull trout were collected at stations located at north Jetty Island and Priest Point when the study began in mid-August, through the following winter (Pentec 2004).

#### 4.4.2.10 *Bull Trout Critical Habitat*

The Clinton Ferry Terminal is within designated bull trout critical habitat (Federal Register 2010a). The PCEs provided in the ferry terminal area, and their existing conditions, are listed in Table CL-3. PCEs relevant to the terminal area are numbered per the CFR (Federal Register 2010a).

**Table CL-3**
**Existing Conditions of Bull Trout PCEs at the Clinton Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 2) 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. | In-water structures include the trestles, the main and auxiliary slips, and dolphins. The existing ferry terminal may affect fish passage in the nearshore and may reduce the production of aquatic invertebrates that are prey species to bull trout. |
| 3) An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish. | Substrates support epibenthic production. Surf smelt spawn approximately 0.75 mile north of the terminal.<br><br>Dominant macroalgae in the area is eelgrass (*Zostera marina* L.) and benthic macroalgae (*Ulva* spp., *Laminaria* sp.).<br><br>There is no large overhanging wood vegetation present to provide a food base from terrestrial organisms. The existing conditions consist of sand and silt below MLLW, with shell fragments in offshore areas and gravel, cobble, and sand above MLLW within the defined area of critical habitat. Some riprap and hardened shoreline are adjacent to the ferry terminal. |
| 4) 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. | In-water structures include the trestles, the main and auxiliary slips, and dolphins. The existing ferry terminal may affect fish passage in the nearshore, and may reduce the production of aquatic invertebrates that are prey species to bull trout.<br><br>There is no large overhanging wood vegetation present to provide a food base from terrestrial organisms. The existing conditions consist of sand and silt below MLLW, with shell fragments in offshore areas and gravel, cobble, and sand above MLLW within the defined area of critical habitat. Some riprap and hardened shoreline are adjacent to the ferry terminal.<br><br>Dominant macroalgae in the area is eelgrass (*Zostera marina* L.) and benthic macroalgae (*Ulva* spp., *Laminaria* sp.). |
| 5) 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. Specific temperatures within this range will depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence. | East Puget Sound water temperatures can range from 41.4 to 75.7 °F (5.2 to 24.3 °C) with an average of 51 °F (10.58 °C) (Ecology 2007). Water temperature data for specific ferry terminals is not available. The in-water components of the ferry terminal provide some shade, which may cause slight localized reductions in water temperatures. |
| 8) Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited. | The marine waters of Possession Sound near the ferry terminal are designated “Excellent” for aquatic life use. No water quality parameters of concern were identified at the current terminal location (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of four drainage areas that drain to Possession Sound. Two of the areas include treatment.<br><br>The first drainage area drains the toll booth area and consists of four catch basins that flow through an oil/water separator (inspected annually), and discharge through a shared 32-inch outfall to the south of the trestle. A fifth catch basin managed by |

| PCEs | Existing Conditions |
|---|---|
| | WSDOT is connected upgradient of this drainage area and shares the same outfall.<br><br>The second drainage area drains the holding lanes on the trestle and the area around the terminal building. The holding lane drainage consists of two trench drains that run most of the length of the trestle. The terminal building drainage consists of two shallow trench drains. All of the trench drains flow through the oil/water separator and discharge through the 32-inch outfall.<br><br>The third drainage area drains the end of the trestle, and consists of five catch basins, two located at the entrance to the auxiliary transfer span, and three more to the southwest that drain the remainder of the main trestle. All five catch basins are fitted with stormwater filter units (inspected annually), and each discharges directly to surface water.<br><br>The fourth drainage area consists of the transfer spans (typically 90 feet long by 24 feet wide that carry traffic between the trestle and ferry), which discharge by sheet-flow directly to surface water.<br><br>The Clinton Ferry Terminal no longer has creosote treated piles, therefore leaching of PAHs from piles has been eliminated at this terminal. |

#### 4.4.2.11 *Green Sturgeon (Acipenser medirostris)*

There are no natal streams in the area of the Clinton Ferry Terminal that support green sturgeon.

Observations of green sturgeon in Puget Sound are much less common compared to the coastal Washington estuaries and bays such as Willapa Bay, Grays Harbor, and the Lower Columbia River estuary (Federal Register 2018). In addition, Puget Sound does not appear to be part of the coastal migratory corridor that Southern DPS fish use to reach overwintering grounds north of Vancouver Island (Federal Register 2018).

NMFS reviewed green sturgeon acoustic detection data from 2002-2019 in Puget Sound and the Strait of Juan de Fuca. From 2002-2008, 350 tagged green sturgeon were at large (67% from the threatened southern DPS). During this time, 17 were detected in Puget Sound (4 from the southern DPS). After 2008, none were detected in central or southern Puget Sound, though 400 were at large (83% southern DPS). From 2013-2018, six (one from the southern DPS) were detected in Admiralty Inlet (northern Puget Sound).

From 2004-2019, 210 green sturgeon were detected in the Strait of Juan de Fuca (71% southern DPS). This indicates that the strait is used as a corridor, with green sturgeon residing at detection sites for short periods as they pass through from open ocean. Few of these fish were detected afterwards in Admiralty Inlet, suggesting that most of the tagged population move northward into the Strait of Georgia after transiting the strait. Data indicates conclusively that green sturgeon from the southern DPS occur in Puget Sound and Admiralty inlet, but at low rates compared to Strait of Juan de Fuca presence. This confirms earlier findings that Puget Sound is of lower conservation value to southern DPS green sturgeon. However, it is noted that the tagged population is a small fraction of the whole green sturgeon population, and that conditions need to be optimum for acoustic detection to occur (Moser, et. al. 2021).

#### 4.4.2.12 *Green Sturgeon Critical Habitat*

The Clinton Ferry Terminal does not fall within designated green sturgeon critical habitat (Federal Register 2009).

#### 4.4.2.13 *Marbled Murrelet (Brachyramphus marmoratus)*

The Clinton terminal area provides suitable marbled murrelet marine foraging habitat.

Documented surf smelt (prey species) spawning is present (see Figures CL-2), extending approximately 193 ft. S and 805 ft. N of the terminal (WSDOT 2018a).

WDFW surveys conducted from 2001 to 2012 show a density of 1-3 birds per square kilometer in the terminal area (WDFW 2016). The nearest documented marbled murrelet nesting site is located 29 miles SW of the terminal (WSDOT 2018b).

The Northwest Forest Plan Marbled Murrelet Effectiveness Monitoring Program (2012) identified habitat suitability throughout the range of the species, and ranked it as Zero, Low, Marginal, Moderately High and Highest. The Clinton murrelet habitat suitability within the pile driving/heavy equipment zone of potential effect (0.25 miles) is Zero (WSDOT 2019b).

There are no coniferous forest that may offer nesting opportunity within the pile driving/heavy equipment zone of potential effect (0.25 miles) (WSDOT 2014/2018c).

Ferry traffic creates regular disturbance in the immediate terminal area. From July 2017 to June 2018, there were approximately 26,800 scheduled arrivals and departures from the Clinton terminal. During the nesting season (April 1-September 23), when foraging murrelet are more active, there were approximately 13,595 scheduled arrivals and departures (WSDOT 2018d).

#### 4.4.2.14 *Marbled Murrelet Critical Habitat*

No marbled murrelet critical habitat has been designated near the terminal (USFW 1996).

#### 4.4.2.15 *Rockfish Species*

*Bocaccio*

Bocaccio are rarely caught in north Puget Sound and only sparse records exist for the Strait of Georgia (Federal Register 2010b). Because larvae are widely dispersed, it is possible that bocaccio juveniles could be found near the Clinton Ferry Terminal at any time of year. Adult bocaccio generally move to very deep water. The water in Possession Sound reaches depths over 100 feet at the midpoint between Whidbey Island and the mainland (NMFS 2009), which is shallower than ideal for bocaccio.

*Yelloweye Rockfish*

Yelloweye rockfish are more closely aligned with rocky, high-relief substrates than with very deep water (Federal Register 2010b). Possession Sound reaches depths of over 100 feet; however, it does not have the rocky substrata preferred by yelloweye.

#### 4.4.2.16 *Rockfish Species Critical Habitat*

The Clinton Ferry Terminal is within rockfish nearshore critical habitat (less than or equal to 98 feet in depth) (Federal Register 2014). The physical and biological features (PBFs) (Federal Register 2014) essential to the conservation of juvenile Bocaccio rockfish are listed in Table CL-4. PBFs relevant to the terminal area are numbered per the CFR (Federal Register 2014). These PBFs are specific to nearshore environments, where only juvenile Bocaccio rockfish could be found. Deepwater (> 98 feet in depth) PBFs exist for adult Bocaccio, and adult and juvenile yelloweye rockfish; however, this habitat is not present at the Clinton Ferry Terminal and will not be discussed here.

#### 4.4.2.17 *Pacific Eulachon (Thaleichthys pacificus)*

The Clinton Ferry Terminal is distant from any of the know eulachon spawning rivers. It is highly unlikely that eulachon will be present at the Clinton Ferry Terminal.

#### 4.4.2.18 *Pacific Eulachon Critical Habitat*

No Pacific eulachon critical habitat has been designated near the Clinton Ferry Terminal (FEDERAL REGISTER 2011).

**Table CL-4**
**Existing Conditions of Rockfish PBFs at the Clinton Ferry Terminal**

| PBFs | Existing Conditions |
|---|---|
| 1) Quantity, quality, and availability of prey species to support individual growth, survivial, reproduction, and feeding opportunities. | The marine waters of Possession Sound near the ferry terminal are designated "Excellent" for aquatic life use. No water quality parameters of concern were identified at the current terminal location (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of four drainage areas that drain to Possession Sound. Two of the areas include treatment. The first drainage area drains the toll booth area, and consists of four catch basins that flow through an oil/water separator (inspected annually), and discharge through a shared 32-inch outfall to the south of the trestle. A fifth catch basin managed by WSDOT is connected upgradient of this drainage area, and shares the same outfall.<br><br>The second drainage area drains the holding lanes on the trestle and the area around the terminal building. The holding lane drainage consists of two trench drains that run most of the length of the trestle. The terminal building drainage consists of two shallow trench drains. All of the trench drains flow through the oil/water separator and discharge through the 32-inch outfall.<br><br>The third drainage area drains the end of the trestle, and consists of five catch basins, two located at the entrance to the auxiliary transfer span, and three more to the southwest that drain the remainder of the main trestle. All five catch basins are fitted with stormwater filter units (inspected annually), and each discharges directly to surface water.<br><br>The fourth drainage area consists of the transfer spans (typically 90 feet long by 24 feet wide that carry traffic between the trestle and ferry), which discharge by sheet-flow directly to surface water.<br><br>The Clinton Ferry Terminal no longer has creosote treated piles, therefore leaching of PAHs from piles has been eliminated at this terminal.<br><br>Overwater coverage from the existing ferry terminal structures may reduce the |

| PBFs | Existing Conditions |
| --- | --- |
| | production of aquatic invertebrates that are prey species to salmon. Epibenthic assemblages occur at and in the vicinity of the ferry terminal.<br><br>Surf smelt spawn at the terminal, and sand lance and surf smelt spawning occur 0.75 mile north of the terminal. |
| 2) Water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities. | There is little to no shoreline vegetation in the vicinity of the terminal. Dominant macroalgae in the area is eelgrass (*Zostera marina* L.) and benthic macroalgae (*Ulva* spp., *Laminaria* sp.). Eelgrass is primarily distributed from MLLW to -10 feet MLLW. *Ulva* is also found between MLLW and -10 feet MLLW, and *Laminaria* typically occurs at depths greater than -10 feet MLLW (Thom et al. 1995). There is no large overhanging wood vegetation. The existing conditions consist of sand and silt below MLLW, with shell fragments in offshore areas, and gravel, cobble, and sand above MLLW within the defined area of critical habitat. Some riprap and hardened shoreline are adjacent to the ferry terminal. Side channels do not occur in the ferry terminal area. |

# COUPEVILLE


**NOTE:** Base map prepared from Terrain Navigator Pro USGS 7.5 minute quadrangle map(s) of Camano, Coupeville, and Port Townsend, Washington.

| Section | Township | Range | Lat | Long | County |
|---|---|---|---|---|---|
| 22 | 31N | 1E | 48º 09' 33" N | 122º 40' 14" W | Island |
| HUC 171100190301 | | | WRIA 6 | | |

0 1 Scale in Miles

**Figure CO-1**
Coupeville Ferry Terminal Vicinity Map
WSF Biological Assessment Reference
Coupeville, Washington

**Figure CO-1**
**Coupeville Ferry Terminal Vicinity Map**


**Figure CO-2**
**Aerial Photo of Coupeville Ferry Terminal**

## 4.5 Coupeville Ferry Terminal

The Coupeville Ferry Terminal (formerly known as the Keystone Ferry Terminal) is one of two terminals located on Whidbey Island. The Coupeville Ferry Terminal is on the western side, near the center between the northern and southern sections of the island. The Coupeville Ferry Terminal links Whidbey Island with Port Townsend, across Admiralty Inlet. See Figures CO-1 and CO-2.

The Coupeville Ferry Terminal provides service to the Port Townsend Ferry Terminal.

Features of the terminal include a terminal building, 10 vehicle holding lanes that accommodate up to 120 vehicles, one small parking lot, and roadside holding areas. The terminal has one slip with steel wingwalls. Three dolphins are associated with the terminal, one steel and two timber dolphins in the main slip.

### *4.5.1 Coupeville Environmental Baseline*

#### 4.5.1.1 *Physical Indicators*

*Substrate and Slope*

There are three distinct areas within Keystone Harbor with respect to substrate composition. The center of the harbor, ferry lane, and terminal area are mostly cobble and gravel with a few patches of sand/shell debris. The side slopes of the harbor are composed of mostly gravel, with some cobble. The areas outside of propeller wash influence and not on a slope are composed of sand, mud, and mud with wood debris. Outside of the harbor mouth, substrate is either gravel or cobble. The jetty that forms the east side of the harbor is composed of large, angular riprap boulders. There are other areas of riprap, most notably the area around the terminal where riprap is used to armor the shoreline from propeller wash scour. The intertidal zone areas that are not riprap are either gravel or mixed sand and gravel. The intertidal and shallow subtidal area on the east side of the harbor is clean homogeneous large gravel, indicative of high energy and regular movement.

See Figures CO-3 and CO-4 for pictures of the shoreline areas west and east of the ferry terminal.

**Figure CO-3**
**Shoreline Area to the West of the Coupeville Ferry Terminal**

**Figure CO-4**
**Shoreline Area to the East of the Coupeville Ferry Terminal**

The shoreline within Keystone Harbor is characterized by a nearly level surface with a gentle slope down toward the water of about 4 percent. The seafloor surface slopes from the shoreline down to the south, with an overall gradient of about 12 percent, with the steepest portion closest to the beach at about 20 percent. Offshore depths of terminal structures are: head of slip (-22.7 feet MLLW). Maximum depth for fixed dolphins is -28.0 feet MLLW. A steep slope, located west of the terminal, is a near-vertical bluff on Keystone Harbor.

The shoreline in the vicinity of the terminal is a depositional beach located in a convergent zone where sediment from two different drift cells meets.

#### *Salt/Freshwater Mixing*

The only quasi-freshwater body near the existing ferry terminal is Crockett Lake. The lake drains to Keystone Harbor via a culvert under SR 20. Crockett Lake is brackish from the inflow of marine water from the harbor.

#### *Flows and Currents*

Nearshore currents are generally westerly and move on the order of 2 feet per second, although currents in excess of 3 feet per second do occur. Wave action at the mouth of the harbor is predominantly in an easterly direction. This results in an easterly transport of sediments originating from the bluffs at nearby Fort Casey State Park. These sediments are transported to the east, past the mouth of the harbor. Annual sediment transport is estimated to be 15,000 cubic yards. The sediments tend to accumulate at the harbor mouth and periodic dredging (by the Corps) is required to maintain adequate depth for ferry operations.

During flood flows, numerous eddies prevail in several locations of Admiralty Inlet, including Admiralty Bay where a counterclockwise rotating eddy is evident. The prevailing flood flow is toward the southwest off the entrance to Keystone Harbor. Unlike flood currents, the counterclockwise eddy is not present during maximum ebb flow.

### 4.5.1.2 *Chemical Indicators*

#### *Water Quality*

The marine waters of Keystone Harbor are designated “Extraordinary” for aquatic life use. No water quality parameters of concern were identified at the current location (Ecology 2018).

#### *Sediment Quality*

The Corps has dredged the harbor a number of times over the past two decades. The dredged material is used to nourish the beach immediately east of the harbor jetty.

The sediment chemistry had been characterized previously and found to be suitable for open-water disposal.

#### 4.5.1.3 *Biological Indicators*

##### *Shoreline Vegetation*

There are several shoreline vegetation communities in and around Keystone Harbor. Coastal dunes with a mosaic of open sand with sparse herbaceous vegetation to dense evergreen shrubs are present. Coastal headland shrub lands and grass lands consisting of evergreen and/or deciduous shrubs and native grasses occur in the area. Along the bluff at Fort Casey State Park, lowland conifer hardwood forest occurs and consists of Douglas fir (*Pseudotsuga menziesii*) and coast pine (*Pinus contorta*) in the tree layer with salal (*Gaultheria shallon*), sword fern (*Nephrolepis cordifolia*), oceanspray, and salmonberry (*Rubus spectabili*) in the shrub layer.

A small, apparently excavated basin on the Keystone Spit contains herbaceous wetland vegetation consisting of Pacific silverweed (*Argentina egedii*) and soft-stem bulrush (*Schoenoplectus tabernaemontani*).

Crockett Lake is considered to be a tidal marsh and is adjacent to the ferry terminal. It consists of marsh species including pickleweed (*Salicornia sp.*), areas dominated by alkali bulrush, seaside arrowgrass, Pacific silverweed, and areas of native and non-native grasses and other herbaceous vegetation.

##### *Macroalgae and Eelgrass*

Most of the harbor bottom is covered with macroalgae of various species and density. The dominant species is sugar kelp (*Laminaria saccharina)*. The ferry lane down the middle of the harbor has relatively sparse macroalgae growth with a prevalence of small, tightly anchored red algae species.

Eelgrass (*Zostera Marine L.*) is absent in Keystone Harbor. No eelgrass is present at Keystone Spit except for one small patch next to the historic Army wharf (Quartermaster Dock), approximately 1,000 feet west of the Keystone Harbor entrance. The closest large documented eelgrass bed occurs about 2 miles east of the ferry terminal. It starts at about -4 feet MLLW and has patches of mixed sugar kelp and eelgrass.  The width of the bed is variable, but in general, extends offshore for a distance of about 400 feet.

The dominant aquatic plants on the Keystone Jetty are kelp species including bull kelp, sugar kelp, ribbon kelp (*Egregia menziesii)*, sea palm (*Postelsia palmaeformis)*, sea lettuce (*Ulva fenestrata*), rockweed, red ribbon (*Palmaria* spp.), and coralline algae (*Corallinaceae* spp.).

*Epibenthos, Macrofauna, Fish, and Marine Mammals*

Substrate characteristics in Keystone Harbor are suitable for epibenthic production. Recent surveys (CH2MHILL 2006a) indicate the presence of Dungeness crab, red rock crab, sunflower star (*Pycnopodia helianthoides*), unidentified flatfish, shiner perch, and unidentified sculpins (various genera).

Dominant macrofauna on the jetty is a massive wall and pasture of white plumed anemones (*Metridium senile*), barnacles, false ochre sea star (*Picaster ochraceus*), sunflower stars, orange sea cucumbers (*Cucumaria miniata*), short spine sea stars (*Pisaster brevispinus*), decorator crabs (*Oregonia gracilus*), kelp crabs (*Pugettia producta*), helmet crabs (*Telmessus cheiragonus*), painted anemones (*Urticina crassicornis*), and bryozoans.

WDFW divers have assessed the density of fish at the Keystone jetty for the past decade, which includes a mix of species typical of nearshore rocky habitats. Rockfish and surfperches were the most dominant species at the jetty.  The schooling Puget Sound rockfish was the most abundant observed species, followed by the striped seaperch (*Embiotoca lateralis*).  Yellowtail rockfish (*Sebastes flavidus*), primarily juveniles, was the second most dominant rockfish, with copper rockfish (*Sebastes caurinus*) the third most common rockfish.  Pile and shiner perch were the fifth and sixth dominant species.  Black rockfish (*Sebastes melanops*) were commonly observed, especially juveniles and adults schooling at the offshore end of the jetty.  Other species often observed were gobies (*Gobiiadae sp.*), wolfeel (*Anarrhicththys ocellatus*), Pacific octopus (*Octopus dofleini*), and a diverse array of sculpins.  Greenlings and lingcod were also commonly observed.

Marine mammals that might use marine habitat in Admiralty Bay and Admiralty Inlet include harbor seal, Steller sea lion, California sea lion, harbor porpoise, Dall's porpoise, humpback whale, gray whale, minke whale, and both resident and transient killer whale.

Several seal, Steller sea lion, and California sea lion haul-outs are located within Admiralty Inlet and around Marrowstone and Indian islands. One large haul-out is located at Fort Flagler State Park, approximately 5 miles southwest of the Coupeville Ferry Terminal. Three separate haul-outs for two to four animals are on marine buoys within the Admiralty Inlet channel and two rock sites are located off the east side of Marrowstone Island.

*Forage Fish*

There is no documented forage fish spawning present at the terminal (WSDOT 2018a).

### 4.5.2 Coupeville Species Distributions

#### 4.5.2.1 *Puget Sound Chinook Salmon (Oncorhynchus tshawytscha)*

No Chinook salmon-bearing streams are located near the Coupeville Ferry Terminal (WDFW 2007a). Chinook may be present from any of the rivers in central and south Puget Sound, including the Stillaguamish River (approximately 52 miles south then northeast, shoreline distance), Skagit River (approximately 60 miles south then northeast, shoreline distance), the Snohomish River (approximately 43 miles south then northeast, shoreline distance), the Lake Washington/Cedar River system (approximately 35 miles southeast), and Duwamish/Green River (approximately 42 miles southeast). Chinook may also be present from rivers and streams in Hood Canal and Puget Sound (WDFW 2007a). Chinook salmon are expected to be found seasonally as migrant juveniles and throughout the year as immature sub-adults in the ferry terminal area (CH2MHILL 2006a).

*Adult and Sub-adult Chinook*

Adult and sub-adult Chinook salmon could be found near the terminal at any time of year. Sub-adults have spent a winter in the marine environment and are not closely oriented to the shoreline like juveniles.

*Juvenile Chinook*

In February and August of 2005, Wild Fish Conservancy crews surveyed the nearshore waters of Admiralty Inlet on Whidbey Island for juvenile salmonid presence. From February through August, crews sampled 10 sites that represent the range of habitats available to juvenile salmon as they migrate along the western shore of Whidbey Island from natal rivers to the Pacific Ocean. Two types of beach seines were employed. A large net beach seine, 120 feet long and 12 feet deep, was used at deep water sites and open beaches, while a small net, 80 feet long and 6 feet deep, was used to sample shallow sites with more complex habitat structure. Figure CO-5 shows the sampling sites.

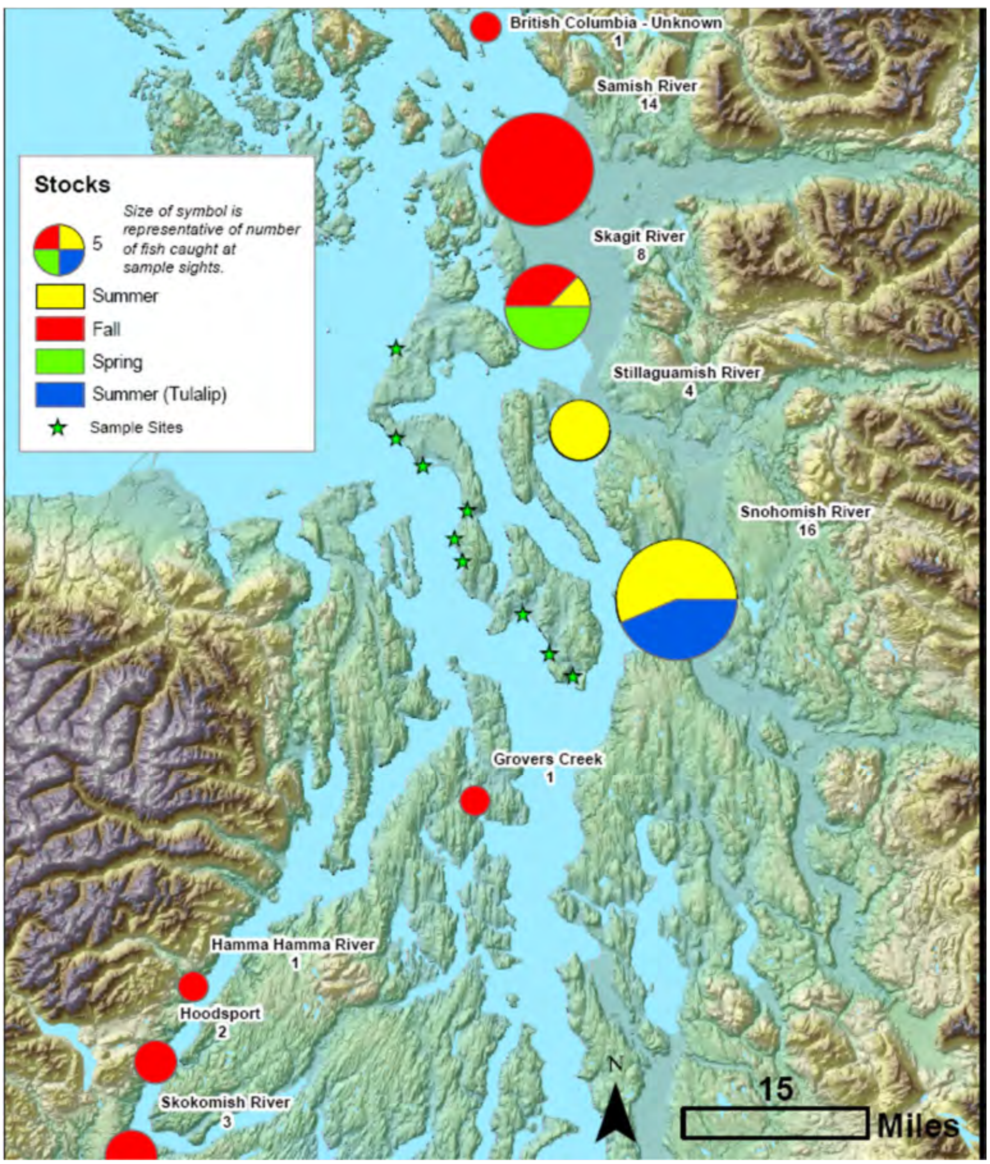


**Figure CO-5**
**Stock and River of Origin for all 50 Coded-wire Tagged Juvenile Chinook Recovered Along the West Coast of Whidbey Island (February through August 2005)**

Figure CO-6 shows the catch per unit of effort for juvenile salmon at all sites, across the entire field season using the large net, while Figure CO-7 shows the catch per unit effort for juvenile salmon at all sites, across the entire field season using the small net. Overall, chum salmon were the most common juvenile salmon caught, while coho salmon were the least common.

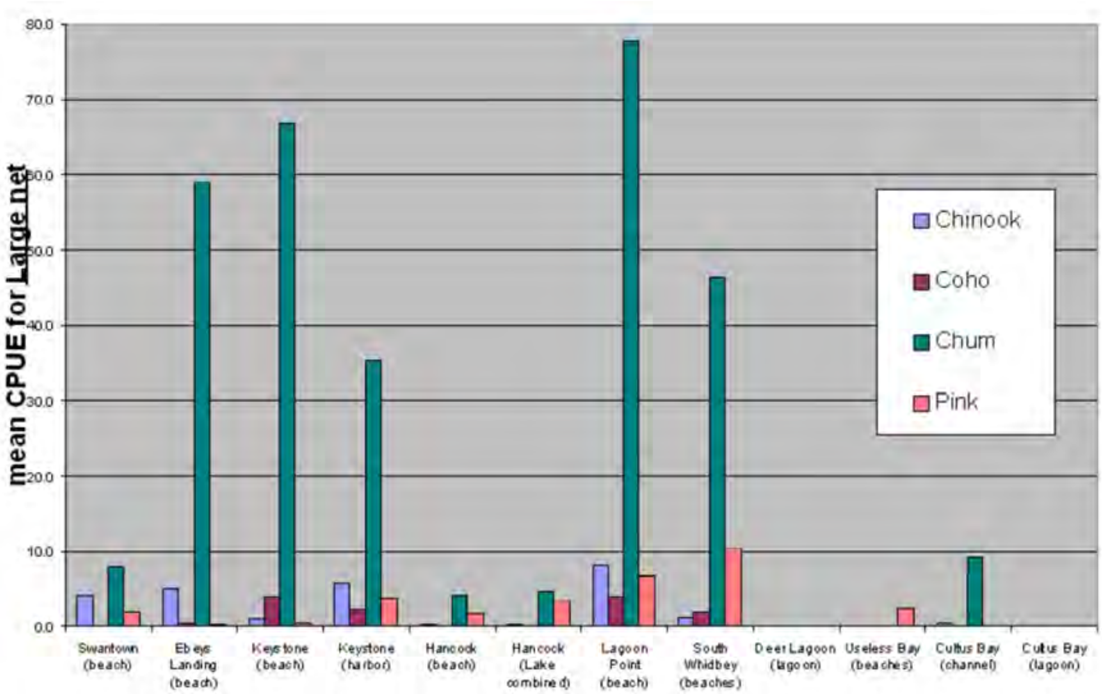



**Figure CO-6**
**Total Catch per Unit Effort for all Juvenile Salmon at all Sites, Across the Sampling Season (February to August) Using the Large Beach Seine**
Source: Wild Fish Conservancy 2007

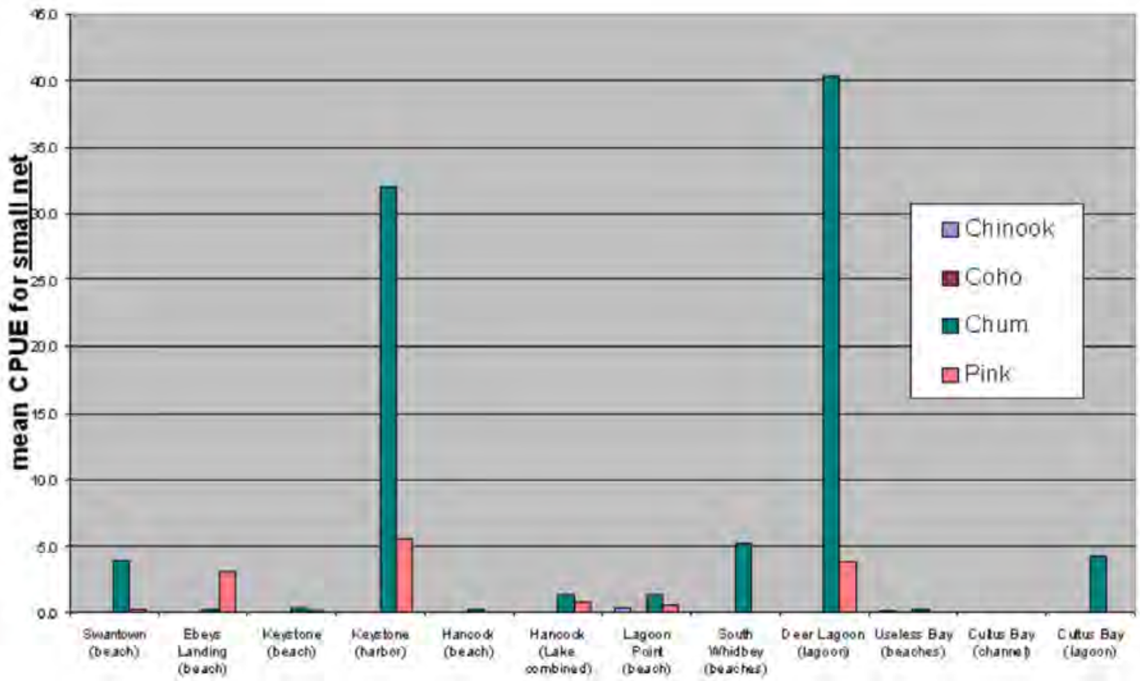



**Figure CO-7**
**Total Catch per Unit Effort for all Juvenile Salmon at all Sites, Across the Sampling Season (February to August) Using the Small Beach Seine**
Source: Wild Fish Conservancy 2007

Approximately 8 percent of the juvenile Chinook caught during the study were marked with CWTs. These tags identify the stock and river of origin for tagged fish, usually hatchery salmon. Figure CO-5 shows the stock and river of origin for the 50 juvenile Chinook sampled with recovered CWTs. Eleven percent of the recovered CWT fish were from rivers draining into the Hood Canal Watershed, indicating that these fish crossed Admiralty Inlet to utilize habitats along Whidbey Island's western shore. Twenty-eight percent of the recovered CWT fish were from the three rivers draining into the Whidbey Basin: the Skagit, Stillaguamish, and Snohomish River systems. One of the recovered fish had a British Columbia tag; however, the stock and river of origin have not been determined for this fish. Fourteen percent of the recovered fish were from the Samish River, which drains into the north Puget Sound.

None of the recovered CWT fish were from south Puget Sound river basins, such as the Puyallup or Nisqually. This could be a result of small sample sizes, hatchery release timing, sample timing, or could indicate that juvenile Chinook from these basins are not occupying habitats on the western shore of Whidbey Island in the same abundances as fish from the Hood Canal, Whidbey Basin, and north Puget Sound (Wild Fish Conservancy 2007).

#### 4.5.2.2 *Puget Sound Chinook Salmon Critical Habitat*

The Coupeville Ferry Terminal lies within Chinook Zone 5 (70 FR 52630). While there are no streams that support Chinook salmon near the ferry terminal, eelgrass beds are present in Admiralty Bay that may be used by juvenile Chinook for rearing. The nearest eelgrass bed to Keystone Harbor is approximately 2 miles southeast (shoreline distance) (CH2MHILL 2006a).

The PCEs provided in the ferry terminal area, and their existing conditions, are listed in Table CO-1. PCEs relevant to the terminal area are numbered per the CFR (70 FR 52630).

**Table CO-1**
**Existing Conditions of Chinook Salmon PCEs at the Coupeville Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 5) Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels. | **Obstructions**<br>In-water structures include the trestle, the slip, and dolphins. The existing ferry terminal may affect fish passage in the nearshore.<br><br>**Water Quality and Forage**<br>The marine waters of Keystone Harbor near the ferry terminal are designated “Extraordinary” for aquatic life. Impaired waters listings in the terminal area do not identify any water quality parameters of concern (Ecology 2018).<br>The existing stormwater system at the ferry terminal consists of two drainage areas that drain to Keystone Harbor. One of the areas includes treatment.<br><br>The first drainage area consists of three catch basins that drain the holding lanes, and two catch basins that drain the parking areas. Some input from the WSDOT Highway 20 system connects to this area. All of the catch basins pass through an oil/water separator (inspected annually) and discharge through a shared outfall to the west of the trestle.<br><br>The second drainage area consists of the transfer span (typically 90 feet long by 24 feet wide that carries traffic between the trestle and ferry), which discharges by sheet flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Overwater coverage from the existing ferry terminal structures may reduce the production of aquatic invertebrates that are prey species to salmon. Substrate characteristics in Keystone Harbor are suitable for epibenthic production.<br><br>There are no forage fish spawning areas in the vicinity, however, the fish community is abundant and diverse.<br><br>**Natural Cover**<br>There are several shoreline vegetation communities in the vicinity, including a tidal marsh (Crockett Lake). No eelgrass is present in Keystone Harbor. Most of the harbor bottom is covered by macroalgae, with the dominant species being sugar kelp. In the ferry lane, small, tightly anchored red algae species are present (CH2MHILL 2006b).<br><br>There is no large overhanging wood vegetation. The existing conditions within the defined area of critical habitat consist of cobble and gravel with small patches of sand/shell debris in the ferry lane. Side slopes of the harbor are mostly gravel with some cobble. Areas outside of propeller wash and not on slopes are sand, mud, and mud with wood debris. The jetty that forms the east side of the harbor is composed of large, angular riprap boulders (CH2MHILL 2006a). Some riprap and hardened shoreline are adjacent to the ferry terminal. Given this is a marine environment, side channels do not occur in the ferry terminal area. |
| 6) Offshore areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation. | The marine waters of Keystone Harbor near the ferry terminal are designated “Extraordinary” for aquatic life use. Impaired waters listings in the terminal area do not identify any water quality parameters of concern (Ecology 2018).<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Offshore areas provide habitat for forage fish. |

#### 4.5.2.3 *Hood Canal Summer-Run Chum Salmon (Oncorhynchus keta)*

No chum salmon bearing streams are located near the Coupeville Ferry Terminal (WDFW 2007a). Chum bearing streams in the area include Chimacum Creek (Port Townsend Bay, approximately 8 miles southwest, shoreline distance), Salmon and Snow Creeks (Discovery Bay, approximately 24 miles southwest, shoreline distance), and Jimmycomelately Creek (Sequim Bay, approximately 26 miles west, shoreline distance). Chum may also be present from rivers and streams in southern Hood Canal and Puget Sound (WDFW 2007a).

Hood Canal summer chum salmon are expected to be present seasonally as migrant juveniles and adults. A number of rivers in Hood Canal produce summer chum that could cross Admiralty Inlet and spend some time along the west Whidbey Island shoreline during their migration out to sea (CH2MHILL 2006a).

During the Wild Fish Conservancy survey, chum salmon were caught in Keystone Harbor. However, for the time of season caught (fall), they were larger than fall chum were expected to be, raising the possibility that they could be summer chum (because the Hood Canal summer chum spawn earlier, emerge earlier, and therefore their fry tend to be larger earlier in the season). Tissue samples were taken, and the Wild Fish Conservancy is looking for funding to have genetic work done to determine their origin. In both years of sampling in Keystone Harbor, Wild Fish Conservancy caught CWT Chinook from Hood Canal hatcheries, and numerous other studies that confirm very small fish crossing large channels in Puget Sound (Wait, personal communication 2007).

However, the working assumption of the Hood Canal Summer Run Chum Salmon Recovery Plan (HCCC 2005) is that juvenile summer chum stay on the west side of Admiralty Inlet, and do not cross to the west side of Whidbey Island (Brewer, personal communication 2007).

#### 4.5.2.4 *Hood Canal Summer-Run Chum Critical Habitat*

The Coupeville Ferry Terminal does not fall within designated Hood Canal summer-run chum critical habitat (70 FR 52630).

#### 4.5.2.5 *Puget Sound Steelhead (Oncorhynchus mykiss)*

There are no natal streams in the area of the Coupeville Ferry Terminal that support Puget Sound steelhead (WDFW 2007a).

Steelhead bearing streams in the area include Chimacum Creek (approximately 10 miles southwest, shoreline distance, a tributary to Port Townsend Bay), and numerous Hood Canal streams.  Major rivers that support winter and summer steelhead include the Skokomish River (approximately 65 miles southwest shoreline distance), Skagit River (approximately 60 miles south then northeast shoreline distance), Stillaguamish River (approximately 52 miles south then northeast shoreline distance), Snohomish River (approximately 43 miles south then northeast shoreline distance), and the Duwamish/Green River (approximately 42 shoreline miles southeast).  The Lake Washington/Cedar River (approximately 35 shoreline miles southeast) supports winter steelhead.  Steelhead may also be present from southern Puget Sound rivers and streams (WDFW 2007a).

Available data from tow-net sampling (deeper nearshore) and beach seine sampling (shallow nearshore) efforts around Puget Sound have reported the capture of few steelhead.  In tow-net sampling in north and south Puget Sound, NMFS captured a total of 18 steelhead (Rice, unpublished data).  The total sampling effort data was not available, but the mean steelhead catch ranged from 0 to 0.2 per net in north Puget Sound and 0.1 to 0.8 per net in south Puget Sound.

Beach seine sampling in Bellingham Bay (north Puget Sound) also captured few steelhead (Lummi Nation, unpublished data).  The Bellingham Bay research reported the capture of two juvenile steelhead salmon in 336 sets between February 14 and December 1, 2003.  The steelhead were captured in the eastern portion of Bellingham Bay near the Taylor Avenue Dock on June 12 and June 25, 2003.

#### 4.5.2.6 *Puget Sound Steelhead Critical Habitat*

The Coupeville Ferry Terminal does not fall within designated steelhead critical habitat (Federal Register 2016a).

#### 4.5.2.7 *Humpback Whale (Megaptera novaeangliae)*

Humpback whales may be present near the Coupeville ferry terminal. Critical habitat has not been designated for humpback whales. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.5.2.8 *Southern Resident Killer Whale (Orcinus orca)*

Southern Resident Killer Whale (SRKW) may be present near the Coupeville ferry terminal. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.5.2.9 *Southern Resident Killer Whale Critical Habitat*

The Coupeville Ferry Terminal lies within Area 2 – Puget Sound, considered to be used by killer whales for fall feeding. Areas with water less than 20 feet deep relative to the extreme high water mark are not included in the critical habitat designation (Federal Register 2006).

The PCEs provided in the ferry terminal area, and their existing conditions, are listed in Table CO-2. PCEs relevant to the terminal area are numbered per Federal Register 2006.

**Table CO-2**
**Existing Conditions of Southern Resident Killer Whale PCEs at the Coupeville Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 1) Water quality to support growth and development | The marine waters of Keystone Harbor near the ferry terminal are designated “Extraordinary” for aquatic life use. Impaired waters listings in the terminal area do not identify any water quality parameters of concern (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of two drainage areas that drain to Keystone Harbor. One of the areas includes treatment.<br><br>The first drainage area consists of three catch basins that drain the holding lanes, and two catch basins that drain the parking areas. Some input from the WSDOT system connects to this area. All of the catch basins pass through an oil/water separator (inspected annually) and discharge through a shared outfall to the west of the trestle.<br><br>The second drainage area consists of the transfer span (typically 90 feet long by 24 feet wide that carries traffic between the trestle and ferry), which discharges by sheet flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column, degrading water quality in the terminal vicinity. |
| 2) Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth | Salmonids are the primary prey of SRKW, and may be present near the terminal. Further information on prey can be found in the Puget Sound Chinook section, and Appendix B – Species Biology. |
| 3) Passage conditions to allow for migration, resting, and foraging | Existing structures that occur below -20 feet in critical habitat include the head of the slip and dolphins. |

#### 4.5.2.10 *Bull Trout (Salvelinus confluentus)*

There are no natal streams in the area of the Coupeville Ferry Terminal that support bull trout (WDFW 2007a). The aquatic portions of the ferry terminal are within marine FMO habitat. While bull trout have not been documented in the ferry terminal area, suitable FMO habitat is present, and bull trout are thought to occur throughout south, central, and northern Puget Sound. Therefore, it is expected that the ferry terminal area would be used by anadromous adult and sub-adult bull trout for foraging, migration, and overwintering (USFWS 2004b). Within the ferry terminal area, it is expected that individual bull trout from the Skokomish River (approximately 65 miles southwest, shoreline distance), Skagit River (approximately 60 miles south then northeast, shoreline distance), Stillaguamish River (approximately 52 miles south then northeast, shoreline distance), Snohomish River (approximately 43 miles south then northeast, shoreline distance), Lake Washington/Cedar River (approximately 35 shoreline miles southeast), and the Duwamish/Green River (approximately 42 shoreline miles southeast) core areas are most likely to be present.

#### 4.5.2.11 *Bull Trout Critical Habitat*

The shoreline of the Coupeville Ferry Terminal is not within designated bull trout critical habitat (Federal Register 2010a).

#### 4.5.2.12 *Green Sturgeon (Acipenser medirostris)*

There are no natal streams in the area of the Coupeville Ferry Terminal that support green sturgeon.

Observations of green sturgeon in Puget Sound are much less common compared to the coastal Washington estuaries and bays such as Willapa Bay, Grays Harbor, and the Lower Columbia River estuary (Federal Register 2018). In addition, Puget Sound does not appear to be part of the coastal migratory corridor that Southern DPS fish use to reach overwintering grounds north of Vancouver Island (Federal Register 2018).

NMFS reviewed green sturgeon acoustic detection data from 2002-2019 in Puget Sound and the Strait of Juan de Fuca. From 2002-2008, 350 tagged green sturgeon were at large (67% from the threatened southern DPS). During this time, 17 were detected in Puget Sound (4 from the southern DPS). After 2008, none were detected in central or southern Puget Sound, though 400 were at large (83% southern DPS). From 2013-2018, six (one from the southern DPS) were detected in Admiralty Inlet (northern Puget Sound).

From 2004-2019, 210 green sturgeon were detected in the Strait of Juan de Fuca (71% southern DPS). This indicates that the strait is used as a corridor, with green sturgeon residing at detection sites for short periods as they pass through from open ocean. Few of these fish were detected afterwards in Admiralty Inlet, suggesting

that most of the tagged population move northward into the Strait of Georgia after transiting the strait. Data indicates conclusively that green sturgeon from the southern DPS occur in Puget Sound and Admiralty inlet, but at low rates compared to Strait of Juan de Fuca presence. This confirms earlier findings that Puget Sound is of lower conservation value to southern DPS green sturgeon. However, it is noted that the tagged population is a small fraction of the whole green sturgeon population, and that conditions need to be optimum for acoustic detection to occur (Moser, et. al. 2021).

#### 4.5.2.13 *Green Sturgeon Critical Habitat*

The Coupeville Ferry Terminal does not fall within designated green sturgeon critical habitat (Federal Register 2009).

#### 4.5.2.14 *Marbled Murrelet (Brachyramphus marmoratus)*

The Coupeville terminal area provides suitable marbled murrelet marine foraging habitat.

There is no documented forage fish spawning present at the terminal (WSDOT 2018ac).

WDFW surveys conducted from 2001 to 2012 show a density of 1-3 birds per square kilometer in the terminal area (WDFW 2016). The nearest documented marbled murrelet nesting site is located 21 miles SW of the terminal (WSDOT 2018b).

The Northwest Forest Plan Marbled Murrelet Effectiveness Monitoring Program (2012) identified habitat suitability throughout the range of the species, and ranked it as Zero, Low, Marginal, Moderately High and Highest. The Coupeville murrelet habitat suitability within the pile driving/heavy equipment zone of potential effect (0.25 miles), ranges from Zero to Marginal (WSDOT 2019b).

Five acres of contiguous coniferous forest that may offer nesting opportunity is present adjacent to the terminal, in Fort Casey State Park (WSDOT 2018c). The 0.25 mile radius of potential effect due to heavy equipment and pile driving in-air noise sources was evaluated. Trees that are ≥ 15 DBH are present within the 0.25 mile radius extent of the forest stand. Nesting platforms that are a minimum of 4 inches wide and a minimum of 33 feet above ground are present within the 0.25 radius extent of the forest stand. Therefore, the stand does have suitable nesting habitat (WSDOT 2014).

Although the coniferous stand meets the definition of potentially suitable nesting habitat, it is an isolated patch of habitat in a disturbed area. The Fort Casey State Park area has a high level of disturbance; including camping, boating, kite flying and corvid presence that increase predation risk for murrelets, making this habitat less suitable. In addition, U.S. Navy jets from nearby Naval Air Station Whidbey Island may fly over the State Park at any time for several hours. Navy personnel conduct training missions at various times during the day and night. Depending on the direction of the wind, their flight pattern may put them above the Park, creating noisy conditions.

It is extremely unlikely that nesting marbled murrelets will be exposed to construction/pile driving noise associated with a project because (1) the nearest known nesting site is on the Olympic Peninsula 21 miles SW of the terminal, (2) no murrelet breeding behavior has been documented within Fort Casey State Park, and (3) existing levels of disturbance likely preclude murrelet presence.

There are no records of marbled murrelets occurring within Keystone Harbor itself. It is unlikely murrelet would use this small harbor as it contains disturbed habitat, and is consistently occupied by WSF vessels, pleasure boats, campers, fishermen, and beachcombers (WSF 2004).

Ferry traffic creates regular disturbance in the immediate terminal area. From July 2017 to June 2018, there were approximately 8,930 scheduled arrivals and departures from the terminal. During the nesting season (April 1-September 23), when foraging murrelet are more active, there were approximately 5,192 scheduled arrivals and departures (WSDOT 2018d).

#### 4.5.2.15 *Marbled Murrelet Critical Habitat*

No marbled murrelet critical habitat has been designated near the terminal (USFWS 1996).

#### 4.5.2.16 *Rockfish Species*

*Bocaccio*

Bocaccio are rarely caught in north Puget Sound and only sparse records exist for the Strait of Georgia (Federal Register 2010b). Because larvae are widely dispersed, it is possible that bocaccio juveniles could be found near the Coupeville Ferry Terminal at any time of year. Adult bocaccio generally move to very deep water. The waters south of the terminal are shallow, less than 40 feet deep (NMFS 2009).

*Yelloweye Rockfish*

Yelloweye rockfish are more closely aligned with rocky, high-relief substrates than with very deep water (Federal Register 2010b). Admiralty Bay and the waters north of Coupeville do not have the rocky substrates preferred by yelloweye.

#### 4.5.2.17 *Rockfish Species Critical Habitat*

The Coupeville Ferry Terminal is within rockfish nearshore critical habitat (less than or equal to 98 feet in depth) (Federal Register 2014). The physical and biological features (PBFs) (Federal Register 2014) essential to the conservation of juvenile Bocaccio rockfish are listed in Table CO-3. PBFs relevant to the terminal area are numbered per the CFR (Federal Register 2014). These PBFs are specific to nearshore environments, where only juvenile Bocaccio rockfish could be found. Deepwater (> 98 feet in depth) PBFs exist for adult Bocaccio, and adult and juvenile yelloweye rockfish; however, this habitat is not present at the Coupeville Ferry Terminal and will not be discussed here.

**Table CO-3**
**Existing Conditions of Rockfish PBFs at the Coupeville Ferry Terminal**

| PBFs | Existing Conditions |
|---|---|
| 1) Quantity, quality, and availability of prey species to support individual growth, survivial, reproduction, and feeding opportunities. | The marine waters of Keystone Harbor near the ferry terminal are designated "Extraordinary" for aquatic life. Impaired waters listings in the terminal area do not identify any water quality parameters of concern (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of two drainage areas that drain to Keystone Harbor. One of the areas includes treatment.<br><br>The first drainage area consists of three catch basins that drain the holding lanes, and two catch basins that drain the parking areas. Some input from the WSDOT Highway 20 system connects to this area. All of the catch basins pass through an oil/water separator (inspected annually) and discharge through a shared outfall to the west of the trestle.<br><br>The second drainage area consists of the transfer span (typically 90 feet long by 24 feet wide that carries traffic between the trestle and ferry), which discharges by sheet flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Overwater coverage from the existing ferry terminal structures may reduce the production of aquatic invertebrates that are prey species to salmon. Substrate characteristics in Keystone Harbor are suitable for epibenthic production.<br><br>There are no forage fish spawning areas in the vicinity, however, the fish community is abundant and diverse. |
| 2) Water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities. | There are several shoreline vegetation communities in the vicinity, including a tidal marsh (Crockett Lake). No eelgrass is present in Keystone Harbor. Most of the harbor bottom is covered by macroalgae, with the dominant species being sugar kelp. In the ferry lane, small, tightly anchored red algae species are present (CH2MHILL 2006b).<br><br>There is no large overhanging wood vegetation. The existing conditions within the defined area of critical habitat consist of cobble and gravel with small patches of sand/shell debris in the ferry lane. Side slopes of the harbor are mostly gravel with some cobble. Areas outside of propeller wash and not on slopes are sand, mud, and mud with wood debris. The jetty that forms the east side of the harbor is composed of large, angular riprap boulders (CH2MHILL 2006a). Some riprap and hardened shoreline are adjacent to the ferry terminal. Given this is a marine environment, side channels do not occur in the ferry terminal area. |

#### 4.5.2.18 *Pacific Eulachon (Thaleichthys pacificus)*

The Coupeville Ferry Terminal is approximately 73 shoreline miles from the Fraser River, a confirmed spawning river. Eulachon use the Strait of Juan de Fuca as a migration corridor, so it is possible that eulachon might be present at the Coupeville Ferry Terminal.

A monthly bottom trawl study was funded by Fisheries and Oceans Canada's National Rotational Survey Fund from October 2017 to June 2018 to sample

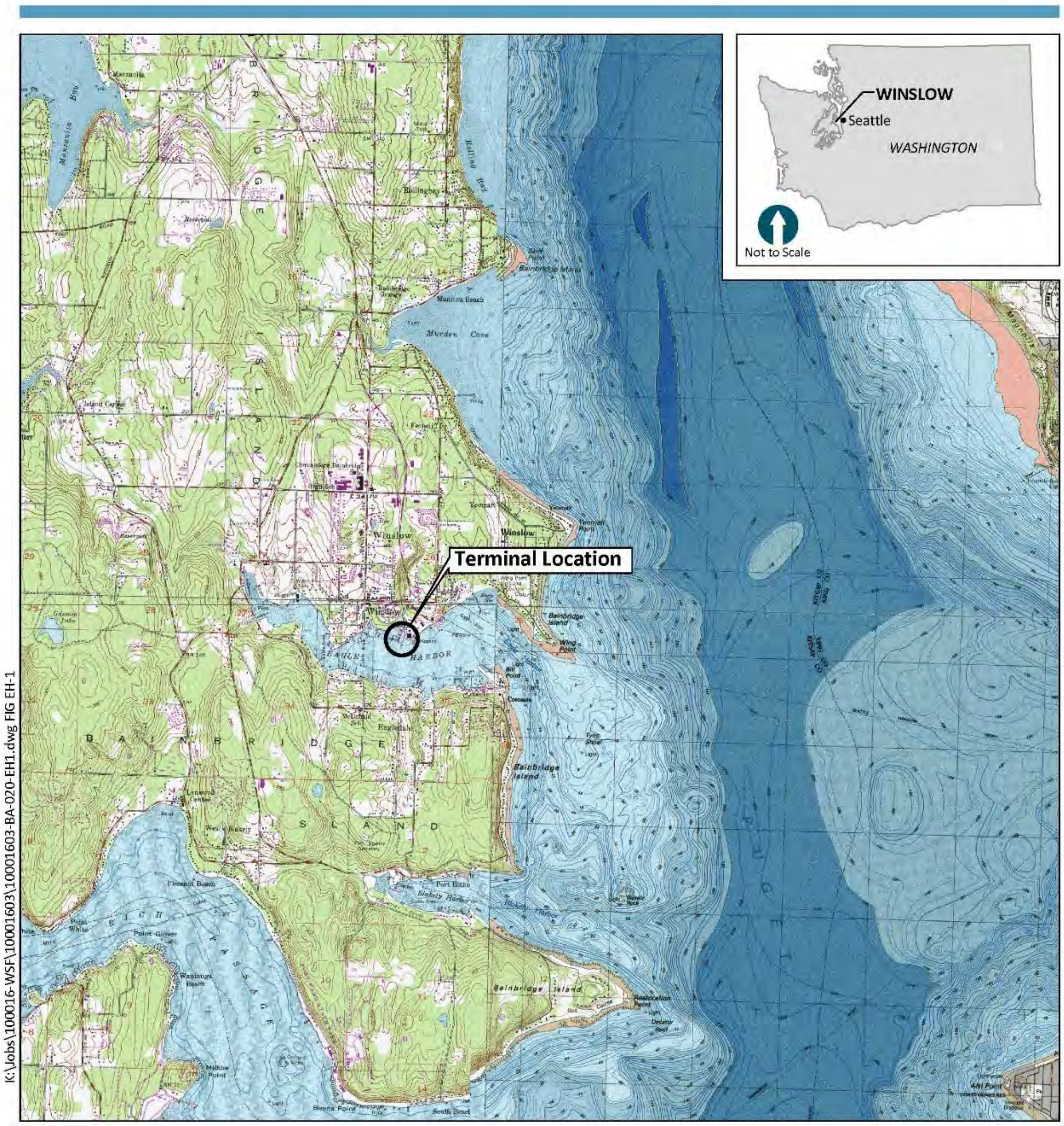
Eulachon in three regional strata in Juan de Fuca Strait and the Strait of Georgia. The goal of this study was to gain insights into the biology, distribution, and migration timing of Eulachon to the Fraser River by observing their spatial and temporal occurrence and biological condition over a wide survey region and over a series of months. Eulachon catch per unit effort (CPUE), size distributions, sex ratios, and maturity observations varied over time and space, as did the occurrence of stomach contents and presence/absence of teeth. Highest catches of Eulachon occurred in Juan de Fuca and lowest near the Fraser River. Mean catch rates at sites near the Fraser River plume corresponded with expected peak spawning periods in the Fraser River. The sex ratio of Eulachon sampled throughout the study region in all months was approximately 1:1 although most samples in the Strait of Georgia in May and June were female. The presence of Eulachon with maturing gonads increased in frequency from west to east in January to April before sharply decreasing throughout the survey region in May and June. Stomach contents and teeth decreased in frequency with proximity to the Fraser River.

Trends in CPUE, fish length, presence of teeth, and stomach contents demonstrate that Juan de Fuca Strait likely provides an important year-round marine habitat for Eulachon feeding and growth as well as being a migration corridor to and from the west coast of Vancouver Island, which offers a large range of additional Eulachon habitat for foraging, growth habitat and mixing of stocks (Dealy et. al., 2019).

#### 4.5.2.19 *Pacific Eulachon Critical Habitat*

No Pacific eulachon critical habitat has been designated near the Coupeville Ferry Terminal (FEDERAL REGISTER 2011).

# EAGLE HARBOR




K:\Jobs\100016-WSF\10001603\10001603-BA-020-EH1.dwg FIG EH-1 Jan 11, 2012 1:08pm heriksen

**NOTE:** Base map prepared from Terrain Navigator Pro USGS 7.5 minute quadrangle map(s) of Bremerton East, Seattle North and South, and Suquamish, Washington.

| Section | Township | Range | Lat | Long | County |
|---|---|---|---|---|---|
| 26 | 25N | 2E | 47º 37' 21" N | 122º 30' 32.2" W | Kitsap |
| HUC 171100190402 | | | WRIA 15 | | |

0 1
Scale in Miles

**Figure EH-1**
Eagle Harbor Maintenance Facility Vicinity Map
WSF Biological Assessment Reference
Winslow, Washington

**Figure EH-1**
**Eagle Harbor Maintenance Facility Vicinity Map**


**Figure EH-2**
**Aerial Photo of Eagle Harbor Maintenance Facility**

## 4.6 Eagle Harbor Maintenance Facility

The Eagle Harbor Maintenance Facility is located on Bainbridge Island, on the Eagle Harbor shoreline just west of the Bainbridge Island Ferry Terminal (see Figures EH-1 and EH-2).

The Eagle Harbor Maintenance Facility provides routine and emergency maintenance services for all WSF ferries and terminals. Features of the facility include maintenance buildings and parking areas for contractors and employees. The facility has six slips, two slips have vehicle loading capability and one is a passenger-only ferry tie-up slip. Six wingwalls are present at the facility, one steel and five timber wingwalls. Nineteen dolphins are associated with the facility, four steel, 15 timber, and one floating timber dolphin.

### *4.6.1 Eagle Harbor Environmental Baseline*

#### 4.6.1.1 *Physical Indicators*

*Substrate and Slope*

Substrate conditions adjacent to the maintenance facility are highly variable. Substrate beneath the facility is sandy silt, gravel, and shell. Propeller scour has removed most fine material leaving coarse sand, gravel, and shell debris. The depth/slope in the area is relatively flat with shallow depths (especially in the western portion of the harbor) and shoaling near the outlet to Puget Sound on the east side of the harbor. Offshore depths of maintenance facility structures are: head of Pier 1 (-35.8 feet MLLW), Pier 2 (-30.0 feet MLLW), and Slip E (-25.4 feet MLLW). Maximum depth for fixed dolphins is -37.0 feet MLLW.

See Figures EH-3 and EH-4 for pictures of the shoreline areas east and west of the maintenance facility.

**Figure EH-3**
**Shoreline Area East of the Eagle Harbor Maintenance Facility**

**Figure EH-4**
**Shoreline Area West of the Eagle Harbor Maintenance Facility**

### *Salt/Freshwater Mixing*

There are three year-round streams and six seasonal streams that discharge into Eagle Harbor. A narrow, approximately 0.5-mile-long ravine drains into the harbor adjacent to the maintenance facility (see Figure EH-5).

**Figure EH-5**
**The Ravine Adjacent to the Eagle Harbor Maintenance Facility (photo is looking upstream)**

*Flows and Currents*

Circulation in Eagle Harbor is driven predominantly by tidal mixing, which can be influenced by wind. The current flow moves through the center of the channel and follows an east to west direction (EPA 1989).

### 4.6.1.2 *Chemical Indicators*

*Water Quality*

Marine waters in Eagle Harbor are designated "Extraordinary" for aquatic life use. Impaired waters listings in the terminal area include bacteria and copper (water) and arsenic (tissue).

*Sediment Quality*

Portions of Eagle Harbor, including some areas of the maintenance facility, are within the Wyckoff Eagle Harbor Superfund site. Within the Superfund site, PAHs and mercury are the primary chemicals of potential concern. Cleanup of the West Harbor, including the maintenance facility, was driven by mercury concentrations that exceeded state Sediment Management Standards (SMS). Remediation consisted of dredging and capping. No action was taken in areas where sediment chemical concentrations were below the standards.

#### 4.6.1.3 *Biological Indicators*

*Shoreline Vegetation*

Ravine Creek (aka Canyon/Winslow) flows into Eagle Harbor at the northwest corner of the maintenance facility property into an inlet that is lined with large overhanging wood vegetation on the west (see Figure EH-6). There is little to no shoreline vegetation in the remaining area of the maintenance facility. The east side of the inlet adjacent to the maintenance facility property is lined with riprap and gravel, covered with a habitat mix along much of the bank. Shoreline vegetation east of the maintenance facility is characterized by grass above a bulkhead. Shoreline vegetation within the area is variable ranging from undeveloped areas with mature trees overhanging the upper intertidal zone to grass lawns behind a vertical bulkhead.

**Figure EH-6**
**The Mouth of Ravine Creek as it Empties into Eagle Harbor**

*Macroalgae and Eelgrass*

No eelgrass occurs around the maintenance facility (BERGER/ABAM 2006). While there are no eelgrass or kelp *(Laminaria* sp.) communities in the area near the maintenance facility, both are present at the mouth of Eagle Harbor near Wing Point, approximately 0.95 miles away. Based on a 1999 dive survey (Antrium et al. 2000) macroalgae were relatively abundant and likely provide habitat for benthic and demersal species in areas landward of -22 feet MLLW. Sparse cover of unattached *Ulva* and *Porphyra perforate* was observed from -6 feet MLLW to -22 feet MLLW. No macroalgae was observed deeper than -22 feet MLLW. Other types of macroalgae that are typical of Puget Sound are expected throughout the harbor.

As part of a seep remediation, much of the bank along the east edge was re-graded in August 2006 to provide a better slope for habitat. The shallow inlet supports macroalgae growth.

*Epibenthos, Macrofauna, Fish, and Marine Mammals*

Upper intertidal areas within the Eagle Harbor Maintenance Facility and within the area near the facility are characterized by barnacles, amphipods, periwinkle snails, mussels, and infrequently by crabs. The mid to lower intertidal areas contain bivalves, sea stars, clams, urchins, and sea pens. Fish species in the area may include coho and chum salmon, and cutthroat trout. Additionally, sole species, perch (especially around piling), ratfish, rockfish, sand dabs, and other species typically found in embayments are also expected. Seals, Steller sea lions, California sea lions, and river otters may occur in Eagle Harbor. Other marine mammals (e.g., killer whale) do not occur in Eagle Harbor.

*Forage Fish*

Documented surf smelt spawning is present (see Figure EH-2), approximately 228 feet northeast of the maintenance facility (WSDOT 2018a). There is no documented herring or sand lance spawning at the terminal. Note that the survey line for surf smelt in the South and West portion of Figure EH-2 is from a survey that pre-dates construction of the Eagle Harbor contaminated sediment confined disposal facility (under the parking lot). Current conditions preclude surf smelt presence in this area.

### 4.6.2 Eagle Harbor Species Distributions

#### 4.6.2.1 *Puget Sound Chinook Salmon (Oncorhynchus tshawytscha)*

No Chinook salmon bearing streams are located near the Eagle Harbor Maintenance Facility. However, major rivers that support Chinook salmon in this area of Puget Sound include the Lake Washington/Cedar River system (approximately 6 miles northeast, shoreline distance), Duwamish/Green River (approximately 7 miles southeast, shoreline distance), and the Puyallup River (approximately 27 miles southeast, shoreline distance) (WDFW 2007a). Chinook may also be present from rivers and streams in southern Puget Sound (WDFW 2007a). Smaller drainages are discussed below.

### *Adult and Subadult Chinook*

Adult Puget Sound Chinook salmon destined for Sinclair Inlet and other west-central Puget Sound tributaries probably migrate through Eagle Harbor in late summer and early fall as they return from the ocean to natal streams and rivers (NMFS 2005).

Sub-adult Chinook have access to the terminal area and may be found there at any time of year. Sub-adults have spent a winter in the marine environment and are not closely oriented to the shoreline like juveniles.

### *Juvenile Chinook*

Eagle Harbor provides habitat for multiple populations of Chinook salmon that are natal to streams elsewhere in Puget Sound. Use of this habitat necessitates crossing an open, deep water channel away from the protection of the nearshore environment. In Eagle Harbor, juvenile Chinook salmon have been found between April and August, with peak catches in May and June (NMFS 2005).

Near Colvos Passage (southwest of the maintenance facility) and in the Sinclair Inlet drainages, there are several small streams that support Chinook salmon. Curley Creek, which drains Long Lake and is a tributary to Yukon Harbor, is the nearest stream with Chinook salmon (approximately 8 miles southwest, shoreline distance). A tributary to Sinclair Inlet, Gorst Creek (approximately 19 miles, shoreline distance), supports both summer and fall-run Chinook salmon (Williams et al. 1975). Chinook salmon spawning in Gorst Creek has increased in recent years, due in part to a reduction in the fishing effort in the area. Most of these fish are believed to be returns from hatchery Chinook salmon released from the Gorst Creek rearing ponds. An escapement of over 17,000 Chinook salmon to the Inlet (fishery harvests plus stream escapement) in 2002 was the largest on record, with over 10,000 adult Chinook salmon in Gorst Creek. Returns to the stream in the previous 3 years averaged about 2,400 adult Chinook salmon. An outmigrant trap recently installed at River Kilometer 1.4 on Gorst Creek (upstream of the hatchery) captured 1,352 juvenile Chinook salmon in 2001 and 324 juvenile Chinook salmon in 2002. Another tributary to Sinclair Inlet, Blackjack Creek (approximately 17 miles, shoreline distance), supports Chinook salmon (WDFW 2006c).

Between 2002 and 2004, juvenile Chinook salmon were sampled in beach seines set by the City of Bainbridge Island and the Suquamish Tribe in Eagle Harbor and along the eastern shoreline of Bainbridge Island, approximately 1.5 miles from Eagle Harbor (NMFS 2005). In Eagle Harbor, juvenile Chinook salmon were found between April and August, with peak catches in May and June (Table EH-1). Along the eastern shoreline of Bainbridge Island, juvenile Chinook salmon were found between June and September, with peak catches in June and August (Table EH-2). Mean size in April, May, and possibly September for all 3 years and both sampling locations was influenced by the small sample size and may not be reflective of the true size distribution (Table EH-3). However, between June and possibly September, mean size increased from 99 mm to 137 mm fork length, with standard deviations ranging from 6 mm to 25 mm.

**Table EH-1**
**Total Number of Juvenile Chinook Captured in Beach Seine Sampling in Eagle Harbor**

| | Year | | |
|---|---|---|---|
| **Month** | **2002** | **2003** | **2004** |
| January | | | 0 |
| February | | | |
| March | | | 0 (2 sets) |
| April | | | 1 |
| May | | 5 (2 sets) | 1 |
| June | 4 | 0 | 0 |
| July | | 0 | |
| August | | | 4 |
| September | | 0 | |
| October | | | 0 |
| November | | 0 | |
| December | | 0 (2 sets) | 0 |

**Source:** NMFS 2005
**Note:** One set per month unless otherwise indicated. Empty cells indicate that zero sets were conducted.

**Table EH-2**
**Total Number of Juvenile Chinook Captured at a Beach Seine Sampling Station along Eastern Shoreline of Bainbridge Island**

| Month | Year | | |
|---|---|---|---|
| | 2002 | 2003 | 2004 |
| January | | | 0 |
| February | | | 0 |
| March | | | 0 (2 sets) |
| April | | 0 | 0 (2 sets) |
| May | | 0 (2 sets) | 0 (2 sets) |
| June | 6 | 8 (2 sets) | 1 (3 sets) |
| July | 3 (3 sets) | 4 (3 sets) | 1 |
| August | 4 | 2 (2 sets) | 8 (2 sets) |
| September | 0 (2 sets) | 0 | 4 (2 sets) |
| October | | 0 | 0 |
| November | | 0 | 0 |
| December | | 0 | 0 |

**Source:** NMFS 2005
**Note:** One set per month unless otherwise indicated. Empty cells indicate that zero sets were conducted.

**Table EH-3**
**Forklengths of Juvenile Chinook Captured in Beach Seine Sampling in or near Eagle Harbor**

| Month | Sample Size | Mean ± St. Dev. (mm) |
|---|---|---|
| January | 0 | |
| February | 0 | |
| March | 0 | |
| April | 1 | 58 |
| May | 6 | 121 ± 21 |
| June | 19 | 99 ± 17 |
| July | 8 | 118 ± 25 |
| August | 18 | 126 ± 18 |
| September | 4 | 137 ± 6 |
| October | 0 | |
| November | 0 | |
| December | 0 | |

**Source:** NMFS 2005
**Note:** Data from all 3 years and all sampling locations combined per month

#### 4.6.2.2 *Puget Sound Chinook Salmon Critical Habitat*

The Eagle Harbor Maintenance Facility lies within Chinook Zone 14 (70 FR 52630). While there are no streams that support Chinook salmon in Eagle Harbor, there are eelgrass beds at the mouth of Eagle Harbor near Wing Point that may be used by juvenile Chinook for rearing (Ash 2001). Use of critical habitat in Eagle Harbor necessitates crossing an open, deep water channel away from the protection of the nearshore environment.

The PCEs provided in the maintenance facility area, and their existing conditions, are listed in Table EH-4. PCEs relevant to the maintenance facility area are numbered per the CFR (70 FR 52630).

**Table EH-4**
**Existing Conditions of Chinook Salmon PCEs at the Eagle Harbor Maintenance Facility**

| PCEs | Existing Conditions |
|---|---|
| 5) Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels. | **Obstructions**<br>In-water structures include the maintenance facility dock, passenger only piers, two main piers, one with a passenger only float, two trestles, two vessel slips, four tie-up slips, and dolphins. The existing maintenance facility may affect fish passage in the nearshore.<br><br>**Water Quality and Forage**<br>The marine waters of Eagle Harbor are designated "Extraordinary" for aquatic life use per WAC 173-201(a). The impaired waters listings in the terminal area include bacteria and copper (water), and arsenic (tissue) (Ecology 2018).<br><br>The existing stormwater system at the maintenance facility site consists of two networks of catch basins that drain to Eagle Harbor. One system drains the area of the maintenance building, and consists of 15 open drains and four standard catch basins that discharge under the pier to Eagle Harbor. None of the runoff from this area is treated. The large yard to the west and north is drained by four standard catch basins that flow through three oil/water separators and then discharge through two outfalls to Eagle Harbor. The maintenance facility operates under an Ecology National Pollutant Discharge Elimination System (NPDES) Stormwater Baseline General Permit (1/2/2015), and undergoes regular monitoring.<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Overwater coverage from the existing maintenance facility structures may reduce the production of aquatic invertebrates that are prey species to salmon. Sediment remediation, including capping, has been done in portions of the site. Sediments are expected to support epibenthos.<br><br>Surf smelt spawn year-round in Eagle Harbor. There is also a sand lance spawning area directly across the harbor from the maintenance facility.<br><br>**Natural Cover**<br>There is little to no shoreline vegetation in the vicinity of the maintenance facility with the exception of overhanging mature trees and woody debris along the west side of Ravine Creek, which flows into Eagle Harbor at the northwest corner of the facility. The remaining shoreline areas are armored with riprap and bulkheads. No eelgrass occurs near the maintenance facility. Macro algae, dominated by *Ulva* and *Porphyra perforate*, is abundant out to depth of -22 MLLW. Ravine Creek is the only side channel near the maintenance facility. |
| 6) Offshore areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation. | The marine waters of Eagle Harbor are designated "Extraordinary" for aquatic life use per WAC 173-201(a). Ecology's 2012 303(d) water quality parameters of concern for Eagle Harbor include bacteria and temperature (water), and arsenic (tissue).<br><br>In-water structures include the maintenance facility dock, passenger only piers, two main piers, one with a passenger only float, two trestles, two vessel slips, four tie-up slips, and dolphins. The existing maintenance facility may affect fish passage in the nearshore.<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Offshore areas provide habitat for forage fish. |

#### 4.6.2.3 *Puget Sound Steelhead (Oncorhynchus mykiss)*

There are no natal streams in the area of the Eagle Harbor Maintenance Facility that support Puget Sound steelhead. However, major river systems that support winter steelhead include the Lake Washington/Cedar River system (approximately 6 miles northeast, shoreline distance), Duwamish/Green River (approximately 7 miles southeast, shoreline distance), and the Puyallup River (approximately 27 miles southeast, shoreline distance). The Duwamish/Green River also supports a run of summer steelhead. Steelhead may also be present from rivers and streams in southern Puget Sound (WDFW 2007a).

In addition, winter steelhead are present in Curley Creek just west of the Southworth Ferry Terminal in Yukon Harbor (approximately 8 shoreline miles southwest), Shingle Mill Creek on Vashon Island (approximately 10 shoreline miles southwest), Blackjack Creek (approximately 13 shoreline miles southwest), Ross Creek (approximately 14 shoreline miles southwest), Anderson Creek (approximately 15 shoreline miles southwest), and Gorst Creek (approximately 16 shoreline miles southwest)—all located in Sinclair Inlet; and Chico Creek (approximately 15 shoreline miles northwest), Barker Creek (approximately 17 shoreline miles northwest), Strawberry Creek (approximately 17 shoreline miles northwest), and Clear Creek (approximately 18 shoreline miles northwest)—all located in Dyes Inlet (WDFW 2007a).

Available data from tow-net sampling (deeper nearshore) and beach seine sampling (shallow nearshore) efforts around Puget Sound have reported the capture of few steelhead. In tow-net sampling in north and south Puget Sound, NMFS captured a total of 18 steelhead (Rice, unpublished data). The total sampling effort data was not available, but the mean steelhead catch ranged from 0 to 0.2 per net in north Puget Sound and 0.1 to 0.8 per net in south Puget Sound.

During 2001 and 2002, beach seining conducted in central Puget Sound by King County Department of Natural Resources captured only nine steelhead out of a total of approximately 34,000 juvenile salmonids. All the steelhead were caught between May and August and ranged in size from 141 to 462 mm with a mean size of 258 mm (Brennan et al. 2004). Also during 2001 and 2002, beach seining, tow netting, and purse seining were conducted by WDFW in Sinclair Inlet. This sampling effort focused on beach seining, which occurred monthly from April to October in 2001 and from mid-February to September in 2002. Tow-netting was conducted monthly from May to August in 2002 only and purse seining was limited to only 2 days in July of 2002. The sampling effort resulted in the capture of four steelhead out of a total of 21,500 salmonids. Despite the larger effort given to beach seining, of the four steelhead, only one was caught in the beach seine and the remaining three were caught in deeper water with the tow net and purse seine (Fresh et al. 2006).

Steelhead were infrequently captured in a 2002-2004 beach seine study around Bainbridge Island. The study consisted of 271 beach seine sets conducted between April and September 2002 and between April 2003 and December 2004. Three steelhead were captured in the study; one was captured in May and two were captured in September. The steelhead were 179, 280, and 300 mm in total length. One of the three steelhead had been fin clipped, indicating it was of hatchery origin (City of Bainbridge Island, Suquamish Tribe, and WDFW 2005). During 2001 and 2002, beach seining conducted in central Puget Sound by King County Department of Natural Resources captured only nine steelhead out of a total of approximately 34,000 juvenile salmonids. All the steelhead were caught between May and August and ranged in size from 141 to 462 mm with a mean size of 258 mm (Brennan et al. 2004).

#### 4.6.2.4 *Puget Sound Steelhead Critical Habitat*

The Eagle Harbor Maintenance Facility does not fall within designated steelhead critical habitat (Federal Register 2016a).

#### 4.6.2.5 *Humpback Whale (Megaptera novaeangliae)*

Humpback whales may be present near the Eagle Harbor Maintenance Facility. Critical habitat has not been designated for humpback whales. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.6.2.6 *Southern Resident Killer Whale (Orcinus orca)*

Southern Resident Killer Whale (SRKW) may be present near the Eagle Harbor Maintenance Facility. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.6.2.7 *Southern Resident Killer Whale Critical Habitat*

The Eagle Harbor Maintenance Facility lies within Area 2 – Puget Sound considered to be used by killer whales for fall feeding. Areas with water less than 20 feet deep relative to the extreme high water mark are not included in the critical habitat designation (Federal Register 2006).

The PCEs provided in the maintenance facility area, and their existing conditions, are listed in Table EH-5. PCEs relevant to the maintenance facility area are numbered per the CFR (Federal Register 2006).

**Table EH-5**
**Existing Conditions of Killer Whale PCEs at the Eagle Harbor Maintenance Facility**

| PCEs | Existing Conditions |
|---|---|
| 1) Water quality to support growth and development | The marine waters of Eagle Harbor are designated “Extraordinary” for aquatic life use per WAC 173-201(a). The impaired waters listings in the terminal area include bacteria and copper (water), and arsenic (tissue) (Ecology 2018).<br>The existing stormwater system at the maintenance facility site consists of two networks of catch basins that drain to Eagle Harbor. One system drains the area of the maintenance building, and consists of 15 open drains and four standard catch basins that discharge under the pier to Eagle Harbor. None of the runoff from this area is treated. The large yard to the west and north is drained by four standard catch basins that flow through three oil/water separators and then discharge through two outfalls to Eagle Harbor. The maintenance facility operates under an Ecology NPDES Stormwater Baseline General Permit (1/2/2015), and undergoes regular monitoring.<br><br>Existing creosote treated piles may leach PAHs into the water column, degrading water quality in the terminal vicinity. |
| 2) Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth | Salmonids are the primary prey of SRKW, and may be present near the terminal. Further information on prey can be found in the Puget Sound Chinook section, and Appendix B – Species Biology. |
| 3) Passage conditions to allow for migration, resting, and foraging | Existing structures that occur below -20 feet in critical habitat include a segment of the piers used to tie up passenger only vessels, the two main piers, one with a floating dolphin, one of the vessel slips (Slip E), four tie-up slips, and dolphins. It is unlikely that the presence of these structures affects passage conditions because killer whales have not been observed in Eagle Harbor. |

#### 4.6.2.8 *Bull Trout (Salvelinus confluentus)*

There are no natal streams in the area of the Eagle Harbor Maintenance Facility that support bull trout. It is unlikely that anadromous bull trout would enter Eagle Harbor (WDFW 2007a).

The aquatic portions of the maintenance facility are within marine FMO habitat. While bull trout have not been documented in the maintenance facility area, suitable FMO habitat is present, and bull trout are thought to occur throughout south, central, and northern Puget Sound. Therefore, it is expected that the maintenance facility area would be used by anadromous adult and sub-adult bull trout for foraging, migration, and overwintering (USFWS 2004b). Within the maintenance facility area, it is expected that individual bull trout from the Lake Washington/Cedar River system (approximately 6 miles southeast, shoreline distance) Duwamish/Green River (approximately 7 miles southeast, shoreline distance), and the Puyallup River (approximately 27 miles southeast, shoreline distance) core areas are most likely to be present (WDFW 2007a).

In August 2005, an acoustic tag was detected off the northeast point of Bainbridge Island. The tag code corresponded to a bull trout tagged 2 years earlier in the north Swinomish Channel. The fish was only detected once and therefore there is some uncertainty with the finding (Goetz 2007). No other historic or current references indicate the occurrence of bull trout (or Dolly Varden) on the west side of Puget Sound, main basin, or Kitsap Peninsula. Char are infrequent migrants across deep inlets, such as the main basin (Goetz et al. 2004).

#### 4.6.2.9 *Bull Trout Critical Habitat*

The Eagle Harbor Maintenance Facility does not fall within designated bull trout critical habitat (Federal Register 2010a).

#### 4.6.2.10 *Green Sturgeon (Acipenser medirostris)*

There are no natal streams in the area of the Eagle Harbor Maintenance Facility that support green sturgeon.

Observations of green sturgeon in Puget Sound are much less common compared to the coastal Washington estuaries and bays such as Willapa Bay, Grays Harbor, and the Lower Columbia River estuary (Federal Register 2018). In addition, Puget Sound does not appear to be part of the coastal migratory corridor that Southern DPS fish use to reach overwintering grounds north of Vancouver Island (Federal Register 2018).

NMFS reviewed green sturgeon acoustic detection data from 2002-2019 in Puget Sound and the Strait of Juan de Fuca. From 2002-2008, 350 tagged green sturgeon were at large (67% from the threatened southern DPS). During this time, 17 were detected in Puget Sound (4 from the southern DPS). After 2008, none were detected in central or southern Puget Sound, though 400 were at large (83% southern DPS). From 2013-2018, six (one from the southern DPS) were detected in Admiralty Inlet (northern Puget Sound).

From 2004-2019, 210 green sturgeon were detected in the Strait of Juan de Fuca (71% southern DPS). This indicates that the strait is used as a corridor, with green sturgeon residing at detection sites for short periods as they pass through from open ocean. Few of these fish were detected afterwards in Admiralty Inlet, suggesting that most of the tagged population move northward into the Strait of Georgia after transiting the strait. Data indicates conclusively that green sturgeon from the southern DPS occur in Puget Sound and Admiralty inlet, but at low rates compared to Strait of Juan de Fuca presence. This confirms earlier findings that Puget Sound is of lower conservation value to southern DPS green sturgeon. However, it is noted that the tagged population is a small fraction of the whole green sturgeon population, and that conditions need to be optimum for acoustic detection to occur (Moser, et. al. 2021).

#### 4.6.2.11 *Green Sturgeon Critical Habitat*

The Eagle Harbor Maintenance Facility does not fall within designated green sturgeon critical habitat (Federal Register 2009).

#### 4.6.2.12 *Marbled Murrelet (Brachyramphus marmoratus)*

The Eagle Harbor facility area provides suitable marbled murrelet marine foraging habitat.

There is no documented forage fish spawning present at the facility. The WDFW Spawning Location Map shows surf smelt spawning on the west side of the facility. However, the survey was done in 1992, and the Eagle Harbor Superfund West Operable Unit Confined Disposal Facility (upland cap) was completed in 1997, which eliminated the surf smelt spawning survey area on the west side. Documented surf smelt (prey species) spawning is present approximately 260 ft NE of the facility (see Figure EH-2) (WSDOT 2018a).

WDFW surveys conducted from 2001 to 2012 show a density of less than 1 bird per square kilometer in the terminal area (WDFW 2016). The nearest documented marbled murrelet nesting site is located 27 miles W of the terminal (WSDOT 2018b).

The Northwest Forest Plan Marbled Murrelet Effectiveness Monitoring Program (2012) identified habitat suitability throughout the range of the species, and ranked it as Zero, Low, Marginal, Moderately High and Highest. The Eagle Harbor murrelet habitat suitability within the pile driving/heavy equipment zone of potential effect (0.25 miles), is Zero (WSDOT 2019b).

Five acres of contiguous forest that may offer nesting opportunity is present within the pile driving/heavy equipment zone of potential effect (0.25 miles) (WSDOT 2014/2018c). The 0.25 mile zone radius of potential effect was evaluated. A WSF Biologist visited the facility area on 12/13/18. Although there were 5 acres of contiguous forest, it was less than the required 60% coniferous. Therefore, the forest does not offer appropriate nesting opportunity (WSDOT 2018f).

Ferry traffic creates regular disturbance in the immediate terminal area. From July 2017 to June 2018, there were approximately 16,520 scheduled arrivals and departures from the Bainbridge terminal (1,000 ft. NE of the facility). During the nesting season (April 1-September 23), when foraging murrelet are more active, there were approximately 8,290 scheduled arrivals and departures (WSDOT 2018d).

#### 4.6.2.13 *Marbled Murrelet Critical Habitat*

No marbled murrelet critical habitat has been designated near the facility (USFW 1996).

#### 4.6.2.14 *Rockfish Species*

##### *Bocaccio*

Bocaccio are rarely caught in north Puget Sound and only sparse records exist for the Strait of Georgia (Federal Register 2010b). Because larvae are widely dispersed, it is possible that bocaccio juveniles could be found near the Eagle Harbor Maintenance Facility at any time of year. Adult bocaccio generally move to very deep water. The water near the Eagle Harbor Maintenance Facility reaches a maximum of 70 feet deep near the harbor mouth, about 1 mile from the facility (NMFS 2009).

##### *Yelloweye Rockfish*

Yelloweye rockfish are more closely aligned with rocky, high-relief substrates than with very deep water (Federal Register 2010b). Eagle Harbor is relatively shallow, but does not have the rocky substrata required by adult yelloweye rockfish.

#### 4.6.2.15 *Rockfish Species Critical Habitat*

The Eagle Harbor Maintenance Facility is within rockfish nearshore critical habitat (less than or equal to 98 feet in depth) (Federal Register 2014). The physical and biological features (PBFs) (Federal Register 2014) essential to the conservation of juvenile Bocaccio rockfish are listed in Table EH-6. PBFs relevant to the terminal area are numbered per the CFR (Federal Register 2014). These PBFs are specific to nearshore environments, where only juvenile Bocaccio rockfish could be found. Deepwater (> 98 feet in depth) PBFs exist for adult Bocaccio, and adult and juvenile yelloweye rockfish; however, this habitat is not present at the Eagle Harbor Maintenance Facility and will not be discussed here.

**Table EH-6**
**Existing Conditions of Rockfish PBFs at the Eagle Harbor Maintenance Facility**

| PBFs | Existing Conditions |
|---|---|
| 1) Quantity, quality, and availability of prey species to support individual growth, survivial, reproduction, and feeding opportunities. | The marine waters of Eagle Harbor are designated “Extraordinary” for aquatic life use per WAC 173-201(a). The impaired waters listings in the terminal area include bacteria and copper (water), and arsenic (tissue) (Ecology 2018).<br><br>The existing stormwater system at the maintenance facility site consists of two networks of catch basins that drain to Eagle Harbor. One system drains the area of the maintenance building, and consists of 15 open drains and four standard catch basins that discharge under the pier to Eagle Harbor. None of the runoff from this area is treated. The large yard to the west and north is drained by four standard catch basins that flow through three oil/water separators and then discharge through two outfalls to Eagle Harbor. The maintenance facility operates under an Ecology National Pollutant Discharge Elimination System (NPDES) Stormwater Baseline General Permit 1/2/2015), and undergoes regular monitoring.<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Overwater coverage from the existing maintenance facility structures may reduce the production of aquatic invertebrates that are prey species to salmon. Sediment |

| PBFs | Existing Conditions |
|---|---|
| | remediation, including capping, has been done in portions of the site. Sediments are expected to support epibenthos.<br><br>Surf smelt spawn year-round in Eagle Harbor. There is also a sand lance spawning area directly across the harbor from the maintenance facility. |
| 2) Water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities. | There is little to no shoreline vegetation in the vicinity of the maintenance facility with the exception of overhanging mature trees and woody debris along the west side of Ravine Creek, which flows into Eagle Harbor at the northwest corner of the facility. The remaining shoreline areas are armored with riprap and bulkheads. No eelgrass occurs near the maintenance facility. Macro algae, dominated by *Ulva* and *Porphyra perforate*, is abundant out to depth of -22 MLLW. Ravine Creek is the only side channel near the maintenance facility. |

#### 4.6.2.16 *Pacific Eulachon (Thaleichthys pacificus)*

The Eagle Harbor Maintenance Facility is distant from any of the known eulachon spawning rivers. It is highly unlikely that eulachon will be present at the Eagle Harbor Maintenance Facility.

#### 4.6.2.17 *Pacific Eulachon Critical Habitat*

No Pacific eulachon critical habitat has been designated near the Eagle Harbor Maintenance Facility (FEDERAL REGISTER 2011).

# EDMONDS


**Figure ED-1**
Edmonds Ferry Terminal Vicinity Map
WSF Biological Assessment Reference
Edmonds, Washington

## Figure ED-1
## Edmonds Ferry Terminal Vicinity Map

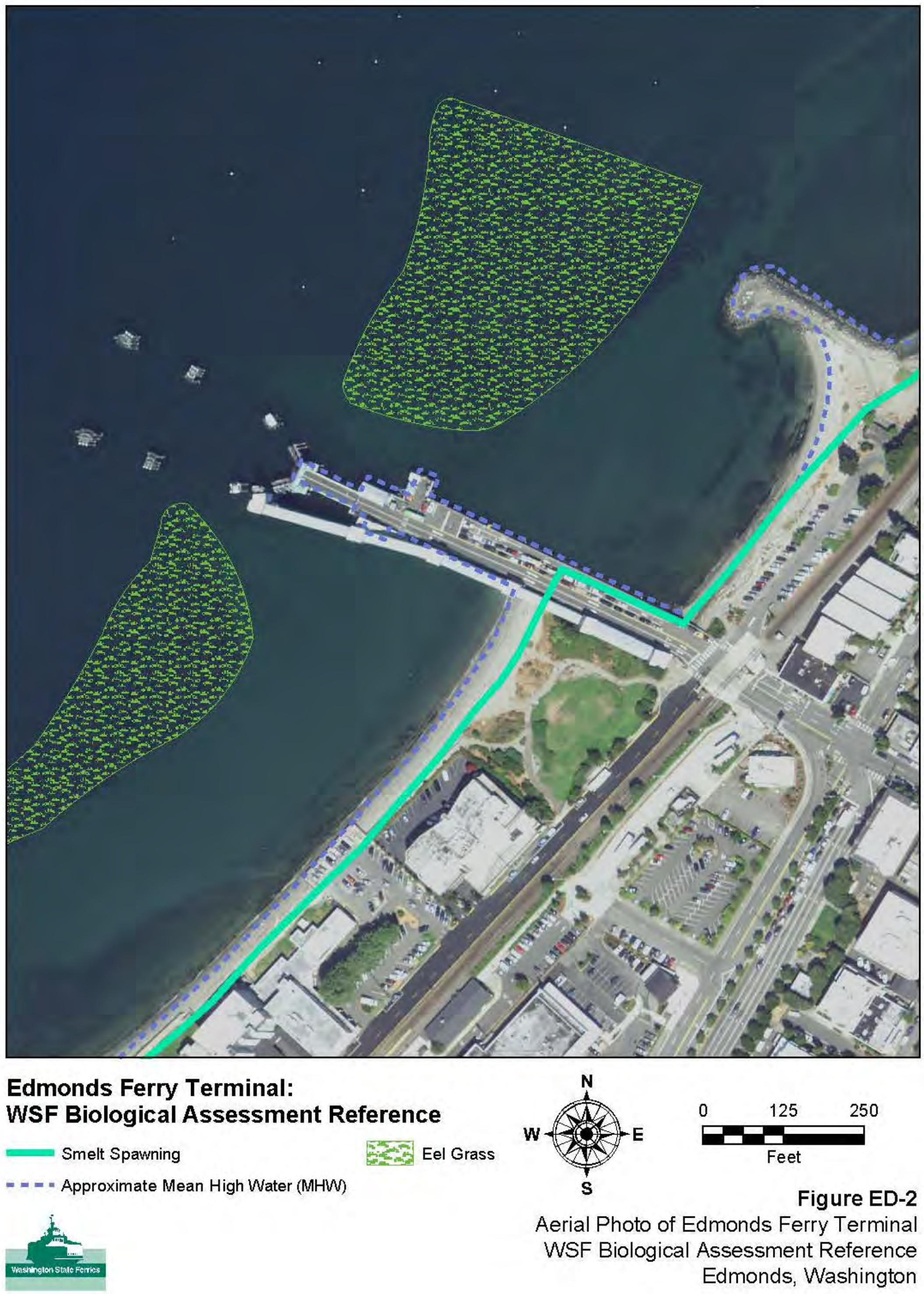



**Figure ED-2**
**Aerial Photo of Edmonds Ferry Terminal**

## 4.7 Edmonds Ferry Terminal

The Edmonds Ferry Terminal is in the city of Edmonds, along the downtown waterfront. The Edmonds-Kingston ferry route is part of SR 104 between the mainland and the Kitsap Peninsula. Edmonds is approximately 15 miles north of Seattle (see Figures ED-1 and ED-2).

The Edmonds Ferry Terminal provides service to the Kingston Ferry Terminal.

Features of the terminal include a terminal building, five vehicle holding lanes that accommodate up to 120 vehicles, three additional holding lanes for 54 vehicles on the dock and associated roadside holding areas, and overhead passenger loading facilities. Paid parking is available at the terminal, though the paid parking areas are not associated with WSDOT. The terminal has one slip with steel wingwalls. Six steel dolphins are associated with the terminal.

### *4.7.1 Edmonds Environmental Baseline*

#### 4.7.1.1 *Physical Indicators*

*Substrate and Slope*

The shoreline is gently sloping low-bank beachfront (see Figures ED-3 and ED-4). Between -7 feet and -15 feet MLLW, substrate consists of 95 percent sand, 4 percent fines, and 0.4 percent gravel. At -25 feet MLLW, the substrate changes to 61 percent sand, 27.4 percent fines, and 11.6 percent gravel, with sand composition increasing to 91 percent at -40 feet MLLW. Offshore depths of terminal structures are: head of main slip (-36.5 feet MLLW). Maximum depth for fixed dolphins is -39.2 feet MLLW.

East of the terminal is an underwater park that contains large rock, cobble, and sand, as well as sunken material (boats, etc.) to provide habitat structure. West of the terminal, substrates are mostly sand above -15 feet MLLW with underwater rock reefs scattered between -15 and -90 feet MLLW.

**Figure ED-3**
**Shoreline Area East of the Edmonds Ferry Terminal**

**Figure ED-4**
**Shoreline Area West of the Edmonds Ferry Terminal**

*Salt/Freshwater Mixing*

Willow Creek, a small perennial surburban stream, drains approximately 4,000 feet south of the terminal. Flows are on the order of 0.1 to 0.5 cubic feet per second (cfs) at the mouth. Shell Creek drains approximately 5,000 feet north of the terminal.

*Flows and Currents*

Currents are estimated to be at least 1.1 to 1.3 knots for maximum floods and ebbs, respectively.

#### 4.7.1.2 *Chemical Indicators*

The marine waters of Possession Sound are designated "Extraordinary" for aquatic life. Ecology's 2012 303(d) water quality parameters of concern for Edmonds Posession Sound include bacteria (water) and organics and metals (tissue-25 parameters).

#### 4.7.1.3 *Sediment Quality*

Impaired waters listings in the terminal area include chromium, copper, lead, zinc, and bis(2-ethylhexyl)phthalate (sediment) (Ecology 2018).

#### *4.7.1.4 Biological Indicators*

*Shoreline Vegetation*

Dominant species of vegetation above the high water mark along the Edmonds waterfront include dune wildrye (*Elymus mollis*), white sweet-clover (*Melilotus alba*), and Puget Sound gumweed (*Grindelia integrifolia*) with oceanspray (*Holodiscus discolor*), English plantain (*Plantago lanceolata*), and Scotch broom. There is no shoreline vegetation east of the terminal and bushes and grass occur above MHHW west of the terminal.

*Macroalgae and Eelgrass*

Aquatic vegetation in the area includes eelgrass (*Zostera marina*) to the north and south of the terminal, as well as *Ulva*, *Iridea*, *Fucus*, *Sarcodiothea*, *Porphyra*, *Smithora*, *Bothryoglossum*, *Gigartina*, and *Polyneura*. Macroalgae, including kelp, is nearly continuous between about -5 feet and -60 feet MLLW. Eelgrass beds are continuous from the marina to the ferry pier and from the ferry pier north through the underwater park at depths ranging from about -2 feet to -20 feet MLLW. The total area of eelgrass is 4.0 acres. Green algae (*Ulva lactuca*) and red algae (*Gracilaria sjoestedtii*) are also common (CH2MHILL 2003).

*Epibenthos, Macrofauna, Fish, and Marine Mammals*

Substrates along the Edmonds waterfront area and in the vicinity of the ferry terminal are suitable to support epibenthos. The eelgrass beds to the north and south of the terminal are important habitat for Dungeness crab. Subtidal geoduck beds occur north of the terminal. Fish known to occur near the terminal include chum and coho salmon, sea-run and resident cutthroat trout, perch, lingcod (*Ophidon elongates*), dogfish (*Squalus acanthias*), flatfish, and other bottom fish. Adjacent to the terminal is an underwater park that predominately supports lingcod, cabezon (*Scorpeanichthys marmoratus*), rockfish, greenlings (*Hexagrammus decagrammus*), perch, and crab. Shrimp, crab, clams, and a variety of fish species common to Puget Sound have been documented in the area. Harbor seals and California and northern Elephant seals (*Mirounga angustirostris*) have been observed in the area, and killer whales may occur seasonally in the area.

*Forage Fish*

Documented surf smelt spawning is present (see Figure ED-2) approximately 105 feet northeast of the terminal (WSDOT 2018a). There is no documented herring, herring holidng areas, or sand lance spawning at the terminal.

### 4.7.2 Edmonds Species Distributions

#### 4.7.2.1 *Puget Sound Chinook Salmon (Oncorhynchus tshawytscha)*

No Chinook salmon-bearing streams are located near the Edmonds Ferry Terminal. However, major rivers that support Chinook salmon in this area of Puget Sound include the Skagit River (approximately 30 shoreline miles north), Stillaguamish River (approximately 25 shoreline miles north), Snohomish River (approximately 17 miles north), Lake Washington/Cedar River (approximately 10 shoreline miles south), and the Duwamish/Green River (approximately 20 shoreline miles south). Chinook may also be present from rivers and streams in southern Puget Sound (WDFW 2007a).

Salmonids originating in the Lake Washington/Cedar River, Duwamish/Green River, and Snohomish River are likely to form the majority of juvenile salmonids present in the ferry terminal area.

### *Adult and Sub-adult Chinook*

Adult Chinook pass through the Edmonds area before they return to the Lake Washington/Cedar River, Duwamish/Green River, and the Snohomish River to spawn.

Sub-adult Chinook have access to the terminal area and may be found there at any time of year. Sub-adults have spent a winter in the marine environment and are not closely oriented to the shoreline like juveniles.

### *Juvenile Chinook*

Juvenile Chinook from the Snohomish/Lake Washington/Cedar River and Duwamish/Green River probably migrate along the Edmonds shoreline prior to moving offshore (CH2MHILL 2003).

Fall Chinook are most likely to be found in nearshore areas and can be found into July and August. Beach seines conducted from April through September of 2001 and 2002 along the mainland of central Puget Sound from Golden Gardens to Picnic Point showed juvenile Puget Sound Chinook salmon first entered the area in mid-May with numbers peaking in mid-June and tapering off through August and September. The average fork length was approximately 85 mm for those juvenile Chinook caught in May and 130 mm for those caught in September (Duffy et al. 2005).

### 4.7.2.2 *Puget Sound Chinook Salmon Critical Habitat*

The Edmonds Ferry Terminal lies within Chinook Zone 7 (70 FR 52630). While there are no streams that support Chinook salmon near the ferry terminal, there are eelgrass beds in close proximity that may be used by juvenile Chinook for rearing.

The PCEs provided in the ferry terminal area, and their existing conditions, are listed in Table ED-1. PCEs relevant to the terminal area are numbered per the CFR (70 FR 52630).

## Table ED-1
## Existing Conditions of Chinook Salmon PCEs at the Edmonds Ferry Terminal

| PCEs | Existing Conditions |
|---|---|
| 5) Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels. | **Obstructions**<br>In-water structures include overhead loading, the trestle, the slip, and dolphins. The existing ferry terminal may affect fish passage in the nearshore.<br><br>**Water Quality and Forage**<br>The marine waters of Possession Sound near the ferry terminal are designated “Extraordinary” for aquatic life use. The impaired waters listings in the terminal area include bacteria (water), organics and metals (tissue-25 parameters), and chromium, copper, lead, zinc, and bis(2-ethylhexyl)phthalate (sediment) (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of four drainage areas that drain to Possession Sound. One of the areas includes treatment.<br><br>The first drainage area drains the vehicle holding area, and consists of eight catch basins that drain through the WSDOT system to the Edmonds Marsh.<br><br>The second drainage area drains the holding lanes, and consists of two trench drains that run the length of the holding lanes. Each trench drain has eight open drains that discharge directly to surface water.<br><br>The third drainage area drains the area near the Terminal Supervisor’s office and the trestle, and consists of two trench drains that flow through a coalescing plate oil/water separator (inspected annually) with an oil boom, that discharges through a City of Edmonds outfall to the south of the ferry terminal area.<br><br>The fourth drainage area consists of the transfer span (typically 90 feet long by 24 feet wide that carry traffic between the trestle and ferry), which discharges by sheet-flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Overwater coverage from the existing ferry terminal structures may reduce the production of aquatic invertebrates that are prey species to salmon. Substrates along the Edmonds waterfront area and in the vicinity of the ferry terminal are suitable to support epibenthos.<br><br>Surf smelt spawn on upper intertidal areas of the beach northeast of the terminal.<br><br>**Natural Cover**<br>There is no shoreline vegetation north of the terminal; bushes and grass occur above MHHW south of the terminal. The area near the existing ferry terminal has expansive macroalgae and eelgrass beds. Macroalgae, including *Laminaria* and *Nereocystis*, are nearly continuous from the -5 foot contour to the -60 foot MLLW contour. Eelgrass beds are continuous from the marina to the ferry pier and from the ferry pier north through the underwater park at depths ranging from about -2 feet to -20 feet MLLW. The total area of eelgrass is 4.0 acres. Green algae (*Ulva lactuca*) and the red algae *Gracilaria sjoestedtii* are also common (CH2MHILL 2003).<br><br>There is no large overhanging wood vegetation near the terminal. The existing conditions within the defined area of critical habitat consist of sand in the nearshore area between the ferry terminal and the Port of Edmonds Marina. There are areas of artificial reef materials and rock at depths of -15 to -90 feet MLLW and some mixed sand/gravel at +5 to -15 feet MLLW (CH2MHILL 2003). Some riprap and hardened shoreline are adjacent to the ferry terminal. Side channels do not occur in the ferry terminal area. |

| PCEs | Existing Conditions |
|---|---|
| 6) Offshore areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation. | The marine waters of Possession Sound near the ferry terminal are designated "Extraordinary" for aquatic life use. The impaired waters listings in the terminal area include bacteria (water), organics and metals (tissue-25 parameters), and chromium, copper, lead, zinc, and bis(2-ethylhexyl)phthalate (sediment) (Ecology 2018).<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Offshore areas provide habitat for forage fish. |

#### 4.7.2.3 *Puget Sound Steelhead (Oncorhynchus mykiss)*

There are no natal streams in the area of the Edmonds Ferry Terminal that support Puget Sound steelhead. The nearest small drainage that supports steelhead is Lunds Gulch (approximately 9 shoreline miles northeast), a tributary to Possession Sound.

Major river systems that support winter and summer steelhead include the Snohomish River (approximately 17 miles northeast), Stillaguamish River (approximately 25 shoreline miles northeast), Skagit River (approximately 30 shoreline miles northeast), and the Duwamish/Green River (approximately 20 shoreline miles south). The Lake Washington/Cedar River (approximately 10 shoreline miles south) supports winter steelhead only. In addition, numerous small streams in the Sinclair/Dyes Inlets (see Section 4.2 for more information), and central and southern Puget Sound rivers and streams support winter steelhead (WDFW 2007a).

Available data from tow-net sampling (deeper nearshore) and beach seine sampling (shallow nearshore) efforts around Puget Sound have reported the capture of few steelhead. In tow-net sampling in north and south Puget Sound, NMFS captured a total of 18 steelhead (Rice, unpublished data). The total sampling effort data was not available, but the mean steelhead catch ranged from 0 to 0.2 per net in north Puget Sound and 0.1 to 0.8 per net in south Puget Sound.

During 2001 and 2002, beach seining conducted in central Puget Sound by King County Department of Natural Resources captured only nine steelhead out of a total of approximately 34,000 juvenile salmonids. All the steelhead were caught between

May and August and ranged in size from 141 to 462 mm with a mean size of 258 mm (Brennan et al. 2004).

#### 4.7.2.4 *Puget Sound Steelhead Critical Habitat*

The Edmonds Ferry Terminal does not fall within designated steelhead critical habitat (Federal Register 2016a).

#### 4.7.2.5 *Humpback Whale (Megaptera novaeangliae)*

Humpback whales may be present near the Edmonds ferry terminal. Critical habitat has not been designated for humpback whales. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.7.2.6 *Southern Resident Killer Whale (Orcinus orca)*

Southern Resident Killer Whale (SRKW) may be present near the Edmonds ferry terminal. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.7.2.7 *Southern Resident Killer Whale Critical Habitat*

The Edmonds Ferry Terminal lies within Area 2 – Puget Sound considered to be used by killer whales for fall feeding. Areas with water less than 20 feet deep relative to the extreme high water mark are not included in the critical habitat designation (Federal Register 2006).

The PCEs provided in the ferry terminal area, and their existing conditions, are listed in Table ED-2. PCEs relevant to the terminal area are numbered per Federal Register 2006.

**Table ED-2**
**Existing Conditions for Southern Resident Killer Whale PCE at the Edmonds Ferry Terminal**

| PCEs | Existing Conditions |
| --- | --- |
| 1) Water quality to support growth and development | The marine waters of Possession Sound near the ferry terminal are designated "Extraordinary" for aquatic life use. The impaired waters listings in the terminal area include bacteria (water), organics and metals (tissue-25 parameters), and chromium, copper, lead, zinc, and bis(2-ethylhexyl)phthalate (sediment) (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of four drainage areas that drain to Possession Sound. One of the areas includes treatment.<br><br>The first drainage area drains the vehicle holding area, and consists of eight catch basins that drain through the WSDOT system to the Edmonds Marsh.<br><br>The second drainage area drains the holding lanes, and consists of two trench drains that run the length of the holding lanes. Each trench drain has eight open drains that discharge directly to surface water.<br><br>The third drainage area drains the area near the Terminal Supervisors office and the trestle, and consists of two trench drains that flow through a coalescing plate oil/water separator (inspected annually) with an oil boom, that discharges through a City of Edmonds outfall to the south of the ferry terminal area.<br><br>The fourth drainage area consists of the transfer span (typically 90 feet long by 24 feet wide that carries traffic between the trestle and ferry), which discharges by sheet-flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column, degrading water quality in the terminal vicinity. |
| 2) Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth | Salmonids are the primary prey of SRKW, and may be present near the terminal. Further information on prey can be found in the Puget Sound Chinook section, and Appendix B – Species Biology. |
| 3) Passage conditions to allow for migration, resting, and foraging | Existing structures that occur below -20 feet in critical habitat include a segment of the overhead loading, the trestle, the slip, and dolphins. |

#### 4.7.2.8 *Bull Trout (Salvelinus confluentus)*

There are no natal streams in the area of the Edmonds Ferry Terminal that support bull trout (WDFW 2007a).

The aquatic portions of the ferry terminal are within marine FMO habitat. Therefore, it is expected that the ferry terminal area would be used by anadromous adult and sub-adult bull trout for foraging, migration and overwintering (USFWS 2004a). Within the ferry terminal area it is expected that individual bull trout from the Skagit River (approximately 30 shoreline miles north), Stillaguamish River (approximately

25 shoreline miles north), Snohomish River (approximately 17 miles north), Lake Washington/Cedar River (approximately 10 shoreline miles south), and the Duwamish/Green River (approximately 20 shoreline miles south) are most likely to be present (WDFW 2007a; USFWS 2004b). Bull trout may also be present from rivers and streams in southern Puget Sound (WDFW 2007a).

#### 4.7.2.9 *Bull Trout Critical Habitat*

The shoreline of the Edmonds Ferry Terminal is within designated bull trout critical habitat (Federal Register 2010a). The PCEs provided in the ferry terminal area, and their existing conditions, are listed in Table ED-3. PCEs relevant to the terminal area are numbered per Federal Register 2010a.

**Table ED-3**
**Existing Conditions of Bull Trout PCEs at the Edmonds Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 2) 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. | In-water structures include overhead loading, the trestle, the slip, and dolphins. The existing ferry terminal may affect fish passage in the nearshore, and may reduce the production of aquatic invertebrates that are prey species to bull trout. |
| 3) An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish. | Substrates support epibenthic production. Surf smelt spawn approximately 0.75 mile north of the terminal.<br><br>Dominant macroalgae in the area is eelgrass (*Zostera marina* L.) and benthic macroalgae (*Ulva* spp., *Laminaria* sp.).<br><br>There is no large overhanging wood vegetation present to provide a food base from terrestrial organisms. The existing conditions consist of sand and silt below MLLW, with shell fragments in offshore areas and gravel, cobble, and sand above MLLW within the defined area of critical habitat. Some riprap and hardened shoreline are adjacent to the ferry terminal. |
| 4) 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. | In-water structures include overhead loading, the trestle, the slip, and dolphins. The existing ferry terminal may affect fish passage in the nearshore, and may reduce the production of aquatic invertebrates that are prey species to bull trout.<br><br>There is no large overhanging wood vegetation present to provide a food base from terrestrial organisms. The existing conditions consist of sand and silt below MLLW, with shell fragments in offshore areas and gravel, cobble, and sand above MLLW within the defined area of critical habitat. Some riprap and hardened shoreline are adjacent to the ferry terminal.<br><br>Dominant macroalgae in the area is eelgrass (*Zostera marina* L.) and benthic macroalgae (*Ulva* spp., *Laminaria* sp.). |
| 5) Water temperatures ranging from 2 to 15 °C (36 to 59 °F), with adequate thermal refugia available for temperatures that exceed the upper | East Puget Sound water temperatures can range from 41.4 to 75.7 °F (5.2 to 24.3 °C) with an average of 51 °F (10.58 °C) (Ecology 2007). Water temperature data for specific ferry terminals is not available. The in-water components of the ferry terminal provide some shade, which may cause slight |

| PCEs | Existing Conditions |
|---|---|
| end of this range. Specific temperatures within this range will depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence. | localized reductions in water temperatures. |
| 8) Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited. | The marine waters of Possession Sound near the ferry terminal are designated “Extraordinary” for aquatic life use. The impaired waters listings in the terminal area include bacteria (water), organics and metals (tissue-25 parameters), and chromium, copper, lead, zinc, and bis(2-ethylhexyl)phthalate (sediment) (Ecology 2018).<br>The existing stormwater system at the ferry terminal consists of four drainage areas that drain to Possession Sound. One of the areas includes treatment.<br><br>The first drainage area drains the vehicle holding area, and consists of eight catch basins that drain through the WSDOT system to the Edmonds Marsh.<br><br>The second drainage area drains the holding lanes, and consists of two trench drains that run the length of the holding lanes. Each trench drain has eight open drains that discharge directly to surface water.<br><br>The third drainage area drains the area near the Terminal Supervisor’s office and the trestle, and consists of two trench drains that flow through a coalescing plate oil/water separator (inspected annually) with an oil boom, that discharges through a City of Edmonds outfall to the south of the ferry terminal area.<br><br>The fourth drainage area consists of the transfer span (typically 90 feet long by 24 feet wide that carry traffic between the trestle and ferry), which discharges by sheet-flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Existing creosote-treated piles may leach PAHs into the water column, degrading water quality in the terminal vicinity. |

#### 4.7.2.10 *Green Sturgeon (Acipenser medirostris)*

There are no natal streams in the area of the Edmonds Ferry Terminal that support green sturgeon.

Observations of green sturgeon in Puget Sound are much less common compared to the coastal Washington estuaries and bays such as Willapa Bay, Grays Harbor, and the Lower Columbia River estuary (Federal Register 2018). In addition, Puget Sound does not appear to be part of the coastal migratory corridor that Southern DPS fish use to reach overwintering grounds north of Vancouver Island (Federal Register 2018).

NMFS reviewed green sturgeon acoustic detection data from 2002-2019 in Puget Sound and the Strait of Juan de Fuca. From 2002-2008, 350 tagged green sturgeon were at large (67% from the threatened southern DPS). During this time, 17 were detected in Puget Sound (4 from the southern DPS). After 2008, none were detected in central or southern Puget Sound, though 400 were at large (83% southern DPS). From 2013-2018, six (one from the southern DPS) were detected in Admiralty Inlet (northern Puget Sound).

From 2004-2019, 210 green sturgeon were detected in the Strait of Juan de Fuca (71% southern DPS). This indicates that the strait is used as a corridor, with green sturgeon residing at detection sites for short periods as they pass through from open ocean. Few of these fish were detected afterwards in Admiralty Inlet, suggesting that most of the tagged population move northward into the Strait of Georgia after transiting the strait. Data indicates conclusively that green sturgeon from the southern DPS occur in Puget Sound and Admiralty inlet, but at low rates compared to Strait of Juan de Fuca presence. This confirms earlier findings that Puget Sound is of lower conservation value to southern DPS green sturgeon. However, it is noted that the tagged population is a small fraction of the whole green sturgeon population, and that conditions need to be optimum for acoustic detection to occur (Moser, et. al. 2021).

#### 4.7.2.11 *Green Sturgeon Critical Habitat*

The Edmonds Ferry Terminal does not fall within designated green sturgeon critical habitat (Federal Register 2009).

#### 4.7.2.12 *Marbled Murrelet (Brachyramphus marmoratus)*

The Edmonds terminal area provides suitable marbled murrelet marine foraging habitat.

There is no documented forage fish spawning present at the terminal. Documented surf smelt (prey species) spawning is present approximately 120 ft. NE of the terminal (see Figure ED-2) (WSDOT 2018a).

WDFW density surveys were not conducted in the terminal area (WDFW 2016). The nearest documented marbled murrelet nesting site is located 34 miles SW of the terminal (WSDOT 2018b).

The Northwest Forest Plan Marbled Murrelet Effectiveness Monitoring Program (2012) identified habitat suitability throughout the range of the species, and ranked it as Zero, Low, Marginal, Moderately High and Highest. The Edmonds murrelet habitat suitability within the pile driving/heavy equipment zone of potential effect (0.25 miles), is Zero (WSDOT 2019b).

There are no coniferous forest that may offer nesting opportunity within the pile driving/heavy equipment zone of potential effect (0.25 miles) (WSDOT 2014/2018c).

Ferry traffic creates regular disturbance in the immediate terminal area. From July 2017 to June 2018, there were approximately 17,210 scheduled arrivals and departures from the terminal. During the nesting season (April 1-September 23), when foraging murrelet are more active, there were approximately 8,630 scheduled arrivals and departures (WSDOT 2018d).

The number of marbled murrelets near the terminal varies seasonally; but the reported fluctuations are consistent with other areas of Puget Sound. Marbled murrelets have been observed year-round at the Edmonds Marina The number of marbled murrelet sightings at Edmonds begins to increase in April with the coming of the nesting season. Marbled murrelets have also been observed in the Edmonds area in September, in both breeding and nonbreeding plumages (USFW 2004a). In May and June 2001, during dye studies in the vicinity of the Edmonds Marina, two to three marbled murrelets were regularly observed at the mouth of the marina (Li, personal communication 2004). The number of sightings peak from May through July.

Abundance of marbled murrelets appears to drop off in October and observation become less frequent November through March; however, marbled murrelets that have been reported flying through the area during the annual Audubon Christmas

Count ranged from zero to 10 individuals per year between 1999 and 2002. The area where marbled murrelets have been observed extends north from the Edwards Point to about 0.5 mile N of Brackets Landing (USFW 2004a).

#### 4.7.2.13 *Marbled Murrelet Critical Habitat*

No marbled murrelet critical habitat has been designated near the terminal (USFWS 1996).

#### 4.7.2.14 *Rockfish Species*

*Bocaccio*

Bocaccio are rarely caught in north Puget Sound and only sparse records exist for the Strait of Georgia (Federal Register 2010b). Because larvae are widely dispersed, it is possible that bocaccio juveniles could be found near the Edmonds Ferry Terminal at any time of year. Adult bocaccio generally move to very deep water. The water near the Edmonds Ferry Terminal reaches 100 feet within 1 mile of shore (NMFS 2009), but does not get much deeper. Edmonds is at the southern limit of what is considered the "north Puget Sound;" adult bocaccio may be in the vicinity of the terminal.

*Yelloweye Rockfish*

Yelloweye rockfish are more closely aligned with rocky, high-relief substrates than with very deep water (Federal Register 2010b). Puget Sound in the terminal vicinity is fairly deep (around 100 feet), but lacks the rocky substrate preferred by yelloweye rockfish.

#### 4.7.2.15 *Rockfish Species Critical Habitat*

The Edmonds Ferry Terminal is within rockfish nearshore critical habitat (less than or equal to 98 feet in depth) (Federal Register 2014). The physical and biological features (PBFs) (Federal Register 2014) essential to the conservation of juvenile Bocaccio rockfish are listed in Table ED-4. PBFs relevant to the terminal area are numbered per the CFR (Federal Register 2014). These PBFs are specific to nearshore environments, where only juvenile Bocaccio rockfish could be found. Deepwater (> 98 feet in depth) PBFs exist for adult Bocaccio, and adult and juvenile yelloweye rockfish; however, this habitat is not present at the Edmonds Ferry Terminal and will not be discussed here.

## Table ED-4
## Existing Conditions of Rockfish PBFs at the Edmonds Ferry Terminal

| PBFs | Existing Conditions |
|---|---|
| 1) Quantity, quality, and availability of prey species to support individual growth, survivial, reproduction, and feeding opportunities. | The marine waters of Possession Sound near the ferry terminal are designated “Extraordinary” for aquatic life use. The impaired waters listings in the terminal area include bacteria (water), organics and metals (tissue-25 parameters), and chromium, copper, lead, zinc, and bis(2-ethylhexyl)phthalate (sediment) (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of four drainage areas that drain to Possession Sound. One of the areas includes treatment.<br><br>The first drainage area drains the vehicle holding area, and consists of eight catch basins that drain through the WSDOT system to the Edmonds Marsh.<br><br>The second drainage area drains the holding lanes, and consists of two trench drains that run the length of the holding lanes. Each trench drain has eight open drains that discharge directly to surface water.<br><br>The third drainage area drains the area near the Terminal Supervisor’s office and the trestle, and consists of two trench drains that flow through a coalescing plate oil/water separator (inspected annually) with an oil boom, that discharges through a City of Edmonds outfall to the south of the ferry terminal area.<br><br>The fourth drainage area consists of the transfer span (typically 90 feet long by 24 feet wide that carry traffic between the trestle and ferry), which discharges by sheet-flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Overwater coverage from the existing ferry terminal structures may reduce the production of aquatic invertebrates that are prey species to salmon. Substrates along the Edmonds waterfront area and in the vicinity of the ferry terminal are suitable to support epibenthos.<br><br>Surf smelt spawn on upper intertidal areas of the beach northeast of the terminal. |
| 2) Water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities. | There is no shoreline vegetation north of the terminal; bushes and grass occur above MHHW south of the terminal. The area near the existing ferry terminal has expansive macroalgae and eelgrass beds. Macroalgae, including *Laminaria* and *Nereocystis*, are nearly continuous from the -5 foot contour to the -60 foot MLLW contour. Eelgrass beds are continuous from the marina to the ferry pier and from the ferry pier north through the underwater park at depths ranging from about -2 feet to -20 feet MLLW. The total area of eelgrass is 4.0 acres. Green algae (*Ulva lactuca*) and the red algae *Gracilaria sjoestedtii* are also common (CH2MHILL 2003).<br><br>There is no large overhanging wood vegetation near the terminal. The existing conditions within the defined area of critical habitat consist of sand in the nearshore area between the ferry terminal and the Port of Edmonds Marina. There are areas of artificial reef materials and rock at depths of -15 to -90 feet MLLW and some mixed sand/gravel at +5 to -15 feet MLLW (CH2MHILL 2003). Some riprap and hardened shoreline are adjacent to the ferry terminal. Side channels do not occur in the ferry terminal area. |

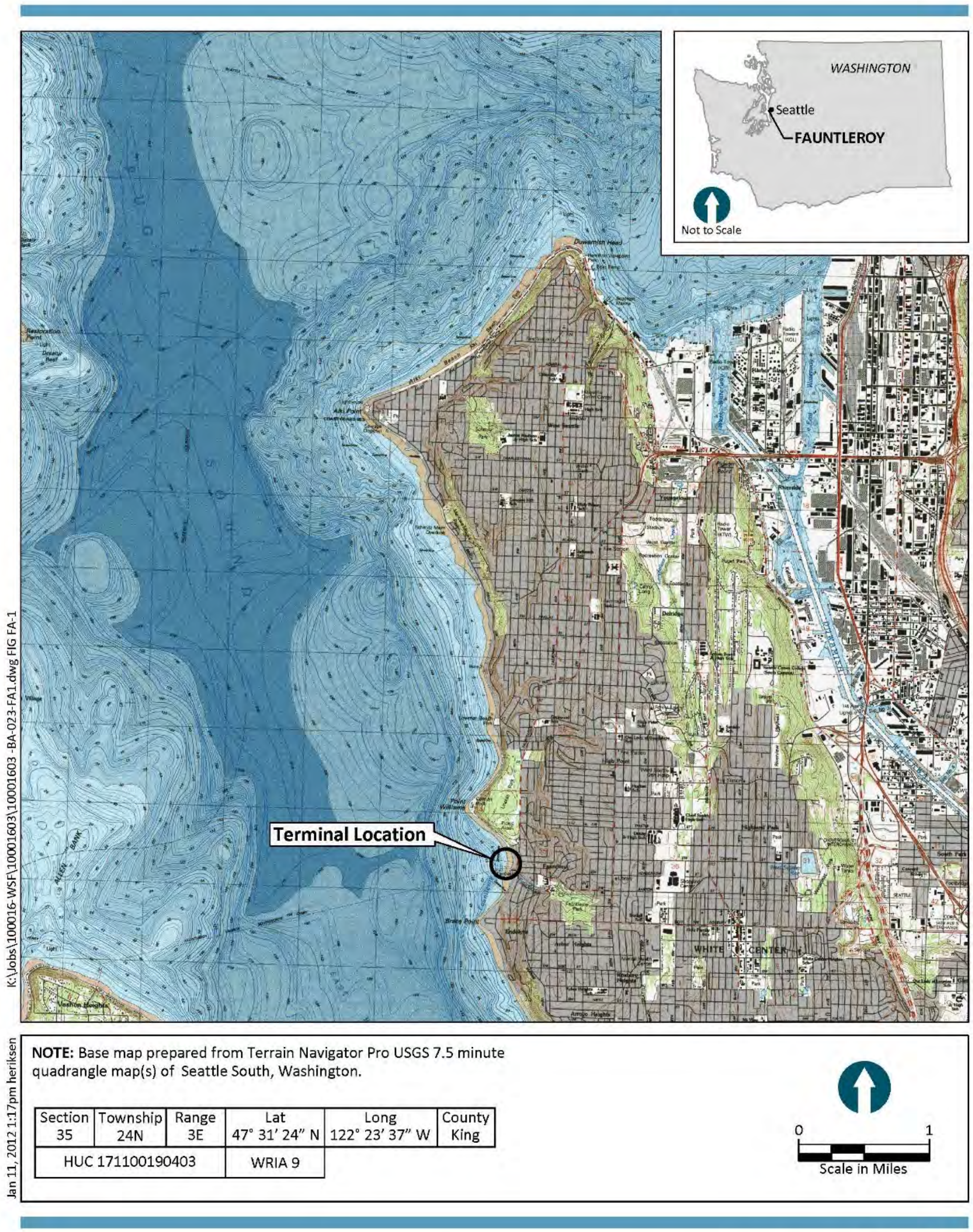
#### 4.7.2.16 *Pacific Eulachon (Thaleichthys pacificus)*

The Edmonds Ferry Terminal is distant from any of the known eulachon spawning rivers.  It is highly unlikely that eulachon will be present at the Edmonds Ferry Terminal.

#### 4.7.2.17 *Pacific Eulachon Critical Habitat*

No Pacific eulachon critical habitat has been designated near the Edmonds Ferry Terminal (FEDERAL REGISTER 2011).

# FAUNTLEROY




| Section | Township | Range | Lat | Long | County |
|---|---|---|---|---|---|
| 35 | 24N | 3E | 47° 31′ 24″ N | 122° 23′ 37″ W | King |
| HUC 171100190403 | | | WRIA 9 | | |

**Figure FA-1**
Fauntleroy Ferry Terminal Vicinity Map
WSF Biological Assessment Reference
Seattle, Washington

**Figure FA-1**
**Fauntleroy Ferry Terminal Vicinity Map**

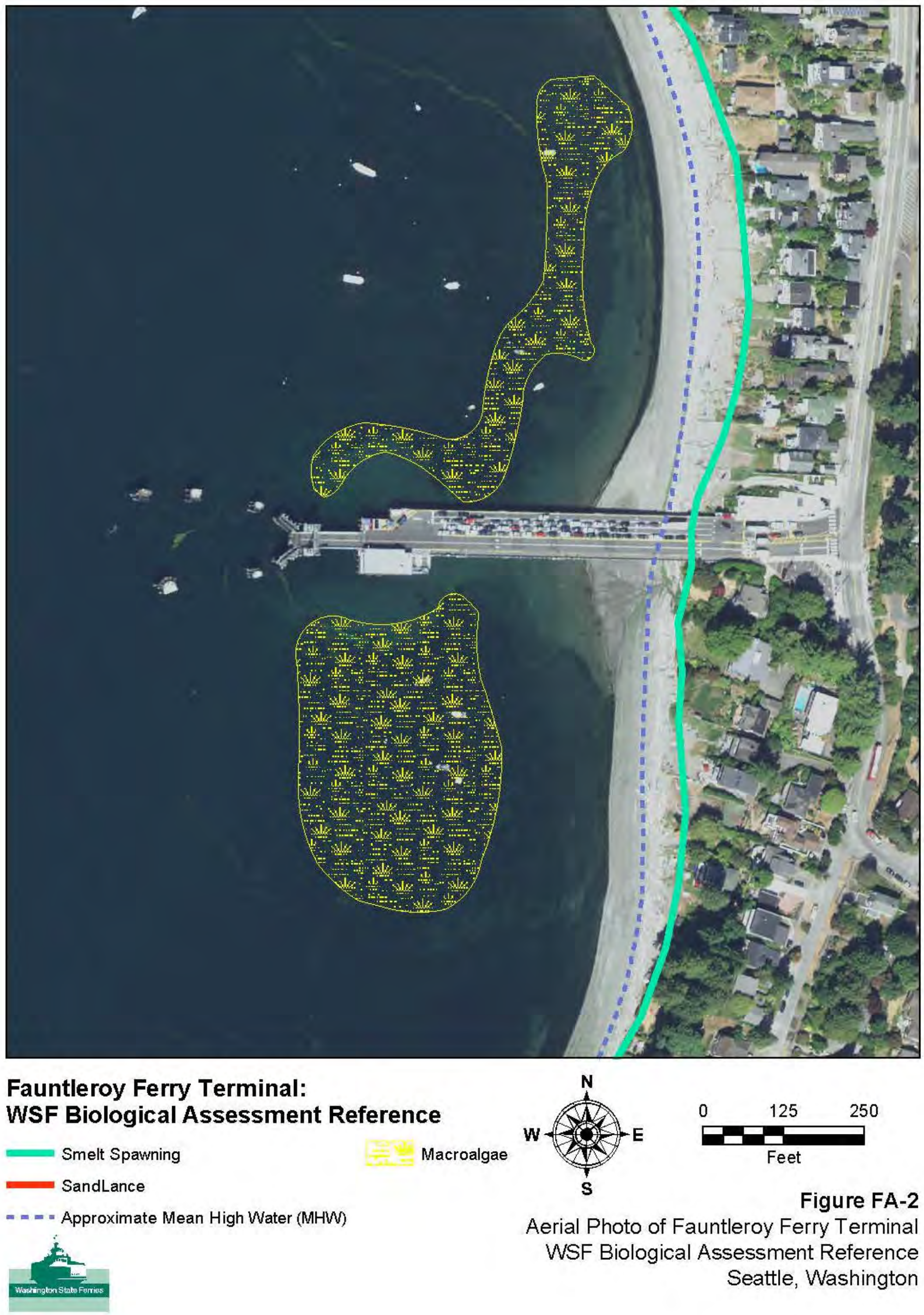



**Figure FA-2**
**Aerial Photo of Fauntleroy Ferry Terminal**

## 4.8 Fauntleroy Ferry Terminal

The Fauntleroy Ferry Terminal is located in West Seattle, south of Lincoln Park. The Fauntleroy Ferry Terminal serves two destinations: Vashon Island and Southworth. See Figures FA-1 and FA-2.

The Fauntleroy Ferry Terminal provides service to the Vashon and Southworth Ferry Terminals.

Features of the terminal include a terminal building, four vehicle holding lanes that accommodate up to 84 vehicles, and roadside holding. Vanpool parking is also available at the terminal.The terminal has one slip with steel wingwalls. Five steel dolphins are associated with the terminal.

### *4.8.1 Fauntleroy Environmental Baseline*

#### 4.8.1.1 *Physical Indicators*

*Substrate and Slope*

Aerial photographs indicate the presence of large woody debris along the shoreline in the area near the terminal. The high intertidal zone is characterized by fine-grained sand, whereas the mid to low intertidal areas are predominantly coarse sand and gravel. Bathymetry gently slopes seaward out to about -15 to -20 feet MLLW at the end of the trestle, and then drops off steeply (about 15 percent) at the end of the trestle. Offshore depths of terminal structures are: head of main slip (-33.6 feet MLLW). Maximum depth for fixed dolphins is -47.4 feet MLLW. The substrate is comprised predominately of sand and gravel. See Figures FA-3 and FA-4 for pictures of the shoreline areas south and north of the ferry terminal.

**Figure FA-3**
**Shoreline Area South of the Fauntleroy Ferry Terminal**

**Figure FA-4**
**Shoreline Area North of the Fauntleroy Ferry Terminal**

### *Salt/Freshwater Mixing*

Fauntleroy Creek discharges into Fauntleroy Cove just south of the ferry terminal (see Figures FA-2 and FA-5) and contributes a small volume of freshwater to the cove.

**Figure FA-5**
**The Mouth of Fauntleroy Creek at the South End of the Ferry Terminal**

*Flows and Currents*

Fauntleroy Cove is a moderately protected marine embayment with an unimpaired connection to Puget Sound. Flows are to the south prior to maximum flood, and reverse direction after the maximum flood. Average current speed is about 0.5 knots (0.85 feet per second). Tides, waves, winds, vessel traffic, and Fauntleroy Creek also likely affect local current patterns.

#### 4.8.1.2 *Chemical Indicators*

*Water Quality*

The marine waters of Fauntleroy Cove are designated “Extraordinary” to aquatic life use. The impaired waters listings near the terminal area include bacteria, ammonia, DO, temperature, and shellfish habitat (Ecology 2018). Water quality near the terminal may be influenced by freshwater input from Fauntleroy Creek and urban runoff.

*Sediment Quality*

Impaired waters listings in the terminal area include organics and metals (sediment – 35 parameters) (Ecology 2018).

#### 4.8.1.3 *Biological Indicators*

*Shoreline Vegetation*

There is limited shoreline vegetation in the vicinity of the terminal; that which exists consists mostly of residential landscaping.

*Macroalgae and Eelgrass*

The area provides suitable physical and chemical conditions for primary production (e.g., macroalgae). Unidentified macroalgae occurs off the northern and southern sides of the trestle (see Figure FA-2). There is no eelgrass in the area near the terminal.

*Epibenthos, Macrofauna, Fish, and Marine Mammals*

Macroalgae and sediment characteristics suggest that the area around the terminal likely supports epibenthos. Subtidal geoduck beds occur in the vicinity of the terminal and north and south of the terminal. The area is also a migratory corridor for adult and juvenile coho salmon and cutthroat trout, which utilize the nearshore area and Fauntleroy Creek. Other fish species common to Puget Sound are expected in the area. Marine mammals likely to occur in the area include killer whale, harbor seal, Steller sea lion, California sea lion, harbor porpoise, and Dall's porpoise.

*Forage Fish*

Documented surf smelt spawning is present (see Figure FA-2), extending approximately 783 feet to the south and 550 feet to the north and documented sand lance spawning 2,000 feet to the south and 307 feet to the north (WSDOT 2018a). There is no documented herring spawning or herring holding areas at the terminal.

### 4.8.2 Fauntleroy Species Distributions

#### 4.8.2.1 *Puget Sound Chinook Salmon (Oncorhynchus tshawytscha)*

No Chinook salmon-bearing streams are located near the Fauntleroy Ferry Terminal (WDFW 2007a).

*Adult and Sub-adult Chinook*

Salmon stocks that may be present in the ferry terminal area for variable lengths of time include runs originating from the Duwamish/Green River (approximately 8 shoreline miles northeast) and the Puyallup River (approximately 22 shoreline miles south). Chinook may also be present from rivers and streams in southern Puget Sound (WDFW 2007a). Adults and sub-adults may be present any time of year.

*Juvenile Chinook*

Juvenile Chinook from the Duwamish/Green River may be present along the Fauntleroy shoreline (Williams et al. 1975).

Beach seining conducted in 2000 at Fauntleroy Cove and Seahurst Park from June 5 through August 16 had the highest catches of juvenile Chinook in mid-June and again in late July. The size of Chinook smolts captured averaged 85 mm in late July, 100 mm in July, and 130 mm in August (Mavros and Brennan 2001). Beach seines conducted from April through September of 2001 and 2002 along the mainland of central Puget Sound from Lincoln Park (just north of the ferry terminal) to Marine View Park showed juvenile Puget Sound Chinook salmon first entered the area in mid-May with numbers peaking in mid-June and tapered off through August and September. The average fork length was approximately 85 mm for those juvenile Chinook caught in May and 130 mm for those caught in September (Duffy et al. 2005). Peak outmigration of juveniles from the Duwamish/Green River system occurs from April through June (Port of Seattle 2006).

#### 4.8.2.2 *Puget Sound Chinook Salmon Critical Habitat*

The Fauntleroy Ferry Terminal lies within Chinook Zone 7 (70 FR 52630). While there are no streams that support Chinook salmon near the ferry terminal, waters in close proximity to the ferry terminal may be used by juvenile Chinook for rearing.

The PCEs provided in the ferry terminal area, and their existing conditions, are listed in Table FA-1. PCEs relevant to the terminal area are numbered per the CFR (70 FR 52630).

**Table FA-1**
**Existing Conditions of Chinook Salmon PCEs at the Fauntleroy Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 5) Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels. | **Obstructions**<br>In-water structures include the ferry terminal building, the trestle, the slip, and dolphins. The existing ferry terminal may affect fish passage in the nearshore.<br><br>**Water Quality and Forage**<br>The marine waters of Fauntleroy Cove near the ferry terminal are designated "Extraordinary" for aquatic life use. The impaired waters listings near the terminal area include bacteria, ammonia, DO, temperature, and shellfish habitat (water) and metals and organics (sediment – 35 parameters) (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of two drainage areas that drain to Fauntleroy Cove. None of the runoff is treated.<br><br>The first drainage area drains the trestle holding lanes and the terminal building area, and consists of one catch basin that connects to the City of Seattle system, and 29 open drains that discharge directly to surface water.<br><br>The second drainage area consists of the transfer span (typically 90 feet long by 24 feet wide that carries traffic between the trestle and ferry), which discharges by sheet flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Overwater coverage from the existing ferry terminal structures may reduce the production of aquatic invertebrates that are prey species to salmon. Macroalgae and sediment characteristics near the terminal indicate that the area supports epibenthos.<br><br>Surf smelt and sand lance spawn on the upper intertidal beaches in Fauntleroy Cove.<br><br>**Natural Cover**<br>Limited shoreline vegetation exists near the terminal in the form of residential landscaping. Dense ulvoid macroalgae impairs the growth of other beneficial macroalgae and eelgrass. Ulvoid macroalgae occurs to the north and south of the ferry terminal trestle. There is no eelgrass in the area. The shoreline is free of private docks and barriers. Aerial photos indicate the presence of large woody debris along the ferry terminal area shoreline (PIE 2001).<br><br>There is no large overhanging wood vegetation near the terminal. The existing conditions within the defined area of critical habitat consist of sand in the nearshore and coarse sand and gravel in the mid to low intertidal areas (PIE 2001). Some riprap and hardened shoreline are adjacent to the ferry terminal. Side channels do not occur in the ferry terminal area. |
| 6) Offshore areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation. | The marine waters of Fauntleroy Cove near the ferry terminal are designated "Extraordinary" for aquatic life use. The impaired waters listings near the terminal area include bacteria, ammonia, DO, temperature, and shellfish habitat (water) and metals and organics (sediment – 35 parameters) (Ecology 2018).<br><br>Offshore areas provide habitat for forage fish. |

#### 4.8.2.3 *Puget Sound Steelhead (Oncorhynchus mykiss)*

There are no natal streams in the area of the Fauntleroy Ferry Terminal that support Puget Sound steelhead. However, major river systems that support winter steelhead include the Duwamish/Green River (approximately 8 miles northeast, shoreline distance) and the Puyallup River (approximately 22 miles south, shoreline distance). The Duwamish/Green River also supports a run of summer steelhead. In addition, numerous rivers and streams in central and southern Puget Sound support winter steelhead (WDFW 2007a).

Available data from tow-net sampling (deeper nearshore) and beach seine sampling (shallow nearshore) efforts around Puget Sound have reported the capture of few steelhead. In tow-net sampling in north and south Puget Sound, NMFS captured a total of 18 steelhead (Rice, unpublished data). The total sampling effort data was not available, but the mean steelhead catch ranged from 0 to 0.2 per net in north Puget Sound and 0.1 to 0.8 per net in south Puget Sound.

During 2001 and 2002, beach seining conducted in central Puget Sound by King County Department of Natural Resources captured only nine steelhead out of a total of approximately 34,000 juvenile salmonids. All the steelhead were caught between May and August and ranged in size from 141 to 462 mm with a mean size of 258 mm (Brennan et al. 2004).

#### 4.8.2.4 *Puget Sound Steelhead Critical Habitat*

The Fauntleroy Ferry Terminal does not fall within designated steelhead critical habitat (Federal Register 2016a).

#### 4.8.2.5 *Humpback Whale (Megaptera novaeangliae)*

Humpback whales may be present near the Fauntleroy ferry terminal. Critical habitat has not been designated for humpback whales. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.8.2.6 *Southern Resident Killer Whale (Orcinus orca)*

Southern Resident Killer Whale (SRKW) may be present near the Fauntleroy ferry terminal. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.8.2.7 Southern Resident Killer Whale Critical Habitat

The Fauntleroy Ferry Terminal lies within Area 2 – Puget Sound considered to be used by killer whales for fall feeding. Areas with water less than 20 feet deep relative to the extreme high water mark are not included in the critical habitat designation (Federal Register 2006).

The PCEs provided in the ferry terminal area, and their existing conditions, are listed in Table FA-2. PCEs relevant to the terminal area are numbered per Federal Register 2006.

**Table FA-2**
**Existing Conditions of Southern Resident Killer Whale PCEs at the Fauntleroy Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 1) Water quality to support growth and development | The marine waters of Fauntleroy Cove near the ferry terminal are designated "Extraordinary" for aquatic life use. The impaired waters listings near the terminal area include bacteria, ammonia, DO, temperature, and shellfish habitat (water) and metals and organics (sediment – 35 parameters) (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of two drainage areas that drain to Fauntleroy Cove. None of the runoff is treated.<br><br>The first drainage area drains the trestle holding lanes and the terminal building area, and consists of one catch basin that connects to the City of Seattle system, and 29 open drains that discharge directly to surface water.<br><br>The second drainage area consists of the transfer span (typically 90 feet long by 24 feet wide that carries traffic between the trestle and ferry), which discharges by sheet flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity. |
| 2) Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth | Salmonids are the primary prey of SRKW, and may be present near the terminal. Further information on prey can be found in the Puget Sound Chinook section, and Appendix B – Species Biology. |
| 3) Passage conditions to allow for migration, resting, and foraging | Existing structures that occur below -20 feet in critical habitat include the trestle, the slip, and dolphins. It is unlikely that the presence of these structures affect passage of killer whales. |

#### 4.8.2.8 *Bull Trout (Salvelinus confluentus)*

There are no natal streams in the area of the Fauntleroy Ferry Terminal that support bull trout (WDFW 2007a).

The aquatic portions of the ferry terminal are within marine FMO habitat. While bull trout have not been documented in the ferry terminal area, suitable FMO habitat is present, and bull trout are thought to occur throughout south, central, and northern Puget Sound. Therefore, it is expected that the ferry terminal area would be used by anadromous adult and sub-adult bull trout for foraging, migration, and overwintering (USFWS 2004b). Within the ferry terminal area, it is expected that individual bull trout from the Duwamish/Green River (approximately 8 miles northeast, shoreline distance) and the Puyallup River (approximately 22 miles south, shoreline distance) core areas are most likely to be present (WDFW 2007a).

#### 4.8.2.9 *Bull Trout Critical Habitat*

The shoreline of the Fauntleroy Ferry Terminal is within designated bull trout critical habitat (Federal Register 2010a). The PCEs provided in the ferry terminal area, and their existing conditions, are listed in Table FA-3. PCEs relevant to the terminal area are numbered per Federal Register 2010a.

**Table FA-3**
**Existing Conditions of Bull Trout PCEs at the Fauntleroy Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 2) 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. | In-water structures include the trestle, the slip, and dolphins. The existing ferry terminal may affect fish passage in the nearshore, and may reduce the production of aquatic invertebrates that are prey species to bull trout. |
| 3) An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish. | Ulvoid macroalgae occurs to the north and south of the ferry terminal trestle. There is no eelgrass in the area. The shoreline is free of private docks and barriers.<br><br>Aerial photos indicate the presence of large woody debris along the ferry terminal area shoreline (PIE 2001). The existing conditions within the defined area of critical habitat consist of sand in the nearshore and coarse sand and gravel in the mid to low intertidal areas (PIE 2001). Some riprap and hardened shoreline are adjacent to the ferry terminal.<br><br>Macroalgae and sediment characteristics indicate that the area likely supports epibenthos. Dense ulvoid macroalgae cover impairs the growth of other beneficial macroalgae and eelgrass. Surf smelt and sand lance spawn on the |

| PCEs | Existing Conditions |
|---|---|
| | upper intertidal beaches in Fauntleroy Cove. |
| 4) 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. | In-water structures include the trestle, the slip, and dolphins. The existing ferry terminal may affect fish passage in the nearshore, and may reduce the production of aquatic invertebrates that are prey species to bull trout.<br><br>Aerial photos indicate the presence of large woody debris along the ferry terminal area shoreline (PIE 2001). The existing conditions within the defined area of critical habitat consist of sand in the nearshore and coarse sand and gravel in the mid to low intertidal areas (PIE 2001). Some riprap and hardened shoreline are adjacent to the ferry terminal.<br><br>Ulvoid macroalgae occurs to the north and south of the ferry terminal trestle. There is no eelgrass in the area. The shoreline is free of private docks and barriers. |
| 5) 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. Specific temperatures within this range will depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence. | East Puget Sound water temperatures can range from 41.4 to 75.7 °F (5.2 to 24.3 °C) with an average of 51 °F (10.58 °C) (Ecology 2007). Water temperature data for specific ferry terminals is not available. The in-water components of the ferry terminal provide some shade, which may cause slight localized reductions in water temperatures. |
| 8) Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited. | The marine waters of Fauntleroy Cove near the ferry terminal are designated “Extraordinary” for aquatic life use per WAC 173-201(a). Ecology’s 2012 303(d) water quality parameters of concern for Fauntleroy Cove include bacteria, ammonia, DO, temperature, and shellfish habitat.<br><br>The existing stormwater system at the ferry terminal consists of two drainage areas that drain to Fauntleroy Cove. None of the runoff is treated.<br><br>The first drainage area drains the trestle holding lanes and the terminal building area, and consists of one catch basin that connects to the City of Seattle system, and 29 open drains that discharge directly to surface water.<br><br>The second drainage area consists of the transfer span (typically 90 feet long by 24 feet wide that carries traffic between the trestle and ferry), which discharges by sheet flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity. |

#### 4.8.2.10 *Green Sturgeon (Acipenser medirostris)*

There are no natal streams in the area of the Fauntleroy Ferry Terminal that support green sturgeon.

Observations of green sturgeon in Puget Sound are much less common compared to the coastal Washington estuaries and bays such as Willapa Bay, Grays Harbor, and the Lower Columbia River estuary (Federal Register 2018). In addition, Puget Sound does not appear to be part of the coastal migratory corridor that Southern DPS fish use to reach overwintering grounds north of Vancouver Island (Federal Register 2018).

NMFS reviewed green sturgeon acoustic detection data from 2002-2019 in Puget Sound and the Strait of Juan de Fuca. From 2002-2008, 350 tagged green sturgeon were at large (67% from the threatened southern DPS). During this time, 17 were detected in Puget Sound (4 from the southern DPS). After 2008, none were detected in central or southern Puget Sound, though 400 were at large (83% southern DPS). From 2013-2018, six (one from the southern DPS) were detected in Admiralty Inlet (northern Puget Sound).

From 2004-2019, 210 green sturgeon were detected in the Strait of Juan de Fuca (71% southern DPS). This indicates that the strait is used as a corridor, with green sturgeon residing at detection sites for short periods as they pass through from open ocean. Few of these fish were detected afterwards in Admiralty Inlet, suggesting that most of the tagged population move northward into the Strait of Georgia after transiting the strait. Data indicates conclusively that green sturgeon from the southern DPS occur in Puget Sound and Admiralty inlet, but at low rates compared to Strait of Juan de Fuca presence. This confirms earlier findings that Puget Sound is of lower conservation value to southern DPS green sturgeon. However, it is noted that the tagged population is a small fraction of the whole green sturgeon population, and that conditions need to be optimum for acoustic detection to occur (Moser, et. al. 2021).

#### 4.8.2.11 *Green Sturgeon Critical Habitat*

The Fauntleroy Ferry Terminal does not fall within designated green sturgeon critical habitat per Federal Register 2018.

#### 4.8.2.12 *Marbled Murrelet (Brachyramphus marmoratus)*

The Fauntleroy terminal area provides suitable marbled murrelet marine foraging habitat.

Documented sand lance (prey species) spawning is present (see Figures FA-2), extending approximately 790 ft. S and 200 ft. N of the terminal. Documented surf smealt spawning is present starting 200 ft. N or the terminal, and extends 375 ft. further north (WSDOT 2018a).

WDFW density surveys were not conducted in the terminal area (WDFW 2016). The nearest documented marbled murrelet nesting site is located 34 miles SW of the terminal (WSDOT 2018b).

The Northwest Forest Plan Marbled Murrelet Effectiveness Monitoring Program (2012) identified habitat suitability throughout the range of the species, and ranked it as Zero, Low, Marginal, Moderately High and Highest. The Fauntleroy murrelet habitat suitability within the pile driving/heavy equipment zone of potential effect (0.25 miles), is Zero (WSDOT 2019b).

There are no coniferous forest that may offer nesting opportunity within the pile driving/heavy equipment zone of potential effect (0.25 miles) (WSDOT 2014/2018c).

Ferry traffic creates regular disturbance in the immediate terminal area. From July 2017 to June 2018, there were approximately 14,040 scheduled arrivals and departures from the terminal. During the nesting season (April 1-September 23), when foraging murrelet are more active, there were approximately 7,080 scheduled arrivals and departures (WSDOT 2018d).

#### 4.8.2.13 *Marbled Murrelet Critical Habitat*

No marbled murrelet critical habitat has been designated near the terminal (USFW 1996).

#### 4.8.2.14 *Rockfish Species*

##### *Bocaccio*

Bocaccio are rarely caught in north Puget Sound and only sparse records exist for the Strait of Georgia (Federal Register 2010b). Because larvae are widely dispersed, it is possible that bocaccio juveniles could be found near the Fauntleroy Ferry Terminal at any time of year. Adult bocaccio generally move to very deep water. The water near the Fauntleroy Ferry Terminal drops off quickly to very deep water, reaching 650 feet within 2 miles of the shore. Adult bocaccio could be in these very deep waters.

*Yelloweye Rockfish*

Yelloweye rockfish are more closely aligned with rocky, high-relief substrates than with very deep water (Federal Register 2010b). The waters adjacent to the Fauntleroy Ferry Terminal are deep enough for yelloweye, but they do not provide the rocky substrata favored by yelloweye rockfish. It is possible, but not likely, that any life stage of yelloweye rockfish could be in the terminal vicinity.

#### 4.8.2.15 *Rockfish Species Critical Habitat*

The Fauntleroy Ferry Terminal is within ockfish nearshore critical habitat (less than or equal to 98 feet in depth) (Federal Register 2014). The physical and biological features (PBFs) (Federal Register 2014) essential to the conservation of juvenile Bocaccio rockfish are listed in Table FA-4. PBFs relevant to the terminal area are numbered per the CFR (Federal Register 2014). These PBFs are specific to nearshore environments, where only juvenile Bocaccio rockfish could be found. Deepwater (> 98 feet in depth) PBFs exist for adult Bocaccio, and adult and juvenile yelloweye rockfish; however, this habitat is not present at the Fauntleroy Ferry Terminal and will not be discussed here.

**Table FA-4**
**Existing Conditions of Rockfish PBFs at the Fauntleroy Ferry Terminal**

| PBFs | Existing Conditions |
|---|---|
| 1) Quantity, quality, and availability of prey species to support individual growth, survivial, reproduction, and feeding opportunities. | The marine waters of Fauntleroy Cove near the ferry terminal are designated “Extraordinary” for aquatic life use. The impaired waters listings near the terminal area include bacteria, ammonia, DO, temperature, and shellfish habitat (water) and metals and organics (sediment – 35 parameters) (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of two drainage areas that drain to Fauntleroy Cove. None of the runoff is treated.<br><br>The first drainage area drains the trestle holding lanes and the terminal building area, and consists of one catch basin that connects to the City of Seattle system, and 29 open drains that discharge directly to surface water. |

| PBFs | Existing Conditions |
|---|---|
| | The second drainage area consists of the transfer span (typically 90 feet long by 24 feet wide that carries traffic between the trestle and ferry), which discharges by sheet flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Overwater coverage from the existing ferry terminal structures may reduce the production of aquatic invertebrates that are prey species to salmon. Macroalgae and sediment characteristics near the terminal indicate that the area supports epibenthos.<br><br>Surf smelt and sand lance spawn on the upper intertidal beaches in Fauntleroy Cove. |
| 2) Water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities. | Limited shoreline vegetation exists near the terminal in the form of residential landscaping. Dense ulvoid macroalgae impairs the growth of other beneficial macroalgae and eelgrass. Ulvoid macroalgae occurs to the north and south of the ferry terminal trestle. There is no eelgrass in the area. The shoreline is free of private docks and barriers. Aerial photos indicate the presence of large woody debris along the ferry terminal area shoreline (PIE 2001).<br><br>There is no large overhanging wood vegetation near the terminal. The existing conditions within the defined area of critical habitat consist of sand in the nearshore and coarse sand and gravel in the mid to low intertidal areas (PIE 2001). Some riprap and hardened shoreline are adjacent to the ferry terminal. Side channels do not occur in the ferry terminal area. |

#### 4.8.2.16 *Pacific Eulachon (Thaleichthys pacificus)*

The Fauntleroy Ferry Terminal is distant from any of the known eulachon spawning rivers. It is highly unlikely that eulachon will be present at the Fauntleroy Ferry Terminal.

#### 4.8.2.17 *Pacific Eulachon Critical Habitat*

No Pacific eulachon critical habitat has been designated near the Fauntleroy Ferry Terminal (FEDERAL REGISTER 2011).

# FRIDAY HARBOR


**NOTE:** Base map prepared from Terrain Navigator Pro USGS 7.5 minute quadrangle map(s) of Friday Harbor and Shaw Island, Washington.

| Section | Township | Range | Lat | Long | County |
|---|---|---|---|---|---|
| 13 | 35N | 3W | 48º 32′ 10″ N | 123º 00′ 50″ W | San Juan |
| HUC 171100190501 | | | WRIA 2 | | |

0 1
Scale in Miles

**Figure FH-1**
Friday Harbor Ferry Terminal Vicinity Map
WSF Biological Assessment Reference
Friday Harbor, Washington

**Figure FH-1**
**Friday Harbor Ferry Terminal Vicinity Map**


**Figure FH-2**
**Aerial Photo of Friday Harbor Ferry Terminal**

## 4.9 Friday Harbor Ferry Terminal

The Friday Harbor Ferry Terminal is located in the town of Friday Harbor, on San Juan Island. The terminal is in a protected harbor that borders on the San Juan Channel (see Figures FH-1 and FH-2).

The Friday Harbor Ferry Terminal provides service to the Anacortes Ferry Terminal, the San Juan inter-island terminals (Lopez, Shaw, Orcas, and Friday Harbor), and to Sidney B.C.

Features of the terminal include a terminal building and 12 vehicle holding lanes that accommodate up to 136 vehicles. No parking lots or overhead passenger loading facilities are present at the terminal. The terminal has two slips, a main and a tie-up slip with steel wingwalls. Six steel dolphins are associated with the terminal.

### *4.9.1 Friday Harbor Environmental Baseline*

#### 4.9.1.1 *Physical Indicators*

*Substrate and Slope*

Substrate conditions adjacent to the terminal are highly variable. Coarser grained sediments and gravel are more prevalent along the offshore areas of the facility and within the areas subject to operations. The shoreline is predominantly bedrock with some coarse sand and cobble (see Figures FH-3 and FH-4). Offshore depths of terminal structures are: head of main slip (-35.4 feet MLLW) and tie-up slip (-30.5 feet MLLW). Maximum depth for fixed dolphins is -46.5 feet MLLW.

**Figure FH-3**
**Shoreline Area on the Northwest Side of the Friday Harbor Ferry Terminal**

**Figure FH-4**
**Shoreline Area on the Southeast Side of the Friday Harbor Ferry Terminal (the structure on the left houses private commercial businesses)**

*Salt/Freshwater Mixing*

San Juan Island is drained by a number of small, mostly unnamed streams. Most streams are seasonal, and are typically dry in the summer months. There are no significant freshwater drainages near the Friday Harbor Ferry Terminal. A small stream drains approximately 4,100 feet (0.78 miles) north of the terminal.

*Flows and Currents*

Strong currents, deep channels, and tidal mixing influence the open marine waters of the San Juan Islands.

#### 4.9.1.2 *Chemical Indicators*

*Water Quality*

Marine waters in the San Juan Channel are designated “Extraordinary” for aquatic life use . The impaired waters listings in the terminal area include DO and bacteria (water) (Ecology 2018).

*Sediment Quality*

The impaired waters listings in the terminal area include PAHs (sediment) (Ecology 2018).

#### 4.9.1.3 *Biological Indicators*

*Shoreline Vegetation*

The majority of the shoreline in the vicinity of the terminal is armored with very little vegetation along the shoreline.

*Macroalgae and Eelgrass*

Eelgrass and biological resource surveys were conducted in March 2002 and August 2002 (PIE 2002d). Both surveys were conducted to determine the areal extent of eelgrass. The survey in March 2002 also cataloged macroalgae, macrofauna, and fish with in the area. Divers also collected shoot counts from identified eelgrass beds. Table FH-1 lists macroalgae and macrofauna species identified at the Friday Harbor Ferry Terminal.

**Table FH-1**
**List of Macroalgae and Macrofauna Species Identified at the Friday Harbor Ferry Terminal**

| Common Name | Scientific Name |
|---|---|
| **Vegetation** | |
| Turkish towel | *Chondracanthus exasperatus* |
| Bleached brunette | *Cryptosiphonia woodii* |
| Rockweed | *Fucus distichus* |
| Splendid iridescent seaweed | *Iridaea cordata* |
| Iridescent seaweed | *Iridaea sp.* |
| Sugar kelp | *Laminaria saccharina* |
| Sea lettuce | *Ulva fenestrata* |
| Eelgrass | *Zostera marina L.* |
| Green algae | Unidentified |
| **Invertebrates** | |
| Sea squirt | *Ascidian* |
| Hermit crab | *Pagurus* spp. |
| Coon-stripe shrimp | *Pandalus danae* |
| Flap-tipped piddock | *Penitella penita* |
| Rock oyster | *Pododesmus macrochisma* |
| Chiton | *Polyplacophora* |
| Sunflower star | *Pycnopodia helianthoides* |
| Polychaete tube worm | *Serpulidae* |
| Bryozoan | Unidentified |
| **Fish** | |
| Sturgeon poacher | *Agonidae* |

Eelgrass (*Zostera marina* L.) occurs west of the main slip and four small eelgrass beds occur east of the tie-up slip. Data collected during the August 2002 eelgrass survey showed the larger eelgrass bed (1) located west of the trestle along the nearby floats is approximately 9,104 square feet and extends from approximately 0 feet to -11 feet MLLW. The area of the larger bed on the east side of the trestle (2) measured 1,418 square feet. The remaining small isolated patches (3, 4, and 5) along the east side cover a combined area of approximately 233 square feet.

Density data were not collected from within the eelgrass bed (1) west of the ferry terminal during the March 2002 investigation but were collected in August 2002. In August 2002, eelgrass density ranged between 16 and 112 shoots per square meter. Densities within the 1,418 square foot eelgrass bed (2) ranged between 92 and 153 shoots per square meter in August 2002. Densities within this same area in March 2002 were between 29 and 57 shoots per square meter. The density of the small eelgrass patch (3) (approximately 124 square feet in size) averaged 65 shoots per square meter. Eelgrass shoot densities in bed 4 were 48 to 52 shoots per square meter and densities in bed 5 were 50 to 88 shoots per square meter.

Several species of macroalgae occur throughout the survey area. Macroalgae does not occur with the immediate area of the main slip. However, macroalgae does occur at many locations surrounding the tie-up slip. Fastened specimens were typically attached to large pieces of hard substrate and shell. Dominant species include *Ulva fenestrata*, *Cryptosiphonia woodii*, and unidentified green algae.

*Epibenthos, Macrofauna, Fish, and Marine Mammals*

Several invertebrate species were observed during the dive surveys. Divers frequently observed pandalid shrimp. Piddock clams occur at lower elevations. Fish were not well represented, with a single sturgeon poacher being the only species observed during the March 2002 survey. Marine mammals likely to occur in the area include killer whale, harbor seal, Steller sea lion, California sea lion, harbor porpoise, and Dall's porpoise.

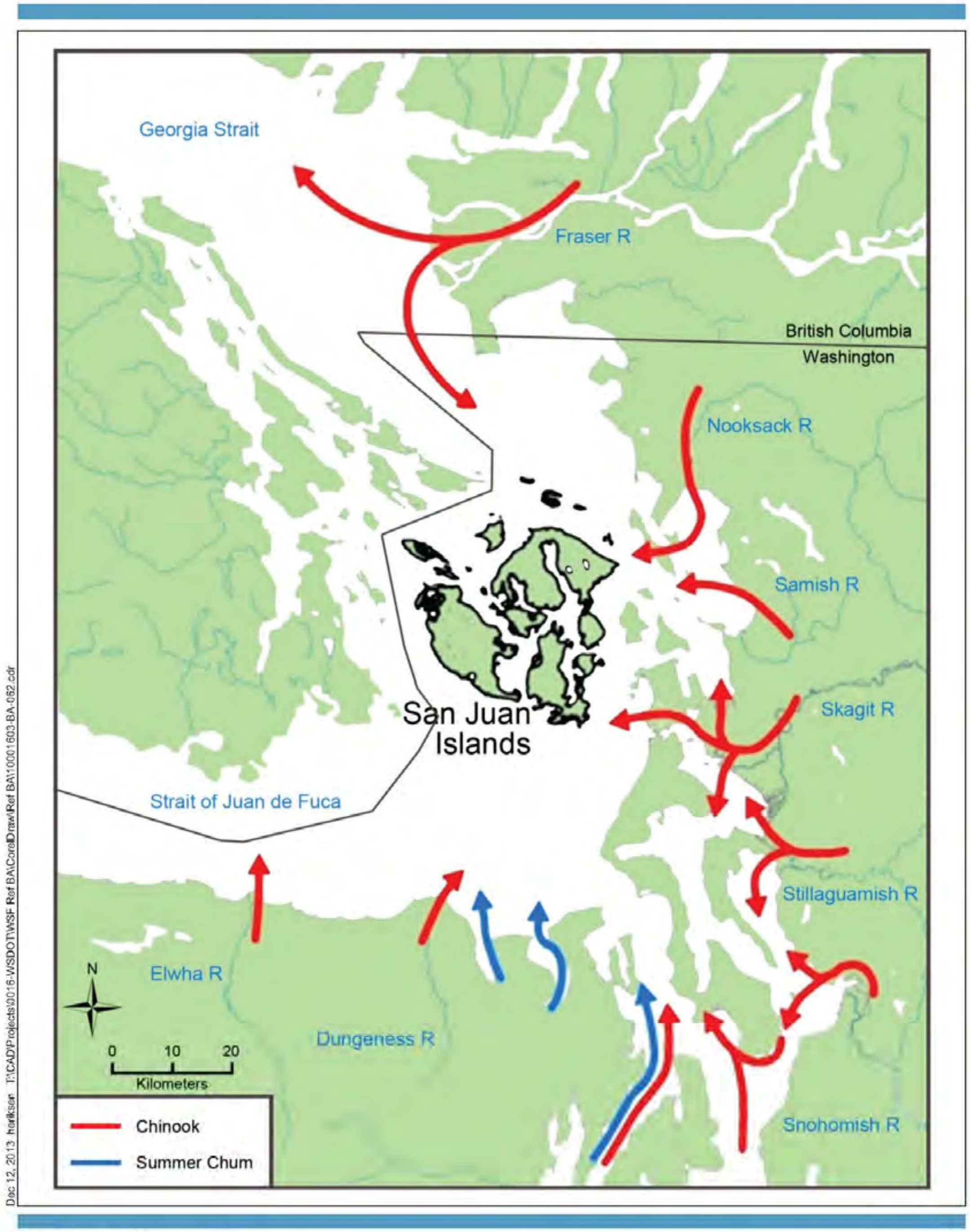
*Forage Fish*

There is no documented forage fish spawning present at the terminal (WSDOT 2018a). No herring holding areas are present at near the terminal.

### 4.9.2 Friday Harbor Species Distributions

#### 4.9.2.1 *Puget Sound Chinook Salmon (Oncorhynchus tshawytscha)*

No Chinook salmon-bearing streams are located near the Friday Harbor Ferry Terminal (WDFW 2007a). However, major rivers that support Chinook salmon occur in this area of Puget Sound, including the Nooksack River (approximately 30 miles northeast), Samish River (approximately 32 miles east), Skagit River (approximately 32 miles southeast), and Stillaguamish River (approximately 42 miles southeast). Chinook may also be present from rivers and streams in central and southern Puget Sound (WDFW 2007a). The results of beach seine sampling completed from March to October in 2008 and 2009 indicate that juvenile Chinook salmon arrive in the San Juan Islands by April, peak in the month of June, remain relatively high in shoreline areas during summer months, and are present through October. Chinook may be present from numerous river systems, as shown in Figure FH-5 (SRSC and NOAA 2012).




**SOURCE:** SRSC/NOAA Fisheries 2012.

**Figure FH-5**
Migratory Pathways for Juvenile Salmon from
Source Population Rivers to the San Juan Islands Area
WSF Biological Assessment Reference
Friday Harbor, Washington

**Figure FH-5**
**Migratory Pathways for Juvenile Salmon from Source Population Rivers to the San Juan Islands Area**

#### *Adult and Sub-adult Chinook*

The watersheds of the San Juan Islands are not large enough to support sustainable wild Chinook salmon populations (Sanford, personal communication 2002). However, the marine environment of northern Puget Sound is a migratory corridor for adults. Adult Chinook salmon collected in the waters around the San Juan archipelago are usually Puget Sound or Fraser River populations (Sanford, personal communication 2002). WDFW micro-tag data analyzed from 1985 showed that five Chinook salmon stocks have been identified in the San Juan region (Moulton, personal communication 2001).

Sub-adult Chinook have access to the terminal area and may be found there at any time of year. Sub-adults have spent a winter in the marine environment and are not closely oriented to the shoreline like juveniles.

#### *Juvenile Chinook*

Chinook salmon do not spawn in the San Juan archipelago (Otis, personal communication 2000). Juveniles that could occur near the ferry terminal are likely of hatchery origin (a hatchery exists on Orcas Island) or have crossed open water to reach the San Juan Islands. Juvenile Chinook salmon habitat in the ferry terminal area includes those occurring in the open water (pelagic zones) of the San Juan Islands and the nearshore and intertidal zones in the San Juan Islands, particularly in areas supporting eelgrass and macroalgae.

### 4.9.2.2 *Puget Sound Chinook Salmon Critical Habitat*

The Friday Harbor Ferry Terminal lies within Chinook Zone 2 (70 FR 52630). While there are no streams that support Chinook salmon near the ferry terminal, there are eelgrass beds in close proximity to the ferry terminal that may be used by juvenile Chinook for rearing.

The PCEs provided in the ferry terminal area, and their existing conditions, are listed in Table FH-2. PCEs relevant to the terminal area are numbered per the CFR (70 FR 52630).

**Table FH-2**
**Existing Conditions of Chinook Salmon PCEs at the Friday Harbor Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 5) Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels. | **Obstructions**<br>In-water structures include the trestles, the main slip, the tie-up slip, and dolphins. The existing ferry terminal may affect fish passage in the nearshore.<br><br>**Water Quality and Forage**<br>The marine waters of San Juan Channel near the ferry terminal are designated "Extraordinary" for aquatic life use. Impaired waters listing in the terminal area includeDO and bacteria (water) and PAHs (sediment) (Ecology 2018).<br>The existing stormwater system at the ferry terminal site consists of four drainage areas that drain to San Juan Channel. One of the areas includes treatment.<br><br>The first drainage area drains the Front Street holding lanes, and consists of three catch basins that discharge through an outfall to the south of the trestle. A city street catch basin also shares this outfall.<br><br>The second drainage area drains the A Street holding lanes, and consists of two catch basins that each flow through an oil/water separator (inspected annually) that connects to the city system.<br><br>The third drainage area drains the trestle approach, and consists of a single catch basin that discharges through an outfall on the immediate south side of the trestle.<br><br>The fourth drainage area consists of the transfer span (typically 90 feet long by 24 feet wide that carries traffic between the trestle and ferry), which discharges by sheet flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Overwater coverage from the existing ferry terminal structures may reduce the production of aquatic invertebrates that are prey species to salmon. Invertebrates such as pandalid shrimp have been observed during dive surveys.<br><br>The nearest forage fish spawning is over 5 miles away.<br><br>**Natural Cover**<br>The majority of the shoreline in the vicinity is armored, with little overhanging vegetation. One large eelgrass (*Zostera marina* L.) bed occurs west of the main slip and four small eelgrass beds occur east of the tie-up slip.<br><br>Several species of macroalgae occur throughout the survey area. Macroalgae does not occur with the immediate area of the main slip. However, macroalgae does occur at many locations surrounding the tie-up slip. Fastened specimens were typically attached to large pieces of hard substrate and shell. Dominant species include *Ulva fenestrata*, *Cryptosiphonia woodii*, and unidentified green algae (PIE 2002d).<br><br>There is no large overhanging wood vegetation. The existing conditions within the defined area of critical habitat consist of coarser grained sediments and gravel along the offshore areas of the ferry terminal and within the areas subject to operations. The shoreline is predominantly bedrock with some coarse sand and cobble (Anchor 2003c). Side channels do not occur in the ferry terminal area. |
| 6) Offshore areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting | The marine waters of San Juan Channel near the ferry terminal are designated "Extraordinary" for aquatic life use. Impaired waters listing in the terminal area includeDO and bacteria (water) and PAHs (sediment) (Ecology 2018).<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in |

| PCEs | Existing Conditions |
|---|---|
| growth and maturation. | the terminal vicinity.<br><br>Offshore areas provide habitat for forage fish. |

#### 4.9.2.3 *Puget Sound Steelhead (Oncorhynchus mykiss)*

There are no natal streams in the area of the Friday Harbor Ferry Terminal that support Puget Sound steelhead. However, major river systems that support winter and summer steelhead include the Nooksack River (approximately 30 miles northeast), Skagit River (approximately 32 miles southeast), and Stillaguamish River (approximately 42 miles southeast). The Samish River (approximately 32 miles southeast) supports winter steelhead only. Steelhead may also be present from rivers and streams in central and southern Puget Sound (WDFW 2007a).

Available data from tow-net sampling (deeper nearshore) and beach seine sampling (shallow nearshore) efforts around Puget Sound have reported the capture of few steelhead. In tow-net sampling in north and south Puget Sound, NMFS captured a total of 18 steelhead (Rice, unpublished data). The total sampling effort data was not available, but the mean steelhead catch ranged from 0 to 0.2 per net in north Puget Sound and 0.1 to 0.8 per net in south Puget Sound.

Beach seine sampling in Bellingham Bay (north Puget Sound) also captured few steelhead (Lummi Nation, unpublished data). The Bellingham Bay research reported the capture of two juvenile steelhead salmon in 336 sets between February 14 and December 1, 2003. The steelhead were captured in the eastern portion of Bellingham Bay near the Taylor Avenue Dock on June 12 and June 25, 2003.

#### 4.9.2.4 *Puget Sound Steelhead Critical Habitat*

The Friday Harbor Ferry Terminal does not fall within designated steelhead critical habitat (Federal Register 2016a).

#### 4.9.2.5 *Humpback Whale (Megaptera novaeangliae)*

Humpback whales may be present near the Friday Harbor ferry terminal. Critical habitat has not been designated for humpback whales. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.9.2.6 *Southern Resident Killer Whale (Orcinus orca)*

Southern Resident Killer Whale (SRKW) may be present near the Friday Harbor ferry terminal. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.9.2.7 *Southern Resident Killer Whale Critical Habitat*

The Friday Harbor Ferry Terminal area lies within Area 1 – Core Sumer Area. Areas with water less than 20 feet deep relative to the extreme high water mark are not included in the critical habitat designation (Federal Register 2006).

The PCEs provided in the ferry terminal area, and their existing conditions, are listed in Table FH-3. PCEs relevant to the terminal area are numbered per Federal Register 2006.

**Table FH-3**
**Existing Conditions of Southern Resident Killer Whale PCEs at the Friday Harbor Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 1) Water quality to support growth and development | The marine waters of San Juan Channel near the ferry terminal are designated “Extraordinary” for aquatic life use. Impaired waters listing in the terminal area includeDO and bacteria (water) and PAHs (sediment) (Ecology 2018).<br>The existing stormwater system at the ferry terminal site consists of four drainage areas that drain to San Juan Channel. One of the areas includes treatment.<br><br>The first drainage area drains the Front Street holding lanes, and consists of three catch basins that discharge through an outfall to the south of the trestle. A city street catch basin also shares this outfall.<br><br>The second drainage area drains the A Street holding lanes, and consists of two catch basins that each flow through an oil/water separator (inspected annually) that connects to the city system.<br><br>The third drainage area drains the trestle approach, and consists of a single catch basin that discharges through an outfall on the immediate south side of the trestle.<br><br>The fourth drainage area consists of the transfer span (typically 90 feet long by 24 feet wide that carries traffic between the trestle and ferry), which discharges by sheet flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column, degrading water quality in the terminal vicinity. |
| 2) Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth | Salmonids are the primary prey of SRKW, and may be present near the terminal. Further information on prey can be found in the Puget Sound Chinook section, and Appendix B – Species Biology. |
| 3) Passage conditions to allow for migration, resting, and foraging | Existing structures that occur below -20 feet in critical habitat include the main slip trestle, the main slip, a segment of the tie-up slip trestle, the tie-up slip, and dolphins. These structures are unlikely to impede passage of killer whales. |

#### 4.9.2.8 *Bull Trout (Salvelinus confluentus)*

There are no natal streams in the area of the Friday Harbor Ferry Terminal that support bull trout (WDFW 2007a).

The aquatic portions of the ferry terminal are within marine FMO habitat. While bull trout have not been documented in the ferry terminal area, suitable FMO habitat is present, and bull trout are thought to occur throughout south, central, and northern Puget Sound. Therefore, it is expected that the ferry terminal area would be used by anadromous adult and sub-adult bull trout for foraging, migration, and overwintering (USFWS 2004b). Within the ferry terminal area, it is expected that individual bull trout from the Nooksack River (approximately 30 miles northeast), Samish River (approximately 32 miles southeast), Skagit River (approximately 32 miles southeast), and Stillaguamish River (approximately 42 miles southeast) are most likely to be present. Bull trout may also be present from rivers and streams in central and southern Puget Sound (WDFW 2007a).

#### 4.9.2.9 *Bull Trout Critical Habitat*

The Friday Harbor Ferry Terminal does not fall within designated bull trout critical habitat (Federal Register 2010a).

#### 4.9.2.10 *Green Sturgeon (Acipenser medirostris)*

There are no natal streams in the area of the Friday Harbor Ferry Terminal that support green sturgeon.

Observations of green sturgeon in Puget Sound are much less common compared to the coastal Washington estuaries and bays such as Willapa Bay, Grays Harbor, and the Lower Columbia River estuary (Federal Register 2018). In addition, Puget Sound does not appear to be part of the coastal migratory corridor that Southern DPS fish use to reach overwintering grounds north of Vancouver Island (Federal Register 2018).

NMFS reviewed green sturgeon acoustic detection data from 2002-2019 in Puget Sound and the Strait of Juan de Fuca. From 2002-2008, 350 tagged green sturgeon were at large (67% from the threatened southern DPS). During this time, 17 were detected in Puget Sound (4 from the southern DPS). After 2008, none were detected in central or southern Puget Sound, though 400 were at large (83% southern DPS). From 2013-2018, six (one from the southern DPS) were detected in Admiralty Inlet (northern Puget Sound).

From 2004-2019, 210 green sturgeon were detected in the Strait of Juan de Fuca (71% southern DPS). This indicates that the strait is used as a corridor, with green sturgeon residing at detection sites for short periods as they pass through from open ocean. Few of these fish were detected afterwards in Admiralty Inlet, suggesting

that most of the tagged population move northward into the Strait of Georgia after transiting the strait. Data indicates conclusively that green sturgeon from the southern DPS occur in Puget Sound and Admiralty inlet, but at low rates compared to Strait of Juan de Fuca presence. This confirms earlier findings that Puget Sound is of lower conservation value to southern DPS green sturgeon. However, it is noted that the tagged population is a small fraction of the whole green sturgeon population, and that conditions need to be optimum for acoustic detection to occur (Moser, et. al. 2021).

#### 4.9.2.11 *Green Sturgeon Critical Habitat*

The Friday Harbor Ferry Terminal does not fall within designated green sturgeon critical habitat (Federal Register 2009).

#### 4.9.2.12 *Marbled Murrelet (Brachyramphus marmoratus)*

The Friday Harbor terminal area provides suitable marbled murrelet marine foraging habitat.

There is no documented forage fish spawning present at the terminal (WSDOT 2018a).

WDFW surveys conducted from 2001 to 2012 show a density of less than 1 bird per square kilometer in the terminal area (WDFW 2016). The nearest documented marbled murrelet nesting site is located 38 miles S of the terminal (WSDOT 2018b).

The Northwest Forest Plan Marbled Murrelet Effectiveness Monitoring Program (2012) identified habitat suitability throughout the range of the species, and ranked it as Zero, Low, Marginal, Moderately High and Highest. The Friday Harbor murrelet habitat suitability within the pile driving/heavy equipment zone of potential effect (0.25 miles), is Zero (WSDOT 2019b).

There are no coniferous forest that may offer nesting opportunity within the pile driving /heavy equipment zone of potential effect (0.25 miles) (WSDOT 2014/2018c).

Ferry traffic creates regular disturbance in the immediate terminal area. From July 2017 to June 2018, there were approximately 4,920 scheduled arrivals and departures from the terminal. During the nesting season (April 1-September 23), when foraging murrelet are more active, there were approximately 2,570 scheduled arrivals and departures (WSDOT 2018d).

#### 4.9.2.13 *Marbled Murrelet Critical Habitat*

No marbled murrelet critical habitat has been designated near the terry Terminal (USFWS 1996).

#### 4.9.2.14 *Rockfish Species*

*Bocaccio*

Bocaccio are rarely caught in north Puget Sound and only sparse records exist for the Strait of Georgia (Federal Register 2010b). The water in Friday Harbor is shallow (less than 30 feet deep), and remains fairly shallow east toward the Upright Channel. The water deepens to the north into the San Juan Channel to depths between 50 and 100 feet (NMFS 2009). Substrates are rocky throughout the area. This area may be occupied by all life stages of bocaccio.

*Yelloweye Rockfish*

Yelloweye rockfish are more closely aligned with rocky, high-relief substrates than with very deep water (Federal Register 2010b). The San Juan and Upright Channels offer this rocky substrate. Yelloweye larvae and juveniles could be present within Friday Harbor; adults could be found in the channels beyond the harbor.

#### 4.9.2.15 *Rockfish Species Critical Habitat*

The Friday Harbor Ferry Terminal is within rockfish nearshore critical habitat (less than or equal to 98 feet in depth) (Federal Register 2014). The physical and biological features (PBFs) (Federal Register 2014) essential to the conservation of juvenile Bocaccio rockfish are listed in Table FH-4. PBFs relevant to the terminal area are numbered per the CFR (Federal Register 2014). These PBFs are specific to nearshore environments, where only juvenile Bocaccio rockfish could be found. Deepwater (> 98 feet in depth) PBFs exist for adult Bocaccio, and adult and juvenile yelloweye rockfish; however, this habitat is not present at the Friday Harbor Ferry Terminal and will not be discussed here.

**Table FH-4**
**Existing Conditions of Rockfish PBFs at the Friday Harbor Ferry Terminal**

| PBFs | Existing Conditions |
|---|---|
| 1) Quantity, quality, and availability of prey species to support individual growth, survivial, reproduction, and feeding opportunities. | The marine waters of San Juan Channel near the ferry terminal are designated “Extraordinary” for aquatic life use. Impaired waters listing in the terminal area includeDO and bacteria (water) and PAHs (sediment) (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal site consists of four drainage areas that drain to San Juan Channel. One of the areas includes treatment.<br><br>The first drainage area drains the Front Street holding lanes, and consists of three catch basins that discharge through an outfall to the south of the trestle. A city street catch basin also shares this outfall.<br><br>The second drainage area drains the A Street holding lanes, and consists of two catch basins that each flow through an oil/water separator (inspected annually) that connects to the city system.<br><br>The third drainage area drains the trestle approach, and consists of a single catch basin that discharges through an outfall on the immediate south side of the trestle.<br><br>The fourth drainage area consists of the transfer span (typically 90 feet long by 24 feet wide that carries traffic between the trestle and ferry), which discharges by sheet flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Overwater coverage from the existing ferry terminal structures may reduce the production of aquatic invertebrates that are prey species to salmon. Invertebrates such as pandalid shrimp have been observed during dive surveys.<br><br>The nearest forage fish spawning is over 5 miles away. |
| 2) Water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities. | The majority of the shoreline in the vicinity is armored, with little overhanging vegetation. One large eelgrass (*Zostera marina* L.) bed occurs west of the main slip and four small eelgrass beds occur east of the tie-up slip.<br><br>Several species of macroalgae occur throughout the survey area. Macroalgae does not occur with the immediate area of the main slip. However, macroalgae does occur at many locations surrounding the tie-up slip. Fastened specimens were typically attached to large pieces of hard substrate and shell. Dominant species include *Ulva fenestrata*, *Cryptosiphonia woodii*, and unidentified green algae (PIE 2002d). |

#### 4.9.2.16 *Pacific Eulachon (Thaleichthys pacificus)*

The Friday Harbor Ferry Terminal is approximately 38 shoreline miles from the Fraser River, a confirmed spawning river. Eulachon use the Strait of Juan de Fuca as a migration corridor, so it is possible that eulachon might be present at the Friday Harbor Ferry Terminal.

A monthly bottom trawl study was funded by Fisheries and Oceans Canada's National Rotational Survey Fund from October 2017 to June 2018 to sample Eulachon in three regional strata in Juan de Fuca Strait and the Strait of Georgia. The goal of this study was to gain insights into the biology, distribution, and migration timing of Eulachon to the Fraser River by observing their spatial and temporal occurrence and biological condition over a wide survey region and over a series of months. Eulachon catch per unit effort (CPUE), size distributions, sex ratios, and maturity observations varied over time and space, as did the occurrence of stomach contents and presence/absence of teeth. Highest catches of Eulachon occurred in Juan de Fuca and lowest near the Fraser River. Mean catch rates at sites near the Fraser River plume corresponded with expected peak spawning periods in the Fraser River. The sex ratio of Eulachon sampled throughout the study region in all months was approximately 1:1 although most samples in the Strait of Georgia in May and June were female. The presence of Eulachon with maturing gonads increased in frequency from west to east in January to April before sharply decreasing throughout the survey region in May and June. Stomach contents and teeth decreased in frequency with proximity to the Fraser River.

Trends in CPUE, fish length, presence of teeth, and stomach contents demonstrate that Juan de Fuca Strait likely provides an important year-round marine habitat for Eulachon feeding and growth as well as being a migration corridor to and from the west coast of Vancouver Island, which offers a large range of additional Eulachon habitat for foraging, growth habitat and mixing of stocks (Dealy et. al., 2019).

#### 4.9.2.17 *Pacific Eulachon Critical Habitat*

No Pacific eulachon critical habitat has been designated near the Friday Harbor Ferry Terminal (FEDERAL REGISTER 2011).

# KINGSTON

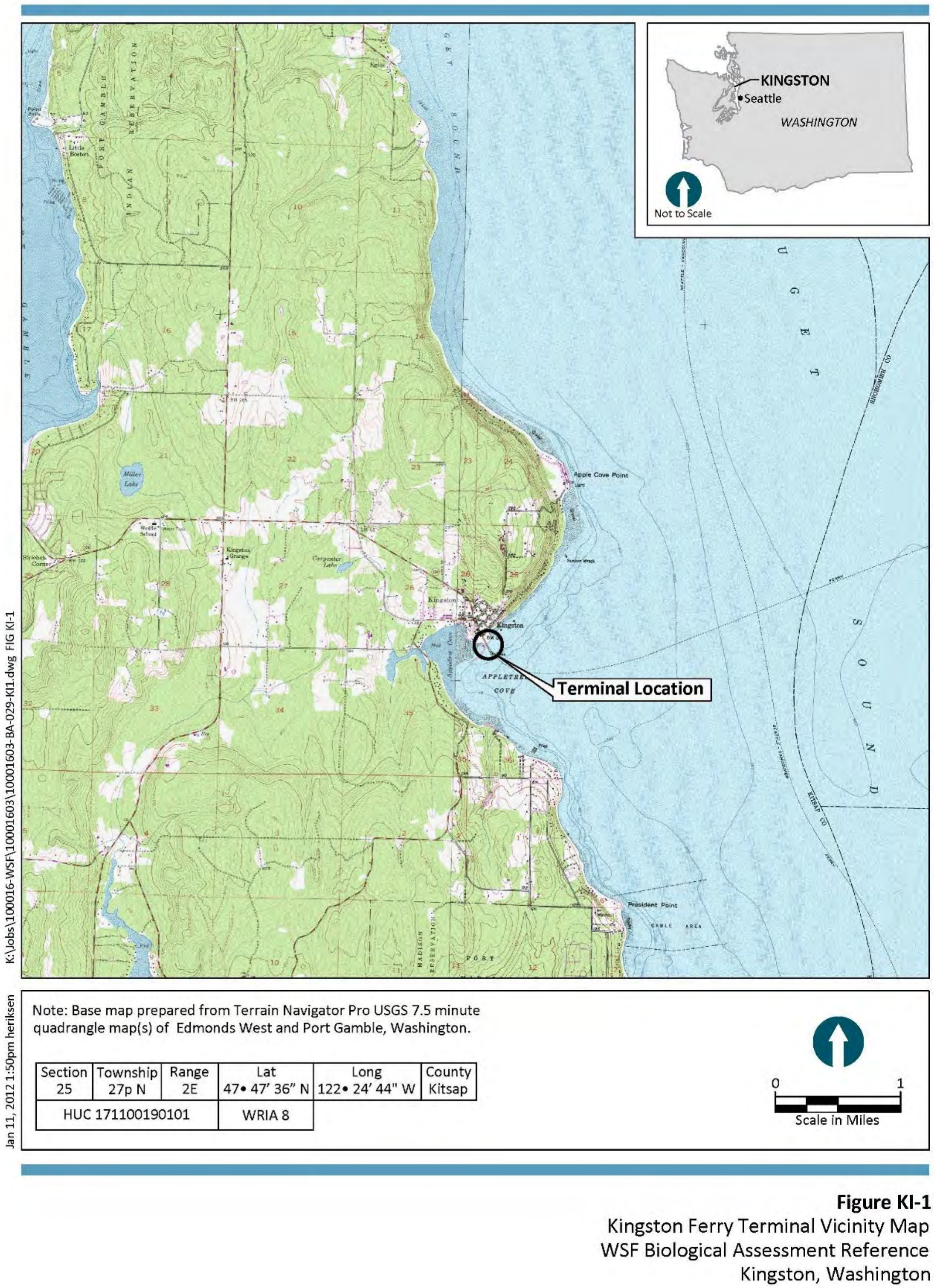



**Figure KI-1**
**Kingston Ferry Terminal Vicinity Map**


**Figure KI-2**
**Aerial Photo of Kingston Ferry Terminal**

## 4.10 Kingston Ferry Terminal

The Kingston Ferry Terminal is located in the town of Kingston, on the Kitsap Peninsula. The terminal is on the shoreline of Appletree Cove, which opens onto Puget Sound (see Figures KI-1 and KI-2).

The Kingston Ferry Terminal provides service to the Edmonds Ferry Terminal.

Features of the terminal include a terminal building, 24 vehicle holding lanes that accommodate up to 288 vehicles, and overhead passenger loading facilities. The terminal has two slips, one main and one tie-up slip. Steel wingwalls are present in the main slip and six-pile steel wingwalls are present in the tie-up slip. Ten dolphins are associated with the terminal, nine steel and one floating timber dolphin in the main slip. No parking is available at the terminal.

### *4.10.1 Kingston Environmental Baseline*

#### 4.10.1.1 *Physical Indicators*

*Substrate and Slope*

The shoreline is heavily armored in the vicinity of the terminal (see Figures KI-3 and KI-4). Steep (2 horizontal to 1 vertical [2H:1V]) riprap slopes dominate from MHHW to about -8 feet MLLW. Beyond about -8 feet MLLW, there is a gentle slope to about -20 or -30 feet MLLW. Deeper intertidal and shallow subtidal substrates consist of gravel and sand, with occasional boulders. Offshore depths of terminal structures are: head of Slip 1 (-42.2 feet MLLW), Slip 2 (-33.5 feet MLLW), and tie-up slip (-26.0 feet MLLW). Maximum depth for fixed dolphins is -36.9 feet MLLW and for floating dolphins -35.7 feet MLLW.

**Figure KI-3**
**Shoreline Area North of the Kingston Ferry Terminal**

**Figure KI-4**
**Shoreline Area South of the Kingston Ferry Terminal**

*Salt/Freshwater Mixing*

Four streams draining into Appletree Cove contribute freshwater in the vicinity of the terminal.

*Flows and Currents*

According to Ecology's report on *Net Shore-Drift in Washington State* (Ecology 1991), the net littoral drift along the drift cell (approximately 1 mile in length) north of the

Kingston Ferry Terminal is towards the south. This southerly sediment transport, however, is small and it settles offshore in deeper, more quiescent areas.

According to Ecology's report (Ecology 1991), the net sediment drift in the littoral cell south of the Kingston Ferry Terminal is to the northwest, ending in Appletree Cove. This sediment does not move farther north (clockwise) into the terminal area. Evidence of this is the fact that maintenance dredging of the entrance channel to the marina has not been required since original dredging of the channel in 1967. This strongly suggests that sediment drifting northward is deposited in the cove and does not travel across the marina entrance channel into the terminal area.

#### 4.10.1.2 *Chemical Indicators*

*Water Quality*

The marine waters near the terminal (Appletree Cove) are designated "Extraordinary" for aquatic use. Impaired waters listings in the terminal area include dissolved oxygen, bacteria, and temperature (water) (Ecology 2018).

*Sediment Quality*

Impaired waters listings in the terminal area include organics (sediment – 8 parameters) (Ecology 2018).

#### 4.10.1.3 *Biological Indicators*

*Shoreline Vegetation*

There is some shoreline vegetation (shrubs) adjacent to the holding lanes, north of the terminal, above the riprap. A wide shrub and forested area occurs farther north of the terminal along the shoreline.

*Macroalgae and Eelgrass*

A variety of red, green, and brown macroalgae occurs in the vicinity of the terminal including rockweed, Turkish towel, sugar wrack, bull kelp, and sea lettuce. Eelgrass occurs northeast and southwest of the terminal. Eelgrass northeast of the terminal is much more abundant than the small, sparse patches of eelgrass southwest of the terminal.

*Epibenthos, Macrofauna, Fish, and Marine Mammals*

Deeper intertidal substrates and the presence of eelgrass would support epibenthos. Macrofauna and fisheries resources observed in the area include Dungeness and red rock crab, cockles (*Clinocardium nuttallii*), nudibranchs (*Triopha catalinae*), anemone, pandalid shrimp, sea stars, kelp, greenling, rock sole, lingcod, starry flounder, a variety of flatfish, and sculpin. Subtidal geoduck beds and Dungeness crab areas are located in the vicinity of the terminal. The streams draining into Appletree Cove support chum and coho salmon and resident cutthroat. Harbor seals, California sea lion, Steller sea lion, and killer whale may occur in the area.

*Forage Fish*

There is no documented forage fish spawning present in the terminal area (WSDOT 2018a). No herring holding areas are located near the terminal.

### 4.10.2 Kingston Species Distributions

#### 4.10.2.1 Puget Sound Chinook Salmon (Oncorhynchus tshawytscha)

No Chinook salmon-bearing streams are located near the Kingston Ferry Terminal (WDFW 2007a). Salmon stocks that may be present in the ferry terminal area include runs originating from Dogfish Creek, a tributary to Liberty Bay (approximately 20 miles southwest, shoreline distance). Chinook are present in this stream in very limited numbers (Williams et al. 1975). The closest major rivers that support Chinook salmon include the Skagit River (approximately 37 shoreline miles north), Stillaguamish River (approximately 30 shoreline miles north), Snohomish River (approximately 22 miles north), Lake Washington/Cedar River (approximately 10 shoreline miles south), and the Duwamish/Green River (approximately 20 shoreline miles south). Chinook may also be present from rivers and streams in southern Puget Sound (WDFW 2007a).

*Adult and Sub-adult Chinook*

Adult Chinook salmon could be present in the ferry terminal area year-round in relatively low numbers. The highest abundance of adults in the ferry terminal area would occur during the summer and early fall as they return from the ocean to their home rivers.

Sub-adult Chinook have access to the terminal area and may be found there at any time of year. Sub-adults have spent a winter in the marine environment and are not closely oriented to the shoreline like juveniles.

*Juvenile Chinook*

Juveniles are likely to use portions of the shoreline during spring (March to June), although most should be located well offshore due to their size (greater than 70 mm) (WSF 1999). Beach seines conducted from April through September of 2001 and 2002 along the mainland of central Puget Sound from Golden Gardens to Picnic Point showed juvenile PS Chinook salmon first entered the area in mid-May with numbers peaking in mid-June and tapered off through August and September. The average fork length was approximately 85 mm for those juvenile Chinook caught in May and 130 mm for those caught in September (Duffy et al. 2005).

#### 4.10.2.2 *Puget Sound Chinook Salmon Critical Habitat*

The Kingston Ferry Terminal lies within Chinook Zone 14 (70 FR 52630). While there are no streams that support Chinook salmon near the ferry terminal, there are eelgrass beds in close proximity to the ferry terminal that may be used by juvenile Chinook for rearing.

The PCEs provided in the ferry terminal area, and their existing conditions, are listed in Table KI-1. PCEs relevant to the terminal area are numbered per the CFR (70 FR 52630).

## Table KI-1
## Existing Conditions of Chinook Salmon PCEs at the Kingston Ferry Terminal

| PCEs | Existing Conditions |
|---|---|
| 5) Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels. | **Obstructions**<br>In-water structures include the overhead loading, the trestles, the main and auxiliary slips, the tie-up slip, and dolphins. The existing ferry terminal may affect fish passage in the nearshore.<br><br>**Water Quality and Forage**<br>The marine waters of Appletree Cove near the ferry terminal are designated "Extraordinary" for aquatic life use. Impaired waters listings in the terminal area include dissolved oxygen, bacteria, and temperature (water) and organics (sediment – 8 parameters) (Ecology 2018).<br>The existing stormwater system at the ferry terminal consists of five drainage areas that drain to Appletree Cove. None of the runoff is treated.<br><br>The first drainage area drains the holding lanes, and consists of five catch basins on the west side of the holding lanes that discharge through an outfall to the immediate west of the terminal building.<br><br>The second drainage area drains the holding lanes further to the east of the first drainage area, and consists of a trench drain that flows through two catch basins to a line shared by four catch basins to the east of the trench drains. Some input from the Kingston and WSDOT systems connect to this area. All six catch basins discharge through an outfall south of the holding lanes.<br><br>The third drainage area consists of two catch basins, each with separate outfall. The first one drains the exit lane area, and the second drains the parking area off of the exit lanes.<br><br>The fourth drainage area drains the trestle, and consists of open drains spaced at 20 foot intervals along either side of the trestle that discharge directly to surface water.<br><br>The fifth drainage area consists of the transfer spans (typically 90 feet long by 24 feet wide that carry traffic between the trestle and ferry), which discharge by sheet flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Overwater coverage from the existing ferry terminal structures may reduce the production of aquatic invertebrates that are prey species to salmon. Deeper intertidal substrates and the presence of eelgrass indicate probable epibenthic production.<br><br>**Natural Cover**<br>Little shoreline vegetation exists adjacent to the holding lanes. A wide shrub and forested area occurs farther north of the terminal. Eelgrass is present primarily north of the ferry terminal, with sparse small patches to the southwest up to 600 feet offshore. Below -5 feet MLLW, macroalgae *Ulva*, *Sargassum*, *Iridaea,* and *Gracilaria* are present (McKenzie 1999).<br><br>There is no large overhanging wood vegetation. The existing conditions within the defined area of critical habitat consist of silty to coarse sand and fine gravel (WSF 1999). Some riprap and hardened shoreline are adjacent to the ferry terminal. Side channels do not occur in the ferry terminal area. |

| PCEs | Existing Conditions |
|---|---|
| 6) Offshore areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation. | The marine waters of Appletree Cove near the ferry terminal are designated “Extraordinary” for aquatic life use. Impaired waters listings in the terminal area include dissolved oxygen, bacteria, and temperature (water) and organics (sediment – 8 parameters) (Ecology 2018).<br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Offshore areas provide habitat for forage fish. |

#### 4.10.2.3 *Puget Sound Steelhead (Oncorhynchus mykiss)*

There are no natal streams in the area of the Kingston Ferry Terminal that support Puget Sound steelhead. Small drainages that support steelhead include Grovers Creek, a tributary to Miller Bay (approximately 9 shoreline miles southwest), and Dogfish Creek, a tributary to Liberty Bay (approximately 20 miles southwest, shoreline distance).

Major rivers that support winter and summer steelhead include the Stillaguamish River (approximately 30 shoreline miles northeast), Skagit River (approximately 37 shoreline miles northeast), the Snohomish River (approximately 22 shoreline miles northeast), and the Duwamish/Green River (approximately 19 miles southeast, shoreline distance). The Lake Washington/Cedar River (approximately 10 shoreline miles southeast) supports winter steelhead only.

In addition, numerous small streams in the Sinclair/Dyes Inlets (see Section 4.2 for more information), and southern Puget Sound rivers and streams support winter steelhead (WDFW 2007a).

Available data from tow-net sampling (deeper nearshore) and beach seine sampling (shallow nearshore) efforts around Puget Sound have reported the capture of few steelhead. In tow-net sampling in north and south Puget Sound, NMFS captured a total of 18 steelhead (Rice, unpublished data). The total sampling effort data was not available, but the mean steelhead catch ranged from 0 to 0.2 per net in north Puget Sound and 0.1 to 0.8 per net in south Puget Sound.

During 2001 and 2002, beach seining conducted in central Puget Sound by King County Department of Natural Resources captured only nine steelhead out of a total of approximately 34,000 juvenile salmonids. All the steelhead were caught between May and August and ranged in size from 141 to 462 mm with a mean size of 258 mm (Brennan et al. 2004).

#### 4.10.2.4 *Puget Sound Steelhead Critical Habitat*

The Kingston Ferry Terminal does not fall within designated steelhead critical habitat (Federal Register 2016a).

#### 4.10.2.5 *Humpback Whale (Megaptera novaeangliae)*

Humpback whales may be present near the Kingston ferry terminal. Critical habitat has not been designated for humpback whales. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.10.2.6 *Southern Resident Killer Whale (Orcinus orca)*

Southern Resident Killer Whale (SRKW) may be present near the Kingston ferry terminal. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### *4.10.2.7 Southern Resident Killer Whale Critical Habitat*

The Kingston Ferry Terminal lies within Area 2 – Puget Sound, considered to be used by killer whales for fall feeding. Areas with water less than 20 feet deep relative to the extreme high water mark are not included in the critical habitat designation (Federal Register 2006).

The PCEs provided in the ferry terminal area, and their existing conditions, are listed in Table KI-2. PCEs relevant to the terminal area are numbered per Federal Register 2006.

**Table KI-2**
**Existing Conditions of Southern Resident Killer Whale PCEs at the Kingston Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 1) Water quality to support growth and development | The marine waters of Appletree Cove near the ferry terminal are designated “Extraordinary” for aquatic life use. Impaired waters listings in the terminal area include dissolved oxygen, bacteria, and temperature (water) and organics (sediment – 8 parameters) (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of five drainage areas that drain to Appletree Cove. None of the runoff is treated.<br><br>The first drainage area drains the holding lanes, and consists of five catch basins on the west side of the holding lanes that discharge through an outfall to the immediate west of the terminal building.<br><br>The second drainage area drains the holding lanes further to the east of the first drainage area, and consists of a trench drain that flows through two catch basins to a line shared by four catch basins to the east of the trench drains. Some input from the Kingston and WSDOT systems connect to this area. All six catch basins discharge through an outfall south of the holding lanes.<br><br>The third drainage area consists of two catch basins, each with separate outfall. The first one drains the exit lane area, and the second drains the parking area off of the exit lanes.<br><br>The fourth drainage area drains the trestle, and consists of open drains spaced at 20 foot intervals along either side of the trestle that discharge directly to surface water.<br><br>The fifth drainage area consists of the transfer spans (typically 90 feet long by 24 feet wide that carry traffic between the trestle and ferry), which discharge by sheet flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column, degrading water quality in the terminal vicinity. |
| 2) Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth | Salmonids are the primary prey of SRKW, and may be present near the terminal. Further information on prey can be found in the Puget Sound Chinook section, and Appendix B – Species Biology. |
| 3) Passage conditions to allow for migration, resting, and foraging | Existing structures that occur below -20 feet in critical habitat include a segment of the overhead loading, the trestles, the main and auxiliary slips, the tie-up slip, and dolphins. |

#### 4.10.2.8 *Bull Trout (Salvelinus confluentus)*

There are no natal streams in the area of the Kingston Ferry Terminal that support bull trout (WDFW 2007a). The aquatic portions of the ferry terminal are within marine FMO habitat. Therefore, it is expected that the ferry terminal area would be used by anadromous adult and sub-adult bull trout for foraging, migration, and overwintering (USFWS 2004b). Within the ferry terminal area, it is expected that individual bull trout from the Skagit River (approximately 37 shoreline miles north), Stillaguamish River (approximately 30 shoreline miles north), Snohomish River (approximately 22 miles north), Lake Washington/Cedar River (approximately 10 shoreline miles south), the Duwamish/Green River (approximately 20 shoreline miles south), and the Puyallup River (approximately 43 shoreline miles south) are most likely to be present (WDFW 2007a).

#### 4.10.2.9 *Bull Trout Critical Habitat*

The shoreline of the Kingston Ferry Terminal is not within designated bull trout critical habitat (Federal Register 2010a).

#### 4.10.2.10 *Green Sturgeon (Acipenser medirostris)*

There are no natal streams in the area of the Kingston Ferry Terminal that support green sturgeon.

Observations of green sturgeon in Puget Sound are much less common compared to the coastal Washington estuaries and bays such as Willapa Bay, Grays Harbor, and the Lower Columbia River estuary (Federal Register 2018). In addition, Puget Sound does not appear to be part of the coastal migratory corridor that Southern DPS fish use to reach overwintering grounds north of Vancouver Island (Federal Register 2018).

NMFS reviewed green sturgeon acoustic detection data from 2002-2019 in Puget Sound and the Strait of Juan de Fuca. From 2002-2008, 350 tagged green sturgeon were at large (67% from the threatened southern DPS). During this time, 17 were detected in Puget Sound (4 from the southern DPS). After 2008, none were detected in central or southern Puget Sound, though 400 were at large (83% southern DPS). From 2013-2018, six (one from the southern DPS) were detected in Admiralty Inlet (northern Puget Sound).

From 2004-2019, 210 green sturgeon were detected in the Strait of Juan de Fuca (71% southern DPS). This indicates that the strait is used as a corridor, with green sturgeon residing at detection sites for short periods as they pass through from open ocean. Few of these fish were detected afterwards in Admiralty Inlet, suggesting

that most of the tagged population move northward into the Strait of Georgia after transiting the strait. Data indicates conclusively that green sturgeon from the southern DPS occur in Puget Sound and Admiralty inlet, but at low rates compared to Strait of Juan de Fuca presence. This confirms earlier findings that Puget Sound is of lower conservation value to southern DPS green sturgeon. However, it is noted that the tagged population is a small fraction of the whole green sturgeon population, and that conditions need to be optimum for acoustic detection to occur (Moser, et. al. 2021).

#### 4.10.2.11 *Green Sturgeon Critical Habitat*

The Kingston Ferry Terminal does not fall within designated green sturgeon critical habitat (Federal Register 2009).

#### 4.10.2.12 *Marbled Murrelet (Brachyramphus marmoratus)*

The Kingston terminal area provides suitable marbled murrelet marine foraging habitat.

There is no documented forage fish spawning present at the terminal (WSDOT 2018a).

WDFW density surveys were not conducted in the terminal area (WDFW 2016). The nearest documented marbled murrelet nesting site is located 42 miles SW of the terminal (WSDOT 2018b).

The Northwest Forest Plan Marbled Murrelet Effectiveness Monitoring Program (2012) identified habitat suitability throughout the range of the species, and ranked it as Zero, Low, Marginal, Moderately High and Highest. The Kingston murrelet habitat suitability within the pile driving/heavy equipment zone of potential effect (0.25 miles), is Zero (WSDOT 2019b).

There are no coniferous forest that may offer nesting opportunity within the pile driving /heavy equipment zone of potential effect (0.25 miles) (WSDOT 2014/2018c).

Ferry traffic creates regular disturbance in the immediate terminal area. From July 2017 to June 2018, there were approximately 17,210 scheduled arrivals and departures from the terminal. During the nesting season (April 1-September 23), when foraging murrelet are more active, there were approximately 8,630 scheduled arrivals and departures (WSDOT 2018d).

#### 4.10.2.13 *Marbled Murrelet Critical Habitat*

No marbled murrelet critical habitat has been designated near the terminal (USFWS 1996).

#### 4.10.2.14 *Rockfish Species*

*Bocaccio*

Bocaccio are rarely caught in north Puget Sound and only sparse records exist for the Strait of Georgia (Federal Register 2010b). Because larvae are widely dispersed, it is possible that bocaccio juveniles could be found near the Kingston Ferry Terminal at any time of year. Adult bocaccio generally move to very deep water. The waters within Appletree Cove are shallow, less than 40 feet deep. Outside the cove, the bottom drops off steeply to about 100 feet deep, and 150 feet deep in the main channel south of the terminal (NMFS 2009).

*Yelloweye Rockfish*

Yelloweye rockfish are more closely aligned with rocky, high-relief substrates than with very deep water (Federal Register 2010bFederal Register 2010b). The waters near the Kingston Ferry Terminal do not have the rocky substrates preferred by yelloweye.

#### 4.10.2.15 *Rockfish Species Critical Habitat*

The Kingston Ferry Terminal is within rockfish nearshore critical habitat (less than or equal to 98 feet in depth) (Federal Register 2014). The physical and biological features (PBFs) (Federal Register 2014) essential to the conservation of juvenile Bocaccio rockfish are listed in Table KI-3. PBFs relevant to the terminal area are numbered per the CFR (Federal Register 2014). These PBFs are specific to nearshore environments, where only juvenile Bocaccio rockfish could be found. Deepwater (>

98 feet in depth) PBFs exist for adult Bocaccio, and adult and juvenile yelloweye rockfish; however, this habitat is not present at the Kingston Ferry Terminal and will not be discussed here.

**Table KI-3**
**Existing Conditions of Rockfish PBFs at the Kingston Ferry Terminal**

| PBFs | Existing Conditions |
| --- | --- |
| 1) Quantity, quality, and availability of prey species to support individual growth, survivial, reproduction, and feeding opportunities. | The marine waters of Appletree Cove near the ferry terminal are designated "Extraordinary" for aquatic life use. Impaired waters listings in the terminal area include dissolved oxygen, bacteria, and temperature (water) and organics (sediment – 8 parameters) (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of five drainage areas that drain to Appletree Cove. None of the runoff is treated.<br><br>The first drainage area drains the holding lanes, and consists of five catch basins on the west side of the holding lanes that discharge through an outfall to the immediate west of the terminal building.<br><br>The second drainage area drains the holding lanes further to the east of the first drainage area, and consists of a trench drain that flows through two catch basins to a line shared by four catch basins to the east of the trench drains. Some input from the Kingston and WSDOT systems connect to this area. All six catch basins discharge through an outfall south of the holding lanes.<br><br>The third drainage area consists of two catch basins, each with separate outfall. The first one drains the exit lane area, and the second drains the parking area off of the exit lanes.<br><br>The fourth drainage area drains the trestle, and consists of open drains spaced at 20 foot intervals along either side of the trestle that discharge directly to surface water.<br><br>The fifth drainage area consists of the transfer spans (typically 90 feet long by 24 feet wide that carry traffic between the trestle and ferry), which discharge by sheet flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Overwater coverage from the existing ferry terminal structures may reduce the production of aquatic invertebrates that are prey species to salmon. Deeper intertidal substrates and the presence of eelgrass indicate probable epibenthic production. |
| 2) Water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities. | Little shoreline vegetation exists adjacent to the holding lanes. A wide shrub and forested area occurs farther north of the terminal. Eelgrass is present primarily north of the ferry terminal, with sparse small patches to the southwest up to 600 feet offshore. Below -5 feet MLLW, macroalgae *Ulva*, *Sargassum*, *Iridaea,* and *Gracilaria* are present (McKenzie 1999).<br><br>There is no large overhanging wood vegetation. The existing conditions within the defined area of critical habitat consist of silty to coarse sand and fine gravel (WSF 1999). Some riprap and hardened shoreline are adjacent to the ferry terminal. Side channels do not occur in the ferry terminal area.There is no large overhanging wood vegetation present to provide a food base from terrestrial organisms. The existing conditions consist of sand and silt below MLLW, with shell fragments in offshore areas and gravel, cobble, and sand above MLLW within the defined area of critical habitat. Some riprap and hardened shoreline are adjacent to the ferry terminal. |

#### 4.10.2.16 *Pacific Eulachon (Thaleichthys pacificus)*

The Kingston Ferry Terminal is distant from any of the known eulachon spawning rivers. It is highly unlikely that eulachon will be present at the Kingston Ferry Terminal.

#### 4.10.2.17 *Pacific Eulachon Critical Habitat*

No Pacific eulachon critical habitat has been designated near the Kingston Ferry Terminal (FEDERAL REGISTER 2011).

# LOPEZ ISLAND


**NOTE:** Base map prepared from Terrain Navigator Pro
USGS 7.5 minute quadrangle map(s) of Blakley Island and Shaw Island, Washington.

| Section | Township | Range | Lat | Long | County |
|---|---|---|---|---|---|
| 36 | 36N | 2W | 48º 34′ 13″ N | 122º, 51′ 35″ W | San Juan |
| HUC 171100030801 | | | WRIA 2 | | |

0 1
Scale in Miles

**Figure LO-1**
Lopez Island Ferry Terminal Vicinity Map
WSF Biological Assessment Reference
Lopez Island, Washington

## Figure LO-1
## Lopez Ferry Terminal Vicinity Map

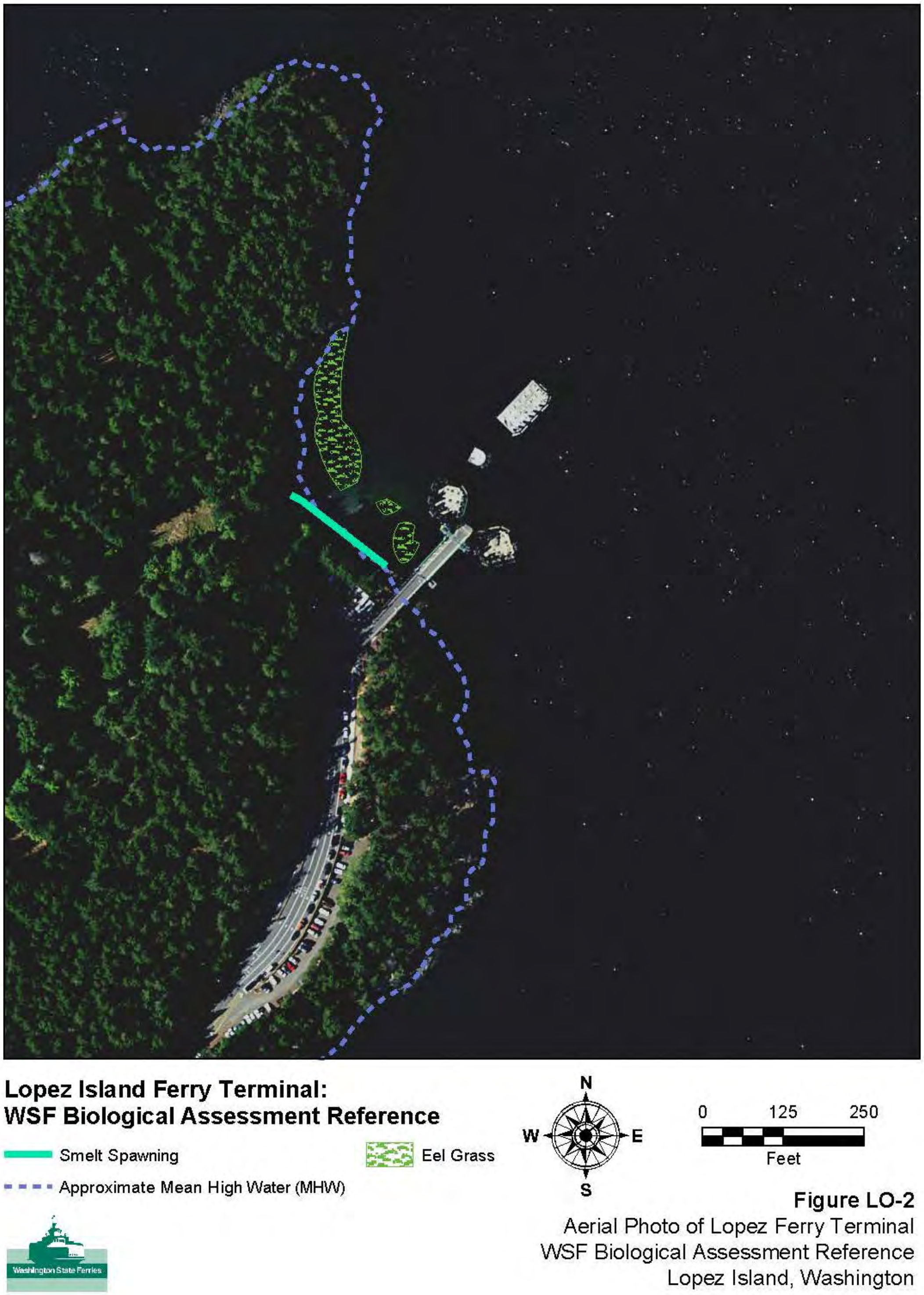



**Figure LO-2**
**Aerial Photo of Lopez Ferry Terminal**

## 4.11 Lopez Island Ferry Terminal

The Lopez Island Ferry Terminal is located near the northern tip of Lopez Island, at the confluence of Upright and Harney Channels (see Figures LO-1 and LO-2).

The Lopez Island Ferry Terminal provides service to the Anacortes and San Juan inter-island terminals (Lopez, Shaw, Orcas, and Friday Harbor).

Features of the terminal include a terminal building, four vehicle holding lanes that accommodate up to 88 vehicles, and roadside vehicle handling. The terminal has one slip with a floating concrete wingwall. Two dolphins are associated with the terminal, one steel and one concrete floating dolphin. One small parking lot is associated with the terminal. No overhead passenger loading facilities exist at the terminal.

### *4.11.1 Lopez Environmental Baseline*

#### 4.11.1.1 *Physical Indicators*

*Substrate and Slope*

The substrate layer is thin and overlays a foundation of bedrock. Substrate consists of fine to coarse sand close to shore, giving way to mud overlying bare bedrock and boulders within the ferry slip. The bottom drops off quickly to deep water, with depths up to 90 feet at the outer dolphins. Offshore depths (feet MLLW) of terminal structures are: head of slip (-35.5). Maximum depth (feet MLLW) for fixed dolphins is -46.5 and for the floating dolphin -77.0. See Figure LO-3 for a picture of the shoreline area at the ferry terminal.

**Figure LO-3**
**Shoreline Area at the Lopez Island Ferry Terminal**

*Salt/Freshwater Mixing*

There are no significant freshwater drainages near the Lopez Island Ferry Terminal. A small stream drains into Shoal Bay, 1.25 miles southeast of the ferry terminal.

*Flows and Currents*

Strong currents, deep channels, and tidal mixing influence the open marine waters of the San Juan Islands.

#### 4.11.1.2 *Chemical Indicators*

*Water Quality*

The marine waters of Harney Channel are designated "Extraordinary" for aquatic life use. Impaired waters listings in the terminal area include dissolved oxygen (water) and 4-methylphenol (sediment) (Ecology 2018).

*Sediment Quality*

The area surrounding the Lopez Island Ferry Terminal is rural in character. There are no known sources of industrial contamination or other sources of hazardous waste.

Impaired waters listings in the terminal area include 4-methylphenol (sediment) (Ecology 2018).

#### 4.11.1.3 *Biological Indicators*

*Shoreline Vegetation*

The shoreline is steep and rocky with a small, sandy stretch of beach adjacent to the terminal. The area is heavily forested and dominated by Douglas fir.

*Macroalgae and Eelgrass*

An eelgrass and macroalgae survey was conducted in August 2004 (Anchor 2004b). No eelgrass was found in the area, which was expected given the deep water and rocky substrate conditions at the site. The macroalgae in depths from -20 feet MLLW to -58 feet MLLW (see Figure LO-2) was generally sparse and very short, growing to lengths of 6 inches or less. *Palmaria* spp. was the most widespread macroalgae identified in the area, although the percent coverage was typically less than 25 percent. Approximately 25 feet from the existing inner dolphin was the only location where *Palmaria* spp. coverage was as high as 50 percent. At this inshore margin, one stipe of *Nereocystis leutkeana* and small percentages of *Alaria marginata* (10 percent) and *Sarcodiotheca* spp. (5 percent) were found. Coralline red algae, a fine red algae, and bryozoans were also commonly found in small percentages (less than 10 percent) near the floating dolphins. *Laminaria saccharina* was infrequently observed in this area and only in small percentages (less than 10 percent).

*Epibenthos, Macrofauna, Fish, and Marine Mammals*

Portions of the nearshore environment (e.g., sandy stretch adjacent to the terminal) contain substrates likely to support epibenthic production. Macrofauna in the area include numerous sea star and fish species. The sunflower star, mottled star (*Evasterias troschellii)*, and ochre star *(Pisaster ochraceous)* are the most abundant sea stars. Small sculpins, red Irish lords (*Hemilepidotus hemilepidotus*), and juvenile lingcod were the most commonly observed fish. Additional species include horse clams, cockles, Dungeness crab, coonstripe shrimp (*Pandalus danae*), and California sea cucumber (*Parastichopus californicus*) (Anchor 2004b). A geoduck clam bed lies 0.75 mile east of the ferry terminal.

Marine mammals likely to occur in the area include killer whale, harbor seal, Steller sea lion, California sea lion, harbor porpoise, and Dall's porpoise. During a preservation project in fall 2006, harbor seals were regularly sighted off Upright Head and on Shag Rock approximately 1.5 miles northeast of the terminal.

*Forage Fish*

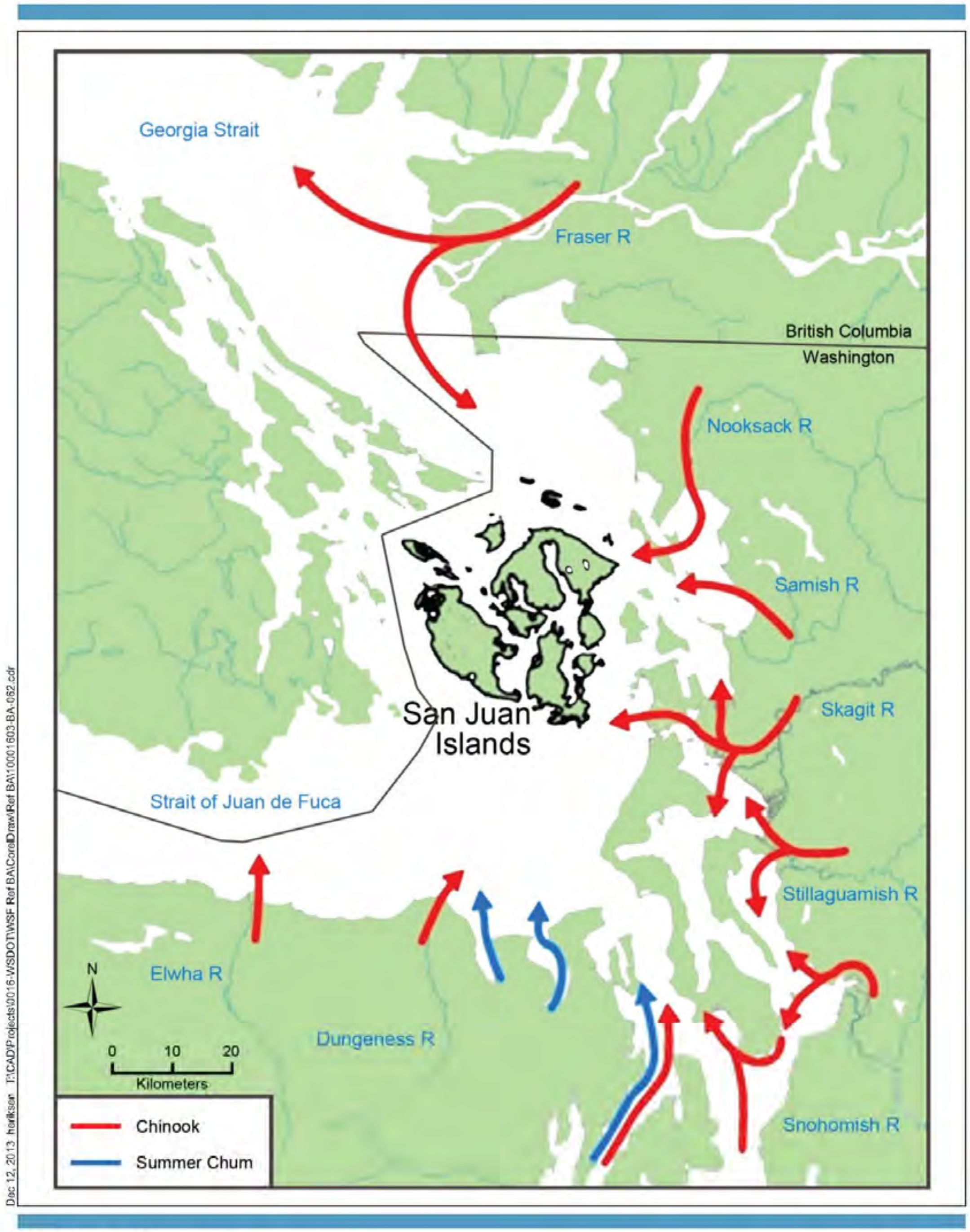
Documented surf smelt spawning is present (see Figure LO-2), extending approximately 110 feet to the northwest (WSDOT 2018a). A large herring holding area exists about 0.25 mile northeast of the ferry terminal in open water.

**Figure LO-4**
**Surf Smelt Spawning Beach just Northwest of the Lopez Island Ferry Terminal**

### *4.11.2 Lopez Species Distributions*

#### 4.11.2.1 *Puget Sound Chinook Salmon (Oncorhynchus tshawytscha)*

No Chinook salmon-bearing streams are located near the Lopez Island Ferry Terminal (WDFW 2007a). However, several major river systems that support Chinook salmon, including the Nooksack River (approximately 23 miles northeast), Samish River (approximately 24 miles east), Skagit River (approximately 25 miles southeast), and Stillaguamish River (approximately 34 miles southeast) occur in this area of the Puget Sound. Chinook may also be present from rivers and streams in central and southern Puget Sound (WDFW 2007a). The results of beach seine sampling completed from March to October in 2008 and 2009 indicate that juvenile Chinook salmon arrive in the San Juan Islands by April, peak in the month of June, remain relatively high in shoreline areas during summer months, and are present through October. Chinook may be present from numerous river systems, as shown in Figure LO-5 (SRSC and NOAA 2012).




SOURCE: SRSC/NOAA Fisheries 2012.

**Figure LO-5**
Migratory Pathways for Juvenile Salmon from
Source Population Rivers to the San Juan Islands Area
WSF Biological Assessment Reference
Lopez Island, Washington

**Figure LO-5**
**Migratory Pathways for Juvenile Salmon from Source Population Rivers to the San Juan Islands Area**

### Adult and Sub-adult Chinook

The watersheds of the San Juan Islands are not large enough to support sustainable wild Chinook salmon populations (Sanford, personal communication 2002). A hatchery exists on Orcas Island. However, the marine environment of northern Puget Sound is a migratory corridor for adults. Adult Chinook salmon collected in the waters around the San Juan archipelago are usually Puget Sound or Fraser River populations (Sanford, personal communication 2002). WDFW micro-tag data analyzed from 1985 showed five Chinook salmon stocks have been identified in the San Juan region (Moulton, personal communication 2001).

Sub-adults have spent a winter in the marine environment and are not closely oriented to the shoreline like juveniles. The marine waters of the San Juan Islands provide habitat for outmigrating sub-yearling Chinook salmon from rivers into Puget Sound before their eventual oceanic phase as adults.

### Juvenile Chinook

Chinook salmon do not spawn in the San Juan archipelago (Otis, personal communication 2000). Juveniles that could occur near the ferry terminal are likely of hatchery origin or have crossed open water to reach the San Juan Islands. Juvenile Chinook salmon habitat in the ferry terminal area includes the open water (pelagic zones) of the San Juan Islands and the nearshore and intertidal zones in the San Juan Islands, particularly areas supporting eelgrass and macroalgae.

## 4.11.2.2 Puget Sound Chinook Salmon Critical Habitat

The Lopez Island Ferry Terminal lies within Chinook Zone 2 (FR 5263070 FR 52630). While there are no streams that support Chinook salmon near the ferry terminal, there are eelgrass beds in close proximity to the ferry terminal that may be used by juvenile Chinook for rearing.

The PCEs provided in the ferry terminal area, and their existing conditions, are listed in Table LO-1. PCEs relevant to the terminal area are numbered per FR 5263070 FR 52630.

**Table LO-1**
**Existing Conditions of Chinook Salmon PCEs at the Lopez Island Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 5) Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels. | **Obstructions**<br>In-water structures include the trestle, the slip, and dolphins. The ferry terminal may affect fish passage in the nearshore.<br><br>**Water Quality and Forage**<br>The marine waters of Harney Channel are designated "Extraordinary" for aquatic life use. Impaired waters listings in the terminal area include dissolved oxygen (water) and 4-methylphenol (sediment) (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of three drainage areas that drain to Upright Channel. None of the runoff is treated.<br><br>The first drainage area drains the forested wetland slope above the terminal area, and consists of a pond and a French drain that flows to a catch basin that is connected to the second drainage area.<br><br>The second drainage area drains the upper and lower drop-off and holding area, and consists of seven catch basins and a swale that discharge through one of two outfalls on either side of the trestle.<br><br>The third drainage area consists of the transfer span (typically 90 feet long by 24 feet wide that carries traffic between the trestle and ferry), which discharges by sheet flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Overwater coverage from the existing ferry terminal structures may reduce the production of aquatic invertebrates that are prey species to salmon. The substrates in the area are thin, overlying bedrock. A sandy area near the terminal contains substrates likely to support epibenthos.<br><br>Documented surf smelt spawning is present (see Figure LO-2), extending approximately 110 feet to the northwest (WSDOT 2018a). A large herring holding area exists about 0.25 mile northeast of the ferry terminal in open water.<br><br>**Natural Cover**<br>The area is heavily forested above a steep and rocky shoreline. No eelgrass beds are present near the ferry terminal. Macroalgae growing in the area is generally sparse and dominated by *Palmaria* spp, with smaller patches of *Nereocystis leutkeana*, *Alaria marginata, Sarcodiotheca* spp. Coralline red algae, and *Laminaria saccharina* (Anchor 2004b).<br><br>There is some large overhanging wood vegetation. The shoreline is steep and rocky with a small sandy stretch of beach adjacent to the ferry terminal. The area is heavily forested and dominated by Douglas fir. The existing conditions within the defined area of critical habitat consist of a thin substrate layer that overlays a foundation of bedrock. Substrate consists of fine to coarse sand close to shore, giving way to mud overlying bare bedrock and boulders within the ferry slip (Anchor 2005b). Side channels do not occur in the ferry terminal area. |
| 6) Offshore areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation. | The marine waters of Harney Channel are designated "Extraordinary" for aquatic life use. Impaired waters listings in the terminal area include dissolved oxygen (water) and 4-methylphenol (sediment) (Ecology 2018).<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Offshore areas provide habitat for forage fish. |

#### 4.11.2.3 *Puget Sound Steelhead (Oncorhynchus mykiss)*

There are no natal streams in the area of the Lopez Island Ferry Terminal that support Puget Sound steelhead. However, major river systems that support winter and summer steelhead include the Nooksack River (approximately 23 miles northeast), Skagit River (approximately 25 miles southeast), and Stillaguamish River (approximately 34 miles southeast). The Samish River (approximately 24 miles southeast) supports winter steelhead only. Steelhead may also be present from rivers and streams in central and southern Puget Sound (WDFW 2007a).

Available data from tow-net sampling (deeper nearshore) and beach seine sampling (shallow nearshore) efforts around Puget Sound have reported the capture of few steelhead. In tow-net sampling in north and south Puget Sound, NMFS captured a total of 18 steelhead (Rice, unpublished data). The total sampling effort data was not available, but the mean steelhead catch ranged from 0 to 0.2 per net in north Puget Sound and 0.1 to 0.8 per net in south Puget Sound.

Beach seine sampling in Bellingham Bay (north Puget Sound) also captured few steelhead (Lummi Nation, unpublished data). The Bellingham Bay research reported the capture of two juvenile steelhead salmon in 336 sets between February 14 and December 1, 2003. The steelhead were captured in the eastern portion of Bellingham Bay near the Taylor Avenue Dock on June 12 and June 25, 2003.

#### 4.11.2.4 *Puget Sound Steelhead Critical Habitat*

The Lopez Island Ferry Terminal does not fall within designated steelhead critical habitat (Federal Register 2016a).

#### 4.11.2.5 *Humpback Whale (Megaptera novaeangliae)*

Humpback whale may be present near the Lopez ferry terminal. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.11.2.6 *Southern Resident Killer Whale (Orcinus orca)*

Southern Resident Killer Whale (SRKW) may be present near the Lopez ferry terminal. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.11.2.7 *Southern Resident Killer Whale Critical Habitat*

The Lopez Island Ferry Terminal area lies within designated critical habitat (Area 1 – Core Summer Area). Areas with water less than 20 feet deep relative to the extreme high water mark are not included in the critical habitat designation (Federal Register 2006).

The PCEs provided in the terminal area, and their existing conditions are listed in Table LO-2. PCEs relevant to the terminal area are numbered per Federal Register 2006.

**Table LO-2**
**Existing Conditions of Southern Resident Killer Whale PCEs at the Lopez Island Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 1) Water quality to support growth and development | The marine waters of Harney Channel are designated "Extraordinary" for aquatic life use. Impaired waters listings in the terminal area include dissolved oxygen (water) and 4-methylphenol (sediment) (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of three drainage areas that drain to Upright Channel. None of the runoff is treated.<br><br>The first drainage area drains the forested wetland slope above the terminal area, and consists of a pond and a French drain that flows to a catch basin that is connected to the second drainage area.<br><br>The second drainage area drains the upper and lower drop-off and holding area, and consists of seven catch basins and a swale that discharge through one of two outfalls on either side of the trestle.<br><br>The third drainage area consists of the transfer span (typically 90 feet long by 24 feet wide that carries traffic between the trestle and ferry), which discharges by sheet flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column, degrading water quality in the terminal vicinity. |
| 2) Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth | Salmonids are the primary prey of SRKW, and may be present near the terminal. Further information on prey can be found in the Puget Sound Chinook section, and Appendix B – Species Biology. |
| 3) Passage conditions to allow for migration, resting, and foraging | Existing structures that occur below -20 feet in critical habitat include the trestle, the slip, and dolphins. |

#### 4.11.2.8 *Bull Trout (Salvelinus confluentus)*

There are no natal streams in the area of the Lopez Island Ferry Terminal that support bull trout (WDFW 2007a).

The aquatic portions of the ferry terminal are within marine FMO habitat. While bull trout have not been documented in the ferry terminal area, suitable FMO habitat is present, and bull trout are thought to occur throughout south, central, and northern Puget Sound. Therefore, it is expected that the ferry terminal area would be used by anadromous adult and sub-adult bull trout for foraging, migration, and overwintering (USFWS 2004b). Within the ferry terminal area, it is expected that individual bull trout from the Nooksack River (approximately 23 miles northeast), Samish River (approximately 24 miles southeast), Skagit River (approximately 25 miles southeast), and Stillaguamish River (approximately 34 miles southeast) may be present. Bull trout may also be present from rivers and streams in central and southern Puget Sound (WDFW 2007a).

#### 4.11.2.9 *Bull Trout Critical Habitat*

The Lopez Island Ferry Terminal does not fall within designated bull trout critical habitat per Federal Register 2010a.

#### 4.11.2.10 *Green Sturgeon (Acipenser medirostris)*

There are no natal streams in the area of the Lopez Island Ferry Terminal that support green sturgeon.

Observations of green sturgeon in Puget Sound are much less common compared to the coastal Washington estuaries and bays such as Willapa Bay, Grays Harbor, and the Lower Columbia River estuary (Federal Register 2018). In addition, Puget Sound does not appear to be part of the coastal migratory corridor that Southern DPS fish use to reach overwintering grounds north of Vancouver Island (Federal Register 2018).

NMFS reviewed green sturgeon acoustic detection data from 2002-2019 in Puget Sound and the Strait of Juan de Fuca. From 2002-2008, 350 tagged green sturgeon were at large (67% from the threatened southern DPS). During this time, 17 were detected in Puget Sound (4 from the southern DPS). After 2008, none were detected in central or southern Puget Sound, though 400 were at large (83% southern DPS). From 2013-2018, six (one from the southern DPS) were detected in Admiralty Inlet (northern Puget Sound).

From 2004-2019, 210 green sturgeon were detected in the Strait of Juan de Fuca (71% southern DPS). This indicates that the strait is used as a corridor, with green sturgeon residing at detection sites for short periods as they pass through from open ocean. Few of these fish were detected afterwards in Admiralty Inlet, suggesting that most of the tagged population move northward into the Strait of Georgia after transiting the strait. Data indicates conclusively that green sturgeon from the southern DPS occur in Puget Sound and Admiralty inlet, but at low rates compared to Strait of Juan de Fuca presence. This confirms earlier findings that Puget Sound is of lower conservation value to southern DPS green sturgeon. However, it is noted that the tagged population is a small fraction of the whole green sturgeon population, and that conditions need to be optimum for acoustic detection to occur (Moser, et. al. 2021).

#### 4.11.2.11 *Green Sturgeon Critical Habitat*

The Lopez Island Ferry Terminal does not fall within designated green sturgeon critical habitat (Federal Register 2009).

#### 4.11.2.12 *Marbled Murrelet (Brachyramphus marmoratus)*

The Lopez terminal area provides suitable marbled murrelet marine foraging habitat.

Documented surf smelt (prey species) spawning is present (see Figure LO-2), extending approximately 110 ft. NW of the terminal (WSDOT 2018a). A large herring holding area exists about 0.25 mile northeast of the terminal in open water.

WDFW surveys conducted from 2001 to 2012 show a density of less than 1 bird per square kilometer in the terminal area (WDFW 2016). The nearest documented marbled murrelet nesting site is located 42 miles SW of the terminal (WSDOT 2018b).

The Northwest Forest Plan Marbled Murrelet Effectiveness Monitoring Program (2012) identified habitat suitability throughout the range of the species, and ranked it as Zero, Low, Marginal, Moderately High and Highest. The Lopez murrelet habitat suitability within the pile driving/heavy equipment zone of potential effect (0.25 miles), ranges from Zero to High (WSDOT 2019b).

Five acres of contiguous coniferous forest that may offer nesting opportunity is present within the pile driving/heavy equipment zone of potential effect (0.25 miles) (WSDOT 2014/2018c). The 0.25 mile Zone of potential effect is discussed in Section 3.4.

Ferry traffic creates regular disturbance in the immediate terminal area. From July 2017 to June 2018, there were approximately 5,980 scheduled arrivals and departures from the terminal. During the nesting season (April 1-September 23), when foraging murrelet are more active, there were approximately 2,910 scheduled arrivals and departures (WSDOT 2018d).

The marbled murrelet population in the San Juan Islands increases in late July. This increase may be the result of British Columbia birds migrating after the breeding season. In late fall/early winter, up to 26 percent of the total marbled murrelets observed in the San Juan Islands are found northwest of Shaw Island near Crane Island, the Wasp Island complex, and the southwestern shoreline of Orcas Island (approximately 1 mile from the Lopez Island Ferry Terminal). (Evans Mack 2002).

#### 4.11.2.13 *Marbled Murrelet Critical Habitat*

No marbled murrelet critical habitat has been designated near the terminal (USFW 1996).

#### 4.11.2.14 *Rockfish Species*

*Bocaccio*

Bocaccio are rarely caught in north Puget Sound and only sparse records exist for the Strait of Georgia (Federal Register 2010b). The water around Lopez Island is shallow (generally less than 30 feet deep), and remains fairly shallow through all the surrounding channels between islands (NMFS 2009). Substrates are rocky throughout the area. This area may be occupied by all life stages of bocaccio.

*Yelloweye Rockfish*

Yelloweye rockfish are more closely aligned with rocky, high-relief substrates than with very deep water (Federal Register 2010b). The area surrounding the San Juan Islands offers this rocky substrate. Yelloweye larvae and juveniles could be present at Lopez Island; adults would be found in the channels beyond the harbor.

#### 4.11.2.15 *Rockfish Species Critical Habitat*

The Lopez Island Ferry Terminal is within rockfish nearshore critical habitat (less than or equal to 98 feet in depth) (Federal Register 2014). The physical and biological features (PBFs) (Federal Register 2014) essential to the conservation of juvenile Bocaccio rockfish are listed in Table LO-3. PBFs relevant to the terminal area are numbered per the CFR (Federal Register 2014). These PBFs are specific to nearshore environments, where only juvenile Bocaccio rockfish could be found. Deepwater (> 98 feet in depth) PBFs exist for adult Bocaccio, and adult and juvenile yelloweye rockfish; however, this habitat is not present at the Lopez Island Ferry Terminal and will not be discussed here.

**Table LO-3**
**Existing Conditions of Rockfish PBFs at the Lopez Island Ferry Terminal**

| PBFs | Existing Conditions |
|---|---|
| 1) Quantity, quality, and availability of prey species to support individual growth, survivial, reproduction, and feeding opportunities. | The marine waters of Harney Channel are designated "Extraordinary" for aquatic life use. Impaired waters listings in the terminal area include dissolved oxygen (water) and 4-methylphenol (sediment) (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of three drainage areas that drain to Upright Channel. None of the runoff is treated.<br><br>The first drainage area drains the forested wetland slope above the terminal area, and consists of a pond and a French drain that flows to a catch basin that is connected to the second drainage area.<br><br>The second drainage area drains the upper and lower drop-off and holding area, and consists of seven catch basins and a swale that discharge through one of two outfalls on either side of the trestle.<br><br>The third drainage area consists of the transfer span (typically 90 feet long by 24 feet wide that carries traffic between the trestle and ferry), which discharges by sheet flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Overwater coverage from the existing ferry terminal structures may reduce the production of aquatic invertebrates that are prey species to salmon. The substrates in the area are thin, overlying bedrock. A sandy area near the terminal contains substrates likely to support epibenthos.<br><br>Documented surf smelt spawning is present (see Figure LO-2), extending approximately 110 feet to the northwest (WSDOT 2018a). A large herring holding area exists about 0.25 mile northeast of the ferry terminal in open water. |
| 2) Water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities. | The area is heavily forested above a steep and rocky shoreline. No eelgrass beds are present near the ferry terminal. Macroalgae growing in the area is generally sparse and dominated by *Palmaria* spp, with smaller patches of *Nereocystis leutkeana*, *Alaria marginata, Sarcodiotheca* spp. Coralline red algae, and *Laminaria saccharina* (Anchor 2004b).<br><br>There is some large overhanging wood vegetation. The shoreline is steep and rocky with a small sandy stretch of beach adjacent to the ferry terminal. The area is heavily forested and dominated by Douglas fir. The existing conditions within the defined area of critical habitat consist of a thin substrate layer that overlays a foundation of bedrock. Substrate consists of fine to coarse sand close to shore, giving way to mud overlying bare bedrock and boulders within the ferry slip (Anchor 2005b). Side channels do not occur in the ferry terminal area. |

#### 4.11.2.16 *Pacific Eulachon (Thaleichthys pacificus)*

The Lopez Island Ferry Terminal is approximately 39 shoreline miles from the Fraser River, a confirmed spawning river. Eulachon use the Strait of Juan de Fuca as a migration corridor, so it is possible that eulachon might be present at the Lopez Island Ferry Terminal.

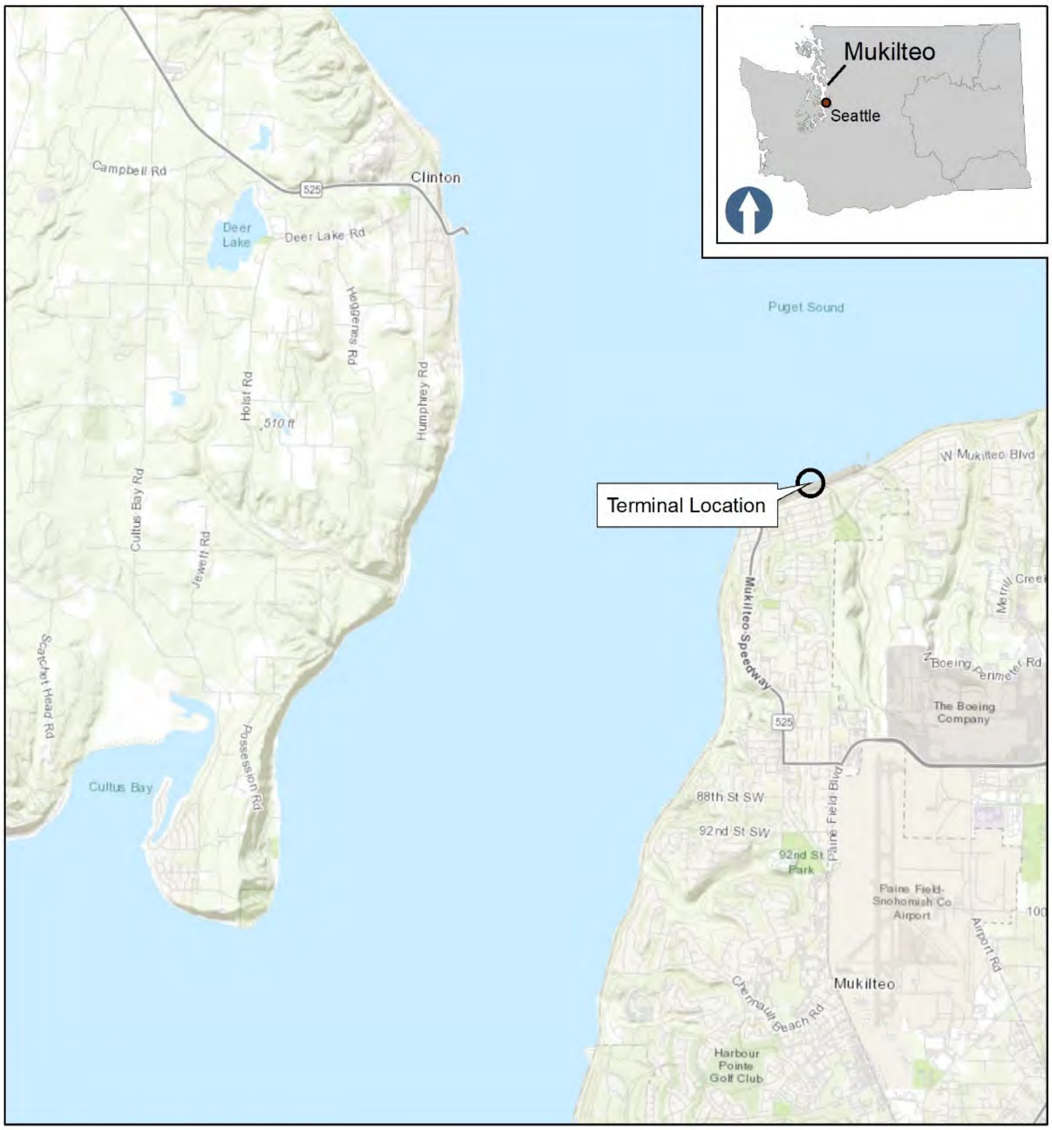
A monthly bottom trawl study was funded by Fisheries and Oceans Canada's National Rotational Survey Fund from October 2017 to June 2018 to sample Eulachon in three regional strata in Juan de Fuca Strait and the Strait of Georgia. The goal of this study was to gain insights into the biology, distribution, and migration timing of Eulachon to the Fraser River by observing their spatial and temporal occurrence and biological condition over a wide survey region and over a series of months. Eulachon catch per unit effort (CPUE), size distributions, sex ratios, and maturity observations varied over time and space, as did the occurrence of stomach contents and presence/absence of teeth. Highest catches of Eulachon occurred in Juan de Fuca and lowest near the Fraser River. Mean catch rates at sites near the Fraser River plume corresponded with expected peak spawning periods in the Fraser River. The sex ratio of Eulachon sampled throughout the study region in all months was approximately 1:1 although most samples in the Strait of Georgia in May and June were female. The presence of Eulachon with maturing gonads increased in frequency from west to east in January to April before sharply decreasing throughout the survey region in May and June. Stomach contents and teeth decreased in frequency with proximity to the Fraser River.

Trends in CPUE, fish length, presence of teeth, and stomach contents demonstrate that Juan de Fuca Strait likely provides an important year-round marine habitat for Eulachon feeding and growth as well as being a migration corridor to and from the west coast of Vancouver Island, which offers a large range of additional Eulachon habitat for foraging, growth habitat and mixing of stocks (Dealy et. al., 2019).

#### 4.11.2.17 *Pacific Eulachon Critical Habitat*

No Pacific eulachon critical habitat has been designated near the Lopez Island Ferry Terminal (FEDERAL REGISTER 2011).

# MUKILTEO




**NOTE:** Updated Feb 02, 2022. Base map prepared from Esri World Topographic Map.

| Section | Township | Range | Lat | Long |
|---|---|---|---|---|
| 33 | 29N | 4E | 47°57'01" N | 122°17'50" W |

| HUC 171100190202 | WRIA 7 |
|---|---|

0 1
Scale in Miles

**Figure MU-1**
Mukilteo Ferry Terminal Vicinity Map
WSF Biological Assessment Reference
Mukilteo, Washington

## Figure MU-1
## Mukilteo Ferry Terminal Vicinity Map


**Figure MU-2**
**Aerial Photo of Mukilteo Ferry Terminal**

### 4.12 Mukilteo Ferry Terminal

The Mukilteo Ferry Terminal is located in the city of Mukilteo, approximately 30 miles north of Seattle and just south of Everett, on Possession Sound (see Figures MU-1 and MU-2). The Mukilteo Ferry Terminal provides service to the Clinton Ferry Terminal on Whidbey Island.

Features of the terminal include a terminal building, 7 vehicle holding lanes that accommodate approximately 245 vehicles, and additional roadside holding. The terminal building is based on a Coast Salish longhouse design, built to LEED-Gold standards (Figure MU-3). The building and terminal grounds include many innovative entironmental features, as shown in Figures MU-4/5.

The terminal has one slip with a hydraulic transfer span, two steel wingwalls, and three dolphins: two fixed steel, and one floating concrete dolphin (Figures MU-6/7). The Mukilteo public fishing pier was relocated to the NE portion of the terminal shoreline (in far foreground of Figure MU-8).

**Figure MU-3 Terminal Building Looking NE**

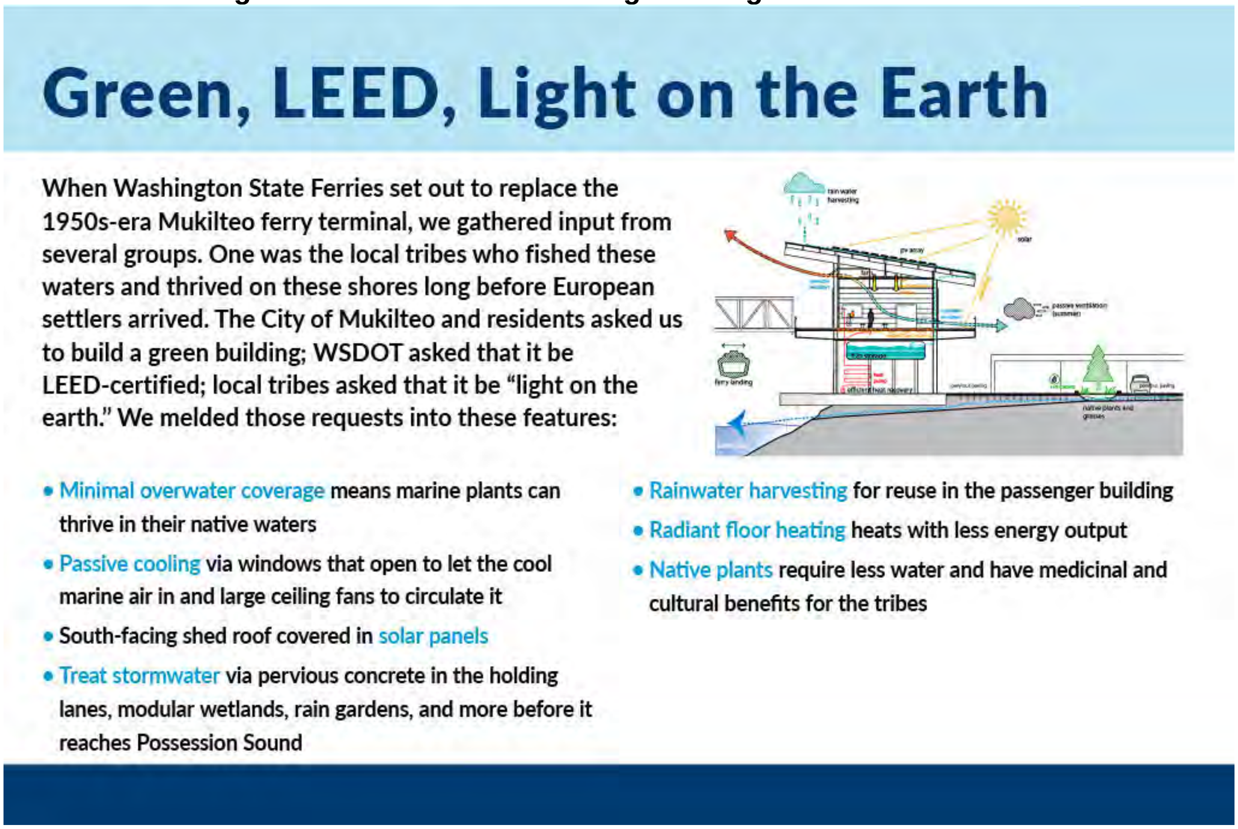



**Figure MU-4 Interpretive Sign in Terminal Building**

**Figure MU-5 Rain Garden to NE of Terminal Building**

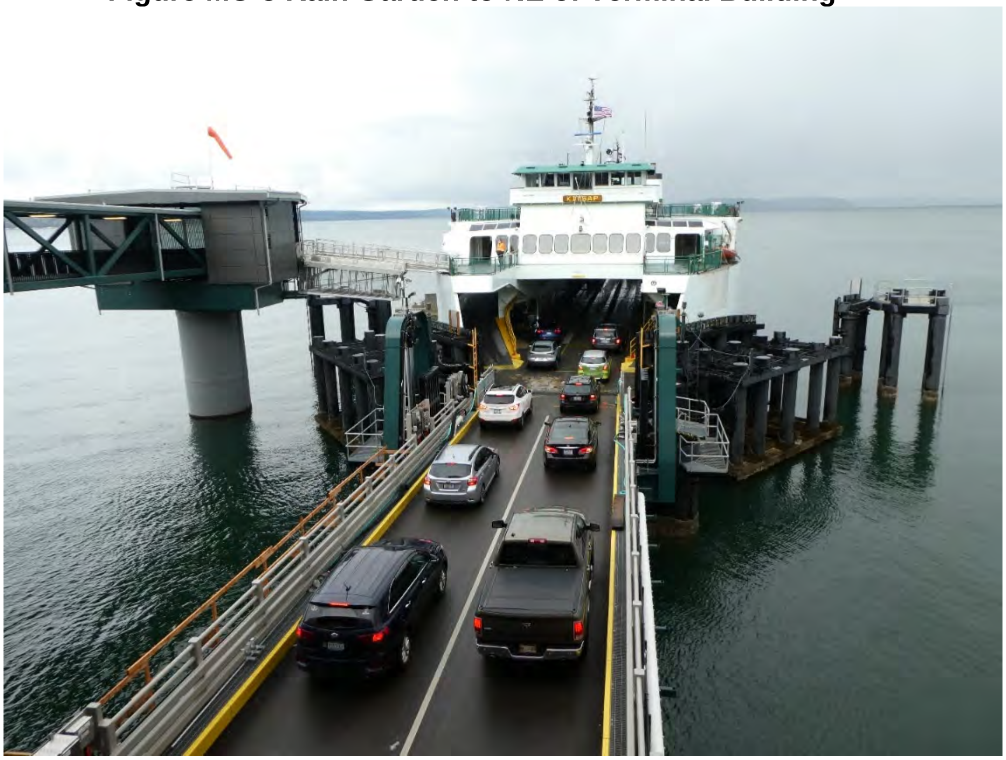


**Figure MU-6  Hydraulic Transfer Span, Wingwalls, Fixed Dolphins, Overhead Loading**

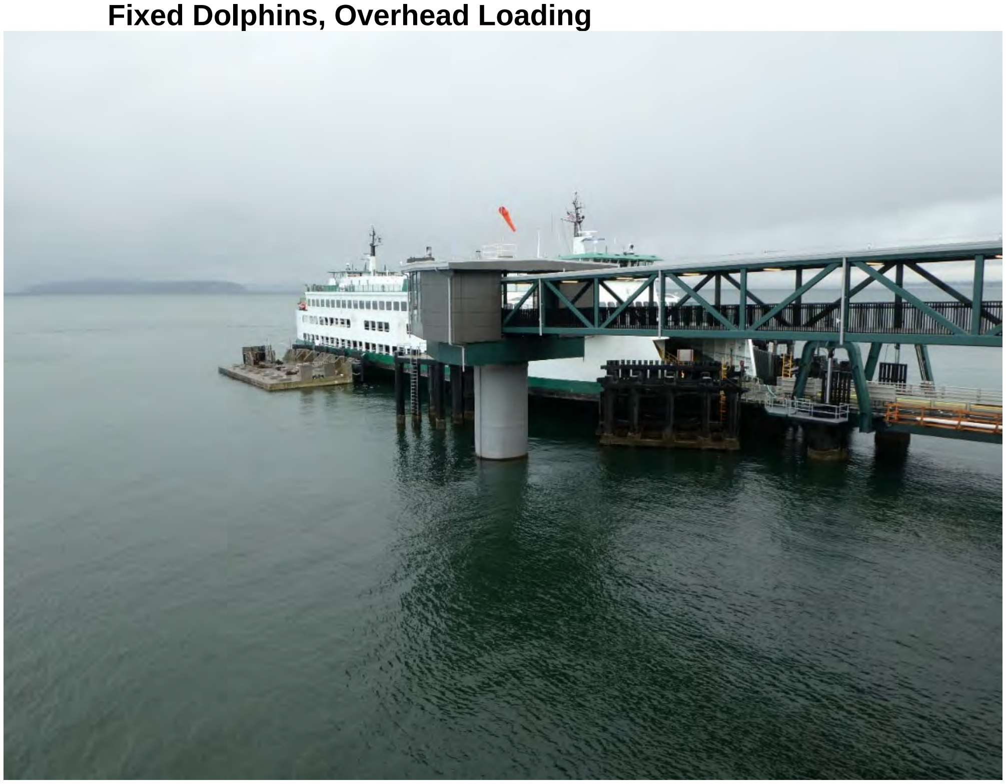


**Figure MU-7  Hydraulic Transfer Span, Wingwall, Overhead Loading, Fixed Dolphin, Floating Dolphin**

### 4.12.1 Mukilteo Environmental Baseline

#### 4.12.1.1 Physical Indicators

*Substrate and Slope*

The shoreline at the Mukilteo terminal consistents completely of retaining walls, rip-rap revetment and a concrete bulkhead (a remnant from the removal of the Tank Farm Pier) from the NE to SW boundaries (Figures MU-8/9/10/11/12).

Waterward of the rip-rap/bulkhead, substrates generally consist of mix of coarse grained sand to cobble. Historically placed rip-rap extends out to -30 feet MLLW in places. The NE edge of the terminal boundary transitions to a gentler slope where rip-rap gives way to Edgewater Beach (WSDOT 2012).

Offshore depths (approximate MLLW) of terminal structures are: head of slip/wingwalls are -30.0 feet; fishing pier is -35.0 feet; maximum depth of fixed dolphins is -40.0 feet, and maximum depth for the floating dolphin anchors is -78.0 feet.

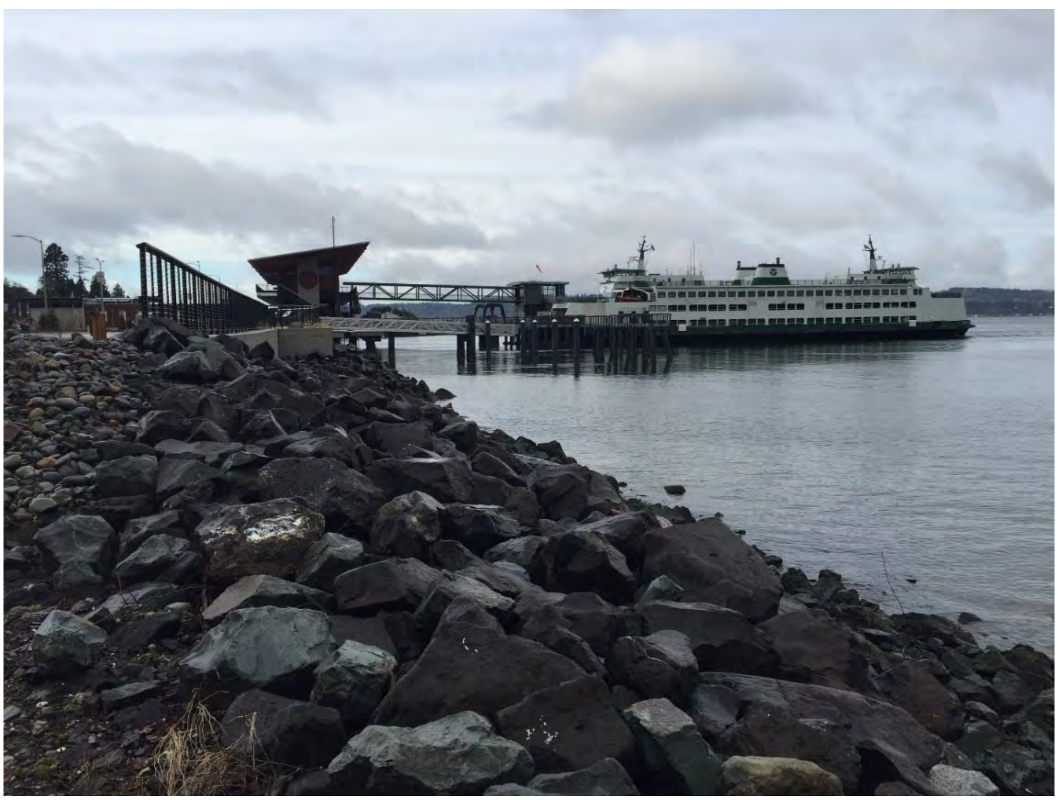


**Figure MU-8 Shoreline from the NE boundary of the terminal looking SW**

**rom the NE boundary of the terminal area looking NE. Edgewater Beach and Mt. Baker Terminal in the distance.**

**Figure MU-10  Shoreline near Terminal Building looking SW.**

**from the SW edge of the Terminal Building looking SW. Concrete bulkhead to right is a remnant of the Tank Farm Fuel Pier removal.**

**Figure MU-12 Shoreline from the SW boundary of the terminal area looking NE.**

### *Salt/Freshwater Mixing*

Within the terminal vicinity, there are a number of small intermittent and perennial streams that drain into Possession Sound. Brewery Creek enters Possession Sound through a culvert SW of the terminal. Japanese Creek enters Puget Sound through two culverts near to the NE of the terminal. Numerous other outfalls occur between Brewery Creek and Japanese Creek within the terminal area and several storm drain systems maintained by the City of Mukilteo discharge into Possession Sound.

The stormwater system at the ferry terminal consists of two systems, each of which conveys flow from impervious and pervious pavement surfaces contained by perimeter curbs. Modular wetlands and biofiltration facilities provide treatment prior to discharging to Possession Sound, or entering the city of Mukilteo Municipal Wastewater system (MWWS).

The smaller system discharges via an outfall to the east of the terminal building to Possession Sound, and the other, larger system discharges to the MWWS .

West of Park Avenue on SR 525 stormwater drains through two bioretention facilities and drain lines that merge with drain lines located east of Park Avenue to the toll booths from one bioretention facility. This system continues to manage stormwater east of the toll booths from the holding lanes through permeable pavement, drain lines, trench drains, and a modular wetland that eventually enters the MWWS .

The second system manages stormwater for the trestle by trench drains and drain lines that discharge through an MWWS outfall to Possession Sound.

The MWWS manages the city of Mukilteo promenade stormwater separately from the WSF facility through two outfalls to Possession Sound. One at the east end of Mukilteo Lane (Front Street) and at the east end of the promenade. Stormwater from the WSF facility enters the MWWS at First Street at five connecting drain points, at one drain point on Park Avenue, and at two drain points in the city of Mukilteo parking area east of Park Avenue running parallel to the south edge of the SR 525 entry.

East of the Maintenance building, the northern lane of the commuter transfer center drains to a bioretention facility with infiltration capacity, and curb inlets allow the employee parking area to drain to the MWWS.

A juncture of the MWWS system at First Street and the SW exit of the transfer center/passenger drop-off/employee parking area manages stormwater flow between the Possession Sound outfall and the main line along First Street."

*Flows and Currents*

Strong current flows and tidal mixing in the area is influenced by the open waters of Possession Sound. Current flow is predominately from the east during an ebb tide. The flood current is generally stronger than the ebb current. Wave energy is moving largely directly onshore (Moffat and Nichol. 2006.).

#### 4.12.1.2 *Chemical Indicators*

*Water Quality*

The marine waters of Possession Sound are designated "Extraordinary" for aquatic life use. The only impaired waters listing for the current terminal location is an exceedance of the Sediment Management Standards CSL bioassay criterion (in the SW portion of the terminal shoreline), from a sample collected in 1986 (Ecology 2022).

*Sediment Quality*

Sediment sampling took place within the new terminal project dredge prisim in 2013 and 2015. There were exceedences of the Dredged Material Management Standards and the Sediment Quality Standards for PAHs. PAHs were likely present in sediments from creosote piles that are no longer present (removed during the Tank Farm Pier demolition). Bioassay tests were completed on the dredge unit with the highest exceedences. Sediments passed the bioassay tests, and were approved for open water disposal in the Port Gardner Bay disposal site. No other sediment quality data is available in the immediate terminal area (DMMP. 2015

#### 4.12.1.3 *Biological Indicators*

*Shoreline Vegetation*

There are several trees and brush along the SW shoreline edge, near the old Tank Farm Pier bulkhead. No other no shoreline vegetation is present within the boundaries. The facility is characterized by steep retaining walls, rip-rap and bulkhead.

### *Macroalgae and Eelgrass*

Almost two dozen macroalgae species have been identified in the terminal area. A small patch of eelgrass (less than one square foot) was identified in a 2011 survey, NE of the terminal.

Although some kelp is present in the project area, no major kelp beds (ribbon or bull kelp) are present. The most common of the larger aquatic plants are sugar wrack (Laminaria saccharina), iridescent seaweed (Sarcodiotheca sp.), and sea lettuce (Ulva spp.) (Mukilteo Multimodal Project. Draft EIS. Ecosystems Discipline Report. WSDOT. January 2012).

### *Epibenthos, Macrofauna, Fish, and Marine Mammals*

Substrate characteristics in the intertidal zone are likely to support epibenthic production. Macrofauna and fisheries resources in the area include salmon, Dungeness crab, red rock crab, sand lance, perch, rockfish, unidentified flat fish, and others common to nearshore areas of Puget Sound. Marbled murrelet have been observed in the terminal area, generally further offshore than the terminal structures extend.

Marine mammals that have been observed in the area include harbor seal, California sea lion, Steller sea lion, harbor porpoise, and Southern Resident and Transient killer whale.

A full list of species that may be present can be found in the terminal Environmental Impact Statement (Mukilteo Multimodal Project. Draft EIS. Ecosystems Discipline Report. WSDOT. January 2012).

### *Forage Fish*

No forage fish spawning is documented within the terminal property shoreline. Documented sand lance spawning is present approximately 0.26 miles west, and 0.40 miles east of the terminal (see Figure MU-2)(WDFW 2022).

### *4.12.2 Mukilteo Species Distributions*

#### 4.12.2.1 *Puget Sound Chinook Salmon (Oncorhynchus tshawytscha)*

The Snohomish River, a Chinook salmon bearing stream, is located about 7 miles north of the Mukilteo Multimodal Ferry Terminal site. Additional major river systems that support Chinook salmon in this area of Puget Sound include the Skagit River (about 23 miles north) and Stillaguamish River (about 15 miles north). Chinook may also be present from rivers and streams in southern Puget Sound (WDFW 2007a).

*Adult and Sub-adult Chinook*

Summer-run Chinook migrate to freshwater in June and July and spawn in September. Summer/fall run (the most common in Puget Sound) begin freshwater migration in August and spawn from late September through January (Myers et al. 1998). Migrating sub-adult and adult Chinook salmon have free access to the entire marine portion of the terminal area. These fish could be present near the area year-round, but are likely to be more abundant in mid- to late summer as they prepare to migrate to their natal rivers to spawn. For the purpose of this analysis, sub-adults are fish that have spent a winter in the marine environment and are no longer closely oriented to the shoreline.

*Juvenile Chinook*

Juvenile Chinook salmon could use the area as they migrate out of their natal streams and rivers. In 1986 and 1987, a beach seine station near Mukilteo was sampled weekly from April through July. Juvenile Puget Sound Chinook salmon were more abundant and sampled more frequently than other salmonid species. The Puget Sound Chinook salmon entered the area in low numbers beginning in late April, peaked in mid-May to early June and continued in moderate to high numbers through mid-July (NOAA Fisheries 2005).

Data collected in Northern Puget Sound (Skagit Bay and Bellingham Bay) on juvenile Chinook utilization of nearshore habitats provide some additional data on the timing of occurrence in the nearshore. Skagit Bay and Bellingham Bay are more than 20 miles north of the Mukilteo Ferry Terminal and are in close proximity to major river systems that support Puget Sound Chinook salmon. They provide the most recent data on use of nearshore areas by Puget Sound Chinook salmon. Eight years of beach seine data in Skagit Bay indicates that wild sub-yearling Chinook are most abundant along the shoreline between May and July, then decrease in August. Wild sub-yearling Chinook were captured infrequently in Skagit Bay during beach seining efforts in September and October.

A nearly identical pattern was observed in Bellingham Bay where monthly sampling continued through December (Rice 2004). The Bellingham Bay research captured two juvenile Chinook in 14 sets in September, and no juvenile Chinook were captured between October and December. Similarly, tow-net sampling in deeper portions of the nearshore reveal a consistent downward trend in Chinook abundance in Skagit Bay between June and October (Rice et al. 2001). Tow-net sampling in Bellingham Bay also documented a summer peak and few juvenile Chinook captured in October (Beamer et al. 2003). No tow-net sampling was conducted in Bellingham Bay during September. In comparison to the beach seine results, juvenile Chinook presence in the Skagit Bay tow-net samples persisted later in the year (Rice et al. 2001). This observation supports the assumption that juvenile Chinook captured in the tow-net are fish that have moved offshore from the immediate shoreline area and are getting closer to beginning their marine migrations. Given the close proximity of these research areas to major salmon producing rivers (Skagit and Nooksack Rivers), and the proximity of the Snohomish River to the project site, juvenile Chinook densities in the research areas are likely to be similar to those anticipated at the Mukilteo Ferry Terminal.

The Skagit Bay and Bellingham Bay research suggests that most juvenile Chinook would be moving offshore into deeper waters in August and September, and few (if any) juvenile Chinook will be in the shallow nearshore areas during late summer/early fall.

#### 4.12.2.2 *Puget Sound Chinook Salmon Critical Habitat*

The Mukilteo Ferry Terminal lies within Chinook Zone 6 (70 FR 52630). While there are no streams that support Chinook salmon near the ferry terminal, eelgrass in close proximity to the ferry terminal may be used by juvenile Chinook for rearing.

The PCEs provided in the ferry terminal area, and their existing conditions, are listed in Table MU-1. PCEs relevant to the terminal area are numbered per 70 FR 52630.

**Table MU-1**
**Existing Conditions of Chinook Salmon PCEs at the Mukilteo Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 5) Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels. | **Obstructions**<br>In-water structures include the trestle, the slip, the public fishing pier and dolphins. The existing ferry terminal may affect fish passage in the nearshore.<br><br>**Water Quality and Forage**<br>The marine waters of Possession Sound are designated “Extraordinary” for aquatic life use. Impaired waters listings include 25 listings in mussel tissue (metals and organics), and six listings in sediment (metals and organics) (Ecology 2020).<br><br>Sediment sampling took place within the new terminal project dredge prisim in 2013 and 2015. There were exceedences of the Dredged Material Management Standards and the Sediment Quality Standards for PAHs. PAHs were likely present in sediments from creosote piles that are no longer present (removed during the Tank Farm Pier demolition). Bioassay tests were completed on the dredge unit with the highest exceedences. Sediments passed the bioassay tests, and were approved for open water disposal in the Port Gardner Bay disposal site. No other sediment quality data is available in the immediate terminal area (Mukileto Multimodal Project. Dredged Material Management Program (DMMP) Suitibility Determination Addendum. 2015).<br><br>The stormwater system at the ferry terminal consists of two systems, each of which conveys flow from impervious and pervious pavement surfaces contained by perimeter curbs. Modular wetlands and biofiltration facilities provide treatment prior to discharging to Possession Sound, or entering the city of Mukilteo Municipal Wastewater system (MWWS). All of the stormwater is treated.<br><br>Overwater coverage from the existing ferry terminal structures may reduce the production of aquatic invertebrates that are prey species to salmon. Substrate characteristics indicate that the nearshore supports epibenthos.<br><br>No forage fish spawning is documented within the terminal property shoreline. Documented sand lance spawning is present approximately 0.26 miles west, and 0.40 miles east of the terminal (see Figure MU-2)(WDFW 2022).<br><br>**Natural Cover**<br>There are several trees and brush along the SW shoreline edge, near the old Tank Farm Pier bulkhead. No other no shoreline vegetation is present within the boundaries. The facility is characterized by steep retaining walls, rip-rap and bulkhead, with substrates below these structures consisting of sand and gravel. Side channels do not occur in the ferry terminal area.<br><br>Almost two dozen macroalgae species have been identified in the terminal area. A small patch of eelgrass (less than one square foot) was identified in a 2011 survey, NE of the terminal.<br><br>Although some kelp is present in the project area, no major kelp beds (ribbon or bull kelp) are present. The most common of the larger aquatic plants are sugar wrack (Laminaria saccharina), iridescent seaweed (Sarcodiotheca sp.), and sea lettuce (Ulva spp.) (Mukilteo Multimodal Project. Draft EIS. Ecosystems Discipline Report. WSDOT. January 2012). |

| PCEs | Existing Conditions |
|---|---|
| | |
| 6) Offshore areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation. | The marine waters of Possession Sound are designated “Extraordinary” for aquatic life use. Impaired waters listings include 25 listings in mussel tissue (metals and organics), and six listings in sediment (metals and organics) (Ecology 2020).<br><br>Offshore areas provide habitat for forage fish. |

#### 4.12.2.3 *Puget Sound Steelhead (Oncorhynchus mykiss)*

There are no natal streams in the area of the Mukilteo Ferry Terminal that support Puget Sound steelhead. However, major river systems that support winter and summer steelhead include the Snohomish River (approximately 7 miles north), Stillaguamish River (approximately 15 shoreline miles north), Skagit River (approximately 20 shoreline miles north), and the Duwamish/Green River (approximately 30 shoreline miles south). The Lake Washington/Cedar River (approximately 20 shoreline miles south) supports winter steelhead only. In addition, numerous small streams in the Sinclair/Dyes Inlets (see Section 4.2 for more information) and southern Puget Sound rivers and streams support winter steelhead (WDFW 2007a).

Available data from tow-net sampling (deeper nearshore) and beach seine sampling (shallow nearshore) efforts around Puget Sound have reported the capture of few steelhead. In tow-net sampling in north and south Puget Sound, NMFS captured a total of 18 steelhead (Rice, unpublished data). The total sampling effort data was not available, but the mean steelhead catch ranged from 0 to 0.2 per net in north Puget Sound and 0.1 to 0.8 per net in south Puget Sound.

During 2001 and 2002, beach seining conducted in central Puget Sound by King County Department of Natural Resources captured only nine steelhead out of a total of approximately 34,000 juvenile salmonids. All the steelhead were caught between May and August and ranged in size from 141 to 462 mm with a mean size of 258 mm (Brennan et al. 2004). Beach seine sampling in Bellingham Bay (north Puget Sound) also captured few steelhead (Lummi Nation, unpublished data). The Bellingham Bay research reported the capture of two juvenile steelhead salmon in 336 sets between February 14 and December 1, 2003. The steelhead were captured in the eastern portion of Bellingham Bay near the Taylor Avenue Dock on June 12 and June 25, 2003.

#### 4.12.2.4 *Puget Sound Steelhead Critical Habitat*

The Mukilteo Ferry Terminal does not fall within designated steelhead critical habitat (Federal Register 2016a).

#### 4.12.2.5 *Humpback Whale (Megaptera novaeangliae)*

Humpback whale may be present near the Mukilteo ferry terminal. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.12.2.6 *Southern Resident Killer Whale (Orcinus orca)*

Southern Resident Killer Whale (SRKW) may be present near the Mukilteo ferry terminal. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.12.2.7 *Southern Resident Killer Whale Critical Habitat*

The Mukilteo Ferry Terminal lies within designated critical habitat (Area 2 – Puget Sound). Areas with water less than 20 feet deep relative to the extreme high water mark are not included in the critical habitat designation (Federal Register 2006).

The PCEs provided in the ferry terminal area, and their existing conditions, are listed in Table MU-2. PCEs relevant to the terminal area are numbered per 71 FR 69504.

**Table MU-2**
**Existing Conditions of Southern Resident Killer Whale PCEs at the Mukilteo Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 1) Water quality to support growth and development | The marine waters of Possession Sound are designated “Extraordinary” for aquatic life use. Impaired waters listings include 25 listings in mussel tissue (metals and organics), and six listings in sediment (metals and organics) (Ecology 2020).<br><br>Sediment sampling took place within the new terminal project dredge prisim in 2013 and 2015. There were exceedences of the Dredged Material Management Standards and the Sediment Quality Standards for PAHs. PAHs were likely present in sediments from creosote piles that are no longer present (removed during the Tank Farm Pier demolition). Bioassay tests were completed on the dredge unit with the highest exceedences. Sediments passed the bioassay tests, and were approved for open water disposal in the Port Gardner Bay disposal site. No other sediment quality data is available in the immediate terminal area (Mukileto Multimodal Project. Dredged Material Management Program (DMMP) Suitibility Determination Addendum. 2015).<br><br>The stormwater system at the ferry terminal consists of two systems, each of which conveys flow from impervious and pervious pavement surfaces contained by perimeter curbs. Modular wetlands and biofiltration facilities provide treatment prior to discharging to Possession Sound, or entering the city of Mukilteo Municipal Wastewater system (MWWS). All of the stormwater is treated. |
| 2) Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth | Salmonids are the primary prey of SRKW, and may be present near the terminal. Further information on prey can be found in the Puget Sound Chinook section, and Appendix B – Species Biology. |
| 3) Passage conditions to allow for migration, resting, and foraging | Existing structures that occur below -20 feet in critical habitat include the head of the trestle, the slip, and dolphins. |

#### 4.12.2.8 *Bull Trout (Salvelinus confluentus)*

There are no natal streams in the area of the Mukilteo Ferry Terminal that support bull trout (WDFW 2007a).

The aquatic portions of the ferry terminal are within marine FMO habitat. Therefore, it is expected that the ferry terminal area would be used by anadromous adult and sub-adult bull trout for foraging, migration, and overwintering (USFWS 2004b). Within the ferry terminal area, it is expected that individual bull trout from the Skagit River (approximately 20 shoreline miles north), Stillaguamish River (approximately 15 shoreline miles north), Snohomish River (approximately 7 shoreline miles north), Lake Washington/Cedar River (approximately 20 shoreline miles south), and the Duwamish/Green River (approximately 30 shoreline miles south) are most likely to be present (WDFW 2007a). Bull trout may also be present from rivers and streams in southern Puget Sound (WDFW 2007a).

Juvenile and sub-adult bull trout generally exit rivers and migrate downstream between mid-February to early September, with peak migration periods between April and July. Upon entry into saltwater, juveniles may rear in tidal delta marshes or distributary channels, or may pass through into nearshore marine areas (Goetz et al. 2004).

Preliminary study results indicate that subadult and adult bull trout first enter the lower Snohomish estuary and marine nearshore by early to mid-April. Presence in the estuary occurs through mid-summer, after which the bull trout begin moving back to freshwater (Goetz 2004). Bull trout were observed in the lower estuary or marine nearshore the first week of August 2003 (Pentec 2004). This is consistent with bull trout monitoring conducted from late summer through winter 2001 in the Snohomish River. Sampling weekly, no bull trout were collected at stations located at north Jetty Island and Priest Point when the study began in mid-August, through the following winter (Pentec 2004). Two instances of tagged bull trout detections have occurred in the Mukilteo area in the tagging program, both in early summer (Goetz, personal communication 2007).

#### 4.12.2.9 *Bull Trout Critical Habitat*

The shoreline of the Mukilteo Ferry Terminal is within designated bull trout critical habitat (Federal Register 2010a). The PCEs provided in the ferry terminal area, and their existing conditions, are listed in Table MU-3. PCEs relevant to the terminal area are numbered per Federal Register 2010a.

**Table MU-3**
**Existing Conditions of Bull Trout PCEs at the Mukilteo Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 2) 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. | In-water structures include the trestle, the slip, the public fishing pier and dolphins. The existing ferry terminal may affect fish passage in the nearshore, and may reduce the production of aquatic invertebrates that are prey species to bull trout. The facility is characterized by steep retaining walls, rip-rap and bulkhead, with substrates below these structures consisting of sand and gravel. Side channels do not occur in the ferry terminal area.<br><br>The marine waters of Possession Sound are designated “Extraordinary” for aquatic life use. Impaired waters listings include 25 listings in mussel tissue (metals and organics), and six listings in sediment (metals and organics) (Ecology 2020).<br><br>Sediment sampling took place within the new terminal project dredge prisim in 2013 and 2015. There were exceedences of the Dredged Material Management Standards and the Sediment Quality Standards for PAHs. PAHs were likely present in sediments from creosote piles that are no longer present (removed during the Tank Farm Pier demolition). Bioassay tests were completed on the dredge unit with the highest exceedences. Sediments passed the bioassay tests, and were approved for open water disposal in the Port Gardner Bay disposal site. No other sediment quality data is available in the immediate terminal area (Mukileto Multimodal Project. Dredged Material Management Program (DMMP) Suitibility Determination Addendum. 2015).<br><br>The stormwater system at the ferry terminal consists of two systems, each of which conveys flow from impervious and pervious pavement surfaces contained by perimeter curbs. Modular wetlands and biofiltration facilities provide treatment prior to discharging to Possession Sound, or entering the city of Mukilteo Municipal Wastewater system (MWWS). All of the stormwater is treated.<br><br>Overwater coverage from the existing ferry terminal structures may reduce the production of aquatic invertebrates that are prey species to salmon. Substrate characteristics indicate that the nearshore supports epibenthos. |
| 3) An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish. | There are several trees and brush along the SW shoreline edge, near the old Tank Farm Pier bulkhead. No other no shoreline vegetation is present within the boundaries. The facility is characterized by steep retaining walls, rip-rap and bulkhead, with substrates below these structures consisting of sand and gravel. Side channels do not occur in the ferry terminal area.<br><br>Almost two dozen macroalgae species have been identified in the terminal area. A small patch of eelgrass (less than one square foot) was identified in a 2011 survey, NE of the terminal.<br><br>Although some kelp is present in the project area, no major kelp beds (ribbon or bull kelp) are present. The most common of the larger aquatic plants are sugar wrack (Laminaria saccharina), iridescent seaweed (Sarcodiotheca sp.), and sea lettuce (Ulva spp.) (Mukilteo Multimodal Project. Draft EIS. Ecosystems Discipline Report. WSDOT. January 2012).<br><br>No forage fish spawning is documented within the terminal property shoreline. Documented sand lance spawning is present approximately 0.26 miles west, and 0.40 miles east of the terminal (see Figure MU-2)(WDFW 2022). |

| PCEs | Existing Conditions |
|---|---|
| 4) 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. | In-water structures include the trestle, the slip, the public fishing pier and dolphins. The existing ferry terminal may affect fish passage in the nearshore, and may reduce the production of aquatic invertebrates that are prey species to bull trout.<br><br>There are several trees and brush along the SW shoreline edge, near the old Tank Farm Pier bulkhead. No other no shoreline vegetation is present within the boundaries. The facility is characterized by steep retaining walls, rip-rap and bulkhead, with substrates below these structures consisting of sand and gravel. Side channels do not occur in the ferry terminal area. |
| 5) 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. Specific temperatures within this range will depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence. | East Puget Sound water temperatures can range from 41.4 to 75.7 °F (5.2 to 24.3 °C) with an average of 51 °F (10.58 °C) (Ecology 2007). Water temperature data for specific ferry terminals is not available. The over-water components of the ferry terminal provide some shade, which may cause slight localized reductions in water temperatures.<br><br>Almost two dozen macroalgae species have been identified in the terminal area. A small patch of eelgrass (less than one square foot) was identified in a 2011 survey, NE of the terminal.<br><br>Although some kelp is present in the project area, no major kelp beds (ribbon or bull kelp) are present. The most common of the larger aquatic plants are sugar wrack (Laminaria saccharina), iridescent seaweed (Sarcodiotheca sp.), and sea lettuce (Ulva spp.) (Mukilteo Multimodal Project. Draft EIS. Ecosystems Discipline Report. WSDOT. January 2012). |
| 8) Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited. | The marine waters of Possession Sound are designated “Extraordinary” for aquatic life use (Ecology 2018). Impaired waters listings include 25 listings in mussel tissue (metals and organics), and six listings in sediment (metals and organics) (Ecology 2020).<br><br>Sediment sampling took place within the new terminal project dredge prisim in 2013 and 2015. There were exceedences of the Dredged Material Management Standards and the Sediment Quality Standards for PAHs. PAHs were likely present in sediments from creosote piles that are no longer present (removed during the Tank Farm Pier demolition). Bioassay tests were completed on the dredge unit with the highest exceedences. Sediments passed the bioassay tests, and were approved for open water disposal in the Port Gardner Bay disposal site. No other sediment quality data is available in the immediate terminal area (Mukileto Multimodal Project. Dredged Material Management Program (DMMP) Suitibility Determination Addendum. 2015).<br><br>The stormwater system at the ferry terminal consists of two systems, each of which conveys flow from impervious and pervious pavement surfaces contained by perimeter curbs. Modular wetlands and biofiltration facilities provide treatment prior to discharging to Possession Sound, or entering the city of Mukilteo Municipal Wastewater system (MWWS). All of the stormwater is treated. |

#### 4.12.2.10 *Green Sturgeon (Acipenser medirostris)*

There are no natal streams in the area of the Mukilteo Ferry Terminal that support green sturgeon.

Observations of green sturgeon in Puget Sound are much less common compared to the coastal Washington estuaries and bays such as Willapa Bay, Grays Harbor, and the Lower Columbia River estuary (Federal Register 2018). In addition, Puget Sound does not appear to be part of the coastal migratory corridor that Southern DPS fish use to reach overwintering grounds north of Vancouver Island (Federal Register 2018).

NMFS reviewed green sturgeon acoustic detection data from 2002-2019 in Puget Sound and the Strait of Juan de Fuca. From 2002-2008, 350 tagged green sturgeon were at large (67% from the threatened southern DPS). During this time, 17 were detected in Puget Sound (4 from the southern DPS). After 2008, none were detected in central or southern Puget Sound, though 400 were at large (83% southern DPS). From 2013-2018, six (one from the southern DPS) were detected in Admiralty Inlet (northern Puget Sound).

From 2004-2019, 210 green sturgeon were detected in the Strait of Juan de Fuca (71% southern DPS). This indicates that the strait is used as a corridor, with green sturgeon residing at detection sites for short periods as they pass through from open ocean. Few of these fish were detected afterwards in Admiralty Inlet, suggesting that most of the tagged population move northward into the Strait of Georgia after transiting the strait. Data indicates conclusively that green sturgeon from the southern DPS occur in Puget Sound and Admiralty inlet, but at low rates compared to Strait of Juan de Fuca presence. This confirms earlier findings that Puget Sound is of lower conservation value to southern DPS green sturgeon. However, it is noted that the tagged population is a small fraction of the whole green sturgeon population, and that conditions need to be optimum for acoustic detection to occur (Moser, et. al. 2021).

#### 4.12.2.11 *Green Sturgeon Critical Habitat*

The Mukilteo Ferry Terminal does not fall within designated green sturgeon critical habitat (Federal Register 2018).

#### 4.12.2.12 *Marbled Murrelet (Brachyramphus marmoratus)*

The Mukilteo terminal area provides suitable marbled murrelet marine foraging habitat.

No forage fish spawning is documented within the terminal property shoreline. Documented sand lance spawning is present approximately 0.26 miles west, and 0.40 miles east of the terminal (see Figure MU-2)(WDFW 2022).

WDFW surveys conducted from 2001 to 2012 show a density of 1-3 birds per square kilometer in the terminal area (WDFW 2016). The nearest documented marbled murrelet nesting site is located 27 miles NE of the terminal (WSDOT 2018b).

The Northwest Forest Plan Marbled Murrelet Effectiveness Monitoring Program (2012) identified habitat suitability throughout the range of the species, and ranked it as Zero, Low, Marginal, Moderately High and Highest. The Mukilteo murrelet habitat suitability within the pile driving/heavy equipment zone of potential effect (0.25 miles), is Zero (WSDOT 2019b).

Murrelets are known to forage in the terminal area. Murrelets are regularly found near the terminal and the lighthouse during the summer months (April through August) approximately 1,300 feet W of the terminal. They are also found intermittently at other times of the year (ESA Adolfson 2006). During the November 2017- March 2018 construction season of the new Mukilteo terminal (approximately 0.4 miles NE of the current terminal), 219 marbled murrelet were observed between 55 and 600+ m from the new terminal location. These are likely multiple observations of individual birds, rather than 219 individuals observed, though on one day, 3 foraging pairs (6 individuals) were confirmed (WSDOT 2018e).

There are no coniferous forest near the terminal that may offer nesting opportunity (WSDOT 2018c).

Ferry traffic creates regular disturbance in the immediate terminal area. From July 2017 to June 2018, there were approximately 26,800 scheduled arrivals and departures from the terminal. During the nesting season (April 1-September 23), when foraging murrelet are more active, there were approximately 13,595 scheduled arrivals and departures (WSF 2018d).

#### 4.12.2.13 *Marbled Murrelet Critical Habitat*

No marbled murrelet critical habitat has been designated near the terminal (USFWS 1996).

#### 4.12.2.14 *Rockfish Species*

*Bocaccio*

Bocaccio are rarely caught in north Puget Sound and only sparse records exist for the Strait of Georgia (Federal Register 2010b). Because larvae are widely dispersed, it is possible that bocaccio juveniles could be found near the Mukilteo Ferry Terminal at any time of year. Adult bocaccio generally move to very deep water. The water in Possession Sound reaches depths over 100 feet at the midpoint between Whidbey Island and the mainland (NMFS 2009). This is still shallower than ideal for bocaccio.

*Yelloweye Rockfish*

Yelloweye rockfish are more closely aligned with rocky, high-relief substrates than with very deep water (Federal Register 2010b). Possession Sound reaches depths of over 100 feet; however, it does not have the rocky substrata preferred by yelloweye.

#### 4.12.2.15 *Rockfish Species Critical Habitat*

The Mukilteo Ferry Terminal is within designated rockfish nearshore critical habitat (less than or equal to 98 feet in depth) (Federal Register 2014). The physical and biological features (PBFs) (Federal Register 2014) essential to the conservation of juvenile Bocaccio rockfish are listed in Table MU-4. PBFs relevant to the terminal area are numbered per the CFR (Federal Register 2014). These PBFs are specific to nearshore environments, where only juvenile Bocaccio rockfish could be found. Deepwater (> 98 feet in depth) PBFs exist for adult Bocaccio, and adult and juvenile yelloweye rockfish; however, this habitat is not present at the Mukilteo Ferry Terminal and will not be discussed here.

**Table MU-4**
**Existing Conditions of Rockfish PBFs at the Mukilteo Ferry Terminal**

| PBFs | Existing Conditions |
|---|---|
| 1) Quantity, quality, and availability of prey species to support individual growth, survivial, reproduction, and feeding opportunities. | Overwater coverage from the existing ferry terminal structures may reduce the production of aquatic invertebrates that are prey species. Substrate characteristics indicate that the area is likely to support epibenthic production.<br><br>Almost two dozen macroalgae species have been identified in the terminal area. A small patch of eelgrass (less than one square foot) was identified in a 2011 survey, NE of the terminal.<br><br>Although some kelp is present in the project area, no major kelp beds (ribbon or bull kelp) are present. The most common of the larger aquatic plants are sugar wrack (Laminaria saccharina), iridescent seaweed (Sarcodiotheca sp.), and sea lettuce (Ulva spp.) (Mukilteo Multimodal Project. Draft EIS. Ecosystems Discipline Report. WSDOT. January 2012).<br><br>No forage fish spawning is documented within the terminal property shoreline. Documented sand lance spawning is present approximately 0.26 miles west, and 0.40 miles east of the terminal (see Figure MU-2)(WDFW 2022). |
| 2) Water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities. | The marine waters of Possession Sound are designated “Extraordinary” for aquatic life use (Ecology 2018). Impaired waters listings include 25 listings in mussel tissue (metals and organics), and six listings in sediment (metals and organics) (Ecology 2020).<br><br>Sediment sampling took place within the new terminal project dredge prisim in 2013 and 2015. There were exceedences of the Dredged Material Management Standards and the Sediment Quality Standards for PAHs. PAHs were likely present in sediments from creosote piles that are no longer present (removed during the Tank Farm Pier demolition). Bioassay tests were completed on the dredge unit with the highest exceedences. Sediments passed the bioassay tests, and were approved for open water disposal in the Port Gardner Bay disposal site. No other sediment quality data is available in the immediate terminal area (Mukileto Multimodal Project. Dredged Material Management Program (DMMP) Suitibility Determination Addendum. 2015).<br><br>East Puget Sound water temperatures can range from 41.4 to 75.7 °F (5.2 to 24.3 °C) with an average of 51 °F (10.58 °C) (Ecology 2007). Water temperature data for specific ferry terminals is not available. The over-water components of the ferry terminal provide some shade, which may cause slight localized reductions in water temperatures.<br><br>The stormwater system at the ferry terminal consists of two systems, each of which conveys flow from impervious and pervious pavement surfaces contained by perimeter curbs. Modular wetlands and biofiltration facilities provide treatment prior to discharging to Possession Sound, or entering the city of Mukilteo Municipal Wastewater system (MWWS). All of the stormwater is treated. |

#### 4.12.2.16 *Pacific Eulachon (Thaleichthys pacificus)*

The Mukilteo Ferry Terminal is distant from any of the known eulachon spawning rivers. It is highly unlikely that eulachon will be present at the Mukilteo Ferry Terminal.

#### 4.12.2.17 *Pacific Eulachon Critical Habitat*

No Pacific eulachon critical habitat has been designated near the Mukilteo Ferry Terminal (FEDERAL REGISTER 2011).

# ORCAS ISLAND


**NOTE:** Base map prepared from Terrain Navigator Pro USGS 7.5 minute quadrangle map(s) of Blakely Island and Shaw Island, Washington.

| Section | Township | Range | Lat | Long | County |
|---|---|---|---|---|---|
| 22 | 30N | 2W | 48° 35' 51" N | 122° 56' 33" W | San Juan |
| HUC 171100030201 | | | WRIA 2 | | |

0 1
Scale in Miles

**Figure OR-1**
Orcas Island Ferry Terminal Vicinity Map
WSF Biological Assessment Reference
Orcas Island, Washington

**Figure OR-1**
**Orcas Island Ferry Terminal Vicinity Map**


**Figure OR-2**
**Aerial Photo of Orcas Island Ferry Terminal**

## 4.13 Orcas Island Ferry Terminal

The Orcas Island Ferry Terminal is located on the southeast shoreline of Orcas Island, with the West Sound to the west and northwest, and the Harney Channel to the east (see Figures OR-1 and OR-2).

The Orcas Island Ferry Terminal provides service to the Anacortes and San Juan inter-island terminals (Lopez, Shaw, Orcas, and Friday Harbor).

Features of the terminal include a passenger shelter and eight vehicle holding lanes that accommodate up to 75 vehicles. The terminal has one slip with steel wingwalls. Three dolphins are associated with the terminal, one steel and two floating concrete dolphins. One parking lot is present at the facility. No overhead passenger loading facilities are present at the terminal.

### *4.13.1 Orcas Environmental Baseline*

#### 4.13.1.1 *Physical Indicators*

*Substrate and Slope*

Substrates are composed primarily of sand with gravel and shell. Beach slopes appear to be gradual. See Figures OR-3 and OR-4 for pictures of the shoreline areas west and east of the ferry terminal. Offshore depths of terminal structures are: head of slip (-30.5 feet MLLW). Maximum depth for the floating dolphins is -46.5 feet MLLW.

**Figure OR-3**
**Shoreline Area to the West of the Orcas Island Ferry Terminal**

**Figure OR-4**
**Shoreline Area to the East of the Orcas Island Ferry Terminal**

### *Salt/Freshwater Mixing*

There are two streams about 0.25 mile east of the terminal that contribute freshwater to West Sound.

### *Flows and Currents*

There is no specific data on flows and currents in the vicinity of the ferry terminal. Based on current data from NOAA, in Harney Channel it appears that current flows are relatively weak in the vicinity of the ferry terminal.

#### 4.13.1.2 *Chemical Indicators*

##### *Water Quality*

The marine waters of West Sound are designated "Extraordinary" for aquatic life use. No impaired waters listing data is available for the current terminal location (Ecology 2018).

##### *Sediment Quality*

There is no data available on sediment quality in the vicinity of the ferry terminal(Ecology 2018).

#### 4.13.1.3 *Biological Indicators*

##### *Shoreline Vegetation*

Herbaceous, shrub, and forested shoreline vegetation occurs east and west of the terminal with more forested shoreline vegetation occurring east of the terminal.

##### *Macroalgae and Eelgrass*

An eelgrass survey was conducted in 2002 to gather preliminary eelgrass and biological resources information for the proposed use of a private fuel dock (105 feet west of the ferry terminal) for passenger-only operations. The survey found an eelgrass bed that extends about 150 feet west of the private dock. Based on 21 quadrat counts, the mean shoot density within the eelgrass bed ranges between 1 to 32 shoots per 0.25 square meters and 2 to 127 shoots per square meter between about -5 and -25 feet MLLW. The highest densities of eelgrass occur between about -6 and -8 feet MLLW (inshore of the private dock) (PIE 2002b). A larger eelgrass bed is located approximately 100 feet to the east of the ferry terminal. See Figure OR-2.

Macroalgae and colonial diatomaceous mats occur in the vicinity of the fuel dock and float. Dominant macroalgae species include *Ulva* sp. and unidentified algal mats. Other species observed during the dive survey include: *Iridaea cordata, Sparlingia pertusa, Palmaria mollis, Palmaria callophylloides, Laminaria saccharina, Chondracanthus exasperatus, Petalonia fascia, Cryptosiphonia woodii, Sargassum muticum,* *Ulva* spp., *Gracilaria pacifica, Ulvaria obscura, Nereocystis luetkeana*, and *Costaria costata* (PIE 2002b). Though this survey was focused on the private dock, similar species can be expected to occur in the ferry terminal area.

*Epibenthos, Macrofauna, Fish, and Marine Mammals*

Substrate characteristics are likely to support epibenthic production. Macrofauna in the area includes horse clams, Dungeness crab, shrimp, anemones, and sunflower stars. Finfish in the area include rockfish, greenling, and flatfish. Marine mammals expected to be in the area include killer whale, Dall's porpoise, harbor porpoise, harbor seal, Steller sea lion, and California sea lion.

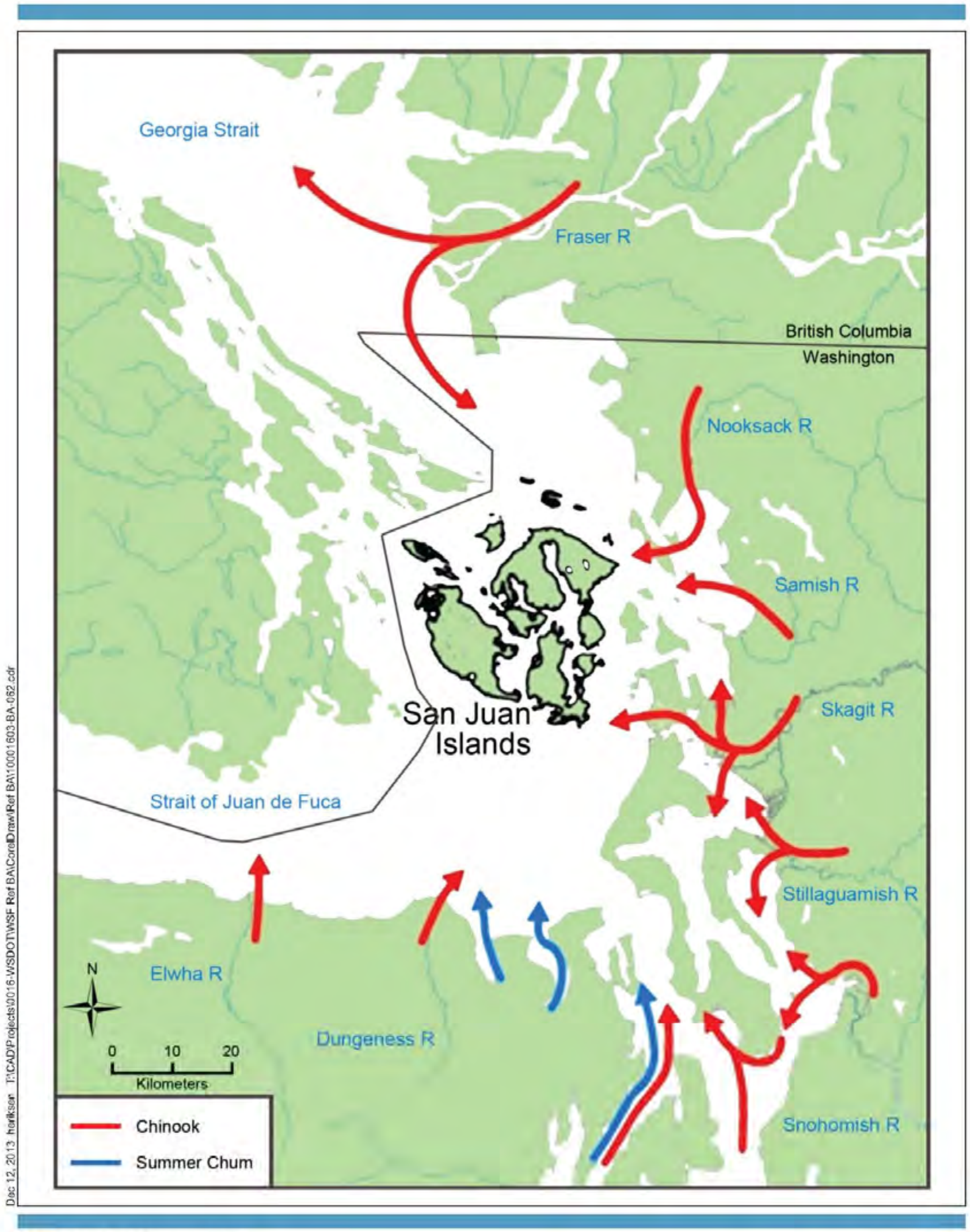
*Forage Fish*

There is no documented forage fish spawning present at the terminal. Documented sand lance spawning is present approximately 1,000 feet east of the terminal (WSDOT 2018a).

### 4.13.2 Orcas Species Distributions

#### 4.13.2.1 Puget Sound Chinook Salmon (Oncorhynchus tshawytscha)

No Chinook salmon bearing streams are located near the Orcas Island Ferry Terminal (WDFW 2007a). However, several major river systems that support Chinook salmon, including the Nooksack River (approximately 28 miles northeast), Samish River (approximately 25 miles east), Skagit River (approximately 30 miles southeast), and Stillaguamish River (approximately 40 miles southeast), occur in this area of the Puget Sound. Chinook may also be present from rivers and streams in central and southern Puget Sound (WDFW 2007a). Orcas Island's Crow Valley stream supports coho, and the Orcas Island Glenwood Springs Salmon Hatchery produces Chinook and coho runs (WDFW 2007b). The results of beach seine sampling completed from March to October in 2008 and 2009 indicate that juvenile Chinook salmon arrive in the San Juan Islands by April, peak in the month of June, remain relatively high in shoreline areas during summer months, and are present through October. Chinook may be present from numerous river systems, as shown in Figure OR-5 (SRSC and NOAA 2012).




**SOURCE:** SRSC/NOAA Fisheries 2012.

**Figure OR-5**
Migratory Pathways for Juvenile Salmon from
Source Population Rivers to the San Juan Islands Area
WSF Biological Assessment Reference
Orcas Island, Washington

**Figure OR-5**
**Migratory Pathways for Juvenile Salmon from Source Population Rivers to the San Juan Islands Area**

#### *Adult and Sub-adult Chinook*

The marine environment of northern Puget Sound is a migratory corridor for adults. Adult Chinook salmon collected in the waters around the San Juan archipelago are usually Puget Sound or Fraser River populations (Sanford, personal communication 2002). WDFW micro-tag data analyzed from 1985 showed five Chinook salmon stocks have been identified in the San Juan region (Moulton, personal communication 2001).

Migrating adult and sub-adult Chinook salmon have free access to the entire marine portion of the ferry terminal area. Sub-adults have spent a winter in the marine environment and are not closely oriented to the shoreline like juveniles. Adults and sub-adults could be present near the ferry terminal area year-round, but are likely to be more abundant in summer as they prepare to migrate to their natal rivers to spawn (Anchor 2002).

#### *Juvenile and Sub-adult Chinook*

Chinook salmon do not spawn in the San Juan archipelago (Otis, personal communication 2000). Juveniles that could occur near the ferry terminal are likely of hatchery origin or have crossed open water to reach the San Juan Islands. The watersheds of this region are not large enough to support sustainable wild Chinook salmon populations (Sanford, personal communication 2002). A hatchery exists on Orcas Island but the hatchery origin Chinook are not part of the ESU.

The marine waters of the San Juan Islands provide habitat for outmigrating sub-yearling Chinook salmon from rivers into Puget Sound before their eventual oceanic phase as adults. Juvenile Chinook salmon habitat in the ferry terminal area includes the open water (pelagic zones) of the San Juan Islands and the nearshore and intertidal zones in the San Juan Islands, particularly areas supporting eelgrass and macroalgae.

### 4.13.2.2 *Puget Sound Chinook Salmon Critical Habitat*

The Orcas Island Ferry Terminal lies within Chinook Zone 2 (70 FR 52630). While there are no streams that support Chinook salmon near the ferry terminal, there are eelgrass beds in close proximity to the ferry terminal that may be used by juvenile Chinook for rearing.

The PCEs provided in the ferry terminal area, and their existing conditions, are listed in Table OR-1. PCEs relevant to the terminal area are numbered per the CFR (70 FR 52630).

**Table OR-1**
**Existing Conditions of Chinook Salmon PCEs at the Orcas Island Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 5) Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels. | **Obstructions**<br>In-water structures include the trestle, the slip, and dolphins. The existing ferry terminal may affect fish passage in the nearshore.<br><br>**Water Quality and Forage**<br>The marine waters of West Sound are designated "Extraordinary" for aquatic life use. No impaired waters listing data is available for the current terminal location (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of three drainage areas that drain to West Sound. Two of the areas include treatment.<br><br>The first drainage area drains the toll booth area, the holding lanes, and long-term parking and consists of 12 catch basins that flow through an oil/water separator (inspected annually), and discharge through an outfall to the east of the trestle.<br><br>The second drainage area drains the immediate area in front of the waiting shelter, and consists of two catch basins. Input from four Island County catch basins connects upgradient to this area. All stormwater flows through an oil/water separator (inspected annually), and discharges through an outfall to the east of the trestle.<br><br>The third drainage area consists of the trestle and transfer span (typically 90 feet long by 24 feet wide that carries traffic between the trestle and ferry), which discharges by sheet flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Overwater coverage from the existing ferry terminal structures may reduce the production of aquatic invertebrates that are prey species to salmon. Substrate characteristics indicate that the area is likely to support epibenthic production.<br><br>There is no documented forage fish spawning present at the terminal. Documented sand lance spawning is present approximately 1,000 feet east of the terminal (WSDOT 2018a).<br><br>**Natural Cover**<br>Herbaceous, shrub, and forested shoreline vegetation occurs east and west of the terminal with more forested shoreline vegetation occurring east of the terminal.<br><br>Macroalgae in vicinity of the vicinity of the terminal includes bleached brunette, sea lettuce, Turkish towel, and red algae. Eelgrass does not occur immediately at the terminal; rather, two eelgrass beds have been identified east of the terminal and west in the vicinity of the private dock. The eelgrass extends out to a depth of approximately -24 feet MLLW. |

| PCEs | Existing Conditions |
|---|---|
| | There is no large overhanging woody vegetation. A small gently sloping sandy beach exists to the east of the ferry terminal. Large diameter riprap is present under the ferry terminal dock and extends to the west. The existing conditions within the defined area of critical habitat consist of sand, gravel, and shell (PIE 2002b). Side channels do not occur in the ferry terminal area. |
| 6) Offshore areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation. | The marine waters of West Sound are designated "Extraordinary" for aquatic life use.West Sound is rated extraordinary for aquatic life. No impaired waters listing data is available for the current terminal location (Ecology 2018).<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Offshore areas provide habitat for forage fish. |

#### 4.13.2.3 *Puget Sound Steelhead (Oncorhynchus mykiss)*

There are no natal streams in the area of the Orcas Island Ferry Terminal that support Puget Sound steelhead. However, major river systems that support winter and summer steelhead include the Nooksack River (approximately 28 miles northeast), Skagit River (approximately 30 miles southeast), and Stillaguamish River (approximately 40 miles southeast). The Samish River (approximately 25 miles east) supports winter steelhead only. Steelhead may also be present from rivers and streams in central and southern Puget Sound (WDFW 2007a).

Available data from tow-net sampling (deeper nearshore) and beach seine sampling (shallow nearshore) efforts around Puget Sound have reported the capture of few steelhead. In tow-net sampling in north and south Puget Sound, NMFS captured a total of 18 steelhead (Rice, unpublished data). The total sampling effort data was not available, but the mean steelhead catch ranged from 0 to 0.2 per net in north Puget Sound and 0.1 to 0.8 per net in south Puget Sound.

Beach seine sampling in Bellingham Bay (north Puget Sound) also captured few steelhead (Lummi Nation, unpublished data). The Bellingham Bay research reported the capture of two juvenile steelhead salmon in 336 sets between February 14 and December 1, 2003. The steelhead were captured in the eastern portion of Bellingham Bay near the Taylor Avenue Dock on June 12 and June 25, 2003.

#### 4.13.2.4 *Puget Sound Steelhead Critical Habitat*

The Orcas Island Ferry Terminal does not fall within designated steelhead critical habitat (Federal Register 2016a).

#### 4.13.2.5 *Humpback Whale (Megaptera novaeangliae)*

Humpback whale may be present near the Orcas ferry terminal. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.13.2.6 *Southern Resident Killer Whale (Orcinus orca)*

Southern Resident Killer Whale (SRKW) may be present near the Orcas ferry terminal. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.13.2.7 *Southern Resident Killer Whale Critical Habitat*

The Orcas Island Ferry Terminal area lies within designated critical habitat (Area 1 – Core Summer Area). Areas with water less than 20 feet deep relative to the extreme high water mark are not included in the critical habitat designation (Federal Register 2006).

The PCEs provided in the terminal area, and their existing conditions are listed in Table OR-2. PCEs relevant to the terminal area are numbered per Federal Register 2006 .

**Table OR-2**
**Existing Conditions of Southern Resident Killer Whale PCEs at the Orcas Island Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 1) Water quality to support growth and development | The marine waters of West Sound are designated "Extraordinary" for aquatic life use. No impaired waters listing data is available for the current terminal location (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of three drainage areas that drain to West Sound. Two of the areas include treatment.<br><br>The first drainage area drains the toll booth area, the holding lanes, and long-term parking and consists of 12 catch basins that flow through an oil/water separator (inspected annually), and discharge through an outfall to the east of the trestle.<br><br>The second drainage area drains the immediate area in front of the waiting shelter, and consists of two catch basins. Input from four Island County catch basins connects upgradient to this area. All stormwater flows through an oil/water separator (inspected annually), and discharges through an outfall to the east of the trestle.<br><br>The third drainage area consists of the trestle and transfer span (typically 90 feet long by 24 feet wide that carries traffic between the trestle and ferry), which discharges by sheet flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity. |
| 2) Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth | Salmonids are the primary prey of SRKW, and may be present near the terminal. Further information on prey can be found in the Puget Sound Chinook section, and Appendix B – Species Biology. |
| 3) Passage conditions to allow for migration, resting, and foraging | Existing structures that occur below -20 feet in critical habitat include the head of the trestle, the slip, and dolphins. |

#### 4.13.2.8 *Bull Trout (Salvelinus confluentus)*

There are no natal streams in the area of the Orcas Island Ferry Terminal that support bull trout (WDFW 2007a).

The aquatic portions of the ferry terminal are within marine FMO habitat. While bull trout have not been documented in the ferry terminal area, suitable FMO habitat is present, and bull trout are thought to occur throughout south, central, and northern Puget Sound. Therefore, it is expected that the ferry terminal area would be used by anadromous adult and sub-adult bull trout for foraging, migration, and overwintering (USFWS 2004b). Within the ferry terminal area, it is expected that individual bull trout from the Nooksack River (approximately 28 miles northeast), Samish River (approximately 25 miles east), Skagit River (approximately 30 miles southeast), and Stillaguamish River (approximately 40 miles southeast) may be present. Bull trout may also be present from rivers and streams in central and southern Puget Sound (WDFW 2007a).

#### 4.13.2.9 *Bull Trout Critical Habitat*

The Orcas Island Ferry Terminal does not fall within designated bull trout critical habitat (Federal Register 2010a).

#### 4.13.2.10 *Green Sturgeon (Acipenser medirostris)*

There are no natal streams in the area of the Orcas Island Ferry Terminal that support green sturgeon.

Observations of green sturgeon in Puget Sound are much less common compared to the coastal Washington estuaries and bays such as Willapa Bay, Grays Harbor, and the Lower Columbia River estuary (Federal Register 2018). In addition, Puget Sound does not appear to be part of the coastal migratory corridor that Southern DPS fish use to reach overwintering grounds north of Vancouver Island (Federal Register 2018).

NMFS reviewed green sturgeon acoustic detection data from 2002-2019 in Puget Sound and the Strait of Juan de Fuca. From 2002-2008, 350 tagged green sturgeon were at large (67% from the threatened southern DPS). During this time, 17 were detected in Puget Sound (4 from the southern DPS). After 2008, none were detected in central or southern Puget Sound, though 400 were at large (83% southern DPS). From 2013-2018, six (one from the southern DPS) were detected in Admiralty Inlet (northern Puget Sound).

From 2004-2019, 210 green sturgeon were detected in the Strait of Juan de Fuca (71% southern DPS). This indicates that the strait is used as a corridor, with green sturgeon residing at detection sites for short periods as they pass through from open ocean. Few of these fish were detected afterwards in Admiralty Inlet, suggesting that most of the tagged population move northward into the Strait of Georgia after transiting the strait. Data indicates conclusively that green sturgeon from the southern DPS occur in Puget Sound and Admiralty inlet, but at low rates compared to Strait of Juan de Fuca presence. This confirms earlier findings that Puget Sound is of lower conservation value to southern DPS green sturgeon. However, it is noted that the tagged population is a small fraction of the whole green sturgeon population, and that conditions need to be optimum for acoustic detection to occur (Moser, et. al. 2021).

#### 4.13.2.11 *Green Sturgeon Critical Habitat*

The Orcas Island Ferry Terminal does not fall within designated green sturgeon critical habitat (Federal Register 2009).

#### 4.13.2.12 *Marbled Murrelet (Brachyramphus marmoratus)*

The Orcas terminal area provides suitable marbled murrelet marine foraging habitat.

There is no documented forage fish spawning present at the terminal. Documented sand lance spawning is present approximately 1,000 ft. E of the terminal (WSDOT 2018a).

WDFW surveys conducted from 2001 to 2012 show a density of less than 1 bird per square kilometer in the terminal area (WDFW 2016). The nearest documented marbled murrelet nesting site is located 42 miles SW of the terminal (WSDOT 2018b).

The Northwest Forest Plan Marbled Murrelet Effectiveness Monitoring Program (2012) identified habitat suitability throughout the range of the species, and ranked it as Zero, Low, Marginal, Moderately High and Highest. The Orcas murrelet habitat suitability within the pile driving/heavy equipment zone of potential effect (0.25 miles), ranges from Zero to Marginal (WSDOT 2019b).

There are no coniferous forest that may offer nesting opportunity within the pile driving/heavy equipment zone of potential effect (0.25 miles) (WSDOT 2014/2018c).

The marbled murrelet population in the San Juan Islands increases in late July. This increase may be the result of British Columbia birds immigrating after the breeding season. In late fall/early winter, up to 26 percent of the total marbled murrelets observed in the San Juan Islands are found northwest of Shaw Island near Crane Island, the Wasp Island complex, and the southwestern shoreline of Orcas Island (approximately 3.8 miles from the Orcas Island Ferry Terminal, and 4.8 miles from the Shaw Island Ferry Terminal). This region represents an important concentration area during the molting period (Evans Mack 2002).

Ferry traffic creates regular disturbance in the immediate terminal area. From July 2017 to June 2018, there were approximately 4,990 scheduled arrivals and departures from the terminal. During the nesting season (April 1-September 23), when foraging murrelet are more active, there were approximately 2,650 scheduled arrivals and departures (WSDOT 2018d).

#### 4.13.2.13 *Marbled Murrelet Critical Habitat*

No marbled murrelet critical habitat has been designated near the terminal (USFWS 1996).

#### 4.13.2.14 *Rockfish Species*

##### *Bocaccio*

Bocaccio are rarely caught in north Puget Sound and only sparse records exist for the Strait of Georgia (Federal Register 2010b). West Sound and the Harney Channel is shallow (less than 40 feet deep). The water is generally shallow throughout the central area between the islands (NMFS 2009). Substrates are rocky throughout the area. This area may be occupied by all life stages of bocaccio.

##### *Yelloweye Rockfish*

Yelloweye rockfish are more closely aligned with rocky, high-relief substrates than with very deep water (Federal Register 2010b). The San Juan and Upright Channels offer this rocky substrate. Yelloweye larvae and juveniles could be present in the harbor area; adults would be found in the channels and open-water areas beyond the harbor.

#### 4.13.2.15 *Rockfish Species Critical Habitat*

The Orcas Island Ferry Terminal is within rockfish nearshore critical habitat (less than or equal to 98 feet in depth) (Federal Register 2014). The physical and biological features (PBFs) (Federal Register 2014) essential to the conservation of juvenile Bocaccio rockfish are listed in Table OR-3. PBFs relevant to the terminal area are numbered per the CFR (Federal Register 2014). These PBFs are specific to nearshore environments, where only juvenile Bocaccio rockfish could be found. Deepwater (> 98 feet in depth) PBFs exist for adult Bocaccio, and adult and juvenile yelloweye rockfish; however, this habitat is not present at the Orcas Island Ferry Terminal and will not be discussed here.

**Table OR-3**
**Existing Conditions of Rockfish PBFs at the Orcas Island Ferry Terminal**

| PBFs | Existing Conditions |
|---|---|
| 1) Quantity, quality, and availability of prey species to support individual growth, survivial, reproduction, and feeding opportunities. | The marine waters of West Sound are designated "Extraordinary" for aquatic life use. No impaired waters listing data is available for the current terminal location (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of three drainage areas that drain to West Sound. Two of the areas include treatment.<br><br>The first drainage area drains the toll booth area, the holding lanes, and long-term parking and consists of 12 catch basins that flow through an oil/water separator (inspected annually), and discharge through an outfall to the east of the trestle.<br><br>The second drainage area drains the immediate area in front of the waiting shelter, and consists of two catch basins. Input from four Island County catch basins connects upgradient to this area. All stormwater flows through an oil/water separator (inspected annually), and discharges through an outfall to the east of the trestle.<br><br>The third drainage area consists of the trestle and transfer span (typically 90 feet long by 24 feet wide that carries traffic between the trestle and ferry), which discharges by sheet flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Overwater coverage from the existing ferry terminal structures may reduce the production of aquatic invertebrates that are prey species to salmon. Substrate characteristics indicate that the area is likely to support epibenthic production.<br><br>There is no documented forage fish spawning present at the terminal. Documented sand lance spawning is present approximately 1,000 feet east of the terminal (WSDOT 2018a). |
| 2) Water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities. | Herbaceous, shrub, and forested shoreline vegetation occurs east and west of the terminal with more forested shoreline vegetation occurring east of the terminal.<br><br>Macroalgae in vicinity of the vicinity of the terminal includes bleached brunette, sea lettuce, Turkish towel, and red algae. Eelgrass does not occur immediately at the terminal; rather, two eelgrass beds have been identified east of the terminal and west in the vicinity of the private dock. The eelgrass extends out to a depth of approximately -24 feet MLLW.<br><br>There is no large overhanging woody vegetation. A small gently sloping sandy beach exists to the east of the ferry terminal. Large diameter riprap is present under the ferry terminal dock and extends to the west. The existing conditions within the defined area of critical habitat consist of sand, gravel, and shell (PIE 2002b). Side channels do not occur in the ferry terminal area. |

#### 4.13.2.16 *Pacific Eulachon (Thaleichthys pacificus)*

The Orcas Island Ferry Terminal is approximately 36 shoreline miles from the Fraser River, a confirmed spawning river. Eulachon use the Strait of Juan de Fuca as a migration corridor, so it is possible that eulachon might be present at the Orcas Island Ferry Terminal.

A monthly bottom trawl study was funded by Fisheries and Oceans Canada's National Rotational Survey Fund from October 2017 to June 2018 to sample Eulachon in three regional strata in Juan de Fuca Strait and the Strait of Georgia. The goal of this study was to gain insights into the biology, distribution, and migration timing of Eulachon to the Fraser River by observing their spatial and temporal occurrence and biological condition over a wide survey region and over a series of months. Eulachon catch per unit effort (CPUE), size distributions, sex ratios, and maturity observations varied over time and space, as did the occurrence of stomach contents and presence/absence of teeth. Highest catches of Eulachon occurred in Juan de Fuca and lowest near the Fraser River. Mean catch rates at sites near the Fraser River plume corresponded with expected peak spawning periods in the Fraser River. The sex ratio of Eulachon sampled throughout the study region in all months was approximately 1:1 although most samples in the Strait of Georgia in May and June were female. The presence of Eulachon with maturing gonads increased in frequency from west to east in January to April before sharply decreasing throughout the survey region in May and June. Stomach contents and teeth decreased in frequency with proximity to the Fraser River.

Trends in CPUE, fish length, presence of teeth, and stomach contents demonstrate that Juan de Fuca Strait likely provides an important year-round marine habitat for Eulachon feeding and growth as well as being a migration corridor to and from the west coast of Vancouver Island, which offers a large range of additional Eulachon habitat for foraging, growth habitat and mixing of stocks (Dealy et. al., 2019).

#### 4.13.2.17 *Pacific Eulachon Critical Habitat*

No Pacific eulachon critical habitat has been designated near the Orcas Island Ferry Terminal (FEDERAL REGISTER 2011).

# POINT DEFIANCE

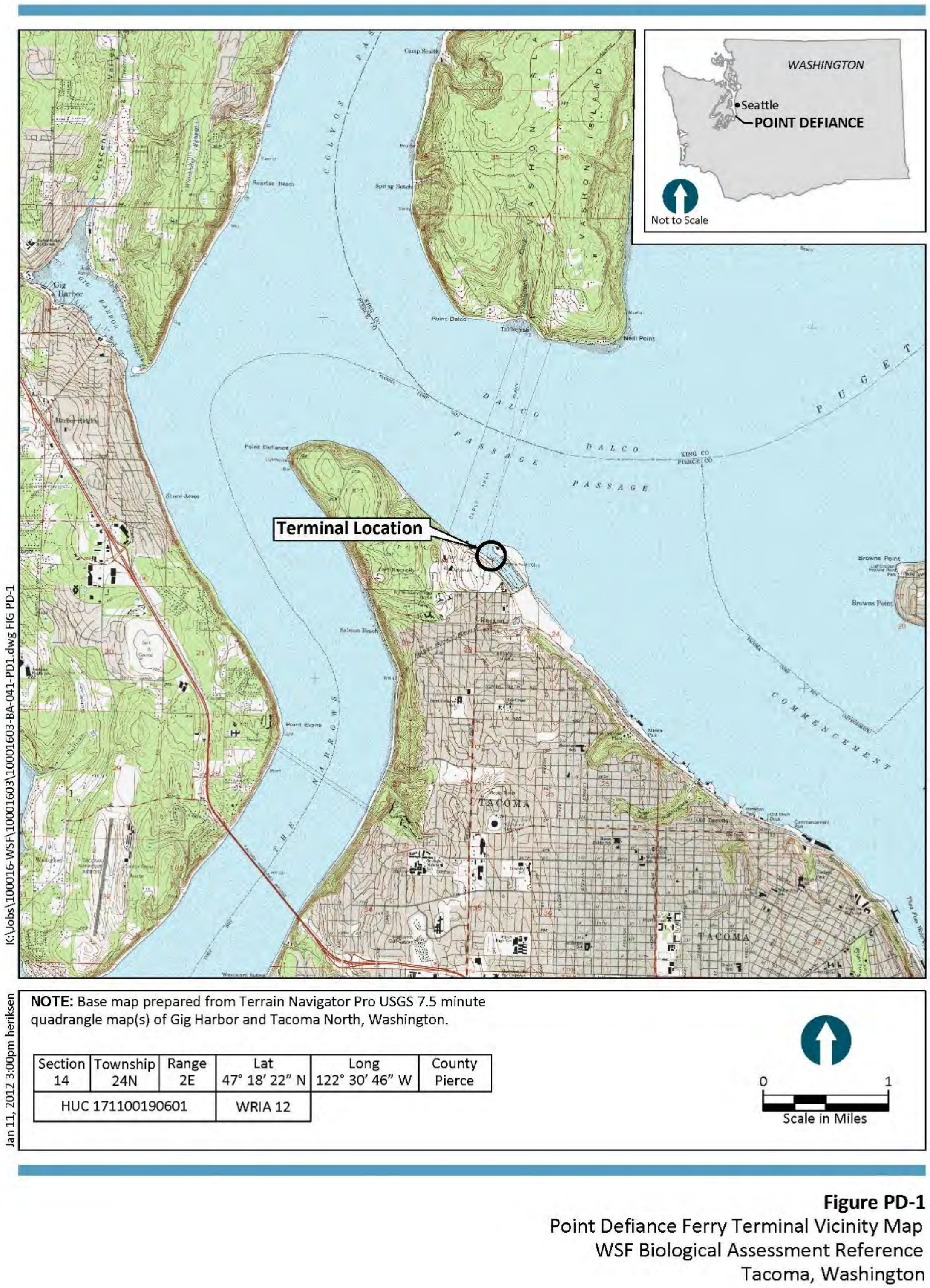



**Figure PD-1**
**Point Defiance Ferry Terminal Vicinity Map**

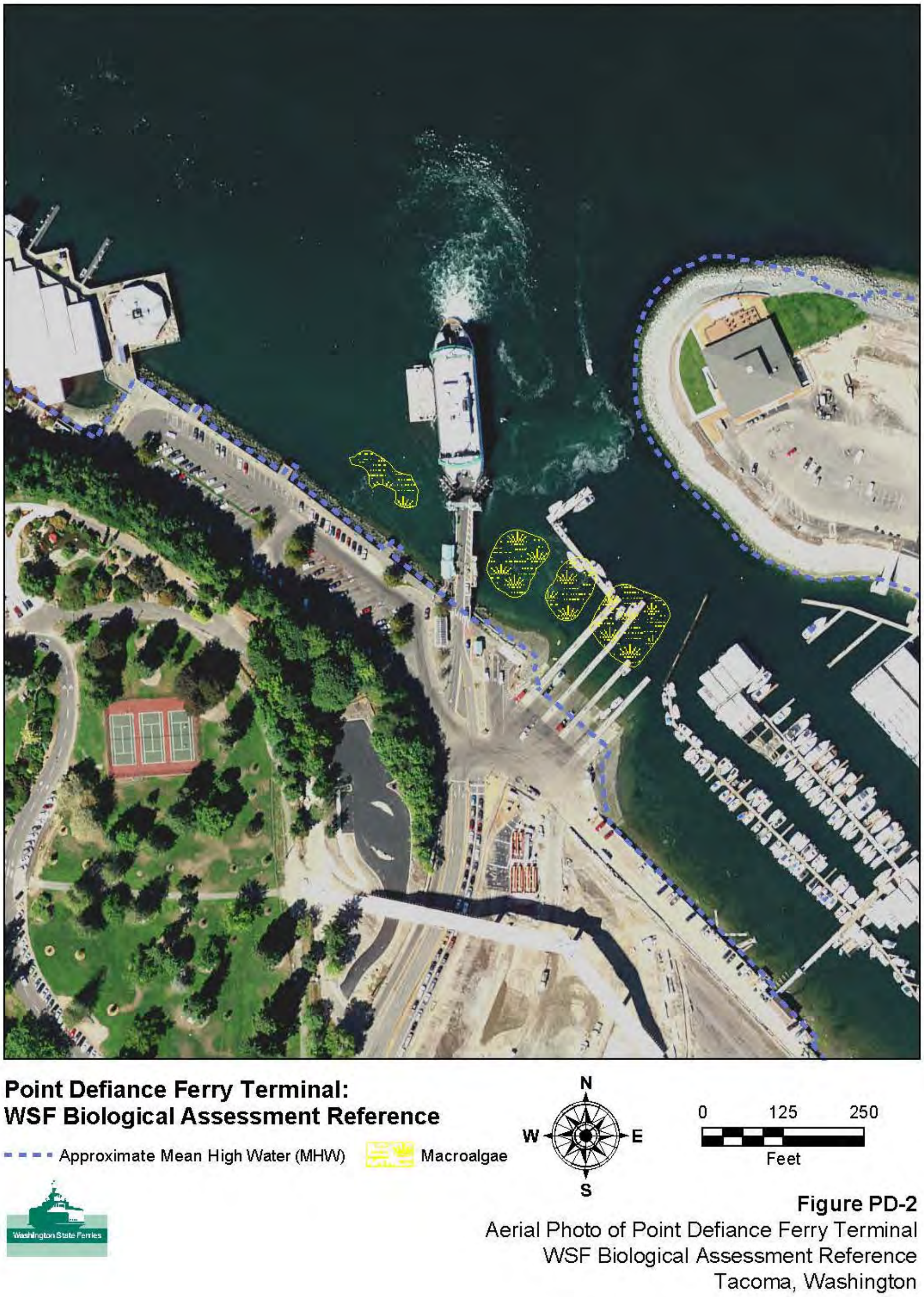



**Figure PD-2**
**Aerial Photo of Point Defiance Ferry Terminal**

## 4.14 Point Defiance Ferry Terminal

The Point Defiance Ferry Terminal is located on Point Defiance, in north Tacoma and just northeast of the Tacoma Narrows. Point Defiance is on the Dalco Passage, which leads into Commencement Bay (see Figures PD-1 and PD-2).

The Point Defiance Ferry Terminal provides service to the Talequah Ferry Terminal.

Features of the terminal include a terminal building, two vehicle holding lanes that accommodate up to 50 vehicles, and a private paid parking lot. The terminal has one slip with steel wingwalls. Two dolphins are associated with the terminal, one steel and one floating steel dolphin. No overhead loading facilities exist at the terminal.

### *4.14.1 Point Defiance Environmental Baseline*

#### 4.14.1.1 *Physical Indicators*

*Substrate and Slope*

The substrate is composed of medium dense silty fines to sand and gravel with riprap and bulkheads in the high intertidal. Based on aerial photographs, it appears that the aquatic bed slopes off steeply a short distance from the riprap bulkhead. Offshore depths of terminal structures are: head of slip (-18.5 feet MLLW). Maximum depth for fixed dolphin is -32.7 feet MLLW and for the floating dolphin -30.2 feet MLLW. See Figures PD-3 and PD-4 for pictures of the shoreline areas south and north of the ferry terminal.

**Figure PD-3**
**Shoreline South of the Point Defiance Ferry Terminal**

**Figure PD-4**
**Shoreline North of the Point Defiance Ferry Terminal**

### *Salt/Freshwater Mixing*

The closest stream appears to drain into Dalco Passage about 0.5 mile east of the ferry terminal.

*Flows and Currents*

No specific information is available to characterize flow and current patterns.

#### 4.14.1.2 *Chemical Indicators*

*Water Quality*

The marine waters of Dalco Passage are designated "Extraordinary" for aquatic life use. Impaired waters listings in the terminal area include metals in sediment (Ecology 2018).

*Sediment Quality*

The ferry terminal is located within the Asarco Tacoma Sediment Superfund Site. Impaired waters listings in the terminal area include metals in sediment (Ecology 2018).

#### 4.14.1.3 *Biological Indicators*

*Shoreline Vegetation*

There is no shoreline vegetation in the immediate vicinity of the ferry terminal. Shoreline vegetation consisting of shrubs and trees occurs east of the terminal.

*Macroalgae and Eelgrass*

Patches of eelgrass were observed during a 2013 dive survey. Macroalgae was abundant on both sides of the trestle, and included rockweed, sea lettuce, red ribbon, red filamentous algaes (*Gracillaria* spp.), black tassel (*Pterosiphonia* spp.), Turkish towel, and low densities of sugar kelp in several places (CH2MHILL 2005). See Figure PD-2 for locations of eelgrass and macroalgae.

*Epibenthos, Macrofauna, Fish, and Marine Mammals*

Given the characteristics of the intertidal area in the vicinity of the ferry terminal, the substrates are expected to support epibenthic production. There is no site-specific information on macrofauna or fisheries resources in the vicinity of the terminal. Given the amount of rocky habitat in the general area, fisheries resources common to Puget Sound rocky shorelines are expected.

Given the proximity of the ferry terminal to the Yacht Club, and the somewhat enclosed area where the terminal occurs, marine mammals that could occur in the vicinity include harbor seal, Steller sea lion, and California sea lion. It is unlikely that cetaceans occur in the vicinity of the ferry terminal; however, they are likely to occur in Dalco Passage.

*Forage Fish*

There is no documented forage fish spawning present at the terminal. Documented sand lance spawning is present approximately 4,000 feet NW of the terminal (WSDOT 2018a).

### 4.14.2 Point Defiance Species Distributions

#### 4.14.2.1 Puget Sound Chinook Salmon (*Oncorhynchus tshawytscha*)

No Chinook salmon bearing streams are located near the Point Defiance Ferry Terminal. However, major rivers that support Chinook salmon include the Puyallup River (approximately 5 miles southeast, shoreline distance) and the Nisqually River (approximately 25 miles southwest, shoreline distance). Chinook may also be present from rivers and streams in southern Puget Sound (WDFW 2007a).

*Adult and Sub-adult Chinook*

Adults may be found near the terminal at any time of year, but are most abundant during late summer and fall when returning from the ocean to their natal streams.

Sub-adult Chinook have access to the terminal area and may be found there at any time of year. Sub-adults have spent a winter in the marine environment and are not closely oriented to the shoreline like juveniles.

*Juvenile Chinook*

While there are no streams that support Chinook salmon near the ferry terminal, nearshore waters may be used by juvenile Chinook for rearing. Juveniles would likely be most abundant during late spring/early summer.

### 4.14.2.2 *Puget Sound Chinook Salmon Critical Habitat*

The Point Defiance Ferry Terminal lies within Chinook Zone 11 (70 FR 52630). The PCEs provided in the ferry terminal area, and their existing conditions, are listed in Table PD-1. PCEs relevant to the terminal area are numbered per the CFR (70 FR 52630).

**Table PD-1**
**Existing Conditions of Chinook Salmon PCEs at the Point Defiance Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 5) Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels. | **Obstructions**<br>In-water structures include the trestle, the slip, and dolphins. The existing ferry terminal may affect fish passage in the nearshore.<br><br>**Water Quality and Forage**<br>The marine waters of Dalco Passage are designated "Extraordinary" for aquatic life. Impaired waters listings in the terminal area include metals in sediment (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of three drainage areas that drain to Dalco Passage. Two of the areas include treatment.<br><br>The first drainage area drains the holding and exit lanes, and consists of two catch basins that flow through an oil/water separator (inspected annually) before connecting to the second drainage area. Input from the WSDOT system connects upgradient to this area.<br><br>The second drainage area drains the trestle approach, exit lanes, and the parking area, and consists of five catch basins that flow through an oil/water separator maintained by the City of Tacoma. Both areas discharge through a City of Tacoma outfall to the west of the pier.<br><br>The third drainage area consists of the transfer span (typically 90 feet long by 24 feet wide that carries traffic between the trestle and ferry), which discharges by sheet flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Overwater coverage from the existing ferry terminal structures may reduce the production of aquatic invertebrates that are prey species to salmon. The ferry terminal lies within the Asarco Tacoma Sediments Superfund Site. Substrates in the area are expected to support epibenthic production.<br><br>There is no documented forage fish spawning present at the terminal. Documented sand lance spawning is present approximately 4,000 feet NW of the terminal (WSDOT 2018a).<br><br>**Natural Cover**<br>Shoreline vegetation consisting of shrubs and trees occurs east of the terminal. Macroalgae species at the Point Defiance Ferry Terminal include kelp, rockweed, sea lettuce, and other red and brown algae. Two very small patches of eelgrass were observed during a 2003 dive survey.<br><br>There is no large overhanging woody vegetation. The existing conditions within the defined area of critical habitat consist of gravel with areas of sand. Clam shells and shell hash were commonly mixed with gravel, sand, and gravel/sand substrates. The area between the transfer span towers was cobble. The shoreline adjacent to the terminal is entirely riprap (CH2MHILL 2005). Side channels do not occur in the ferry terminal area. |

| PCEs | Existing Conditions |
|---|---|
| 6) Offshore areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation. | The marine waters of Dalco Passage near the ferry terminal are designated “Extraordinary” for aquatic life use. Impaired waters listings in the terminal area include metals in sediment (Ecology 2018).<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Offshore areas provide habitat for forage fish. |

#### 4.14.2.3 *Puget Sound Steelhead (Oncorhynchus mykiss)*

There are no natal streams in the area of the Point Defiance Ferry Terminal that support Puget Sound steelhead. However, major river systems and streams that support winter steelhead include the Puyallup River (approximately 5 miles southeast, shoreline distance), Chambers Creek (approximately 12 miles southwest, shoreline distance), Red Salmon Creek (approximately 24 miles southwest, shoreline distance), the Nisqually River (approximately 25 miles southwest, shoreline distance), and McAllister Creek (approximately 26 miles southwest, shoreline distance). In addition, the Deschutes River and smaller drainages in southern Puget Sound also support winter steelhead (WDFW 2007a).

Available data from tow-net sampling (deeper nearshore) and beach seine sampling (shallow nearshore) efforts around Puget Sound have reported the capture of few steelhead. In tow-net sampling in north and south Puget Sound, NMFS captured a total of 18 steelhead (Rice, unpublished data). The total sampling effort data was not available, but the mean steelhead catch ranged from 0 to 0.2 per net in north Puget Sound and 0.1 to 0.8 per net in south Puget Sound.

During 2001 and 2002, beach seining conducted in central Puget Sound by King County Department of Natural Resources captured only nine steelhead out of a total of approximately 34,000 juvenile salmonids. All the steelhead were caught between May and August and ranged in size from 141 to 462 mm with a mean size of 258 mm (Brennan et al. 2004).

#### 4.14.2.4 *Puget Sound Steelhead Critical Habitat*

The Point Defiance Ferry Terminal does not fall within designated steelhead critical habitat (Federal Register 2016a).

#### 4.14.2.5 *Humpback Whale (Megaptera novaeangliae)*

Humpback whale may be present near the Point Defiance ferry terminal. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.14.2.6 *Southern Resident Killer Whale (Orcinus orca)*

Southern Resident Killer Whale (SRKW) may be present near the Point Defiance ferry terminal. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.14.2.7 *Southern Resident Killer Whale Critical Habitat*

The Point Defiance Ferry Terminal area lies within designated critical habitat (Area 2 – Puget Sound). Areas with water less than 20 feet deep relative to the extreme high water mark are not included in the critical habitat designation (Federal Register 2006).

The PCEs provided in the terminal area, and their existing conditions are listed in Table PD-2. PCEs relevant to the terminal area are numbered per Federal Register 2006.

**Table PD-2**
**Existing Conditions of Southern Resident Killer Whale PCEs at the Point Defiance Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 1) Water quality to support growth and development | The marine waters of Dalco Passage are designated "Extraordinary" for aquatic life use. Impaired waters listings in the terminal area include metals in sediment (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of three drainage areas that drain to Dalco Passage. Two of the areas include treatment.<br><br>The first drainage area drains the holding and exit lanes, and consists of two catch basins that flow through an oil/water separator (inspected annually) before connecting to the second drainage area. Input from the WSDOT system connects upgradient to this area.<br><br>The second drainage area drains the trestle approach, exit lanes, and the parking area, and consists of five catch basins that flow through an oil/water separator maintained by the City of Tacoma. Both areas discharge through a City of Tacoma outfall to the west of the pier.<br><br>The third drainage area consists of the transfer span (typically 90 feet long by 24 feet wide that carries traffic between the trestle and ferry), which discharges by sheet flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column, degrading water quality in the terminal vicinity. |
| 2) Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth | Salmonids are the primary prey of SRKW, and may be present near the terminal. Further information on prey can be found in the Puget Sound Chinook section, and Appendix B – Species Biology. |
| 3) Passage conditions to allow for migration, resting, and foraging | Existing structures that occur below -20 feet in critical habitat include the dolphins. |

#### 4.14.2.8 *Bull Trout (Salvelinus confluentus)*

There are no natal streams in the area of the Point Defiance Ferry Terminal that support bull trout (WDFW 2007a). However, bull trout are documented in the Puyallup River and Commencement Bay, which are both near the Point Defiance Terminal (Goetz et al. 2004). The aquatic portions of the terminal are within marine FMO habitat. While bull trout have not been documented in the terminal area, suitable FMO habitat is present, and bull trout are thought to occur throughout south, central, and northern Puget Sound. Therefore, it is expected that the terminal area would be used by anadromous adult and sub-adult bull trout for foraging, migration, and overwintering (USFWS 2004b). Within the terminal area, it is expected that individual bull trout from the Puyallup River (approximately 5 miles southeast, shoreline distance) core area are most likely to be present (WDFW 2007a).

#### 4.14.2.9 *Bull Trout Critical Habitat*

The shoreline of the Point Defiance Ferry Terminal is within designated bull trout critical habitat. The PCEs provided in the ferry terminal area, and their existing conditions, are listed in Table PD-3. PCEs relevant to the terminal area are numbered per Federal Register 2010a.

**Table PD-3**
**Existing Conditions of Bull Trout PCEs at the Point Defiance Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 2) 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. | In-water structures include the trestle, the slip, and dolphins. The existing ferry terminal may affect fish passage in the nearshore, and may reduce the production of aquatic invertebrates that are prey species to bull trout. |
| 3) An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish. | Macroalgae species at the Point Defiance Ferry Terminal include kelp, rockweed, sea lettuce, and other red and brown algae. Two very small patches of eelgrass were observed during a 2003 dive survey.<br><br>There is no large overhanging woody vegetation. The existing conditions within the defined area of critical habitat consist of gravel with areas of sand. Clam shells and shell hash were commonly mixed with gravel, sand, and gravel/sand substrates. The area between the transfer span towers was cobble. The shoreline adjacent to the ferry terminal is entirely riprap (CH2MHILL 2005).<br><br>The ferry terminal lies within the Asarco Tacoma Sediments Superfund Site. Substrates in the area are expected to marginally support epibenthic production.<br><br>Sand lance spawning occurs about 0.5 miles west of the terminal. |
| 4) 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. | In-water structures include the trestle, the slip, and dolphins. The existing ferry terminal may affect fish passage in the nearshore, and may reduce the production of aquatic invertebrates that are prey species to salmon.<br><br>There is no large overhanging woody vegetation. The existing conditions within the defined area of critical habitat consist of gravel with areas of sand. Clam shells and shell hash were commonly mixed with gravel, sand, and gravel/sand substrates. The area between the transfer span towers was cobble. The shoreline adjacent to the ferry terminal is entirely riprap (CH2MHILL 2005).<br><br>Macroalgae species at the Point Defiance Ferry Terminal include kelp, rockweed, sea lettuce, and other red and brown algae. Two very small patches of eelgrass were observed during a 2003 dive survey. |
| 5) 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. Specific | East Puget Sound water temperatures can range from 41.4 to 75.7 °F (5.2 to 24.3 °C) with an average of 51 °F (10.58 °C) (Ecology 2007). Water temperature data for specific ferry terminals is not available. The over-water components of the ferry terminal provide some shade, which may cause slight localized reductions in water temperatures. |

| PCEs | Existing Conditions |
|---|---|
| temperatures within this range will depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence. | |
| 8) Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited. | The marine waters of Dalco Passage are designated "Extraordinary" for aquatic life use. Impaired waters listings in the terminal area include metals in sediment (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of three drainage areas that drain to Dalco Passage. Two of the areas include treatment.<br><br>The first drainage area drains the holding and exit lanes, and consists of two catch basins that flow through an oil/water separator (inspected annually) before connecting to the second drainage area. Input from the WSDOT system connects upgradient to this area.<br><br>The second drainage area drains the trestle approach, exit lanes, and the parking area, and consists of five catch basins that flow through an oil/water separator maintained by the City of Tacoma. Both areas discharge through a City of Tacoma outfall to the west of the pier.<br><br>The third drainage area consists of the transfer span (typically 90 feet long by 24 feet wide that carries traffic between the trestle and ferry), which discharges by sheet flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column, degrading water quality in the terminal vicinity. |

#### 4.14.2.10 *Green Sturgeon (Acipenser medirostris)*

There are no natal streams in the area of the Point Defiance Ferry Terminal that support green sturgeon.

Observations of green sturgeon in Puget Sound are much less common compared to the coastal Washington estuaries and bays such as Willapa Bay, Grays Harbor, and the Lower Columbia River estuary (Federal Register 2018). In addition, Puget Sound does not appear to be part of the coastal migratory corridor that Southern DPS fish use to reach overwintering grounds north of Vancouver Island (Federal Register 2018).

NMFS reviewed green sturgeon acoustic detection data from 2002-2019 in Puget Sound and the Strait of Juan de Fuca. From 2002-2008, 350 tagged green sturgeon were at large (67% from the threatened southern DPS). During this time, 17 were detected in Puget Sound (4 from the southern DPS). After 2008, none were detected in central or southern Puget Sound, though 400 were at large (83% southern DPS). From 2013-2018, six (one from the southern DPS) were detected in Admiralty Inlet (northern Puget Sound).

From 2004-2019, 210 green sturgeon were detected in the Strait of Juan de Fuca (71% southern DPS). This indicates that the strait is used as a corridor, with green sturgeon residing at detection sites for short periods as they pass through from open ocean. Few of these fish were detected afterwards in Admiralty Inlet, suggesting that most of the tagged population move northward into the Strait of Georgia after transiting the strait. Data indicates conclusively that green sturgeon from the southern DPS occur in Puget Sound and Admiralty inlet, but at low rates compared to Strait of Juan de Fuca presence. This confirms earlier findings that Puget Sound is of lower conservation value to southern DPS green sturgeon. However, it is noted that the tagged population is a small fraction of the whole green sturgeon population, and that conditions need to be optimum for acoustic detection to occur (Moser, et. al. 2021).

#### 4.14.2.11 *Green Sturgeon Critical Habitat*

The Point Defiance Ferry Terminal does not fall within designated green sturgeon critical habitat (Federal Register 2009).

#### 4.14.2.12 *Marbled Murrelet (Brachyramphus marmoratus)*

The Point Defiance terminal area provides suitable marbled murrelet marine foraging habitat.

There is no documented forage fish spawning present at the terminal. Documented sand lance spawning is present approximately 4,000 ft. NW of the terminal (WSDOT 2018a).

WDFW surveys conducted from 2001 to 2012 show a density of less than 1 bird per square kilometer in the terminal area (WDFW 2016). The nearest documented marbled murrelet nesting site is located 37 NW miles of the terminal (WSDOT 2018b).

The Northwest Forest Plan Marbled Murrelet Effectiveness Monitoring Program (2012) identified habitat suitability throughout the range of the species, and ranked it as Zero, Low, Marginal, Moderately High and Highest. The Point Defiance murrelet habitat suitability within the pile driving/heavy equipment zone of potential effect (0.25 miles), is Zero (WSDOT 2019b).

There are no coniferous forest that may offer nesting opportunity within the pile driving/heavy equipment zone of potential effect (0.25 miles) (WSDOT 2014/2018c).

Ferry traffic creates regular disturbance in the immediate terminal area. From July 2017 to June 2018, there were approximately 13,970 scheduled arrivals and departures from the terminal. During the nesting season (April 1-September 23), when foraging murrelet are more active, there were approximately 7,010 scheduled arrivals and departures (WSDOT 2018d).

#### 4.14.2.13 *Marbled Murrelet Critical Habitat*

No marbled murrelet critical habitat has been designated near the terminal (USFWS 1996).

#### 4.14.2.14 *Rockfish Species*

*Bocaccio*

Bocaccio are rarely caught in north Puget Sound and only sparse records exist for the Strait of Georgia (Federal Register 2010b). Because larvae are widely dispersed, it is possible that bocaccio juveniles could be found near the Point Defiance Ferry Terminal at any time of year. Adult bocaccio generally move to very deep water. The waters of Dalco Passage range from about 40 to 90 feet deep and are subject to strong currents (NMFS 2009). This is still shallower than ideal for bocaccio, but rockfish-suitable substrates exist in the Tacoma Narrows and rockfish populations exist there (NMFS 2009).

*Yelloweye Rockfish*

Yelloweye rockfish are more closely aligned with rocky, high-relief substrates than with very deep water (Federal Register 2010b). The waters near Point Defiance offer both rocky substrates and deep water. It is likely that yelloweye rockfish are in the vicinity.

#### 4.14.2.15 *Rockfish Species Critical Habitat*

The Point Defiance Ferry Terminal is within rockfish nearshore critical habitat (less than or equal to 98 feet in depth) (Federal Register 2014). The physical and biological features (PBFs) (Federal Register 2014) essential to the conservation of juvenile Bocaccio rockfish are listed in Table PD-4. PBFs relevant to the terminal area are numbered per the CFR (Federal Register 2014). These PBFs are specific to nearshore environments, where only juvenile Bocaccio rockfish could be found. Deepwater (> 98 feet in depth) PBFs exist for adult Bocaccio, and adult and juvenile yelloweye rockfish; however, this habitat is not present at the Point Defiance Ferry Terminal and will not be discussed here.

**Table PD-4**
**Existing Conditions of Rockfish PBFs at the Point Defiance Ferry Terminal**

| PBFs | Existing Conditions |
|---|---|
| 1) Quantity, quality, and availability of prey species to support individual growth, survivial, reproduction, and feeding opportunities. | The marine waters of Dalco Passage are designated “Extraordinary” for aquatic life. Impaired waters listings in the terminal area include metals in sediment (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of three drainage areas that drain to Dalco Passage. Two of the areas include treatment.<br><br>The first drainage area drains the holding and exit lanes, and consists of two catch basins that flow through an oil/water separator (inspected annually) before connecting to the second drainage area. Input from the WSDOT system connects upgradient to this area.<br><br>The second drainage area drains the trestle approach, exit lanes, and the parking area, and consists of five catch basins that flow through an oil/water separator maintained by the City of Tacoma. Both areas discharge through a City of Tacoma outfall to the west of the pier.<br><br>The third drainage area consists of the transfer span (typically 90 feet long by 24 feet wide that carries traffic between the trestle and ferry), which discharges by sheet flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Overwater coverage from the existing ferry terminal structures may reduce the production of aquatic invertebrates that are prey species to salmon. The ferry terminal lies within the Asarco Tacoma Sediments Superfund Site. Substrates in the area are expected to support epibenthic production.<br><br>There is no documented forage fish spawning present at the terminal. Documented sand lance spawning is present approximately 4,000 feet NW of the terminal (WSDOT 2018a). |
| 2) Water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities. | Shoreline vegetation consisting of shrubs and trees occurs east of the terminal. Macroalgae species at the Point Defiance Ferry Terminal include kelp, rockweed, sea lettuce, and other red and brown algae. Two very small patches of eelgrass were observed during a 2003 dive survey.<br><br>There is no large overhanging woody vegetation. The existing conditions within the defined area of critical habitat consist of gravel with areas of sand. Clam shells and shell hash were commonly mixed with gravel, sand, and gravel/sand substrates. The area between the transfer span towers was cobble. The shoreline adjacent to the terminal is entirely riprap (CH2MHILL 2005). Side channels do not occur in the ferry terminal area. |

#### 4.14.2.16 *Pacific Eulachon (Thaleichthys pacificus)*

The Point Defiance Ferry Terminal is distant from any of the known eulachon spawning rivers. It is highly unlikely that eulachon will be present at the Point Defiance Ferry Terminal.

#### 4.14.2.17 *Pacific Eulachon Critical Habitat*

No Pacific eulachon critical habitat has been designated near the Point Defiance Ferry Terminal (FEDERAL REGISTER 2011).

# PORT TOWNSEND


**Figure PT-1**
Port Townsend Ferry Terminal Vicinity Map
WSF Biological Assessment Reference
Port Townsend, Washington

**Figure PT-1**
**Port Townsend Ferry Terminal Vicinity Map**

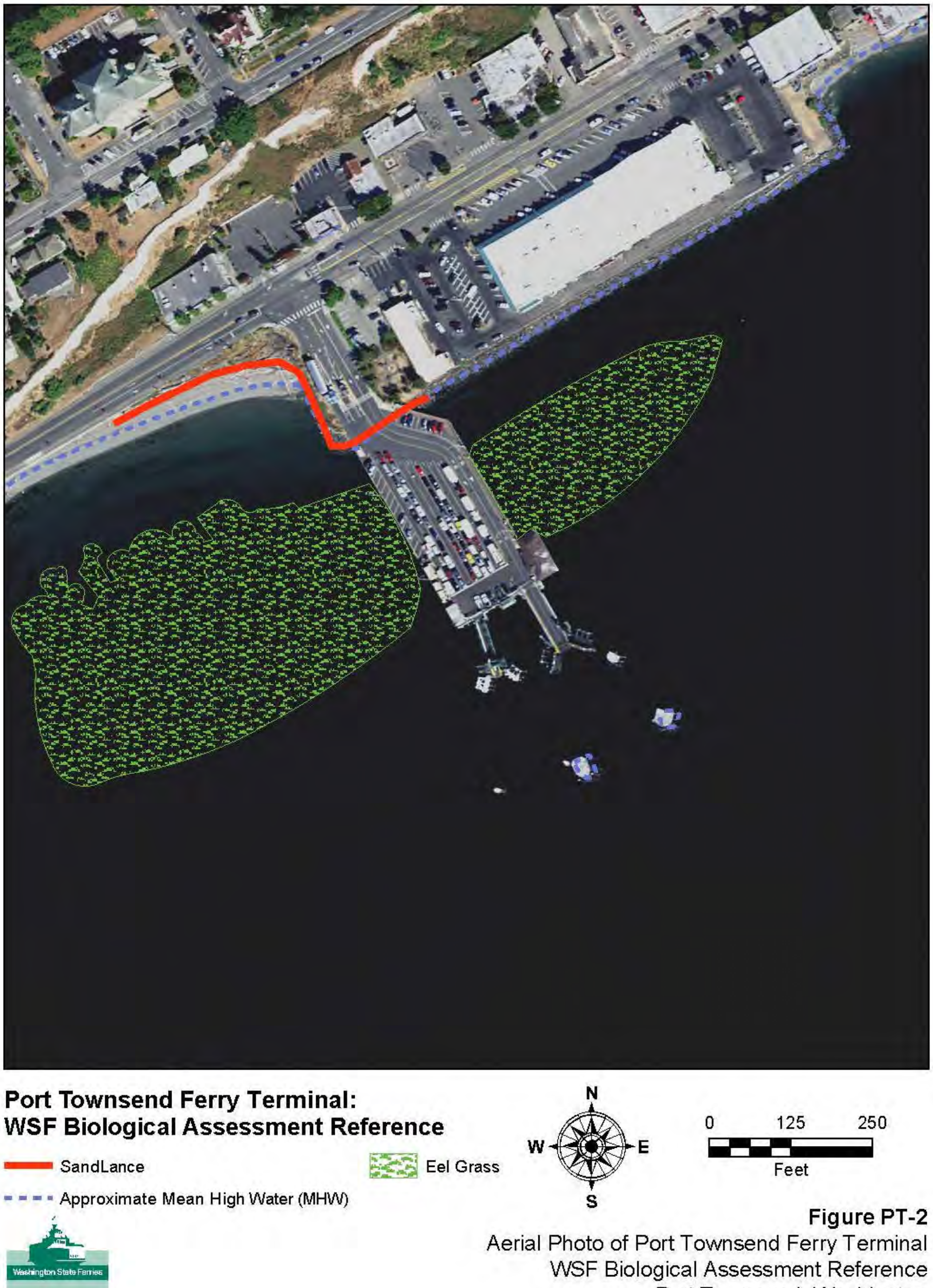



**Figure PT-2**
**Aerial Photo of Port Townsend Ferry Terminal**

## 4.15 Port Townsend Ferry Terminal

The Port Townsend Ferry Terminal is located in the city of Port Townsend, on Port Townsend Bay, tributary to Admiralty Inlet (see Figures PT-1 and PT-2).

The Port Townsend Ferry Terminal provides service to the Coupeville Terminal.

Features of the terminal include a terminal building, 10 vehicle holding lanes that accommodate up to 100 vehicles, and overhead passenger loading facilities. The terminal has main and auxiliary slips. Steel wingwalls are present in the main slip and nine-pile steel wingwalls are present in the auxiliary slip. Five dolphins are associated with the terminal, three steel in the main slip and two timber dolphins in the auxiliary slip. No paid parking or passenger overhead loading facilities exist at the terminal.

### *4.15.1 Port Townsend Environmental Baseline*

#### 4.15.1.1 *Physical Indicators*

*Substrate and Slope*

Substrate conditions in Port Townsend Bay are generally soft bottom types. The northern portion of the bay tends to be more coarse and the inner bay is more muddy. Littoral drift has an influence on the substrate character along shorelines. Within Port Townsend Bay, the pattern of littoral drift is north along the northwest shoreline, south along the southwest shoreline, and south along nearly the entire east shoreline of the bay. The drift cell along the city waterfront has been cut off from its feeder bluffs by fill and shoreline armoring.

A sill (a shallow vertical constriction) in Admiralty Inlet adjacent to Port Townsend Bay is less than 200 feet deep. This sill separates waterbodies with depths of over 600 feet on either side of the sill. Admiralty Inlet is also a horizontal constriction. This underwater topography results in very high tidal velocities and subsequent mixing over the rocky irregular bottom (Strickland 1983).

On shoreline areas where constructed seawalls exist at intertidal elevations, gravel pocket beaches are present. These gravel pocket beaches transition to sandy substrates at subtidal depths. Sand and gravel recruitment from the feeder bluffs adjacent to the ferry terminal have been cut off from shoreline erosional processes due to fill and seawalls associated with the construction of SR 20 and other shoreline development. See Figures PT-3 and PT-4 for pictures of the shoreline areas north and south of the ferry terminal.

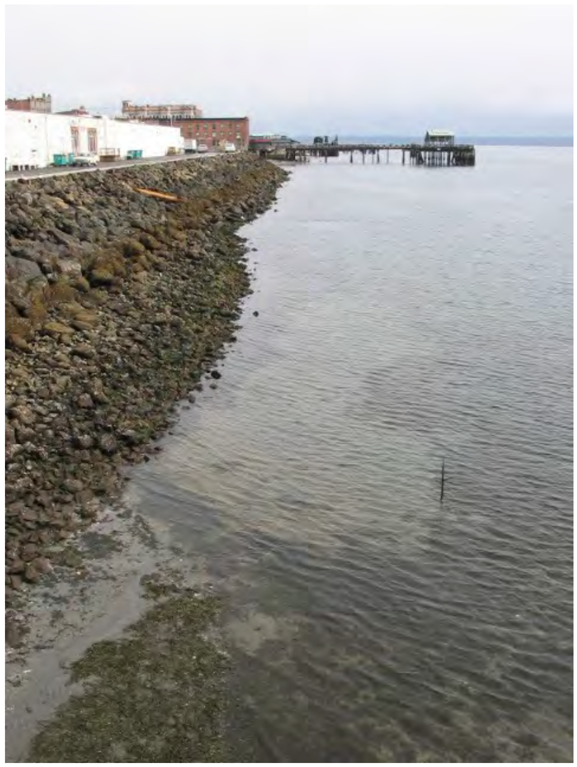


**Figure PT-3**
**Shoreline Area North of the Port Townsend Ferry Terminal**

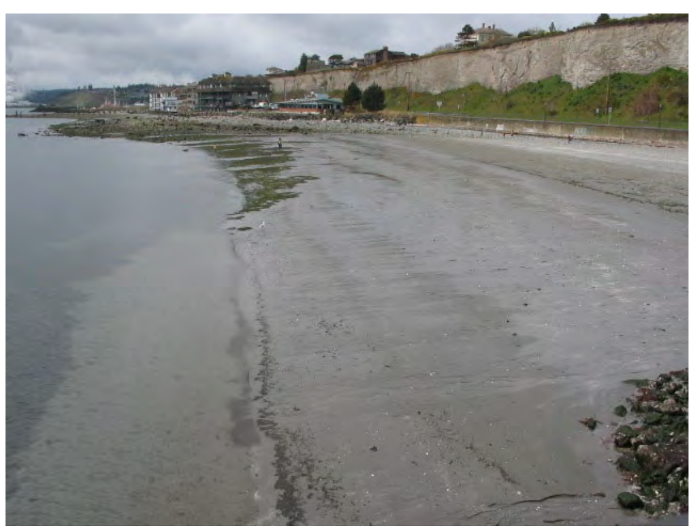


**Figure PT-4**
**Shoreline Area South of the Port Townsend Ferry Terminal**

During May 2005, Marine Resources Consultants (MRC) and the project fisheries discipline team biologist used underwater videography to examine subtidal substrate conditions in the immediate vicinity of the ferry terminal and the area between the terminal and the Union Wharf pier to the east (Norris and Fraser 2005). The predominant subtidal substrate type in the project area is sand mixed with clam shells or clam shell fragments. The shell fraction within 8 feet of the ferry terminal perimeter and the riprap seawall is composed of barnacle shell fragments. Pure sand substrates are only found in a few patches in the borrow pit located to the east of the ferry terminal. Sand mixed with gravel substrate is present in patches offshore of the ferry slips where propeller wash has blown away some of the finer particles. Gravel bottom conditions are present offshore of the main ferry slip. A small amount of cobble substrate is present well offshore of the main ferry slip.

The walls of the borrow pit are relatively steep just offshore of the Port Townsend Plaza. The pit was excavated when the Port Townsend Plaza was built to provide fill behind the riprap seawall (Nightengale 2002). Although the dominant substrate observed in the pit was sand with shells or pure sand, most of the bottom was unobservable due to the very thick growth of macroalgae.

Offshore depths of terminal structures are: head of main slip (-24.8 feet MLLW), and auxiliary slip (-22.5 feet MLLW). Maximum depth for fixed dolphins is -23.0 feet MLLW and for the floating dolphin -20.5 feet MLLW.

#### *Salt/Freshwater Mixing*

The only freshwater body in the immediate vicinity of the ferry terminal is Kah Tai Lagoon. This waterbody is brackish due to inflow of marine water from Port Townsend Bay. Stormwater from a sizable portion of the city of Port Townsend drains to this lagoon before discharging into the bay. Stormwater runoff from the city enters Port Townsend Bay through several outfalls, five of which are within 1 mile of the Port Townsend Ferry Terminal.

A high degree of mixing occurs in the adjacent waterbody of Admiralty Inlet. As stated in the previous Substrate and Slope section, a sill (a shallow vertical constriction) in Admiralty Inlet adjacent to Port Townsend Bay is less than 200 feet deep. This sill separates waterbodies with depths of over 600 feet on either side of the sill. Admiralty Inlet is also a horizontal constriction. This underwater topography results in very high tidal velocities and subsequent mixing over the rocky irregular bottom (Strickland 1983).

Turbulence caused by strong currents in the eastern Strait of Juan de Fuca and high seasonal winds increases mixing.

*Flows and Currents*

Weak currents travel parallel to the shoreline, controlled primarily by tidal conditions. During ebb tide, the current moves westerly at about 1 foot per second. The current moves easterly, generally less than 0.5 foot per second, during the flood tide. Along the shoreline, the current is even slower.

#### 4.15.1.2 *Chemical Indicators*

*Water Quality*

The marine waters of Port Townsend Bay are designated "Extraordinary" for aquatic life use. Impaired waters listings in the terminal area include inorganic nitrogen loading resulting in human-caused eutrophication of eelgrass beds (Ecology 2018). Ecology's 2012 303(d) list identified no water quality parameters of concern for Port Townsend Bay.

Major water uses designated by the State of Washington include salmon rearing, shellfish rearing and harvesting, primary contact recreation, and commerce and navigation. The water temperature standard for marine water is 55°F. Temperature in the south Port Townsend Bay has been found to exceed 55°F on many occasions. These higher temperatures have been attributed to warmer weather conditions during the summer, which promote temporary water stratification (City of Port Townsend 2002).

DO generally stays above 7.0 mg/L (the state standard) in most years (PTMSC 2001). This is partly due to the general lack of water column stratification that is common in other similar embayments such as nearby Discovery Bay (Nightingale 2000). The weak water column stratification in Port Townsend Bay is due to the high degree of mixing that occurs in the adjacent waterbody of Admiralty Inlet. The occasional low DO conditions in Port Townsend Bay are due to deep bottom water, with naturally low DO from the Strait of Juan De Fuca, upwelling at the entrance of Admiralty Inlet adjacent to Port Townsend Bay.

There are five untreated stormwater outfalls along the southern shoreline of Port Townsend Bay where the ferry terminal is located. Since the majority of the surfaces generating runoff along this shoreline consist of large commercial parking lots and roadways, these stormwater outfalls most likely introduce pollutants to marine waters such as total suspended solids (TSS) and oil.

Inorganic nitrogen, usually nitrate, is the leading cause of plankton blooms in marine waters. According to Ecology analysis, Port Townsend Bay has detectable levels of inorganic nitrogen (primarily nitrate), which tend to drop to scarcely detectable levels in summer. This drop during the summer months is attributed to uptake by the phytoplankton.

*Sediment Quality*

Sediment samples collected southwest of the terminal in 1998 indicate no exceedences of Sediment Management Standards (Ecology 2018).

#### 4.15.1.3 *Biological Indicators*

*Shoreline Vegetation*

The shoreline of the city of Port Townsend is approximately 3 miles long. Many overwater structures, armored walls, and artificial fills are present on the city's waterfront. The southern shoreline, from Point Hudson to Indian Point, is approximately 1 mile long and contains the ferry terminal. About 98 percent of the downtown Port Townsend shoreline is armored by riprap, overwater structures, bulkheads, or jetties (Nightengale 2003).

The shoreline east of the Port Townsend Ferry Terminal was formerly dominated by tidal marshes, whereas the shoreline to the west has steep bluffs that likely provided sediments to the adjacent intertidal beaches. A long history of human activity, which includes artificial fills, dredging, and construction of overwater structures, has re-shaped this shoreline completely. SR 20 runs along the shoreline. The majority of land use along the shore is commercial, and only 15 percent is residential—mainly condominiums and apartments.

Riprap and vertical concrete seawalls extend down to subtidal depths including the shoreline immediately to the east of the ferry terminal. There are areas where seawalls only exist at the extreme high tidal elevation, such as the beach immediately to the west of the ferry terminal. Feeder bluffs along the city waterfront have been cut off from the shore by fill and shoreline armoring.

#### *Macroalgae and Eelgrass*

Macroalgae is present and is interlaced with eelgrass growth where eelgrass is present and is thicker in areas where eelgrass is absent. Rockweed occurs in the higher intertidal area on riprap. Sea lettuce is abundant at depths less than -15 feet MLLW. At depths greater than about -10 feet MLLW, the macroalgae community shifts towards brown and red algae species, and at depth greater than about -30 feet MLLW, the community shifts to red algae species.

Eelgrass is present throughout Port Townsend Bay. The eelgrass bed west of the ferry terminal extends to the Boat Haven (0.75 miles southwest), then from the Boat Haven to the pulp mill (2 miles southwest). Eelgrass east of the terminal occurs in more discreet beds. See Figure PT-2. There are long, continuous eelgrass beds along the western shoreline and the south end of the bay. Eelgrass exists in patchy beds along the eastern shoreline of the bay. Eelgrass beds line almost all of the shorelines of Kilisut Harbor, which lies between Indian Island and Marrowstone Island (harbor entrance 2 miles southeast).

#### *Epibenthos, Macrofauna, Fish, and Marine Mammals*

The substrate composition and presence of eelgrass would support epibenthic production. Dungeness crab occur in the bay, and are more abundant farther offshore than in the vicinity of the waterfront or in the center of the bay. Concentrations of spot shrimp are present on the east side of the bay. Geoduck are abundant in several areas of the bay, and hardshell clams, such as littleneck clams (*Protothaca staminea*) and butter clams (*Saxidomus giganteus*), are likely found wherever habitat is suitable in the bay.

Port Townsend Bay supports a wide variety of dermersal fish. Otter trawls were conducted in June of each year over a 10 year period. A total of 73 species were caught and the most abundant species in the bay was Pacific tomcod (*Microgadus proximus*). Other relatively abundant species included snake prickleback (*Lumpenus sagitta*), Pacific herring, walleye Pollock (*Theragra chalcogramma*), English sole, ribbed sculpin (*Triglops pingelii*), flathead sole (*Hippoglossoides elassodon*), blackbelly eelpout (*Lycodes pacificus*), Pacific sand dab (*Citharichthys sordidus*), and spotted ratfish (*Hydrolagus colliei*) (CH2MHILL 2006a). Other species observed in the vicinity of the ferry terminal included sand lance; perch; gunnel (*Pholis ornata*); starry flounder; chum, pink, and Chinook salmon; and coastal cutthroat trout.

Marine mammals that might use marine habitat in Port Townsend Bay include harbor seal, California sea lion, Steller sea lion, harbor porpoise, Dall's porpoise, gray whale, minke whale, and killer whale.

Harbor seal, Steller sea lion, and California sea lion are common, year-round residents. A seal and sea lion haul-out is located at Fort Flagler State Park, approximately 2 miles southeast of the ferry terminal.

### *Forage Fish*

Documented surf smelt (prey species) spawning is present at the terminal (see Figure PT-2), and extends approximately 270 feet to the southwest of the terminal (WSDOT 2018a).

Port Townsend Bay and Kilisut Harbor are important spawning areas for three species of forage fish: Pacific herring, sand lance, and surf smelt. Herring spawning in the vicinity is referred to as the Kilisut Harbor stock. In recent years, all spawning has occurred within Kilisut Harbor (Stick 2005). This spawning stock is small relative to others in Puget Sound, averaging about 400 tons. Stock abundance fluctuates widely from year to year, with 2004 spawning biomass estimated at about 200 tons (Stick 2005). The pre-spawning holding area is in the deep central portion of Port Townsend Bay. Spawning starts in February and ends in mid-April.

Surf smelt are known to use a number of beaches for spawning within Port Townsend Bay. These areas are scattered throughout the bay, with a large concentration of spawning beaches in Kilisut Harbor. Surf smelt spawning can occur during summer, fall, and winter.

Sand lance are known to use a number of beaches for spawning in Port Townsend Bay and Kilisut Harbor. Spawning in Puget Sound occurs annually from the beginning of November through mid-February. Sand lance spawn on sand or sand mixed with small gravel between tide elevations of +5 feet MLLW to MHHW (+8.45 feet MLLW in Port Townsend Bay) in the upper intertidal zone.

### *4.15.2 Port Townsend Species Distributions*

#### 4.15.2.1 *Puget Sound Chinook Salmon (Oncorhynchus tshawytscha)*

No Chinook salmon-bearing streams are located near the Port Townsend Ferry Terminal (WDFW 2007a).

Chinook bearing rivers in Hood Canal include the Big and Little Quilcene Rivers (approximately 48 miles southeast, shoreline distance), the Dosewallips River (approximately 38 miles southeast, shoreline distance), the Duckabush River (approximately 44 miles southeast, shoreline distance), and other Hood Canal rivers and streams farther south. Chinook bearing rivers in central and south Puget Sound include the Stillaguamish River (approximately 57 miles south then northeast, shoreline distance), Skagit River (approximately 65 miles south then northeast, shoreline distance), the Snohomish River (approximately 48 miles south then northeast, shoreline distance), the Lake Washington/Cedar River (approximately 40 miles southeast), and Duwamish/Green River (approximately 47 miles southeast). Chinook may also be present from rivers and streams in southern Hood Canal and Puget Sound (WDFW 2007a).

*Adult and Sub-adult Chinook*

Adults could be present in deeper offshore waters year-round. The greatest abundance of adults would occur between early summer and early fall as they return from the ocean to their natal streams and rivers. Resident Chinook salmon can be found in the bay all year long. Mid Channel Bank at the mouth of the bay is a very popular sport fishing location for Chinook.

Sub-adult Chinook have access to the terminal area and may be found there at any time of year. Sub-adults have spent a winter in the marine environment and are not closely oriented to the shoreline like juveniles.

*Juvenile Chinook*

Puget Sound Chinook salmon are expected to be found seasonally as migrant juveniles. Their origin could be any of the rivers in south and central Puget Sound, but most likely they come from rivers in Hood Canal that are closer to Port Townsend. These fish would be smaller in size and more shoreline-oriented than fish with more distant origins (CH2MHILL 2006a).

#### 4.15.2.2 *Hood Canal Summer-Run Chum Salmon (Oncorhynchus keta)*

No chum salmon-bearing streams are located near the Port Townsend Ferry Terminal (WDFW 2007a). Hood Canal summer chum salmon are expected to be present seasonally as migrant juveniles and adults. The greatest abundance of adults is expected to occur in late summer and early fall as they return to their natal streams and rivers to spawn. Spawning occurs in September and October. Eggs incubate for about 4 months and hatch in February and March. Juveniles begin their migration toward the ocean immediately (WDFW 2008). Juveniles could be found near the terminal in spring and early summer. There is a run of Hood Canal summer chum in Chimacum Creek at the south end of Port Townsend Bay. Other rivers in Hood Canal may produce summer chum that could enter and spend some time in the bay during their migration out to sea (CH2MHILL 2006a).

Chum bearing streams in the area include Chimacum Creek (Port Townsend Bay, approximately 5 miles south, shoreline distance), Salmon and Snow Creeks (Discovery Bay, approximately 20 miles southwest, shoreline distance), and

Jimmycomelately Creek (Sequim Bay, approximately 22 miles west, shoreline distance). Chum bearing rivers in the area include Dungeness River (approximately 38 miles north then west, shoreline distance), the Little Quilcene and Big Quilcene Rivers (approximately 48 miles southeast, shoreline distance), the Dosewallips River (approximately 38 miles southeast, shoreline distance), the Duckabush River (approximately 44 miles southeast, shoreline distance), and other Hood Canal rivers and streams.

Hood Canal summer chum salmon are expected to be present seasonally as migrant juveniles and adults (CH2MHILL 2006a). Hood Canal summer run chum are known to migrate on the west side of Admiralty Inlet and Port Townsend Bay (Brewer, personal communication 2007).

#### 4.15.2.3 *Puget Sound Chinook and Hood Canal Summer-Run Chum Salmon Critical Habitat*

The Port Townsend Ferry Terminal lies within Chinook Zone 8 and within the designated critical habitat nearshore zone for chum (70 FR 52630). While there are no streams that support Chinook and Hood Canal summer-run chum salmon near the ferry terminal, there are eelgrass beds in close proximity to the ferry terminal that may be used by juvenile Chinook and chum for rearing.

The PCEs provided in the ferry terminal area, and their existing conditions, are listed in Table PT-1. PCEs relevant to the terminal area are numbered per the CFR (70 FR 52630).

**Table PT-1**
**Existing Conditions of Chinook and Hood Canal Summer-Run Chum Salmon PCEs at the Port Townsend Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 5) Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels. | **Obstructions**<br>In-water structures include the two trestles, the main and auxiliary slips, and dolphins. The existing ferry terminal may affect fish passage in the nearshore.<br><br>**Water Quality and Forage**<br>The marine waters of Port Townsend Bay are designated “Extraordinary” for aquatic life use. Impaired waters listings in the terminal area include inorganic nitrogen loading resulting in human-caused eutrophication of eelgrass beds (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of two drainage areas that drain to Port Townsend Bay. None of the runoff is treated.<br><br>The first drainage area drains the holding lanes, and consists of 30 deck drains that all connect to the WSDOT SR 20 system, which discharges through an outfall to the west of the trestle.<br><br>The second drainage area consists of the transfer spans (typically 90 feet long by 24 feet wide that carry traffic between the trestle and ferry), which discharge by sheet flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Overwater coverage from the existing ferry terminal structures may reduce the production of aquatic invertebrates that are prey species to salmon. The composition of substrate and presence of eelgrass indicate epibenthic production.<br><br>Documented surf smelt (prey species) spawning is present at the terminal (see Figure PT-2), and extends approximately 270 feet to the southwest of the terminal (WSDOT 2018a).<br><br>**Natural Cover**<br>There is no shoreline vegetation in the vicinity of the terminal. There is a small area of shoreline vegetation west of the Port Townsend Marina. Eelgrass near the ferry terminal includes a relatively large bed to the west of the ferry dock, and a small bed to the east.<br><br>There is no large overhanging wood vegetation. The existing conditions within the defined area of critical habitat consist of sand in the shoreward half of the former underwater borrow pit to the northeast. Sand with shell hash was observed everywhere except in the deep channel off the northeast transfer span, which was dominated by gravel. Shell with gravel was located mostly in the channel off the southwest transfer span. A small amount of cobble was observed in the deepest portion of the channel off the northeast transfer span (CH2MHILL 2006b). Riprap and hardened shoreline are adjacent to the ferry terminal. Side channels do not occur in the ferry terminal area. |
| 6) Offshore areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation. | The marine waters of Port Townsend Bay are designated “Extraordinary” for aquatic life use. Impaired waters listings in the terminal area include inorganic nitrogen loading resulting in human-caused eutrophication of eelgrass beds (Ecology 2018).<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Offshore areas provide habitat for forage fish. |

#### 4.15.2.4 *Puget Sound Steelhead (Oncorhynchus mykiss)*

The closest natal stream in the area of the Port Townsend Ferry Terminal that supports Puget Sound steelhead is Chimacum Creek (approximately 5 miles south shoreline distance, a tributary to Port Townsend Bay). Other steelhead bearing Hood Canal rivers and streams include Thorndyke Creek (approximately 32 miles south, shoreline distance), the Big and Little Quilcene Rivers (approximately 48 miles southeast, shoreline distance), and Tarboo Creek (approximately 51 miles southeast, shoreline distance) (WDFW 2007a).

Major rivers that support winter and summer steelhead include the Skagit River (approximately 65 miles south then northeast, shoreline distance), Stillaguamish (approximately 57 miles south then northeast, shoreline distance), Snohomish River (approximately 48 miles south then northeast, shoreline distance), and the Duwamish/Green (approximately 47 shoreline miles southeast). The Lake Washington/Cedar River system (approximately 40 shoreline miles southeast) supports winter steelhead. Steelhead may also be present from southern Puget Sound and other Hood Canal rivers and streams (WDFW 2007a).

Available data from tow-net sampling (deeper nearshore) and beach seine sampling (shallow nearshore) efforts around Puget Sound have reported the capture of few steelhead. In tow-net sampling in north and south Puget Sound, NMFS captured a total of 18 steelhead (Rice, unpublished data). The total sampling effort data was not available, but the mean steelhead catch ranged from 0 to 0.2 per net in north Puget Sound and 0.1 to 0.8 per net in south Puget Sound.

Beach seine sampling in Bellingham Bay (north Puget Sound) also captured few steelhead (Lummi Nation, unpublished data). The Bellingham Bay research reported the capture of two juvenile steelhead salmon in 336 sets between February 14 and December 1, 2003. The steelhead were captured in the eastern portion of Bellingham Bay near the Taylor Avenue Dock on June 12 and June 25, 2003.

#### 4.15.2.5 *Puget Sound Steelhead Critical Habitat*

The Port Townsend Ferry Terminal does not fall within designated steelhead critical habitat (Federal Register 2016a).

#### 4.15.2.6 *Humpback Whale (Megaptera novaeangliae)*

Humpback whale may be present near the Port Townsend ferry terminal. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.15.2.7 *Southern Resident Killer Whale (Orcinus orca)*

Southern Resident Killer Whale (SRKW) may be present near the Port Townsend ferry terminal. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.15.2.8 *Southern Resident Killer Whale Critical Habitat*

The Port Townsend ferry terminal area lies within designated critical habitat (Area 2 – Puget Sound). Areas with water less than 20 feet deep relative to the extreme high water mark are not included in the critical habitat designation (Federal Register 2006).

The PCEs provided in the terminal area, and their existing conditions are listed in Table PT-2. PCEs relevant to the terminal area are numbered per Federal Register 2006.

**Table PT-2**
**Existing Conditions of Southern Resident Killer Whale PCEs at the Port Townsend Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 1) Water quality to support growth and development | The marine waters of Port Townsend Bay are designated "Extraordinary" for aquatic life use. Impaired waters listings in the terminal area include inorganic nitrogen loading resulting in human-caused eutrophication of eelgrass beds (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of two drainage areas that drain to Port Townsend Bay. None of the runoff is treated.<br><br>The first drainage area drains the holding lanes, and consists of 30 deck drains that all connect to the WSDOT SR 20 system, which discharges through an outfall to the west of the trestle.<br><br>The second drainage area consists of the transfer spans (typically 90 feet long by 24 feet wide that carry traffic between the trestle and ferry), which discharge by sheet flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column, degrading water quality in the terminal vicinity. |
| 2) Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth | Salmonids are the primary prey of SRKW, and may be present near the terminal. Further information on prey can be found in the Puget Sound Chinook section, and Appendix B – Species Biology. |
| 3) Passage conditions to allow for migration, resting, and foraging | Existing structures that occur below -20 feet in critical habitat include the heads of the trestles, the main and auxiliary slip, and dolphins. |

#### 4.15.2.9 *Bull Trout (Salvelinus confluentus)*

There are no natal streams in the area of the Port Townsend Ferry Terminal that support bull trout (WDFW 2007a). The aquatic portions of the ferry terminal are within marine FMO habitat. While bull trout have not been documented in the ferry terminal area, suitable FMO habitat is present, and bull trout are thought to occur throughout south, central, and northern Puget Sound. Therefore, it is expected that the ferry terminal area would be used by anadromous adult and sub-adult bull trout for foraging, migration, and overwintering (USFWS 2004b). Within the ferry terminal area, it is expected that individual bull trout from the Skokomish River (approximately 65 miles southwest, shoreline distance), Skagit River (approximately 65 miles south then northeast, shoreline distance), Stillaguamish (approximately 57 miles south then northeast, shoreline distance), Snohomish River (approximately 48 miles south then northeast, shoreline distance), Lake Washington/Cedar River (approximately 40 shoreline miles southeast), the Duwamish/Green River (approximately 47 shoreline miles southeast), and Puyallup River (approximately 65 miles southwest, shoreline distance) core areas are most likely to be present.

#### 4.15.2.10 *Bull Trout Critical Habitat*

The shoreline of the Port Townsend Ferry Terminal is not within designated bull trout critical habitat per Federal Register 2010a.

#### 4.15.2.11 *Green Sturgeon (Acipenser medirostris)*

There are no natal streams in the area of the Port Townsend Ferry Terminal that support green sturgeon.

Observations of green sturgeon in Puget Sound are much less common compared to the coastal Washington estuaries and bays such as Willapa Bay, Grays Harbor, and the Lower Columbia River estuary (Federal Register 2018). In addition, Puget Sound does not appear to be part of the coastal migratory corridor that Southern DPS fish use to reach overwintering grounds north of Vancouver Island (Federal Register 2018).

NMFS reviewed green sturgeon acoustic detection data from 2002-2019 in Puget Sound and the Strait of Juan de Fuca. From 2002-2008, 350 tagged green sturgeon were at large (67% from the threatened southern DPS). During this time, 17 were detected in Puget Sound (4 from the southern DPS). After 2008, none were detected in central or southern Puget Sound, though 400 were at large (83% southern DPS). From 2013-2018, six (one from the southern DPS) were detected in Admiralty Inlet (northern Puget Sound).

From 2004-2019, 210 green sturgeon were detected in the Strait of Juan de Fuca (71% southern DPS). This indicates that the strait is used as a corridor, with green sturgeon residing at detection sites for short periods as they pass through from open ocean. Few of these fish were detected afterwards in Admiralty Inlet, suggesting that most of the tagged population move northward into the Strait of Georgia after transiting the strait. Data indicates conclusively that green sturgeon from the southern DPS occur in Puget Sound and Admiralty inlet, but at low rates compared to Strait of Juan de Fuca presence. This confirms earlier findings that Puget Sound is of lower conservation value to southern DPS green sturgeon. However, it is noted that the tagged population is a small fraction of the whole green sturgeon population, and that conditions need to be optimum for acoustic detection to occur (Moser, et. al. 2021).

#### 4.15.2.12 *Green Sturgeon Critical Habitat*

The Port Townsend Ferry Terminal does not fall within designated green sturgeon critical habitat (Federal Register 2009).

#### 4.15.2.13 *Marbled Murrelet (Brachyramphus marmoratus)*

The Port Townsend terminal area provides suitable marbled murrelet marine foraging habitat.

Documented surf smelt (prey species) spawning is present at the terminal (see Figure PT-2), and extends approximately 270 ft. SW of the terminal. A large herring holding area exists about 0.7 miles S of the terminal in open water (WSDOT 2018a).

WDFW surveys conducted from 2001 to 2012 show a density of 3-5 birds per square kilometer in the terminal area (WDFW 2016).

Marbled murrelet density in Port Townsend Bay has been surveyed by the PSAMP and the Pacific Northwest Forest Plan Research and Monitoring between 1993 and 2005. Results from their spring and winter density surveys are provided in Table PT-3.

**Table PT-3**
**Marbled Murrelet Density Estimates in Port Townsend Bay1**

| Jan | Feb | Mar | May through July | Aug | Sept | Oct | Dec |
|---|---|---|---|---|---|---|---|
| 9.7[1] | 8.37 | 7.03 | 5.7[1] | 6.7 | 7.7 | 8.7 | 9.7[1] |

**Source:** Deanna Lynch of the USFWS (Lynch 2007)
**Note:**
1 Interpolation is based on the assumption of immigration in the fall and emigration in the spring months of Zone 2 and Canada marbled murrelets.

The nearest documented marbled murrelet nesting site is located 15 miles SW of the terminal (WSDOT 2018b).

The Northwest Forest Plan Marbled Murrelet Effectiveness Monitoring Program (2012) identified habitat suitability throughout the range of the species, and ranked it as Zero, Low, Marginal, Moderately High and Highest. The Port Townsend murrelet habitat suitability within the pile driving/heavy equipment zone of potential effect (0.25 miles), is Zero (WSDOT 2019b).

There are no coniferous forest that may offer nesting opportunity within the pile driving/heavy equipment zone of potential effect (0.25 miles) (WSDOT 2014/2018c).

Ferry traffic creates regular disturbance in the immediate terminal area. From July 2017 to June 2018, there were approximately 8,930 scheduled arrivals and departures from the terminal. During the nesting season (April 1-September 23), when foraging murrelet are more active, there were approximately 5,192 scheduled arrivals and departures (WSDOT 2018d).

#### 4.15.2.14 *Marbled Murrelet Critical Habitat*

No marbled murrelet critical habitat has been designated near the terminal (USFWS 1996).

#### 4.15.2.15 *Rockfish Species*

*Bocaccio*

Bocaccio are rarely caught in north Puget Sound and only sparse records exist for the Strait of Georgia (Federal Register 2010b). Because larvae are widely dispersed, it is possible that bocaccio juveniles could be found near the Port Townsend Ferry Terminal at any time of year. Adult bocaccio generally move to very deep water. The waters at the mouth of Admiralty Inlet are relatively shallow, generally less than 50 feet deep (NMFS 2009). North of the terminal, the Strait of Juan de Fuca and the San Juan Islands offer the rocky substrates preferred by bocaccio.

*Yelloweye Rockfish*

Yelloweye rockfish are more closely aligned with rocky, high-relief substrates than with very deep water (Federal Register 2010b). The waters surrounding the Port Townsend Ferry Terminal do not have the rocky substrates preferred by yelloweye. These substrates are found approximately 25 miles north in the San Juan Islands.

#### 4.15.2.16 *Rockfish Species Critical Habitat*

The Port Townsend Ferry Terminal is within rockfish nearshore critical habitat (less than or equal to 98 feet in depth) (Federal Register 2014). The physical and biological features (PBFs) (Federal Register 2014) essential to the conservation of juvenile Bocaccio rockfish are listed in Table PT-4. PBFs relevant to the terminal area are numbered per the CFR (Federal Register 2014). These PBFs are specific to nearshore environments, where only juvenile Bocaccio rockfish could be found. Deepwater (> 98 feet in depth) PBFs exist for adult Bocaccio, and adult and juvenile yelloweye rockfish; however, this habitat is not present at the Port Townsend Ferry Terminal and will not be discussed here.

**Table PT-4**
**Existing Conditions of Rockfish PBFs at the Port Townsend Ferry Terminal**

| PBFs | Existing Conditions |
|---|---|
| 1) Quantity, quality, and availability of prey species to support individual growth, survivial, reproduction, and feeding opportunities. | The marine waters of Port Townsend Bay are designated “Extraordinary” for aquatic life use. Impaired waters listings in the terminal area include inorganic nitrogen loading resulting in human-caused eutrophication of eelgrass beds (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of two drainage areas that drain to Port Townsend Bay. None of the runoff is treated.<br><br>The first drainage area drains the holding lanes, and consists of 30 deck drains that all connect to the WSDOT SR 20 system, which discharges through an outfall to the west of the trestle.<br><br>The second drainage area consists of the transfer spans (typically 90 feet long by 24 feet wide that carry traffic between the trestle and ferry), which discharge by sheet flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Overwater coverage from the existing ferry terminal structures may reduce the production of aquatic invertebrates that are prey species to salmon. The composition of substrate and presence of eelgrass indicate epibenthic production.<br><br>Documented surf smelt (prey species) spawning is present at the terminal (see Figure PT-2), and extends approximately 270 feet to the southwest of the terminal (WSDOT 2018a). |
| 2) Water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities. | There is no shoreline vegetation in the vicinity of the terminal. There is a small area of shoreline vegetation west of the Port Townsend Marina. Eelgrass near the ferry terminal includes a relatively large bed to the west of the ferry dock, and a small bed to the east.<br><br>There is no large overhanging wood vegetation. The existing conditions within the defined area of critical habitat consist of sand in the shoreward half of the former underwater borrow pit to the northeast. Sand with shell hash was observed everywhere except in the deep channel off the northeast transfer span, which was dominated by gravel. Shell with gravel was located mostly in the channel off the southwest transfer span. A small amount of cobble was observed in the deepest portion of the channel off the northeast transfer span (CH2MHILL 2006b). Riprap and hardened shoreline are adjacent to the ferry terminal. Side channels do not occur in the ferry terminal area. |

#### 4.15.2.17 *Pacific Eulachon (Thaleichthys pacificus)*

The Port Townsend Ferry Terminal is approximately 73 shoreline miles from the Fraser River, a confirmed spawning river. Eulachon use the Strait of Juan de Fuca as a migration corridor, so it is possible that eulachon might be present at the Port Townsend Ferry Terminal.

A monthly bottom trawl study was funded by Fisheries and Oceans Canada's National Rotational Survey Fund from October 2017 to June 2018 to sample Eulachon in three regional strata in Juan de Fuca Strait and the Strait of Georgia. The goal of this study was to gain insights into the biology, distribution, and migration timing of Eulachon to the Fraser River by observing their spatial and temporal occurrence and biological condition over a wide survey region and over a series of months. Eulachon catch per unit effort (CPUE), size distributions, sex ratios, and maturity observations varied over time and space, as did the occurrence of stomach contents and presence/absence of teeth. Highest catches of Eulachon occurred in Juan de Fuca and lowest near the Fraser River. Mean catch rates at sites near the Fraser River plume corresponded with expected peak spawning periods in the Fraser River. The sex ratio of Eulachon sampled throughout the study region in all months was approximately 1:1 although most samples in the Strait of Georgia in May and June were female. The presence of Eulachon with maturing gonads increased in frequency from west to east in January to April before sharply decreasing throughout the survey region in May and June. Stomach contents and teeth decreased in frequency with proximity to the Fraser River.

Trends in CPUE, fish length, presence of teeth, and stomach contents demonstrate that Juan de Fuca Strait likely provides an important year-round marine habitat for Eulachon feeding and growth as well as being a migration corridor to and from the west coast of Vancouver Island, which offers a large range of additional Eulachon habitat for foraging, growth habitat and mixing of stocks (Dealy et. al., 2019).

#### 4.15.2.18 *Pacific Eulachon Critical Habitat*

No Pacific eulachon critical habitat has been designated near the Port Townsend Ferry Terminal (FEDERAL REGISTER 2011).

# SEATTLE


**Figure SE-1**
Seattle Ferry Terminal Vicinity Map
WSF Biological Assessment Reference
Seattle, Washington

**Figure SE-1**
**Seattle Ferry Terminal Vicinity Map**


**Figure SE-2**
**Aerial Photo of Seattle Ferry Terminal**

## 4.16 Seattle Ferry Terminal

The Seattle Ferry Terminal is located on the downtown Seattle waterfront, on Elliott Bay (see Figures SE-1 and SE-2).

The Seattle Ferry Terminal, also known as Colman Dock, provides WSF service to the to the Bainbridge and Bremerton Terminals. Passenger-only ferry service is also available to West Seattle and Vashon Island (King Co. Water Taxi), and Bremerton, Southworth and Kingston (Kitsap Co. Transit).

Starting in 2017, WSF began replacing the aging and seismically vulnerable Colman Dock in Seattle. Key project elements include a new steel trestle, main terminal building, entry building, elevated walkway between the terminal building and the passenger-only ferry, and replacing the overhead passenger walkway on the northernmost slip (Slip 3). The project is scheduled to be completed in 2025. The terminal has three primary slips and a passenger-only slip (all with steel wingwalls), and five dolphins (two floating concrete and three fixed steel).

### *4.16.1 Seattle Environmental Baseline*

#### 4.16.1.1 *Physical Indicators*

*Substrate and Slope*

Much of the shoreline along the Seattle waterfront contains riprap and seawalls. Common shoreline features within the area include constructed bulkheads, with manmade structures such as piers, wharves, and buildings extending over the water, and steeply sloped banks armored with riprap or other fill materials (e.g., concrete slabs and miscellaneous debris). See Figures SE-3 for a view of shoreline areas near terminal. Newer features in the area include the Seattle seawall (that includes salmon passage and habitat structures), the Seattle habitat beach to the south of the terminal, and a habitat element of the project sediment cleanup to the north.

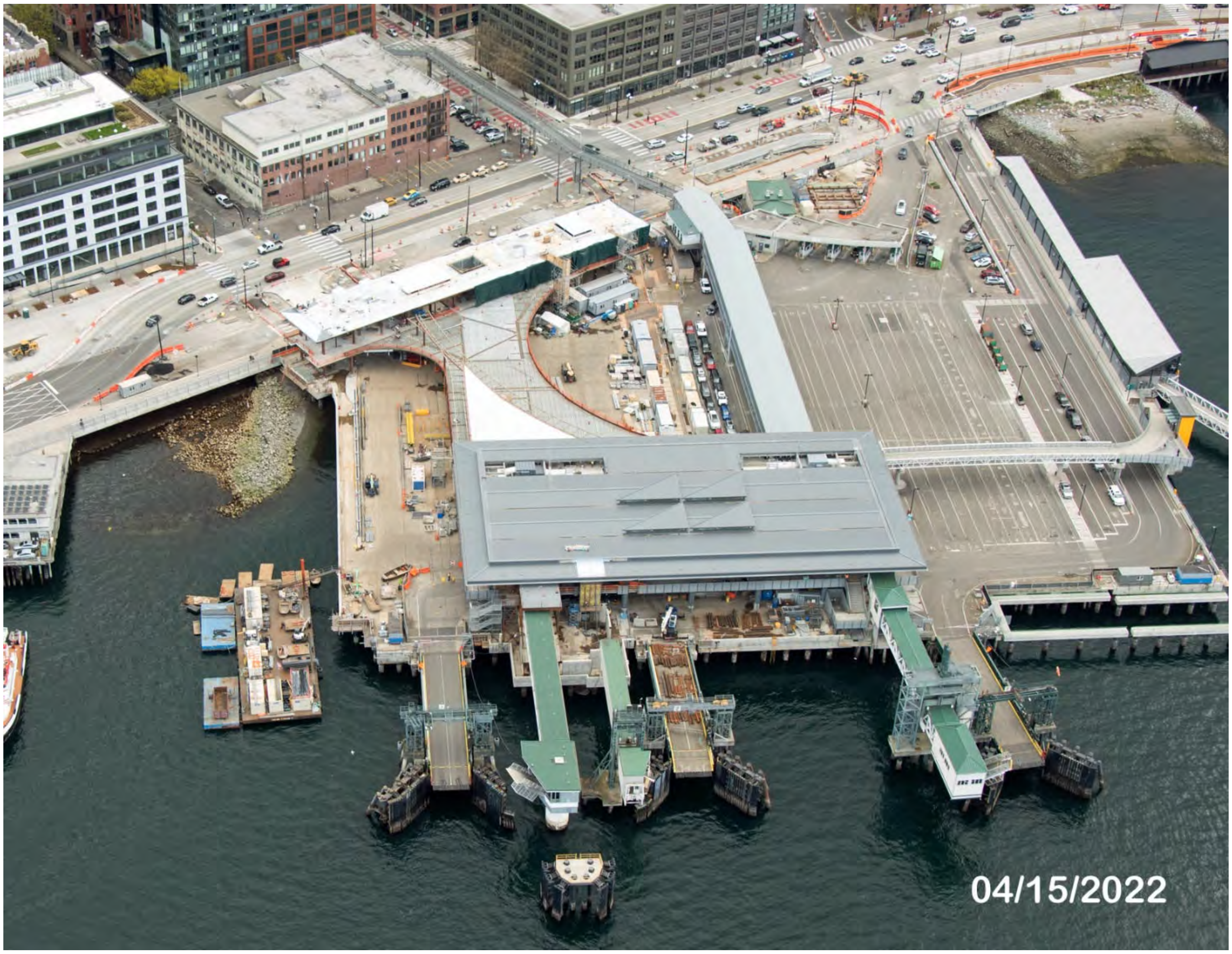



**Figure SE-3**
**Shoreline Area at the Seattle Ferry Terminal**

Starting in 2017, a sediment cap was placed within the construction footprint of the project to contain historical contaminants that are present in the area. Figure SE-4 shows the cap area, and the phases of the project. The cap is now complete and will be monitored to confirm that it is performing as expected.

Outside of the sediment cap, substrates are silty, except in the operating ferry slips, where propeller wash has washed away fine particles, leaving coarser sand. Offshore depths of terminal structures are: head of Slip 1 (-44.3 feet MLLW), Slip 2 (-41.2 feet MLLW), and Slip 3 (-47.5 feet MLLW). The head of the passenger only ferry landing is approximately -40.0 feet MLLW. Maximum depth for the floating dolphins is -66.0 feet MLLW.

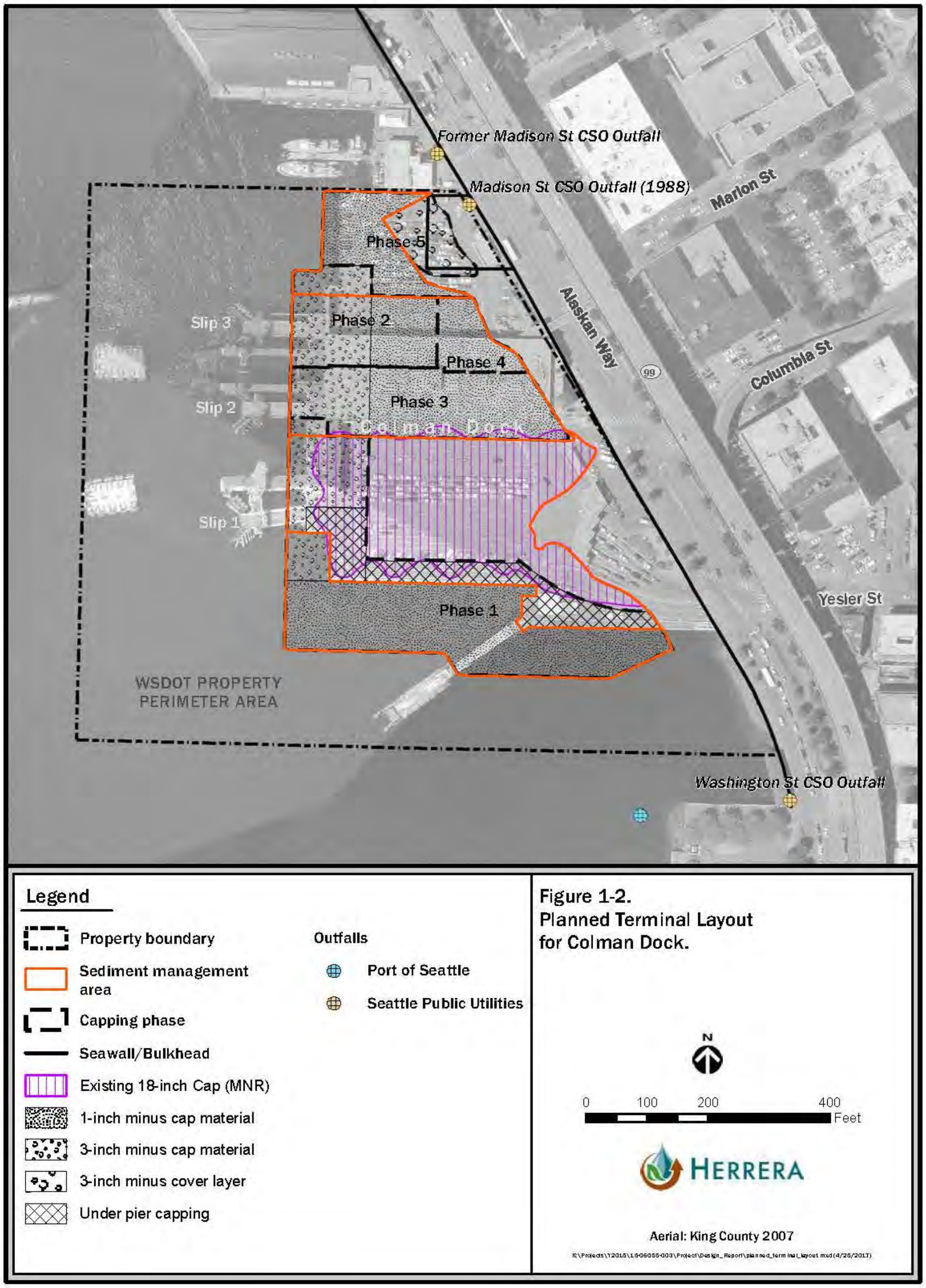



**Figure SE-4**
**Sediment Cap Plan**

*Salt/Freshwater Mixing*

The Duwamish River is approximately 1 mile south of the ferry terminal and delivers freshwater to Elliott Bay.

*Flows and Currents*

Water currents are influenced primarily by tides with some influence from the Duwamish River. The Duwamish River discharges from 250 cubic feet per second ( CFS) of water in summer to 6,000 CFS in winter. In Elliott Bay, the river flows north along the Seattle waterfront, splitting at Smith Cove, with some flow turning south, and some following the Magnolia bluff north. Ebb tides tend to enhance this flow, while flood tides stall or reverse the flow pattern.

#### 4.16.1.2 *Chemical Indicators*

*Water Quality*

The marine waters of Elliott Bay are designated "Excellent" for aquatic life use. Impaired waters listings in the terminal area include bacteria, and PCBs and Dioxin in sediment (Ecology 2018).

*Sediment Quality*

Exceedance of the State of Washington SMS has been identified for the sediments of Elliott Bay over a wide range of constituents. Impaired waters listings in the terminal area include PCBs and Dioxin in sediment (Ecology 2018). Additional sediment contaminants in the terminal area include PAHs, metals and organics (Herrera 2015). Sampling at Pier 48 (south of the Colman Dock) indicates sediment quality exceedances for metals, PAHs, organics, and PCBs (Shannon and Wilson 2017).In 1989, WSF placed a 3.4 acre sediment cap at the southern portion of the ferry terminal to contain contaminated sediments. Post-cleanup monitoring of the cap indicates that it is continues to be effective in its role of containing contaminants.

Beginning in 2017, WSF began placement of an extension of the 1989 cap as an element of the Seattle Multimodal Project at Colman Dock. The approximately 4 acre extension cap will be placed in phases over 4 years. These two caps address the majority of contaminated sediments within the WSF terminal right of way, but additional future actions will be needed to complete sediment cleanup.

#### 4.16.1.3 *Biological Indicators*

*Shoreline Vegetation*

The shoreline is heavily urbanized and virtually no shoreline vegetation occurs at or near the terminal. The shoreline along the majority of the Duwamish Waterway has been developed for industrial and commercial operations; the waterway serves as a major shipping route for containerized and bulk cargo. Common shoreline features within the area include constructed bulkheads, with manmade structures such as piers, wharves, and buildings extending over the water, and steeply sloped banks armored with riprap or other fill materials (e.g., concrete slabs and miscellaneous debris).

*Macroalgae and Eelgrass*

No eelgrass or kelp occurs in the area near the terminal. *Ulva, Enteromorpha, and Fucus* have been observed under the terminal. The site contains poor substrate conditions and existing overwater structures, which preclude colonization by eelgrass.

*Epibenthos, Macrofauna, Fish, and Marine Mammals*

Epibenthic productivity is expected to be very low due to the condition and type of substrates, intense vessel traffic along the waterfront and at the ferry terminal, and dominance of an altered shoreline. Barnacles, anemones, mussels, and sea stars have been observed at the terminal. The closest salmon-bearing river system is the Duwamish River, located approximately 1 mile south of the Seattle Ferry Terminal, which is used by several runs of salmonids, including Puget Sound Chinook, coho, and chum salmon; steelhead; and sea-run cutthroat trout. Other organisms observed at the terminal include tube worms, tunicates, pile and shiner perch, red rock crab, and shrimp. Marine mammals that may occur in Elliott Bay include resident and transient killer whale, Steller sea lion, California sea lion, and harbor seal.

*Forage Fish*

There is no documented forage fish spawning present at the terminal (WSDOT 2018a).

### 4.16.2 Seattle Species Distributions

#### 4.16.2.1 Puget Sound Chinook Salmon (*Oncorhynchus tshawytscha*)

No Chinook salmon bearing streams are located near the current Seattle Ferry Terminal (Colman Dock) (WDFW 2007a). However, major rivers that support Chinook salmon in this area of Puget Sound include the Duwamish/Green River (approximately 1 shoreline mile southwest), and the Puyallup River (approximately 32 shoreline miles southwest). Chinook may also be present from rivers and streams in southern Puget Sound (WDFW 2007a).

*Adult and Sub-adult Chinook*

Adults could be present in deeper offshore waters year-round. The greatest abundance of adults would occur between early summer and early fall as they return from the ocean to the Duwamish/Green River (Anchor 2003d).

Sub-adult Chinook have access to the terminal area and may be found there at any time of year. Sub-adults have spent a winter in the marine environment and are not closely oriented to the shoreline like juveniles.

*Juvenile Chinook*

Brennan et al. (2004) used beach seines to sample the nearshore of King County, Washington, and they caught Chinook salmon in October of 2001 and 2002. Brennan et al. (2004) captured five Chinook salmon in December of 2002. These fish were captured at three locations that were north and southwest of the terminal: Golden Gardens (north), Lincoln Park (southwest), and Seahurst Park (southwest). Golden Gardens is located just north of Shilshole Bay and the Lake Washington Ship Canal. One Chinook salmon was captured at this site. One Chinook salmon was caught at Lincoln Park, which is located in the City of Seattle south of Elliott Bay. Three Chinook salmon were caught farther south at Seahurst Park, which is located in Burien, Washington. Beach seines conducted from April through September of 2001 and 2002 along the mainland of central Puget Sound from Golden Gardens to Picnic Point showed juvenile Puget Sound Chinook salmon first entered the area in mid-May with numbers peaking in mid-June and tapered off through August and

September. The average fork length was approximately 85 mm for those juvenile Chinook caught in May and 130 mm for those caught in September (Duffy et al. 2005).

Little information is available on Chinook salmon use within Elliott Bay itself, as most of the sampling occurs outside of Elliott Bay. An assessment by Taylor and Associates of juvenile salmonid use of Elliott Bay in 1999 found the greatest numbers of juvenile Chinook salmon at Terminal 5, located on the southwest side of Elliott Bay, in mid-May, and at Pier 91, located along the north shore of Elliott Bay, in early June (NMFS and USFWS 2005).

#### 4.16.2.2 *Puget Sound Chinook Salmon Critical Habitat*

The Seattle Ferry Terminal lies within Chinook Zone 7 (70 FR 52630). The PCEs provided in the ferry terminal area, and their existing conditions, are listed in Table SE-2. PCEs relevant to the terminal area are numbered per the CFR (70 FR 52630).

**Table SE-1**
**Existing Conditions of Chinook Salmon PCEs at the Seattle Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 5) Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels. | **Obstructions**<br>In-water structures include two piers, the passenger only ferry landing, overhead loading, three trestles, three slips, and dolphins. The existing ferry terminal may affect fish passage in the nearshore.<br><br>**Water Quality and Forage**<br>The marine waters of Elliott Bay are designated “Excellent” for aquatic life use. . Impaired waters listings in the terminal area include bacteria (water), organics and metals (tissue) and bioassay (sediment) (Ecology 2018).The terminal area is an Ecology listed contaminated sediment site that is being remediated.<br><br>The existing stormwater system at the ferry terminal is divided between Pier 52, Pier 50, and the trestles and transfer spans.<br><br>The Pier 52 system consists of two drainage areas that drain to Elliott Bay. None of these areas includes treatment.<br><br>The first drainage area drains the holding lanes on the northeast side of Pier 52, and consists of six catch basins that discharge through four outfalls directly to surface water.<br><br>The second drainage area drains the holding lanes on the northwest side of Pier 52, and consists of many through-drains that discharge directly under the pier to surface water.<br><br>The Pier 50 system consists of one drainage area that drains the toll booth area and |

| PCEs | Existing Conditions |
|---|---|
| | holding lanes. Most of this area includes treatment. The drainage area consists of three catch basins that flow through simple oil/water separators then discharge directly to surface water, and two through-drains.<br><br>All trestles and transfer spans (typically 90 feet long by 24 feet wide that carry traffic between the trestle and ferry) discharge by sheet-flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Overwater coverage from the existing ferry terminal structures may reduce the production of aquatic invertebrates that are prey species to salmon. Substrates in the area are degraded, but may support some epibenthic production.<br><br>Contaminated sediments are capped in the southern portion of the terminal area. Exceedances of state SMS have been identified in Elliott Bay for a wide range of constituents.<br><br>There is no documented forage fish spawning present at the terminal (WSDOT 2018a).<br><br>**Natural Cover**<br>The shoreline is heavily urbanized and virtually no vegetation occurs along the shoreline. No eelgrass, kelp, or macroalgae occurs in the area near the terminal. The site contains poor substrate conditions, many existing in-water structures, and sufficient water depth to preclude colonization by eelgrass. Macroalgae may occur sporadically along the Elliott Bay shoreline, but does not occur at or near the ferry terminal.<br><br>There is no large overhanging wood vegetation. The existing conditions within the defined area of critical habitat consist of very soft, black, organic-clayed silt with shell hash and wood debris sub-tidally. In the operating ferry slips, propeller wash has washed away fine particles, leaving coarser sand. Riprap and seawalls are adjacent to the terminal (Anchor 2003d). Side channels do not occur in the ferry terminal area. |
| 6) Offshore areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation. | The marine waters of Elliott Bay are designated “Extraordinary” for aquatic life use. Impaired waters listings in the terminal area include bacteria (water), organics and metals (tissue) and bioassay (sediment) (Ecology 2018).The terminal area is an Ecology listed contaminated sediment site that is being remediated. |

#### 4.16.2.3 *Puget Sound Steelhead (Oncorhynchus mykiss)*

Within the Seattle Ferry Terminal area, it is expected that steelhead from the Duwamish/Green River (approximately 1.7 miles southeast shoreline distance) may be present. The Duwamish/Green supports both winter and summer steelhead. In addition, the Puyallup River (approximately 32 shoreline miles southwest) and numerous rivers and streams in central and southern Puget Sound support winter steelhead (WDFW 2007a).

Available data from tow-net sampling (deeper nearshore) and beach seine sampling (shallow nearshore) efforts around Puget Sound have reported the capture of few steelhead. In tow-net sampling in north and south Puget Sound, NMFS captured a total of 18 steelhead (Rice, unpublished data). The total sampling effort data was not available, but the mean steelhead catch ranged from 0 to 0.2 per net in north Puget Sound and 0.1 to 0.8 per net in south Puget Sound.

During 2001 and 2002, beach seining conducted in central Puget Sound by King County Department of Natural Resources captured only nine steelhead out of a total of approximately 34,000 juvenile salmonids. All of the steelhead were caught between May and August and ranged in size from 141 to 462 mm with a mean size of 258 mm (Brennan et al. 2004).

#### 4.16.2.4 *Puget Sound Steelhead Critical Habitat*

The Seattle Ferry Terminal does not fall within designated steelhead critical habitat (Federal Register 2016a).

#### 4.16.2.5 *Humpback Whale (Megaptera novaeangliae)*

Humpback whale may be present near the Seattle ferry terminal. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.16.2.6 *Southern Resident Killer Whale (Orcinus orca)*

Southern Resident Killer Whale (SRKW) may be present near the Seattle ferry terminal. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.16.2.7 *Southern Resident Killer Whale Critical Habitat*

The Seattle ferry terminal area lies within designated critical habitat (Area 2 – Puget Sound). Areas with water less than 20 feet deep relative to the extreme high water mark are not included in the critical habitat designation (Federal Register 2006).

The PCEs provided in the terminal area, and their existing conditions are listed in Table SE-2. PCEs relevant to the terminal area are numbered per Federal Register 2006.

#### 4.16.2.8 *Bull Trout (Salvelinus confluentus)*

Within the Seattle Ferry Terminal area, it is expected that individual bull trout from the Duwamish/Green River (approximately 1 shoreline mile southwest) core area are most likely to be present (WDFW 2007a). Bull trout may also be present from the Puyallup River (approximately 32 shoreline miles southwest).

The aquatic portions of the terminal are within marine FMO habitat. While bull trout have not been documented in the ferry terminal area, suitable FMO habitat is present, and bull trout are thought to occur throughout south, central, and northern Puget Sound. Therefore, it is expected that the ferry terminal area would be used by anadromous adult and sub-adult bull trout for foraging, migration, and overwintering (USFWS 2004b). Due to extensive habitat degradation, including filling of wetland and subtidal areas, shoreline armoring, presence of overwater piers, and sediment contamination, the number of bull trout in Elliot Bay is believed to be small. However, captures in the Duwamish River indicate that bull trout do migrate through the area (NMFS and USFWS 2005). They are likely to be present in Elliot Bay as juveniles from March to June and as adults from July to October (Tetra Tech 2012).

In April 1978, anglers caught four fish that were identified as adult char by the Muckleshoot Tribe Hatchery Manager (Brunner 1999a *Cited in*: NMFS and USFWS 2005). Another adult bull trout was captured in a net near Pier 91 (Brunner 1999b *Cited in*: NMFS and USFWS 2005). In August and September of 2000, eight subadult bull trout averaging 299 mm in length were captured near river mile 5.3 of the Duwamish River and in September 2002 a single char was caught at that same location (Shannon, personal communication 2002 *Cited in*: NMFS and USFWS 2005). In May 2003, an adult char (582 mm) was captured and released at Kellogg Island (Shannon, personal communication 2003 *Cited in*: NMFS and USFWS 2005).

**Table SE-2**
**Existing Conditions of Southern Resident Killer Whale PCEs at the Seattle Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 1) Water quality to support growth and development | The marine waters of Elliott Bay near the terminal are designated “Excellent” for aquatic life use. Impaired waters listings in the terminal area include bacteria (water), organics and metals (tissue) and bioassay (sediment) (Ecology 2018).The terminal area is an Ecology listed contaminated sediment site that is being remediated.<br><br>The existing stormwater system at the ferry terminal is divided between Pier 52, Pier 50, and the trestles and transfer spans.<br><br>The Pier 52 system consists of two drainage areas that drain to Elliott Bay. None of these areas includes treatment.<br><br>The first drainage area drains the holding lanes on the northeast side of Pier 52, and consists of six catch basins that discharge through four outfalls directly to surface water.<br><br>The second drainage area drains the holding lanes on the northwest side of Pier 52, and consists of many through-drains that discharge directly under the pier to surface water.<br><br>The Pier 50 system consists of one drainage area that drains the toll booth area and holding lanes. Most of this area includes treatment. The drainage area consists of three catch basins that flow through simple oil/water separators then discharge directly to surface water, and two through-drains.<br><br>All trestles and transfer spans (typically 90 feet long by 24 feet wide that carry traffic between the trestle and ferry) discharge by sheet-flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column, degrading water quality in the terminal vicinity. |
| 2) Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth | Salmonids are the primary prey of SRKW, and may be present near the terminal. Further information on prey can be found in the Puget Sound Chinook section, and Appendix B – Species Biology. |
| 3) Passage conditions to allow for migration, resting, and foraging | Existing structures occur below -20 feet in critical habitat include the trestle, the passenger only ferry landing, overhead loading, three trestles, three slips, and dolphins. The shoreline is heavily urbanized. The entire eastern shore of Elliott Bay has been developed with piers, docks, marinas, and bulkheads. Almost no natural shoreline habitat remains. |

#### 4.16.2.9 *Bull Trout Critical Habitat*

The shoreline of the Seattle Ferry Terminal is within designated bull trout critical habitat. The PCEs provided in the ferry terminal area, and their existing conditions, are listed in Table SE-4. PCEs relevant to the terminal area are numbered per Federal Register 2010a.

**Table SE-3**
**Existing Conditions of Bull Trout PCEs at the Seattle Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 2) 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. | In-water structures include two piers, the passenger only ferry landing, overhead loading, three trestles, three slips, and dolphins. The existing ferry terminal may affect fish passage in the nearshore. |
| 3) An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish. | No eelgrass, kelp, or macroalgae occurs in the area near the terminal. The site contains poor substrate conditions, many existing in-water structures, and sufficient water depth to preclude colonization by eelgrass. Macroalgae may occur sporadically along the Elliott Bay shoreline, but does not occur at or near the ferry terminal.<br><br>There is no large overhanging wood vegetation. The existing conditions within the defined area of critical habitat consist of very soft, black, organic-clayed silt with shell hash and wood debris sub-tidally. In the operating ferry slips, propeller wash has washed away fine particles, leaving coarser sand. Riprap and seawalls are adjacent to the terminal (Anchor 2003d).<br><br>Contaminated sediments are capped in the southern portion of the terminal area. Exceedances of state SMS have been identified in Elliott Bay for a wide range of constituents.<br><br>There are no known forage fish spawning areas near the Seattle Ferry Terminal. |
| 4) 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. | In-water structures include the trestle, the passenger only ferry landing, overhead loading, three trestles, three slips, and dolphins. The existing ferry terminal may affect fish passage in the nearshore, and may reduce the production of aquatic invertebrates that are prey species to bull trout.<br><br>There is no large overhanging wood vegetation. The existing conditions within the defined area of critical habitat consist of very soft, black, organic-clayed silt with shell hash and wood debris sub-tidally. In the operating ferry slips, propeller wash has washed away fine particles, leaving coarser sand. Riprap and seawalls are adjacent to the terminal (Anchor 2003d).<br><br>No eelgrass, kelp, or macroalgae occurs in the area near the terminal. The site contains poor substrate conditions, many existing in-water structures, and sufficient water depth to preclude colonization by eelgrass. Macroalgae may occur sporadically along the Elliott Bay shoreline, but does not occur at or near the ferry terminal. |
| 5) 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. Specific temperatures within this range will depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence. | East Puget Sound water temperatures can range from 41.4 to 75.7 °F (5.2 to 24.3 °C) with an average of 51 °F (10.58 °C) (Ecology 2007). Water temperature data for specific terminals is not available. The in-water components of the ferry terminal provide some shade, which may cause slight localized reductions in water temperatures. |
| 8) Sufficient water quality and | The marine waters of Elliott Bay near the terminal are designated “Excellent” for |

| PCEs | Existing Conditions |
|---|---|
| quantity such that normal reproduction, growth, and survival are not inhibited. | aquatic life use. Impaired waters listings in the terminal area include bacteria (water), organics and metals (tissue) and bioassay (sediment) (Ecology 2018).The terminal area is an Ecology listed contaminated sediment site that is being remediated.<br><br>The existing stormwater system at the ferry terminal is divided between Pier 52, Pier 50, and the trestles and transfer spans.<br><br>The Pier 52 system consists of two drainage areas that drain to Elliott Bay. None of these areas includes treatment.<br><br>The first drainage area drains the holding lanes on the northeast side of Pier 52, and consists of six catch basins that discharge through four outfalls directly to surface water.<br><br>The second drainage area drains the holding lanes on the northwest side of Pier 52, and consists of many through-drains that discharge directly under the pier to surface water.<br><br>The Pier 50 system consists of one drainage area that drains the toll booth area and holding lanes. Most of this area includes treatment. The drainage area consists of three catch basins that flow through simple oil/water separators then discharge directly to surface water, and two through-drains.<br><br>All trestles and transfer spans (typically 90 feet long by 24 feet wide that carry traffic between the trestle and ferry) discharge by sheet-flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column, degrading water quality in the terminal vicinity. |

#### 4.16.2.10 *Green Sturgeon (Acipenser medirostris)*

There are no natal streams in the area of the Seattle Ferry Terminal that support green sturgeon.

Observations of green sturgeon in Puget Sound are much less common compared to the coastal Washington estuaries and bays such as Willapa Bay, Grays Harbor, and the Lower Columbia River estuary (Federal Register 2018). In addition, Puget Sound does not appear to be part of the coastal migratory corridor that Southern DPS fish use to reach overwintering grounds north of Vancouver Island (Federal Register 2018).

NMFS reviewed green sturgeon acoustic detection data from 2002-2019 in Puget Sound and the Strait of Juan de Fuca. From 2002-2008, 350 tagged green sturgeon were at large (67% from the threatened southern DPS). During this time, 17 were detected in Puget Sound (4 from the southern DPS). After 2008, none were detected

in central or southern Puget Sound, though 400 were at large (83% southern DPS). From 2013-2018, six (one from the southern DPS) were detected in Admiralty Inlet (northern Puget Sound).

From 2004-2019, 210 green sturgeon were detected in the Strait of Juan de Fuca (71% southern DPS). This indicates that the strait is used as a corridor, with green sturgeon residing at detection sites for short periods as they pass through from open ocean. Few of these fish were detected afterwards in Admiralty Inlet, suggesting that most of the tagged population move northward into the Strait of Georgia after transiting the strait. Data indicates conclusively that green sturgeon from the southern DPS occur in Puget Sound and Admiralty inlet, but at low rates compared to Strait of Juan de Fuca presence. This confirms earlier findings that Puget Sound is of lower conservation value to southern DPS green sturgeon. However, it is noted that the tagged population is a small fraction of the whole green sturgeon population, and that conditions need to be optimum for acoustic detection to occur (Moser, et. al. 2021).

#### 4.16.2.11 *Green Sturgeon Critical Habitat*

The Seattle Ferry Terminal does not fall within designated green sturgeon critical habitat per Federal Register 2018.

#### 4.16.2.12 *Marbled Murrelet (Brachyramphus marmoratus)*

The Seattle terminal area provides limited marbled murrelet marine foraging habitat, due to the density of ferry and other marine traffic in the area.

There is no documented forage fish (prey species) spawning present at the terminal area (WSDOT 2018a).

WDFW surveys conducted from 2001 to 2012 show a density of less than 1 bird per square kilometer in the terminal area (WDFW 2016). The nearest documented marbled murrelet nesting site is located 35 miles NW of the terminal (WDFW 2015).

The Northwest Forest Plan Marbled Murrelet Effectiveness Monitoring Program (2012) identified habitat suitability throughout the range of the species, and ranked it as Zero, Low, Marginal, Moderately High and Highest. The Seattle murrelet habitat suitability within the pile driving/heavy equipment zone of potential effect (0.25 miles), is Zero (WSDOT 2019b).

There are no coniferous forest that may offer nesting opportunity within the pile driving/heavy equipment zone of potential effect (0.25 miles) (WSDOT 2014/2018c).

Marbled murrelet summer foraging has been observed off West Point, over 6.5 miles northwest of the ferry terminal (Anchor 2003d). In July 2012, on two occasions, a single foraging marbled murrelet was observed near the Myrtle Edwards Park grain elevator (2.1 miles north of the terminal), and the fishing pier (2.3 miles north of the terminal) (Miller, personal communication, 2012). During the 2017-18 construction season of the Seattle Multimodal Project at Colman Dock, 2 murrelet were observed. One was approximately 110 m from the terminal, and the other was observed from a ferry vessel mid-channel between the Seattle terminal and Bainbridge Island (WSF 2018e).

Ferry traffic creates regular disturbance in the immediate terminal area. From July 2017 to June 2018, there were approximately 27,420 scheduled arrivals and departures from the Seattle terminal. During the nesting season (April 1-September 23), when foraging murrelet are more active, there were approximately 13,755 scheduled arrivals and departures (WSF 2018d). In addition, the Seattle terminal experiences regular passenger only ferry vessel arrivals and departures, and Elliott Bay is heavily trafficked by large commercial and tourist tour vessels.

#### 4.16.2.13 *Marbled Murrelet Critical Habitat*

No marbled murrelet critical habitat has been designated near the terminal (USFWS 1996).

#### 4.16.2.14 *Rockfish Species*

*Bocaccio*

Bocaccio are rarely caught in north Puget Sound and only sparse records exist for the Strait of Georgia (Federal Register 2010b). Because larvae are widely dispersed, it is possible that bocaccio juveniles could be found near the Seattle Ferry Terminal at any time of year. Adult bocaccio generally move to very deep water. The waters within Elliott Bay are 80 feet deep in some places. Outside the bay to the north, the water reaches depths of 110 feet (NMFS 2009). Rockfish presence has been documented in Elliott Bay (WDFW 2009c).

*Yelloweye Rockfish*

Yelloweye rockfish are more closely aligned with rocky, high-relief substrates than with very deep water (Federal Register 2010b). The waters of Elliott Bay are neither very deep nor underlain with rocky substrates.

#### 4.16.2.15 *Rockfish Species Critical Habitat*

The Seattle Ferry Terminal does not fall within rockfish critical habitat (Federal Register 2014).

#### 4.16.2.16 *Pacific Eulachon (Thaleichthys pacificus)*

The Seattle Ferry Terminal is distant from any of the known eulachon spawning rivers. It is highly unlikely that eulachon will be present at the Seattle Ferry Terminal.

#### 4.16.2.17 *Pacific Eulachon Critical Habitat*

No Pacific eulachon critical habitat has been designated near the Seattle Ferry Terminal (FEDERAL REGISTER 2011).

# SHAW ISLAND


**NOTE:** Base map prepared from Terrain Navigator Pro USGS 7.5 minute quadrangle map(s) of Blakley Island and Shaw Island, Washington.

| Section | Township | Range | Lat | Long | County |
|---|---|---|---|---|---|
| 27 | 36N | 2W | 48° 35' 87" N | 122° 55' 40" W | San Juan |
| HUC 171100030601 | | | WRIA 2 | | |

**Figure SH-1**
Shaw Island Ferry Terminal Vicinity Map
WSF Biological Assessment Reference
Shaw Island, Washington

**Figure SH-1**
**Shaw Island Ferry Terminal Vicinity Map**


**Figure SH-2**
**Aerial Photo of Shaw Island Ferry Terminal**

## 4.17 Shaw Island Ferry Terminal

The Shaw Island Ferry Terminal is located on Shaw Island in the San Juan Islands. Shaw Island is west of Lopez Island and south of Orcas Island. (See Figures SH-1 and SH-2.)

The Shaw Island Ferry Terminal provides service to the Anacortes and San Juan inter-island terminals (Lopez, Shaw, Orcas, and Friday Harbor).

Features of the terminal include a small waiting shelter, two vehicle holding lanes that accommodate up to 22 vehicles, and a small parking lot. The terminal has one slip with steel wingwalls. Three steel dolphins are associated with the terminal. No overhead passenger loading facilities exist at the terminal.

### *4.17.1 Shaw Environmental Baseline*

#### 4.17.1.1 *Physical Indicators*

*Substrate and Slope*

Substrate conditions adjacent to the terminal are a mixture of sand, shell, gravel, cobble, and bedrock. Areas of coarser grained sediments and bedrock occur within the areas subject to vessel operations. Offshore depths of terminal structures are: slip (-34.5 feet MLLW). Maximum depth for fixed dolphins is -39.5 feet MLLW.

With the exception of the Shaw Island Ferry Terminal, general store, chapel, music studio, and a private marina, the shoreline in the area is generally undeveloped. A small, gently sloping sandy beach exists to the southeast of the terminal, and another to the southwest. However, much of the shoreline area is steep and rocky (see Figures SH-3 and SH-4).

**Figure SH-3**
**Shoreline Area West of the Shaw Island Ferry Terminal**

**Figure SH-4**
**Shoreline Area East of the Shaw Island Ferry Terminal**

### *Salt/Freshwater Mixing*

Shaw Island is drained by a number of small, mostly unnamed streams. Most streams are seasonal, and are typically dry in the summer months. There are no significant freshwater drainages near the Shaw Island Ferry Terminal.

*Flows and Currents*

Strong currents, deep channels, and tidal mixing influence the open marine waters of the San Juan Islands.

### 4.17.1.2 *Chemical Indicators*

*Water Quality*

The marine waters of Harney Channel near the terminal are designated "Extraordinary" for aquatic life use. Impaired waters listings in the terminal area include bacteria (water), and phenol (sediment) (Ecology 2018).

*Sediment Quality*

Impaired waters listings in the terminal area include phenol in sediment (Ecology 2018).

### 4.17.1.3 *Biological Indicators*

*Shoreline Vegetation*

Forested shoreline vegetation predominately occurs west and east of the ferry terminal.

*Macroalgae and Eelgrass*

PIE completed an eelgrass and biological resources survey in March 2002 (PIE 2002a). Battelle Marine Sciences Laboratory conducted a previous survey at the Shaw Island Ferry Terminal in March 1997 (Thom et al. 1997a). Both surveys were conducted to determine the spatial extent and density of eelgrass and the percent cover of macroalgae near the Shaw Island Ferry Terminal and the adjacent private marina.

The presence of a large eelgrass bed was confirmed within the private marina, approximately 150 feet east of the ferry terminal (see Figure SH-2). A second small patch of eelgrass (approximately 16 square feet) has been documented as occurring southwest of the ferry terminal, but the exact location is unknown. Based on 45 quadrat counts collected, the mean shoot density of the larger eelgrass bed ranges between four and 48 shoots per 0.25 square meter. The densest eelgrass occurs between about -4 and -6 feet MLLW in the marina. The mean density of the smaller eelgrass area identified southwest of the ferry terminal is two shoots per 0.25 square meter and nine shoots per square meter. This eelgrass patch occurs between -15 and -20 feet MLLW. Reconnaissance dives along the seaward edge of the larger eelgrass bed revealed a similar distribution pattern to that of the investigation conducted by Battelle (Thom et al. 1997a). The westernmost edge of the larger eelgrass bed does not extend beyond the west side of the private marina.

Macroalgae was frequently observed in the intertidal zone. Macroalgae density and diversity was greatest in the intertidal area on the north side of the trestle. Fastened macroalgae was typically attached to large pieces of substrate and bedrock. Observed macroalgae includes Turkish towel, seersucker (*Costaria costata*), rockweed, sugar kelp, bull kelp, red ribbon, false kelp (*Petalonia fascia*), diatoms, and sea lettuce.

### *Epibenthos, Macrofauna, Fish, and Marine Mammals*

The presence of bedrock is likely to limit epibenthic production; however, areas within the intertidal zone consisting of sand, cobble, and gravel are likely to support epibenthic production.

Cnidarians, echinoderms, mollusks, and arthropods were frequently observed including nudibranchs, red rock crab, Dungeness crab, decorator crab, piddock, rock oyster, sunflower star, horse clams, anemones, limpets, and shrimp.

Fish species in the area include unidentified flatfish, sculpins, perch, lingcod, and greenling, and as well as other fish typically found in shallow marine unconsolidated substrate habitats.

Marine mammals likely to occur in the area are resident and transient killer whale, harbor porpoise, harbor seal, Californian sea lion, and Dall’s porpoise.

### *Forage Fish*

There is no documented forage fish spawning present at the terminal (WSDOT 2018a). Herring spawning ground is present 450 ft. SW of the terminal.

### 4.17.2 Shaw Species Distributions

#### 4.17.2.1 Puget Sound Chinook Salmon (*Oncorhynchus tshawytscha*)

No Chinook salmon-bearing streams are located near the Shaw Island Ferry Terminal (WDFW 2007a). However, several major river systems that support Chinook salmon, including the Nooksack River (approximately 27 miles northeast, shoreline distance), Samish River (approximately 24 miles east), Skagit (approximately 29 miles southeast), and Stillaguamish (approximately 39 miles southeast) occur in this area of Puget Sound. Chinook may also be present from rivers and streams in central and southern Puget Sound (WDFW 2007a). The results of beach seine sampling completed from March to October in 2008 and 2009 indicate that juvenile Chinook salmon arrive in the San Juan Islands by April, peak in the month of June, remain relatively high in shoreline areas during summer months, and are present through October. Chinook may be present from numerous river systems, as shown in Figure SH-5 (SRSC and NOAA 2012).

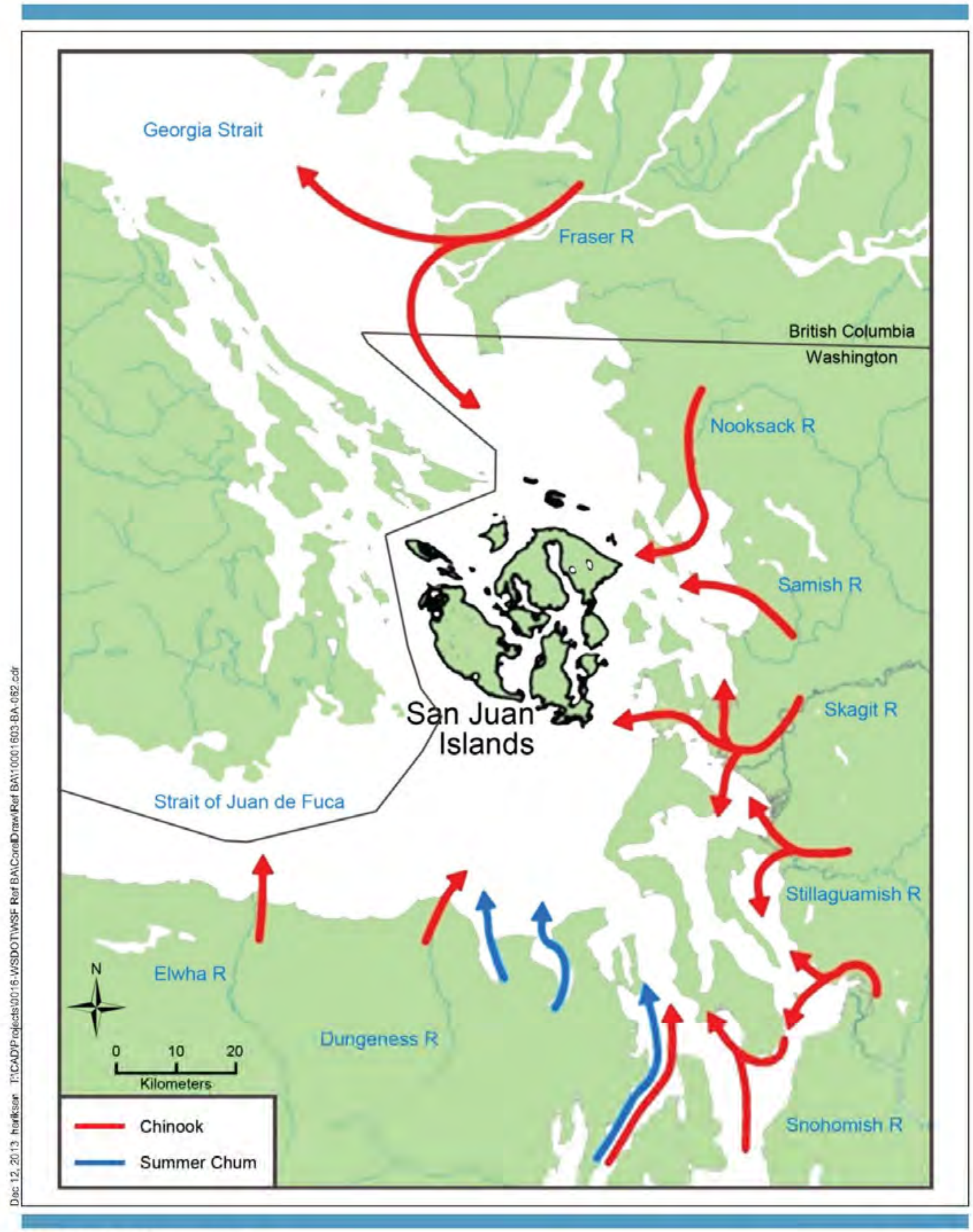
*Adult and Sub-adult Chinook*

The marine environment of northern Puget Sound is a migratory corridor for adults. Adult Chinook salmon collected in the waters around the San Juan archipelago are usually Puget Sound or Fraser River populations (Sanford, personal communication 2002). WDFW micro-tag data analyzed from 1985 showed five Chinook salmon stocks have been identified in the San Juan region (Moulton, personal communication 2001).

The marine waters of the San Juan Islands provide habitat for out-migrating sub-adult Chinook salmon from rivers into Puget Sound before their eventual oceanic phase as adults. Sub-adults have spent a winter in the marine environment and are not closely oriented to the shoreline like juveniles.

*Juvenile Chinook*

Chinook salmon do not spawn in the San Juan archipelago (Otis, personal communication 2000). Juveniles that could occur near the ferry terminal are likely of hatchery origin or have crossed open water to reach the San Juan Islands. These hatchery fish are not part of the ESU. The watersheds of this region are not large enough to support sustainable wild Chinook salmon populations (Sanford, personal




**SOURCE:** SRSC/NOAA Fisheries 2012.

**Figure SH-5**
Migratory Pathways for Juvenile Salmon from
Source Population Rivers to the San Juan Islands Area
WSF Biological Assessment Reference
Shaw Island, Washington

**Figure SH-5**
**Migratory Pathways for Juvenile Salmon from Source Population Rivers to the San Juan Islands Area**

communication 2002). A hatchery exists on Orcas Island. Juvenile Chinook salmon habitat in the ferry terminal area includes the open water (pelagic zones) of the San Juan Islands and the nearshore and intertidal zones in the San Juan Islands, particularly areas supporting eelgrass and macroalgae.

#### 4.17.2.2 *Puget Sound Chinook Salmon Critical Habitat*

The Shaw Island Ferry Terminal lies within Chinook Zone 2 (70 FR 52630). While there are no streams that support Chinook salmon near the ferry terminal, there are eelgrass beds in close proximity to the ferry terminal that may be used by juvenile Chinook for rearing.

The PCEs provided in the ferry terminal area, and their existing conditions, are listed in Table SH-1. PCEs relevant to the terminal area are numbered per the CFR (70 FR 52630).

**Table SH-1**
**Existing Conditions of Chinook Salmon PCEs at the Shaw Island Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 5) Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels. | **Obstructions**<br>In-water structures include the trestle, the slip, and dolphins. The ferry terminal may affect fish passage in the nearshore.<br><br>**Water Quality and Forage**<br>The marine waters of Harney Channel near the terminal are designated “Extraordinary” for aquatic life use. Impaired waters listings in the terminal area include bacteria (water), and phenol (sediment) (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of two drainage areas that drain to Harney Channel. None of the runoff is treated.<br><br>The first drainage area drains the holding lanes, and consists of one catch basin that discharges through an outfall to the southeast of the terminal building.<br><br>The second drainage area consists of the transfer span (typically 90 feet long by 24 feet wide that carries traffic between the trestle and ferry), which discharges by sheet flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Overwater coverage from the existing ferry terminal structures may reduce the production of aquatic invertebrates that are prey species to salmon. The presence of bedrock is likely to limit epibenthic production; however, areas within the intertidal zone consisting of sand, cobble, and gravel are likely to support epibenthic production.<br><br>There is no documented forage fish spawning present at the terminal (WSDOT 2018a). ). Herring spawning ground is present 450 ft. SW of the terminal. |

| PCEs | Existing Conditions |
|---|---|
| | **Natural Cover**<br>Forested vegetation occurs west and east of the ferry terminal. The presence of a large eelgrass bed was confirmed within the private marina, approximately 150 feet east of the ferry terminal. A second small patch of eelgrass (approximately 16 square feet) has been documented as occurring southwest of the ferry terminal, but the exact location is unknown. Macroalgae was frequently observed in the intertidal zone. Macroalgae density and diversity was greatest in the intertidal area on the north side of the trestle. Fastened macroalgae was typically attached to large pieces of substrate and bedrock. Observed macroalgae includes: Turkish towel, seersucker, rockweed, sugar kelp, bull kelp, red ribbon, false kelp, diatoms, and sea lettuce (PIE 2002a).<br><br>The beach area is gently sloping, with sand, shell debris, gravel, and cobble near shore and bare bedrock offshore (PIE 2002a). Side channels do not occur in the ferry terminal area. |
| 6) Offshore areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation. | The marine waters of Harney Channel near the terminal are designated “Extraordinary” for aquatic life use. Impaired waters listings in the terminal area include bacteria (water), and phenol (sediment) (Ecology 2018).<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Offshore areas provide habitat for forage fish. |

#### 4.17.2.3 *Puget Sound Steelhead (Oncorhynchus mykiss)*

There are no natal streams in the area of the Shaw Island Ferry Terminal that support Puget Sound steelhead. However, major river systems that support winter and summer steelhead include the Nooksack River (approximately 28 miles northeast), Skagit River (approximately 30 miles southeast), and Stillaguamish River (approximately 40 miles southeast). The Samish River (approximately 25 miles east) supports winter steelhead only. Steelhead may also be present from rivers and streams in central and southern Puget Sound (WDFW 2007a).

Available data from tow-net sampling (deeper nearshore) and beach seine sampling (shallow nearshore) efforts around Puget Sound have reported the capture of few steelhead. In tow-net sampling in north and south Puget Sound, NMFS captured a total of 18 steelhead (Rice, unpublished data). The total sampling effort data was not available, but the mean steelhead catch ranged from 0 to 0.2 per net in north Puget Sound and 0.1 to 0.8 per net in south Puget Sound.

Beach seine sampling in Bellingham Bay (north Puget Sound) also captured few steelhead (Lummi Nation, unpublished data). The Bellingham Bay research reported the capture of two juvenile steelhead salmon in 336 sets between February 14 and December 1, 2003. The steelhead were captured in the eastern portion of Bellingham Bay near the Taylor Avenue Dock on June 12 and June 25, 2003.

#### 4.17.2.4 *Puget Sound Steelhead Critical Habitat*

The Shaw Island Ferry Terminal does not fall within designated steelhead critical habitat (Federal Register 2016a).

#### 4.17.2.5 *Humpback Whale (Megaptera novaeangliae)*

Humpback whale may be present near the Shaw ferry terminal. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.17.2.6 *Southern Resident Killer Whale (Orcinus orca)*

Southern Resident Killer Whale (SRKW) may be present near the Shaw ferry terminal. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.17.2.7 *Southern Resident Killer Whale Critical Habitat*

The Shaw ferry terminal area lies within designated critical habitat (Area 1 – Core Summer Area). Areas with water less than 20 feet deep relative to the extreme high water mark are not included in the critical habitat designation (Federal Register 2006).

The PCEs provided in the terminal area, and their existing conditions are listed in Table SH-2. PCEs relevant to the terminal area are numbered per Federal Register 2006.

The PCEs provided in the ferry terminal area, and their existing conditions, are listed in Table SH-2. PCEs relevant to the terminal area are numbered per the CFR (Federal Register 2006).

**Table SH-2**
**Existing Conditions of Southern Resident Killer Whale PCEs at the Shaw Island Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 1) Water quality to support growth and development | The marine waters of Harney Channel near the terminal are designated "Extraordinary" for aquatic life use. Impaired waters listings in the terminal area include bacteria (water), and phenol (sediment) (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of two drainage areas that drain to Harney Channel. None of the runoff is treated.<br><br>The first drainage area drains the holding lanes, and consists of one catch basin that discharges through an outfall to the southeast of the terminal building.<br><br>The second drainage area consists of the transfer span (typically 90 feet long by 24 feet wide that carries traffic between the trestle and ferry), which discharges by sheet flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column, degrading water quality in the terminal vicinity. |
| 2) Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth | Salmonids are the primary prey of SRKW, and may be present near the terminal. Further information on prey can be found in the Puget Sound Chinook section, and Appendix B – Species Biology. |
| 3) Passage conditions to allow for migration, resting, and foraging | Existing structures that occur below -20 feet in critical habitat include the trestle, the slip, and dolphins. |

#### 4.17.2.8 *Bull Trout (Salvelinus confluentus)*

There are no natal streams in the area of the Shaw Island Ferry Terminal that support bull trout (WDFW 2007a).

The aquatic portions of the ferry terminal are within marine FMO habitat. While bull trout have not been documented in the ferry terminal area, suitable FMO habitat is present, and bull trout are thought to occur throughout south, central, and northern Puget Sound. Therefore, it is expected that the ferry terminal area would be used by anadromous adult and sub-adult bull trout for foraging, migration, and overwintering (USFWS 2004b). Within the ferry terminal area, it is expected that individual bull trout may be present from the Nooksack River (approximately 27 miles northeast), Samish River (approximately 24 miles east), Skagit River (approximately 29 miles southeast), and Stillaguamish River (approximately 39 miles southeast). Bull trout may also be present from rivers and streams in central and southern Puget Sound (WDFW 2007a).

#### 4.17.2.9 *Bull Trout Critical Habitat*

The Shaw Island Ferry Terminal does not fall within designated bull trout critical habitat (Federal Register 2010a).

#### 4.17.2.10 *Green Sturgeon (Acipenser medirostris)*

There are no natal streams in the area of the Shaw Island Ferry Terminal that support green sturgeon.

Observations of green sturgeon in Puget Sound are much less common compared to the coastal Washington estuaries and bays such as Willapa Bay, Grays Harbor, and the Lower Columbia River estuary (Federal Register 2018). In addition, Puget Sound does not appear to be part of the coastal migratory corridor that Southern DPS fish use to reach overwintering grounds north of Vancouver Island (Federal Register 2018).

NMFS reviewed green sturgeon acoustic detection data from 2002-2019 in Puget Sound and the Strait of Juan de Fuca. From 2002-2008, 350 tagged green sturgeon were at large (67% from the threatened southern DPS). During this time, 17 were detected in Puget Sound (4 from the southern DPS). After 2008, none were detected in central or southern Puget Sound, though 400 were at large (83% southern DPS). From 2013-2018, six (one from the southern DPS) were detected in Admiralty Inlet (northern Puget Sound).

From 2004-2019, 210 green sturgeon were detected in the Strait of Juan de Fuca (71% southern DPS). This indicates that the strait is used as a corridor, with green sturgeon residing at detection sites for short periods as they pass through from open ocean. Few of these fish were detected afterwards in Admiralty Inlet, suggesting that most of the tagged population move northward into the Strait of Georgia after transiting the strait. Data indicates conclusively that green sturgeon from the southern DPS occur in Puget Sound and Admiralty inlet, but at low rates compared to Strait of Juan de Fuca presence. This confirms earlier findings that Puget Sound is of lower conservation value to southern DPS green sturgeon. However, it is noted that the tagged population is a small fraction of the whole green sturgeon population, and that conditions need to be optimum for acoustic detection to occur (Moser, et. al. 2021).

#### 4.17.2.11 *Green Sturgeon Critical Habitat*

The Shaw Island Ferry Terminal does not fall within designated green sturgeon critical habitat (Federal Register 2009).

#### 4.17.2.12 *Marbled Murrelet (Brachyramphus marmoratus)*

The Shaw terminal area provides suitable marbled murrelet marine foraging habitat.

There is no documented forage fish spawning present at the terminal (WSDOT 2018a).

WDFW surveys conducted from 2001 to 2012 show a density of less than 1 bird per square kilometer in the terminal area (WDFW 2016). The nearest documented marbled murrelet nesting site is located 42 miles SW of the terminal (WSDOT 2018b).

The Northwest Forest Plan Marbled Murrelet Effectiveness Monitoring Program (2012) identified habitat suitability throughout the range of the species, and ranked it as Zero, Low, Marginal, Moderately High and Highest. The Shaw murrelet habitat suitability within the pile driving/heavy equipment zone of potential effect (0.25 miles), ranges from Zero to High (WSDOT 2019b).

Five acres of contiguous coniferous forest that may offer nesting opportunity is present within the pile driving/heavy equipment zone of potential effect (0.25 miles) (WSDOT 2014/2018c). The 0.25 mile Zone of potential effect is discussed in Section 3.4.

Ferry traffic creates regular disturbance in the immediate terminal area. From July 2017 to June 2018, there were approximately 4,900 scheduled arrivals and departures from the terminal. During the nesting season (April 1-September 23), when foraging murrelet are more active, there were approximately 2,540 scheduled arrivals and departures (WSDOT 2018d).

The marbled murrelet population in the San Juan Islands increases in late July. This increase may be the result of British Columbia birds immigrating after the breeding season. In late fall/early winter, up to 26 percent of the total marbled murrelets observed in the San Juans are found northwest of Shaw Island near Crane Island, the Wasp Island complex, and the southwestern shoreline of Orcas Island (approximately 3.8 miles from the Orcas Island Ferry Terminal, and 4.8 miles from the Shaw Island Ferry Terminal). This region represents an important concentration area during the molting period (Evans Mack 2002).

#### 4.17.2.13 *Marbled Murrelet Critical Habitat*

No marbled murrelet critical habitat has been designated near the terminal (USFWS 1996).

#### 4.17.2.14 *Rockfish Species*

##### *Bocaccio*

Bocaccio are rarely caught in north Puget Sound and only sparse records exist for the Strait of Georgia (Federal Register 2010b). The water surrounding the Shaw Island Ferry Terminal is shallow (less than 30 feet deep), and subject to very strong currents (NMFS 2009). Substrates are rocky throughout the area. This area may be occupied by all life stages of bocaccio.

##### *Yelloweye Rockfish*

Yelloweye rockfish are more closely aligned with rocky, high-relief substrates than with very deep water (Federal Register 2010b). The waters surrounding the San Juan Islands offer this rocky substrate. This area may be occupied by all life stages of yelloweye.

### 4.17.2.15 *Rockfish Species Critical Habitat*

The Shaw Island Ferry Terminal is within rockfish nearshore critical habitat (less than or equal to 98 feet in depth) (Federal Register 2014). The physical and biological features (PBFs) (Federal Register 2014) essential to the conservation of juvenile Bocaccio rockfish are listed in Table SH-4. PBFs relevant to the terminal area are numbered per the CFR (Federal Register 2014). These PBFs are specific to nearshore environments, where only juvenile Bocaccio rockfish could be found. Deepwater (> 98 feet in depth) PBFs exist for adult Bocaccio, and adult and juvenile yelloweye rockfish; however, this habitat is not present at the Shaw Island Ferry Terminal and will not be discussed here.

### 4.17.2.16 *Pacific Eulachon (Thaleichthys pacificus)*

The Shaw Island Ferry Terminal is approximately 37 shoreline miles from the Fraser River, a confirmed spawning river. Eulachon use the Strait of Juan de Fuca as a migration corridor, so it is possible that eulachon might be present at the Shaw Island Ferry Terminal.

A monthly bottom trawl study was funded by Fisheries and Oceans Canada's National Rotational Survey Fund from October 2017 to June 2018 to sample Eulachon in three regional strata in Juan de Fuca Strait and the Strait of Georgia. The goal of this study was to gain insights into the biology, distribution, and migration timing of Eulachon to the Fraser River by observing their spatial and temporal occurrence and biological condition over a wide survey region and over a series of months. Eulachon catch per unit effort (CPUE), size distributions, sex ratios, and maturity observations varied over time and space, as did the occurrence of stomach contents and presence/absence of teeth. Highest catches of Eulachon occurred in Juan de Fuca and lowest near the Fraser River. Mean catch rates at sites near the Fraser River plume corresponded with expected peak spawning periods in the Fraser River. The sex ratio of Eulachon sampled throughout the study region in all months was approximately 1:1 although most samples in the Strait of Georgia in May and June were female. The presence of Eulachon with maturing gonads

**Table SH-4**
**Existing Conditions of Rockfish PBFs at the Shaw Island Ferry Terminal**

| PBFs | Existing Conditions |
|---|---|
| 1) Quantity, quality, and availability of prey species to support individual growth, survivial, reproduction, and feeding opportunities. | The marine waters of Harney Channel near the terminal are designated “Extraordinary” for aquatic life use. Impaired waters listings in the terminal area include bacteria (water), and phenol (sediment) (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of two drainage areas that drain to Harney Channel. None of the runoff is treated.<br><br>The first drainage area drains the holding lanes, and consists of one catch basin that discharges through an outfall to the southeast of the terminal building.<br><br>The second drainage area consists of the transfer span (typically 90 feet long by 24 feet wide that carries traffic between the trestle and ferry), which discharges by sheet flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Overwater coverage from the existing ferry terminal structures may reduce the production of aquatic invertebrates that are prey species to salmon. The presence of bedrock is likely to limit epibenthic production; however, areas within the intertidal zone consisting of sand, cobble, and gravel are likely to support epibenthic production.<br><br>There is no documented forage fish spawning present at the terminal (WSDOT 2018a). ). Herring spawning ground is present 450 ft. SW of the terminal. |
| 2) Water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities. | Forested vegetation occurs west and east of the ferry terminal. The presence of a large eelgrass bed was confirmed within the private marina, approximately 150 feet east of the ferry terminal. A second small patch of eelgrass (approximately 16 square feet) has been documented as occurring southwest of the ferry terminal, but the exact location is unknown. Macroalgae was frequently observed in the intertidal zone. Macroalgae density and diversity was greatest in the intertidal area on the north side of the trestle. Fastened macroalgae was typically attached to large pieces of substrate and bedrock. Observed macroalgae includes: Turkish towel, seersucker, rockweed, sugar kelp, bull kelp, red ribbon, false kelp, diatoms, and sea lettuce (PIE 2002a).<br><br>The beach area is gently sloping, with sand, shell debris, gravel, and cobble near shore and bare bedrock offshore (PIE 2002a). Side channels do not occur in the ferry terminal area. |

increased in frequency from west to east in January to April before sharply decreasing throughout the survey region in May and June. Stomach contents and teeth decreased in frequency with proximity to the Fraser River.

Trends in CPUE, fish length, presence of teeth, and stomach contents demonstrate that Juan de Fuca Strait likely provides an important year-round marine habitat for Eulachon feeding and growth as well as being a migration corridor to and from the west coast of Vancouver Island, which offers a large range of additional Eulachon habitat for foraging, growth habitat and mixing of stocks (Dealy et. al., 2019).

#### 4.17.2.17 *Pacific Eulachon Critical Habitat*

No Pacific eulachon critical habitat has been designated near the Shaw Island Ferry Terminal (FEDERAL REGISTER 2011).

# SOUTHWORTH

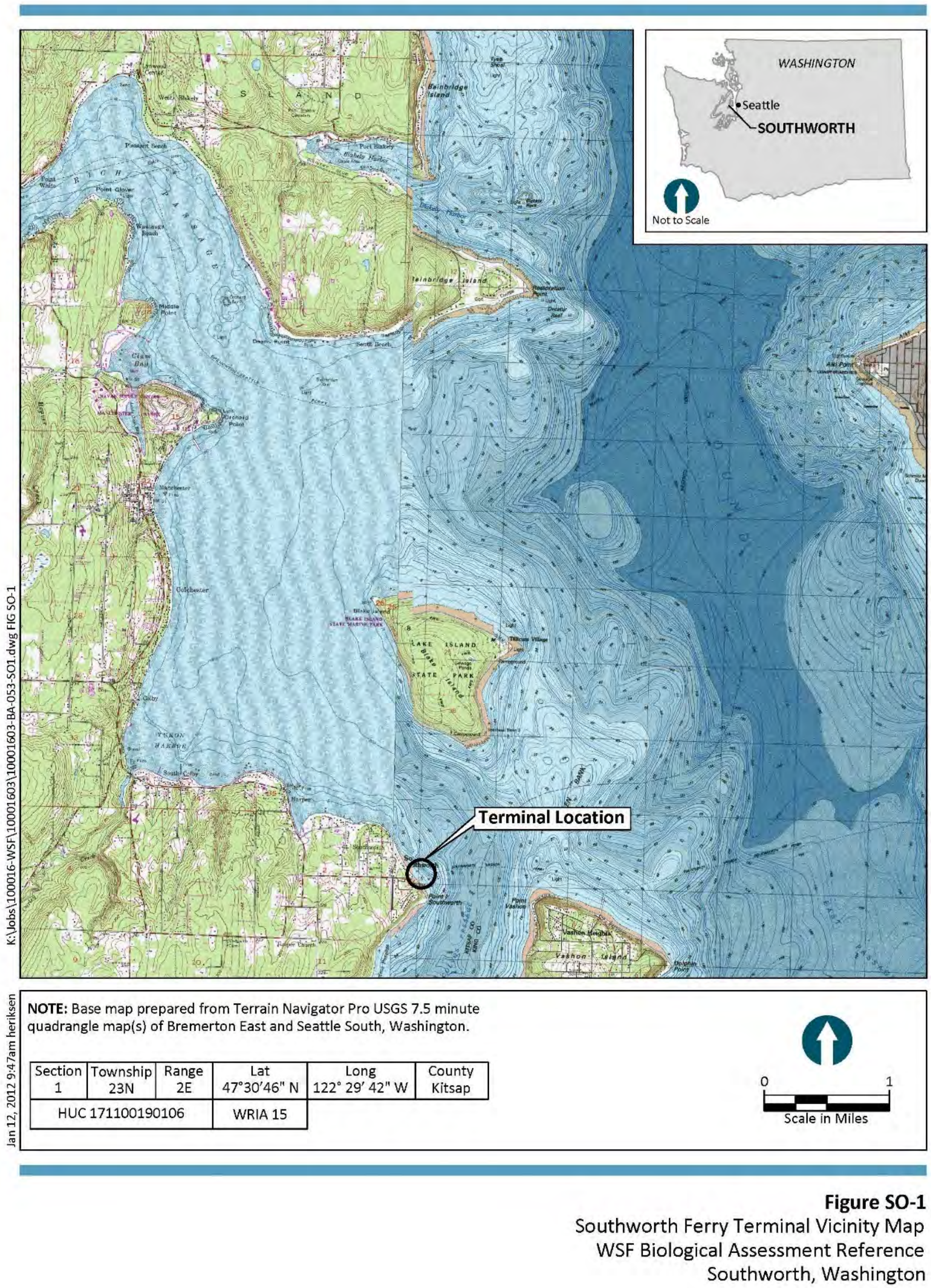



**Figure SO-1**
**Southworth Ferry Terminal Vicinity Map**

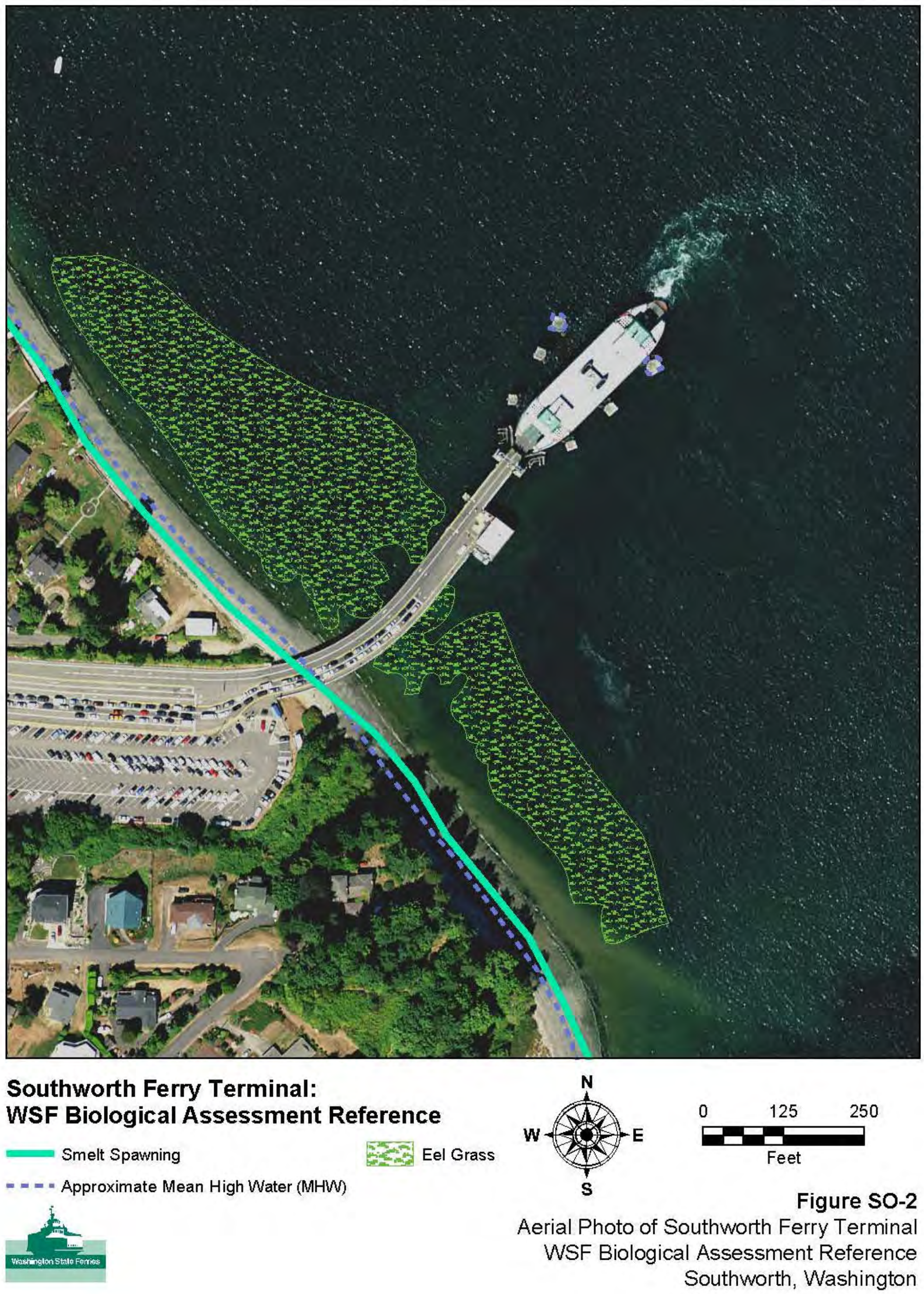



**Figure SO-2**
**Aerial Photo of Southworth Ferry Terminal**

## 4.18 Southworth Ferry Terminal

The Southworth Ferry Terminal is located on the Colvos Passage shoreline, linking the Key Peninsula with Vashon Island and Seattle (see Figures SO-1 and SO-2).

The Southworth Ferry Terminal provides service to the Vashon Island and Fauntleroy Terminals.

Features of the terminal include a terminal building, two vehicle holding lanes that accommodate up to 22 vehicles, and two parking lots. The terminal has one slip with steel wingwalls. Six steel dolphins are associated with the terminal. No overhead passenger loading facilities exist at the terminal.

### *4.18.1 Southworth Environmental Baseline*

#### 4.18.1.1 *Physical Indicators*

*Substrate and Slope*

The intertidal and shallow subtidal habitat areas within the area are characterized by a mixture of sand, coarse sand, and gravel material. The Southworth Ferry Terminal currently exists within a portion of intertidal habitat. The nearshore intertidal habitat extends gradually from MHHW (+11.53 feet) to about -4 feet. A transition occurs in the shallow subtidal zone from approximately -4 feet to the -10 feet boundary of the shallow subtidal zone. Habitat transitions quickly to deeper subtidal habitat beyond about -14 feet with a slope of about 15:1. Offshore depths of terminal structures are: slip (-29.0 feet MLLW). Maximum depth for fixed dolphins is -39.5 feet MLLW.

Beach material to the south of the terminal is sand and clay; to the north is sand and cobble with sections of beach-stabilizing riprap or other constructed shore protection material (see Figures SO-3 and SO-4). Silt, sand, dense clay, and coarse sand are found in the intertidal and subtidal marine portions of the area.

On the south side of the ferry terminal, there is a very steep bluff composed of clay and sands where sloughing is common (Figure SO-4). Erosion from the bluff ranges between 2 and 5 feet per year and is a significant source of sediments to the beach.

**Figure SO-3**
**Beach and Intertidal Area North of the Southworth Ferry Terminal**

**Figure SO-4**
**Beach and Bluff South of the Southworth Ferry Terminal**

### *Salt/Freshwater Mixing*

There are no freshwater inputs in the vicinity of the ferry terminal. The closest stream is located about 1 mile northwest of the terminal.

*Flows and Currents*

The prevailing currents at the Southworth Ferry Terminal move along the shoreline from south to north. Ferry captains have identified an eddy, or sudden reversal in water flow direction, that complicates landing at this terminal. The eddy is caused by ebb current shear, a condition occurring when a section of water with a strong current exists next to a section of relatively still water. Wind fetch from the north, northwest, northeast, east, and south are also likely to affect localized current patterns.

#### 4.18.1.2 *Chemical Indicators*

*Water Quality*

The marine waters of Colvos Passage near the terminal are designated "Extraordinary" for aquatic life use. Impaired waters listings in the terminal area include eelgrass eutrophication due to inorganic nitrogen loading, dissolved oxygen and bacteria (water), (Ecology 2018).

*Sediment Quality*

No impaired waters listing data is available for the current terminal location (Ecology 2018).

#### 4.18.1.3 *Biological Indicators*

*Shoreline Vegetation*

Uplands in the area have been altered by the development of the rural community of Southworth. Most of the forests have been removed and replaced by landscaped lawns, gardens, and young forest trees. Some larger trees have been preserved, but they are typically single trees or clustered in small numbers.

The topography of the area consists of rolling hills, sandy beaches, and a seaside bluff just south of the terminal near Point Southworth. Seawalls and bulkheads exist along the shore to protect single-family homes that exist in the high intertidal area in portions of the area and on top of the bluff.

#### *Macroalgae and Eelgrass*

Sandy substrates with low, medium, and high densities of eelgrass occur from approximately 0 feet to -8 feet on the northwest side of the ferry terminal and from 0 feet to about -20 feet on the southeast side of the ferry terminal. A band of eelgrass occurs under the southern edge of the trestle. Subtidal macroflora occurs in portions of this habitat with a low to moderate density. The dominant macrophytes in the intertidal areas are free-floating sea lettuce, red algae, rock weed, and sugar wrack. *Ulva* is found throughout the site, red algae is generally located beneath the dock attached to pilings, rock weed inhabits the larger cobble and riprap shoreline, and sugar wrack was observed in areas of cobble approximately 100 feet from the north side of the ferry terminal. In general, the distribution of macroflora is determined by the availability of appropriate attachment sites.

#### *Epibenthos, Macrofauna, Fish, and Marine Mammals*

Substrate characteristics likely support epibenthic production. Diver surveys completed in October 1996, November 1998, and January 1999 identified species in the area and their spatial distribution (Thom et al. 1997b; PIE 1999). These species were distributed over the intertidal, shallow subtidal, and subtidal zones of the area. Dominant macrofauna include red crab (*Pleuroncodes planipes*), horse clam, shiner surf perch, tube snout fish (*Aulorhynchus flavidus*), and some piddock clams. Marine mammals likely to occur in the area include killer whale, harbor seal, Steller sea lion, California sea lion, harbor porpoise, and Dall's porpoise.

#### *Forage Fish*

Documented surf smelt spawning is present (see Figures SW-2), extending approximately 550 ft. NW and 415 ft. SE of the terminal (WSDOT 2018a).

### 4.18.2 Southworth Species Distributions

#### 4.18.2.1 *Puget Sound Chinook Salmon (Oncorhynchus tshawytscha)*

Near Colvos Passage and in the Sinclair Inlet drainages, there are several small streams that support Chinook salmon. Curley Creek, which drains Long Lake and is a tributary to Yukon Harbor, is the nearest stream with Chinook salmon (approximately 3 miles northwest, shoreline distance). Tributaries to Sinclair Inlet, Blackjack Creek (approximately 15 miles shoreline distance), and Gorst Creek (approximately 17 miles shoreline distance) also support Chinook salmon (WDFW 2007a).

Chinook salmon have been documented by WDFW as present in Judd Creek (Vashon Island), but there is no documented spawning or juvenile rearing in the creek. Judd Creek is a tributary to Quartermaster Harbor (approximately 23 miles southeast shoreline distance) (WDFW 2007a).

The closest major rivers that support Chinook salmon are the Duwamish/Green River (approximately 9 miles northeast, shoreline distance) and the Puyallup River (approximately 18 miles southeast, shoreline distance). Chinook may also be present from rivers and streams in southern Puget Sound (WDFW 2007a).

#### *Adult and Sub-adult Chinook*

Adult Chinook salmon may be found near the terminal at any time of year, but are most abundant in the late summer and fall when returning from the ocean to their natal streams.

Sub-adult Chinook have access to the terminal area and may be found there at any time of year. Sub-adults have spent a winter in the marine environment and are not closely oriented to the shoreline like juveniles.

#### *Juvenile Chinook*

Near Colvos Passage and in the Sinclair Inlet drainages, there are several small streams that support Chinook salmon. Curley Creek, which drains Long Lake and is a tributary to Yukon Harbor, is the nearest stream with Chinook (approximately 3 miles northwest, shoreline distance). Tributaries to Sinclair Inlet, Blackjack Creek (approximately 15.0 miles shoreline distance) and Gorst Creek (approximately 17 miles shoreline distance), also support Chinook salmon (WDFW 2007a).

Chinook salmon spawning in Gorst Creek has increased in recent years, due in part to a reduction in the fishing effort in the area. Most of these fish are believed to be returns from hatchery Chinook salmon released from the Gorst Creek rearing ponds.

An escapement of over 17,000 Chinook salmon to the Inlet (fishery harvests plus stream escapement) in 2002 was the largest on record, with over 10,000 adult Chinook salmon in Gorst Creek. Returns to the stream in the previous 3 years averaged about 2,400 adult Chinook salmon. An out-migrant trap recently installed at River Kilometer 1.4 on Gorst Creek (upstream of the hatchery) captured 1,352 juvenile Chinook salmon in 2001 and 324 juvenile Chinook salmon in 2002 (Fresh et al. 2006).

#### 4.18.2.2 *Puget Sound Chinook Salmon Critical Habitat*

The Southworth Ferry Terminal lies within Chinook Zone 14 (70 FR 52630). Eelgrass in close proximity to the facility may be used by juvenile Chinook for rearing.

The PCEs provided in the ferry terminal area, and their existing conditions, are listed in Table SO-1. PCEs relevant to the terminal area are numbered per the CFR (70 FR 52630).

**Table SO-1**
**Existing Conditions of Chinook Salmon PCEs at the Southworth Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 5) Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels. | **Obstructions**<br>In-water structures include the trestle, the slip, and dolphins. The existing ferry terminal may affect fish passage in the nearshore.<br><br>**Water Quality and Forage**<br>The marine waters of Colvos Passage near the terminal are designated “Extraordinary” for aquatic life use. Impaired waters listings in the terminal area include eelgrass eutrophication due to inorganic nitrogen loading, dissolved oxygen and bacteria (water), (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of four drainage areas that drain to Colvos Passage. One of the areas includes treatment.<br><br>The first drainage area drains the holding lanes and the commuter park and ride lot, and consists of 18 catch basins and a short trench drain that all discharge through an outfall to the southeast of the trestle.<br><br>The second drainage area drains the trestle, and consists of 18 drains that discharge directly to surface water.<br><br>The third drainage area drains the end of the trestle near the terminal building, and consists of two Gullywasher® catch basins (inspected annually) that treat sediment and oily runoff before discharging to surface water.<br><br>The fourth drainage area consists of the transfer span (typically 90 feet long by 24 feet wide that carries traffic between the trestle and ferry), which discharges by |

| PCEs | Existing Conditions |
|---|---|
| | sheet flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Overwater coverage from the existing ferry terminal structures may reduce the production of aquatic invertebrates that are prey species to salmon. Substrate characteristics support epibenthic production.<br><br>Documented surf smelt spawning is present (see Figures SW-2), extending approximately 550 ft. NW and 415 ft. SE of the terminal (WSDOT 2018a).<br><br>**Natural Cover**<br>Forested shoreline vegetation has been replaced in many areas by residential landscaping.<br><br>A band of eelgrass occurs under the southern edge of the existing trestle. Subtidal macroflora occurs in portions of this habitat with a low to moderate density. The dominant macrophytes in the intertidal areas are free floating sea lettuce, red algae, rock weed, and sugar wrack. *Ulva* is found throughout the site, red algae is generally located beneath the dock attached to pilings, rock weed inhabits the larger cobble and riprap shoreline, and sugar wrack was observed in areas of cobble approximately 100 feet from the north side of the ferry terminal (Anchor 2001).<br><br>There is no large overhanging wood vegetation. The existing conditions within the defined area of critical habitat consist of sandy substrates with low, medium, and high densities of eelgrass occurring from approximately 0 feet to -8 feet on the northwest side of the existing ferry terminal and from 0 feet to about -20 feet on the southeast side of the existing facility (Anchor 2001). Some riprap and hardened shoreline are adjacent to the ferry terminal. Side channels do not occur in the ferry terminal area. |
| 6) Offshore areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation. | The marine waters of Colvos Passage near the terminal are designated “Extraordinary” for aquatic life use. Impaired waters listings in the terminal area include eelgrass eutrophication due to inorganic nitrogen loading, dissolved oxygen and bacteria (water), (Ecology 2018).<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Offshore areas provide habitat for forage fish. |

### 4.18.2.3 *Puget Sound Steelhead (Oncorhynchus mykiss)*

The nearest natal streams in the area of the Southworth Ferry Terminal that support Puget Sound steelhead are Curley Creek (tributary to Yukon Harbor approximately 3 shoreline miles northwest) and Shingle Mill Creek on Vashon Island (approximately 3 shoreline miles southwest). Major river systems in this area of Puget Sound that support winter steelhead include the Lake Washington/Cedar River (approximately 13 miles northeast shoreline distance), Duwamish/Green River (approximately 9 miles northeast shoreline distance), and the Puyallup River (approximately 18 miles southeast shoreline distance). The Duwamish/Green River also supports a run of summer steelhead.

In addition, winter steelhead are present in Blackjack Creek (approximately 12 shoreline miles northwest), Ross Creek (approximately 13 shoreline miles northwest), Anderson Creek (approximately 15 shoreline miles northwest), and Gorst Creek (approximately 15.5 shoreline miles northwest)—all tributaries to Sinclair Inlet; and Chico Creek (approximately 17 shoreline miles northwest), Barker Creek (approximately 17 shoreline miles northwest), Strawberry Creek (approximately 18 shoreline miles northwest), and Clear Creek (approximately 18 shoreline miles northwest)—all tributaries to Dyes Inlet (WDFW 2007a).

Available data from tow-net sampling (deeper nearshore) and beach seine sampling (shallow nearshore) efforts around Puget Sound have reported the capture of few steelhead. In tow-net sampling in north and south Puget Sound, NMFS captured a total of 18 steelhead (Rice, unpublished data). The total sampling effort data was not available, but the mean steelhead catch ranged from 0 to 0.2 per net in north Puget Sound and 0.1 to 0.8 per net in south Puget Sound.

During 2001 and 2002, beach seining conducted in central Puget Sound by King County Department of Natural Resources captured only nine steelhead out of a total of approximately 34,000 juvenile salmonids. All the steelhead were caught between May and August and ranged in size from 141 to 462 mm with a mean size of 258 mm (Brennan et al. 2004). Also during 2001 and 2002, beach seining, tow netting, and purse seining were conducted by WDFW in Sinclair Inlet. This sampling effort focused on beach seining, which occurred monthly from April to October in 2001 and from mid-February to September in 2002. Tow-netting was conducted monthly from May to August in 2002 only and purse seining was limited to only 2 days in July of 2002. The sampling effort resulted in the capture of four steelhead out of a total of 21,500 salmonids. Despite the larger effort given to beach seining, of the four steelhead, only one was caught in the beach seine and the remaining three were caught in deeper water with the tow net and purse seine (Fresh et al. 2006).

Steelhead were also infrequently captured in a beach seine study around Bainbridge Island (City of Bainbridge Island, Suquamish Tribe, and WDFW 2005). The study consisted of 271 beach seine sets conducted between April and September 2002 and between April 2003 and December 2004. Three steelhead were captured in the study: one in May and two in September. Lengths were 179, 280, and 300 mm. One had been fin clipped, indicating it was of hatchery origin.

#### 4.18.2.4 *Puget Sound Steelhead Critical Habitat*

The Southworth Ferry Terminal does not fall within designated steelhead critical habitat (Federal Register 2016a).

#### 4.18.2.5 *Humpback Whale (Megaptera novaeangliae)*

Humpback whale may be present near the Southworth ferry terminal. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.18.2.6 *Southern Resident Killer Whale (Orcinus orca)*

Southern Resident Killer Whale (SRKW) may be present near the Southworth ferry terminal. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.18.2.7 *Southern Resident Killer Whale Critical Habitat*

The Southworth ferry terminal area lies within designated critical habitat (Area 2 – Puget Sound). Areas with water less than 20 feet deep relative to the extreme high water mark are not included in the critical habitat designation (Federal Register 2006).

The PCEs provided in the terminal area, and their existing conditions are listed in Table SO-2. PCEs relevant to the terminal area are numbered per Federal Register 2006.

**Table SO-2**
**Existing Conditions of Southern Resident Killer Whale PCEs at the Southworth Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 1) Water quality to support growth and development | The marine waters of Colvos Passage near the terminal are designated "Extraordinary" for aquatic life use. Impaired waters listings in the terminal area include eelgrass eutrophication due to inorganic nitrogen loading, dissolved oxygen and bacteria (water), (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of four drainage areas that drain to Colvos Passage. One of the areas includes treatment.<br><br>The first drainage area drains the holding lanes and the commuter park and ride lot, and consists of 18 catch basins and a short trench drain that all discharge through an outfall to the southeast of the trestle.<br><br>The second drainage area drains the trestle, and consists of 18 drains that discharge directly to surface water.<br><br>The third drainage area drains the end of the trestle near the terminal building, and consists of two Gullywasher® catch basins (inspected annually) that treat sediment and oily runoff before discharging to surface water.<br><br>The fourth drainage area consists of the transfer span (typically 90 feet long by 24 feet wide that carries traffic between the trestle and ferry), which discharges by sheet flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column, degrading water quality in the terminal vicinity. |
| 2) Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth | Salmonids are the primary prey of SRKW, and may be present near the terminal. Further information on prey can be found in the Puget Sound Chinook section, and Appendix B – Species Biology. |
| 3) Passage conditions to allow for migration, resting, and foraging | Existing structures that occur below -20 feet in critical habitat include the head of the trestle, the slip, and dolphins. |

#### 4.18.2.8 *Bull Trout (Salvelinus confluentus)*

There are no natal streams in the area of the Southworth Ferry Terminal that support bull trout (WDFW 2007a).

The aquatic portions of the ferry terminal are within marine FMO habitat. While bull trout have not been documented in the ferry terminal area, suitable FMO habitat is present, and bull trout are thought to occur throughout south, central, and northern Puget Sound. Therefore, it is expected that the ferry terminal area would be used by anadromous adult and sub-adult bull trout for foraging, migration, and overwintering (USFWS 2004b). Within the ferry terminal area, it is expected that individual bull trout from the Duwamish/Green River (approximately 9 miles northeast, shoreline distance) and the Puyallup River (approximately 18 miles southeast, shoreline distance) core areas are most likely to be present (WDFW 2007a).

#### 4.18.2.9 *Bull Trout Critical Habitat*

The shoreline of the Southworth Ferry Terminal is not within designated bull trout critical habitat per Federal Register 2010a.

#### 4.18.2.10 *Green Sturgeon (Acipenser medirostris)*

There are no natal streams in the area of the Southworth Ferry Terminal that support green sturgeon.

Observations of green sturgeon in Puget Sound are much less common compared to the coastal Washington estuaries and bays such as Willapa Bay, Grays Harbor, and the Lower Columbia River estuary (Federal Register 2018). In addition, Puget Sound does not appear to be part of the coastal migratory corridor that Southern DPS fish use to reach overwintering grounds north of Vancouver Island (Federal Register 2018).

NMFS reviewed green sturgeon acoustic detection data from 2002-2019 in Puget Sound and the Strait of Juan de Fuca. From 2002-2008, 350 tagged green sturgeon were at large (67% from the threatened southern DPS). During this time, 17 were detected in Puget Sound (4 from the southern DPS). After 2008, none were detected in central or southern Puget Sound, though 400 were at large (83% southern DPS). From 2013-2018, six (one from the southern DPS) were detected in Admiralty Inlet (northern Puget Sound).

From 2004-2019, 210 green sturgeon were detected in the Strait of Juan de Fuca (71% southern DPS). This indicates that the strait is used as a corridor, with green sturgeon residing at detection sites for short periods as they pass through from open ocean. Few of these fish were detected afterwards in Admiralty Inlet, suggesting that most of the tagged population move northward into the Strait of Georgia after transiting the strait. Data indicates conclusively that green sturgeon from the southern DPS occur in Puget Sound and Admiralty inlet, but at low rates compared to Strait of Juan de Fuca presence. This confirms earlier findings that Puget Sound is of lower conservation value to southern DPS green sturgeon. However, it is noted that the tagged population is a small fraction of the whole green sturgeon population, and that conditions need to be optimum for acoustic detection to occur (Moser, et. al. 2021).

#### 4.18.2.11 *Green Sturgeon Critical Habitat*

The Southworth Ferry Terminal does not fall within designated green sturgeon critical habitat (Federal Register 2009).

#### 4.18.2.12 *Marbled Murrelet (Brachyramphus marmoratus)*

The Southworth terminal area provides suitable marbled murrelet marine foraging habitat.

Documented surf smelt spawning (prey species) is present (see Figure SW-2), extending approximately 550 ft. NW and 415 ft. SE of the terminal (WSDOT 2018a).

WDFW surveys conducted from 2001 to 2012 show a density of less than 1 bird per square kilometer in the terminal area (WDFW 2016). The nearest documented marbled murrelet nesting site is located 29 miles NW of the terminal (WSDOT 2018b).

The Northwest Forest Plan Marbled Murrelet Effectiveness Monitoring Program (2012) identified habitat suitability throughout the range of the species, and ranked it as Zero, Low, Marginal, Moderately High and Highest. The Southworth murrelet habitat suitability within the pile driving/heavy equipment zone of potential effect (0.25 miles), is Zero (WSDOT 2019b).

Five acres of contiguous forest that may offer nesting opportunity is present within the pile driving/heavy equipment zone of potential effect (0.25 miles) (WSDOT 2014/2018c). A WSF Biologist visited the terminal area on 11/26/18. Although there were 5 acres of contiguous forest, it was less than the required 60% coniferous. Therefore, the forest does not offer appropriate nesting opportunity (WSDOT 2018f).

Ferry traffic creates regular disturbance in the immediate terminal area. From July 2017 to June 2018, there were approximately 8,560 scheduled arrivals and departures from the terminal. During the nesting season (April 1-September 23), when foraging murrelet are more active, there were approximately 4,325 scheduled arrivals and departures (WSDOT 2018d).

#### 4.18.2.13 *Marbled Murrelet Critical Habitat*

No marbled murrelet critical habitat has been designated near the terminal (USFWS 1996).

#### 4.18.2.14 *Rockfish Species*

*Bocaccio*

Bocaccio are rarely caught in north Puget Sound and only sparse records exist for the Strait of Georgia (Federal Register 2010b). Because larvae are widely dispersed, it is possible that bocaccio juveniles could be found near the Southworth Ferry Terminal at any time of year. Adult bocaccio generally move to very deep water. The waters within Colvos Passage drop off sharply from the shoreline to a depth of over 300 feet at the center (NMFS 2009).

*Yelloweye Rockfish*

Yelloweye rockfish are more closely aligned with rocky, high-relief substrates than with very deep water (Federal Register 2010b). Yelloweye may potentially be found in Colvos Passage.

#### 4.18.2.15 *Rockfish Species Critical Habitat*

The Southworth Ferry Terminal is within rockfish nearshore critical habitat (less than or equal to 98 feet in depth) (Federal Register 2014). The physical and biological features (PBFs) (Federal Register 2014) essential to the conservation of juvenile Bocaccio rockfish are listed in Table SO-3. PBFs relevant to the terminal area are numbered per the CFR (Federal Register 2014). These PBFs are specific to nearshore environments, where only juvenile Bocaccio rockfish could be found. Deepwater (>

**Table SO-3**
**Existing Conditions of Rockfish PBFs at the Southworth Ferry Terminal**

| PBFs | Existing Conditions |
|---|---|
| 1) Quantity, quality, and availability of prey species to support individual growth, survivial, reproduction, and feeding opportunities. | The marine waters of Colvos Passage near the terminal are designated “Extraordinary” for aquatic life use. Impaired waters listings in the terminal area include eelgrass eutrophication due to inorganic nitrogen loading, dissolved oxygen and bacteria (water), (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of four drainage areas that drain to Colvos Passage. One of the areas includes treatment.<br><br>The first drainage area drains the holding lanes and the commuter park and ride lot, and consists of 18 catch basins and a short trench drain that all discharge through an outfall to the southeast of the trestle.<br><br>The second drainage area drains the trestle and consists of 18 drains that discharge directly to surface water.<br><br>The third drainage area drains the end of the trestle near the terminal building, and consists of two Gullywasher® catch basins (inspected annually) that treat sediment and oily runoff before discharging to surface water.<br><br>The fourth drainage area consists of the transfer span (typically 90 feet long by 24 feet wide that carries traffic between the trestle and ferry), which discharges by sheet flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Overwater coverage from the existing ferry terminal structures may reduce the production of aquatic invertebrates that are prey species to salmon. Substrate characteristics support epibenthic production.<br><br>Documented surf smelt spawning is present (see Figures SW-2), extending approximately 550 ft. NW and 415 ft. SE of the terminal (WSDOT 2018a). |
| 2) Water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities. | Forested shoreline vegetation has been replaced in many areas by residential landscaping.<br><br>A band of eelgrass occurs under the southern edge of the existing trestle. Subtidal macroflora occurs in portions of this habitat with a low to moderate density. The dominant macrophytes in the intertidal areas are free floating sea lettuce, red algae, rock weed, and sugar wrack. *Ulva* is found throughout the site, red algae is generally located beneath the dock attached to pilings, rock weed inhabits the larger cobble and riprap shoreline, and sugar wrack was observed in areas of cobble approximately 100 feet from the north side of the ferry terminal (Anchor 2001).<br><br>There is no large overhanging wood vegetation. The existing conditions within the defined area of critical habitat consist of sandy substrates with low, medium, and high densities of eelgrass occurring from approximately 0 feet to -8 feet on the northwest side of the existing ferry terminal and from 0 feet to about -20 feet on the southeast side of the existing facility (Anchor 2001). Some riprap and hardened shoreline are adjacent to the ferry terminal. Side channels do not occur in the ferry terminal area. |

98 feet in depth) PBFs exist for adult Bocaccio, and adult and juvenile yelloweye rockfish; however, this habitat is not present at the Southworth Ferry Terminal and will not be discussed here.

#### 4.18.2.16 *Pacific Eulachon (Thaleichthys pacificus)*

The Southworth Ferry Terminal is distant from any of the known eulachon spawning rivers. It is highly unlikely that eulachon will be present at the Southworth Ferry Terminal.

#### 4.18.2.17 *Pacific Eulachon Critical Habitat*

No Pacific eulachon critical habitat has been designated near the Southworth Ferry Terminal (FEDERAL REGISTER 2011).

# TAHLEQUAH


**NOTE:** Base map prepared from Terrain Navigator Pro USGS 7.5 minute quadrangle map(s) of Gig Harbor and Tacoma North, Washington.

| Section | Township | Range | Lat | Long | County |
|---|---|---|---|---|---|
| 2 | 21N | 2E | 47° 20′ 2″ N | 122° 30′ 29″ W | King |
| HUC 171100190403 | | | WRIA 15 | | |

0 1
Scale in Miles

**Figure TA-1**
Tahlequah Ferry Terminal Vicinity Map
WSF Biological Assessment Reference
Vashon Island, Washington

**Figure TA-1**
**Tahlequah Ferry Terminal Vicinity Map**


**Figure TA-2**
**Aerial Photo of Tahlequah Ferry Terminal**

### 4.19 Tahlequah Ferry Terminal

The Tahlequah Ferry Terminal is on the southern tip of Vashon Island, across Dalco Passage from Point Defiance (see Figures TA-1 and TA-2).

The Tahlequah Ferry Terminal provides service to the Point Defiance Terminal.

Features of the terminal include a passenger shelter, and one vehicle holding lane that accommodates up to four vehicles, additional roadside holding, and a parking lot. The terminal has one slip with steel wingwalls. Three steel dolphins are associated with the terminal. No overhead passenger loading facilities exist at the terminal.

During the summer of 2021, WSF constructed a soft-shore erosion control/restoration project along the terminal shoreline. The interpretive sign in Figure TA-3 provides more information.


**Figure TA-3**
**Tahlequah Soft Shore Sign**

### *4.19.1 Tahlequah Environmental Baseline*

#### 4.19.1.1 *Physical Indicators*

*Substrate and Slope*

Beach substrate between MHHW and +2 feet MLLW is primarily gravel. A sand-gravel mix exists between +2 feet MLLW and MLLW, and from MLLW to -4 feet MLLW, the substrate is predominantly sand with some shell hash. On either side of the ferry terminal, there is extensive hardening of the shoreline to protect single-family homes. Figure TA-3 shows the shoreline east of the trestle (with residential bulkhead). Figures TA-4 to TA-5 show the shoreline west of the trestle, immediately post soft-shore project. Figure TA-6 shows the same area, after wood was recruited to the shoreline. Wood recruitment was expected post-project, though was accelerated by exceptional high tides and storms.

**Figure TA-3**
**Shoreline East of the trestle**

**Figure TA-4**
**Shoreline West of the trestle post soft-shore project**

**Figure TA-5**
**Shoreline West toward the trestle post soft-shore project**

**Figure TA-6**
**Shoreline West of the trestle post-storm wood recruitment**

From MHHW to about -10 feet MLLW, the nearshore intertidal habitat extends gradually. The habitat transitions quickly to deeper subtidal habitat beyond about -14 feet MLLW. The slope is approximately 13 percent along the east and west sides of the site. Steep slopes (greater than 25 percent) exist upland of the site. The subtidal slope is approximately 8 percent. Offshore depths of terminal structures are: slip (-20.5 feet MLLW). Maximum depth for fixed dolphins is -25.8 feet MLLW.

### *Salt/Freshwater Mixing*

Tahlequah Creek and stormwater runoff from the surrounding area are the most significant sources of freshwater into the ferry terminal area. Tahlequah Creek enters Puget Sound about 500 feet west of the ferry terminal (see Figure TA-2). Approximately the last 300 feet of the creek is directed through private property via a concrete culvert (see Figure TA-5).

**Figure TA-5**
**Concrete Culvert Carrying Talequah Creek and the Creek as it Flows onto the Beach**

*Flows and Currents*

The prevailing currents at Tahlequah move generally along the shoreline from east to west. However, the ferry captains have identified multiple long-shore currents, or sudden reversal in water flow direction. Wind fetch from multiple directions is also likely to affect localized current patterns.

### 4.19.1.2 *Chemical Indicators*

*Water Quality*

The marine waters of Dalco Passage near the terminal are designated “Extraordinary” for aquatic life use. Impaired waters listings in the terminal area include organics (including PCBs)(tissue), and bacteria (water)(Ecology 2018).

*Sediment Quality*

No impaired waters listing data is available for the current terminal location (Ecology 2018).

#### 4.19.1.3 *Biological Indicators*

*Shoreline Vegetation*

There is some forested vegetation on either side of the ferry terminal. The immediate shoreline area is lined with private homes.

*Macroalgae and Eelgrass*

The east side of the ferry terminal area supports sandy substrates with low, medium, and high densities of eelgrass. Eelgrass (*Zostera marina* L.) along the east side occurs from -2 feet MLLW to approximately -6 feet MLLW and comes within 75 feet of the trestle. Two small (less than 3 square foot) patches of eelgrass also occur between MLLW and -1 feet MLLW on the west side approximately 15 feet from the trestle.

Macroalgae occurs within the nearshore habitats of the area with a low to moderate density. The dominant macrophytes include: sea lettuce *(Ulva* spp.), red algae, Turkish towel, bleached brunette, rock weed, red cellophane (*Porphyra cuneiformis*), long laver (*P. pseudolinearis*), graceful sea hair (*Cladophora sericea*), twisted sea tube (*Melanosiphon intestinalis*), arctic sea moss (*Acrosiphonia arcta*), and wireweed (*Sargassum muticum*). Sugar wrack, seersucker, flattened acid kelp (*Desmarestia ligulata*), and bull kelp were more frequently encountered in the lower intertidal zone. Macroalgae is attached to a variety of hard substrates, such as piling beneath the trestle, rocks, and shells (PIE 2002c).

*Epibenthos, Macrofauna, Fish, and Marine Mammals*

The sand-gravel substrate in the intertidal zone likely supports epibenthic production. Dominant macrofauna include red crab, moon snails, starfish, mussels, clingfish, and chum salmon. Tahlequah Creek supports resident cutthroat. The WDFW PHS maps show that geoduck utilizes the subtidal areas approximately 0.1 mile from the terminal in Quartermaster Harbor.

Marine mammals that may occur in the area include killer whale, Dall's porpoise, harbor porpoise, harbor seal, Steller sea lion, and California sea lion.

*Forage Fish*

Surf smelt, Pacific herring and unidentified eggs were found in small numbers during the pre-restoration monitoring of the Tahlequah beach (VNC 2021). Monitoring will continue post-restoration to determine if spawning increases. Sand lance and herring spawning, and pre-spawn herring holding are present within 0.3 miles of the terminal (WSDOT 2018a).

### 4.19.2 Tahlequah Species Distributions

#### 4.19.2.1 Puget Sound Chinook Salmon (Oncorhynchus tshawytscha)

No Chinook salmon-bearing streams are located near the Tahlequah Ferry Terminal (WDFW 2007a).

Salmon stocks that may be present in the ferry terminal area for variable lengths of time include runs originating from the Puyallup River (approximately 7 miles southeast shoreline distance), Nisqually River (approximately 21 miles southwest shoreline distance), and the Deschutes River and smaller drainages in southern Puget Sound (WDFW 2007a). Chinook salmon have been documented by WDFW as present in Judd Creek (Vashon Island), but there is no documented spawning or juvenile rearing in the creek. Judd Creek is tributary to Quartermaster Harbor (approximately 8 miles southeast shoreline distance) (WDFW 2007a).

*Adult and Sub-adult Chinook*

Adult Chinook from the South Sound river systems may be present near Vashon Island at any time of year.

Sub-adult Chinook have access to the terminal area and may be found there at any time of year. Sub-adults have spent a winter in the marine environment and are not closely oriented to the shoreline like juveniles.

*Juvenile Chinook*

Juvenile salmon from Judd Creek may be found in the nearshore during the spring months. Juveniles from other areas would have to cross open water in order to reach the nearshore; therefore, they would likely be more mature than the local run.

Beach seines were conducted from April through September of 2001 and 2002 on Vashon and Maury Island. Juvenile Chinook salmon first entered the area in mid-May with numbers peaking in mid-July and steadily tapering off through August and September (Duffy et al. 2005).

#### 4.19.2.2 *Puget Sound Chinook Salmon Critical Habitat*

The Tahlequah Ferry Terminal lies within Chinook Zone 14 (70 FR 52630). While there are no streams that support Chinook salmon near the ferry terminal, eelgrass in close proximity to the ferry terminal may be used by juvenile Chinook for rearing.

The PCEs provided in the ferry terminal area, and their existing conditions, are listed in Table TA-1. PCEs relevant to the terminal area are numbered per the CFR (70 FR 52630).

**Table TA-1**
**Existing Conditions of Chinook Salmon PCEs at the Tahlequah Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 5) Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels. | **Obstructions**<br>In-water structures include the trestle, the slip, and dolphins. The existing ferry terminal may affect fish passage in the nearshore.<br><br>**Water Quality and Forage**<br>The marine waters of Dalco Passage near the terminal are designated “Extraordinary” for aquatic life use. Impaired waters listings in the terminal area include organics (including PCBs in tissue), and bacteria (water)(Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of four drainage areas that drain to Dalco Passage. One of the areas includes treatment.<br><br>The first drainage area drains the upper former house lot, the park and ride lot and the hillside above and below the lot, the side street parking, and the road at the east entrance to the pier, and consists of 13 catch basins, two daylight under-drains to quarry spall, and a swale. The under-drains and swale provide some stormwater treatment. This drainage area discharges through an outfall to the east of the trestle.<br><br>The second drainage area drains the road at the west entrance to the trestle, consists of two catch basins that discharges through an outfall to the west of the trestle.<br><br>The third drainage area drains the former house lots to the west of the trestle, and consists of infiltration to soil, and discharge directly to the beach or surface water (depending on tide level).<br><br>The fourth drainage area consists of the trestle and transfer span (typically 90 feet long by 24 feet wide that carries traffic between the trestle and ferry), which discharges by sheet flow directly to surface water. |

| PCEs | Existing Conditions |
|---|---|
| | Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Overwater coverage from the existing ferry terminal structures may reduce the production of aquatic invertebrates that are prey species to salmon. The sand-gravel substrate in the intertidal zone likely supports epibenthic production.<br><br>There is no documented forage fish spawning present at the terminal. Sand lance and herring spawning, and pre-spawn herring holding are present within 0.3 miles of the terminal (WSDOT 2018a).<br><br>**Natural Cover**<br>There is some forested vegetation on either side of the ferry terminal. The immediate shoreline area is residentially landscaped.<br><br>The east side of the ferry terminal area supports sandy substrates with low, medium, and high densities of eelgrass. Macroalgae occurs within the nearshore habitats of the area with a low to moderate density. The dominant macrophytes include: sea lettuce *(Ulva* spp.), red algae, Turkish towel, bleached brunette, rock weed, red cellophane, long laver, graceful sea hair, twisted sea tube, arctic sea moss, and wireweed. Sugar wrack, seersucker, flattened acid kelp, and bull kelp were more frequently encountered in the lower intertidal zone (PIE 2002c).<br><br>There is no large overhanging wood vegetation. The existing conditions within the defined area of critical habitat consist of gravel between MHHW and +2 feet MLLW, a sand-gravel mix exists between +2 feet MLLW and MLLW, and from MLLW to -4 feet MLLW the substrate is predominantly sand with some shell hash (PIE 2002c). Some hardened shoreline is adjacent to the ferry terminal. Side channels do not occur in the ferry terminal area. |
| 6) Offshore areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation. | The marine waters of Dalco Passage near the terminal are designated “Extraordinary” for aquatic life use. Impaired waters listings in the terminal area include organics (including PCBs in tissue), and bacteria (water)(Ecology 2018).<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Offshore areas provide habitat for forage fish. |

#### 4.19.2.3 *Puget Sound Steelhead (Oncorhynchus mykiss)*

There are no natal streams in the area of the Tahlequah Ferry Terminal that support Puget Sound steelhead. However, major rivers and streams that support winter steelhead include the Puyallup River (approximately 7 miles southeast shoreline distance), Chambers Creek (approximately 12 miles southwest shoreline distance), Red Salmon Creek (approximately 24 miles southwest shoreline distance), the Nisqually River (approximately 25 miles southwest shoreline distance), and McAllister Creek (approximately 26 miles southwest shoreline distance). In addition, the Deschutes River and smaller drainages in southern Puget Sound also support winter steelhead (WDFW 2007a).

Available data from tow-net sampling (deeper nearshore) and beach seine sampling (shallow nearshore) efforts around Puget Sound have reported the capture of few steelhead. In tow-net sampling in north and south Puget Sound, NMFS captured a total of 18 steelhead (Rice, unpublished data). The total sampling effort data was not available, but the mean steelhead catch ranged from 0 to 0.2 per net in north Puget Sound and 0.1 to 0.8 per net in south Puget Sound.

Beach seine sampling in Bellingham Bay (north Puget Sound) also captured few steelhead (Lummi Nation, unpublished data). The Bellingham Bay research reported the capture of two juvenile steelhead salmon in 336 sets between February 14 and December 1, 2003. The steelhead were captured in the eastern portion of Bellingham Bay near the Taylor Avenue Dock on June 12 and June 25, 2003.

#### 4.19.2.4 *Puget Sound Steelhead Critical Habitat*

The Tahlequah Ferry Terminal does not fall within designated steelhead critical habitat (Federal Register 2016a).

#### 4.19.2.5 *Humpback Whale (Megaptera novaeangliae)*

Humpback whale may be present near the Tahlequah ferry terminal. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.19.2.6 *Southern Resident Killer Whale (Orcinus orca)*

Southern Resident Killer Whale (SRKW) may be present near the Tahlequah ferry terminal. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.19.2.7 *Southern Resident Killer Whale Critical Habitat*

The Tahlequah ferry terminal area lies within designated critical habitat (Area 2 – Puget Sound). Areas with water less than 20 feet deep relative to the extreme high water mark are not included in the critical habitat designation (Federal Register 2006).

The PCEs provided in the terminal area, and their existing conditions are listed in Table TA-2. PCEs relevant to the terminal area are numbered per Federal Register 2006.

**Table TA-2**
**Existing Conditions of Southern Resident Killer Whale PCEs at the Tahlequah Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 1) Water quality to support growth and development | The marine waters of Dalco Passage near the terminal are designated “Extraordinary” for aquatic life use. Impaired waters listings in the terminal area include organics (including PCBs in tissue), and bacteria (water)(Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of four drainage areas that drain to Dalco Passage. One of the areas includes treatment.<br><br>The first drainage area drains the upper former house lot, the park and ride lot and the hillside above and below the lot, the side street parking, and the road at the east entrance to the pier, and consists of 13 catch basins, two daylight under-drains to quarry spall, and a swale. The under-drains and swale provide some stormwater treatment. This drainage area discharges through an outfall to the east of the trestle.<br><br>The second drainage area drains the road at the west entrance to the trestle, and consists of two catch basins that discharge through an outfall to the west of the trestle.<br><br>The third drainage area drains the former house lots to the west of the trestle, consists of infiltration to soil, and discharges directly to the beach or surface water (depending on tide level).<br><br>The fourth drainage area consists of the trestle and transfer span (typically 90 feet long by 24 feet wide that carries traffic between the trestle and ferry), which discharges by sheet flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column, degrading water quality in the terminal vicinity. |
| 2) Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth | Salmonids are the primary prey of SRKW, and may be present near the terminal. Further information on prey can be found in the Puget Sound Chinook section, and Appendix B – Species Biology. |
| 3) Passage conditions to allow for migration, resting, and foraging | Existing structures that occur below -20 feet in critical habitat include a segment of the trestle, the slip, and dolphins. |

#### 4.19.2.8 *Bull Trout (Salvelinus confluentus)*

There are no natal streams in the area of the Tahlequah Ferry Terminal that support bull trout (WDFW 2007a).

The aquatic portions of the ferry terminal are within marine FMO habitat. While bull trout have not been documented in the ferry terminal area, suitable FMO habitat is present, and bull trout are thought to occur throughout south, central, and northern Puget Sound. Therefore, it is expected that the ferry terminal area would be used by anadromous adult and sub-adult bull trout for foraging, migration, and overwintering (USFWS 2004b). Within the ferry terminal area, it is expected that individual bull trout from the Puyallup River (approximately 7 miles southeast shoreline distance) core area are most likely to be present (WDFW 2007a).

#### 4.19.2.9 *Bull Trout Critical Habitat*

The shoreline of the Tahlequah Ferry Terminal is not within designated bull trout critical habitat per Federal Register 2010a.

#### 4.19.2.10 *Green Sturgeon (Acipenser medirostris)*

There are no natal streams in the area of the Tahlequah Ferry Terminal that support green sturgeon.

Observations of green sturgeon in Puget Sound are much less common compared to the coastal Washington estuaries and bays such as Willapa Bay, Grays Harbor, and the Lower Columbia River estuary (Federal Register 2018). In addition, Puget Sound does not appear to be part of the coastal migratory corridor that Southern DPS fish use to reach overwintering grounds north of Vancouver Island (Federal Register 2018).

NMFS reviewed green sturgeon acoustic detection data from 2002-2019 in Puget Sound and the Strait of Juan de Fuca. From 2002-2008, 350 tagged green sturgeon were at large (67% from the threatened southern DPS). During this time, 17 were detected in Puget Sound (4 from the southern DPS). After 2008, none were detected

in central or southern Puget Sound, though 400 were at large (83% southern DPS). From 2013-2018, six (one from the southern DPS) were detected in Admiralty Inlet (northern Puget Sound).

From 2004-2019, 210 green sturgeon were detected in the Strait of Juan de Fuca (71% southern DPS). This indicates that the strait is used as a corridor, with green sturgeon residing at detection sites for short periods as they pass through from open ocean. Few of these fish were detected afterwards in Admiralty Inlet, suggesting that most of the tagged population move northward into the Strait of Georgia after transiting the strait. Data indicates conclusively that green sturgeon from the southern DPS occur in Puget Sound and Admiralty inlet, but at low rates compared to Strait of Juan de Fuca presence. This confirms earlier findings that Puget Sound is of lower conservation value to southern DPS green sturgeon. However, it is noted that the tagged population is a small fraction of the whole green sturgeon population, and that conditions need to be optimum for acoustic detection to occur (Moser, et. al. 2021).

#### 4.19.2.11 *Green Sturgeon Critical Habitat*

The Tahlequah Ferry Terminal does not fall within designated green sturgeon critical habitat (Federal Register 2009).

#### 4.19.2.12 *Marbled Murrelet (Brachyramphus marmoratus)*

The Tahlequah terminal area provides suitable marbled murrelet marine foraging habitat.

There is no documented forage fish spawning present at the terminal. Documented sand lance spawning is present 1,340 ft. E and 1,640 ft. W of the terminal. Herring spawning is present 1,760 ft. E, and a pre-spawn herring holding area is present 1,530 ft. S of the terminal (WSDOT 2018a).

WDFW surveys conducted from 2001 to 2012 show a density of less than 1 bird per square kilometer in the terminal area (WDFW 2016). The nearest documented marbled murrelet nesting site is located 35 miles NW of the terminal (WSDOT 2018b).

The Northwest Forest Plan Marbled Murrelet Effectiveness Monitoring Program (2012) identified habitat suitability throughout the range of the species, and ranked it as Zero, Low, Marginal, Moderately High and Highest. The Tahlequah murrelet habitat suitability within the pile driving/heavy equipment zone of potential effect (0.25 miles), ranges from Zero to Marginal (WSDOT 2019b).

Five acres of contiguous forest that may offer nesting opportunity is present within the pile driving/heavy equipment zone of potential effect (0.25 miles) (WSDOT 2014/2018c). A WSF Biologist visited the terminal area on 12/3/18. Although there were 5 acres of contiguous forest, it was less than the required 60% coniferous. Therefore, the forest does not offer appropriate nesting opportunity (WSDOT 2018f). Ferry traffic creates regular disturbance in the immediate terminal area. From July 2017 to June 2018, there were approximately 13,970 scheduled arrivals and departures from the terminal. During the nesting season (April 1-September 23), when foraging murrelet are more active, there were approximately 7,010 scheduled arrivals and departures (WSDOT 2018d).

#### 4.19.2.13 *Marbled Murrelet Critical Habitat*

No marbled murrelet critical habitat has been designated near the terminal (USFWS 1996).

#### 4.19.2.14 *Rockfish Species*

*Bocaccio*

Bocaccio are rarely caught in north Puget Sound and only sparse records exist for the Strait of Georgia (Federal Register 2010b). Because larvae are widely dispersed, it is possible that bocaccio juveniles could be found near the Tahlequah Ferry Terminal at any time of year. Adult bocaccio generally move to very deep water. The waters of Dalco Passage range from about 40 to 90 feet deep and subject to strong currents

(NMFS 2009). This is still shallower than ideal for bocaccio, but rocky substrates exist in the Tacoma Narrows and rockfish populations exist there (NMFS 2009).

*Yelloweye Rockfish*

Yelloweye rockfish are more closely aligned with rocky, high-relief substrates than with very deep water (Federal Register 2010b). The waters near Tahlequah offer both rocky substrates and deep water. It is likely that yelloweye rockfish are in the vicinity.

#### 4.19.2.15 *Rockfish Species Critical Habitat*

The Tahlequah Ferry Terminal is within rockfish nearshore critical habitat (less than or equal to 98 feet in depth) (Federal Register 2014). The physical and biological features (PBFs) (Federal Register 2014) essential to the conservation of juvenile Bocaccio rockfish are listed in Table TA-3. PBFs relevant to the terminal area are numbered per the CFR (Federal Register 2014). These PBFs are specific to nearshore environments, where only juvenile Bocaccio rockfish could be found. Deepwater (> 98 feet in depth) PBFs exist for adult Bocaccio, and adult and juvenile yelloweye rockfish; however, this habitat is not present at the Tahlequah Ferry Terminal and will not be discussed here.

#### 4.19.2.16 *Pacific Eulachon (Thaleichthys pacificus)*

The Tahlequah Ferry Terminal is distant from any of the known eulachon spawning rivers. It is highly unlikely that eulachon will be present at the Tahlequah Ferry Terminal.

#### 4.19.2.17 *Pacific Eulachon Critical Habitat*

No Pacific eulachon critical habitat has been designated near the Tahlequah Ferry Terminal (FEDERAL REGISTER 2011).

## Table TA-3
## Existing Conditions of Rockfish PBFs at the Tahlequah Ferry Terminal

| PBFs | Existing Conditions |
| --- | --- |
| 1) Quantity, quality, and availability of prey species to support individual growth, survivial, reproduction, and feeding opportunities. | The marine waters of Dalco Passage near the terminal are designated “Extraordinary” for aquatic life use. Impaired waters listings in the terminal area include organics (including PCBs in tissue), and bacteria (water)(Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of four drainage areas that drain to Dalco Passage. One of the areas includes treatment.<br><br>The first drainage area drains the upper former house lot, the park and ride lot and the hillside above and below the lot, the side street parking, and the road at the east entrance to the pier, and consists of 13 catch basins, two daylight under-drains to quarry spall, and a swale. The under-drains and swale provide some stormwater treatment. This drainage area discharges through an outfall to the east of the trestle.<br><br>The second drainage area drains the road at the west entrance to the trestle, consists of two catch basins that discharges through an outfall to the west of the trestle.<br><br>The third drainage area drains the former house lots to the west of the trestle, and consists of infiltration to soil, and discharge directly to the beach or surface water (depending on tide level).<br><br>The fourth drainage area consists of the trestle and transfer span (typically 90 feet long by 24 feet wide that carries traffic between the trestle and ferry), which discharges by sheet flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Overwater coverage from the existing ferry terminal structures may reduce the production of aquatic invertebrates that are prey species to salmon. The sand-gravel substrate in the intertidal zone likely supports epibenthic production.<br><br>There is no documented forage fish spawning present at the terminal. Sand lance and herring spawning, and pre-spawn herring holding are present within 0.3 miles of the terminal (WSDOT 2018a). |
| 2) Water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities. | There is some forested vegetation on either side of the ferry terminal. The immediate shoreline area is residentially landscaped.<br><br>The east side of the ferry terminal area supports sandy substrates with low, medium, and high densities of eelgrass. Macroalgae occurs within the nearshore habitats of the area with a low to moderate density. The dominant macrophytes include: sea lettuce *(Ulva* spp.), red algae, Turkish towel, bleached brunette, rock weed, red cellophane, long laver, graceful sea hair, twisted sea tube, arctic sea moss, and wireweed. Sugar wrack, seersucker, flattened acid kelp, and bull kelp were more frequently encountered in the lower intertidal zone (PIE 2002c).<br><br>There is no large overhanging wood vegetation. The existing conditions within the defined area of critical habitat consist of gravel between MHHW and +2 feet MLLW, a sand-gravel mix exists between +2 feet MLLW and MLLW, and from MLLW to -4 feet MLLW the substrate is predominantly sand with some shell hash (PIE 2002c). Some hardened shoreline is adjacent to the ferry terminal. Side channels do not occur in the ferry terminal area. |

# VASHON ISLAND

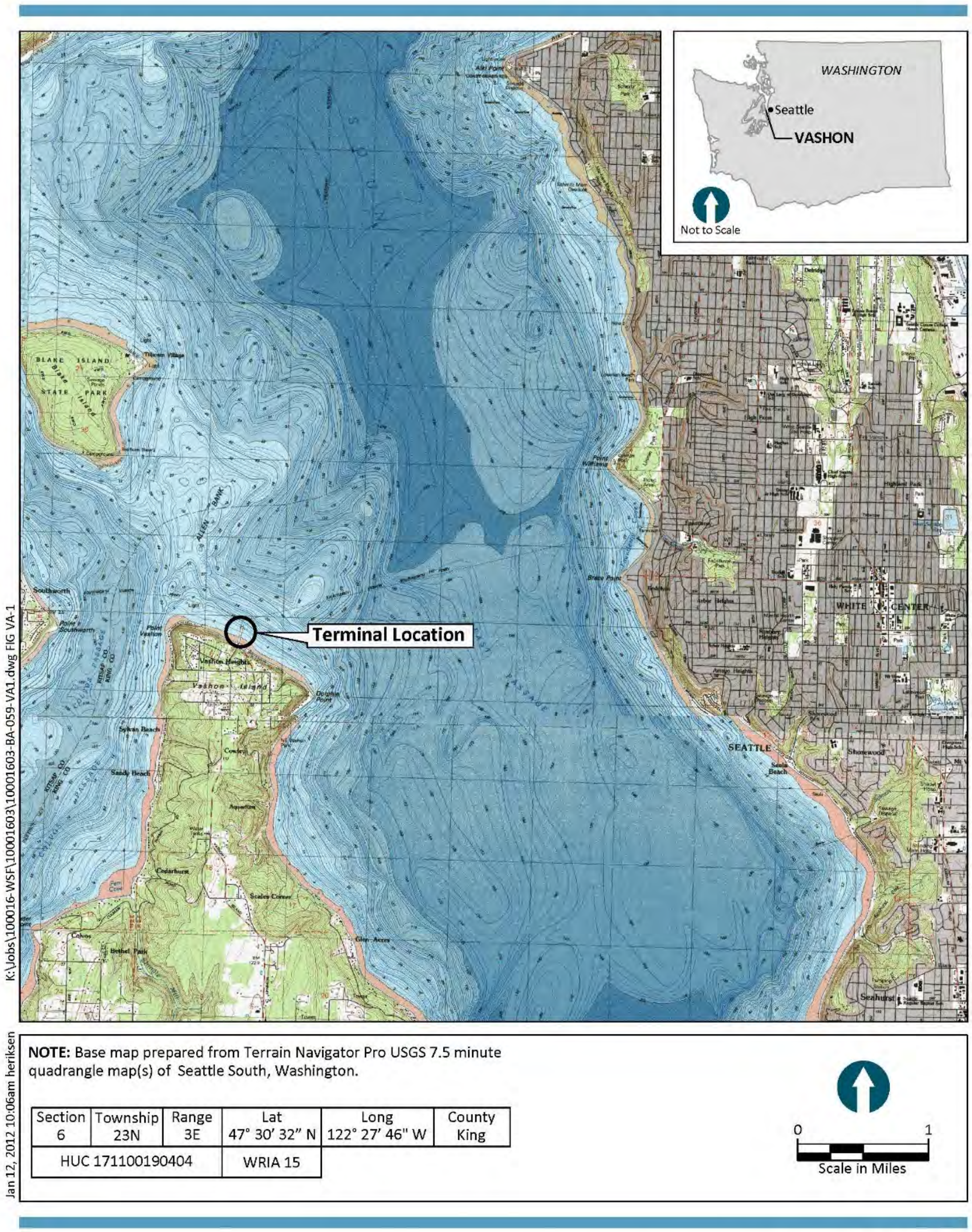



**Figure VA-1**
Vashon Island Ferry Terminal Vicinity Map
WSF Biological Assessment Reference
Vashon Island, Washington

## Figure VA-1
## Vashon Island Ferry Terminal Vicinity Map

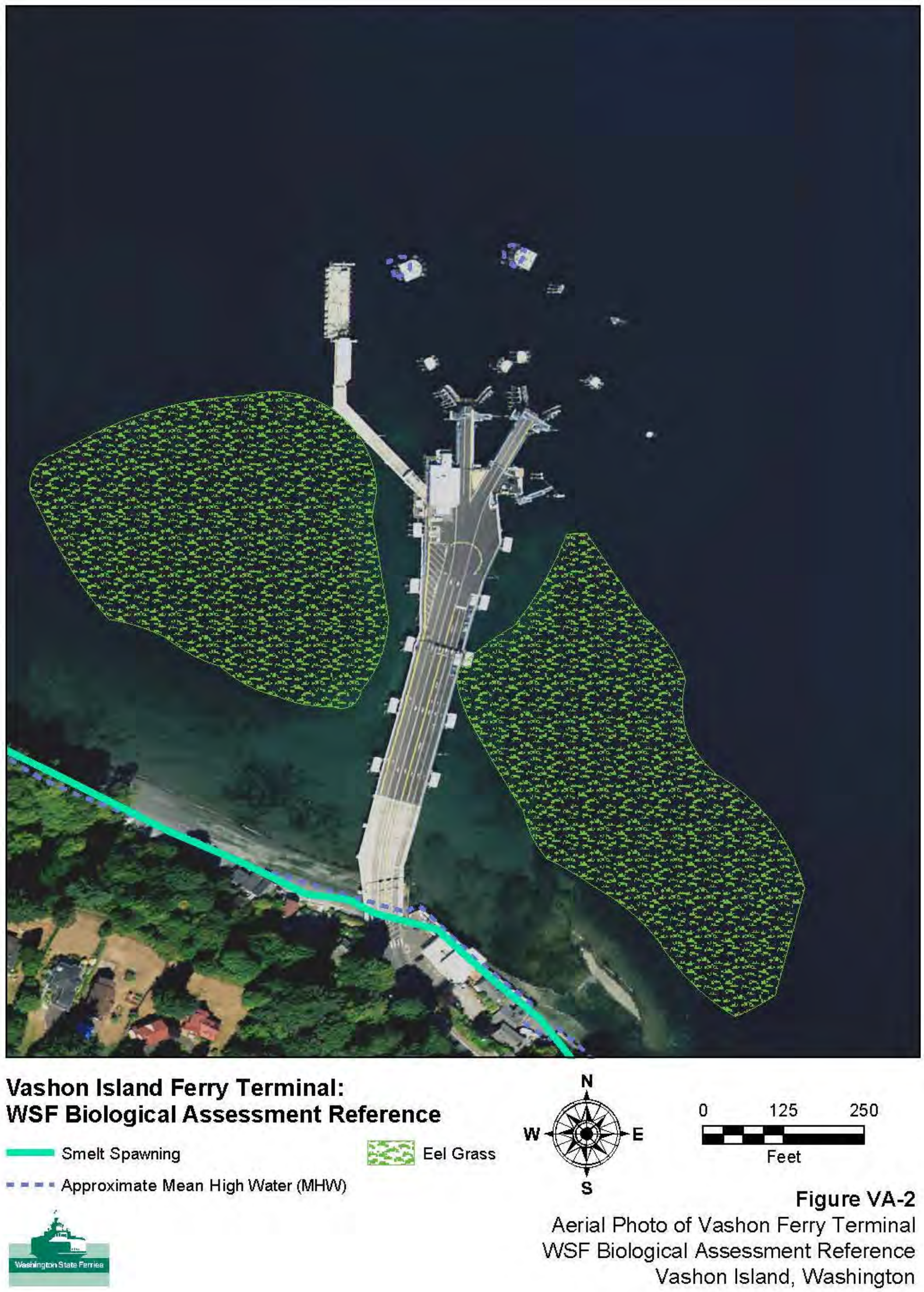



**Figure VA-2**
**Aerial Photo of Vashon Island Ferry Terminal**

## 4.20 Vashon Island Ferry Terminal

The Vashon Island Ferry Terminal is on the northern end of Vashon Island, with the Colvos Passage to the west and south, and the East Passage to the east (see Figures VA-1 and VA-2).

The Vashon Island Ferry Terminal provides service to the Southworth and Fauntleroy Terminals. Additionally, King County provides passenger-only ferry service to the Seattle Terminal.

Features of the terminal include a terminal building, four vehicle holding lanes that accommodate up to 80 vehicles, and a parking lot. The terminal has main and auxiliary slips, a tie-up slip, and a passenger only slip. Steel wingwalls are present in the main and auxiliary slips and a two-pile steel tie up is present in the tie-up slip. Seven dolphins are associated with the terminal, four steel in the main slip, one steel and one timber dolphin in the auxiliary slip, and one composite dolphin in the tie-up slip. No overhead passenger loading facility exists at the terminal.

### *4.20.1 Vashon Environmental Baseline*

#### 4.20.1.1 *Physical Indicators*

*Substrate and Slope*

Substrates on the beach are composed of fine sand, coarse sand, shell hash, gravel, and cobble with a rocky intertidal area (Figure VA-3). The beach has a gentle slope. Substrates in the off-shore area consist of loose sands underlain by glacial till. Offshore depths of terminal structures are: head of Slip 1 (-35.5 feet MLLW), Slip 2 (-36.5 feet MLLW), and tie-up slip (-29.0 feet MLLW). Maximum depth for fixed dolphins is -45.0 feet MLLW. The head of the passenger only pier is approximately -25.0 feet MLLW.

**Figure VA-3**
**Beach and Intertidal Area West of the Vashon Island Ferry Terminal**

*Salt/Freshwater Mixing*

An unnamed type 5 stream drains into Puget Sound via a pipe under the north end of the ferry terminal (Figure VA-4). Similar unnamed streams drain into the Sound approximately 700 feet west and 0.5 mile east of the terminal.

*Flows and Currents*

No site specific data are available in the vicinity of the ferry terminal. Based on data from NOAA, current flows are expected to be weak and variable.

### 4.20.1.2 *Chemical Indicators*

*Water Quality*

The marine waters of Colvos Passage near the terminal are designated "Extraordinary" for aquatic life use. No Impaired waters listings data is available in the terminal area (Ecology 2018).

*Sediment Quality*

No information is available on sediment quality in the vicinity of the ferry terminal.

#### 4.20.1.3 *Biological Indicators*

*Shoreline Vegetation*

Shrub and forested shoreline vegetation occurs east and west of the ferry terminal and includes Douglas fir, western red cedar, big-leaf maple, and red alder.

*Macroalgae and Eelgrass*

Macroalgae in the area includes Turkish towel, gracilaria, red algae, sugar wrack, bull kelp, sea lettuce, and diatoms. Eelgrass occurs east and west of the terminal (see Figure VA-2) getting sparser towards the northern end of the passenger only float.

*Epibenthos, Macrofauna, Fish, and Marine Mammals*

The shoreline area and substrates are expected to support epibenthic production. Macrofauna in the area includes red rock crab, plume worm (*Eudistylia vancouveri*), chink shell snail (*Lacuna vincta*), anemone, hermit crab, coon-striped shrimp, moon snail, sea pens, kelp crab, sunflower star, sun star, horse clam, and sponge. Subtidal geoducks occur north of the terminal. Fisheries resources include tubesnout, lingcod, sand sole (*Psettichthys melnaostictus*), pile perch, cabezon, and various flatfish and sculpin. Marine mammals likely to occur in the area include killer whale, harbor seal, Steller sea lion, California sea lion, harbor porpoise, and Dall's porpoise.

*Forage Fish*

Documented surf smelt spawning is present (see Figures VA-2), extending approximately 500 ft. to the NW of the terminal (WSDOT 2018a).

### *4.20.2 Vashon Species Distributions*

#### 4.20.2.1 *Puget Sound Chinook Salmon (Oncorhynchus tshawytscha)*

Adult and juvenile Chinook salmon could occur throughout the marine portions of the project area. Chinook salmon use much of Puget Sound for feeding during their migration to and from the open ocean and their upriver spawning grounds.

### Adult and Sub-adult Chinook

Migrating adult and sub-adult Chinook salmon have free access to the entire marine portion of the project area. These fish could be present near the project year-round, but are likely to be more abundant in mid- to late summer as they prepare to migrate to their natal rivers to spawn.

### Juvenile Chinook

Juvenile Chinook salmon could use the project area as they migrate out of their natal streams and rivers. As described below, juvenile Chinook salmon are generally most abundant along the shoreline in the action area between May and July, with a consistent downward trend in abundance from August to October.

The closest major rivers that support Chinook salmon are the Duwamish/Green River (approximately 8.5 miles northeast shoreline distance) and the Puyallup River (approximately 21 miles southeast shoreline distance). Chinook may also be present from rivers and streams in southern Puget Sound (WDFW 2007a). Chinook salmon have been documented by WDFW as present in Judd Creek (Vashon Island), but there is no documented spawning or juvenile rearing in the creek. Judd Creek is tributary to Quartermaster Harbor (approximately 22 miles southeast shoreline distance).

Near Colvos Passage and in the Sinclair Inlet drainages, there are several small streams that support Chinook salmon. Curley Creek, which drains Long Lake and is a tributary to Yukon Harbor, is the nearest stream with Chinook (approximately 4 miles northwest shoreline distance). Tributaries to Sinclair Inlet, Blackjack Creek (approximately 16 miles shoreline distance) and Gorst Creek (approximately 18 miles shoreline distance), also support Chinook salmon (WDFW 2007a).

Beach seines were conducted from April through September of 2001 and 2002 on Vashon and Maury Island. Juvenile Puget Sound Chinook salmon first entered the area in mid-May with numbers peaking in mid-July and steadily tapering off through August and September (Duffy et al. 2005). Additional beach seining was conducted in 2000 at Fauntleroy Cove and Seahurst Park from June 5 through

August 16. Catches of juvenile Chinook peaked in mid-June and again in late July. The size of Chinook smolts captured in late June averaged 85 mm, 100 mm in July, and 130 mm in August (Mavros and Brennan 2001).

#### 4.20.2.2 *Puget Sound Chinook Salmon Critical Habitat*

The Vashon Island Ferry Terminal lies within Chinook Zone 14 (70 FR 52630). While there are no streams that support Chinook salmon near the ferry terminal, eelgrass in close proximity to the facility may be used by juvenile Chinook for rearing.

The PCEs provided in the ferry terminal area, and their existing conditions, are listed in Table VA-1. PCEs relevant to the terminal area are numbered per the CFR (70 FR 52630).

#### 4.20.2.3 *Puget Sound Steelhead (Oncorhynchus mykiss)*

The nearest natal streams in the area of the Vashon Island Ferry Terminal that support Puget Sound steelhead are Shingle Mill Creek on Vashon Island (approximately 3 shoreline miles southwest) and Curley Creek, a tributary to Yukon Harbor, (approximately 4 shoreline miles northwest). Major river systems in this area of Puget Sound that support winter steelhead include the Lake Washington/Cedar River (approximately 13 shoreline miles northeast), and the Puyallup River (approximately 21 shoreline miles southeast). The Duwamish/Green River also supports a run of summer steelhead.

Available data from tow-net sampling (deeper nearshore) and beach seine sampling (shallow nearshore) efforts around Puget Sound have reported the capture of few steelhead. In tow-net sampling in north and south Puget Sound, NMFS captured a total of 18 steelhead (Rice, unpublished data). The total sampling effort data was not available, but the mean steelhead catch ranged from 0 to 0.2 per net in north Puget Sound and 0.1 to 0.8 per net in south Puget Sound.

**Table VA-1**
**Existing Conditions of Chinook Salmon PCEs at the Vashon Island Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 5) Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels. | **Obstructions**<br>In-water structures include the passenger only pier and slip, two trestles and two slips, the tie-up slip, and dolphins. The existing ferry terminal may affect fish passage in the nearshore.<br><br>**Water Quality and Forage**<br>The marine waters of Colvos Passage near the terminal are designated “Extraordinary” for aquatic life use. No Impaired waters listings data is available in the terminal area (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of two drainage areas that drain to Colvos Passage. None of the runoff is treated.<br><br>The first drainage area drains the trestle holding lanes, and consists of 26 3-inch drains that discharge directly to surface water.<br><br>The second drainage area consists of the transfer spans (typically 90 feet long by 24 feet wide that carry traffic between the trestle and ferry), which discharge by sheet flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Overwater coverage from the existing ferry terminal structures may reduce the production of aquatic invertebrates that are prey species to salmon. Substrates are expected to support epibenthic production.<br><br>Documented surf smelt spawning is present (see Figures VA-2), extending approximately 500 ft. to the NW of the terminal (WSDOT 2018a).<br><br>**Natural Cover**<br>Shrub and forested shoreline vegetation occurs east and west of the ferry terminal. Eelgrass is present to the east and west of the ferry terminal. There is no large overhanging wood vegetation. The existing conditions within the defined area of critical habitat consist of sand in the nearshore area. Some riprap and hardened shoreline are adjacent to the ferry terminal. Side channels do not occur in the ferry terminal area. |
| 6) Offshore areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation. | The marine waters of Colvos Passage near the terminal are designated “Extraordinary” for aquatic life use. No Impaired waters listings data is available in the terminal area (Ecology 2018).<br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Offshore areas provide habitat for forage fish. |

During 2001 and 2002, beach seining conducted in central Puget Sound by King County Department of Natural Resources captured only nine steelhead out of a total of approximately 34,000 juvenile salmonids. All the steelhead were caught between May and August and ranged in size from 141 to 462 mm with a mean size of 258 mm (Brennan et al. 2004). Also during 2001 and 2002, beach seining, tow netting, and purse seining were conducted by WDFW in Sinclair Inlet. This sampling effort focused on beach seining, which occurred monthly from April to October in 2001 and from mid-February to September in 2002. Tow-netting was conducted monthly from May to August in 2002 only and purse seining was limited to only 2 days in July of 2002. The sampling effort resulted in the capture of four steelhead out of a total of 21,500 salmonids. Despite the larger effort given to beach seining, of the four steelhead, only one was caught in the beach seine and the remaining three were caught in deeper water with the tow net and purse seine (Fresh et al. 2006).

Steelhead were also infrequently captured in a beach seine study around Bainbridge Island (City of Bainbridge Island, Suquamish Tribe, and WDFW 2005). The study consisted of 271 beach seine sets conducted between April and September 2002 and between April 2003 and December 2004. Three steelhead were captured in the study: one in May and two in September. Lengths were 179, 280, and 300 mm. One had been fin clipped, indicating it was of hatchery origin.

#### 4.20.2.4 *Puget Sound Steelhead Critical Habitat*

The Vashon Island Ferry Terminal does not fall within designated steelhead critical habitat (Federal Register 2016a).

#### 4.20.2.5 *Humpback Whale (Megaptera novaeangliae)*

Humpback whale may be present near the Vashon ferry terminal. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.20.2.6 *Southern Resident Killer Whale (Orcinus orca)*

Southern Resident Killer Whale (SRKW) may be present near the Vashon ferry terminal. Sightings data will be summarized in each project BA. The data may come from previous WSF projects, relevant Navy documents, or reports requested from the Friday Harbor Whale Museum.

#### 4.20.2.7 *Southern Resident Killer Whale Critical Habitat*

The Vashon ferry terminal area lies within designated critical habitat (Area 2 – Puget Sound). Areas with water less than 20 feet deep relative to the extreme high water mark are not included in the critical habitat designation (Federal Register 2006).

The PCEs provided in the terminal area, and their existing conditions are listed in Table VA-2. PCEs relevant to the terminal area are numbered per Federal Register 2006.

**Table VA-2**
**Existing Conditions of Southern Resident Killer Whale PCEs at the Vashon Island Ferry Terminal**

| PCEs | Existing Conditions |
|---|---|
| 1) Water quality to support growth and development | The marine waters of Colvos Passage near the terminal are designated "Extraordinary" for aquatic life use. No Impaired waters listings data is available in the terminal area (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of two drainage areas that drain to Colvos Passage. None of the runoff is treated.<br><br>The first drainage area drains the trestle holding lanes, and consists of 26 3-inch drains that discharge directly to surface water.<br><br>The second drainage area consists of the transfer spans (typically 90 feet long by 24 feet wide that carry traffic between the trestle and ferry), which discharge by sheet flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column, degrading water quality in the terminal vicinity. |
| 2) Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth | Salmonids are the primary prey of SRKW, and may be present near the terminal. Further information on prey can be found in the Puget Sound Chinook section, and Appendix B – Species Biology. |
| 3) Passage conditions to allow for migration, resting, and foraging | Existing structures that occur below -20 feet in critical habitat include the passenger only pier and slip, two trestles and two slips, the tie-up slip, and dolphins. |

#### 4.20.2.8 *Bull Trout (Salvelinus confluentus)*

There are no natal streams in the area of the Vashon Island Ferry Terminal that support bull trout (WDFW 2007a).

The aquatic portions of the ferry terminal are within marine FMO habitat. While bull trout have not been documented in the ferry terminal area, suitable FMO habitat is present, and bull trout are thought to occur throughout south, central, and northern Puget Sound. Therefore, it is expected that the ferry terminal area would be used by anadromous adult and sub-adult bull trout for foraging, migration, and overwintering (USFWS 2004b). Within the ferry terminal area it is expected that individual bull trout from the Duwamish/Green River (approximately 8.5 miles northeast shoreline distance) and the Puyallup River (approximately 21 miles southeast shoreline distance) core areas are most likely to be present (WDFW 2007a).

#### 4.20.2.9 *Bull Trout Critical Habitat*

The shoreline of the Vashon Island Ferry Terminal is not within designated bull trout critical habitat per Federal Register 2010a.

#### 4.20.2.10 *Green Sturgeon (Acipenser medirostris)*

There are no natal streams in the area of the Vashon Island Ferry Terminal that support green sturgeon.

Observations of green sturgeon in Puget Sound are much less common compared to the coastal Washington estuaries and bays such as Willapa Bay, Grays Harbor, and the Lower Columbia River estuary (Federal Register 2018). In addition, Puget Sound does not appear to be part of the coastal migratory corridor that Southern DPS fish use to reach overwintering grounds north of Vancouver Island (Federal Register 2018).

NMFS reviewed green sturgeon acoustic detection data from 2002-2019 in Puget Sound and the Strait of Juan de Fuca. From 2002-2008, 350 tagged green sturgeon were at large (67% from the threatened southern DPS). During this time, 17 were detected in Puget Sound (4 from the southern DPS). After 2008, none were detected in central or southern Puget Sound, though 400 were at large (83% southern DPS). From 2013-2018, six (one from the southern DPS) were detected in Admiralty Inlet (northern Puget Sound).

From 2004-2019, 210 green sturgeon were detected in the Strait of Juan de Fuca (71% southern DPS). This indicates that the strait is used as a corridor, with green sturgeon residing at detection sites for short periods as they pass through from open ocean. Few of these fish were detected afterwards in Admiralty Inlet, suggesting that most of the tagged population move northward into the Strait of Georgia after transiting the strait. Data indicates conclusively that green sturgeon from the southern DPS occur in Puget Sound and Admiralty inlet, but at low rates compared to Strait of Juan de Fuca presence. This confirms earlier findings that Puget Sound is of lower conservation value to southern DPS green sturgeon. However, it is noted that the tagged population is a small fraction of the whole green sturgeon population, and that conditions need to be optimum for acoustic detection to occur (Moser, et. al. 2021).

#### 4.20.2.11 *Green Sturgeon Critical Habitat*

The Vashon Island Ferry Terminal does not fall within designated green sturgeon critical habitat (Federal Register 2009).

#### 4.20.2.12 *Marbled Murrelet (Brachyramphus marmoratus)*

The Vashon terminal area provides suitable marbled murrelet marine foraging habitat.

Documented surf smelt spawning (prey species) is present (see Figure VA-2), extending approximately 500 ft. NW of the terminal (WSDOT 2018a).

WDFW surveys conducted from 2001 to 2012 show a density of less than 1 bird per square kilometer in the terminal area (WDFW 2016). The nearest documented marbled murrelet nesting site is located 31 miles NW of the terminal (WSDOT 2018b).

The Northwest Forest Plan Marbled Murrelet Effectiveness Monitoring Program (2012) identified habitat suitability throughout the range of the species, and ranked it as Zero, Low, Marginal, Moderately High and Highest. The Vashon murrelet habitat suitability within the pile driving/heavy equipment zone of potential effect (0.25 miles), ranges from Zero to Marginal (WSDOT 2019b).

Five acres of contiguous forest that may offer nesting opportunity is present within the pile driving/heavy equipment zone of potential effect (0.25 miles) (WSDOT 2014/2018c). The 0.25 mile zone radius of potential effect was evaluated. A WSF Biologist visited the terminal area on 12/3/18. Although there were 5 acres of contiguous forest, it was less than the required 60% coniferous. Therefore, the forest does not offer appropriate nesting opportunity (WSDOT 2018f).

Ferry traffic creates regular disturbance in the immediate terminal area. From July 2017 to June 2018, there were approximately 18,200 scheduled arrivals and departures from the terminal. During the nesting season (April 1-September 23), when foraging murrelet are more active, there were approximately 9,260 scheduled arrivals and departures (WSDOT 2018d).

#### 4.20.2.13 *Marbled Murrelet Critical Habitat*

No marbled murrelet critical habitat has been designated near the terminal (USFWS 1996).

#### 4.20.2.14 *Rockfish Species*

*Bocaccio*

Bocaccio are rarely caught in north Puget Sound and only sparse records exist for the Strait of Georgia (Federal Register 2010b). Because larvae are widely dispersed, it is possible that bocaccio juveniles could be found near the Vashon Island Ferry Terminal at any time of year. Adult bocaccio generally move to very deep water. The waters beyond Vashon Point drop off sharply from the shoreline to a depth of over 300 feet (NMFS 2009).

#### *Yelloweye Rockfish*

Yelloweye rockfish are more closely aligned with rocky, high-relief substrates than with very deep water (Federal Register 2010b). Yelloweye may potentially be found near Vashon Point.

### 4.20.2.15 *Rockfish Species Critical Habitat*

The Vashon Island Ferry Terminal is within rockfish nearshore critical habitat (less than or equal to 98 feet in depth) (Federal Register 2014). The physical and biological features (PBFs) (Federal Register 2014) essential to the conservation of juvenile Bocaccio rockfish are listed in Table VA-3. PBFs relevant to the terminal area are numbered per the CFR (Federal Register 2014). These PBFs are specific to nearshore environments, where only juvenile Bocaccio rockfish could be found. Deepwater (> 98 feet in depth) PBFs exist for adult Bocaccio, and adult and juvenile yelloweye rockfish; however, this habitat is not present at the Vashon Island Ferry Terminal and will not be discussed here.

### 4.20.2.16 *Pacific Eulachon*

The Vashon Island Ferry Terminal is distant from any of the known eulachon spawning rivers. It is highly unlikely that eulachon will be present at the Vashon Island Ferry Terminal.

### 4.20.2.17 *Pacific Eulachon Critical Habitat*

No Pacific eulachon critical habitat has been designated near the Vashon Island Ferry Terminal (FEDERAL REGISTER 2011).

**Table VA-3**
**Existing Conditions of Rockfish PBFs at the Vashon Island Ferry Terminal**

| PBFs | Existing Conditions |
|---|---|
| 1) Quantity, quality, and availability of prey species to support individual growth, survivial, reproduction, and feeding opportunities. | The marine waters of Colvos Passage near the terminal are designated "Extraordinary" for aquatic life use. No Impaired waters listings data is available in the terminal area (Ecology 2018).<br><br>The existing stormwater system at the ferry terminal consists of two drainage areas that drain to Colvos Passage. None of the runoff is treated.<br><br>The first drainage area drains the trestle holding lanes, and consists of 26 3-inch drains that discharge directly to surface water.<br><br>The second drainage area consists of the transfer spans (typically 90 feet long by 24 feet wide that carry traffic between the trestle and ferry), which discharge by sheet flow directly to surface water.<br><br>Existing creosote treated piles may leach PAHs into the water column degrading water quality in the terminal vicinity.<br><br>Overwater coverage from the existing ferry terminal structures may reduce the production of aquatic invertebrates that are prey species to salmon. Substrates are expected to support epibenthic production.<br><br>Documented surf smelt spawning is present (see Figures VA-2), extending approximately 500 ft. to the NW of the terminal (WSDOT 2018a). |
| 2) Water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities. | Shrub and forested shoreline vegetation occurs east and west of the ferry terminal. Eelgrass is present to the east and west of the ferry terminal. There is no large overhanging wood vegetation. The existing conditions within the defined area of critical habitat consist of sand in the nearshore area. Some riprap and hardened shoreline are adjacent to the ferry terminal. Side channels do not occur in the ferry terminal area. |

# 5 REFERENCES


Adams, P.B., C.B. Grimes, S.T. Lindley, and M.L. Moser. 2002. Status Review for North American Green Sturgeon, Acipenser medirostris. National Marine Fisheries Service. http://www.nmfs.noaa.gov/pr/pdfs/statusreviews/greensturgeon.pdf.

Allen, P.J., and J.J. Cech. 2007. Age/size effects on juvenile green sturgeon, Acipenser medirostris, oxygen consumption, growth, and osmoregulation in saline environments. Environmental Biology of Fishes 79:211-229.

Allen, M.J., and G.B. Smith. 1988. Atlas and zoogeography of common fishes in the Bering Sea and northeastern Pacific. NOAA Tech. Rep. NMFS 66, 151 p.

American Cetacean Society. 2009. A.C.S. Fact Sheet : Humpback Whale (*Megaptera novaeangliae*). Web page http://www.acsonline.org/factpack/humpback.htm, queried May 21, 2009. San Pedro, California.

Anchor. (Anchor Environmental, L.L.C.). 2005a. Biological Assessment. Bainbridge Island Trestle Widening. Prepared for: Washington State Ferries. September 2005.

_____. 2005b. Biological Evaluation. Lopez Island Ferry Terminal Dolphin Replacement. Prepared for Washington State Ferries. Anchor Environmental. November 2005

_____. 2004a. Biological Assessment Anacortes Tie-Up Slip Relocation. Anacortes Ferry Terminal. Prepared for Washington State Ferries. December 2004.

_____. 2004b. Draft Aquatic Vegetation Survey Report for the Proposed Dolphin Replacement at the Lopez Ferry Terminal. Anchor Environmental. November 2004.

_____. 2003a. Acoustic Monitoring of Pile Driving Activities at the Bainbridge Island Ferry Terminal. Prepared for Washington State Ferries Terminal Engineering. Seattle, Washington. May 2003.

_____. 2003b. Literature Review of Effects of Resuspended Sediments due to Dredging Operations. Prepared for Los Angeles Contaminated Sediments Task Force, Los Angeles, CA. Prepared by Anchor Environmental CA, L.P. June 2003.

_____. 2003c. Biological Evaluation. Friday Harbor Ferry Terminal Preservation Project. Friday Harbor Ferry Terminal. Prepared for Washington State Ferries. June 2003.

_____. 2003d. Biological Evaluation. Seattle Ferry Terminal Trestle Preservation Project. Prepared for Washington State Ferries. Anchor Environmental. May 2003.

_____. 2002. Biological Evaluation. Shaw Island Ferry Terminal Slip Reconstruction Project. Prepared for Washington State Ferries. July 2002.

_____. 2001. Biological Evaluation. Southworth Ferry Terminal Slip Refurbishment Project. Prepared for Washington State Ferries. April 2001.

Arkoosh, MR, E. Casillas, E. Clemons, A.N. Kagley, R. Olson, P. Reno, and J.E. Stein. 1998. Effect of Pollution on Fish Diseases: Potential Impacts on Salmonid Populations. American Fisheries Society Journal. 10, 182-190. (2).

Ash, Terry. 2001. City of Bainbridge Island, Washington. Personal communication to Sasha Visconty, Pacific International Engineering.

Baird, R. W., and M. B. Hanson. 2004. A progress report on diving behavior of Southern Resident killer whales. Contract report under Order No. AB133F-03-SE-1070. (Available from M. B. Hanson, NWFSC, 2725 Montlake Blvd. East, Seattle, WA 98112.)

_____. L.M. Dill, and M.B. Hanson. 1998. Diving Behavior of Killer Whales. Abstract of a paper presented at the World Marine Mammal Conference, Monaco, January, 1998.

_____. Foraging behaviour and ecology of transient killer whales. Ph.D. thesis, Simon Fraser University, Burnaby, B.C.

Balcomb, K.C., J.R. Boran, R.W. Osborne, and N.J. Haenel. 1980. Observations of Killer Whales (*Orcinus orca*) in Greater Puget Sound, State of Washington, NTISPB80- 224728, U.S. Dept. of Commerce, Springfield, VA.

Ballenger, Dean. 1996. 1995 Lummi Shore Beach Seine Study. Lummi Natural Resources Department. February 1996.

Barnhart. 1986. Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Pacific Southwest)-steelhead. U.S. Fish and Wildlife Service. Biol. Rep. 82(11.60), 21p.

Barraclough, W.E. 1964. Contributions to the marine life history of the eulachon (*Thaleichthys pacificus*). Journal of the Fisheries Research Board of Canada 21(5): 1333-1337.

Bash, J., C. Berman, and S. Bolton. 2001. Effects of Turbidity and Suspended Solids on Salmonids. Report No. WA-RD 526.1 Washington State Transportation Center (TRAC), University of Washington. November 2001.

Bateson, G. 1974. Observations of a Cetacean Community. In: J. McIntyre (Ed.), Mind in the Waters, New York, Charles Scribner's Sons, Sierra Club Books, 146-165.

Beamer, Eric. 2004. Timing of Juvenile Chinook in Skagit Bay and Swinomish Channel. Memorandum to Pentec Environmental. Skagit River System Cooperative. February 27, 2004.

_____. 2003. The importance of non-natal pocket estuaries in Skagit Bay to wild Chinook salmon: an emerging priority for restoration. Prepared by the Skagit System Cooperative Research Department. La Conner, WA. May 2003.

Beamesderfer, R.C.P., and M.A.H. Webb. 2002. Green sturgeon status review information. S.P. Cramer and Associates, Gresham, Oregon, U.S.

Berg, L. and T.G. Northcote. 1985. Changes in territorial, gill flaring and feeding behavior in juvenile coho salmon (*Oncorhynchus kisutch*) following short-term pulses of suspended sediment. Can. J. Fish. Aquat. Sci. 42:1410-1417.

BERGER/ABAM. 2006. Underwater Inspection Report for the WSF Eagle Harbor Maintenance Facility. Bridge No. 305/8FTM. BERGER/ABAM Engineers Inc. Federal Way, WA. May 22, 2006.

Bigg, M.A., G.M. Ellis, J.K.B. Ford, and K.C. Balcomb. 1987. Killer whales: a study of their identification, genealogy, and natural history in British Columbia and Washington State. Phantom Press, Nanaimo, B.C.

Bisson, P.A. and R.E. Bilby. 1982. Avoidance of suspended sediment by juvenile coho salmon. N. Amer. J. Fish. Manage. 2:371-374.

Brennan, J.S., K.F. Higgins, J.R. Cordell, and V.A. Stamatiou. 2004. Juvenile salmonid composition, timing, distribution, and diet in marine nearshore waters of Central Puget Sound in 2001-2002. King County Department of Natural Resources and Parks, Seattle, WA. 164 pp.

Brewer, Scott. 2007. Hood Canal Coordinating Council. Personal communication with Rick Huey (Washington State Ferries). March 14, 2007.

Brooks, K.M. 2004. The effects of dissolved copper on salmon and the environmental effects associated with the use of wood preservatives in aquatic environments. Prepared for Western Wood Preservers Institute, Vancouver, Washington. December 13, 2004.

Brown, L.G. 1992. Draft management guide for the bull trout *Salvelinus confluetus* (Suckley) on the Wenatchee National Forest.Washington Department of Wildlife, Wenatchee, Washington. 75pp.

Brunner, K. 1999a. Meeting notes from December 12, 1999, Minutes of Third Bull Trout Working Group Meeting. Communication from Doug Hotchkiss, Port of Seattle. Seattle District, U.S. Army Corps of Engineer.

_____. Meeting notes from November 4, 1999, Minutes of the First Bull Trout Working Group Meeting. Communication from Doug Hotchkiss, Port of Seattle. Seattle District, U.S. Army Corps of Engineer.

Busby, Peggy J., Thomas C. Wainwright, Gregory J. Bryant, Lisa J. Lierheimer, Robin S. Waples, F. William Waknitz, and Irma V. Lagomarsino. 1996. Status Review of West Coast Steelhead from Washington, Idaho, Oregon, and California. National Marine Fisheries Service, August 1996. NOAA Technical Memorandum, National Marine Fisheries Service-NWFSC-27

Calambokidis, J. 1998. Personal Communication, October 27, 1998. Cascadia Research, Olympia, Washington.

_____. and G. H. Steiger. 1990. Sightings and movements of humpback whales in Puget Sound, Washington. Northwestern Naturalist 71:45-49.

Carter, H.R. and J.L. Stein. 1995. Molts and Plumages in the Annual Cycle of the Marbled Murrelet. In: C.J. Ralph, G.L. Hunt, M.G. Raphael, and J.F. Piatt (Tech eds)., Ecology and Conservation of the Marbled Murrelet. Gen. Tech. Rept. PSW-GTR-152. Albany, California: Pacific Southwest Experiment Station, Forest Service, U.S. Dept. of Agriculture. 420 pp.

Cascadia Research Collective (CRC). 2017. Cascadia Research Collective. Return of the Humpback Whales to the Salish Sea. Olympia, WA. http://www.cascadiaresearch.org/projects/return-humpback-whales-salish-sea

Center for Biological Diversity. 2001. Petition to list the southern resident killer whale (*Orcinus orca*) as an endangered species under the Endangered Species Act. Center for Biological Diversity, Berkeley, CA.

Center for Whale Research. 2006. Update on the Southern Resident Killer Whale Population September 2006. http://www.whaleresearch.com/thecenter/southern.html. Friday Harbor, Washington.

CH2MHILL. 2006a. Port Townsend Ferry Terminal Preservation and Improvement Project: Fisheries Discipline Report. Preliminary Draft. Prepared for Washington State Ferries. CH2MHILL. July 2006.

_____. 2006b. Port Townsend Ferry Terminal Preservation and Improvement Project: Wildlife Discipline Report. Preliminary Draft. Prepared for Washington State Ferries. CH2MHILL. December 2006.

_____. 2005. Eelgrass and Biological Resource Survey Technical Memorandum. Point Defiance Terminal, September 2003. Prepared for Washington State Ferries. January 24, 2005.

_____. 2004. South Cap Monitoring Report (Draft), Seattle Ferry Terminal. Prepared for Washington State Ferries, December 17, 2004.

_____. 2003. Edmonds Crossing Biological Assessment. Prepared for Federal Highway Administration, Washington State Department of Transportation, and the City of Edmonds. May 2003.

Chan, J. 2005. Bull Trout Core Areas to Address in the Anacortes Ferry Terminal Opinion. U.S. Fish and Wildlife Service.

City of Bainbridge Island, Suquamish Tribe, and Washington Department of Fish and Wildlife (WDFW). 2005. Bainbridge Island Beach Seine Project. Unpublished Microsoft Access Database. Provided by Peter Namtvedt Best (City of Bainbridge Island) to Paul Schlenger (Anchor Environmental) on January 21, 2005.

City of Port Townsend. 2002. Shoreline Master Program Update – Phase I, Shoreline Inventory Summary Report. Port Townsend, Washington.

Congleton, J.L., S.K. Davis, and S.R. Foley. 1982. Distribution, abundance and outmigration timing of chum and Chinook salmon fry in the Skagit salt marsh. Pages 153-163 in E.L. Brannon and E.O. Salo, editors. Salmon and trout migratory behavior symposium. School of Fisheries, University of Washington, Seattle, WA.

COSEWIC. 2002. CSEWIC assessment and status report on the bocaccio (*Sebastes paucispinis*) in Canada. Committee in the Status of Endangered Wildlife in Canada. Ottawa. vii + 43 pp.

Dealy, L.V. and Hodes, V.R. 2019. Monthly distribution and catch trends of Eulachon (Thaleichthys pacificus) from Juan de Fuca Strait to the Fraser River, British Columbia, October 2017 to June 2018. Can. Manuscr. Rep. Fish. Aquat. Sci. 3179: viii + 39 p.

DeLacy, A.C., B. S. Miller, and S. F. Borton. 1972. Checklist of Puget Sound Fishes. Wash. Sea Grant, Div. Mar. Res., Univ. Wash., Seattle, 43 p.

Dredged Material Management Program (DMMP). Mukileto Multimodal Project. Suitibility Determination Addendum. 2015.

Duffy, E.J., D.A. Beauchamp, N.C. Overman, and R.L. Buckley. 2005. Marine Distribution and Trophic Interactions of Juvenile Salmon in Puget Sound: A Synthesis of Trends among Basins. Hatchery Scientific Review Group. August 29, 2005.

Dumbauld, B.R., D.L. Holden, and O.P. Langness. 2008. Do sturgeon limit burrowing shrimp populations in Pacific Northwest estuaries? Environmental Biology of Fishes, DOI 10.1007/s 10641-008-9333-y: 14 pp.

Ecology (Washington State Department of Ecology). 2020. Ecology Water Quality Atlas. https://fortress.wa.gov/ecy/waterqualityatlas/map.aspx

_____. 2018. Ecology Water Quality Atlas. https://fortress.wa.gov/ecy/waterqualityatlas/map.aspx

_____. 2007. Long term marine water quality data. Available multi-year data 1989-2006 (varies by station) for stations PSS019, PSS008, PSB003, ELB015, CMB003, CMB006. http://www.ecy.wa.gov/apps/eap/marinewq/mwdataset.

_____. 1991. Net Shore-Drift in Washington State. Shorelands and Environmental Assistance Program. Olympia, Washington.

Emmett, R.L., G.T. McCabe Jr., and W.D. Muir. 1988. Effects of the 1980 Mount St. Helens eruption on Columbia River estuarine fishes: implications for dredging in northwest estuaries. Pages 75-91 in C.A. Simenstad, ed. Effects of Dredging on Anadromous Pacific Coast Fishes. University of Washington, Seattle, Washington.

EPA (U.S. Environmental Protection Agency). 2003. Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures. EPA-600-R-02-013. Office of Research and Development. Washington, DC 20460.

_____. 1989. Environmental Protection Agency. Final Remedial Investigation Report for Eagle Harbor Site, Kitsap County, Washington. November 1989.

ESA Adolfson. 2006. Terrestrial Plants and Animals Discipline Report: Mukilteo Multimodal Ferry Terminal. Prepared for Washington State Ferries and Washington State Department of Transportation.

Evans Mack, D. 2002. As cited in Friday Harbor Ferry Terminal Preservation Project. Biological Evaluation. Prepared for WSF by Sasha Visconty. June 2003.

Falcone, E., J. Calambokidis, G. Steiger, M. Malleson, and J. Ford. 2005. Humpback whales in the Puget Sound/Georgia Strait region. Proceedings of the 2005 Puget Sound Georgia Basin Research Conference. March 29-31, 2005. Seattle, Washington.

Federal Register. 2018. Southern DPS Green Sturgeon Recovery Plan. Federal Register 2018. January 9, 2018.

_____. 2016a. Endangered and Threatened Species; Designation of Critical Habitat for Lower Columbia River Coho Salmon and Pugest Sound Steelhead. Federal Register 2016a. February 24, 2016.

_____. 2016b. Endangered and Threatened Wildlife and Plants; Indentification of 14 Distinct Population Segments of the Humpback Whale and Revision of Species Wide Listing. 81 FR 93639. December 21, 2016.

_____. 2015. Endangered and Threatened Species; Designation of Critical Habitat for the Puget Sound/Georgia Basin Distinct Population Segments of Yelloweye Rockfish, Canary Rockfish and Bocaccio; Correction. 50FR 7977. February 13, 2015.

_____. 2013a. Endangered and Threatened Species; Designation of Critical Habitat for Lower Columbia River Coho Salmon and Puget Sound Steelhead; Proposed Rule. 50 FR 2726. January 14, 2013.

_____. 2011. Critical Habitat Designation: Final Rule Southern DPS Pacific Eulachon. Federal Register 2011. December 19, 2011.

_____. 2010a. Endangered and threatened wildlife and plants: Revised Designation of critical habitat for bull trout in the Coterminus United States; Final Rule. 50 CFR Part 63898. October 18, 2010.

_____. 2010b. Endangered and threatened wildlife and plants: Threatened status for southern distinct population segment of eulachon. 74 FR 10857. March 18, 2010.

______. 2010c. Endangered and Threatened Wildlife and Plants: Threatened Status for the Puget Sound/Georgia Basin Distinct Population Segments of Yelloweye and Canary Rockfish and Endangered Status for the Puget Sound/Georgia Basin Distinct Population Segment of Bocaccio Rockfish. 50 FR 22276. April 28, 2010.

_____. 2009. Endangered and Threatened Wildlife and Plants: Final Rulemaking to Designate Critical Habitat for the Threatened Southern Population Segment of North American Green Sturgeon; Final Rule. 74 FR 10857. March 13, 2009.

_____. 2007. Endangered and Threatened Species: Final Listing Determination for Puget Sound Steelhead. 72 FR 26722. May 11, 2007.

_____. 2006a. Endangered and threatened species; Designation of critical habitat for the Southern Resident Killer Whale; Final Rule. 50 FR 690540.

_____. 2006b. Endangered and Threatened Wildlife and Plants: Threatened Status for Southern Distinct Population Segment of North American Green Sturgeon. 50 FR 17757. April 7, 2006.

_____. 2005a. Endangered and threatened species; Designation of critical habitat for 12 evolutionarily significant units of west coast salmon and steelhead in Washington, Oregon, and Idaho; Final Rule. 50 FR 52630. September 2, 2005.

_____. 2005b. Endangered and Threatened Wildlife and Plants: Endangered Status for Southern Resident Killer Whales. 70 FR 69903. November 18, 2005.

_____2005c. Endangered and Threatened Wildlife and Plants: Proposed Threatened Status for Southern Population Segment of North American Green Sturgeon. 70 FR 173867. April 6, 2005.

_____. 2000. Designated Criticat Habitat: Critical Habitat for 19 Evolutionarily Significant Units of Salmon and Steelhead in Washington, Oregon, Idaho, and California. 65 FR 7764. February 2, 2000.

_____. 1999a. Endangered and threatened wildlife and plants; Listing of nine evolutionarily significant units of Chinook salmon, chum salmon, sockeye salmon, and steelhead. 64FR41835. August 2, 1999.

_____. 1999b. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for Bull Trout in the Coterminous United States; Final Rule Notice of Intent To Prepare a Proposed Special Rule Pursuant to Section 4(d) of the Endangered Species Act for the Bull Trout; Proposed Rule. 64 FR 58910. November 1, 1999.

_____. 1996. Endangered and Threatened Wildlife and Plants; Revised Critical Habitat for the Marbled Murrelet. 76 FR 61599. October 5, 2011.

_____. 1992. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Washington, Oregon and California Population of Marbled Murrelet. 57 FR 45328. October 1, 1992.

_____. 1970. Humpback whale Endangered Species Listing. 35 FR 18309. December 2, 1970.

Fisheries Hydroacoustic Working Group. 2008. Memorandum of the Agreement in Principle for Interim Criteria for Injury to Fish from Pile Driving Activities; Marine mammal, fish, and marbled murrelet injury and disturbance thresholds for marine construction activity. October 1, 2008. Available: http://www.wsdot.wa.gov/Environment/Biology/BA#Noise.

Fresh, K.L., D.J. Small, H. Kimm, C. Waldbilling, M. Mizell, M.I. Carr, and L. Stamatiou. 2006. Juvenile Salmon use of Sinclair Inlet, Washington in 2001 and 2002. WDFW (Washington Department of Fish and Wildlife), Technical Report No. FPT 05-08, Olympia,WA.

Goetz, Fred, et al. 2004. United States Army Corps of Engineers. Bull Trout in the Nearshore. Preliminary Draft June 2004.

Goetz, Fred. 2007. Personal communication via email between Fred Goetz, United States Army Corps of Engineers and Nancy Brennan-Dubbs, USFWS. January 17, 2007.

Gustafson, R. and nine coauthors. 2008. Summary of scientific conclusions of the review of the status of eulachon (*Thaleichthys pacificus*) in Washington, Oregon, and California. NMFS Northwest Fisheries Science Center. Seattle, WA. 114 p

Haas, M.E., C.A. Simenstad, J.R. Cordell, D.A. Beauchamp, and B.S. Miller. 2002. Effects of large overwater structures on epibenthic juvenile salmon prey assmblages in Puget Sound, Washington. Prepared by the University of Washington School of Aquatic and Fishery Sciences and the Washington State Transportation Center (TRAC) for the Washington State Transportation Commission. June 2002.

Hanson, M. Bradley, R.W. Baird, J.K.B. Ford, J. Hempleman-Halos, D. M. Van Doornik, J.R. Candy, C.K. Emmons, G.S. Schorr, B. Gisborne, K.L. Ayres, S. K. Wasser, K.C. Balcomb, K. Balcomb-Bartok, J.G. Sneva, and M. J. Ford. 2010. Species and stock identification of prey consumed by endangered southern resident killer whales in their summer range. Endangered Species Research. Vol. 11:69-82, 2010.

Havis, R.N. 1988. Sediment resuspension by selected dredges. EEDP-09-2. U.S. Army Engineer Waterways Experiment Station. Vicksburg, Mississippi.

Hay, D.E. and McCarter, P.B. 2000. Status of the eulachon *Thaleichthys pacificus* in Canada. Department of Fisheries and Oceans Canada, Canadian Stock Assessment Secretariat, Research Document 2000-145. Ottawa, Ontario.

HCCC (Hood Canal Coordinating Council). 2005. Hood Canal & Eastern Strait of Juan de Fuca Summer Chum Salmon Recovery Plan. Scott Brewer, Jay Watson, Dave Christensen, and Richard Brocksmith. Hood Canal Coordinating Council. Draft version November 15, 2005.

Herman, L.M. 1991. What the Dolphin Knows, or Might Know, in its Natural World. In: K.W. Pryor and L.S. Norris (Eds.), Dolphin Societies: Discoveries and Puzzles, Berkeley, University of California Press, pp. 349-363.

Holmberg, E.K., D. Day, N. Pasquale, and B Pattie. 1967. Research report on the Washington trawl fishery 1962-64. Technical report, Washington Department os Fisheries, Research Division, unpublished report.

Herrera Environmental Consultants. Preconstruction Sediment Data Report. Seattle Multimodal Terminal Project at Colman Dock. Prepared for Washington State Ferries and Washington State Department of Transportation. April 27, 2015. Seattle, WA.

Kraemer, C. 1994. Some observations on the life history and behavior of the native char, Dolly Varden (*Salvelinus malma*) and bull trout (*Salvelinus confluentus*) of the north Puget Sound region.

Krahn, M.M., M.J. Ford, W.F. Perrin, P.R. Wade, R.P. Angliss, M.B. Hanson, B.L. Taylor, G.M. Ylitalo, M.E. Dahlheim, J.E. Stein, and R.S. Waples. 2004. 2004 Status review of Southern Resident killer whales (Orcinus orca) under the Endangered Species Act. U.S. Dept. Commer., NOAA Tech. Memo. NMFSNWFSC-62, 73 p.

LaSalle, M.W. 1988. Physical and chemical alterations associated with dredging: an overview. Pages 1-12 in C.A. Simenstad, ed. Effects of dredging on anadromous Pacific coast fishes. University of Washington, Seattle, Washington.

LeGore, R.S. and D.M. DesVoigne. 1973. Absence of acute effects of threespine sticklebacks (Gasterosteus aculeatus) and coho salmon (Oncorhynchus kisutch) exposed to resuspended harbor sediment concentrations. J. Fish. Res. Bd. Can. 30(8): 1240-1242.

Levings, C. D., K. Conlin, and B. Raymond. 1991. Intertidal habitats used by juvenile Chinook salmon (*Oncorhynchus tshawytscha*) rearing in the north arm of the Fraser River estuary. Marine Pollution Bulletin 22:20-26.

Levy, D. A., T. G. Northcote, and G. J. Birch. 1979. Juvenile salmon utilization of tidal channels in the Fraser River estuary, British Columbia. 23, Westwater Research Centre, Vancouver, B.C. Canada.

Lewis, A.F.J., M.D. McGurk, and M.G. Galesloot. 2002. Alcan's Kemano River eulachon (Thaleichthys pacificus) monitoring program 1988-1998. Consultant's report prepared by Ecofish Research Ltd. Fir Alcan Primary Metal Ltd., Kitimat, British Columbia. 136 p.

Love, M.S., M.M. Yoklavich, and L. Thorsteinson. 2002. The rockfishes of the Northeast Pacific. University of California Press, Berkeley, California.

Lynch, Deanna. 2007. Port Townsend Bay Murrelet Density Information. Email from Deanna Lynch, USFWS, to Emily Teachout, USFWS, on February 13, 2007.

Martin, J.D., E.O. Salo and B.P. Snyder. 1977. Field bioassay studies on the tolerance of juvenile salmonids to various levels of suspended solids. University of Washington School of Fisheries Research Institute. Seattle, WA. FRI-UW-7713.

Mavros, B. and J. Brennan. 2001. Nearshore beach seining for juvenile Chinook (*Onchorhynchus tshawytscha*) and other salmonids in King County intertidal and shallow subtidal zones. August 10, 2004. Located at: www.psat.wa.gov/Publications/01_proceedings/sessions/oral/2a_mavrs.pdf.

McKenzie, T.P. 1999. Marine Characterization Report and Mitigation Plan. Kingston. Prepared for WSF.

McMullen Associates, Inc. 2005. Waterborne and Airborne Noise Survey for Washington State Ferries. Technical Memorandum. May 16, 2006.

Meehan, W.R., and T.C. Bjornn ed. 1991. Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. American Fisheries Society Special Publication 19. Bethesda, Maryland.

Miller, D.J. and S.F. Borton. 1980. Geographical distribution of Puget Sound fishes: Maps and data source sheets. University of Washington Fisheries Research Institute. 3 vols.

Moffat and Nichol. 2006. Mukilteo Multimodal Ferry Terminal. Coastal Sediment Technical Memorandum. April 2006.

Mortensen, D.G., B.P. Snyder, and E.O. Salo. 1976. An analysis of the literature on the effects of dredging on juvenile salmonids. University of Washington. Fisheries Research Institute, FRI-UW-7605.

Moser, M.L., K.S. Andrews, S. Corbett, B.E. Feist, and M.E. Moore. 2021. Occurrence of Green Sturgeon in Puget Sound and the Strait of Juan de Fuca: a review of detection data from 2002 to 2019. Report of the National Marine Fisheries Service to the U.S. Navy Pacific Fleet Environmental Readiness Division. Pearl Harbor, Hawaii.

Moulton, L. 2001. Personal communication (email to J. Haddad, Pacific International Engineering, Edmonds, WA, on December 17, 2001). MJM Research, Lopez Island, WA.

Moyle, P.B. 2002. Inland fishes of California. University of California Press, Berkeley, CA. 502 pp.

Moyle, P.B., P.J. Foley, and R.M. Yoshiyama. 1992. Status of green sturgeon, Acipenser medirostris, in California. Final Report submitted to National Marine Fisheries Service. 11 p. University of California, Davis, CA 95616.

Moyle, P.B., R.M. Yoshiyama, J.E. Williams, and E.D. Wikramanayake. 1995. Fish Species of Special Concern in California. Second edition. Final report to CA Department of Fish and Game, contract 2128IF.

MRC (Marine Resources Consultants). 2000. Underwater Videographic Survey at the Mukilteo Ferry Terminal December 22, 1999. Norris, J. and Wyllie-Echeverria, S. March 10, 2000.

Myers, J.M., R.G. Kope, G.J. Bryant, D. Teel, L.J. Lierheimer, T.C. Wainwright, W.S. Grand, F.W. Waknitz, K. Neely, S.T. Lindley, and R.W. Waples. 1998. Status review of chinook salmon from Washington, Idaho, Oregon, and California. U.S. Department of Commer., NOAA Technical Memorandum NMFS-NWFSC-35.

Nakamoto, R.J., T.T. Kisanuki, and G.H. Goldsmith. 1995. Age and growth of Klamath River green sturgeon (Acipenser medirostris). U.S. Fish and Wildlife Service Project 93-FP-13, Yreka, CA. 20 pp.

National Park Service (NPS). 2009. Web page for Glacier Bay National Park. http://www.nps.gov/glba/naturescience/whales.htm Queried May 21, 2009.

Nightengale, B. and C. Simenstad. 2001. Overwater Structures: Marine Issues. White Paper Prepared for the Washington Department of Fish and Wildlife. May 2001.

National Marine Fisheries Service (NMFS). 2018. 2018 Revision to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0). Underwater Thresholds for Onset of Temporary and Permanent Threshold Shifts. Office of Protected Resources. National Marine Fisheries Service. Silver Springs, MD.

_____. 2016. West Coast Region's Endangered Species Act implications and considerations about "take"given the September 16 humpback whale DPS status review and species-wide revision of listings. Protected Resources Division, West Coast Region. Chris Yates, Assistant Regional Director for Protected Resources. December 7, 2016.

_____. 2009. Endangered and Threatened Wildlife and Plants: Proposed Endangered, Threatened and Not Warranted Status for Distinct Population Segments of Rockfish in Puget Sound. Federal Register. Vol. 74, No. 77, pp. 18516-18542.

_____. 2008a. Recovery Plan for Southern Resident Killer Whales (*Orcinus orca*). National Marine Fisheries Service, Northwest Region, Seattle, Washington. 251 pp.

_____. 2008b. Preliminary Scientific Conclusion of the Review of the Status of Five Species of Rockfish: Bocaccio (*Sebastes paucispinis),* Canary Rockfish (*Sebastes pinniger*), Yelloweye Rockfish (*Sebastes ruberrimus)*, Greenstriped Rockfish (*Sebastes elongates),* and Redstripe Rockfish (*Sebastes proriger*) in Puget Sound, Washington. Northwest Fisheries Science Center, National Marine Fisheries Service. Seattle, Washington. December 2, 2008.

_____. 2008c. Proposed designation of critical habitat for the Southern Distinct Population Segment of North American green sturgeon. Draft biological report, September 2008. National Marine Fisheries Service, Southwest Region Protected Resources Division, 501 West Ocean Blvd., Suite 4200, Long Beach California, 90802. Accessed online on November 24, 2008: http://swr.nmfs.noaa.gov/gs/Final_Draft_GS_BioRpt.pdf.

_____. 2007. Magnuson-Stevens Fishery Conservation and Management Act; As Amended Through January 12, 2007. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. May 2007.

_____. 2005. Biological Opinion: Eagle Harbor Maintenance Facility Slip B Improvements Project, NMFS Tracking No. 2004-01747. Issued May 3, 2005.

_____. 1999. Evaluation of the status of Chinook and chum salmon and steelhead hatchery populations for ESUs identified in Final Listing Determinations. Report to NMFS Northwest Region Conservation Biology Division, 70 p.

NMFS and USFWS. 2005. National Marine Fisheries Service/U.S. Fish and Wildlife Service. Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the proposed Seattle Aquarium, Pier 59 Piling Superstructure Maintenance project in the City of Seattle, King County, Washington. Fifth Field HUC 1711001904, Puget Sound/East Passage. (COE No. 200301370). February 23, 2005.

Noggle, C.C. 1978. Behavioral, physiological and lethal effects of suspended sediment on juvenile salmonids. Master's thesis. University of Washington, Seattle, Washington.

Ono, Kotaro, Charles A. Simenstad, Jason D. Toft, Susan L. Southard, Kathryn L. Sobocinski, and Amy Borde. 2010. Assessing and Mitigating Dock Shading Impacts on the Behavior of Juvenile Pacific Salmon (Oncorhynchus spp.): Can Artificial Light Mitigate the Effects? University of Washington School of Aquatic and Fishery Sciences. Seattle, WA. Batelle Marine Science Laboratory. Squim, WA. July 2010.

Osborne, R.J., J. Calambokidis, and E.M. Dorsey. 1998. A guide to marine mammals of greater Puget Sound. Island Publishers, Anacortes, Washington. 191 pp.

Palermo, M.R., J.H. Homziak, and A.M. Teeter. 1990. Evaluation of clamshell dredging and barge overflow, Military Ocean Terminal, Sunny Point, North Carolina. U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg Mississippi. March, 1990.

Palm, Roger C., David B. Powell, Ann Skillman, and Kathy Godtfredsen. 2003. Immunocompetence of Juvenile Chinook Salmon Against Listonella Anguillarum Following Dietary Exposure to Polycyclic Aromatic Hydrocarbons. Environmental Toxicology and Chemistry, Vol. 22, No. 12, pp. 2986-2994.

Parametrix. 1996. Bainbridge Island Ferry Terminal Eelgrass, Macroalgae, and Macrofauna Habitat Survey Report. Prepared for Sverdrup Civil, Inc. and the Washington Department of Transportation, Washington State Ferries. October, 1996.

Perry, S.L, D.P. DeMaster, and G.K. Silber. 1999. Special Issue: The great whales: History and status of six species listed as endangered under the U.S. Endangered Species Act of 1973. Marine Fisheries Review 61(1).

PFMC (Pacific Fisheries Management Council). 2003. Groundfish Bycatch Program EIS: Appendix A. Biological Environment: Distribution, Life History, and Status of Relevant Species. Pacific Fisheries Management Council. August 11, 2003.

PIE. 2002a. Pacific International Engineering. Eelgrass and Biological Resources Survey, Shaw - Island Ferry Terminal. Prepared for Washington State Ferries, Seattle, WA.

PIE. 2002b. Pacific International Engineering. Eelgrass and Biological Resources Survey, Orcas Island Ferry Terminal. Prepared for Washington State Ferries, Seattle, WA.

PIE. 2002c. Biological Evaluation Talequah Ferry Terminal Dolphin Replacement Project. Prepared for Washington State Ferries. Pacific International Engineering. May 2002.

PIE. 2002d. Eelgrass and Biological Resource Survey, Friday Harbor Ferry Terminal. Prepared for Washington State Ferries. Seattle, Washington. April 2002.

PIE. 2001. Biological Evaluation. Fauntleroy Slip Refurbishment Project. Prepared for Washington State Ferries. June 2001.

PIE. 1999. Marine Characterization Report and Mitigation Plan. Southworth Passenger-Only Fast Ferry Terminal Development. Prepared for WSF.

PIE (Pacific International Engineering). 1998. PSDDA Sediment Characterization Report. Kingston Passenger-Only Ferry Terminal. Prepared for WSF.

Port of Seattle. 2006. Terminal 30 Container Reactivation and Cruise Terminal Relocation. Draft Environmental Impact Statement. Seattle, Washington. October 2006.

Poston, Ted. 2001. Treated Wood White Paper. Prepared for Washington Department of Fish and Wildlife by Battelle Marine Research Laboratory, Sequim, Washington. October 18, 2001.

PSAMP (Puget Sound Ambient Monitoring Program) and WDFW (Washington Department of Fish and Wildlife). 1994. Marbled murrelet survey maps for winter and summer 1993-1994.

PTMSC (Port Townsend Marine Science Center). 2001. Port Townsend Bay Marine Resource Monitoring Project, 1990-2000. Unpublished newsletter.

Redding, M. J., C.B. Schreck., and F.H. Everest. 1987. Physiological effects on coho salmon and steelhead of exposure to suspended solids. Trans. of the Am. Fish. Soc. 116:737-744.

REEF. 2009. Bocaccio (*Sebastes paucispinus*), Canary Rockfish (*Sebastes pinniger*), and Yelloweye Rockfish (*Sebastes ruberrimus*) Distribution Reports. The Reef Environmental Education Foundation. Data range 01/01/1996 to 12/31/2007. http://www.reef.org/db/reports/dist/PAC. Accessed May 20, 2009.

Rice, C. et al. 2001. Skagit Bay Tow-netting Pilot Study. Prepared by the Northwest Fisheries Science Center, NMFS and Skagit System Cooperative Research Program. 2001.

Rice, C. A. 2004. 2003 Bellingham Bay juvenile Chinook tow-netting project field sampling and data summary. Report to Port of Bellingham

Rice, Casimir A. Unpublished data furnished to Ali Wick, Anchor Environmental, L.L.C., March 2007. National Marine Fisheries Service, Northwest Fisheries Science Center. Seattle, Washington.

Ricker, W.E., D.F. Manzer, and E.A. Neave. 1954. The Fraser River eulachon fishery, 1941-1953. Fisheries Research Board of Canada, Manuscript Report No. 583. 35 p.

Richards, L.J. 1986. Depth and habitat distributions of threee species of rockfish (*Sebastes)* in British Columbia: observations from the submersible PISCES IV. Environ. Biol. Fishes 17: 13-21

Roni, P.R and L.A. Weitkamp. 1996. Environmental monitoring of the Manchester naval fuel pier replacement, Puget Sound, Washington, 1991-1994. Report for the Department of the Navy and the Coastal Zone and Estuarine Studies Division, Northwest Fisheries Science Center, National Marine Fisheries Service, January 1996.

Salo, E.O., T.E. Prinslow, R.A Campbell, D.W. Smith, and B.P. Snyder. 1979. Trident Dredging Study: the effects of dredging at the U.S. Naval submarine base at Bangor on outmigrating juvenile chum salmon, Oncorhynchus keta, in Hood Canal, Washington. FRI-UW-7918. University of Washington College of Fisheries, Fisheries Research Institute, September 1979.

Salo, E.O, N.J. Bax, T.E. Prinslow, C.J. Whitmus, B.P. Snyder, and C.A. Simenstad. 1980. The effects of construction of naval facilities on the outmigration of juvenile salmonids from Hood Canal, Washington. FRI-UW-8006. University of Washington College of Fisheries, Fisheries Research Institute. April 1980.

Sandahl, J.F., D.H. Baldwin, J.J. Jenkins, and N.L. Scholz. 2007. A Sensory System at the Interface between Urban Stormwater Runoff and Salmon Survival. Environmental Science & Technology, Vol. 41, No. 8, pp. 2998-3004.

Servizi, J.A. 1988. Sublethal Effects of Dredged Sediments on Juvenile Salmonids. Pages 57-63 in C.A. Simenstad, ed. Effects of dredging on anadromous Pacific coast fishes. University of Washington, Seattle, Washington.

Servizi, J.A. and D.W. Martens. 1987. Some effects of suspended Fraser River sediments on sockeye salmon (*Oncorhynchus nerka*). Page 254-264 in H.D. Smith, L. Margolis, and C.C. Wood, eds. Sockeye salmon (*Oncorhynchus nerka*) population biology and future management. Can. Spec. Publ. Fish. Aquat. Sci. 96.

Servizi, J.A., and D.W. Martens. 1992. Sublethal responses of coho salmon (*Oncorhynchus kisutch*) to suspended sediments. Can. J. Fish. Aquat. Sci. 49:1389-1395.

Shaffer, J.A., D. Penttila, M. McHenry, and D. Vilella. 2007. Observations of eulachon, *Thaleichthys pacificus*, in the Elwha River, Olympic Peninsula Washington. Northwest Science 81: 76-81.

Shannon and Wilson. DRAFT. Washington Landings Pier 48 Preliminary Sediment Cap Design. Waterfront Seattle Project. December 15, 2017. Seattle, Washington.

Simenstad, C.A., B. Nightingale, R. Thom, D. Shreffler. 1999. Impacts of Ferry Terminals on Juvenile Salmon Migrating Along Puget Sound Shorelines. Phase 1: Synthesis of State of Knowledge. Prepared for WSDOT, Olympia, WA.

Simenstad, C.A. 1988. Summary and conclusions from workshop and working group discussions. Pages 144-152 in C.A. Simenstad, ed. Effects of dredging on anadromous Pacific coast fishes. University of Washington, Seattle, Washington.

Simenstad, C.A., B.S. Miller, J.N. Cross, K.L. Fresh, S.N. Steinfort, and J.C. Fegley. 1979. Nearshore fish and macroinvertebrate assemblages along the Strait of Juan de Fuca, including food habits of nearshore fish. NOAA Tech. Memo. ERL-MESA-20. U.S. Department of Commerce. Boulder, Colorado. 144pp.

Smith, W.E. and R.W. Saalfeld. 1955. Studies on the Columbia River smelt, (*Thaleichthys pacificus*). Washington Department of Fisheries, Fisheries Research Papers 1(3): 3-26.

Southard, S.L., R.M. Thom, G.D. Williams, J.D. Toft, C.W. May, G.A. McMichael, J.A. Vucelick, J.T. Newell, J.A. Southard. 2006. Impacts of Ferry Terminals on Juvenile Salmon Movement along Puget Sound Shorelines. Prepared for WSDOT, Olympia, WA.

Southall, B.L., A.E. Bowles, W.T. Ellison, J.J. Finneran, and others. 2007. Marine mammal noise exposure criteria: initial scientific recommendations. Aquat Mamm 33:411–522.

Spangler, E.A.K. 2002. The ecology of eulachon (*Thaleichthys pacificus*) in Twentymile River, Alaska. M.S. Thesis. University of Alaska, Fairbanks.

SRSC and NOAA (Skagit River System Cooperative and NOAA Fisheries). 2012. *Draft* Juvenile Salmon and Forage Fish Presence and Abundance in Shoreline Habitats of the San Juan Islands, 2008-2009. Eric Beamer and Kurt Fresh. MAP Applications for Selected Fish Species. April 2012.

Stanley, R.D., K. Rutherford and N. Olsen. 2001. Preliminary status report on bocaccio (*Sebastes paucispinis*). Stock Assessment Division, Science Branch, Pacific Region, Fisheries and Oceans, Canada. Pacific Biological Station, Nanaimo, BC.

Stein, J. and D. Nysewander. 1995. An estimate of the proportion of juvenile marbled murrelets, *Brachyramphus marmoratus*, in the inland marine waters of Washington State during the 1994 post-breeding season and a comparison between boat and aerial survey counts. Washington Department of Fish and Wildlife, Mill Creek, WA, December 1995.

Stick, K.C. 2005. 2004 Washington State Herring Stock Status Report. SS 05-01. Washington Department of Fish and Wildlife, Fish Program, Fish Management Division.

Stober, Q. J., and E. O. Salo. 1973. Ecological studies of the proposed Kiket Island nuclear power site. Snohomish County P.U.D. and Seattle City Light. FRI-UW-7304.

Stober, Q.J., B.D. Ross, C.L Melby, P.A. Dimmel, T.H. Jagielo, and E.O. Salo. 1981. Effects of Suspended Sediment on Coho and Chinook Salmon in the Toutle and Cowlitz Rivers. FRI-UW-8124. University of Washington College of Fisheries, Fisheries Research Institute. November 1981.

Strickland, R.M. 1983. The Fertile Fiord. Puget Sound Books.

Sturdevant, M.V., T.M. Willette, S. Jewett, E. Deberc. 1999. Diet composition, diet overlap, and size of 14 species of forage fish collected monthly in PWS, Alaska, 1994-1995. Chapter 1. Forage Fish Diet Overlap, 1994-1996. *Exxon Valdez* Oil Spill Restoration final report 98163C, 12-36.

Teachout, E. 2004. Personal communication via email between Emily Teachout, USFWS, and Sasha Visconty, Anchor Environmental, L.L.C. October 14, 2004.

Thom, R., A.B. Borde, L.D. Antrim, W.W. Gardiner, J.G. Norris, and S.W. Echeverria. 1997a. Eelgrass and biological resources survey at Shaw Island Ferry Terminal. Prepared for Washington State Department of Transportation, Olympia. July 1997.

_____, J. Norris, S. Wyllie-Echeverria, A. Borde, L. Antrim, and T.P. McKenzie. 1997b. Eelgrass and Resource Surveys at Bremerton, Kingston, Southworth, and Vashon Island terminals.

_____, D. Shreffler, and J. Schafer. 1995. Mitigation Plan for Impacts to Subtidal Vegetation Associated with Reconstruction and Expansion of the Ferry Terminal at Clinton, Whidbey Island, Washington. Prepared for the Washington Department of Transportation. Olympia, Washington. September 1995.

Tracy, C. Minutes to USFWS meeting. *Cited in*: Moyle, P.B., R.M. Yoshiyama, J.E. Williams, and E.D. Wikramanayake. 1995. Fish species of special concern in California, 2$^{nd}$ edition. CDFG, Inland Fisheries Division, Rancho Cordova, CA. 277 pp.

Tyler, R.W. 1964. Distribution and migration of young salmon in Bellingham Bay, Washington. Univ. Wash., Fish. Res. Inst. Circular No. 212. 26 pp.

Tyler, R.W. and D.E. Bevan. 1964. Migration of juvenile salmon in Bellingham Bay, Washington. Research in Fisheries, 1963. Univ. Washington Coll. Fish. Ontrib. No. 166. P 44-45.

USDA (U.S. Department of Agriculture). 2007. At-Sea Marbled Murrelet Surveys in the Manette Bridge Vicinity-Bremerton, WA July 2006 - January 2007. Report to Washington Department of Transportation. February 2007. Thomas D. Bloxton, Jr. and Martin G. Raphael. USDA Forest Service. Pacific Research Station. Olympia, WA.

USFWS. 2010. Biological Opinion: Port Townsend Ferry Terminal Dolphin Replacement, Jefferson and Snohomish Counties, Washington. June 29, 2010.

_____. 2004a. Biological Opinion: Edmonds Crossing Ferry Terminal, USFWS Log # 1-3-03-F-1499. Prepared for the Federal Highway Administration, August 30, 2004.

_____. 2004b. Draft Recovery Plan for the Coastal-Puget Sound Distinct Population Segment of Bull Trout (*Salvelinus confluentus*). Volume I (of II): Puget Sound Management Unit. Portland, Oregon. 389 + xvii pp.

_____. 2003. Biological Opinion: SR 104 Hood Canal Bridge Retrofit and East Half Replacement Project, USFWS Log # 1-3-02-F-1484. Prepared for the Federal Highway Administration. May 2003.

_____. 1997. Recovery Plan for the Threatened Marbled Murrelet in Washington, Oregon, and California. 296 pp.

_____. 1996. Critical Habitat for Marbled Murrelet Map. April 1996.

Vashon Nature Center (VNC). Tahlequah Restoration Monitoring Report Pre-restoration baseline 2020-2021. Bianca Perla, PhD. June 28, 2021.

Wait, Micah. 2007. Wild Fish Conservancy. Personal communication with Rick Huey (Washington State Ferries). March 14, 2007.

WDF (Washington Department of Fisheries), Habitat Management Division. 1992. Technical Report: Salmon, marine fish, and shellfish resources and associated fisheries in Washington's coastal and inland marine waters, March 1992.

Washington State Department of Fish and Wildlife. WDFW 2022. Forage Fish Spawning Map - Washington State (arcgis.com)

_____. 2009. Recreation Groundfish: Rockfish Common to the Waters off Washington State. Recreational yelloweye rockfish harvest. http://wdfw.wa.gov/fish/bottomfish/rockfish.htm#yelloweye Accessed May 26, 2009.

_____. 2008. Fish and Wildlife Science: Puget Sound Chum Salmon. http://wdfw.wa.gov/fish/chum/chum-5.htm. Queried April 11, 2008.

_____. 2007a. Washington Lakes and Rivers Inventory System. Fish Distribution. WSDOT GIS Workbench. February 2, 2007.

_____. 2007b. SalmonScape interactive mapping tool. http://wdfw.wa.gov/mapping/salmonscape/index.html

_____. 2006a. Salmon Recovery web page. Hood Canal Summer Chum Life History. http://wdfw.wa.gov/fish/chum/chum.htm.

_____. 2006b. Washington Department of Fish and Wildlife. Priority Habitats and Species Maps. April 26, 2006.

_____. 2006c. Juvenile Salmon Use of Sinclair Inlet, Washington in 2001 and 2002. Washington State Department of Fish and Wildlife. March 2006.

_____. 2005. 2004 Washington State Herring Stock Status Report. Washington State Department of Fish and Wildlife Fish Program Fish Management Division. May 2005.

WDFW and ODFW. 2002. Washington Department of Fish and Wildlife/Oregon Department of Fish and Wildlife. Use of an Artificial Substrate to Capture Eulachon (Thaleichthys pacificus) Eggs in the Lower Columbia River (Draft). Marc D. Romano, Matthew D. Howell1 , and Thomas A. Rien. May 31, 2002.

WDFW (Washington Department of Fish and Wildlife) and ODFW (Oregon Department of Fish and Wildlife). 2001. Washington and Oregon eulachon management plan. Washington Department of Fish and Wildlife and Oregon Department of Fish and Wildlife. Online at http://wdfw.wa.gov/fish/creel/smelt/wa-ore_eulachonmgmt.pdf [accessed April 2009].

WDW (Washington Department of Wildlife). 1991. Management Recommendations for Washington's Priority Species. Washington Department of Wildlife, Wildlife Management, Fish Management, and Habitat Management Divisions. May 1991.

WSDOT. 2019a. WSDOT Biological Assessment Manual. Washington State Department of Transportation. Olympia, WA. January 2019.

_____. 2019b. WSDOT GIS Workbench. USFW Northwest Forest Plan Marbled Murrelet Effectiveness Monitoring Program Habitat Suitability (2012). Washington State Department of Transportation. Olympia, WA. January 2019.

_____. 2018a. WSDOT GIS Workbench. WDFW Forage Fish Surveys. Washington State Department of Transportation. Olympia, WA. November 2018.

_____. 2018b. WSDOT GIS Workbench. WDFW Marbled Murrelet Detection Sites. Washington State Department of Transportation. Olympia, WA. November 2018.

_____. 2018c. WSDOT GIS Workbench. Microsoft Bing Maps Orthophotos. Washington State Department of Transportation. Olympia, WA. November 2018.

_____. 2018d. WSF Fiscal Year 2018 (July 1-June 30) Ferry Trip Data. Washington State Department of Transportation Ferries Division. Seattle, WA. June 2018.

_____. 2018e. Mukilteo Multimodal Project Marbled Murrelet Monitoring Data (2017/18). Washington State Department of Transportation Ferries Division. Seattle, WA. March 2018.

_____. 2018f. Bainbridge/Eagle Harbor Site Visit. Rick Huey, WSF Biologist. Washington State Department of Transportation Ferries Division. Seattle, WA. December 13, 2018.

_____. 2016. Periodic Status Review for the Marbled Murrelet. Washington State Department of Fish and Wildlife. Olympia, WA. October 2016.

_____. 2014. WSDOT Roadside Maintenance Programmatic Biological Opinion – Supplemental Analysis: Appendix H2: Marbled Murrelet Site Evaluation, Impacts, and Effect Determinations. Washington State Department of Transportation. Olympia, WA. 2014.

_____. 2012. Mukilteo Multimodal Project. Draft EIS. Ecosystems Discipline Report. WSDOT. January 2012.

WSF (Washington State Ferries). 1999. Biological Evaluation. Kingston Ferry Terminal Dolphin Improvement Project. November 1999.

WSF. 2007a. Draft Biological Assessment Mukilteo Multimodal Ferry Terminal Project. Prepared for Federal Transit Administration by Washington State Ferries and Anchor Environmental, L.L.C. January 2007.

WSF. 2007b. Marbled Murrelett Monitoring Report for the Anacortes Ferry Terminal Dolphin Replacement Project. March 2007.

WSF. 2005a. Ellie Ziegler (WSF) letter to Kerry Carroll (WA Dept. of Ecology). Water quality monitoring data for creosote and steel pile removal during October 2005 at the Eagle Harbor Maintenance Facility Slip B. November 1, 2005.

WSF. 2005b. Ellie Ziegler (WSF) email to Kerry Carroll (WA Dept. of Ecology). Water quality monitoring data for steel pile removal during December 2005 at the Friday Harbor Ferry Terminal. January 4, 2006.

WSF. 2004. Keystone Wingwall and Lift Tower Repair. Biological Evaluation. September 2004.

Weitkamp, D. E. and T.J. Schadt. 1982. Juvenile chum and Chinook salmon behavior at Terminal 91, Seattle, Washington. Port of Seattle, Document No. 82-0415-013F.

The Whale Museum. 2005. Issues Affecting the Southern Resident Orcas. http://www.whale-museum.org/education/library/issues.html. Downloaded June 27, 2005.

Whitman, R.P., T.P. Quinn, and E.L. Brannon. 1982. Influence of suspended volcanic ash on homing behavior of adult Chinook salmon. Trans. Am. Fish. Soc. 111:63-69. 1982.

Wild Fish Conservancy. 2007. Whidbey Island Nearshore Juvenile Chinook Sampling. Wild Fish Conservancy (formerly Washington Trout). 2007. http://www.washingtontrout.org/WFRnov05.shtml#Hwhidbey

Williams, R.W., R.M. Laramie, and J.J. Ames. 1975. A catalog of Washington streams and salmon utilization, volume 1, Puget Sound region. Washington State Department of Fisheries, Olympia, Washington.

Willams, G.D., R.M. Thom, D.K. Shreffler, J.A. Southard, L.K. O'Rourke, S.L. Sargeant, V.I. Cullinan, R. Moursund, M. Stamey. 2003. Assessing Overwater Structure-Related Predation Risk on Juvenile Salmon: Field Observations and Recommended Protocols. Prepared for the Washington State Department of Transportation, Under a Related Services Agreement with the U.S. Department of Energy Under Contract DE-AC06-76RLO 1830. Pacific Northwest National Laboratory, Sequim, Washington 98382.

Wilson, M.F., R.H. Armstrong, M.C. Hermans, and K. Koski. 2006. Eulachon: A review of biology and an annotated bibliography. AFSC Processed Report 2006-12 (August). National Marine Fisheries Service, Alaska Fisheries Science Center, Juneau, Alaska. 229 p.

Wyllie Echeverria, T. 1987. Thirty-four species of California rockfishes: maturity and seasonality of reproduction. Fish. Bull. 85:229-250.

Yamanaka, K.L., L.C. Lacko, R. Withler, C. Grandin, J.K. Lochead, J.C. Martin, N. Olsen and S.S. Wallace. 2006. A review of yelloweye rockfish *Sebastes ruberrimus* along the Pacific coast of Canada: biology, distribution, and abundance trends Research Document 2006/076.

# APPENDIX A

# PROJECT FORM

# WASHINGTON STATE FERRIES (WSF) CAPITAL, REPAIR, AND MAINTENANCE PROJECTS

## BIOLOGICAL ASSESSMENT REFERENCE

## PROJECT FORM

1. **Date:** ______________________________

2. **Federal Lead:** ______________________________
   Contact Name: ______________________________
   Address: ______________________________
   City: ______________ State: ______ Zip: __________

3. **WSF Contact:** ______________________________
   Address: ______________________________
   City: ______________ State: ______ Zip: __________

4. **Project Title:** ______________________________

5. **Location(s) of Activity:**
   Ferry Terminal __________ Waterbody: __________ HUC Code: __________

6. **Summary of Effects Determinations:**

| Species or Critical Habitat | Effect Determination |
|---|---|
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7. **Project Description:**
*The project description should include the following:*
- *Location (including depth) and size of project structures including number and diameter of piles to be installed and removed; type of piles/materials to be used; size and type of overwater structures to be removed and replaced; construction equipment needed; any necessary temporary structures*
- *Proposed upland work including a description of trenching and utility work; new impervious surfaces, proposed stormwater treatment of new impervious; stormwater retrofits if any, and a stormwater analysis based on the WSDOT/FHWA interim guidance or latest agreed-upon stormwater guidance.*
- *Construction schedule and project timing.*
- *Unusual construction techniques not discussed in the BAR and any associated Minimization Measures.*
- *Specific Minimization Measures not discussed in the BAR. This might include monitoring for specific species, the type of noise attenuation methods proposed, etc.*
- *Proposed offsetting measures (creosote removal, eelgrass restoration, etc.)*
- *Project drawings and photos (if available).*

8. **Action Area Description (Include Figure):**
*The project action area should be based on specific construction activities. In the case of in-water work, the action area will likely be based on noise generated by pile installation, but could be based on other construction activities that generate turbidity or other disturbance of aquatic or terrestrial species. The action area should include both in-water and in-air impacts.*

*Attach a figure showing the extent of the action area.*

9. **Environmental Baseline**
*The environmental baseline information provided in the BAR is specific to the immediate ferry terminal areas. Provide additional baseline information if the action area extends past the terminal area.*

**10. Effects Analysis:**

- *Direct / Indirect Effects*
  *Describe the effects determination for listed and proposed species and critical habitat. Effects such as noise and turbidity are described in detail in the BAR but should also be summarized here.*
- *Interrelated and interdependent actions*
- *Cumulative Effects (If formal consultation)*

________________________________________
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________________________________________
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**11. Essential Fish Habitat (EFH) Effects Analysis**

*Identify EFH in the action area, effects, and any minimization measures not described in the BAR.*

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# APPENDIX B

# SPECIES BIOLOGY

# SPECIES BIOLOGY

Species covered in this Biological Assessment Reference were chosen on the basis of species lists obtained from the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) (see Appendix C). Because of the inland marine nature of all the Washington State Ferries (WSF) terminals, freshwater fish, oceangoing mammals, and sea turtles (including leatherback sea turtles), terrestrial species, and upland and freshwater plants were excluded from this analysis.

## NMFS – Listed Threatened, Endangered, and Proposed Species

### Puget Sound Chinook Salmon (*Oncorhynchus tshawytscha*)

#### *Status*

Puget Sound Chinook salmon were listed as threatened on August 2, 1999 (Federal Register 1999a.). The evolutionarily significant unit (ESU) includes naturally spawned fish and stocks from 26 artificial propagation programs.

#### *Critical Habitat*

Critical habitat was designated for Puget Sound Chinook salmon on February 16, 2000 (Federal Register 2000.). Critical habitat is designated for areas containing the physical and biological habitat features, or primary constituent elements (PCEs) essential for the conservation of the species or which require special management considerations. PCEs include sites that are essential to supporting one or more life stages of the ESU and that contain physical or biological features essential to the conservation of the ESU. Specific sites and features designated for Puget Sound Chinook salmon include the following:

1. Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning incubation and larval development
2. Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile development; and natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks

3. Freshwater migration corridors 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
4. Estuarine areas free of obstruction with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation
5. Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.
6. Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation

The critical habitat proposal for Puget Sound Chinook salmon includes 61 occupied watersheds in 18 associated subbasins as well as 19 nearshore marine zones. In setting this designation, the conservation value of each habitat area was considered in the context of the productivity, spatial distribution, and diversity of habitats across the range of five geographical regions of correlated risk.

In estuarine and marine nearshore areas, the inshore extent is defined by the line of extreme high water. The proposed offshore extent of critical habitat for marine nearshore areas is to the depth of 30 meters (98 feet) relative to mean lower low water (MLLW; average of all the lower low water heights of the two daily tidal levels), and area that "generally coincides with the maximum depth of the photic zone in Puget Sound."

### Biology and Distribution

Puget Sound Chinook salmon exhibit two life history types: ocean-type and stream-type. The most common life history in Puget Sound is ocean-type. Ocean-type Chinook can be over 70 millimeters (mm) long when they reach estuaries in late spring. These fish are capable of moving offshore very soon after migrating from the river. However, Chinook longer than 70 mm are captured along estuarine and marine shorelines. Sampling has been conducted for juvenile Chinook in saltwater near the mouths of the major rivers on the east side of Puget Sound (Tyler 1964; Tyler and Bevan 1964; Stober and Salo 1973; Weitkamp and Schadt 1982; Congleton et al. 1982). Ocean-type Chinook were captured near these river mouths from March through June in high numbers, with much smaller catches occurring through the summer.

Puget Sound is a migratory corridor for adult Chinook salmon and provides habitat for out-migrating juvenile Chinook salmon from rivers into Puget Sound before their eventual oceanic phase as adults.

Adults typically spawn in the mainstems and larger tributaries of Puget Sound. Spawning preferences include clean gravel riffles with moderate water velocity and mainstem and lower reaches of tributaries (WDF 1992). Adult spring-run Chinook typically return to freshwater in April and May and spawn in August and September. Adults migrate to the upper portions of their natal streams and hold until they reach maturity. Summer-run Chinook migrate to freshwater in June and July, and spawn in September. Summer/fall run (the most common in Puget Sound) begin freshwater migration in August and spawn from late September through January (Myers et al. 1998).

Recent studies on Chinook salmon use of Puget Sound have found that juveniles begin migrating into estuaries and the nearshore in late January and early February, with peak migration into the Sound occurring in June and July. Juvenile Chinook are found along the nearshore through October and may utilize the nearshore year-round.

Adults could be present in deeper offshore waters year round. The greatest abundance of adults would occur between early summer and early fall as they return from the ocean to natal streams and rivers.

#### *Prey*

The harvest of salmonid prey species (e.g., forage fishes such as herring, anchovy, and sardines) may present another potential habitat-related management activity. Chinook salmon feed primarily on forage fishes.

Juvenile Chinook salmon in Pacific Northwest estuaries primarily feed on chironomids (order: *Diptera*, family: *Chironomidae*), yet also consume additional larvae, pupae, and adult forms of other Insecta. Annelids, crustaceans, arachnids, playhelminthes, gastropoda, rotifera, and osteicthyes are also part of the juvenile Chinook diet (Levy et al. 1979; Levings et al. 1991). Chinook fry also feed on forage fish eggs in large aggregations along protected shorelines, thus generating a base of prey for the migrating salmon fry.

### Puget Sound Steelhead (*Oncorhynchus mykiss*)

#### *Status*

Puget Sound steelhead were listed as threatened on May 11, 2007 (Federal Register 2007).

#### *Critical Habitat*

Critical habitat for steelhead was designated in 2016; no WSF facilities are within proposed steelhead critical habitat (Federal Register 2016.) 78 FR2725.

#### *Biology and Distribution*

The present spawning distribution of steelhead extends from the Kamchatka Peninsula in Asia, east through Alaska, and south to southern California. The historical range of steelhead extended at least as far south as the Mexico border (Busby et al. 1996). Anadromous forms of *O. mykiss* are called steelhead, and non-anadromous forms (fresh water resident forms) are called rainbow trout.

Steelhead exhibits perhaps the greatest diversity of life history patterns of any Pacific salmonid species (Barnhart 1986). Individuals rear in freshwater between 1 and 4 years and remain at sea between 1 and 4 years (Meehan and Bjornn 1991). Other sources indicate that steelhead can spend up to 7 years in fresh water prior to smoltification and then spend up to 3 years in salt water prior to first spawning (Busby et al. 1996). In the Pacific Northwest, steelhead that enter freshwater systems between May and October are considered summer steelhead (stream-maturing type) and steelhead that enter fresh water between November and April are considered winter steelhead (ocean-maturing type). Summer steelhead enter fresh water in a sexually immature condition and require several months to mature and spawn; whereas, winter steelhead enter fresh water with well-developed gonads and spawn shortly thereafter. Some river basins have both summer and winter runs, but some rivers only have one type. In rivers where the two types co-occur, they are often separated by a seasonal hydraulic barrier, such as a waterfall.

Unlike the five Pacific salmon species, steelhead are iteroparous; they do not invariably die after spawning. Some significant post-spawning mortality occurs; however, a small number of steelhead adults migrate out of the river after spawning and return to spawn in subsequent years (Busby et al. 1996). The frequency of multiple spawnings is variable both within and among populations of steelhead. For North American steelhead populations north of Oregon, repeat spawning is relatively uncommon, and more than two spawning migrations are rare. In Oregon and California, the frequency of two spawning migrations is higher, but more than two spawning migrations are still unusual. Iteroparous steelhead are predominately female.

Generally, juvenile steelhead out-migrate from freshwater between mid-March and early June. Juvenile steelhead enter marine waters at a much larger size and have a higher rate of survival than other salmonid species. The majority of steelhead smolts appear to migrate directly to the open ocean and do not rear extensively in the estuarine or coastal environments (Burgner et al. 1992).

Recent sampling in the Puget Sound nearshore supports the general life history model that juvenile steelhead use of the nearshore is very limited. Available data from townet sampling (deeper nearshore) and beach seine sampling (shallow nearshore) efforts around Puget Sound have reported the capture of few steelhead. In townet sampling in North and South Puget Sound, NMFS captured a total of 18 steelhead (Rice unpublished data). The total sampling effort was not available, but the mean steelhead catch ranged from 0 to 0.2 per net in North Puget Sound and 0.1 to 0.8 per net in South Puget Sound. Beach seine sampling in Bellingham Bay (North Puget Sound) also captured few steelhead (Lummi Nation unpublished data). The Bellingham Bay research reported the capture of two juvenile steelhead salmon in 336 sets between February 14 and December 1, 2003. The steelhead were captured in the eastern portion of Bellingham Bay near the Taylor Avenue Dock on June 12 and June 25.

Steelhead were also infrequently captured in a beach seine study around Bainbridge Island (City of Bainbridge Island, Suquamish Tribe, and WDFW 2005). The study consisted of 271 beach seine sets conducted between April and September 2002 and between April 2003 and December 2004. Three steelhead were captured in the study; one was captured in May and two were captured in September. The steelhead were 179, 280, and 300 mm in total length. One of the three steelhead had been fin clipped, indicating it was of hatchery origin.

#### *Prey*

Juvenile steelhead eat invertebrates: crustaceans and insects, such as mayflies, caddis flies, and black flies. Steelhead will also eat salmon eggs when available. Adults at sea feed primarily on fish, squid, and amphipods.

### Hood Canal Summer Chum Salmon (*Oncorhynchus keta*)

#### *Status*

Hood Canal summer-run chum salmon were listed as threatened on August 2, 1999 (64 Fed Reg 41835-41839).

#### *Critical Habitat*

Critical habitat was designated for Hood Canal chum salmon on February 2, 2000 (Federal Register 2000).

### *Biology and Distribution*

A total of 11 streams that are tributaries to the Hood Canal have been identified as recently having indigenous summer chum populations (WDFW 2006a).

Summer chum salmon are the earliest returning chum salmon stock in the Hood Canal and Strait of Juan de Fuca region. Spawning occurs from late August to late October, generally within the lowest 1 to 2 miles of the streams. Eggs and alevins develop in the redds for approximately 18 to 20 weeks before emerging as fry between February and the last week of May (WDFW 2006a).

In Puget Sound, chum fry have been observed through annual estuarine area fry surveys to reside for their first few weeks in the top 2 to 3 centimeters of surface waters and extremely close to the shoreline. Chum fry maintain a nearshore distribution until they reach a size of about 45 to 50 mm, at which time they move to deeper offshore areas (NMFS 1999).

Summer chum entering the estuary are thought to immediately commence migration seaward. After 2 to 4 years of rearing in the northeast Pacific Ocean, maturing Puget Sound-origin chum salmon follow a southerly migration path parallel to the coastlines of southeast Alaska and British Columbia. Summer chum mature primarily at 3 and 4 years of age with low numbers returning at age 5. They enter the Strait of Juan de Fuca from the first week of July through September and the Hood Canal terminal marine area from early August through the end of September. Summer chum adults may mill in front of their stream of origin for up to 12 days before entering freshwater to spawn (WDFW 2006a).

### *Prey*

Chum salmon feed on insects as they migrate downriver and on insects and marine invertebrates in estuaries and nearshore marine habitats. As adults in the ocean, they eat copepods, fishes, mollusks, squid, and tunicates.

## Humpback Whale (*Megaptera novaeangliae*)

### *Status*

Humpback whales were listed as endangered on June 2, 1970 (Federal 1970). In 2016, NMFS revised the ESA listing for the humpback whale to identify 14 Distinct Population Segments, and listed one as threatened, four as endangered, and nine others as not warranted for listing (Federal Register 2016b). When a humpback whale is sighted in Washington inland waters (Puget Sound, Strait of Juan de Fuca, San Juan Islands) it is 43% likely to be from the unlisted Hawaii Distinct Population Segment (DPS), 42% likely to be from the threatened Mexico DPS, and 15% likely to be from the endangered Central American DPS (NMFS 2016).

### *Critical Habitat*

Critical habitat has not been designated for humpback whales.

### *Biology and Distribution*

Major humpback whale breeding and calving areas are in Mexican and Hawaiian waters. Humpback whales migrate to Alaska during the summer to feed. The Washington coast is a corridor for their annual migration north to feeding grounds and south to breeding grounds. Feeding groups of up to five whales have been documented on Juan de Fuca Bank and La Perouse Bank in summer (Osborne et al. 1998). Sightings of humpbacks in Puget Sound are infrequent; however, reported sightings have been increasing since the late 1990s. Until the late 1990s, sighting of humpback whales in Puget Sound occurred approximately once every 2 years (Calambokidis 1998). However, since 2001 there have been several Puget Sound humpback whale sightings reported through the Orca Network annually. The increase in sightings is likely due to increased local awareness and the establishment of sighting networks such as the Orca Network where residents can easily report whale sightings.

Humpbacks in Puget Sound are typically sighted as single individuals. An exception occurred in 1988 when two juvenile whales were reported in south Puget Sound (Calambokidis and Steiger 1990).

Cascadia Research Collective has been studying humpback whales along the US West Coast since 1986. In the early 2000s, increasing numbers of humpback whales were sighted in Washington inland waters (Figure B-1) (CRC 2017).

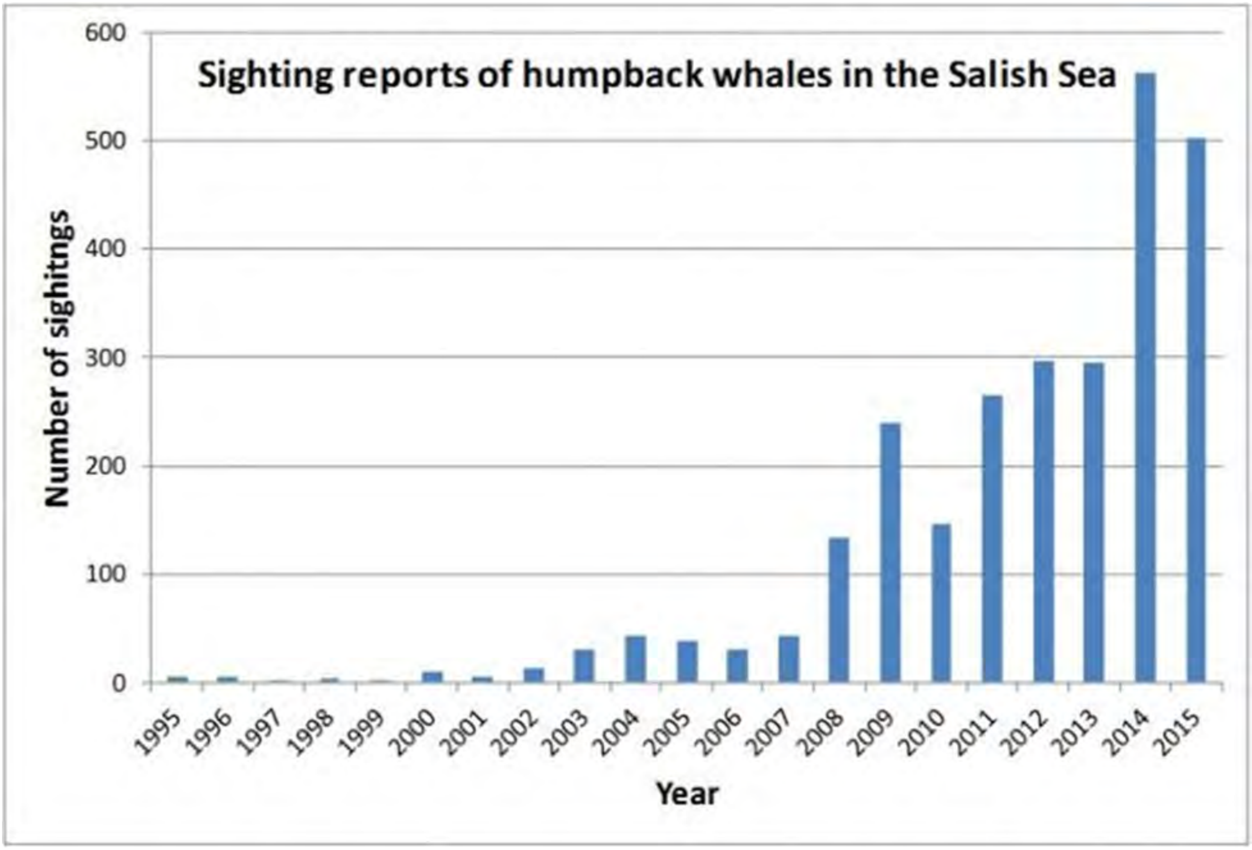


**Figure B-1. Humpback Sightings by Year**

### *Prey*

Humpback whales forage either at or below the water surface. Humpback whales feed on benthic and pelagic organisms including euphausiids, copepods, and other crustacean zooplankton; small schooling fish such as sand lance and herring; and salmonids, pollock, capelin, and some cephalopod mollusks (Perry et al. 1999). Simenstad et al. (1979) listed four species of euphausiids and four species of small schooling fish found in stomachs of humpback whales taken in the eastern North Pacific Ocean.

The most significant prey item for humpback whales in Puget Sound is herring (American Cetacean Society 2009). A large herring holding area exists in the south Sound near the southern tip of Vashon Island (WDFW 2005c). Herring spawn on macroalgae, mainly eelgrass and kelp (WDFW 2005c).

Documented forage fish (prey species) spawning beaches are present at nine WSF facilities. Eelgrass and/or kelp that provide forge fish egg spawning habitat are present at 11 WSF facilities (Table B-1).

| Facility | Documented Prey Species Spawning[1] | Eelgrass/Kelp Presence[2] |
|---|---|---|
| Anacortes | **Surf Smelt** | **Eelgrass** |
| Bainbridge | **Surf Smelt** | |
| Bremerton | | |
| Clinton | **Surf Smelt** | **Eelgrass** |
| Coupeville | | |
| Eagle Harbor | | |
| Edmonds | | **Eelgrass/Kelp** |
| Fauntleroy | **Sand Lance** | **Eelgrass** |
| Friday Harbor | | **Eelgrass** |
| Kingston | | **Eelgrass** |
| Lopez | **Surf Smelt** | |
| Mukilteo | **Sand Lance** | **Eelgrass** |
| Orcas | | **Eelgrass** |
| Point Defiance | | |
| Port Townsend | **Surf Smelt** | **Eelgrass** |
| Seattle | | |
| Shaw | | |
| Southworth | **Surf Smelt** | **Eelgrass** |
| Tahlequah | | **Eelgrass** |
| Vashon | **Surf Smelt** | **Eelgrass** |

**Table B-1. Humpback Prey Species Presence**

## Southern Resident Killer Whale (*Orcinus orca*)

### *Status*

The Southern Resident DPS of killer whales was listed as endangered on February 16, 2005 (Federal Register 2005b).

### *Critical Habitat*

Critical habitat was designated for Southern Resident killer whales on November 29, 2006 (Federal Register 2006). Three specific areas are designated: the Summer Core Area in Haro Strait and waters around the San Juan Islands, Puget Sound, and the Strait of Juan de Fuca. Areas with water less than 20 feet deep relative to the extreme high water mark are not included in the critical habitat designation (Federal Register 2006).

NMFS has identified physical and biological PCEs essential for the conservation of the species that require special management considerations or protection. Based on the natural history of the Southern Residents and their habitat needs, NMFS has identified the following three PCEs for proposed critical habitat:

1. Water quality to support growth and development
2. Prey species of sufficient quantity, quality, and availability to support growth, reproduction, and development as well as overall population growth
3. Passage conditions to allow for migration resting and foraging

### *Biology and Distribution*

Killer whales in the Eastern North Pacific region are categorized as resident, transient, or offshore whales. Residents in the North Pacific are further classified into Northern, Southern, Southern Alaska, and Western North Pacific groups. The Southern Resident killer whale group has been established as a DPS and a stock under the Marine Mammal Protection Act of 1972; this group contains the pods, or groups, of J pod, K pod, and L pod, and was estimated to include approximately 90 individuals in 2006 (Center for Whale Research 2006).

The geographic distribution of Southern Resident killer whales is year-round in the coastal waters off Oregon, Washington, Vancouver Island, and off the coast of central California and the Queen Charlotte Islands (Center for Biological Diversity 2001). In the summer, Southern Residents are typically found in the Georgia Strait, Strait of Juan de Fuca, and the outer coastal waters of the continental shelf. In the fall, the J pod migrates into Puget Sound, while the rest of the population makes extended trips through the Strait of Juan de Fuca. In the winter, the K and L pods retreat from inland waters and are seldom detected in the core areas until late spring. The J pod generally remains in inland waterways throughout the winter, with most of their activity in Puget Sound. Other winter movements and ranges of Southern Residents are not well understood.

Killer whales use the entire water column, including regular access to the ocean surface to breathe and rest (Bateson 1974; Herman 1991). They remain underwater 95 percent of the time, with 60 to 70 percent of their time spent between the surface and a depth of 20 meters, while diving regularly to depths of over 200 meters (Baird 1994; Baird et al. 1998). Southern Residents spend less than 5 percent of their time between depths of 60 and 250 meters (Center for Biological Diversity 2001). Time-depth recorder tagging studies of Southern Residents have documented that whales regularly dive to greater than 150 meters. In recent years, however, there has been a trend toward a greater frequency of shallower dives (Baird and Hanson 2004).

### *Prey*

Residents tend to feed primarily on fish, whereas transients prey on other marine mammals (Morton 1990). Southern Residents primarily feed upon salmon species (Balcomb et al. 1980; Bigg et al. 1987). Chinook salmon dominate their diet, making up 78 percent of identified prey. Chum salmon (11 percent) are also a significant prey source especially in autumn. Other species eaten include coho salmon (5 percent), steelhead (2 percent), sockeye salmon (1 percent), and non-salmonids such as herring and rockfish (3 percent combined) (several sources *cited in* NMFS 2008a).

## Southern DPS North American Green Sturgeon (*Acipenser medirostris*)

### *Status*

The Southern DPS of green sturgeon was listed as threatened on April 7, 2006 (Federal Register 2006b).

### *Critical Habitat*

On October 9, 2009, NMFS designated critical habitat for the Southern DPS of green sturgeon (Federal Register 2009). In this designation, NMFS identified the following areas as critical habitat in Washington:

- Nearshore marine areas comprising coastal waters within 361 feet (110 meters) depth from the Columbia River estuary north to the Washington/Canada border, and the Washington waters of the Strait of Juan de Fuca
- Estuarine areas of comprising the Columbia River estuary (includes all tidally influenced areas of the Columbia River downstream of Bonneville Dam)
- Willapa Bay and Grays Harbor, Washington

PCEs of critical habitat are areas containing the physical and biological habitat features essential for the conservation of the species and that may require special management considerations or protection. PCEs may include, but are not limited to, the following: spawning site, feeding sites, seasonal wetland or dryland, water quality or quantity, geological formation, vegetation type, tide, and specific soil types. Only areas that contain one or more PCEs are, by definition, critical habitat. The different systems occupied by green sturgeon at specific stages of their life cycle serve distinct purposes and thus may contain different PCEs.

Based on the best available scientific information, NMFS identified PCEs for freshwater riverine systems, estuarine areas, and coastal marine waters. However, freshwater riverine systems in Washington are not designated as critical habitat. The PCEs for estuarine areas and nearshore marine waters are summarized below. The PCEs for freshwater riverine systems were excluded since no freshwater riverine systems were included in the critical habitat for Washington. Each specific area must contain at least one of the PCEs to be considered for critical habitat designation. These PCEs are described in detail beginning on page 52088 of the Federal Register (Federal Register 2009).

Estuarine Areas

2. **Food Resources** – Abundant prey items within estuarine habitats and substrates for juvenile, subadult, and adult life stages
3. **Water Quality** – Water quality, including temperature, salinity, oxygen content, and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages
4. **Migratory Corridor** – A migratory pathway necessary for the safe and timely passage of Southern DPS fish within estuarine habitats and between estuarine and riverine or marine habitats
5. **Water Depth** – A diversity of depths necessary for shelter, foraging, and migration of juvenile, subadult, and adult life stages (based on studies described on page 52089 of 73 FR 52084), shallow depths of less than 10 m for adults and subadults; and shallow waters of 1 to 3 m for juveniles)
6. **Sediment Quality** – Sediment quality (i.e., chemical characteristics) necessary for normal behavior, growth, and viability of all life stages

Nearshore Marine Waters

1. **Migratory Corridor** – *A migratory pathway necessary for the safe and timely passage of Southern DPS fish within marine* habitats *and between* estuarine and marine habitats
7. **Water Quality** – *Coastal marine waters with adequate dissolved oxygen levels and acceptably low levels of contamin*ants
8. **Food Resources** – *Abundant prey items for subadults and adults, which may include ben*thic invertebrates and fishes

### Biology and Distribution

The Southern DPS of green sturgeon spawns in the Sacramento River (Adams et al. 2002) and is found along the west coasts of Mexico, the United States, and Canada. They are known to enter Washington estuaries during summer when estuary water temperatures are more than 2°C warmer than adjacent coastal water (Moser and Lindley 2007).

Green sturgeon are anadromous, and when not spawning, spend the majority of their lives in oceanic waters, bays, and estuaries. Early life-history stages reside in freshwater, with adults returning to freshwater to spawn. Spawning is believed to occur every 2 to 5 years (Moyle 2002). Adults typically migrate into freshwater beginning in late February; spawning occurs from March to July, with peak activity from April to June (Moyle et al. 1995). Juvenile green sturgeon spend 1 to 4 years in fresh and estuarine waters before dispersal to saltwater (Beamesderfer and Webb 2002). Juvenile green sturgeon can completely transition from fresh and estuarine waters to salt water by around 1.5 years in age (Allen and Cech 2007, as cited in NMFS 2008c). They disperse widely in the ocean after their out-migration from freshwater (Moyle et al. 1992).

Subadult male and female green sturgeon spend approximately 6 and 10 years at sea, respectively, before reaching reproductive maturity and returning to freshwater to spawn for the first time (Nakamoto et al. 1995, as cited in NMFS 2008c). Adults spend 2 to 4 years at sea between spawning events (Moyle 2002; Lindley and Moser, NMFS, pers. comm. 2008, cited inFederal Register 2005cand NMFS 2008c; Erickson and Webb 2007, as cited in NMFS 2008c), and spend up to 6 months in freshwater during their spawning migration. Upstream migrations begin in February, and the spawning period occurs from March to July and peaks in mid-April to mid-June (Moyle et al. 1992). Spawning habitat includes deep pools or "holes" in large, turbulent freshwater mainstems (Moyle et al. 1992). Eggs are likely broadcast over large cobble substrates, but substrates may range from clean sand to bedrock (Moyle et al. 1995).

Observations of green sturgeon in the Puget Sound region are much less common compared to coastal estuaries in Washington such as the Columbia River estuary, Grays Harbor, and Willapa Bay. In addition, Puget Sound does not appear to be part of the coastal migratory corridor that Southern DPS fish use to reach overwintering grounds north of Vancouver Island (pers. comm. with Steve Lindley, NMFS, and Mary Moser, *as cited in* Federal Register 2009). There are no green sturgeon concentrations or spawning areas in Puget Sound.

NMFS reviewed green sturgeon acoustic detection data from 2002-2019 in Puget Sound and the Strait of Juan de Fuca. From 2002-2008, 350 tagged green sturgeon were at large (67% from the threatened southern DPS). During this time, 17 were detected in Puget Sound (4 from the southern DPS). After 2008, none were detected in central or southern Puget Sound, though 400 were at large (83% southern DPS). From 2013-2018, six (one from the southern DPS) were detected in Admiralty Inlet (northern Puget Sound).

From 2004-2019, 210 green sturgeon were detected in the Strait of Juan de Fuca (71% southern DPS). This indicates that the strait is used as a corridor, with green sturgeon residing at detection sites for short periods as they pass through from open ocean. Few of these fish were detected afterwards in Admiralty Inlet, suggesting that most of the tagged population move northward into the Strait of Georgia after transiting the strait. Data indicates conclusively that green sturgeon from the southern DPS occur in Puget Sound and Admiralty inlet, but at low rates compared to Strait of Juan de Fuca presence. This confirms earlier findings that Puget Sound is of lower conservation value to southern DPS green sturgeon. However, it is noted that the tagged population is a small fraction of the whole green sturgeon population, and that conditions need to be optimum for acoustic detection to occur (Moser, et. al. 2021).

#### *Prey*

Data from the Sacramento-San Joaquin delta showed that adults fed on benthic invertebrates including shrimp, mollusks, amphipods, and small fish (Moyle et al. 1992). Adult and subadult green sturgeon in the Columbia River estuary, Willapa Bay, and Grays Harbor feed on crangonid shrimp, burrowing thalassinidean shrimp (primarily the burrowing ghost shrimp *Neotrypaea californiensis*), amphipods, clams, juvenile Dungeness crab (*Cancer magister*), anchovies, sand lance (*Ammodytes hexapterus*), lingcod (*Ophiodon elongatus*), and other unidentified fish species (as cited in NMFS 2008c: Foley, unpublished data cited in Moyle et al. 1995; Tracy, cited in Moyle et al. 1995; Langness, pers. comm., cited in Moser and Lindley 2007; Dumbauld et al. 2008).

## Pacific Eulachon (*Thaleichthys pacificus*)

### *Status*

The Southern DPS of Pacific eulachon was listed as threatened on March 18, 2010 (Federal Register 2010b).

### *Critical Habitat*

Pacific eulachon critical habitat has been designated, but none is located near any of the WSF facilities (Federal Register 2011).

### *Biology and Distribution*

Eulachon (also called Columbia River smelt, candlefish, or hooligan) are a member of the osmerid family (smelts) and are endemic to the northeastern Pacific Ocean, ranging from northern California to southwest and south-central Alaska and into the southeastern Bering Sea. The ESA-listed Southern DPS of Eulachon occurs in the California Current and spawns in rivers ranging from the Mad River in California to the Skeena River in northern British Columbia, Canada. (NMFS 2022). Within this range, major production areas or “core populations” for this species include the Columbia River and Frasier River.

The Columbia River and its tributaries support the largest known eulachon run in the world (Gustafson et al. 2008). Within the Columbia River Basin, the major and most consistent spawning runs return to the mainstem of the Columbia River (from just upstream of the estuary, river mile (RM) 25, to immediately downstream of Bonneville Dam, RM 146, and the Cowlitz, Grays, Kalama and Lewis Rivers. Table B-1 contains a list and classification of all known eulachon spawning areas in Washington, based on the 2008 Eulachon Status Review (Gustafson et al. 2008).

**Table B-1**
**Eulachon Spawning and Estuarine Areas in Washington**

| Eulachon Spawning Areas | Spawning Regularity[1] | Estuary |
|---|---|---|
| Columbia River Mainstem | Regular | Columbia River |
| Grays River | Regular | Columbia River |
| Skamokawa Creek | Rare | Columbia River |
| Elochoman River | Irregular | Columbia River |
| Cowlitz River | Regular | Columbia River |
| Toutle River | Rare | Columbia River |
| Kalama River | Regular | Columbia River |
| Lewis River | Regular | Columbia River |
| Washougal River | Rare | Columbia River |
| Klickitat River | Anecdotal | Columbia River |
| Bear River | Occasional | Willapa Bay |
| Naselle River | Occasional | Willapa Bay |
| Nemah River | Rare | Willapa Bay |
| Wynoochie River | Rare | Grays Harbor |
| Quinault River | Occasional | Coast |
| Queets River | Occasional | Coast |
| Quillayute River | Rare | Coast |
| Elwha River | Occasional | Juan de Fuca |
| Puyallup River | Rare | Puget Sound |

**Notes:**
Table from Gustafson et al. 2008
1 **Regular –** occurring yearly or in most years
**Rare, Irregular, Anecdotal, Occasional –** sporadic, infrequent occurrence, does not occur every year and may not occur in most years, especially those rivers with a spawning regularity of "rare." Eulachon are described as "common" in Grays Harbor and Willapa Bay on the Washington coast, and "abundant" in the Columbia River (Gustafson *et al.* 2008).

Eulachon typically spend 3 to 5 years in saltwater before returning to fresh water to spawn from late winter through early summer. River entry and spawning begin as early as December and January in the Columbia River Basin, and last through May with peak entry and spawning during February and March (see Table B-2; WDFW and ODFW 2002; Gustafson et al. 2008; Shaffer et al. 2007). Entry into the spawning rivers appears to be related to water temperature and the occurrence of high tides (Ricker et al. 1954; Smith and Saalfeld 1955; Spangler 2002), although eulachon have been observed ascending well beyond tidally influenced areas (Wilson et al. 2006; Lewis et al. 2002).

Spawning grounds are typically in the lower reaches of larger rivers fed by snowmelt (Hay and McCarter 2000). Spawning typically occurs at night. Spawning occurs at temperatures from 4 degrees to 10 degrees Celsius in the Columbia River and tributaries (WDFW and ODFW 2002). In the Cowlitz River, spawning generally occurs at

**Table B-2**
**Range and Peak Timing of Documented Washington River-entry and/or Spawn-timing for Eulachon**

| Basin | Source | December | January | February | March | April | May |
|---|---|---|---|---|---|---|---|
| **Columbia Basin** | | | | | | | |
| Columbia River | 1 | | | | | | |
| Cowlitz River, WA | 1 | | | | | | |
| **Juan de Fuca** | | | | | | | |
| Elwha River, WA | 2 | | | | | | |

**Notes:**
Gray shading = range
Black shading = peak
Table from Gustafson et al. 2008
1 WDFW and ODFW 2002
2 Shaffer et al. 2007

temperatures from 4 degrees to 7 degrees Celsius (Smith and Saalfeld 1955). Eulachon broadcast spawn over sand, coarse gravel, or detrital substrates. Preferred spawning habitat consists of coarse, sandy substrates (WDFW and ODFW 2002).

Eggs are fertilized in the water column, sink, and adhere to the river bottom typically in areas of gravel and coarse sand. Approximately 7,000 to 31,000 eggs are laid, depending on the size of the female (WDFW and ODFW 2002). Eggs are spherical and 1 mm in diameter (WDFW and ODFW 2002). Eulachon eggs hatch in 20 to 40 days, with incubation time dependent on water temperature. Within days of hatching, the larvae, ranging from 4 to 8 mm in length, are rapidly carried downstream and dispersed by estuarine and ocean currents. Eulachon larvae are found in the scattering layer of nearshore marine areas when they reach the sea (Morrow 1980). Juveniles rear in nearshore marine areas at moderate or shallow depths, and acquire lengths of 46 to 51 mm within 8 months (Barraclough 1964). As eulachon grow, they migrate out to deeper water depths and have been found as deep as 625 m (Allen and Smith 1988). Adult eulachon range in size from 14 to 30 cm and return to freshwater to spawn at 3 to 5 years of age, with the majority of adults returning as 3-year-olds (WDFW and ODFW 2002). Although adults can repeatedly spawn, most die shortly after spawning (WDFW and ODFW 2002).

Similar to salmon, juvenile eulachon are thought to imprint on the chemical signature of their natal river basins. However, juvenile eulachon spend less time in freshwater environments than do juvenile salmon. Researchers believe that this short freshwater residence time may cause returning eulachon to stray more from their natal spawning sites than salmon (Hay and McCarter 2000). This short freshwater residence time may result from the spawning grounds occurring in snowmelt-fed rivers that have a pronounced peak freshet in the spring, rapidly flushing eggs and larvae out of the spawning river reach. As such, eulachon may tend to imprint and hone in on the larger local estuary rather than to individual spawning rivers (Hay and McCarter 2000). Adults and juveniles commonly forage at moderate depths (15 to 182 m) in inshore waters (Hay and McCarter 2000). Eulachon are very important to the Pacific coastal food web due to their availability during spawning runs and their high lipid content. Avian predators include harlequin ducks, pigeon guillemots, common murres, mergansers, cormorants, gulls, and eagles. Marine mammal predators include baleen whales, orcas, dolphins, pinnipeds, and beluga whales. Fish that feed on eulachon include white sturgeon, spiny dogfish, sablefish, salmon sharks, arrowtooth flounder, salmon, Dolly Varden, Pacific halibut, and Pacific cod. Eulachon and their eggs provide a significant food source for white sturgeon in the Columbia River.

A monthly bottom trawl study was funded by Fisheries and Oceans Canada's National Rotational Survey Fund from October 2017 to June 2018 to sample Eulachon in three regional strata in Juan de Fuca Strait and the Strait of Georgia. The goal of this study was to gain insights into the biology, distribution, and migration timing of Eulachon to the Fraser River by observing their spatial and temporal occurrence and biological condition over a wide survey region and over a series of months. Eulachon catch per unit effort (CPUE), size distributions, sex ratios, and maturity observations varied over time and space, as did the occurrence of stomach contents and presence/absence of teeth. Highest catches of Eulachon occurred in Juan de Fuca and lowest near the Fraser River. Mean catch rates at sites near the Fraser River plume corresponded with expected peak spawning periods in the Fraser River. The sex ratio of Eulachon sampled throughout the study region in all months was approximately 1:1 although most samples in the Strait of Georgia in May and June were female. The presence of Eulachon with maturing gonads increased in frequency from west to east in January to April before sharply decreasing throughout the survey region in May and June. Stomach contents and teeth decreased in frequency with proximity to the Fraser River.

Trends in CPUE, fish length, presence of teeth, and stomach contents demonstrate that Juan de Fuca Strait likely provides an important year-round marine habitat for Eulachon feeding and growth as well as being a migration corridor to and from the west coast of Vancouver Island, which offers a large range of additional Eulachon habitat for foraging, growth habitat and mixing of stocks (Dealy et. al., 2019).

#### *Prey*

Eulachon feed on zooplankton, primarily eating crustaceans such as copepods and euphausiids, including *Thysanoessa* spp. (Barraclough 1964; Hay and McCarter 2000), unidentified malacostraceans (Sturdevant et al. 1999), and cumaceans (Smith and Saalfeld 1955). Eulachon larvae and post-larvae eat phytoplankton, copepods, copepod eggs, mysids, barnacle larvae, worm larvae, and eulachon larvae (WDFW and ODFW 2002).

### Bocaccio Rockfish (*Sebastes paucispinus*)

#### *Status*

The Georgia Basin DPS of bocaccio rockfish was listed as endangered on April 28, 2010 (Federal Register 2010c).

#### *Critical Habitat*

Critical habitat for bocaccio rockfish was designated in 2015. All WSF facilities are within rockfish nearshore (less than or equal to 98 feet in depth) critical habitat (Federal Register 2015).

### Biology and Distribution

Bocaccio are large piscivorous rockfish (of the scorpaenid family) ranging in eastern Pacific coastal waters from Stepovac Bay, Alaska, to Punta Blanca, Baja California (NMFS 2008b; COSEWIC 2002). Bocaccio are most notably identified by a large jaw that extends often past the eye. They can range in color from olive orange to burnt orange or brown on the back. Bocaccio are one of the largest rockfish reaching up to 36 inches in length and living up to 55 years. Other names for bocaccio include rock salmon, salmon rockfish, Pacific red snapper, Pacific snapper, and Oregon snapper (Stanley et al. 2001). Most commonly, bocaccio are found from Oregon to California and were once common on steep walls of Puget Sound (Love et al. 2002). Genetic studies suggest that there are two DPSs of coastal bocaccio consisting of northern (north of the Oregon/California border) and southern (California south). However, based on the limited mobility and typical travel distance of rockfish species, it was determined that the Georgia Basin represented a third DPS for the species (NMFS 2008b).

Recreational catch data reported between the mid-1960s and the 1970s suggested that bocaccio were rare in Puget Sound proper (south of Admiralty Inlet) (NMFS 2008b). However, throughout the late 1970s, the Washington State Department of Fish and Wildlife (WDFW) Washington State Sport Catch Reports documented that 8 to 9 percent of catches included bocaccio. These reports were primarily (66 percent) in punch card area 13 (south of the Tacoma Narrows Bridge). Specifically, the reports indicated high abundance numbers of bocaccio at Point Defiance and the Tacoma Narrows for the years 1975 to 1986 (NMFS 2008b). Between 1996 and 2007, bocaccio were not documented in dockside surveys of recreational catches. WDFW catch reports and REEF surveys between 1994 and 2001 contain sporadic observations of bocaccio in Areas 5 (Seiku), 6 (Port Townsend/Port Angeles), 7 (Island County), and 11 (Tacoma and Vashon Island) (NMFS 2008b). REEF survey data for January 1996 through May 2009 indicates that bocaccio are identified in less than 0.1 percent of surveys and those observed were in the Tacoma area (REEF 2009). The latest records of bocaccio sightings in 2001 documented three observations of 2 to 10 fish in Area 13 (Tacoma Narrows south). In North Puget Sound and the Straight of Georgia, records and observations of bocaccio are rare, sparse, in isolated inlets, and often based on anecdotal reports (NMFS 2008b).

Male bocaccio are somewhat smaller than females and mature slightly earlier, between ages three and seven. Females typically mature between age four and eight (Wyllie Echeverria 1987). At maturity, males range from 16.5 to 21.6 inches (42 to 55 cm) in length, while females are 18.9 to 23.6 inches (48 to 60 cm). Maturity is reached at later ages in the northern populations of the species (NMFS 2008b). Bocaccio, as with all rockfish, are livebearers. Females produce 20,000 to 2,298,000 eggs annually. Copulation and fertilization generally occur in the fall between August and November (Table B-3). Embryonic development takes about 1 month. In Washington, the females release the larvae beginning in January through April, peaking in February (NMFS 2008b).

**Table B-3**
**Lifestage, Water Column, and Timing of Bocaccio in the Georgia Basin**

| Lifestage | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Copulation/Fertilization | | | | | | | | | | ■ | ░ | |
| Embryonic Development | | | | | | | | | | | | ■ |
| Larval Release | | ■ | ░ | ░ | | | | | | | | |
| Pelagic Juveniles | | | ░ | ░ | ░ | ░ | ░ | ░ | | | | |
| Settlement of Juveniles | | | | | | | | ■ | ■ | ░ | ░ | ░ |

**Notes:**
Table from NMFS 2008b
Gray shading = range
Black shading = peak

Larvae are 4.0 to 5.0 mm (less than 0.2 inch) long at release, generally well-developed, and have functional organs and the ability to swim and regulate buoyancy (NMFS 2008b). Larvae are highly dispersal and are generally associated with surface waters, significant patches of kelp, and drifting kelp mats (NMFS 2009). The larvae metamorphose into pelagic juveniles after 3.5 to 5.5 months (typically 155 days) and settle to shallow, algae covered rocky areas or eelgrass and sand over several months (Love et al. 1991). As the juveniles age into adulthood, the fish move into deeper waters where they are found on rocky reefs and near oil platforms. As juveniles age, they move into deeper waters. Tagging data indicates that juveniles will migrate as much as 92 miles (0.9 to 148 km) within 2 years of tagging (NMFS 2008b). However, once bocaccio reach adulthood, they settle and remain relatively localized as they age.

Bocaccio will make short forays outside home ranges or vertically in the water column to feed (COSEWIC 2002; NMFS 2008b). Adults are most commonly found in waters between 164 and 820 feet in depth, but can inhabit waters 39 to 1,568 feet deep (NMFS 2008b). Adults are very unlikely to occur within the immediate terminal areas because of ferry facility shallower depths (64 ft. MLLW maximum depth).

Although rockfish are generally associated with hard substrata, bocaccio are found in nearly all types of substrate. They are typically not associated with the bottom and tend to be more pelagic than other rockfish species (NMFS 2009). Adult bocaccio seem to be limited to certain areas in southern Puget Sound around the Tacoma Narrows and Point Defiance (NMFS 2009). Chinook salmon, terns, and harbor seals are known predators of bocaccio (Love et al. 2002).

#### *Prey*

The diet of the larval bocaccio consists of larval krill, diatoms, and dinoflagellates. Pelagic juveniles continue to be planktivores, eating fish larvae, copepods, krill, and other small prey. As adults, bocaccio are piscivorous and eat other rockfish, hake, sablefish, anchovies, lanternfish, and squid.

### Yelloweye Rockfish (*Sebastes ruberrimus*)

#### *Status*

The Georgia Basin DPS of yelloweye rockfish was listed as threatened on April 28, 2010 (Federal Register 2010c ).

#### *Critical Habitat*

Critical habitat for yelloweye rockfish was designated in 2015. All WSF facilities are within rockfish nearshore (less than or equal to 98 feet in depth) critical habitat (Federal Register 2015).

#### *Biology and Distribution*

Yelloweye rockfish are one of the longest lived in the scorpaenid family (rockfish), living up to 118 years (NMFS 2009). They are also one of the largest (up to 25 pounds) and most noticeable, given the bright yellow eyes and red-orange coloring. Yelloweye rockfish are also known by the common names rock cod, red snapper, rasphead rockfish, red cod, and turkey-red rockfish. This species ranges from northern Baja California to the Aleutian Islands in Alaska. Most commonly, yelloweye rockfish are found between central California and the Gulf of Alaska, but are rare in Puget Sound Proper (Table B-4), south of Admiralty Inlet (NMFS 2008b; Love et al. 2002). When observed, yelloweye rockfish are more frequently observed in north Puget Sound than in south Puget Sound (Miller and Borton 1980), likely due to the larger amount of rocky habitat in north Puget Sound.

**Table B-4**
**Observations and Distribution of Yelloweye Rockfish in Inland Washington Waters as Reported in REEF Surveys Between January 1996 and May 2009**

| Survey Area | Individual Sighting Frequency[1] | YOY Sighting Frequency[1] |
|---|---|---|
| Strait of Georgia | 10.7 | - |
| Texada Island (NE Georgia Strait) | 60 | - |
| Jervis Inlet (NE Georgia Strait) | 64.3 | - |
| Agamemnon Bay Area (N Georgia Strait) | 70 | - |
| Gulf Islands (N. of Orcas Island) | 23.8 | - |
| Pt Atkinson – Squamish (N. of Vancouver, BC) | 2.3 | - |
| Saanich Inlet (Eastern Vancouver Is.) | 2.3 | - |
| Moses Point/Albert Head, Victoria (W. Orcas Is) | 2.4 | - |
| Straight of Juan de Fuca | 1.9 | - |
| W. of Discovery Island and Cadboro Point | 2.3 | - |
| San Juan Islands | 1.5 | - |
| Orcas Island | 3.2 | - |
| Cypress Island | 2.7 | - |
| Decatur Island | 14.3 | - |
| Hood Canal | 1.4 | - |
| Dabob Bay | 1.4 | - |
| Quatsap Pt/Misery Pt – Potlatch State Park | 1.3 | - |
| Mt Vernon/Everett | 1.5 | - |
| Whidbey Island | 1.5 | - |
| Everett to Seattle | 0.5 | 0.2 |
| Edmonds | 0.5 | 0.2 |
| Seattle/Olympia | 0.1 | 0.1 |
| Vashon Island | 1.6 | - |
| Tacoma | - | 0.2 |
| Olympic Peninsula | 1.7 | - |
| Dungeness Bay to Kydaka Point | 1.0 | - |
| Kydaka Point - Cape Flattery | 2.5 | - |

Table from REEF 2009

1 Sighting frequency represents the percentage of surveys conducted that contained individuals of yelloweye rockfish. Individual = adults and juveniles combined. YOY = young of year only

Yelloweye rockfish are consistently observed throughout the Georgia Basin. However, significantly higher observation frequencies occur in north Puget Sound and the Georgia Strait within British Columbian waters (see Table B-4). REEF surveys indicate the further south in Puget Sound, the lower the potential for yelloweye rockfish presence or use, except around Decatur Island in the San Juan Islands where there is a spike in observations (REEF 2009). This is likely due to the fewer areas of rocky habitat in southern Puget Sound (Miller and Borton 1980).

Adults typically occupy waters deeper than 120 feet (Love et al., 2002). Adults are very unlikely to occur within the immediate terminal areas because of ferry facility shallower depths (64 ft. MLLW maximum depth).
General distribution occurs in the Georgia Strait and around the Gulf Islands in British Columbia (Yamanaka et al. 2006; NMFS 2008b; REEF 2009). Between 2000 and 2008, WDFW recreational catch surveys have documented a progressive decline in the number of yelloweye rockfish caught (WDFW 2009). In 2000, approximately 5,800 individuals were caught in recreational catches. By 2008, fewer than 1000 were recorded (WDFW 2009).

As with other rockfish species, juveniles are generally found in shallow waters and move deeper as they age. Juveniles are found throughout the life stage between 49 and 1,801 feet in depth (NMFS 2008b). As juveniles settle, they are found in high relief areas, crevices, and sponge gardens (NMFS 2009; Love et al. 1991). Adults are typically found at depths between 300 and 590 feet (NMFS 2008b). The adult yelloweye rockfish tend also toward rocky, high relief zones (NMFS 2009). The adults have very small home ranges, generally site attached and affiliated with caves, crevices, bases of rocky pinnacles, and boulder fields (Richards 1986). Adult yelloweye rockfish are rarely found in congregations, but are more commonly seen as solitary individuals (Love et al. 2002; PFMC 2003).

Males generally have slightly larger mean sizes than females, with both species topping out at approximately 35 inches (NMFS 2008b). Maturity in yelloweye rockfish is attained much later than some rockfish, between 15 and 20 years and as early as 7 years (NMFS 2008b). Sperm is stored in males for many months (September to April) prior to fertilization. Females can produce up to 300 eggs per gram of body weight, which totals between 1.2 and 2.7 million eggs per cycle (Hart 1973). In Puget Sound, eggs are fertilized between winter and summer months (NMFS 2009). Parturition occurs in Puget Sound in early spring through late summer. Although rockfish generally spawn once per year, there is some evidence that yelloweye rockfish in Puget Sound spawn up to twice per year (Washington et al. 1978). Larvae remain pelagic for 2 months or more and then begin to settle to deeper waters (NMFS 2008b). Although the specific larval duration is unknown, it is assumed to be similar to that of bocaccio or canary rockfish (116 to 155 days) (NMFS 2009). Settling size is slightly less than 1 inch. Presence timing for various rockfish life stages in the Georgia Basin is given in Table B-5.

**Table B-5**
**Lifestage, Water Column, and Timing of Yelloweye Rockfish in the Georgia Basin**

| Lifestage | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Copulation/Fertilization | | | | | | | | | | | | |
| Embryonic Development | | | | | | | | | | | | |
| Larval Release | | | | | | | | | | | | |
| Pelagic Juveniles | | | | | | | | | | | | |
| Settlement of Juveniles | | | | | | | | | | | | |

**Notes:**
Table from NMFS 2008b
Gray shading = range
Black shading = peak

Typical predators of yelloweye rockfish include salmon and orca (Love et al. 2002; NMFS 2009).

### *Prey*

Yelloweye rockfish have a diverse diet and are typically opportunistic feeders (NMFS 2008b). As larvae and juveniles, they typically eat larval krill, diatms, dinoflagellates, fish larvae, copepods, and krill. Prey size increases and diversifies as yelloweye rockfish age (due to their large size) to include small yelloweye rockfish, sand lance, gadids, flatfishes, shrimp, crabs, and gastropods.

## USFWS – Listed Threatened, Endangered, and Proposed Species

### Bull Trout (*Salvelinus confluentus*)

#### *Status*

Bull trout were listed as threatened on November 1, 1999 (Federal Register 1999ab).

#### *Critical Habitat*

On January 13, 2010, USFWS published the Final Rule for designating critical habitat for the Coastal-Puget Sound DPS of bull trout in the Federal Register (Federal Register 2010a).

Critical habitat designates areas that contain the physical and biological habitat features (called PCEs) essential for the conservation of a threatened or endangered species and that may require special management considerations. Areas providing at least one of the following nine PCEs are designated as critical habitat:

1. Springs, seeps, groundwater sources, and subsurface water connectivity (hyporehic flows) to contribute to water quality and quantity and provide thermal refugia.
2. Migratory 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.
3. An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.
4. Complex river, stream, lake, reservoir, and marine shoreline aquatic environments and processes with features such as large wood, side channels, pools, undercut banks and substrates to provide a variety of depths, gradients, velocities, and structure.
5. Water temperatures ranging from 2 to 15°C (36 to 59°F), with adequate thermal refugia available for temperatures at the upper end of this range.; specific temperatures within this range will vary depending on bull trout life-history stage and form, geography, elevation, diurnal and seasonal variation, shade such as that provided by riparian habitat, and local groundwater influence.

6. Substrates 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; a minimal amount (e.g., less than 12 percent) of fine substrate less than 0.85 mm (0.03 inches) in diameter and minimal embeddedness of these fines in larger substrates are characteristic of these conditions.
7. A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, minimal departures from a natural hydrograph.
8. Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.
9. Few or no nonnative predatory (e.g., lake trout, walleye, northern pike, smallmouth bass), inbreeding (e.g., brook trout), or competitive (e.g., brown trout) species present.

In marine nearshore areas, the inshore extent of critical habitat is the mean higher high water line (MHHW; average of all the higher high-water heights of the two daily tidal levels), including tidally influenced freshwater heads of estuaries. Adjacent shoreline riparian areas, bluffs, and uplands are not included in the critical habitat designation. The offshore extent of critical habitat for marine nearshore areas is to the depth of 33 feet (10 meters) relative to MLLW (average of all the lower low water heights of the two daily tidal levels), which is the average depth of the photic zone.

### *Biology and Distribution*

Bull trout are members of the char subgroup of the salmon family. Bull trout feed on terrestrial and aquatic insects and, as they grow in size, their diets include whitefish, sculpins, and other trout. Bull trout spawn from August through November when they reach maturity (between 4 and 7 years) and when temperatures begin to drop, in cold, clear streams. Bull trout can spawn repeatedly and can live over 20 years. Resident forms of bull trout spend their entire lives in freshwater, while anadromous forms live in tributary streams for 2 or 3 years before migrating to estuaries as smolts. Char species are generally longer-lived than salmon; bull trout up to 12 years old have been identified in Washington (Brown 1992).

In northern Puget Sound, bull trout occur in the Nooksack, Skagit, Stillaguamish, and Snohomish basins. Sub-adult and adult bull trout feed mostly on fish in marine/estuarine areas of northern Puget Sound (i.e., smelt, herring and juvenile salmonids). They are also believed to return to overwinter in lower mainstem rivers following their first summer in saltwater, before returning to saltwater the following spring (Kraemer 1994).

#### *Prey*

Bull trout are opportunistic feeders that prey on other organisms. Prey selection is primarily a function of size and life-history strategy. Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macro-zooplankton, and small fish. Adult migratory bull trout feed almost exclusively on other fish species (Federal Register 2010a).

### Marbled Murrelet (*Brachyramphus marmoratus marmoratus*)

#### *Status*

The marbled murrelet was listed as threatened on October 1, 1992 (Federal Register 1992).

#### *Critical Habitat*

The USFWS designated revised critical habitat for the marbled murrelet in 2011. Designated critical habitat includes old growth stands and other suitable nesting areas. No critical habitat has been designated near WSF ferry facilities (Federal Register 1996).

#### *Biology and Distribution*

Marbled murrelets are small seabirds that occur along the Pacific Coast from the Bering Sea to central California, with the largest population occurring in southeastern Alaska and northern British Columbia. Marbled murrelets feed in the nearshore marine environment, usually up to 350 to 2,000 feet off the shoreline. They forage year-round in waters generally less than 90 feet deep and are most frequently within 1,500 feet of protected shoreline waters. Marbled murrelets generally do not forage in shallow waters less than 30 feet deep.

Although marbled murrelets feed primarily on fish and invertebrates in nearshore marine waters, they fly inland to nest on large limbs of mature conifers. Most nesting habitat likely occurs within 50 miles of the marine environment (USFWS 1997). The nesting period is between April 1 and September 23, with peak activity occurring between July and August when adults are increasing foraging trips to feed their young. Old-growth or mature forest stands appear to be crucial for breeding and foraging, and most nests are in conifers over 150 years old, and in trees greater than 55 inches diameter at breast height (dBH). Most nests have been found on large flat conifer branches that are covered with thick moss (WDW 1991).

Murrelets undergo two periods of molting: one preceding (prealternate) and one following (prebasic) the molting season. The prealternate molt is incomplete and the birds retain their ability to fly, while the prebasic molt is comlete and renders them unable to fly for up to 2 months (Nelson 1997). Timing of molts varies year-to-year and by location, but in general, the prealternate molt occurs from late February to mid-May and the prebasic molt from mid-July through December (Carter and Stein 1995). In Washington, there is some evidence that the prebasic molt extends from mid-July through late August or as late as September (USFWS 2004a).

#### *Prey*

In the Pacific Northwest, marbled murrelets live near shore, feeding on fish, small crustaceans, and invertebrates. Marbled murrelets prefer to forage near kelp beds and at stream mouths, and feed on a variety of prey including sand lance, Pacific herring, and northern anchovy.

## REFERENCES

References for Appendix B are included in Section 5 of the BAR.

# APPENDIX C

# ESSENTIAL FISH HABITAT

# ESSENTIAL FISH HABITAT CONSULTATION

**Action Agency:** Washington State Ferries (WSF)

**Project Name:** WSF Capital, Repair, and Maintenance Projects

## Essential Fish Habitat Background

The Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 94-265), requires federal agencies to consult with National Marine Fisheries Service (NMFS) on activities that may adversely affect Essential Fish Habitat (EFH).

The objective of this EFH assessment is to determine whether or not the projects described in this Biological Assessment Reference (BAR) may adversely affect designated EFH for relevant federally managed commercial fisheries species within the proposed action area. This assessment describes Minimization Measures associated with the activities in this BAR used to avoid, minimize, or otherwise offset potential adverse effects to designated EFH resulting from the activities described in Chapter 2 of the BAR (Construction Methods).

## Description of the Proposed Action

This consultation covers capital, repair, and maintenance projects proposed by WSF. All WSF terminals are within Pacific groundfish, coastal pelagic, and Pacific salmon EFH. Coastal pelagic fish are primarily associated with the open-ocean and coastal areas and are not likely to occur near WSF terminals. WSF has found that the construction methods are similar for many types of projects and has described these methods in Chapter 2 of the BAR. Species of fish with designated EFH are listed in Table C-1.

## Potential Adverse Effects of Proposed Project

Specific adverse effects depend on the nature of the work being done. The majority of environmental effects of WSF projects are temporary, such as noise and turbidity. Permanent effects to habitat may occur as a result of installing in-water and over-water structures. A discussion of typical project effects is included in Chapter 3 of the BAR. Table C-2 lists potential effects to EFH and Minimization Measures proposed to offset the effects of those activities on EFH.

**Table C-1**
**Species of Fishes and Life-History Stages with Designated EFH in Puget Sound**

| Species | Adult | Spawning/ Mating | Juvenile | Larvae | Eggs/ Parturition |
|---|---|---|---|---|---|
| **Groundfish Species** | | | | | |
| Arrowtooth flounder | X | X | X | | |
| Big skate | X | X | X | | X |
| Black rockfish | X | | X | | |
| Bocaccio | | | ? | X | |
| Brown rockfish | X | ? | ? | X | |
| Butter sole | X | X | X | | |
| Cabezon | X | X | X | ? | X |
| California skate | X | | | | |
| Canary rockfish | ? | ? | X | | |
| China rockfish | X | | X | | |
| Copper rockfish | X | | X | ? | |
| Curlfin sole | X | | | | |
| Darkblotched rockfish | X | | X | | |
| Dover sole | X | X | X | | |
| English sole | X | X | X | X | X |
| Flathead sole | X | X | X | | |
| Greenstriped rockfish | | | | | |
| Kelp greenling | X | X | X | X | X |
| Lingcod | | | X | X | |
| Pacific cod | X | X | X | X | X |
| Pacific Ocean perch | X | | X | | |
| Pacific sanddab | | | | X | X |
| Pacific whiting (Hake) | | | X | | |
| Petrale sole | X | | X | | |
| Quillback rockfish | X | | X | ? | |
| Ratfish | X | | | | |
| Redbanded rockfish | X | | | | |
| Redstripe rockfish | ? | | | | |
| Rex sole | X | | | | ? |
| Rock sole | X | X | X | | |
| Rosethorn rockfish | X | | X | | |
| Rosy rockfish | ? | | | | |
| Rougheye rockfish | X | | ? | | |
| Sablefish | | | X | | |
| Sand sole | X | X | X | | |
| Sharpchin rockfish | X | | ? | | |
| Shortspine thornyhead | X | | X | | |
| Spiny dogfish | X | | X | | X |
| Splitnose rockfish | X | | X | | |
| Starry flounder | X | X | X | X | X |
| Stripetail rockfish | X | | | | |

| Species | Adult | Spawning/ Mating | Juvenile | Larvae | Eggs/ Parturition |
|---|---|---|---|---|---|
| Tiger rockfish | X | | X | | |
| Vermilion rockfish | X | ? | X | | |
| Yelloweye rockfish | X | | | | |
| **Pacific Salmon Species** | | | | | |
| Chinook salmon | X | | X | | |
| Coho salmon | X | | X | | |
| Puget Sound pink salmon | X | | X | | |
| **Coastal Pelagic Species** | | | | | |
| Northern anchovy | X | X | X | X | X |
| Pacific sardine | X | | | | |
| Pacific mackerel | X | | | | |
| Market squid | X | | | | |
| Northern anchovy | X | X | X | X | X |

5. **Notes:**
6. ? = uncertain, but attribute may apply to life stage
7. Table from NMFS website, http://www.nwr.noaa.gov/Groundfish-Halibut/Groundfish-Fishery-Management/Groundfish-EFH/Index.cfm

**Table C-2**
**Affected EFH by Project Element and Proposed Minimization Measures**

| Type of Work | Associated Effects | | | | |
|---|---|---|---|---|---|
| | Noise | Turbidity | Change in Over-Water Coverage | Other Potential Effects | Minimization Measures* |
| Pile removal | X | X | X | Water quality (resuspended contaminants) | A, B, C |
| Pile repair | | X | X | | A, B, C |
| Pile installation | X | X | X | Water quality (turbidity) | A, B, D |
| Rock anchors and Cast-in-place concrete | X | X | | Water quality (elevated pH) | A, B, D |
| New or replacement structures (and associated temporary structures) | X | | X | | A, B, D, E |
| Dredging | X | X | | Water quality (resuspended contaminants) | A, B |

**Note:**
* Letters correspond to general categories of Minimization Measures in the sections below.

### A. General Minimization Measures to Protect Water Quality

- All WSF construction is performed in accordance with the current WSDOT Standard Specifications for Road, Bridge, and Municipal Construction. Special Provisions contained in preservation and repair contracts are used in conjunction with, and supersede, any conflicting provisions of the Standard Specifications.
- WSF must adhere to the measures outlined in the Implementing Agreement (IA) with the Washington State Department of Ecology (Ecology)/Washington State Department of Transportation (WSDOT) Memorandum of Agreement (MOA) dated February 13, 1998 (to be superseded by any agreement than is more current that the 1998 IA)
- The contractor shall be responsible for the preparation of a Spill Prevention, Control, and Countermeasures (SPCC) plan to be used for the duration of the project. The plan shall be submitted to the Project Engineer prior to the commencement of any construction activities. A copy of the plan with any updates will be maintained at the work site by the contractor.

6 The SPCC plan shall be consistent with the Ecology/WSDOT IA, identify construction planning elements, and recognize potential spill sources at the site. The SPCC shall outline best management practices and responsive actions in the event of a spill or release, and identify notification and reporting procedures. The SPCC shall also outline contractor management elements such as personnel responsibilities, project site security, site inspections, and training.

7 The SPCC will outline what measures shall be taken by the contractor to prevent the release or spread of hazardous materials, either found on site and encountered during construction but not identified in contract documents, or any hazardous materials that the contractor stores, uses, or generates on the construction site during construction activities. These items include, but are not limited to, gasoline, oils, and chemicals. Hazardous materials are defined in RCW 70.105.010 under “hazardous substance.”

8 The contractor shall maintain, at the job site, the applicable spill response equipment and material designated in the SPCC plan.

- No petroleum products, fresh cement, lime, concrete, chemicals, or other toxic or deleterious materials shall be allowed to enter surface waters.
- WSF will comply with water quality restrictions imposed by Ecology (Chapter 173-201A WAC), which specify a mixing zone beyond which water quality standards cannot be exceeded. Compliance with Ecology's standards is intended to ensure that fish and aquatic life are being protected to the extent feasible and practicable.
- Wash water resulting from washdown of equipment or work areas shall 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 shall be maintained to prevent any visible sheen from petroleum products appearing on the water.
- There shall 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 shall be discharged to ground or surface waters.
- The contractor shall regularly check fuel hoses, oil drums, oil or fuel transfer valves, fittings, etc. for leaks, and shall maintain and store materials properly to prevent spills.

### B. *General Minimization Measures to Protect Habitat*

- The contractor will be advised that eelgrass beds are protected under local, state and federal law. When work will occur near eelgrass beds, WSF will provide plan sheets showing eelgrass boundaries to the contractor. The contractor shall exercise extreme caution when working in the area indicated on the plans as "Eelgrass Beds." The contractor shall adhere to the following restrictions during the life of the contract. The contractor shall not:

9 Place derrick spuds or anchors in the area designated as "Eelgrass."

10 Shade the eelgrass beds for a period of time greater than 3 consecutive days during the growing season (generally March through September).

11 Allow debris or any type of fuel, solvent, or lubricant in the water.

12 Perform activities that could cause significant levels of sediment to contaminate the eelgrass beds.

13 Conduct activities that may cause scouring of sediments within the eelgrass beds or other types of sediment transfer out of or into the eelgrass beds.

14 Any damage to eelgrass beds or substrates supporting eelgrass beds that results from a contractor's operations will be repaired at the contractor's expense.

- If beach access is required, use of equipment on the beach area shall be held to a minimum and confined to designated access corridors that minimize foot traffic on the upper beach.
- Projects and associated construction activities will be designed so potential effects to species and habitat are avoided and minimized.
- WSF will obtain Hydraulic Project Approval (HPA) from the Washington State Department of Fish and Wildlife (WDFW) for each project and the contractor will follow the conditions of the HPA. HPA requirements are listed in the contract specifications for the contractor to agree to prior to construction and the HPA is attached to the contract such that conditions of the HPA are made part of the contract.

### C. *Minimization Measures Employed During Pile and Structure Removal*

- A containment boom surrounding the work area will be used during pile removal to contain and collect any floating debris and sheen, provided that the boom does not interfere with operations. The contractor will also retrieve any debris generated during construction with a skiff and net, or other means of retrieval.
- The contractor will have oil-absorbent materials on site to be used in the event of a spill if any oil product is observed in the water.
- All creosote-treated material, pile stubs, and associated sediments will be disposed of by the contractor in a landfill that meets the liner and leachate standards of the Minimum Functional Standards, Chapter 173-304 WAC. The contractor will provide receipts of disposal to the WSF Project Engineer. Both waste facilities that accept creosote waste in Washington State dispose of the piling in a landfill where they are buried.

- Removed piles, stubs, and associated sediments (if any) shall be contained on a barge. The storage area shall consist of a row of hay or straw bales, or filter fabric, or other containment placed around the perimeter of the barge.
- Excess or waste materials will not be disposed of or abandoned waterward of Ordinary High Water (OHW) or allowed to enter waters of the state, as per WAC 220-110-070. Waste materials will be disposed of in a landfill. Hazardous waste and treated wood waste will be disposed of by the contractor in a landfill that meets the liner and leachate standards of the Minimum Functional Standards, Chapter 173-304 WAC.
- Piling that break or are already broken below the waterline will be removed with a clamshell bucket. To minimize disturbance to bottom sediments and splintering of piling, the contractor will use the minimum size bucket required to pull out piling based on pile depth and substrate. The clamshell bucket will be emptied of piling and debris on a contained barge before it is lowered into the water. If the bucket contains only sediment, the bucket will remain closed, be lowered to the mudline, and opened to redeposit the sediment.
- Demolition and construction materials shall not be stored where high tides, wave action, or upland runoff can cause materials to enter surface waters.

### *D. Minimization Measures Employed During Pile Installation, Pile Repair, and Installation of Structures*

- Creosote-treated timber piling shall be replaced with non-creosote-treated piling.
- The contractor will be required to ensure that wet concrete does not come in contact with marine waters.
- The contractor will be required to retrieve any floating debris generated during construction. Debris will be disposed of upland.
- Excess or waste materials will not be disposed of or abandoned waterward of OHW or allowed to enter waters of the state.
- ACZA-treated wood will be treated using the April 17, 2002 revised Amendment to Best Management Practices for the Use of Treated Wood in Aquatic Environments; USA Version-Revised July 1996-Western Wood Preservers Institute.

- Demolition and construction materials shall not be stored where high tides, wave action, or upland runoff can cause materials to enter surface waters.
- Hand tools or a siphon dredge will be used to excavate around piles to be replaced.

### *E. Minimization Measures Employed for Temporary Structures*

- Temporary structures associated with facility closures during construction will be removed before the contractor demobilizes from the site or before the February 15 construction closure, whichever comes first.
- Temporary structures installed to maintain existing service to the facility will typically be replaced with the permanent structure within 2 years of installation.
- If temporary passenger-only service is required to maintain service during construction, WSF will develop operational criteria for vessels including maximum horsepower ratings, propeller diameters, and depth of propeller to centerline thresholds that the provider of the passenger-only service must meet to operate at temporary passenger only facilities to prevent scouring the seabed.
- If temporary floats are to be installed to provide passenger service in areas adjacent to eelgrass beds, floats will be designed to avoid shading of eelgrass beds or will be installed in water depths to prevent scouring of eelgrass beds (based on propeller scour analysis prepared by the temporary vessel servicing the route).

## Adverse Effects on Essential Fish Habitat for Groundfish

Groundfish EFH could be affected by the types of work listed in Table C-2. Short-term effects to EFH for groundfish may result from resuspension of contaminated sediments during creosote-treated pile removal. However, the long-term benefits of creosote removal are considered much greater than the temporary adverse effects. A detailed discussion of contaminant resuspension is in the BAR, Section 3.1. Minimization Measures to protect groundfish EFH are included in Table C-2.

### Adverse Effects on Essential Fish Habitat for Salmonids

Potential effects to EFH for salmonids result from changes in overwater structure area, changes in underwater structural materials (such as replacement of a timber dolphin with one made of steel piling) that affect long-term water quality, and the establishment or removal of impediments to fish passage. Short-term effects to EFH can result from sediment deposition in projects generating high turbidity, such as dredging or pile removal. Minimization Measures employed to minimize adverse effects from the activities described in the BAR on salmon EFH are included in Table C-2.

### Adverse Effects on Essential Fish Habitat for Coastal Pelagic Species

Potential effects to EFH for coastal pelagic species result from changes in overwater structure area, changes in underwater structural materials (such as replacement of a timber dolphin with one made of steel piling) that affect long-term water quality, and the establishment or removal of impediments to fish passage. Short-term effects to EFH can result from sediment deposition in projects generating high turbidity, such as dredging or pile removal.

Minimization Measures employed to minimize adverse effects from the activities described in the BAR on coastal pelagic EFH are included in Table C-2.

### EFH Conclusion and Effect Determination

A Project Form (Appendix A) for each project will contain an effects determination for EFH for groundfish, salmon, and coastal pelagic species based on an analysis of the proposed activities