UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
1201 NE Lloyd Boulevard, Suite 1100
Portland, OR 97232

Refer to NMFS No.:
WCR-2018-10181

October 4, 2018

Amy Changchien
Director, Office of Planning and Program Development
U.S. Department of Transportation
Federal Transit Administration
915 Second Avenue
Federal Bldg. Suite 3142
Seattle, Washington 98174-1002

Re: Reinitiation of Endangered Species Act Section 7(a)(2) Biological Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for One Structure in Inland Marine Waters of Washington State: Annapolis Ferry Terminal Pier, Ramp, and Float Structure.

Dear Ms. Changchien:

Thank you for your June 6, 2018, letter requesting reinitiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.). We also completed an essential fish habitat (EFH) consultation on the proposed action, in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801 et seq.) and implementing regulations at 50 CFR 600.

The enclosed document contains a biological opinion (opinion) that analyzes the effects of your proposal to permit the removal of one pier, ramp, float (PRF) structure and the installation of one PRF structure. In this opinion, we conclude that the proposed action is not likely to jeopardize the continued existence of Puget Sound (PS) Chinook salmon (*Oncorhynchus tshawytscha*), PS steelhead (*O. mykiss*), or PS/Georgia Basin (GB) bocaccio (*Sebastes paucispinis*), PS/GB yelloweye rockfish *(S. ruberrimus*), Southern Resident killer whale *(Orcinus orca*), and humpback whales (*Megaptera novaeangliae*). Further, we conclude that the proposed action will not result in the destruction or adverse modification of their designated critical habitats.

This document also contains the results of the MSA Essential Fish Habitat (EFH) consultation. The Federal Transit Administration (FTA) determined that the project will adversely affect Pacific salmon EFH. NMFS concurs with that determination and is, therefore, providing conservation recommendations pursuant to the MSA (Section 305(b)(4)(A)). The FTA must respond to those recommendations within 30 days (MSA Section 305(b)(4)(B)).

Please contact Lisa Abernathy of my staff at the Oregon Washington Coastal Office at (206) 526-4742, or e-mail at lisa.abernathy@noaa.gov if you have any questions concerning this section 7 consultation, or if you require additional information.

Sincerely,

Barry A. Thom.
Regional Administrator

cc: Mark Assam, FTA

Reinitiation of Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation

One Structure in Inland Marine Waters of Washington State: Annapolis Ferry Terminal Pier, Ramp, and Float Structure

NMFS Consultation Number: WCR-2018-10181

Action Agency: Department of Transportation, Federal Transit Authority

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?*	Is Action Likely To Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Puget Sound Steelhead (*Oncorhynchus mykiss*)	Threatened	Yes	No	N/A	No
Puget Sound Chinook (*O. tshawytscha*)	Threatened	Yes	No	Yes	No
Puget Sound/Georgia Basin Bocaccio (*S. paucispinis*)	Endangered	Yes	No	Yes	No
Puget Sound/Georgia Basin yelloweye rockfish (*S. ruberrimus*)	Threatened	No	No	No	No
Southern Resident Killer whale (*Orcinus orca*)	Endangered	No	No	No	No
Humpback whale; Mexico DPS	T	No	No	N/A	N/A
Humpback whale; Central America DPS	E	No	No	N/A	N/A

Fishery Management Plan That Describes EFH in the Project Area	Does Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific Coast Salmon	Yes	Yes
Pacific Coast Groundfish	Yes	Yes
Coastal Pelagic Species	Yes	Yes

Consultation Conducted By: National Marine Fisheries Service
West Coast Region

Issued By:

Barry A. Thom
Regional Administrator

Date: October 4, 2018

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LIST OF ABBREVIATIONS AND ACRONYMS

BMP	Best Management Practices
CFR	Code of Federal Regulations
CHART	Critical Habitat Analytical Review Teams
CR	Conservation Recommendation
dB	Decibel
DPS	Distinct Population Segment
DQA	Data Quality Act
EFH	Essential Fish Habitat
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FR	Federal Register
FTA	Federal Transit Administration
GB	Georgia Basin
HAPC	Habitat Area of Particular Concern
HPA	Hydraulic Project Approval
HUC	Hydrologic Unit Code
Hz	Hertz
LW	large wood
MHHW	Mean High Higher Water
MLLW	Mean Lower Low Water
MPGs	Major Population Groups
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OHW	Ordinary High Water
Opinion	Biological and Conference Opinion
OWS	Overwater Structures
PBF	Physical or Biological Features
PCE	Primary Constituent Element
PRFs	Piers, Ramps, and Floats
PS	Puget Sound
PSP	Puget Sound Partnership
RL	Received Levels
SRKW	Southern Resident Killer Whales
SAV	Submerged Aquatic Vegetation
SEL	Sound Exposure Level
SPCC	Spill Prevention, Control and Countermeasures
TESC	Temporary Erosion and Sedimentation Control
TSS	Total Suspended Solids
TTS	Temporary Threshold Shift
U.S.C.	United States Code
VSP	Viable Salmonid Population
WDFW	Washington State Department of Fish and Wildlife
WSDOT	Washington State Department of Transportation

1. INTRODUCTION

This Introduction section provides information relevant to the other sections of this document and is incorporated by reference into Sections 2 and 3 below.

1.1 Background

The National Marine Fisheries Service (NMFS) prepared the biological opinion (opinion) and incidental take statement portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531 et seq.), and implementing regulations at 50 CFR 402.

We also completed an essential fish habitat (EFH) consultation on the proposed action, in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801 et seq.) and implementing regulations at 50 CFR 600.

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). A complete record of this consultation is on file at the Oregon Washington Coastal Area Office.

1.2 Consultation History

On September 20, 2017, we received a biological assessment from the U.S. Department of Transportation, Federal Transit Administration (FTA) along with a letter requesting informal consultation on the potential effects of permitting the removal and installation of portions of public ferry terminal pier, ramp, float (PRF) in Sinclair Inlet, along Beach Drive in Port Orchard, Kitsap County, Washington. The FTA determined the action may affect, and is not likely to adversely affect, Puget Sound (PS) Chinook and their critical habitat, PS steelhead and their critical habitat, PS/Georgia Basin (GB) distinct population segment (DPS) bocaccio and PS/GB yelloweye rockfish and their critical habitats, Southern Resident Killer Whales (SRKW) and their critical habitat, and Humpback whales.

NMFS, FTA, and the applicant, Kitsap Transit, participated in a conference call on November 20, 2017 to discuss the project and potential impacts to ESA listed species and critical habitat. We believe the project requires formal consultation. We responded by letter to the informal request on November 20, 2017, stating that NMFS did not concur with the FTA's determination.

On December 8, 2017, FTA requested formal consultations on the above listed species. Formal consultation was initiated on December 12, 2017 and a Biological Opinion was issued on April 5, 2018 (refer to NMFS No.: WCR-2017-8482).

On June 6, 2018, the FTA notified NMFS that the project had been modified (change in pile driving plan and the amount of overwater coverage) which triggered a reinitiation. Reinitiation of this Biological Opinion began on June 28, 2018.

The FTA has determined that the proposed project revisions may affect, but are not likely to adversely affect the following listed species under NMFS management authority, nor critical habitat designated for any of these species:

- PS Chinook
- PS steelhead
- PS/GB bocaccio
- PS/GB yelloweye rockfish
- Southern resident killer whale
- Humpback whale

NMFS agrees with the FTA's determination that the revised proposed action is not likely to adversely affect:

- GB/PS adult bocaccio (*Sebastes paucispinis*) critical habitat,
- PS/GB yelloweye rockfish (*S. ruberrimus*) or their critical habitat,
- SRKW (*Orcinus orca*) or their critical habitat,
- humpback whale (*Megaptera novaeangliae*) (Central America DPS and Mexico DPS).

Our concurrence is documented in the "Not Likely to Adversely Affect" Determinations Section (2.11).

We have determined that the revised proposed action remains likely to adversely affect PS Chinook salmon, PS steelhead (*O. mykiss*), and juvenile GB/PS bocaccio as well as critical habitat for Chinook salmon and juvenile GB/PS bocaccio. Because the revised proposal includes additional effects that were evaluated in the original biological opinion and EFH consultation, NMFS provides this new consultation document.

1.3 Proposed Action

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR 402.02).

The Annapolis Ferry terminal is 34 years old with a useful life of 40 years. The concrete pier is in above-average condition, but the float and ramp do not meet Americans with Disabilities Act requirements. The proposed improvements include removing a portion of the existing pier, installing a longer pier and ramp, removing the existing float and constructing a larger float in deeper water. Other improvements include pedestrian protection from the weather, new railing, lighting, potable water and fendering. The proposed work will improve the ferry operation, environmental conditions, over all experience for all passengers and provide equal access for elderly and disabled passengers. Impact minimization measures are included in the project design to avoid or minimize the adverse effects of the project on marine fish and wildlife species and their habitats. Mitigation is also proposed to offset unavoidable impacts.

The proposed project involves removing one PRF and replacing it with a new PRF. The Annapolis Ferry Dock currently consists of an 8-foot by 500-foot long fixed concrete pier with concrete decking, a 4-foot by 50-foot metal ramp, and a 20-foot wide by 40-foot long float with a solid concrete decking. The pier is supported by 20 concrete piles and the float is secured in place with six steel piles.

***Proposed removal*:** The proposed project consists of leaving approximately 400-feet concrete pier in place, removing an 8-foot by 50-foot and 16-foot by 50-foot section of pier, the 4-foot by 50-foot metal ramp, a 20-foot wide by 40-foot long float with a solid concrete decking, and four 16.6-inch concrete piles and six 18-inch steel piles. This equates to approximately 2,160 square feet of existing structures and 16 square feet of piles. This includes a solid concrete pier decking located between -4 feet and -6 feet Mean Lower Low Water (MLLW), a ramp, and solid concrete float located between -6 feet and -11 feet MLLW, and 10 piles.

***Revised Element- Proposed New*:** This revised element increases the amount of overwater structure by expanding the float size by 219 square feet and while the revised proposal does not increase the number of piles, they are being driven deeper to hold a heavier dock which increases the number of necessary pile strikes from 800 strikes per day as originally evaluated to 2000 strikes a day, as well as increasing the duration of work from 10 days of pile work to 17 days.

The proposed PRF now consists of a fully grated 30-foot by 8-foot pier and 23-foot by 20-foot landing, a fully grated 120-foot by 5-foot ramp, a 50 percent grated 120-foot by 25-foot float, two pile frames and four pile hoops, and four 12-inch and eight 24-inch steel piles. The proposed new PRF equates to approximately 4,470 square feet of structures and 28 square feet of piles. This is a net increase of 2,310 square feet of new overwater structure. This proposal includes grated pier decking located between -3 feet and -11 feet MLLW, and a ramp, a concrete float located between -l1 feet -27 feet MLLW.

In order to increase the durability of the float structure, and to provide a more stable berth to accommodate a safe ADA-accessible berth for year-round use, the proposed float will be a prestressed concrete pontoon with a deep draft. This will provide more wave protection to the berth, and improve stability for loading and unloading operations during more severe weather events. The improved performance from an increase in float draft would result in larger forces on the pile anchors. Based on geotechnical data, the modified Project design assumes that each pile would require between 800 and 1,000 strikes per pile to reach the required embedment, and assumes up to two piles per day, for a total of up to 2,000 impact pile strikes per day. The project design assumes up to five days for pile removal, and up to 12 days for pile installation, for a total of up to 17 days for pile removal and installation. Placement of a 6-inch-thick piece of wood, mica, or similar material will be used between the hammer and pile. A bubble curtain will be employed during impact pile driving. Figure 1 shows the existing structure and proposes structure in approximate relation to each other. Table 1 breaks down the coverage.

***Revised Element - Equipment and Methods*:** Equipment used during construction includes: support vessels (Skiffs, tug boats, etc.), crane, vibratory hammer, impact hammer, excavator, dump trucks and/or other heavy trucks (e.g., tractor-trailer with flatbed), and other general construction tools, including hand tools to perform various construction tasks. Pilings will be installed by impact hammer and vibratory hammer. To reduce sound levels, Kitsap Transit will use a bubble curtain on all impact-proofed piles.

Figure 1: Existing structure left, proposed structure right.

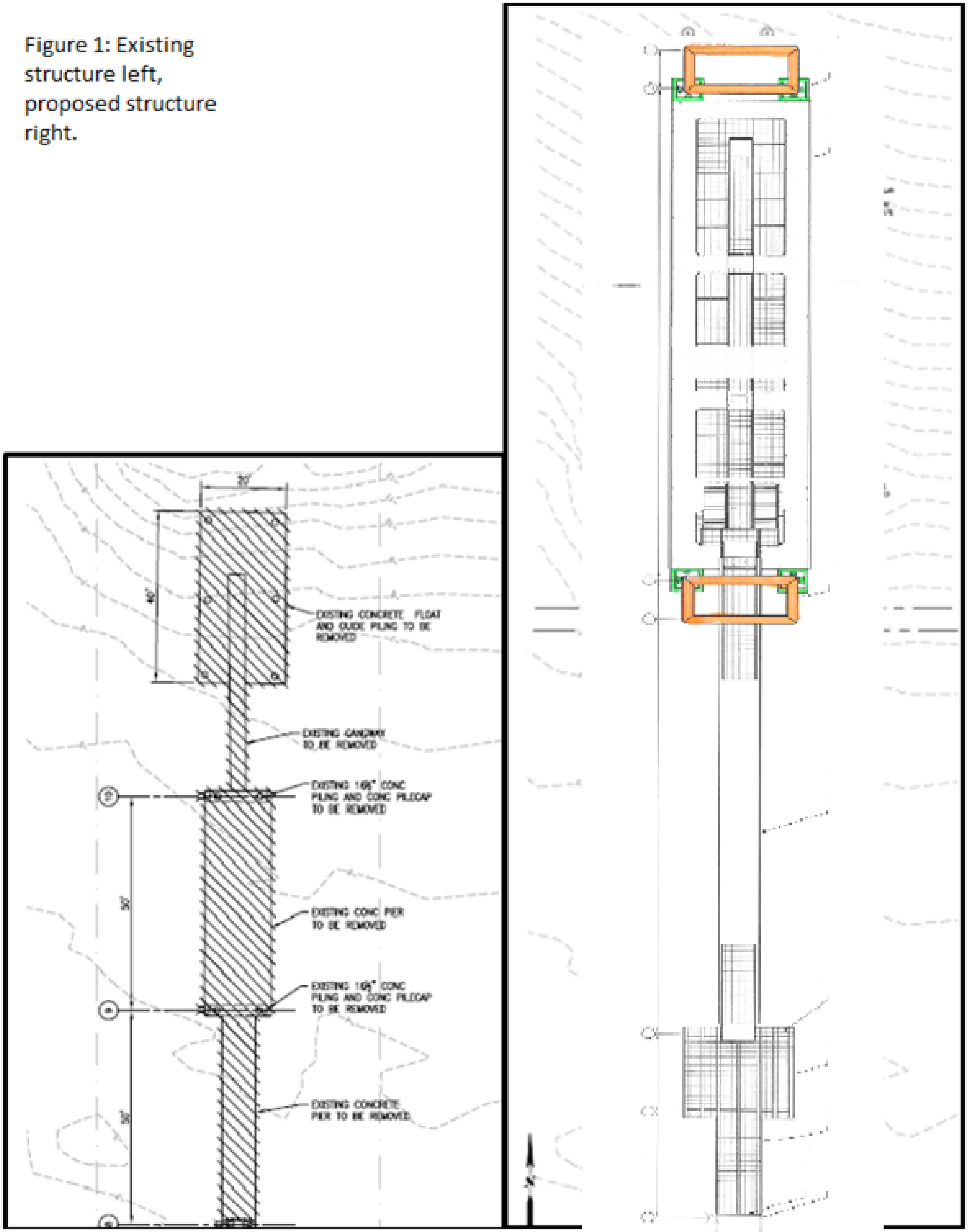

Table 1. Project Coverage

Type	Purpose	Quantity	Location	Area1
Structure Removal				
16.5-in. piles	Pier removal	4	In-water	-6 SF2
18-in. piles	Float removal	6	In-water	-10 SF2
			In-Water Total:	-16 SF2
Solid decking	Pier and float removal	1 each	Over-water	-2,000 SF
Minimal grating	Ramp removal	1	Over-water	-160 SF
			Over-Water Totals:	-2,160 SF
Structure Installation				
12-in. piles	Pier replacement	4	In-water	+3 SF2
24-in. piles	Float replacement	8	In-water	+25 SF2
			In-Water Total:	+28 SF2
Full grated decking	Pier and ramp replacement	1 each	Over-water	+1,251 SF
Pile hoops and frames	Stabilize piles	6	Above and around piles	+219 SF
50% grated decking	Float replacement	1	Over-water	+3,000 SF
			Over-Water Totals:	+4,470 SF
Summary				
			Net Change In-Water:	+12 SF
			Net Change Over-water:	+2,310 SF

Impact minimization measures are included in the project design to avoid or minimize the adverse effects of the project on marine fish and wildlife species and their habitats, and mitigation is also proposed to offset unavoidable impacts. Mitigation includes intertidal debris removal and riparian shoreline enhancement.

***Revised Element - Proposed Intertidal debris removal*:** The intertidal zone in the vicinity of Annapolis Dock contains artificial debris primarily composed of angular riprap and concrete. This debris covers potential forage fish spawning habitat located in the upper intertidal area and extends down the shoreline into lower intertidal areas. An additional mitigation measure will include removal of the debris from the intertidal zone with a primary focus of removing debris within the +5 foot to +9 foot mean lower low water (MLLW) range to improve opportunities for forage fish spawning. Debris removal will also be conducted lower on the beach and will require the use of heavy equipment, such as an excavator, to remove the angular rock, concrete, and other artificial debris. The goal of the intertidal debris removal is to mitigate at as close to a 1:1 ratio for the net increase in overwater coverage as possible by removing approximately 2,322 square feet of artificial debris from the site. If the debris removal comes close to this goal after removing the available debris and is not able to fully achieve 2,322 square feet of debris removal, the remaining mitigation need will be accounted for through the approximately 8,600 square feet of shoreline enhancement plantings. Relative to the prior proposed action and analysis the new proposal increases the debris pick up by 219 square feet

***Proposed Shoreline Enhancement*:** A 4-foot-wide gravel walkway is located along the north side of the parking lot. To the north of the walkway, a vegetated strip between 4 and 12 feet in width abuts the shoreline. In this strip vegetation consists of lawn grasses, invasive Himalayan blackberry (*Rubus armeniacus*) and English ivy (*Hedera helix*), non-native decorative hedges, and several mature, deciduous trees and shrubs. One young, coniferous western red cedar (*Thuja plicata*) is also located in the western portion of the vegetated strip near the covered waiting area. Invasive and non-native shrub and vine species will be removed from the riparian strip between the walkway and the shoreline. This area will be replanted with native herbaceous, shrub, and tree species. Native tree species will also include coniferous species to provide shade on the shoreline throughout the year once the trees have matured. This will improve opportunities for forage fish spawning.

No eelgrass was identified in the vicinity of the proposed PRF, but submerged macroalgae was mapped in the location of the existing float and in deeper water within the footprint of the proposed float. In the upland, a gravel walkway and vegetated strip are located between the parking lot and the shoreline. Vegetation include lawns grasses with native and ornamental tree and shrub species. The shoreline is armored with riprap and intertidal substrate consists of a mix of cobbles, gravel and sand; with large angular rock and concrete scattered throughout.

Construction is planned to occur in 2018. Because project actions will occur below Ordinary High Water (OHW) in Sinclair Inlet, work must be completed during the in-water work windows for salmon, including PS Chinook and steelhead. Surf smelt spawning is documented along the shoreline of the project area by Washington Department of Fish and Wildlife (WDFW) Priority Habitats and Species data[1]. The construction window for in-water work in Sinclair Inlet is July 2 to March 2 to protect salmon and "year-round" for surf smelt. A forage fish spawning survey may be required prior to construction.

Kitsap Transit proposes a marine mammal monitoring plan. This monitoring plan was developed to address potential impacts to marine mammals during certain construction activities (vibratory and impact pile driving). Marine mammal monitoring will be land and/or water based with one to two monitors during seas of Beaufort scale 2 or less. Additional monitors will be used as needed if seas reach a Beaufort scale of greater than 2. A final monitoring report will be prepared to document results of the monitoring and changes to the monitoring protocol, which may occur during construction. Further detail of the monitoring plan can be found in Section 2.11.

General Measures to Avoid and Minimize Effects of the Action

Best Management Practices (BMPs) and conservation measures will be employed throughout the execution of the project to minimize negative effects on the environment. BMPs and conservation measures are determined on a project-specific basis according to the project location and type of ecosystem present in the action area. These include but are not limited to the following measures:

[1] http://wdfw.wa.gov/mapping/phs/

- A Temporary Erosion and Sedimentation Control (TESC) Plan will be developed and implemented as part of the Stormwater Pollution Prevention Plan required under the National Pollution Discharge Elimination System stormwater regulations for construction sites. Construction techniques will utilize BMPs such as those described in the 2016 version of Washington State Department of Transportation's (WSDOT's) Standards and Specifications for Road, Bridge, and Municipal Construction (WSDOT 2016) and Washington State Department of Ecology's Stormwater Management Manual for Western Washington (Ecology 2014). TESC measures are required to prevent discharge of sediment-laden runoff from entering surface waters. Measures that will be employed to achieve this purpose may include silt fencing, straw bales/wattles, retention of runoff, and/or other similar BMPs that are determined to meet erosion control objectives.

- The contractor will prepare a construction Spill Prevention, Control and Countermeasures (SPCC) Plan for this project. Any potential spills will be handled and disposed of in a manner that does not contaminate the surrounding area. Adequate materials and procedures to respond to unanticipated weather conditions or accidental releases of materials (sediment, petroleum hydrocarbons, etc.) will be available on site. This will include materials necessary to cover stockpiles (e.g., tarpaulins), isolate pollutants from the environment (e.g., protective containers), and contain and absorb spills (e.g., disposable absorbent materials). The SPCC Plan will also ensure the proper management of oil, gasoline and solvents used in the operation and maintenance of construction equipment and that equipment remain free of external petroleum-based products prior to entering the work area and during the work, and for making any necessary repairs prior to returning the equipment to operation in the work area. The SPCC Plan will be consistent with 40 Code of Federal Regulations (CFR) 112.3 as well as the State of Washington Oil Spill Contingency Plan (WAC 173-182).

- An emergency spill containment kit must be located on-site along with a pollution prevention plan detailing planned fueling, materials storage and equipment storage. Waste storage areas must be prepared to address prevention and cleanup of accidental spills.

- To reduce the potential for spills and leaks, the barge will contain an adequate supply of materials (such as a vacuum pump, booms, diapers, and other absorbent material) to control and contain deleterious materials in the event of an accidental spill.

- The contractor will limit work at the site to daylight hours and comply with local, state and federal permit restrictions.

- All construction-related debris will be cleaned up daily. Proper conservation measures will be taken to ensure that debris will not contaminate the marine shoreline or marine waters.

- During impact pile driving, noise attenuation BMPs (i.e. bubble curtain or similar) will be utilized to reduce underwater sound pressures.

- All equipment used for construction activities will be cleaned and inspected prior to arriving at the project site, and daily thereafter prior to commencing work, to ensure no potentially hazardous materials are exposed, no leaks are present and the equipment is functioning properly. Fueling of land based equipment will be limited to upland areas on the street (southwest) side of the existing fire station building and will not be allowed immediately adjacent to or over the water.

- Waste materials, including riprap, derelict piles, miscellaneous garbage and/or other debris removed from the shoreline environment, will be transported off site for disposal in accordance with applicable regulations.

- Work will follow all other local, state and federal regulations and restrictions (e.g., WDFW Hydraulic Project Approval (HPA), local Critical Areas Ordinance and land use regulations, Shoreline Master Plan, State Environmental Policy Act, and United States Army Corps of Engineers Nationwide Permit (Section 10, Rivers and Harbors Act).

Additional Construction Measures to Reduce Impacts to Species and Habitats

- The project will obtain and comply with conditions that will be outlined in the HPA permit issued for the project by WDFW and the Nationwide Permit issued by the USACE.

- All work below OHW will be conducted during the approved work windows for fish species that may occur in the project area.

- All debris resulting from construction shall be removed from the project area and prevented from entering the water.

- The barge will not contact the substrate of Sinclair Inlet. Work at high tide, low draft barges and/or other engineering controls will be employed.

- The contractor will limit construction impacts to the minimum area necessary to complete the project.

"Interrelated actions" are those that are part of a larger action and depend on the larger action for their justification. "Interdependent actions" are those that have no independent utility apart from the action under consideration (50 CFR 402.02). No interrelated or interdependent actions were identified for this consultation

1.4 Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02).

The project is located in Sinclair Inlet, within the limits of the City of Port Orchard, Kitsap County, Washington, (6th Field hydrologic unit code (HUC) 171100190704, Lat: 47.548369, Long: -122.616310). Sinclair Inlet is a moderately developed pocket estuary with a U.S. Naval port on the north side of the inlet, the Port Orchard and Kitsap marinas on the south side of the inlet, and the recreational boat traffic and associated facilities. At the project site under this review, NMFS has determined the extreme high tide in Sinclair Inlet (i.e., the highest predicted tide in the 19 year tidal cycle) to be 13.8 feet, which is 2.1 feet above mean high higher water (MHHW), and will assess potential effects on designated critical habitat based on these numbers.

The action area is determined by the greatest extent of effects stemming from the project, in this case the action area is defined by both temporary and permanent effects. Temporary effects defining the short term action area result from the sound pressure emanating from the installation of 24-inch steel piles using a vibratory hammer. The temporarily affected area is estimated to its furthest reach at approximately five miles from the project area (Figure 2). The action area resulting from permanent effects is defined by the continuation of a degraded state caused by the overwater shading, reductions in forage, increases in predator populations, and effects from boating activity. We determined the extent of the action area by the likely geographic extent of the most extensive effect which is the pile driving associated with the proposed ferry terminal.

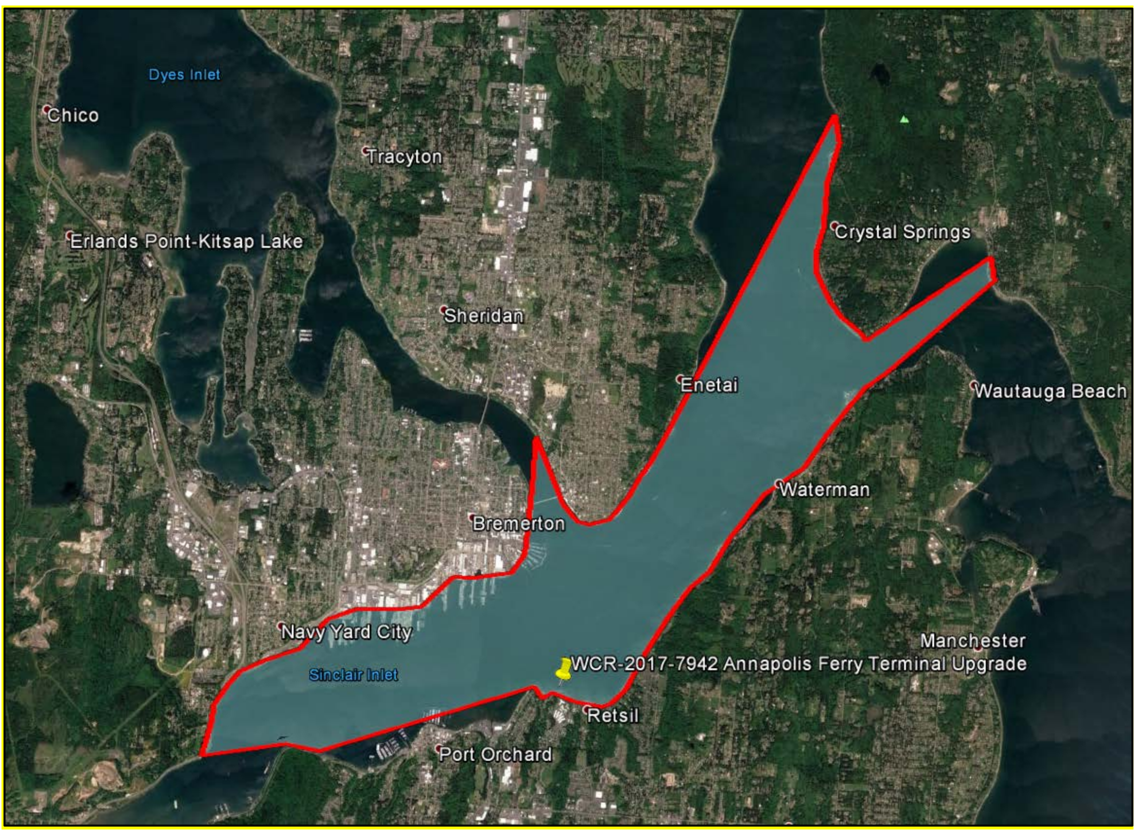

Figure 2. Project Action Area

The action area may be occupied by PS Chinook salmon, PS steelhead, PS/GB yelloweye rockfish, PS/GB bocciaco, SRKW, and humpback whale. Portions of the action area are designated as critical habitat for PS chinook, PS/GB yelloweye rockfish, PS/GB bocciaco, and

SRKW. Sinclair Inlet is also EFH for Chinook, coho and pink salmon, as well as groundfish and coastal pelagic species[2].

2. ENDANGERED SPECIES ACT: BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by section 7(a)(2) of the ESA, Federal agencies must ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provides an opinion stating how the agency's actions would affect listed species and their critical habitat. If incidental take is expected, section 7(b)(4) requires NMFS to provide an incidental take statement that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures and terms and conditions to minimize such impacts.

2.1 Analytical Approach

This biological opinion includes both a jeopardy analysis and an adverse modification analysis.

The jeopardy analysis relies upon the regulatory definition of "to jeopardize the continued existence of a listed species," which is "to engage in an action that would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

This opinion relies on the definition of "destruction or adverse modification", which "means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features" (81 FR 7414).

We use the following approach to determine whether a proposed action is likely to jeopardize listed species or destroy or adversely modify critical habitat:

- Identify the rangewide status of the species and critical habitat likely to be adversely affected by the proposed action.
- Describe the environmental baseline in the action area.
- Analyze the effects of the proposed action on both species and their habitat using an "exposure-response-risk" approach.
- Describe any cumulative effects in the action area.

[2] http://www.westcoast.fisheries.noaa.gov/habitat/fish_habitat/efh_consultations_go.html

- Integrate and synthesize the above factors to assess the risk that the proposed action poses to species and critical habitat.
- Reach jeopardy and adverse modification conclusions.
- If necessary, define a reasonable and prudent alternative to the proposed action.

2.2 Rangewide Status of the Critical Habitat and Species

This opinion examines the status of each species that would be affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR 402.02. The opinion also examines the condition of critical habitat throughout the designated area, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the current function of the essential physical and biological features that help to form that conservation value.

One factor affecting the status of ESA-listed species considered in this opinion, and aquatic habitat at large, is climate change. Climate change is likely to play an increasingly important role in determining the abundance of ESA-listed species, and the conservation value of designated critical habitats, in the Pacific Northwest. Climate change is expected to make recovery targets for these species more difficult to achieve.

During the last century, average regional air temperatures increased by an average of 1.3°F. Warming is likely to continue and annual average air temperatures are predicted to increase 3°F to 10°F by 2070 to 2099 compared to 1970 to 1999. Temperature increases are expected to be largest in the summer (Melillo et al., 2014). Overall, about one-third of the current cold-water fish habitat in the Pacific Northwest is likely to exceed key water temperature thresholds by the end of this century (Karl et al., 2009). And in the interior western U.S., suitable habitat for salmon and steelhead is projected to decline an average of 47 percent by 2080 compared to 1978-1997 (Melillo et al., 2014).

Forecasts for precipitation trends during the next century are less certain than for air temperature and vary depending on model assumptions and season. However, assuming continued growth in global heat-trapping gas emissions, summer precipitation in the Pacific Northwest is projected to decrease by an average of 10 percent during the remainder of this century (Melillo et al., 2014). Where snow occurs, a warmer climate will cause earlier snowmelt, resulting in increased late winter/early spring stream flows and reduced summer/fall flows (ISAB, 2007; Karl et al., 2009; Melillo et al., 2014).

Global warming projections show the highest risk for flooding in basins where rivers derive their water from both winter rainfall and spring snowmelt runoff (Melillo et al., 2014). Higher winter stream flows increase the risk that winter floods will damage spawning redds and wash away incubating eggs. Earlier peak stream flows will also flush some young salmon and steelhead from rivers to estuaries before they are physically mature, increasing stress and the risk of predation. Lower stream flows and warmer water temperatures during summer will degrade summer rearing conditions, in part by increasing the prevalence and virulence of fish diseases and parasites (Karl et al., 2009). Other adverse effects are likely to include altered migration patterns, accelerated embryo development, premature emergence of fry, variation in quality and quantity of tributary rearing habitat, and increased competition and predation risk from warm-water, non-native species (ISAB, 2007).

The earth's oceans are also warming, with considerable interannual and interdecadal variability superimposed on the longer-term trend (Bindoff et al. 2007). Historically, warm periods in the coastal Pacific Ocean have coincided with relatively low abundances of salmon and steelhead, while cooler ocean periods have coincided with relatively high abundances (Scheuerell and Williams, 2005; Zabel et al., 2006; Karl et al., 2009). Ocean conditions adverse to salmon and steelhead may be more likely under a warming climate (Zabel et al., 2006). This is supported by the recent observation that anomalously warm sea surface temperatures off the coast of Washington from 2013 to 2016 resulted in poor coho and Chinook salmon body condition for juveniles caught in those waters (NWFSC 2015). Changes to estuarine and coastal conditions, as well as the timing of seasonal shifts in these habitats, have the potential to impact a wide range of listed aquatic species (Tillmann and Siemann 2011, Reeder et al. 2013).

Moreover, as atmospheric carbon emissions increase, increasing levels of carbon are absorbed by the oceans, changing the pH of the water. Acidification also impacts sensitive estuary habitats, where organic matter and nutrient inputs further reduce pH and produce conditions more corrosive than those in offshore waters (Feely et al. 2012, Sunda and Cai 2012). Ocean acidification resulting from the uptake of carbon dioxide by ocean waters threatens corals, shellfish, and phytoplankton (e.g. foraminifera and coccolithophores) that form their shells and skeletons from calcium carbonate (Orr et al., 2005); (Feely et al., 2012). Such ocean acidification is essentially irreversible over a time scale of centuries (Royal Society, 2005). Increasing carbon dioxide concentrations are reducing ocean pH and dissolved carbonate ion concentrations, and thus calcium carbonate saturation. Over the past several centuries, ocean pH has decreased by about 0.1 pH units (an approximately 30 percent increase in acidity), and is projected to decline by another 0.3 to 0.4 pH units (approximately 100 to 150 percent increase in acidity) by the end of this century (Orr et al. 2005; Feely et al. 2012). As aqueous carbon dioxide concentrations increase, carbonate ion concentrations decrease, making it more difficult for marine calcifying organisms to form biogenic calcium carbonate needed for shell and skeleton formation. The reduction in pH also affects photosynthesis, growth, and reproduction. Further, the upwelling of deeper ocean water, deficient in carbonate, and thus potentially detrimental to the food chains supporting juvenile salmon has recently been observed along the U.S. west coast (Feely et al. 2008).

Acidification in Washington State coastal and estuarine waters is compounded by a combination of factors (Feely et al. 2012). Upwelling of carbon dioxide-rich offshore waters with naturally low pH from respiration processes exacerbates the effects of anthropogenic carbon dioxide. Inputs of nutrients such as nitrogen, silicate, and phosphorus from upwelling and surface runoff stimulate the growth of marine algae, temporarily decreasing carbon dioxide and increasing pH. As these blooms die and decompose, carbon dioxide is released and pH is driven down in deeper waters. Similarly, carbon dioxide is released via bacterial respiration from decaying organic matter delivered to coastal and estuarine waters from freshwater rivers and streams. All of these forces converge and interact at the coasts and estuaries, making these areas particularly sensitive to the impacts of climate change.

Finally, especially relevant to this consultation, sea level rise is a reality of climate change. Global sea level has risen about 7 inches during the 20th century and is projected to rise at a higher rate in the future. In the PS region sea level rise is expected to be moderated by tectonic uprising and range between about 3/5 and 11/5 inches per decade (Committee on Sea Level Rise in California et al., 2012). These changes will likely result in increased erosion and more frequent and severe coastal flooding, and shifts in the composition of nearshore habitats (Tillmann and Siemann 2011, et al. 2013). Estuarine-dependent salmonids such as chum and Chinook salmon are predicted to be impacted by significant reductions in rearing habitat in some Pacific Northwest coastal areas (Glick et al. 2007). Meanwhile, sea level rise is putting pressures on coastal regions to protect against flooding. New stressors generated by climate change, or existing stressors with effects that have been amplified by climate change, may also have synergistic impacts on species and ecosystems (Doney et al. 2012). These conditions will possibly intensify the climate change stressors inhibiting recovery of ESA-listed species in the future.

2.2.1 Status of Critical Habitat

Past critical habitat designations have used the terms primary constituent element (PCE) to identify important habitat qualities. However, the new critical habitat regulations (81 FR 7414; February 11, 2016) replace those terms with physical or biological features (PBF). This shift in terminology does not change the approach used in conducting our analysis, whether the original designation identified PCE or PBF. For simplicity, we universally apply the term PBF in this Opinion for all critical habitat, regardless of the term used in the specific critical habitat designation

This section describes the status of designated critical habitat relevant to the proposed action by examining the condition and trends of the essential physical and biological features of that habitat throughout the designated areas. These features are essential to the conservation of the ESA-listed species because they support one or more of the species' life stages (e.g., sites with conditions that support spawning, rearing, migration and foraging). Designated critical habitat for Puget Sound steelhead does not include the action area, and so no analysis of effects to critical habitat for this species will be presented.

***PS Chinook salmon critical habitat*:**
Critical habitat for PS chinook includes 1,683 mi (2,709 km) of streams, 41 sq mi (106 sq km) of lakes, and 2,182 mi (3,512 km) of nearshore marine habitat in PS. The PS Chinook salmon ESU has 61 freshwater and 19 marine areas within its range. Of the freshwater watersheds, 41 are rated high conservation value, 12 low conservation value, and eight received a medium rating. Of the marine areas, all 19 are ranked with high conservation value. For salmon, NMFS's critical habitat analytical review teams (CHARTs) ranked the watersheds within designated critical habitat at the scale of the HUC5 high, medium, or low based on the quantity and quality of habitat features, the relationship of the area compared to other areas within the species' range,

and the significance to the species of the population occupying that area. Even if a location had poor habitat quality, it could be ranked with a high conservation value if it were essential due to factors such as limited availability, a unique contribution of the population it served, or serving another important role.

CHART for the PS recovery domain determined that only a few watersheds in the Whidbey Basin (Skagit River/Gorge Lake, Cascade River, Upper Sauk River, and the Tye and Beckler rivers) are in good to excellent condition with no potential for improvement. However, most HUC5 watersheds are in fair-to-poor or fair-to-good condition, with most of these watersheds having some or a high potential for improvement. The Snohomish River is considered to be in fair to good condition, with a high potential for improvement, whereas the Lower Green River (Upper Duwamish) is considered to be in fair to poor condition, with some potential for improvement.

Major tributary river basins in the Puget Sound basin include the Nooksack, Samish, Skagit, Sauk, Stillaguamish, Snohomish, Lake Washington, Cedar, Sammamish, Green, Duwamish, Puyallup, White, Carbon, Nisqually, Deschutes, Skokomish, Duckabush, Dosewallips, Big Quilcene, Elwha, and Dungeness rivers and Soos Creek. Critical habitat throughout the Puget Sound basin has been degraded by numerous activities, including hydropower development, loss of mature riparian forests, increased sediment inputs, removal of large wood (LW) from the waterways, intense urbanization, agriculture, alteration of floodplain and stream morphology (*i.e*., channel modifications and diking), riparian vegetation disturbance, wetland draining and conversion, dredging, armoring of shorelines, marina and port development, road and railroad construction and maintenance, logging, and mining. Changes in habitat quantity, availability, and diversity, and flow, temperature, sediment load and channel instability are common limiting factors of critical habitat throughout the basin.

Land use practices have likely accelerated the frequency of landslides delivering sediment to streams. Fine sediment from unpaved roads also contributes to stream sedimentation. Unpaved roads are widespread on forested lands in the Puget Sound basin, and to a lesser extent, in rural residential areas. Historical logging removed most of the riparian trees near stream channels. Subsequent agricultural and urban conversion permanently altered riparian vegetation in the river valleys, leaving either no trees, or a thin band of trees. The riparian zones along many agricultural areas are now dominated by alder, invasive canary grass and blackberries, and provide substantially reduced stream shade and LW recruitment (SSPS 2007).

Diking, agriculture, revetments, railroads and roads in lower stream reaches have caused significant loss of secondary channels in major valley floodplains in this region. Confined main channels create high-energy peak flows that remove smaller substrate particles and LW. The loss of side-channels, oxbow lakes, and backwater habitats has resulted in a significant loss of juvenile salmonid rearing and refuge habitat. When the water level of Lake Washington was lowered 9 feet in the 1910s, thousands of acres of wetlands along the shoreline of Lake Washington, Lake Sammamish and the Sammamish River corridor were drained and converted to agricultural and urban uses. Wetlands play an important role in hydrologic processes, as they store water which ameliorates high and low flows. The interchange of surface and groundwater in complex stream and wetland systems helps to moderate stream temperatures. Forest wetlands are estimated to have diminished by one-third in Washington State (FEMAT 1993; Spence *et al*. 1996; SSPS 2007).

Loss of riparian habitat, elevated water temperatures, elevated levels of nutrients, increased nitrogen and phosphorus, and higher levels of suspended sediment, presumably from urban and highway runoff, wastewater treatment, failing septic systems, and agriculture or livestock impacts, have been documented in many Puget Sound tributaries (SSPS 2007).

Peak stream flows have increased over time due to paving (roads and parking areas), reduced percolation through surface soils on residential and agricultural lands, simplified and extended drainage networks, loss of wetlands, and rain-on-snow events in higher elevation clear cuts (SSPS 2007). In urbanized Puget Sound, there is a strong association between land use and land cover attributes and rates of coho spawner mortality likely due to runoff containing contaminants emitted from motor vehicles (Feist *et al*. 2011).

Dams constructed for hydropower generation, irrigation, or flood control have substantially affected PS Chinook salmon populations in a number of river systems. The construction and operation of dams have blocked access to spawning and rearing habitat (*e.g*., Elwha River dams block anadromous fish access to 70 miles of potential habitat) changed flow patterns, resulted in elevated temperatures and stranding of juvenile migrants, and degraded downstream spawning and rearing habitat by reducing recruitment of spawning gravel and LW to downstream areas (SSPS 2007). These actions tend to promote downstream channel incision and simplification (Kondolf 1997), limiting fish habitat. Water withdrawals reduce available fish habitat and alter sediment transport. Hydropower projects often change flow rates, stranding and killing fish, and reducing aquatic invertebrate (food source) productivity (Hunter 1992).

Juvenile mortality occurs in unscreened or inadequately screened diversions. Water diversion ditches resemble side channels in which juvenile salmonids normally find refuge. When diversion headgates are shut, access back to the main channel is cut off and the channel goes dry. Mortality can also occur with inadequately screened diversions from impingement on the screen, or mutilation in pumps where gaps or oversized screen openings allow juveniles to get into the system. Blockages by dams, water diversions, and shifts in flow regime due to hydroelectric development and flood control projects are major habitat problems in many Puget Sound tributary basins (SSPS 2007).

The nearshore marine habitat has been extensively altered and armored by industrial and residential development near the mouths of many of Puget Sound's tributaries. A railroad runs along large portions of the eastern shoreline of Puget Sound, eliminating natural cover along the shore and natural recruitment of beach sand (SSPS 2007).

In designating critical habitat for PS Chinook in estuarine and nearshore marine areas, NMFS determined that the area from extreme high water extending out to the maximum depth of the photic zone (no greater than 30 meters relative to MLLW) contain essential features that require special protection. For nearshore marine areas, NMFS designated the area inundated by extreme high tide because it encompasses habitat areas typically inundated and regularly

occupied during the spring and summer when juvenile salmon are migrating in the nearshore zone and relying heavily on forage, cover, and refuge qualities provided by these occupied habitats. Degradation of the near-shore environment has occurred in the southeastern areas of Hood Canal in recent years, resulting in late summer marine oxygen depletion and significant fish kills. Circulation of marine waters is naturally limited, and partially driven by freshwater runoff, which is often low in the late summer. However, human development has increased nutrient loads from failing septic systems along the shoreline, and from use of nitrate and phosphate fertilizers on lawns and farms. Shoreline residential development is widespread and dense in many places. The combination of highways and dense residential development has degraded certain physical and chemical characteristics of the near-shore environment (HCCC 2005; SSPS
2007).

The degradation of multiple aspects of PS Chinook critical habitat indicates that the conservation potential of the critical habitat is not being reached, even in areas where the conservation value of habitat is ranked high.

PS Chinook Critical Habitat in the Action Area:
The action area includes most of Sinclair Inlet (Figure 2), west of Bainbridge Island. Table 2 contains the estuarine and nearshore PBFs for critical habitat:

Table 2. PS Chinook, and corresponding life history events, critical habitat PBFs

Physical or Biological Features		**Life History Event**
Site Type	**Site Attribute**	
Estuarine	(Free of obstruction and excessive predation) Water quality, quantity, and salinity Natural cover Forage	Adult sexual maturation and "reverse smoltification" Adult upstream migration and holding Kelt (steelhead) seaward migration Fry/parr/smolt growth, development, and seaward migration
Nearshore marine	(Free of obstruction and excessive predation) Water quality, quantity, and forage Natural cover	Adult growth and sexual maturation Adult spawning migration Nearshore juvenile rearing

The attributes of the estuarine PBF, where they are present in the action area, are poorly functioning. Sinclair Inlet is a small, highly developed inlet that exhibits poorly functioning attributes of the estuarine and nearshore PBFs. Shorelines in Sinclair Inlet are dominated by armored/bulkheaded banks with very little riparian vegetation. The majority of upland areas in the action area consists of developed and impervious surfaces. Infrastructure within the steep, mid- to high-elevation intertidal zone includes many commercial piers, a U.S. Naval Base, and other overwater structures (OWS). Habitat in the immediate project area are poorly functioning, indicative of greater Sinclair Inlet.

PS/GB bocaccio critical habitat:

Critical habitat for PS/GB bocaccio includes roughly 590 square miles of nearshore habitat and 414 square miles of deepwater habitat. Critical habitat is not designated in areas outside of United States jurisdiction; therefore, although waters in Canada are part of the DPSs' ranges for this species, critical habitat was not designated in that area.

Based on the natural history of bocaccio and their habitat needs, NMFS identified two physical or biological features, essential for their conservation: 1) Deepwater sites (>30 meters) that support growth, survival, reproduction, and feeding opportunities; 2) Nearshore juvenile rearing sites with sand, rock and/or cobbles to support forage and refuge. Habitat threats include degradation of rocky habitat, loss of eelgrass and kelp, introduction of non-native species that modify habitat, and degradation of water quality as specific threats to rockfish habitat in the Georgia Basin.

Overall, nearshore critical habitat has been degraded in many areas by shoreline development. Both nearshore and deepwater critical habitat has been degraded by the presence of derelict fishing gear and reduced water quality that is widespread throughout Puget Sound. As of the late 1990s, shoreline development had impacted about 30 percent of the Puget Sound (Broadhurst 1998), and has increased since then (Cornwall and Mayo 2008). Shoreline development has been linked to reductions in invertebrate abundance and diversity, reduced forage fish reproduction, and reductions in eelgrass and kelp.

Thousands of lost fishing nets and shrimp and crab pots (derelict fishing gear) have been documented within Puget Sound. Most derelict gear is found in waters less than 100 feet deep, but several hundred derelict nets have also been documented in waters deeper than 100 feet (NRC 2014). Derelict fishing gear degrades rocky habitat by altering bottom composition and killing encrusting organisms. It also kills rockfish, salmon, and marine mammals, as well as numerous species of fish and invertebrates that are rockfish prey resources (Good et al. 2010).

Designated critical habitat for PS/GB bocaccio includes marine waters and substrates of the US in Puget Sound east of Green Point in the Strait of Juan de Fuca. Nearshore critical habitat is defined as areas that are contiguous with the shoreline from the line of extreme high water out to a depth no greater than 98 feet (30 m) relative to mean lower low water. The PBF of nearshore critical habitat include settlement habitats with sand, rock, and/or cobble substrates that also support kelp. Important site attributes include: (1) Quantity, quality, and availability of prey species to support individual growth, survival, reproduction, and feeding opportunities; and (2) Water quality and sufficient levels of dissolved oxygen (DO) to support growth, survival, reproduction, and feeding opportunities.

PS/GB Bocaccio Critical Habitat in the Action Area:

The action area includes most of Sinclair Inlet (Figure 2), west of Bainbridge Island. Table 3 contains the estuarine and nearshore PBFs for critical habitat:

Table 3. PS/GB bocaccio, and corresponding life history events, critical habitat PBFs

Physical or Biological Features		Species Life History Event
Site Type	**Site Attributes**	
Nearshore habitats with substrate that supports kelp	Prey quantity, quality, and availability Water quality and sufficient DO	Juvenile settlement, growth, and development

The attributes of the estuarine PBF, where they are present in the action area, are poorly functioning. Sinclair Inlet is a small, highly developed inlet that exhibits poorly functioning attributes of the estuarine and nearshore PBFs. Shorelines in Sinclair Inlet are dominated by armored/bulkheaded banks with very little riparian vegetation. The majority of upland areas in the action area consists of developed and impervious surfaces. Infrastructure within the steep, mid- to high-elevation intertidal zone includes many commercial piers, a U.S. Naval Base, and other OWS. Habitat in the immediate project area are poorly functioning, indicative of greater Sinclair Inlet.

2.2.2 Status of the Species

For Pacific salmon, steelhead, and certain other species, we commonly use the four "viable salmonid population" (VSP) criteria (McElhany et al. 2000) to assess the viability of the populations that, together, constitute the species. These four criteria (spatial structure, diversity, abundance, and productivity) encompass the species' "reproduction, numbers, or distribution" as described in 50 CFR 402.02. When these parameters are collectively at appropriate levels, they maintain a population's capacity to adapt to various environmental conditions and allow it to sustain itself in the natural environment.

"Abundance" generally refers to the number of naturally-produced adults (i.e., the progeny of naturally-spawning parents) in the natural environment (e.g., on spawning grounds).

"Productivity," as applied to viability factors, refers to the entire life cycle (i.e., the number of naturally-spawning adults produced per parent). When progeny replace or exceed the number of parents, a population is stable or increasing. When progeny fail to replace the number of parents, the population is declining. McElhany et al. (2000) use the terms "population growth rate" and "productivity" interchangeably when referring to production over the entire life cycle. They also refer to "trend in abundance," which is the manifestation of the long-term population growth rate.

"Spatial structure" refers both to the spatial distributions of individuals in the population and the processes that generate that distribution. A population's spatial structure depends on habitat quality and spatial configuration, and the dynamics and dispersal characteristics of individuals in the population.

"Diversity" refers to the distribution of traits within and among populations. These range in scale from DNA sequence variation in single genes to complex life history traits (McElhany et al. 2000).

For species with multiple populations, once the biological status of a species' populations has been determined, we assess the status of the entire species using criteria for groups of populations, as described in recovery plans and guidance documents from technical recovery teams. Considerations for species viability include having multiple populations that are viable, ensuring that populations with unique life histories and phenotypes are viable, and that some viable populations are both widespread to avoid concurrent extinctions from mass catastrophes and spatially close to allow functioning as metapopulations (McElhany, 2000).

Abundance

Puget Sound Chinook salmon. Abundance across the PS Chinook ESU has generally decreased between 2010 and 2014, with only 6 of 22 populations (Cascade, Cedar, Mid-Hood Canal, Nisqually, Suiattle and Upper Sauk) showing a positive change in the 5-year geometric mean natural-origin spawner abundances (recent 5-year status review). However, all 6 of these populations have relatively low natural spawning abundances of < 1,000 fish, so these increases represent small changes in total ESU abundance. Fifteen-year trends in log wild spawner abundance (1990-2005 and 1999-2014) for each PS Chinook population were negative in the latter period for 17 of the 22 populations but for only 2 of the 22 populations (Elwha and Puyallup) in the earlier period. Thus, there is a stronger decline in wild spawner abundance across all major population groups (MPGs) in the recent 15 years compared to the previous 15 years (NWFSC, 2015). Combined spawner abundance for the ESU ranges around 40,000 Chinook[3] (NOAA Salmon Population Summary SPS Database, Northwest Fisheries Science Center).

Puget Sound Steelhead. No abundance estimates exist for most of the summer-run populations; all appear to be small, most averaging less than 200 spawners annually. Summer-run populations are concentrated in northern PS and Hood Canal; only the Elwha River and Canyon Creek support summer-run steelhead in the rest of the DPS. Steelhead are most abundant in northern PS, with winter-run steelhead in the Skagit and Snohomish rivers supporting the two largest populations (approximately 3,000 and 5,000 respectively). From 2005-2009, geometric means of natural spawners indicate relatively low abundance (4 of 15 populations with fewer than 500 spawners annually) and declining trends (6 of 16 populations) in natural escapement of winter-run steelhead throughout PS, particularly in southern PS and on the Olympic Peninsula (Ford et al. 2011).

Puget Sound/Georgia Basin Bocaccio. There are no estimates of historic or present-day abundance of bocaccio across the full DPSs area. In 2013, the WDFW published abundance estimates from a remotely operated vehicle survey conducted in 2008 in the San Juan Island area (Pacunski et al. 2013). This survey was conducted exclusively within rocky habitats and represents the best available abundance estimates to date for one basin of the DPS. The survey produced estimates of 4,606 (100 percent variance) bocaccio in the San Juan area (Tonnes et al., 2016).

[3] Combined Chinook spawner abundance for 2013 is 38,960.

Further, data suggest that total rockfish declined at a rate of 3.1 to 3.8 percent per year from 1977 to 2014 or a 69 to 76 percent total decline over that period. The three listed species declined over-proportional compared to the total rockfish assemblage. Therefore, long-term population growth rate for the listed species was likely even lower (more negative) than that for total rockfish. Finally, there is little to no evidence of recent recovery of total rockfish abundance to recent protective measures.

Productivity

Puget Sound Chinook salmon. Chinook salmon productivity in the PS ESU across the time period 1980-2015 has been variable. Across the PS ESU, 8 of 22 PS Chinook populations show natural productivity below replacement in all years since the mid-1980's. However in many cases total spawning abundance was maintained through hatchery supplementation. The White River population in the Central/South Puget Sound MPG was above replacement from the mid 1980's to early 2000's, but has dropped in productivity consistently since the late 1980's. In recent years, only 8 populations have shown productivities above zero. These are Cascade, Lower Sauk, Lower Skagit, Suiattle, Upper Sauk, Upper Skagit in the Whidby Basin MPG, and Mid-Hood Canal and Cedar River in the Hood Canal and Central/South Puget Sound MPG's, respectively.

Puget Sound Steelhead. Since 1992 there has been a general downward trend in steelhead populations in this DPS. Busby et al. (1996) reviewed the 21 populations in the PS DPS and found that 17 had declining trends and four had increasing trends. Marked declines in natural run size are evident in all areas of the DPS. Even sharper declines are observed in southern PS and in Hood Canal. Throughout the DPS, natural steelhead production has shown a weak response to reduced harvest since the mid-1990s. Median population growth rates were estimated for several populations in the DPS, using the 4-year running sums method (Holmes 2001; Holmes and Fagan 2002). They estimated that the growth rate was less than 1 for most populations in the DPS, meaning the populations are declining.

Puget Sound/Georgia Basin Bocaccio. Mature females bocaccio produce from several thousand to over a million eggs annually (Love et al., 2002). In rockfish the number of embryos produced by the female increases with size. For example, female copper rockfish that are 20 cm in length produce 5,000 eggs while a female 50 cm in length may produce 700,000 eggs (Palsson, 2009). These specific observations come from other rockfish, not the three listed species. However, the generality of maternal effects in Sebastes suggests that some level of age or size influence on reproduction is likely for all species.

Spatial Structure and Diversity

Puget Sound Chinook salmon. One indicator of spatial structure and diversity is the proportion of natural-origin spawners; another is the distribution of a population across different life history strategies. Generally, populations with high natural-origin spawner contributions show higher spatial structure and diversity than populations with high hatchery-origin spawner contributions. For PS Chinook salmon, there is a declining trend in the proportion of natural-origin spawners across the ESU during the entire time period 1990-2014.

Individual members of stream and ocean-type Skagit River Chinook salmon exhibit a variety of alternative spatial and temporal life history strategies in their use of available habitat (Beamer, 2005). Four different alternative life history strategies based upon the size at estuarine entry and estuarine arrival time can be defined: fry migrants, delta migrants, parr migrants, and yearlings. Residence time in the Skagit River estuary was found to decrease as the size of the fish entering the estuary increased (Beamer, 2005). Fry migrants reared for only a short period in delta habitat and migrated into deeper water (Skagit Bay) early in the year, usually February and March at an average fork length of 39 millimeters. Some fry migrants take up residence in pocket estuaries (Beamer et al., 2003). Especially for these small fish, unobstructed nearshore passage to pocket estuaries is important for survival. In Skagit bay the growth rate is size dependent, larger juveniles exhibiting higher growth rates. Juveniles that reside the shortest in the Skagit delta, the fry migrants, show the smallest growth rate of all life history stages in Skagit bay. Furthermore, Beamish et al. (2004) find it likely that fry migrants survive poorly once they reach Skagit Bay. One reason for the poor bay survival of fry migrants is that the small size upon entry into the bay makes them susceptible to predation by predators like the ubiquitous staghorn sculpin (Beamer, 2007).

Even though these different life history forms have to date been studied most extensively in Skagit River Chinook salmon, Beamer et al. (2005) assume that they naturally occur in other populations, too. Further, Beamer et al. (2005) assume that the distribution within a population will depend upon environmental conditions. For example, the large number of fry migrants in the Skagit can be interpreted as a response to limited delta habitat.

In general, delta rearing Chinook salmon rear in the natal river delta one to two months before moving out into the bay. In the Skagit River, they reach an average size of 74 millimeter fork lengths at bay entry in May and June (Beamer et al., 2005). Parr migrants rear for a couple of months in freshwater to achieve a similar size as their tidal delta rearing cohorts over the same time period. Parr migrants do not reside in tidal delta habitats. They mainly migrate through the delta to adjacent nearshore areas. Yearlings rear in freshwater for over a year. Then they migrate quickly through the estuary and shallow subtidal areas. They quickly take up residence in deeper subtidal or offshore areas. A variable and small percentage of PS ocean type Chinook expresses the yearling life history type. For all but the small percentage of yearling life history type, the shallow marine nearshore habitat is important for early marine rearing.

Puget Sound Steelhead. PS steelhead are found in all accessible large tributaries to PS and the eastern Strait of Juan de Fuca (WDFG 1932). Nehlsen et al. (1991) identified nine PS steelhead stocks at some degree of risk or concern.

The WDF et al. (1993) identified 53 stocks within the DPS, of which 31 were considered to be of native origin and predominantly natural production. Of the 31 stocks, they rated 11 as healthy, three as depressed, one as critical, and 16 as unknown.

There are two types of steelhead, winter steelhead and summer steelhead. Winter steelhead become sexually mature during their ocean phase and spawn soon after arriving at their spawning grounds. Adult summer steelhead enter their natal streams and spend several months holding and maturing in freshwater before spawning. The PS steelhead DPS is composed primarily of winter-run populations.

Steelhead habitat has been dramatically affected by a number of large dams in the PS Basin that eliminated access to habitat or degraded habitat by changing river hydrology, temperature profiles, downstream gravel recruitment, and movement of large woody debris.

In the lower reaches of rivers and their tributaries, urban development has converted natural areas (e.g. forests, wetlands, and riparian habitat) into impervious surfaces (buildings, roads, parking lots, etc.). This has changed the hydrology of urban streams causing increases in flood frequency, peak flow, and stormwater pollutants. The hydrologic changes have resulted in gravel scour, bank erosion, sediment deposition during storm events, and reduced summer flows (Moscrip and Montgomery 1997; Booth et al. 2002).

Agricultural development has reduced river braiding, sinuosity, and side channels through the construction of dikes and the hardening of banks with rip-rap. Constriction of rivers, especially during high flow events, increases gravel scour and the dislocation of rearing juveniles. Much of the habitat that existed before European immigration has been lost due to these land use changes (Beechie et al. 2001; Collins and Montgomery 2002; Pess et al. 2002).

In the mid-1990s, WDFW banned commercial harvest of wild steelhead. Previous harvest management practices contributed to the decline of PS steelhead (Busby et al. 1996). Predation by marine mammals (principally seals and sea lions) and birds may be of concern in some local areas experiencing dwindling steelhead run sizes (Kerwin 2001).

Ocean and climate conditions can have profound impacts on steelhead populations. Changing weather patterns affect their natal streams. As snow pack decreases, in-stream flow is expected to decline during summer and early fall (Battin et al. 2007).

The extensive propagation of the Chambers Creek winter steelhead and the Skamania Hatchery summer steelhead stocks have contributed to the observed decline in abundance of native PS steelhead populations (Hard et al. 2007). Approximately 95 percent of the hatchery production in the PS DPS originates from these two stocks. The Chambers Creek stock has undergone extensive breeding to provide an earlier and more uniform spawn timing. This has resulted in a large degree of reproductive divergence between hatchery and wild winter-run fish. The Skamania Hatchery stock is derived from summer steelhead in the Washougal and Klickitat rivers and is genetically distinct from the PS populations of steelhead. For these reasons, Hard et al. (2007) concluded that all hatchery summer- and winter-run steelhead populations in PS derived from the Chambers Creek and Skamania Hatchery stocks should be excluded from the DPS. NMFS included two hatchery populations that were derived from native steelhead, the Green River winter-run and the Hamma Hamma winter-run, as part of the DPS (72 FR 26722).

Puget Sound/Georgia Basin Bocaccio. Most bocaccio within the DPS may have been historically spatially limited to several basins. They were historically most abundant in the Central and South Sound (Drake et al. 2010) with no documented occurrences in the San Juan Basin until 2008 (WDFW 2011). Positive signs for spatial structure and connectivity come from the propensity of some adults and pelagic juveniles to migrate long distances, which could re-establish aggregations of fish in formerly occupied habitat (Drake et al. 2010). The apparent reduction of populations of bocaccio in the Main Basin and South Sound represents a further reduction in the historically spatially limited distribution of bocaccio, and adds significant risk to the viability of the DPS (NMFS 2016a).

Size-frequency distributions for bocaccio in the 1970s indicate a wide range of sizes, with recreationally caught individuals from 9.8 to 33.5 in (25 to 85 cm). This broad size distribution suggests a spread of ages, with some successful recruitment over many years. A similar range of sizes is also evident in the 1980s catch data. The temporal trend in size distributions for bocaccio also suggests size truncation of the population, with larger fish becoming less common over time. By the decade of the 2000s, no size distribution data for bocaccio were available. Bocaccio in the Puget Sound/Georgia Basin may have physiological or behavioral adaptations because of the unique habitat conditions in the range of the DPS. The potential loss of diversity in the bocaccio DPS, in combination with their relatively low productivity, may result in a mismatch with habitat conditions and further reduce population viability (Drake et al. 2010).

2.3 Environmental Baseline

The "environmental baseline" includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

The State of the Sound biannual report produced by the Puget Sound Partnership (PSP) (Partnership et al., 2015) summarizes how different indicators of health of the PS ecosystem are changing[4]. Their assessment can be summarized to a few key points: (1) development pressure continues to impact habitat in the marine and freshwater portion of the range; (2) improvements in human use patterns are slow at best; and (3) few of the 2020 improvement targets identified by the PSP will be reached. While this report refers to all of Puget Sound, the key point also apply to Hidden Cove. In more detail, this most recent report points out the following issues:

- Chinook salmon: ongoing decline. PSP Target: Stop the overall decline and start seeing improvements in wild Chinook salmon abundance in two to four populations in each biogeographic region.
- Herring stocks: declining
- Loss of non-federal forested land cover to developed land cover: continuing. Loss of 1,196 acres of non-federal forested land per year between 2006 and 2011.
- Shoreline armoring: Stable between 2011 and 2014. No recent net increase, restoration actions balance out increase from private shoreline armoring. However, this could be related to poor economic conditions. More years of data are needed to determine trend.

[4] The Puget Sound Partnership tracks 21 different metrics (vital signs) to measure progress toward different PS recovery goals. The recovery goals most relevant for this Opinion include: Thriving species and food webs, Protected and Restored Habitat, Healthy Water Quality and Quantity.

- Accelerated conversion/loss of vegetation cover on ecologically important lands: 0.36 percent loss for 2006-2011. This is even more loss than the cautious 2020 Target: Basin-wide loss of vegetation cover on ecologically important lands under high pressure from development does not exceed 0.15 percent of the total 2011 baseline land area over a 5-year period.
- Marine water Quality: Overall, trends have been getting worse with closures of beaches and shellfish harvest in some bays. While there has been some increase between 2011 and 2014 in the amount of shellfish beds open to harvest, about 19 percent are still closed. PCB levels in fish[5] are still high.
- Native Eelgrass (*Z. marina*) abundance seems stable comparing 2011 to 2013 data to baseline from 2000 to 2008. This does not account for losses that occurred prior to 2000.
- Human Sound Behavior Index: No change in average behavior. Thus, an increase in population is likely to continue to degrade habitat quality. (The Sound Behavior Index tracks 28 human use practices[6] that likely affect habitat and water quality and quantity).
- OWS: not assessed by PSP. Current percent of nearshore coverage is 0.63 percent for all of PS, as detailed below.

The PSP concludes the overall decline in habitat conditions and native species abundance in the PS has been caused by development and climate change pressures. Over the last 150+ years, 4.5 million people have settled in the PS region. With the level of infrastructure development associated with this population growth the PS nearshore has been altered significantly. Major physical changes documented include the simplification of river deltas, the elimination of small coastal bays, the reduction in sediment supplies to the foreshore due to beach armoring, and the loss of tidally influenced wetlands and salt marsh (Fresh et al., 2011). In addition to beach armoring, other shoreline changes including OWS, marinas, roads, and railroads reduce habitat quality. The amount of these changes varies, and their source, varies by region, generally correlating with development, but overall is staggering (Simenstad et al., 2011). The simplification of the largest river deltas has caused a 27 percent decline in shoreline length compared to historical conditions. Of 884 historic small embayments, 308 have been eliminated. About 27 percent of PS's shorelines are armored and only 112 of 828 shoreline segments remain in properly functioning condition. The loss of tidal wetlands in the largest deltas averages 26 percent (Fresh et al., 2011). Each of these habitat changes is related to development and overall reduces the quality and quantity of PS Chinook and steelhead habitat in the PS foreshore and nearshore.

Shoreline armoring often results in increased beach erosion waterward of the armoring, which, in turn, leads to beach lowering, coarsening of substrates, increases in sediment temperature, and reductions in invertebrate density (Fresh et al., 2011;Morley et al., 2012; Dethier et al., 2016). New shoreline armoring continues to reduce the suitable habitat for Pacific sand lance and surf smelt spawning and may reduce their numbers. Fresh et al. (2011) write "We can only surmise how much forage fish spawning habitat we have lost because we lack comprehensive historical data on spawning areas." Considering that these forage fish are an essential food source for

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[5] Monitored species Pacific herring.

[6] Human use practices include among others: (a) Number of residents with native vegetation on banks of waterways; (b) number of residents using pump stations for boat wastewater; (c) residents using herbicides and pesticides, and (d) pasture practices for residents with livestock.

salmon, the beach armoring has multiple negative effects on salmon including reductions in prey and reductions in access to shallow water rearing habitat and refuge.

The distribution and sizes of OWS in the nearshore[4] are detailed further in Schlenger et al. (2011) and (Simenstad et al., 2011). The South Central PS sub-basin in which the action area is located has the highest number (2,040), density (4 per km), and area of OWS (6.8 km^2) of all sub-basins (Table 4).

More than one-third (67) of marinas in PS are in the South Central sub-basin, and they cover over 3 square kilometers, which is nearly half of the total PS area covered by marinas (Schlenger et al., 2011). More than 1 percent of the nearshore zone area of the South Central PS sub-basin is covered by marinas.

Table 4. Number and Area of OWS in PS Sub-basins, Schlenger et al. (2011) & Simenstad et al. (2011)

Puget Sound Sub-basins (see Figure 3)	**Number of Overwater Structures *(And Marinas)***	**Number of Structures Per Kilometer of Shoreline**	**Area of Overwater Structures[5] *(Marinas)* (km^2)**	**Total Area of OWS including marinas (km^2)**	**Nearshore Area (km^2)**	**Percent of Nearshore Area Coverage for OWS & Marinas combined**
South Central Puget Sound	2,040 *(67)*	4.1	3.7 *(3.1)*	6.78	262.9	2.6
Puget Sound Basin[6]	**6,927** *(171)*	**2.3**	**6.45** ***(6.3)***	12.78	**2,035.8**	**0.63**

[4] The nearshore area includes the area from the deepest part of the photic zone (approximately 10 meters below Mean Lower Low Water [MLLW]) landward to the top of shoreline bluffs, or in estuaries upstream to the head of tidal influence (Clancy, M., et al., 2009).
[5] OWS include large industrial/commercial docks, family residence docks, floating docks, fixed piers, bridges, floating breakwaters, moored vessels, but not marinas. Marinas are listed in parentheses.
[6] The Puget Sound Basin number and area of OWS is not a summation of the contributing subbasins, because the sub-basins overlap in shared divergence zones at sub-basin margins.

Figure 3. Puget Sound Sub-basin Boundaries

The effects of climate change and increased population and development also have impacted the freshwater portion of the salmonid habitat. Habitat in tributary watersheds continues to be disconnected, lost, and degraded by diking, operation of hydropower facilities, flow regulation, timber harvest, land conversions, effects of transportation infrastructure, and growth-related commercial and residential development (Beechie et al., 1994; Hough-Snee 2010). Further, water quality reductions, from multiple pollutant sources - stormwater, municipal and industrial discharges, agricultural and non-point source conveyances - continue to compromise water quality in freshwater and marine portions of PS (Ruckelshaus and McClure 2007). Other activities occurring as a baseline condition within the action areas are both ferry traffic and other vessel traffic, which create chronic background noise in aquatic habitat, and episodic generalized disturbance (e.g. waves and visual disturbance).

The project site is located within Sinclair Inlet, across the waterway from Bremerton. The system is tidally influenced with limited wave action and low to moderate freshwater input (highest in winter and spring). These habitat characteristics define Sinclair Inlet as a “Pocket Estuary”. Pocket estuaries within Puget Sound are unique with defining features of; complex shape, small size and relative isolation from one another (Fetherston and Abbe 2001). Their definition relies less on the presence or absence of freshwater input and therefor can include habitats with significant salinity dilution (estuaries) and habitats with little to no salinity change (lagoons) (Shipman 2008). The key attribute of any pocket estuary is the protection provided to young life stages of out-migrating and rearing fish species (Beamer 2003).

2.4 Effects of the Action

Under the ESA, “effects of the action” means the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur. Interrelated actions are part of a larger action and depend on the larger action for their justification.

The effects of these actions include those resulting from the construction, maintenance, and presence of the structures in the aquatic environment. Future use of the PRF is interrelated, but because the vessel traffic associated with this proposed action exists as a baseline condition and is not planned to increase as a design goal of the repairs and expansion of the facility. Vessel traffic to and from the ferry terminal, will however, continue to as an effect on aquatic habitat and species over additional coming years, as it is associated with the extended design-life of the structure.

As introduced in Section 1.3, we consider the 1) pile driving effects such as sound and turbid conditions, 2) shading from OWS, and 3) changes in the physical features of aquatic habitat related to the in-water structures as direct effects of the action. We analyze these effects on features of critical habitat first, and then we identify the multiple lifestages of listed species that will encounter these effects, because different lifestages of a species can respond in different ways to the same habitat perturbations. This effects analysis presents anticipated species responses to the habitat modifications including changes in fish behavior, injury, or death of individual fish.

2.4.1. Effects on Critical Habitat

The proposed action has effects in shoreline areas, shallow water, and deeper water. Designated critical habitat within the action area for ESA-listed salmon and bocaccio consists of estuarine and marine rearing sites, migration corridors, and their component PBFs, such as water quality, adequate forage, natural cover, and safe passage conditions. Effects of the proposed project within critical habitat are reasonably certain to include: (1) Obstruction of the migratory pathway, (2) reduction in forage and natural cover, and (3) a habitat enhancements to mitigate these effects. The Critical Habitat analysis that follows addresses salmonid and juvenile bocaccio habitat only. The features of SRKW, adult bocaccio, and adult and juvenile yelloweye, habitat are only ephemerally affected, and we construe these effects to be insignificant. Accordingly, the review for these critical habitats is presented in Section 2.11, Not Likely to Adversely Affect.

Obstruction of Salmonid Migratory Pathway and Safe Passage

Permanent effects of replacement and new in-water structure: The proposed placement of the PRF structure in aquatic habitat will alter outmigration routes of juvenile PS Chinook salmon. Juveniles will likely alter their migratory route to navigate around the proposed structures, and move into even deeper water. When juveniles leave the shallow nearshore it increases their migration route and will likely increase their risk of predation, see below 2.4.2. Therefore, we expect this project to degrade the quality of the migratory corridor and impair safe passage.

Temporary effects of increased sound: The proposed action will increase cause sound waves that disrupt the aquatic habitat. The sound pressure levels from pile driving and extraction will occur contemporaneous with the work, and radiate outward; the effect attenuates with distance. Cumulative SEL is a measure of the sound energy integrated across all of the pile strikes. The Equal Energy Hypothesis, described by NMFS (2007), is used as a basis for calculating Cumulative SEL. The number of pile strikes is estimated per continuous work period. This approach defines a work period as all the pile driving between 12-hour breaks. NMFS uses the practical spreading model to calculate transmission loss, and define the area affected. Both vibratory noise and impact noise can create sufficient disturbance that the action area is impaired as a migratory area, but this persists only for the duration of the pile driving or removal. Because work ceases each day, migration values are re-established during the evening, night, and early morning hours.

Sound will also occur with the interrelated ferry use of the PRF via engine operation. Vessel noise is not expected to exceed that which already occurs at the baseline level in the action area, but is expected to be a corollary effect that exists episodically for the 40-year life of the structure. Engine noise from vessels is a low frequency sound which will extend throughout the action area, but is not expected to alter the suitability of the migratory pathway from the baseline condition, and the critical habitat is expected to continue to function with a comparable level of safe passage.

Temporary effects on water quality: Turbidity and suspended sediment are expected to occur during pile removal and pile driving. Pile driving causes pulses of turbidity and total suspended sediment, at each location where pile installation or extraction occurs, but each instance is short-term and localized. When these occur in migration areas, it can delay or alter migration behavior, slightly reducing the migration values of the habitat.

Effects on Salmonid Forage and Cover

Permanent effects of replacement structures and additional overwater structure/shade: PRF structures can adversely affects primary productivity and submerged aquatic vegetation (SAV) if present in the shadow zone of the OWS. In the case of the Annapolis Ferry Terminal PRF, the closest documented SAV is approximately ¾ of a mile away, exiting Sinclair Inlet, towards the Sound. Although SAV is not documented in the area, there is a high likelihood that SAV patches will come and go within the action area within the life of the PRF, and therefore will be discussed. SAV is important in providing cover and a food base for juvenile PS Chinook. PRFs shade SAV for the life of the structure (Kelty and Bliven, 2003).

Fresh et al. (2006) researched the effects of grating in residential floats on eelgrass, a substrate for herring spawning, a Chinook salmon forage species documented in the action area. They reported a statistically significant decline in eelgrass shoot density underneath six of the 11 studied floats in northern PS. Grating explained 22 percent of the variation in the relative amount of change in shoot density. Although results indicated that using grating (16 to 50 percent) did not avoid impacts to eelgrass, there may have been some beneficial effect from the use of grating. Within the grating range tested (16 to 50 percent), the authors did not find a relationship between the percentage of grating on the float and the change in eelgrass density. The authors hypothesize that there are likely other variables influencing eelgrass density and that there may be a threshold effect when it comes to light under the float; grating up to a certain amount would have had no effect, but losses would be reduced above this threshold value. The authors conclude with the recommendation that, "because of the high level of uncertainty associated with the effectiveness of changes in any one attribute, managers should take all possible steps to maximize the amount of submarine light to reduce risks to eelgrass" (Fresh et al. 2006).

The NMFS could not find studies examining the effect of OWS on SAV other than eelgrass and kelp (Mumford, 2007). However, the physiological pathways that result in the reduction in shoot density and biomass from shading applies to all SAV. Thus, it is reasonable to assume that shading from OWS adversely affects all SAV. A reduction to the primary production of SAV beds is likely to incrementally reduce the food sources and cover for PS Chinook salmon and steelhead. The reduction in food source includes epibenthos (Haas et al., 2002) as well as forage fish.

In addition to reduced SAV biomass and shoot density, shading also has been shown to be correlated with reduced density of the epibenthic assemblage under ferry terminals compared to a control site (Haas et al., 2002). With few exceptions (insignificant decrease for non-salmonid-prey taxa), the significant differences suggest adverse impacts for salmon from reduced epibenthos density under these ferry terminals. While the reduction in light and SAV were likely a cause for the reduction in epibenthos, changes in grain size due to boat action and current alteration also may have contributed (Haas et al., 2002). The likely incremental reduction in epibenthic prey associated with the PRF projects, including the project, will likely adversely affect the forage for PS Chinook.

Herring, another food source for listed PS Chinook, has a documented spawning location in the action area. Thus, it is important to avoid, minimize, and offset all impacts of PRFs on the SAV that support herring spawning. Spawning areas for PS herring are largely limited to depth at which SAV will grow with herring using several species of macroalgae as spawning substrate. In shallower areas, *Zostera marina* is of primary importance, and in slightly deeper areas, *Gracilaria* spp. predominates (Penttila, 2007). An essential element of herring spawning habitat appears to be the presence of perennial marine vegetation beds at rather specific locations (Penttila, 2007). While across the PS region native eelgrass (*Zostera marina)* is of primary importance as spawning substrate, other SAV is used locally. In some parts of PS, algal turf, often formed by dozens of species of red, green and brown algae, is used by spawning herring (Millikan and Penttila, 1974). In deeper water and in areas where native eelgrass beds do not predominate, herring spawn on the mid-bottom-dwelling red alga *Gracilariopsis sp.* (referred to as *Gracilaria* in some sources) (Penttila, 2007). In Wollochet Bay WDFW documented spawning mainly on *Ulva sp*.

Forage fish such as Pacific herring, Pacific sandlance and surf smelt are present in Sinclair Inlet and the action area, but spawning locations are few. We assume that some adverse impacts to documented spawning substrate and epibenthic prey as a result of shading will result as part of the proposed action. All PRFs are likely to result in a reduction of epibenthic prey and most in some reduction of SAV. In addition, the PRFs in areas with herring spawning are likely to result in reduced numbers of herring. All salmon exposed to these changed conditions are likely to experience a reduction in their individual growth, fitness, survival, and abundance. In general, early marine juvenile growth is dependent on ample food supply and has been shown to be linked to overall salmonid survival and production (Beamish et al., 2004) (Tomaro et al., 2012). Rapid growth of PS Chinook salmon during the early marine period is critical for improved marine survival (Duffy and Beauchamp, 2011). In summary, the PBFs of early marine rearing will be permanently negatively affected by the action through a relatively small reduction in forage and cover.

Habitat Water Quality Reductions for salmonids and Juvenile PS/GB Bocaccio

Impact to prey species and water quality are the only impacted rockfish PBFs by the proposed action. Pile driving causes short-term and localized increases in turbidity and total suspended solids (TSS) as the bottom materials are displaced during the intrusion of the pile structures, and from the percussive effect of the driving. This affects water quality and benthic prey communities.

Water Quality Impairment

To estimate the magnitude of suspended sediment associated with the proposed pile driving, NMFS reviewed results from a vibratory pile removal project near the mouth of Jimmycomelately Creek in Sequim Bay (Weston Solutions, 2006). Because the character of vibration is the same for both installation and removal, the analysis of sediments for removal provides a reliable review of likely suspended sediments from installation. In that study, TSS concentrations associated with activation of the vibratory hammer to loosen the pile from the substrate ranged from 13 to 42 milligrams per liter (mg/L) and averaged 25 mg/L. During the pile driving, elevated levels of TSS averaging 40 mg/L were recorded near the pile and 26 mg/L at the sensors located 16 to 33 feet from the pile. Concentrations during extraction ranged from 20 to 82.9 mg/L and were sometimes visible in the water column as a 10- to 16-foot diameter plume that extended at least 15 to 20 feet from the actual pulling event. Although concentrations decreased after pile extraction, the time interval was unavailable due to tug movement as soon as the pile cleared the water's surface.

Sediment will also be disturbed, impairing water quality, with pile removal. A total of 10 existing piles (four 16.5-inch concrete piles and six 18-inch steel piles) will be removed by vibratory extraction. We anticipate multiple episodes of suspended sediment daily for 17 days of piling work, with each pile extraction and installation, creating a small, temporary, turbidity plume at each site.

Benthic and Prey Communities/Forage Base

Pile removal and installation activities, with disruption of the sediment will create at least partial loss of the community in the affected area. There will be some minor loss of encrusting species (e.g., mussels) on the piles removed from the existing pier. The benthic communities in the footprints of the new piles (28 square feet) will be eliminated when the piles are installed. A total of 16 square feet of piles will be removed, for a net conversion of 12 square feet of benthic habitat. There will be some disturbance to sediments and benthic community from pile removal and vessel anchors, but there will be little potential disturbance from propeller wash and no potential for barge grounding due to the water depths at the site. The potential area that will be disturbed by construction activity was estimated by adding the area within 150 feet of the proposed structure to the structure footprint (WDOE 2016). For marine waters, the point of compliance for a temporary area of mixing shall be at a radius of one hundred fifty feet from the activity causing the turbidity exceedance

Marine macroinvertebrates and other organisms have a demonstrated ability to recolonize disturbed substrates (Dernie et al. 2003); most of the benthic habitat, with the exception of very small areas displaced by piles, will begin to recover within months after construction is completed. Previous studies of dredged, sediment capped, and other disturbed sites show that many benthic and epibenthic invertebrates rapidly recolonize disturbed bottom areas within 2 years of disturbance (Romberg et al., 1995; Parametrix, 1994, 1999; Vivan et al., 2009). Many benthic organisms lost due to turbidity and bottom disturbances by barges, tugboats, and anchors recolonize the construction areas quickly, for example, mobile species such as crabs and short-lived species such as polychaetes and become reestablished over a 3-year period after sediment disturbance at the site has ceased. Less mobile, longer-lived benthic species such as clams can take two to three years to reach sexual maturity (Chew and Ma, 1987; Goodwin and Pease, 1989) and may require five years to recover from disturbance such as smothering by sediment. Therefore, shellfish communities under the ferry terminal impacted by construction are expected to recover within approximately five years after construction. Ecological productivity will be reduced during the five-year recovery period. Any geoduck or other clams lost in the pile footprints during construction will no longer be available to contribute as seed stock for future generations

The only forage fish species with documented spawning habitat occurring along the shoreline near the action area is the Pacific sand lance and surf smelt, which is documented to occur near the project site. Temporary increase of suspended solids during pile driving and other in-water construction activities (debris removal) would be expected. However, due to strong nearshore currents and nearshore wind waves, the small portion of suspended fine sediments that would settle out of the water column onto intertidal beaches are not expected to be high enough to adversely impact the spawning success of the nearest forage fish spawning habitat near the project site.

Forage fish that occur in the immediate project vicinity during in-water construction will be exposed to increased levels of turbidity. It is reasonable to assume that forage fish, primarily sand lance and surf smelt, utilize the shoreline at the project site. In Tidal Reference Area 5, the forage fish have potential so spawn year round, which means that the in-water work will be conducted during the sand lance and surf smelt spawning period. Therefore, forage fish could be present and potentially affected by construction activities. In general, behavioral response including shoreline avoidance from visual stimuli of nearshore-occurring pre-spawn adult sand lance would not be expected from the offshore construction activity. Additionally, increase in vessels activity could have minor effects to distribution and behavior of adult and larvae forage fish.

Habitat Enhancement/Minimization/Mitigation

The proposed action incorporates a number of minimization measures to avoid, reduce, and minimize the adverse effects of the action on PBFs including forage and cover. These minimization measures include maximization of grating to pass light through the structure. This element reduces, but do not eliminate, the extent of the project's permanent negative shading effects on the aquatic environment.

To offset the remaining negative habitat effects, Kitsap Transit proposes to remove debris from the intertidal zone with a primary focus of removing debris within the +5 foot to +9 foot MLLW range to improve opportunities for forage fish spawning. Debris removal will also be conducted lower on the beach and will require the use of heavy equipment, such as an excavator, to remove the angular rock, concrete, and other artificial debris.

Additionally, Kitsap Transit proposes approximately 8,600 square feet of shoreline enhancement plantings. Invasive and non-native shrub and vine species will be removed from the riparian strip between the walkway and the shoreline. This area will be replanted with native herbaceous, shrub, and tree species. Native tree species will also include coniferous species to provide shade on the shoreline throughout the year once the trees have matured. This will improve slightly, but permanently, opportunities for forage fish spawning, as well as provide a source of detrital prey inputs.

2.4.2 Effects on Species

As described in Section 1.3, all work would occur between July 2nd and March 2nd in any year the permit is valid. This work window is designed to minimize juvenile salmonid exposure to construction effects. However, they will not completely avoid exposure to construction effects, exposure to long-term effects from the existence of the structure will remain. Additionally, surf smelt spawning may occur year-round in Sinclair Inlet, as forage fish spawning is documented to occur near the project site. NMFS recommends forage fish surveys prior to construction (Section 2.9 Conservation Recommendations).

Presence and Exposure

Juvenile Salmon. Juvenile PS Chinook and salmon will be exposed to both construction effects, and the long-term effects of habitat modifications caused by over-water structures. Juvenile Chinook salmon are nearshore oriented (Fresh, 2006) and have been found in PS neritic waters between April and November (Rice et al., 2011). Once constructed, the structure is expected to remain in Sinclair Inlet, for the life of each structure (approximately 40 years[7]). Thus, juveniles will experience the long-term habitat modifications associated with the presence of this structure.

Steelhead Smolts. PS steelhead yearlings migrate quickly, within weeks, through PS into the Straights and open Ocean. After entry into the estuary, they quickly move into off-shore waters (Goetz et al., 2015). However, steelhead smolts have been found in low abundances in the marine nearshore, outside of their natal estuary, between May and August (Brennan, 2004) (Fresh, 2006). Thus, steelhead smolt exposure is mostly limited to construction effects and effects from boat use in deeper water.

As steelhead smolts are not nearshore-dependent, leave PS quickly, and are larger and more mobile than PS Chinook, we expect the permanent habitat effects from the structures to be of little importance to steelhead smolts because their exposure is expected to be only episodic and generally brief.

Adult Salmon and Steelhead. Adult PS Chinook salmon can reside in PS year-round. PS Chinook usually inhabit water much deeper than where the proposed structures will be located. Two general life history types of steelhead co-exist in PS, winter-run and summer-run steelhead. Adult winter-run steelhead typically return to their natal river November through May; summer-run steelhead return between April and October. Their presence in Sinclair Inlet will overlap with the construction windows. Like PS Chinook adults, steelhead occupy deep water, generally deeper than the location where the structures are proposed. Thus, we expect the direct habitat effects from the structures to be of little importance to PS Chinook and steelhead adults as they do not frequent the nearshore. We expect varying levels of behavioral responses from no change, to mild awareness, or a startle response during the installation (Hastings and Popper, 2005), but we do not believe that this response will alter the fitness of any adults.

Puget Sound/Georgia Basin Bocaccio. Rockfish fertilize their eggs internally and extrude the young as larvae (Love et al. 2002). Inflation of the swim bladder has been shown to generally occur within 48 hours after release (McConnell Chaille, 2006). Larval rockfish appear in the greatest numbers during the spring months (Moser and Boehlert 1991; Palsson et al. 2009). However, PS/GB rockfish have been reported to extrude larvae as late as September (Beckman et al 1998). Rockfish larvae are typically found in the pelagic zone, often occupying the upper layers of open waters, under floating algae, detached seagrass, and kelp. Rockfish larvae are thought to be mostly distributed passively by currents (Love et al. 2002). Juvenile bocaccio are known to settle onto rocky or cobble substrates in the shallow nearshore at 3 to 6 months of age in areas that support kelp and other aquatic vegetation, and then move to progressively deeper waters as they grow (Love et al. 1991; Love et al. 2002; Palsson et al. 2009). Juvenile bocaccio also recruit to sandy zones with eelgrass or drift algae (Love et al. 2002). As reported, rockfish larvae presence can overlap with the work window (July through September) so their exposure to construction effects is likely. Adult bocaccio occupy deeper water areas where we do not expect any of the effects of the project to be discernible.

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[7] Estimated lifespan of a PRF (pers. com Marine Floats and Thomson Pile Driving).

Due to the habitat characteristics of Sinclair Inlet, the closest adult ESA-listed rockfish are likely several thousand feet away from the Annapolis Ferry Terminal, within waters deeper than 120 feet. If any juvenile and sub-adult bocaccio are within the action area, they would be expected to be found near benthic areas with steep slopes, rock, or kelp beds; there is kelp habitat along some sections of Sinclair Inlet nearshore which may be seasonally used by juvenile and sub-adult bocaccio. It is unlikely that juvenile yelloweye rockfish will occur within kelp habitats of the action area because they do not use the nearshore for rearing. It is possible that larval bocaccio occur within the action area during project activities. Larval rockfish likely remain within the basin they are released (Drake et al. 2010) but may be broadly dispersed from the place of their birth (NMFS 2003) and could occur within the action area during project activities. An effect exists, regardless of their magnitude, even if only one individual or habitat segment may be affected.

Species Response to Migratory Pathway Obstruction

Shade and migration behavior: PRFs create a sharp edged shadow. Based on the findings of numerous studies, we are reasonably certain that the placement of PRFs in shallow water will adversely affect juvenile salmonid migration. Juvenile salmon in the marine nearshore as well as in freshwater have been reported to migrate along the edges of shadows rather than through them (Nightingale and Simenstad, 2001; Southard et al., 2006; Celedonia et al., 2008a; Celedonia et al., 2008b; Ono, 2010; Moore et al., 2013; Munsch et al., 2014). In freshwater, about three-quarters of migrating Columbia River fall Chinook salmon smolts avoided a covered channel and selected an uncovered channel when presented with a choice in an experimental flume setup (Kemp et al., 2005). In Lake Washington, actively migrating juvenile Chinook salmon appeared to change course when they approached a structure, swimming around structures through deeper water rather than remaining in shallow water and swimming underneath a structure (Celedonia et al., 2008b). Structure width, light conditions, water depth, and presence of macrophytes appeared to influence the degree of avoidance, with juvenile Chinook salmon appearing less hesitant to pass beneath narrower structures. Finally, juvenile Chinook salmon appeared to move into deeper water to travel beneath or around structures (Celedonia et al. 2008b).

In the marine nearshore, there is also substantial evidence that OWS impede the nearshore movements of juvenile salmonids with fish stopping at the edge of the OWS and avoiding swimming into the shadow or underneath the structure (Heiser and Finn 1970; Able et al., 1998; Simenstad 1988; Southard et al., 2006; Toft et al., 2013; Ono 2010). In the PS nearshore, 35 millimeter to 45 millimeter juvenile chum and pink salmon were reluctant to pass under docks (Heiser and Finn 1970). Southard et al. (2006) snorkeled underneath ferry terminals and found that juvenile salmon were not underneath the terminals at high tides when the water was closer to the structure, but only moved underneath the terminals at low tides when there was more light penetrating the edges. Ono (2010) reports that juveniles tended to stay on the bright side of the shadow edge, two to five meters away from the dock, even when the shadow line moved underneath the dock. These findings suggest that overwater-structures can disrupt juvenile migration in the PS nearshore. Increased energy expenditure during migration can impair growth and fitness at a time when juveniles are maturing for their ocean life history phase.

Of further concern, studies have shown that swimming around OWS not only lengthens the salmonid migration route but is correlated to increased mortality. For example, migratory travel distance rather than travel time or migration velocity has been shown to have the greatest influence on survival of juvenile spring Chinook salmon migrating through the Snake River (Anderson et al., 2005).

Shade and predation risk: An implication of juvenile salmon avoiding OWS is that some of them will swim around the structure (Nightingale and Simenstad 2001). This behavioral modification will cause them to temporarily utilize deeper habitat, thereby exposing them to increased piscivorous predation. Typical piscivorous juvenile salmonid predators, such as flatfish, sculpin, and larger juvenile salmonids, being larger than their prey, generally avoid the shallowest nearshore waters that outmigrant juvenile salmonids prefer—especially in the earliest periods of their marine residency. The project as revised will now replace an existing 2,160-square-feet of an existing structure with a 4,470-square-foot structure. The continued presence of the new structure may continue to disrupt juvenile PS Chinook migration and result in juvenile PS Chinook mortality. NMFS assumes that the increase in migratory path length from swimming around the float will increase exposure to piscivorous predators in deeper water and result in proportionally increased juvenile PS Chinook mortality. When juvenile salmonids temporarily leave the relative safety of the shallow water, their risk to being preyed upon by other fish increases. This has been shown in the marine environment where juvenile salmonid consumption by piscivorous predators increased fivefold when juvenile pink salmon were forced to leave the shallow nearshore (Willette, 2001). Juvenile salmon are present in the action area from March through December, and most numerous from May through August (Dorn and Best 2005; SSPS 2007), and, therefore, may be adversely affected by the presence of overwater structure. Lastly, juveniles hesitating upon first encountering the structure, as discussed, are also exposed to avian predators that may use the floating structures as perches.

Shade and visual reduction: he reduced light regime under OWS is also likely to result in temporarily decreased visual ability and decreased feeding success for those juveniles that do swim under floats in PS. In freshwater laboratory studies, schools of Pacific salmon disbanded and stopped feeding when light dropped below the rod[8] threshold (Ali, 1959). Juvenile chum and pink salmon take 30 to 40 minutes to fully adapt to dark conditions, and 20 to 25 minutes to adapt to increased light conditions. During the adaptation period to the new light regime the visual acuity is diminished, depending upon the magnitude of the light intensity contrast. The adverse effects of temporarily decreased visual ability and resulting decreased feeding success are considered reasonably likely to occur from the long term operation of the proposed PRF. While the short-term decreased feeding success will likely result in a minor sub-lethal response of incrementally reduced growth, the decreased visual ability can lead to increased susceptibility to predation, as mentioned above.

Species Response to Sound

The new project's revised schedule for pile driving is expected to cause temporary underwater noise. Fishes with swimbladders are sensitive to underwater impulsive sounds (*i.e.*, sounds with

[8] Rods are photoreceptors in the retina of the eye responsible for peripheral and night vision.

a sharp sound pressure peak occurring in a short interval of time) such as those produced by impact pile driving. When a fish with a swim bladder is exposed to impulsive energies, including pile driving, the swim bladder acts like an air bubble that vibrates with sufficient magnitude to cause damage to tissues and organs within close proximity as well as to the swim bladder itself (Casper 2012, Halvorsen 2012). Fishes with a physoclistous (closed) swim bladders, such as salmon and rockfish, are incapable of decreasing the volume of gases fast enough to avoid sustaining more severe injuries. The injuries caused by such pressure waves are known as barotraumas. They include the hemorrhage and rupture of internal organs, damage to the auditory system, and death for individuals that are sufficiently close to the source (Abbott *et al.* 2002; Caltrans 2009). Death can occur instantaneously, within minutes after exposure, or several days later.

A multi-agency work group identified criteria to define sound pressure levels where effects to fish are likely to occur from pile driving (Hydroacoustic Working Group, 2008). Keep in mind these thresholds represent the initial onset of injury, and not the levels at which fish will be severely injured or killed. A single strike generates peak noise levels greater than 206 dB_{peak} where direct injury or death of fish can occur. Besides peak levels, sound exposure levels (SEL) (the amount of energy dose the fish receive) can also injure fish. These criteria are either 187 dB_{SEL} for fish two grams or larger or 183 dB_{SEL} for fish smaller than two grams for cumulative strikes (Hydroacoustic Working Group, 2008). In addition, any salmonid within a certain distance of the source (*i.e.* the radius where the root mean square (RMS) sound pressure level will exceed 150 dB_{RMS}) will be exposed to levels that might change the fish's behavior or cause physical injury (*i.e.* harm). The result of exposure could be a temporary threshold shift (TTS) in hearing due to fatigue of the auditory system, which can increase the risk of predation and reduce foraging or spawning success (Stadler and Woodbury, 2009). When these effects take place, they are likely to reduce the survival, growth, and reproduction of the affected fish.

Adverse effects on survival and fitness can occur even in the absence of overt injury. Exposure to elevated noise levels, which can be caused by both impact and vibratory driving, can cause a TTS, decreasing sensory capability for periods lasting from hours to days (Turnpenny *et al*. 1994; Hastings *et al*. 1996). Popper *et al*. (2005) found TTS in hearing sensitivity after exposure to Cumulative SELs as low as 184 dB. TTS' reduce the survival, growth, and reproduction of the affected fish by increasing the risk of predation and reducing foraging or spawning success. To discern the duration and intensity of species exposure, we consider specific elements of the proposed project.

Previous studies on salmonid distribution in the nearshore indicate a low likelihood for Chinook salmon or steelhead presence during in-water work. Fry first enter estuaries around 50-millimeter fork length, weighing less than two grams (Fresh 2006). As salmonids grow in size (to two grams or larger), the water depth and habitat diversity used by rearing juvenile salmonids may change (Fresh 2006). There are streams that support salmon spawning in Sinclair Inlet. Most juvenile salmonids are likely two grams or larger. Beach-seining surveys conducted in the shore zones of Bainbridge Island indicate that juvenile Chinook salmon are most numerous from May through August, but may be present in the action area from March through December (Dorn and Best 2005; SSPS 2007). Steelhead are less common in the shallow nearshore (Rice, unpublished data). Forage fish spawn in Sinclair Inlet year-round, increasing the probability of occurrence of Chinook salmon and steelhead during in-water activity. Forage fish spawn in the action area, and may be less than two grams or two grams and larger.

Adult forage fish two grams or larger, and juveniles and larval forage fish smaller than two grams, may be exposed to injurious levels of underwater noise as forage fish spawn year-round in and close to the action area. Thus, we expect a one-time, small-scale, construction-related reduction in salmonid forage. Considering the larger extent of forage fish spawning in Puget Sound (266 miles of known surf smelt spawning beaches and 118 miles of known sand lance spawning beaches[9]), this small-scale, one-time reduction likely results in a is relatively minor reduction of forage for salmonids.

We used the following assumptions for estimating the effects of the pile driving component of the proposed action on juvenile and adult salmon and steelhead and juvenile bocaccio:

- PS Chinook salmon juveniles in the vicinity of pile driving activity during the work window will weigh more than two grams. This is based on fork length data of juvenile salmonids passing through the PS nearshore (Rice, 2011). After July 2 juvenile Chinook can be expected to be longer than 80 mm fork length (FL). Weight of 80 mm FL Chinook ranges above 4 grams (McFarlane and North, 2002).

- The density of steelhead smolts in the vicinity of pile driving is extremely low and all steelhead smolts in PS are larger than two grams.

- Larval and juvenile listed bocaccio may be present in the nearshore during impact pile driving. Exposure of adult rockfish to construction effects is discountable since they do not occupy the nearshore.

- In-water work window in Tidal Reference Area 5 *which includes Sinclair Inlet) is July 2 to March 2.

- Adults of listed salmonids may be present during piling installation.

- If an impact hammer (e.g., drop, hydraulic, or diesel) is used to drive or proof steel pilings, one of the following sound attenuation methods will be employed:

    - Placement of a 6-inch-thick piece of wood, mica, or similar material between the hammer and pile.

    - Use of a bubble curtain that distributes air bubbles around 100 percent of the perimeter of the piles over the full depth of the water column.

[9] https://wdfw.wa.gov/commission/meetings/2016/12/dec0916_12_presentation.pdf

Vibratory Pile Driving/Removal

Vibratory Removal. The applicant's contractor would use a vibratory extractor to remove ten piles. The applicant assumes 10-hours of continuous vibratory work per day. Twenty-five to 30 minutes of vibratory work is typically required to extract a pile, with extended periods without vibratory work occurring between piles. It is possible that the contractors would be able to extract all 10 piles in a single work day. However, that is very unlikely given that the piles are installed as components of two different structures. Kitsap Transit proposes to remove two piles a day for five days.

Vibratory Driving. To the maximum extent possible, the contractors would use a vibratory driver to install 12 steel pipe piles. They would install two piles per day, with up to 1000 impact strikes required per pile to complete the driving and/or to proof the piles. As above, the assumption that 10-hours of continuous vibratory work would be required each day is excessive. Forty-five to 60 minutes of vibratory work could be required to install a pile, with extended periods without vibratory work occurring between piles. This assessment is based on the expectation that two piles would be installed per day, and that up to 60 minutes of vibratory work (and 1000 impact strikes) may be required per pile, for a daily total of two hours of vibratory installation (and 2000 pile strikes). Construction is planned for 2018, and would require about eight weeks of work during the July 2 to March 2 work window for the area. PS Chinook salmon and steelhead present in the action area are unlikely to be less than two grams during this work window.

Information about the sound levels for driving and extracting various pile types and sizes is somewhat limited, and variability often exists between the reported received levels (RL) for identical piles that are driven by the same driver at a given project site. The California Department of Transportation Compendium of Pile Driving Sound Data (Compendium, CalTrans 2009) provides detailed information about in-water RL for numerous pile types and sizes, under a wide range of situations. It is a reference commonly used to help estimate in-water noise levels that may result from pile driving projects where site-specific and/or action-specific information is not available.

Table I.2-2 in the Compendium reports 10-meter RL of 171 dB_{peak}, and 155 dB_{RMS} and dB_{SEL} for un-attenuated vibratory driving 12-inch diameter steel pipe piles in about 5-meter deep water. No specific information was given for vibratory driving 24-inch steel pipe piles. The available information suggests that the received sound levels for vibratory driving steel pipe piles increases with increased pile size, but the relationship appears to be non-linear (Table 5).

Table 5. RL at 10 meters (m) for vibratory driving steel pipe piles in shallow (~5 m deep) water

Pipe Pile Dia. "	Water Depth m	dB_{peak}	dB_{RMS}	dB_{SEL}
72	~ 5	195	180	180
36	~ 5	185	175	175
13	5	171	155	155
12	< 5	171	155	155

All data were taken from Tables 1.2-2 and 1.2-3 in the 2012 Compendium. All sound levels are in-water.

Multiplying the estimated rates of sound increase by the 12-inch size difference between 12- and 24-inch piles, then adding those values to the typical 10-meter RL for 12-inch piles in Table 5 (rounded to the nearest whole number) suggests that the 10-meter RL for vibratory driving 24-inch pipe piles in shallow water would be about 178 dB_{peak}, and 165 $dB_{RMS}/dB_{SEL.}$

Response to Vibratory Driver. Vibratory hammers have not been observed to cause injury or death to fishes or other aquatic organisms. This may be due to the slower rise time (the time taken for the impulse to reach its peak pressure) and the fact that the energy produced is spread out over the time it takes to drive the pile. We anticipate that vibratory pile driving will cause only minor behavioral effects to adults but may cause behavioral changes in juvenile steelhead, juvenile Chinook, and juvenile bocaccio that can lead to predation. We expect varying levels of behavioral responses, from no change, to mild awareness, or a startle response (Hastings and Popper, 2005), but we do not believe that this response will alter the fitness of any adults. However, a small number of juvenile salmonids and bocaccio may exhibit a behavioral response from pile driving that can lead to changes in feeding behavior or movement to a location where they are predated on, meaning the behavioral response of juveniles is an effect that may kill or injure a listed juvenile.

Impact Pile Driving

NMFS currently uses two metrics to estimate the onset of injury for fish exposed to high intensity impulsive sounds: 1) exposure to 206 dB_{peak}; and 2) exposure to 187 dB SEL_{cum} for fish 2 grams or larger, or 183 dB SEL_{cum} for fish under 2 grams. The distance from a pile driver where the RL for single-strike dB_{SEL} drops to background noise is considered the maximum distance from a pile that fishes can be affected by that noise, regardless of how many times the pile is struck (Stadler and Woodbury 2009). Therefore, when there is a difference between the ranges to the isopleths for effective quiet and Cumulative SEL, the shorter range shall apply.

The available information for impact driving steel pipe piles (Table 6) supports the understanding that sound level increases non-linearly with pile size. However, when graphed, there is near-linear rise in sound level for piles up to 20-inches, after which the curve flattens.

Table 6. RL at 10 meters (m) for impact driving steel pipe piles in shallow water (2 to 6 m deep)

Pipe Pile Dia. "	Water Depth m	dB_{peak}	dB_{RMS}	dB_{SEL}
66	4	210	195	---
60	< 5	210	195	185
48	2	205	195	185
36	< 5	208	190	180
30	4-5	205	190	---
30	3	210	190	177
24	~ 5	203	190	177
20	3-4	208	187	176
20	3	204	161	--
13	5	185	170	---
12	< 5	192	177	---
12	2	177	165	152

Data were taken from Tables 1.2-1, 1.2-2, 1.2-3 in the 2012 Compendium. All sound levels are in-water RL measured at 10 meters from the source.

Response to Impact Driver. Using the worst-case scenario of the 24-inch pile sound levels (largest piles with highest expected sound levels), dB_{peak} is 207, dB_{SEL} is 178 and dB_{RMS} is 194. Proper implementation of a bubble curtain is anticipated to reduce noise levels by a minimum of 6 dB_{RMS} at 10 meters, however the applicant preferred to be more conservative and run the numbers without a noise attenuation device. NMFS uses a Sound Pressure Exposure spreadsheet or calculator to estimate the area around each pile where fish would be considered at risk of injury or behavioral disruption during pile driving using the measurements 207 $dB_{peak,}$ 178 $dB_{SEL,}$ and 194 dB_{RMS}. Table 7 lists the expected sound levels that could be generated by the largest proposed steel pile driving associated with the project.

Table 7. Expected sound levels with attenuation reduction

Distance (m) to threshold		Onset of Physical Injury	
		Cumulative SEL dB	
		Fish ≥ 2 g	Fish < 2 g
Peak dB:	206	187	183
Distance:	**12 m**	**399 m**	**736 m**

Using this calculation, the 24-inch pile sound, and assuming an estimated 2,000 strikes per day, the maximum distance to the 206 dB peak injury threshold is calculated to 12 meters or less. We would expect the pile driving noise to carry for 8.5 km. The maximum distance to the 187 dB (fish ≥ 2) and 183 dB (fish < 2 g) cumulative SEL thresholds is calculated to 399 meters and 736 meters, respectively.

Cumulative SEL is intended as a measure of the risk of injury from exposure to multiple pile strikes. A sound exposure formula based on the Equal Energy Hypothesis is used to calculate cumulative SEL exposure:

Cumulative SEL = Single-strike SEL + 10*log (number of pile strikes)
Cumulative SEL = 178 + 10*log (2000)
Cumulative SEL = 178 + 10*33
Cumulative SEL = 211

The Cumulative SEL for this project is 211 dB at 10 meters.

The above discussed criteria specifically address fish exposure to impulsive sound. No consideration of non-impulsive sounds is given, and the discussion in Stadler and Woodbury (2009) makes it clear that the thresholds likely overestimate the potential for impacts on fish. Further, non-impulsive sounds have less potential to cause adverse effects in fish than impulsive sounds. Impulsive sources cause short bursts of sound with very fast rise times and the majority of the energy in the first fractions of a second. Whereas, non-impulsive sources cause noise with slower rise times and sound energy that is spread across an extended period of time; ranging from several seconds to many minutes in duration. Therefore, any application of these criteria to non-impulsive sound is likely to overestimate the potential for effects in fish.

The proposed action states that a bubble curtain or other noise attenuating devices will be used to attenuate the effects of impact proofing steel piles. However, a bubble curtain may not bring the sound pressure levels below the threshold where physical harm is likely. Thus, we expect that some death or injury of ESA-listed salmonids and rockfish is likely to occur. Although the proposed steel pile driving is scheduled to occur at a time when most salmonid species are not actively migrating through the action area, we expect some salmon and steelhead to be present during this time period and these are reasonably certain to be injured or killed if they are within 158 meters of construction. Likewise, adult and juvenile bocaccio and yelloweye rockfish may be in the action are during this time period as an effect exists even if only one individual or habitat segment may be affected.

Vessel Noise. The existing float and gangway will be removed via barge. Tugboat operation to position the barge may increase the amount of noise before and after the construction of the new PRF, but it will be short term. Tugboats will be deployed once to position the barge, and once to remove it once construction is complete. The barge will only serve as a work platform. Additionally, ferry traffic to and from the facility will continue to create noise comparable to that which already occurs at the sited, and we expect this to occur for the design-life of the project – roughly an additional 40 years.

The noise related to vessel traffic may also affect salmonids. Because few studies on the response of salmonids to vessel noise exist, we infer from other species' response to sound. Increased background noise has been shown to increase stress in humans (Hattis and Richardson 1980) and other mammals (Owen *et al*. 2004), and several studies support that the same is true for fish (Mueller 1980; Scholik and Yan 2002; Picciulin *et al*. 2010). Recreational boat noise diminished the ability of resident red-mouthed goby (*Gobius cruentatus*) to maintain its territory (Sebastianutto *et al*. 2011). Depending on speed and proximity to nests, boats caused spawning long-eared sunfish to abandon their nests for varying periods in order to find shelter (Mueller 1980). Xie *et al*. (2008) report that adult migrating salmon avoid vessels, within seven meters of the fish, by swimming away. Graham and Cooke (2008) studied the effects of three boat noise disturbances (canoe paddling, trolling motor, and combustion engine (9.9 horsepower) on the cardiac physiology of largemouth bass (*Micropterus salmoides*). Exposure to each of the treatments resulted in an increase in cardiac output in all fish, associated with a dramatic increase in heart rate and a slight decrease in stroke volume, with the most extreme response being to that of the combustion engine treatment (Graham and Cooke 2008). Recovery times were the least with canoe paddling (15 minutes) and the longest with the power engine (40 minutes). Graham and Cooke (2008) postulate that the fishes' reactions demonstrate that the fish experienced sublethal physiological disturbances in response to the noise propagated from recreational boating activities. Even though NMFS did not find studies exploring the physiological effects of increased noise from vessel traffic specifically on salmon, it is reasonable to assume that juvenile and adult salmon, in addition to avoiding boats (Xie *et al*. 2008), experience sublethal physiological stress at levels above background noise (effective quiet). However, construction-related vessel traffic will be limited to a few tugboat trips, and is not likely to significantly disrupt feeding, predator avoidance, or other behaviors.

Species Response to Water Quality Reductions (Turbidity and Suspended Sediment) from Pile Driving

Pile driving causes short-term and localized increases in turbidity and total suspended solids (TSS). The effects of suspended sediment on fish increase in severity with sediment concentration and exposure time and can progressively include behavioral avoidance and/or disorientation, physiological stress (e.g., coughing), gill abrasion, and death—at extremely high concentrations. Newcombe and Jensen (1996) analyzed numerous reports on documented fish responses to suspended sediment in streams and estuaries, and identified a scale of ill effects based on sediment concentration and duration of exposure, or dose. Exposure to concentrations of suspended sediments expected during the proposed pile driving could elicit sublethal effects such as a short-term reduction in feeding rate or success, or minor physiological stress such as coughing or increased respiration. Studies show that salmonids have an ability to detect and distinguish turbidity and other water quality gradients (Quinn, 2005; Simenstad, 1988), and that larger juvenile salmonids are more tolerant to suspended sediment than smaller juveniles (Servizi and Martens, 1991; Newcombe and Jensen, 1996).

Very little data exists regarding the temporary increase in suspended sediment associated with pile removal and driving. To estimate the magnitude of suspended sediment associated with the proposed pile driving, NMFS reviewed results from a vibratory pile removal project near the mouth of Jimmycomelately Creek in Sequim Bay (Weston_Solutions, 2006). In that study, TSS concentrations associated with activation of the vibratory hammer to loosen the pile from the substrate ranged from 13 to 42 milligrams per liter (mg/L) and averaged 25 mg/L. During the pile driving, elevated levels of TSS averaging 40 mg/L were recorded near the pile and 26 mg/L at the sensors located 16 to 33 feet from the pile. Concentrations during extraction ranged from 20 to 82.9 mg/L, and were sometimes visible in the water column as a 10- to 16-foot diameter plume that extended at least 15 to 20 feet from the actual pulling event. Although concentrations decreased after pile extraction, the time interval was unavailable due to tug movement as soon as the pile cleared the water’s surface.

To consider how the TSS generated from vibratory pile driving might affect juvenile PS Chinook, NMFS used the Weston Solutions (2006) data as an estimate for the range of expected TSS and Newcombe and Jensens (1996) ‘scale of ill effects’ to determine likely associated biological responses. For an exposure duration of up to two hours and an increase in TSS over background of up to 240 mg/L, the calculated severity of ill effect for juvenile salmon does not exceed a behavioral effect of short-term reduction in feeding rates and feeding success (the fish is startled, experiences reduced vision, stops feeding to reorient, and may swim away). The maximum increase in TSS reported in Weston Solutions (2006) is 83 mg/L. Even if the pile driving that is part of this proposed project would result in double the TSS as reported for vibratory pile driving in Weston Solutions (2006), the likely level of TSS is well below levels and durations that could result in injurious physiological stress. Further, any elevations in turbidity and TSS generated by the pile driving will be localized, short-term and similar to the variations that occur normally within the environmental baseline of the marine nearshore—which is regularly subject to strong winds and currents that generate suspended sediments. Thus, the juvenile salmonids likely will have encountered similar turbidity before. In summary, the short duration of the proposed pile driving (a few minutes per piling), generally low level expected increase in TSS, and small affected area renders the effects of the increased TSS on juvenile salmonids not meaningful.

Species Response to Habitat Enhancement/Minimization/Mitigation

The following mitigation actions will be conducted to offset unavoidable impacts associated with the proposed upgrade project.

Overwater Structure, Float, and Pile Removal. The existing pier and float decking is solid, which does not allow light penetration and casts a wide shadow into intertidal and subtidal habitats. The existing gangway contains a small amount of grating, which is designed to improve traction on the steep gangway, but does not appreciably improve light transmission through the gangway surface. The project will remove approximately 2,000 square feet of existing solid surface float and pier, 160 square feet of gangway, and 10 piles. Salmonids in the action area for the foreseeable future will still respond to shade and structure in their migration and rearing areas by expending more energy to avoid/ navigate around the structures, locate more productive feeding areas, and as a corollary, incur greater exposure to predation risk, decreasing growth and survival.

Invasive Species Removal and Native Riparian Plantings. A 4-foot-wide gravel walkway is located along the north side of the parking lot. To the north of the walkway, a vegetated strip between four and 12 feet in width abuts the shoreline. In this strip vegetation consists of lawn grasses, invasive Himalayan blackberry and English ivy), non-native decorative hedges, and several mature, deciduous trees and shrubs. One young, coniferous western red cedar (Thuja plicata) is also located in the western portion of the vegetated strip near the covered waiting area.

Invasive and non-native shrub and vine species will be removed from the riparian strip between the walkway and the shoreline. This area will be replanted with native herbaceous, shrub, and tree species. Native tree species will also include coniferous species to provide shade on the shoreline throughout the year once the trees have matured. This will improve opportunities for forage fish spawning, and be a future source of detrital input of prey, together incrementally but permanently improving preybase for rearing and migrating salmonids in this location, increasing growth and fitness.

Intertidal Debris Removal. The intertidal zone in the vicinity of Annapolis Dock contains artificial debris primarily composed of angular riprap and concrete. This debris covers potential forage fish spawning habitat located in the upper intertidal area and extends down the shoreline into lower intertidal areas. An additional mitigation measure will include removal of the debris from the intertidal zone with a primary focus of removing debris within the +5 foot to +9 foot MLLW range to improve opportunities for forage fish spawning. Debris removal will also be conducted lower on the beach and will require the use of heavy equipment, such as an excavator, to remove the angular rock, concrete, and other artificial debris. If forage fish spawning re-establishes after the debris removal, then this would also be a permanent incremental improvement in prey abundance for salmonid rearing and migration in this location, increasing growth and fitness.

The goal of the intertidal debris removal is to mitigate at as close to a 1:1 ratio for the net increase in overwater coverage as possible by removing approximately 2,322 square feet of artificial debris from the site. An initial survey conducted on February 22, 2017 revealed that there is likely sufficient material to meet or exceed this goal. Kitsap Transit is dedicated to improving the intertidal and shoreline conditions of the site. However, if the debris removal comes close to this goal after removing the available debris but is not able to fully achieve 2,322 square feet of debris removal, the remaining mitigation need will be accounted for through the approximately 8,600 square feet of shoreline enhancement plantings.

Habitat Enhancement/Minimization/Mitigation Summary. The project will remove approximately 2,160 square feet of existing solid concrete pier, gangway, and solid concrete float and 10 piles. The proposed pier, gangway, and float is approximately 4,470 square feet, which is a net increase of 2,379 square feet of new overwater structure, most of which is in deeper water. To mitigate this impact, Kitsap Transit will remove approximately 2,322 square feet of artificial debris from the site and enhance approximately 8,600 square feet of riparian shoreline habitat. Detriments to prey and forage may be offset or more than offset by the mitigation elements of the proposed action, however detriments associated with increased energy expenditure and predation risk will not be offset. Table 8 summarizes the mitigation actions proposed to compensate for unavoidable impacts.

Table 8. Project Impact and Mitigation Summary

Activity	Area[1]
Pile installation	-28 SF[2]
Pile removal	+16 SF[2]
In-Water Net Total:	-12 SF
Pier and ramp installation	-1,251 SF
Float installation	-3,219 SF
Pier, gangway, and float removal	+2,160 SF
Over-Water Net Total:	-2,310 SF
Intertidal debris removal	+2,322 SF (approx.)
Riparian enhancement	+8,600 SF
Lighting modification	NA
Other Mitigation Totals:	+10,922 SF

Notes:

1) negative (-) denotes impact to habitat and positive (+) indicates habitat improvement

2) impact area for piles is given as cross-sectional area

Summary of Effects to Salmonid Population Viability

We assess the importance of habitat effects in the action area to the ESUs/DPS' by examining the relevance of those effects to the characteristics of VSPs. The characteristics of VSPs are sufficient abundance, population growth rate (productivity), spatial structure, and diversity. While these characteristics are described as unique components of population dynamics, each characteristic exerts significant influence on the others. For example, declining abundance can reduce spatial structure of a population; and when habitats are less varied, then diversity among the population declines.

Abundance. In addition to the construction-related effects that will affect only those cohorts of fish present during the work, the placement of the PRF has long-term effects on the marine nearshore environment that multiple cohorts of fish will experience over the life of the project. These long-term effects result in obstruction of fish movement, potential reduction in SAV density and food supply, and disturbance from boating activity and noise. The species is most likely to be repeatedly/ chronically exposed to these conditions are juvenile PS Chinook which migrate or rear in the nearshore area. We have no information that any effects other than the reduction in food supply would affect juvenile bocaccio. These long-term habitat changes, which will persist for the 40-year duration the structures are in place, result in an incremental increase in stress, reduction in foraging success, alteration of migration patterns (forcing juveniles to leave the nearshore), and impairment of predator avoidance. Effects to individual fish will occur among an undetermined percentage of all future cohorts of all populations that use the action area. We anticipate that a small number of juveniles of each species will be injured or killed because of reduced habitat suitability for listed species and increased predation resulting from the action. We expect these decreases to be proportional to the relatively small amount of habitat adversely affected, but that PS Chinook populations that rely on this action area will incur the greatest level of exposure and detrimental response.

Productivity. The new structure will permanently and incrementally degrade nearshore habitat conditions. In response to these habitat changes, we expect changes in behavior of juvenile salmonids including reduced foraging success, changed migratory pathway due to the obstruction from OWS, and increased energy expenditure. All these effects, independently or in combination, are likely to lead to proportional decreases in individual fitness and survival. The long-term changes to the nearshore environment are expected to exert a sustained downward pressure on nearshore habitat function in the PS and, proportionally to the relatively small amount of nearshore habitat affected, reduce the rearing and foraging capacity of the action area. The habitat impacts from the proposed authorization of the PRF will likely contribute to the decreases in productivity of early marine life-history stages in PS Chinook salmon, PS steelhead, and bocaccio already inherent to the baseline. However, the proposed mitigation (plantings and debris removal) will simultaneously improve the current nearshore habitat conditions. On balance, the incremental decrease in abundance among the juvenile cohorts over time is expected to be difficult to impossible to discern among returning adult cohorts, and any downward pressure on productivity from a decrease in adult spawners will not be able to be attributed to the proposed action.

Spatial Structure. We do not expect the proposed project to affect the spatial structure of any of the three affected ESUs/DPS'. Salmonid populations spread across the nearshore and mix when they enter PS (Fresh et al., 2006). This one PRF will likely not disproportionately affect any one population and thus no diminishment in spatial structure will be attributable to the proposed action.

Diversity. Salmon have complex life histories and changes in the nearshore environment will have a greater effect on specific life history traits that make prolonged use of the nearshore. The proposed action will concentrate the effects on PS Chinook delta fry. After emergence, delta fry quickly migrate downstream through the estuary into the marine nearshore and pocket estuaries such as Sinclair Inlet (Beamer, 2005). Over time, selective pressure on one component of a life-history strategy tends to eliminate that divergent element from the population, reducing diversity in successive generations and the ability of the population to adapt to new environmental changes (McElhany et al., 2000). The subset of juvenile salmonids that extensively utilize the nearshore, delta fry, are likely to be killed or injured at a higher rate than other life history forms which use the marine nearshore for a shorter amount of time. These delta fry that experience increased mortality from the proposed action will have their life history strategy selected against. This will likely result in a slight, proportional to the limited habitat alteration, decline in PS Chinook diversity by differentially affecting specific populations that encounter PRFs in greater frequency during their early marine life history. We are not aware of any effects that would result in a reduction in diversity to PS steelhead.

2.5 Cumulative Effects

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

The action area, Sinclair Inlet, is influenced by actions in the nearshore, along the shoreline, in deeper parts of the harbor, and also in tributary watersheds of which effects extend into the action area. Actions in the nearshore and along the shoreline of Sinclair Inlet are mainly commercial development, a U.S. Naval Base, shoreline modifications, road construction and maintenance, but also include some agricultural development. Federal actions dominate current and future impacts in the action area because the vast majority of activities that may affect listed species in the action area will require an approval under the Clean Water Act. Future federal actions will be subject to the section 7(a)(2) consultation under the ESA.

These actions, in the nearshore as well as in tributary watersheds, will cause long-lasting environmental changes and will continue to harm ESA-listed species and their critical habitats. Especially relevant effects include the loss or degradation of nearshore habitats and pocket estuaries (the action area is a pocket estuary). We consider human population growth to be the main driver for most of the future negative effects on salmon, steelhead, bocaccio and their habitat.

Future private and public development actions are very likely to continue in and around Sinclair Inlet. As the human population continues to grow, demand for agricultural, commercial, and residential development and supporting public infrastructure is also likely to grow. We believe the majority of environmental effects related to future growth will be linked to these activities, in particular land clearing, associated land-use changes (i.e., from forest to impervious, lawn or pasture), increased impervious surface, and related contributions of contaminants to area waters. Land use changes and development of the built environment that are detrimental to salmonid habitats are likely to continue under existing regulations. Though the existing regulations could decrease potential adverse effects on salmon habitat, as currently constructed and implemented, they still will allow substantial degradation to occur. Over time, the incremental degradation, when added to the already degraded environmental baseline, will likely result in reduced habitat quality for at-risk salmon, steelhead, and bocaccio.

In addition to these growth-related habitat changes, climate change has become an increasing driver for infrastructure development and changes to protect against sea level rise in coastal areas. These changes to nearshore habitat can include sea walls like the one currently being constructed in Venice, Italy and considered for many major US cities including New York (Marshall, May 2014). Regardless of the environmental effects, the cost of flooding has been predicted to be higher than the cost of building such sea walls (Lehmann, February, 2014) which increases the likelihood of more flood protection projects coming to PS in the future. These flood protection projects will likely include, filling, raising of habitat, dikes, dunes, revetments, flood gates, pump stations, and sea walls; all habitat modifications that will be detrimental to salmon.

In June 2005, the Shared Strategy presented its recovery plan for PS Chinook salmon to NOAA Fisheries who adopted and expanded the recovery plans to meet its obligations under the ESA. Together, the joint plans comprise the 2007 PS Chinook Recovery Plan. Several not for profit organizations and state and Federal agencies are implementing recovery actions identified in these recovery plans. Notwithstanding the beneficial effects of ongoing habitat restoration actions, the cumulative effects associated with continued development are likely to have ongoing adverse effects on salmon and steelhead population abundance and productivity. Only improved low-impact development actions together with increased numbers of restoration actions, watershed planning, and recovery plan implementation would be able to address growth related impacts into the future. To the extent that non-Federal recovery actions are implemented and offset on-going development actions, adverse cumulative effects may be minimized, but will probably not be completely avoided.

2.6 Integration and Synthesis

The Integration and Synthesis section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 2.4) to the environmental baseline (Section 2.3) and the cumulative effects (Section 2.5), taking into account the status of the species and critical habitat (Section 2.2), to formulate the agency’s biological opinion as to whether the proposed action is likely to: (1) Reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) reduce the value of designated or proposed critical habitat for the conservation of the species.

2.6.1 Species Aggregate Analysis

The current status of each of the three affected ESUs/DPS' is poor, which is the reason for their continued listing as threatened with extinction.

Salmonids**:** The PS Chinook salmon ESU and PS steelhead DPS are each at moderate risk of extinction. The threatened status of PS Chinook and steelhead is a result of insufficient abundance, productivity, spatial structure, and/or diversity to persist in the wild. These pressures derive from habitat conditions and other pressures, including factors in the environmental baseline. In general, baseline habitat conditions in the PS region have been degraded chiefly by human development.

Relevant habitat modifications include the channelization and diking of rivers, increase of impervious surfaces in most watersheds, simplification of river deltas, elimination of small coastal bays, reduction in sediment supply due to beach armoring, and loss of tidal wetland (Fresh et al., 2011). In addition to beach armoring, other shoreline changes including OWS, marinas, roads, and railroads reduce marine nearshore habitat quality (Simenstad et al., 2011). As human population growth has increased upland development has continued to cause chronic systemic habitat degradation. The extent of these habitat changes significantly impairs several aspects of critical habitat and puts its function for listed salmonids at risk, which is revealed in habitat trends. Abundance across the PS Chinook ESU has generally decreased between 2010 and 2014, with only 6 small populations of 22 total populations showing a positive change in natural-origin spawner abundances. Abundance of adult steelhead returning to nearly all PS rivers has fallen substantially since estimates began for many populations in the late 1970s and early 1980s. Natural steelhead spawners indicate similar low abundance and declining trends continue in approximately half of the populations throughout Puget Sound, particularly in southern Puget Sound and on the Olympic Peninsula (NWFSC 2015).

In estuaries and Puget Sound, the Puget Sound Salmon Recovery Plan (NMFS 2006) identifies actions for several key factors to support salmon recovery: (1) Protect key fresh- and saltwater processes and habitats from physical or biological disruptions; (2) restore estuarine processes and habitat; (3) restore marine shorelines (including freshwater inputs) outside major deltas; (4) protect and restore fresh- and saltwater quality; (5) protect and restore freshwater quantity; (6) reduce the risk and damage from catastrophic events; and (7) reduce risk and damage from non-indigenous species and other changes to food webs. Similarly, listed rockfish abundances continue to decline with little to no signs of any effects of recent protective measures.

Climate change is likely to exacerbate several of the ongoing habitat issues, especially increased summer temperatures and decreased summer flows in the freshwater environment and ocean acidification and sea level rise in the marine environment. While the net balance of shoreline armoring seems to be somewhat stable at present, with new armoring being offset by restoration actions (Puget Sound Partnership 2017), sea level rise adds pressure to increase future armoring in Puget Sound. More shoreline armoring, along with other infrastructure projects designed to protect against flooding, will likely further reduce habitat quality for salmonids.

While some effects of the proposed action will not likely result in any measurable effect on listed salmon, or steelhead (such as construction vessel traffic and increased turbidity), two construction-related effects are likely to have negative effects: (1) Sound effects from impact driving steel piles and (2) benthic impacts from increased in-water structure. The chronic effect of the project's continued and expanded structure in aquatic habitat is also negative. We cannot quantify the number of individual salmonids that will be injured or killed from such impacts, however, because the precise distribution and abundance of adult and juvenile fish within the action area are not a simple function of the quantity, quality, or availability of predictable habitat resources within that area. Nonetheless, the adverse effects related to construction activities, and the presence of the structures, are likely to kill or injure fish in the action area. When the detrimental effects of the action are considered in the context of: (1) The species threatened or endangered status, (2) the baseline, and (3) likely cumulative effects, the project effects on abundance affect too few fish from any one population to influence any population's viability characteristic for productivity, and, in turn, are insufficient to distinguish any change in trends for spatial structure or diversity among the affected species, and it is impossible to conclude that the project will alter the viability trends of the three species. Effects of the action do not limit any of the estuarine and marine key factors identified in the Puget Sound Salmon Recovery Plan.

We also evaluate the effects of the project on features and functions of salmonid critical habitat in an aggregate analysis, adding them in the context of conservation value and roles of habitat. Critical Habitat throughout the designated area for salmonids is diminished spatially and qualitatively by anthropgenic changes, and the features within the action area are also impaired in several ways. As described above cumulative effects likely will continue to adversely affect critical habitat, and climate change is likely to aggravate those impacts. When we add the adverse effects of the proposed action, the construction effects are too brief to be meaningful to the features or function of habitat, and negative effects on forage will be mitigated or potentially slightly improved. The permanent effect on safe salmonid migration are negative, but are at too small a scale to substantially reduce the value of the critical habitat for migration purposes in the estuarine and marine environment, and they ostensibly do not preclude reestablishing properly functioning conditions at the action area scale. Thus, when added to the baseline and considering the cumulative effects, the effects of the action on critical habitat do not significantly affect the conservation value of critical habitat for salmonids.

Rockfish**:** PS/GB bocaccio abundance and productivity is a fraction of historic abundance. Boccacio abundances continue to decline with little to no signs of any effects of recent protective measures. One of the main factors for their poor status and low abundance and productivity is past practices of overharvesting and a life history that does not allow for fast recovery. Rockfish are long-lived, mature late, and highest fecundity occurs in older and larger fish which largely have been harvested. Climate change is likely to exacerbate several of the ongoing issues for listed rockfish critical habitat, mainly the reduction in available quality nearshore rearing habitat.

On top of the poor abundance, productivity, and nearshore habitat conditions for rockfish, three effects resulting from the proposed action are likely to have measurable adverse effects on bocaccio and its critical habitat: (1) Sound effects from impact driving steel piles and (2) benthic impacts from increased in-water structure. The effects are of the same nature and magnitude as described above for salmonids.

Even though aspects of the baseline are degraded, mainly through nearshore development, and cumulative effects likely will continue to adversely affect the nearshore portion of bocaccio critical habitat, the added adverse effects of the proposed action are too small on a DPS-level to substantially reduce the conditions of critical habitat or preclude re-establishing properly functioning conditions. Overall, when added to the baseline and cumulative effects, the effects of the action on bocaccio critical habitat do not significantly affect the conservation value of critical habitat at the designation scale.

For effects to species, we expect a very small number of larval and juvenile rockfish to experience measurable adverse effects as the result of the construction and existence of the proposed structures. Even when we consider the current poor status of the populations and degraded environmental baseline within the action area, the proposed action itself is not expected to affect abundance, distribution, diversity, or productivity of any of the component populations of the ESA-listed species, nor to further degrade baseline conditions or limiting factors. The effects of the action will be too small in scale and too minor to have a measurable impact on the affected populations. Because the proposed action will not significantly reduce the productivity, spatial structure, or diversity the affected populations, the action, when combined with a degraded environmental baseline and additional pressure from cumulative effects, will not appreciably affect the status of listed rockfish.

2.7 Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, any effects of interrelated and interdependent activities, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of PS Chinook salmon, PS steelhead, and PS/GB bocaccio or destroy or adversely modify PS chinook and juvenile bocaccio designated critical habitats.

2.8 Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this incidental take statement.

2.8.1 Amount or Extent of Take

While NMFS expects species exposure to effects of the proposed action, NMFS cannot estimate the number of individuals that will experience adverse effects because the presence of species varies over time, by cohort, and depending on a variety of environmental factors that cannot be fully predicted, such as stream and ocean temperatures. When take cannot be quantified, we provide an "extent of take" a measure of the habitat area in which conditions are modified by the project resulting in injury or death among species (i.e., "harm").

Impact pile driving will occur episodically throughout the in-water work season. As mentioned above, NMFS cannot predict the number of individual fish that will be exposed. Furthermore, not all exposed individuals will experience adverse effects. Therefore, NMFS will use the physical and temporal extent of aquatic habitat in which we expect injurious levels of underwater sound to occur, as a surrogate for the number of fish that could be injured. This location is that area in which fish would be exposed to a sound at a level that can cause injury as a response, and this location is also one that can be monitored to discern whether or not injurious sound exceeds the anticipated area, and if so, serve as a trigger for re-initiation.

Assuming an estimated 2,000 strikes per day, the maximum distance to the 207 dB_{peak} injury threshold is calculated to 12 meters or less. The maximum distance to the 187 dB (fish ≥ 2) and 183 dB (fish < 2 g) cumulative SEL thresholds is calculated to 399 meters and 736 meters, respectively.

The numbers of fish likely to experience take will be larger than we have evaluated in the foregoing analysis and the take surrogate will be exceeded if sound exceeds 211 dB at 10 meters (cumulative SEL of 178 dB_{SEL} at 10 m). There is a causal link between this surrogate and the take because as sound increases over 211 dB SEL_{cum} at 10 meters the likelihood of harm increases and the bigger the area within which sound over that measurement occurs and the greater the number of fish that will exposed to injurious sound levels.

Proper implementation of a bubble curtain is anticipated to reduce noise levels by a minimum of 6 dB_{RMS} at 10 meters. Using the Sound Pressure Exposure spreadsheet or calculator to estimate the area around each pile where fish would be considered at risk of injury or behavioral disruption during pile driving using the measurements 201 $dB_{peak,}$ 172 $dB_{SEL,}$ and 188 $dB_{RMS.}$ Again assuming an estimated 2,000 strikes per day, the maximum distance to the 201 dB_{peak} injury threshold is calculated to five meters or less. The maximum distance to the 187 dB (fish ≥ 2) and 183 dB (fish < 2 g) cumulative SEL thresholds is calculated to 159 meters and 293 meters, respectively.

Incidental take in the form of harm, (increased predation through obstruction of juvenile migratory pathway obstruction, reduced salmonid vision, and reduced fitness and survival through reduced food source) also cannot be estimated as a number of ESA-listed individuals. For take resulting from response to detrimental habitat modifications, we will use the area of over water coverage from the PRF: 4,470 square feet, as it causes the negative habitat conditions to which the fish exposed will respond. The surrogate measure is proportional to the amount of take considered to result from the action, (summarized in Table 11) because if the size of the structure were to change, the numbers of fish harmed would also change correspondingly, and thus is equivalent to the maximum amount of take considered in our jeopardy analysis. Therefore, if the size of the structure built exceeds the size described in the consultation document, the amount of take will be exceeded, and reinitiation of consultation with the FTA will be required as the funding entity has continued jurisdiction over the appropriate expenditure of its funds received.

An "extent of take" is readily observable and, therefore, suffices to trigger reinitiation of consultation, if exceeded and necessary (see H.R. Rep. No 97-567, 9th Cong., 2d Sess. 27 [1982]).

NMFS summarizes the incidental take expected to occur in the following table:

Table 9. Take Summary

Species	Life Stage	Type of Take	Description of Take Mechanism	Maximum Numbers Affected or Area Affected
Puget Sound Chinook salmon	Juvenile	Harm	Exposure to cSEL above harm threshold	cumulative SEL of 211 dB at 10 m
			Long-term habitat modification that reduces fitness and survival	4,470 square feet of nearshore overwater structure will be degraded by overwater and in-water structure for the expected life of the structures.
Puget Sound steelhead	Juvenile	Harm	Exposure to cSEL above harm threshold	cumulative SEL of 211 dB at 10 m
			Long-term habitat modification that reduces fitness and survival	4,470 square feet of nearshore overwater structure will be degraded by overwater and in-water structure for the expected life of the structures.
PS/ Georgia Basin DPS bocaccio	Juvenile	Harm	Exposure to cSEL above harm threshold	cumulative SEL of 211 dB at 10 m
			Harm through long-term habitat modification that reduces individual fitness and survival through reduced food supply.	4,470 square feet of nearshore overwater structure will be degraded by overwater and in-water structure for the expected life of the structures.

In conclusion, NMFS exempts take for the following:

1. Cumulative SEL of 211 dB at 10 m as calculated using the single strike Peak, SEL, and noise levels, the number of strikes per day, and transmission loss according to the practical spreading model, over a period of 17 days; and

2. The permanent presence of 4,470-square-foot of in and overwater structure in migratory and rearing habitat.

2.8.2 Effect of the Take

In the biological opinion, NMFS determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

2.8.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" are nondiscretionary measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02).

To minimize the impact of incidental take of listed Chinook, steelhead, and bocaccio species from the proposed action (50 CFR 402.14(i)(3)), the FTA must:

1. Ensure completion of a monitoring and reporting program to confirm that the take exemption for the proposed action is not exceeded, and that the terms and conditions in this incidental take statement are effective in minimizing incidental take from permitted activities.

2.8.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the FTA or any applicant must comply with them in order to implement the reasonable and prudent measures (50 CFR 402.14). The FTA or any applicant has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this incidental take statement (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

The following terms and conditions implement the reasonable and prudent measure:

1. In order to monitor the take exemption the FTA shall ensure that Kitsap Transit prepares a monitoring report identifying any incidental take associated with project activities and describing conservation measures implemented to minimize take. The report shall include a description of construction activities conducted and duration of activities to ensure take was not exceeded. The report shall be submitted to NMFS at projectreports.wcr@noaa.gov and lisa.abernathy@noaa.gov, within 6 months of completion of construction. The report shall summarize the compliance with the project description and conservation measures and the level of exempted incidental take during the implementation of the project that year.
   a. The report shall include the following:
      - Final ferry terminal size and grating.
      - Results of the marine mammal monitoring during construction.
      - Results of the acoustic monitoring during pile driving activities. Acoustic monitoring is to identify and confirm pile driving noise levels.

- If sound exceeds cumulative SEL of 211 dB at 10 meters, NMFS thresholds identified in Section 2.4 of this opinion, then the amount of take authorized by the Incidental Take Statement will have been exceeded.
- Dates of construction related activities such as:
    - Removal of the steel and concrete piles.
    - Installation of new steel piles.
- Description of pile driving activities such as:
    - Number and method of piles removed.
    - Number of piles installed with an impact pile driver.
    - Number and duration of strikes per pile and throughout the day.

2. Confirm that all work occurs within work window (all in water work would only occur from July 2 through March 2).

3. Use a bubble curtain or other noise attenuating device during all impact pile driving.

4. Confirm that three years post-planting, the native plants have 80 percent survival. Replace any dead plantings with comparable species in the following autumn planting season.

5. The ATF shall notify the NMFS immediately if the results of this program trigger any of the relevant reinitiation requirements specified in the Reinitiation of Consultation section of this opinion (Section 2.10).

2.9 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations (CR) are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02).

1. Conduct forage fish spawning surveys for evidence of surf smelt and sand lance spawning within 72 hours prior to the start of in-water activities to minimize the impact on spawning forage fish. If forage fish are observed spawning prior to in-water work, in-water work must be delayed until the area is clear of forage fish spawn. Additional forage fish spawning surveys can be conducted at regular intervals (*e.g.*, every 1 to 2 weeks) to determine when in-water work may begin.

2.10 Reinitiation of Consultation

This concludes formal consultation for reinitiation of the Annapolis Ferry Terminal Upgrade.

As 50 CFR 402.16 states, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and if: (1) the amount or extent of incidental taking specified in the incidental take statement is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

2.11 "Not Likely to Adversely Affect" Determinations

The applicable standard to find that a proposed action is not likely to adversely affect listed species or critical habitat is that all the effects of the action are expected to be discountable, insignificant, or completely beneficial. Beneficial effects are contemporaneous positive effects without any adverse effects on the species or critical habitat. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur.

Based on this analysis, NMFS concurs with the FTA that the proposed action is not likely to adversely affect the subject listed species:

2.11.1 Southern Resident Killer Whale

Status of SRKW and Critical Habitat

The SRKW DPS was listed as endangered under the ESA in 2005 (70 FR 69903, November 18, 2005). In December 2016, NMFS finalized a 5-year status review under the ESA, which provided an update to the status of the SRKW DPS and the progress toward meeting the recovery criteria identified in the recovery plan. The status review recommended that the classification for the DPS remain the same: Endangered. Limiting factors described in the final recovery plan for the SRKW DPS include quantity of prey. Data collection and analysis indicate a strong preference for Chinook salmon throughout their geographical range (NMFS 2008; Hanson *et al.* 2010).

Critical habitat for the SRKW was designated in 2006 (71 FR 69054, November 29, 2006). Critical habitat consists of three specific areas: 1) the Summer Core Area in Haro Strait and waters around the San Juan Island; 2) Puget Sound; and 3) the Strait of Juan de Fuca. These areas encompass approximately 2,560 square miles of marine habitat. Based on the natural history of SRKWs and their habitat needs, NMFS identified the following PBFs essential to conservation: 1) water quality to support growth and development; 2) prey species of sufficient quantity, quality and availability to support individual growth, reproduction and development, as well as overall population growth; and 3) passage conditions to allow for migration, resting, and foraging. On February 24, 2015, NMFS announced a 12-month finding to revise the critical habitat designation for the SRKW DPS. NMFS will proceed with a revision to critical habitat and will develop a proposed rule (80 FR 9682, February 24, 2015).

Effects on SRKW Critical Habitat

Most of the action area is within designated SRKW critical habitat. Pile driving will temporarily affect the underwater baseline noise level (a water quality PBF) and prey species PBFs through noise generation. Vibratory pile driving will produce in-water continuous noise that exceeds the 124 dB_{RMS} background/disturbance threshold for cetaceans (NMFS 2016b). However, the vibratory pile driving will be of short daily during duration, will be ameliorated by the implementation of a marine mammal monitoring plan to pause vibratory pile driving when SRKW are present in the action area, and habitat conditions will return to baseline conditions immediately following the completion of pile installation. Therefore, NMFS concludes that the project effects on the aquatic habitat will be insignificant.

The project will result in a net increase of 2,310 square feet of overwater coverage with negative impacts to PS Chinook salmon. The project also includes mitigation for the footprint increase, resulting in long-term incremental beneficial effects on the SRKW prey species. On balance the effect on PS Chinook, as a feature of SRKW critical habitat, is a single construction period causing a small decrease in abundance from construction effects, and a small, permanent, but indiscernible diminishment in migration conditions for PS Chinook, insufficient to increase the risk of jeopardy. Based on the short duration, small area, and low level of the expected construction effects, and the limited area of permanent habitat effects, we do not expect effects on SRKW prey to have any effect on the distribution or abundance of SRKW prey species in the action area in either the short or long term. Therefore, NMFS concludes that project effects on SRKW critical habitat will be insignificant.

Effects to SRKW

The range of SRKWs during the spring, summer, and fall includes the inland waters of Washington and British Columbia, including Puget Sound, the Strait of Juan de Fuca, and the southern Georgia Strait. SRKWs also occur in coastal waters from southeast Alaska to California. Most sightings of SRKWs occur in the summer in inland waters of Washington and southern British Columbia. Satellite tagging and acoustic recorder studies have provided new data about the SRKWs' coastal habitat use (Hanson *et al.* 2010). The data indicate the J pod's limited occurrence along the outer coast and its extensive occurrence in inland waters, particularly in the northern Georgia Strait. The J pod has also only been detected on one of seven passive acoustic recorders positioned along the outer coast; it does not appear to travel to Oregon or California like the K and L pods do (Hanson *et al.* 2010). Detection rates of the K and L pods on the passive acoustic recorders indicate the whales occur with greater frequency off the Columbia River and Westport and are most common in March (Hanson *et al.* 2010). The K and L pods use the coastal waters along Washington, Oregon, and California during non-summer months.

SRKWs may be present in the action area but they are not common in Sinclair Inlet. Within the last five years, SRKW have only been sighted once, April 2016, in the action area (Orca Network 2018). These sighting do not overlap with the in-water work window of July 2 to March 2.

Therefore, even though pile driving will produce in-water continuous noise that exceeds the 124 dB_{RMS} background/disturbance threshold for cetaceans (NMFS 2016b), since no SRKW sightings have occurred in the action area during the proposed in-water work window over five years, the chance of the SRKWs entering the action area during the 10 days of pile driving over the entire work window is low, making exposure discountable. If SRKW did occur in the action area, it would have to be within the 10-day period of driving in order for exposure to occur, but the marine mammal monitoring to be conducted during pile-driving activities to further reduce the likelihood of exposure, with stop work protocols on the condition of marine mammal sighting. Accordingly, NMFS concludes it is unlikely and, thus, discountable that SRKW will be exposed to noise from pile driving.

Kitsap Transit will use tugboats and a barge to construct the project. The barge will provide a work platform during construction. The tugboats will position the barge for overwater construction and will remove the barge when the construction is complete. Noise from tugboat operation will be short term, will be approximately 171 dB when operating at 18 km/hr (Earth Island 2018), and will not rise above the noise level of ferry traffic in the action area. Noise from tugboats, therefore, is not likely to affect SRKW.

Tugboats will operate close to shore, in water depths where SRKW are unlikely to occur. Tugboats are slow moving (less than 18 km/hr), which allows more time for the vessel to react if a whale is observed in the area, and follow a predictable course. Vessel strikes are extremely unlikely to occur, and we consider this risk to also be discountable.

Marine Mammal Monitoring Plan

The objective of a MMMP is to observe for marine mammals within the area of potential sound effect and stop or not start work while a marine mammal is within the area of potential sound effect. Marine mammals could be injured or disturbed by underwater sound pressure generated by in-water construction activities during vibratory and impact pile driving. Assumptions used in calculating the distances underwater sound pressure levels will travel above the injury and disturbance thresholds for marine mammals include:

- Impact pile driving for 24-inch steel piles produces single-strike sound levels of 207 dB_{PEAK}, 194 dB_{RMS}, and 178 dB_{SEL} when measured at 10 meters (32.8 feet) from the source (WSDOT, 2017). Impact pile driving for 12-inch steel piles produces single-strike sound levels of 207 dB_{PEAK}, 189 dB_{RMS}, and 173 dB_{SEL} when measured at 10 meters (32.8 feet) from the source (WSDOT 2017). Eight (8) 24-inch-diameter piles and four (4) 12-inch-diameter piles are proposed for the project. Impact pile installation calculations assumed up to 2000 pile strikes per day (1000 strikes/pile and 2 piles/day) for both 12- and 24-inch steel piles.
- A bubble curtain will be employed during impact pile driving. Proper implementation of a bubble curtain is anticipated to reduce noise levels by a minimum of 6 dB_{RMS} at 10 meters. However, the following noise calculations did not incorporate reduced underwater noise values from bubble curtain sound attenuation.
- Vibratory pile removal and installation will have an underwater noise level of 175 dB_{RMS} for 24-inch steel pipe (typical) piles (Data was only available for 36-inch diameter piles, which was used as a surrogate for 24-inch steel pipe piles) and 155 dB_{RMS} for 12-inch steel pipe piles. Vibratory injury calculations for marine mammals were conservative and assumed a 10-hour continuous work duration within a 24-hour period. Therefore, vibratory hammer underwater noise should attenuate to baseline conditions (120 dB_{RMS})

within less than 0.29 miles (464 meters) and 28.8 miles (46,416 meters) from the project site for 12- and 24-inch steel pipe piles, respectively.

Monitoring will only occur in the vicinity of in-water construction activities that may produce underwater sound pressure levels above the disturbance threshold of 160 dBrms for impact driving and 120 dBrms for vibratory pile driving. No monitoring is necessary during out-of-water construction.

Locations. Monitoring will occur in the vicinity of all in-water construction activities that may produce underwater noise levels in excess of 120 dBrms for vibratory pile driving and 160 dBrms for impact driving as shown on Figure 2. Shore based views of the monitoring zone are available from the project site, Bremerton, and Manette shorelines. Monitoring conducted by boat will provide rapid monitoring of the entire area using less monitors. Construction will only occur when weather conditions are suitable for effective visual monitoring of the action area.

Monitoring Techniques. Two monitoring method options are proposed to meet the marine mammal monitoring requirements. One or both of these methods will be used during pile installation and will be determined in the field based on the current weather conditions and forecast for each day, as well as the likelihood of encountering marine mammals during the construction time-frame. The first option includes one or more qualified observer(s) positioned at on-shore vantage points at the project site or Bremerton Marina. The second option will require one or more monitors patrolling the disturbance areas in a boat. The final monitoring path may be adjusted during construction, but monitoring methods will allow for a complete view of the monitoring zone. The monitoring method and number of monitors may be adjusted based on site specific weather conditions and visibility.

The monitoring area is defined as the area in which marine mammals could be disturbed by in-water pile driving noise. For the project site, the area of potential disturbance for cetaceans and pinnipeds is defined as the distance at which underwater sound attenuates to 160 dBrms for impact driving and 120 dBrms for vibratory pile driving. For 12-inch piles, this attenuation is expected to occur within 1,522 feet (464 meters) for vibratory installation and within 1.33 miles (2,154 meters) for impact installation. 24-inch pile installation underwater sound is expected to attenuate to below disturbance thresholds within 28.8 miles (46,416 meters) for vibratory pile installation and 1.15 miles for impact installation. If the sea state exceeds a Beaufort level 2, additional monitors may be needed to effectively cover the monitoring zone.

The Orca Network website will be accessed each morning prior to in-water construction activities that may produce noise levels above the disturbance threshold. The Orca Network website identifies the most recent opportunistic sighting locations of Southern Resident killer whales and other ESA-listed marine mammals, which can assist in identifying potential presence within the monitoring zone. Using scopes and binoculars, the monitors will search for marine mammals within the monitoring zone. If no ESA-listed marine mammals are within the disturbance zone, the monitors will notify the construction superintendent to begin pile driving.

During pile driving operations, monitors will continue to scan the area for marine mammals. All monitors will have two-way radios to allow for effective communication during pile driving. If

ESA-listed marine mammal species are seen within the monitoring zone during pile driving, the monitors will immediately notify the construction superintendent and he/she will stop pile driving. Pile driving will not resume until ESA-listed marine mammals have left the disturbance zone. If non-ESA-listed marine mammals move into the disturbance zone during pile driving, the monitors will observe and record the animal's behavior but pile driving will not be ordered to stop.

Summary

SRKWs may occur within the action area during in-water work but the chances that SRKWs are in the action area during the pile driving are low. If present during pile driving, the short duration of vibratory pile driving decreases the likelihood for significant exposure. Additionally, marine mammal monitoring will further reduce the likelihood of exposure because vibratory pile driving will pause while SRKWs are in the disturbance zone and will not resume until they have left. Noise from tugboats will be no louder than existing noise levels, and the use of tugboats is highly unlikely to increase the risk of vessel strike.

The use of the salmonid in-water work window and the low level of effects on salmonids associated with vibratory pile driving will reduce effects on SRKW prey, and we do not expect a reduction in available forage. Therefore, we also do not expect a reduction in foraging success, reproductive success, or increase in risk of injury or mortality for any individual. NMFS concludes that the project effects on SRKWs are discountable due to low likelihood of exposure to project construction impacts, and effects on SRKW prey base will be insignificant to SRKW.

2.11.2 Humpback Whales

After completing a comprehensive status review, on September 8, 2016, we reclassified humpback whales as 14 DPSs rather than a single listed species, and listed the Mexico DPS as threatened and 4 DPSs as endangered, including the Western North Pacific DPS and the Central America DPS. (81 FR 62018). The two DPSs that could occur within the action area are Mexico, and Central America.

Humpback whales are baleen whales, filtering their food through the baleen from the water. They feed on tiny crustaceans (mostly krill), plankton, and small fish and can consume up to 3,000 pounds (1,360 kg) of food per day. Factors which may be limiting humpback whale recovery include entanglement in fishing gear, collisions with ships, whale watching harassment, subsistence hunting, and anthropogenic sound (NMFS 1991).

Since 2000, humpback whales have been sighted with increasing frequency in the inside waters of Washington (Falcone et. al. 2005). In 2014 and 2015 sightings sharply increased to around 500 each year (Orca Network). Potential effects from the proposed action include exposure to sound/disturbance from pile driving. While humpback sightings in PS occur during the proposed work window, the likelihood for exposure to vibratory pile driving is discountable because of the proposed conservation measures including marine mammal monitoring protocols which states that, should humpback whales occur offshore of the project site and within the disturbance zone during pile installation activities, all work will stop until the whales leave the identified disturbance zone. For more information on proposed plan, see above.

Above, we indicate that all of the effects of the proposed action will be discountable to humpback whales. This conclusion is made at the level of an individual whale. Since none of the effects of the proposed action will be meaningful to individual animals, the proposed action will result in no population-level impacts to humpback whales. Therefore, our conclusion for the current single listed species would be the same for any of the proposed DPSs and we do not foresee the need to reinitiate this consultation when we finalize our rule to reclassify humpback whales.

2.11.3 Yelloweye Rockfish

Adult and juvenile yelloweye rockfish typically occupy waters deeper than 120 feet and are very unlikely to occur within the action area because of its shallow depth. Furthermore, larval rockfish are largely absent from the action area between September and February when the in-water work activities will occur. Therefore, NMFS concludes that project effects on the yelloweye rockfish will be discountable.

2.11.4 Yelloweye Rockfish Critical Habitat, and Adult Bocaccio, Critical Habitat

PBFs essential to the conservation of adult bocaccio rockfish, and adult and juvenile yelloweye rockfish include benthic habitats or sites deeper than 98 feet that possess or are adjacent to areas of complex bathymetry consisting of rock and or highly rugose habitat. Several attributes of these sites determine the quality of the habitat including (1) quantity, quality, and availability of prey species to support individual growth, survival, reproduction, and feeding opportunities, (2) water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities, and (3) the type and amount of structure and rugosity that supports feeding opportunities and predator avoidance.

Rockfish nearshore and deep water critical habitat are present within the action area. In-water impulsive noise, turbidity do not extend into bocaccio and yelloweye deep water critical habitat. The area of affect for turbidity and contaminants will be limited to the immediate vicinity of the pile (150-foot radius per pile). Based on the short duration, small area, and low level of the expected increase in turbidity, we do not expect the effects on adult bocaccio and adult and juvenile yelloweye rockfish to exceed behavioral modification and expect the overall effect on the distribution and abundance of these fish in the action area to be insignificant. Therefore, NMFS concludes that project effects on the GB/PS DPS adult bocaccio and GB/PS adult and juvenile yelloweye critical habitat will be insignificant.

3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT CONSULTATION

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. The MSA (section 3) defines EFH as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside of it and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH.

This analysis is based, in part, on the EFH assessment provided by the Kitsap Transit and descriptions of EFH for Pacific coast groundfish (PFMC 2005) and Pacific coast salmon (PFMC 2014) contained in the fishery management plans developed by the Pacific Fishery Management Council and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

The proposed action and action area for this consultation are described above in Sections 1.2 (Proposed Action) and 1.3 (Action Area). The action area includes areas designated as EFH for various life-history stages of 31 species of Pacific coast groundfish and three species of Pacific salmon (Table 10).

Sinclair Inlet is a Habitat Area of Particular Concern (HAPC), based on importance of the ecological function provided by the habitat. The environmental effects of the proposed project may adversely affect a maximum of 4,470 square feet of EFH for Pacific coast groundfish and Pacific coast salmon in the HAPC for these species. These 4,470 square feet of nearshore habitat will be impacted by shading form OWS and associated reduction in SAV density, prey abundance, and productivity. The proposed mitigation will offset some of the habitat impacts to EFH for these species.

Table 10. EFH species and life history stage associated with shallow nearshore water in PS.

Scientific Name	Common Name	Adult	Juvenile	Larvae	Egg
Groundfish Species					
Anoplopoma fimbria	Sablefish	X	X	X	X
Citharichthys sordidus	Pacific sanddab	X			
Eopsetta jordani	Petrale sole	X			
Glyptocephalus zachirus	Rex sole	X			
Hexagrammos decagrammus	Kelp greenling	X		X	
Hippoglossoides elassodon	Flathead sole	X			
Hydrolagus colliei	Spotted ratfish	X	X		
Isopsetta isolepis	Butter sole	X			
Lepidopsetta bilineata	Rock sole	X			
Merluccius productus	Pacific hake	X	X		
Ophiodon elongates	Lingcod			X	
Parophrys vetulus	English sole	X	X		
Platichthys stellatus	Starry flounder	X	X		
Psettichthys melanostictus	Sand sole	X	X		
Raja binoculata	Big skate	X			
Raja rhina	Longnose skate	X	X		X
Scorpaenichthys marmoratus	Cabezon	X	X	X	X
Sebastes auriculatus	Brown rockfish	X			
Sebastes caurinus	Copper rockfish	X	X		
Sebastes diploproa	Splitnose rockfish		X	X	
Sebastes entomelas	Widow rockfish		X		
Sebastes flavidus	Yellowtail rockfish	X			
Sebastes maliger	Quillback rockfish	X	X		
Sebastes melanops	Black rockfish	X	X		
Sebastes mystinus	Blue rockfish	X	X	X	
Sebastes nebulosus	China rockfish	X	X		
Sebastes nigrocinctus	Tiger rockfish	X			
Sebastes paucispinis	Bocaccio		X	X	
Sebastes pinniger	Canary Rockfish		X	X	
Sebastes ruberrimus	Yelloweye rockfish			X	
Squalus acanthias	Spiny dogfish	X			
Pacific Salmon					
Oncorhynchus tshawytscha	Chinook salmon	X	X		
Oncorhynchus kisutch	Coho salmon	X	X		
Oncorhynchus gorbuscha	Pink salmon	X	X		

3.2 Adverse Effects on Essential Fish Habitat

The effects of the proposed project on salmon are described in Section 2.4., above. The same mechanisms of effect are likely to affect all Pacific coast groundfish and Pacific coast salmon to varying degrees. These adverse effects include:

- Elevated underwater sound.
- Water quality impacts from increased turbidity and suspended solids during construction.
- Shading of SAV, and resulting reduction in SAV density and abundance and related primary production from the PRF.

- Reduction in quality of nearshore habitat through disturbance associated with OWS and boat use and human activity.

3.3 Essential Fish Habitat Conservation Recommendations

Fully implementing these EFH CRs would protect, by avoiding or minimizing the adverse effects described in Section 3.2, above, approximately 4,470 square feet of designated EFH for Pacific coast salmon and Pacific coast groundfish.

1. The applicant should:
    a. Allow only 4,470 square feet of overwater structure
    b. Work within work window: All in water work would only occur from July 2 through March 2 in any year the permit is valid.
        i. If work is occurring between September 1 and February 15, a qualified biologist must confirm, in writing, that no forage fish are spawning in the area. If the biologist confirms that no forage fish are spawning in the project area, then from the date of the inspection all work below MHHW must be completed within two weeks. If forage fish are found to be spawning in the project area, work may not occur until a new survey has been conducted and it is confirmed that no forage fish are spawning in the project area.

2. Kitsap Transit has designed a mitigation program that will offset effects to EFH. NMFS recommends that the FTA incorporate the following measures to improve this mitigation program and fully address adverse effects listed in Section 3.2, above:
    a. Monitor to ensure the as-built conforms with size, grating and work window criteria, and report back to NMFS whether all parameters are met
    b. If all parameters are not met, contact the NMFS to determine an appropriate adjustment the amount of mitigation, and adjust this rate as monitoring data on success of mitigation become available.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the FTA must provide a detailed response in writing to NMFS within 30 days after receiving an EFH CRs. Such a response must be provided at least 10 days prior to final approval of the action if the response is inconsistent with any of NMFS' EFH CRs unless NMFS and the Federal agency have agreed to use alternative time frames for the Federal agency response. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the CRs, the Federal agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects (50 CFR 600.920(k)(1)).

In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many CRs are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we ask that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of CRs accepted.

3.5 Supplemental Consultation

The FTA must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH CRs (50 CFR 600.920(l)).

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

The Data Quality Act (DQA) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are the FTA and Kitsap Transit. Other interested users could include: pier-ramp and float applicants and their agents, affected tribes, industry, municipalities and county jurisdictions, recreational boaters and fishers. Individual copies of this opinion were provided to the FTA. The format and naming adheres to conventional standards for style.

4.2 Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

4.3 Objectivity

Information Product Category: Natural Resource Plan

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA regulations, 50 CFR 402.01 et seq., and the MSA implementing regulations regarding EFH, 50 CFR 600.

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this opinion and EFH consultation contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA and MSA implementation, and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

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