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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 97232-1274

Refer to NMFS No.:
WCRO-2020-00066

April 27, 2021

Captain Rhinehart
Naval Base Kitsap
120 South Dewey Street, Building 443
Bremerton, Washington 98314-5020

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Transit Protection Program Pier and Support Facilities, Bangor Naval Base, Washington.

Dear Captain Rhinehart:

Thank you for your letter requesting initiation 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.) for U.S. Navy's proposed Transit Protection Program Pier and Support Facilities. This consultation was conducted in accordance with the 2019 revised regulations that implement section 7 of the ESA (50 CFR 402, 84 FR 45016).

Thank you, also, for your request for consultation pursuant to the essential fish habitat (EFH) provisions in Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1855(b)) for this action.

Please contact Lisa Abernathy, consulting biologist at the Oregon Washington Coastal Office (Lisa.Abernathy@noaa.gov; 206-526-4742), if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

Kim W. Kratz. Ph.D
Assistant Regional Administrator
Oregon Washington Coastal Office

cc: Mary Anderson
Cynthia Kunz
Tiffany Selbig

Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the

Transit Protection Program Pier and Support Facilities, Bangor Naval Base, Washington

NMFS Consultation Number: WCRO-2020-00066

Action Agency: U.S. Department of Defense, Department of the Navy

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely to Jeopardize Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely to Destroy or Adversely Modify Critical Habitat?
Puget Sound DPS Chinook Salmon	T	Yes	No	No	No
Puget Sound DPS Steelhead	T	Yes	No	N/A	N/A
Hood Canal summer-run chum	T	Yes	No	No	No
Puget Sound/Georgia Basin DPS bocaccio rockfish	E	Yes	No	No	No
Puget Sound/Georgia Basin DPS yelloweye rockfish	T	Yes	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
Southern Resident Killer Whales	E	Yes	No	Yes	No

Fishery Management Plan That Describes EFH in the Project Area	Does Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific groundfish	Yes	Yes
Pacific coast salmon	Yes	Yes
Coastal pelagic species	Yes	Yes

Consultation Conducted By: National Marine Fisheries Service
West Coast Region

Issued By:

Kim W. Kratz, Ph.D
Assistant Regional Administrator
Oregon Washington Coastal Office

Date: April 27, 2021

TABLE OF CONTENTS

LIST OF ABBREVIATIONS AND ACRONYMS

BA	Biological Assessment
BMP	Best Management Practices
CHARTs	Critical Habitat Analytical Review Teams
CFR	Code of Federal Regulations
dB	Decibel
DPS	Distinct Population Segment
DO	Dissolved Oxygen
DoD	Department of Defense
DQA	Data Quality Act
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
GB	Georgia Basin
HAT	Highest Astronomical Tide
HCCC	Hood Canal Crediting Council
HCSR chum	Hood Canal Summer-run Chum
HEA	Habitat Equivalency Analysis
HTL	High Tide Line
ILF	In-Lieu Fee
INRMP	Integrated Natural Resources Management Plans
ITS	Incidental Take Statement
Km	Kilometer
MLLW	Mean Lower Low Water
MHHW	Mean Higher High Water
MPG	Major Population Group
MSA	Magnuson-Stevens Act
MSGP	Multi-Sector General Permit
NHVM	Nearshore Habitat Values Model
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OWS	Overwater Structures
PAH	Polycyclic aromatic hydrocarbons
PBF	Physical or Biological Features
PS	Puget Sound
PCE	Primary Constituent Element
RIBITS	Regulatory In-lieu Fee and Bank Information Tracking System
RL	Received Levels
RPM	Reasonable and Prudent Measure
RMS	Root Mean Square
SAV	Submerged Aquatic Vegetation
SEL	Sound Exposure Level
SPL	Sound Pressure Levels
SRKW	Southern Resident Killer Whales
TPP	Transit Protection Facility
TSS	Total Suspended Solids
TTS	Temporary Threshold Shift
UST	Underground Storage Tank
VMF	Vessel Maintenance Facility
WDFW	Washington State Department of Fish and Wildlife
WDOE	Washington Department of Ecology
WRIA	Water Resource Inventory Area

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 (ITS) portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 USC 1531 et seq.), and implementing regulations at 50 CFR 402, as amended.

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 (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available within two weeks at the National Oceanic and Atmospheric Administration (NOAA) Library Institutional Repository [https://repository.library.noaa.gov/welcome]. A complete record of this consultation is on file at the Oregon and Washington Coastal Office.

1.2 Consultation History

The NMFS and the Navy held a pre-consultation meeting on the proposed project on October 29, 2019. On January 15, 2020, the Department of the Navy (Navy) requested formal consultation for the Transit Protection Program Pier and Support Facilities (TPP) project. At that time the Navy provided NMFS a Biological Assessment (BA) and a letter requesting formal consultation and concurrence with its findings, Table 1, including the finding of *may adversely affect* designated EFH for Pacific groundfish, Pacific coast salmon, and Coastal Pelagic species.

Table 1: Navy's determinations:

Species	Species Effects	Critical Habitat Effects
Puget Sound DPS Chinook Salmon	May affect, likely to adversely effect	No effect
Puget Sound DPS Steelhead	May affect, likely to adversely effect	N/A
Hood Canal summer-run chum	May affect, likely to adversely effect	No effect
Puget Sound/Georgia Basin DPS bocaccio rockfish	May affect, likely to adversely effect	May affect, not likely to adversely affect
Puget Sound/Georgia Basin DPS yelloweye rockfish	May affect, likely to adversely effect	No effect
Humpback whale	May affect, Not likely to adversely effect	N/A
Southern Resident Killer Whale	May affect, Not likely to adversely effect	No effect

Additional NMFS and Navy meetings were held on November 3, 2020, December 1, 2020, and December 15, 2020, to discuss components of the federal action.

On December 30, 2020, NMFS emailed the Navy for clarification on the Navy's inclusion or exclusion of Southern Killer Whales (SRKW) effects determination. On January 27, the Navy provided a "may affect, not likely to adversely affect," determination for the whales, and a "No effect" for their habitat. NMFS has provided a non-concurrnence with both effect determinations and conveyed to the Navy that we the final Opinion would contain an analysis for SRKW and their listed critical habitat.

On January 15, 2021, NMFS transmitted a draft Biological Opinion to the Navy for review. The Navy returned the draft with several comments, which NMFS address. On January 29, 2021, NMFS officially initiated consultation with the Navy. On March 1, 2021, at the request of the Navy, NMFS submitted a second draft for Navy review.

1.3 Proposed Federal 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). Likewise, under MSA, Federal action means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a Federal Agency (50 CFR 600.910).

The Navy proposes to construct and operate a pier and support facilities for berthing TPP blocking vessels and maintaining TPP vessels, which provide security escort to TRIDENT and SEAWOLF submarines between Naval Base Kitsap Bangor (Figure 1) and the Straits of Juan de Fuca. The TPP utilizes up to nine naval vessels including 250-foot blocking vessels, 87-foot coastal patrol boat/reaction vessels, 64-foot screening vessels, and 33-foot screening vessels. These vessels are currently berthed on a space-available basis at other locations at Naval Base Kitsap Bangor. The proposed location of the pier is Keyport/Bangor (K/B) Spit (Figure 2). Construction of the pier and associated upland construction will occur over a 3-year period. Operations will consist of fueling, provision of utilities (power, potable water, and sanitary and oily waste discharge), and periodic cleaning of pier structures. Bangor berthing for the TPP mission is required approximately 253 days per year.

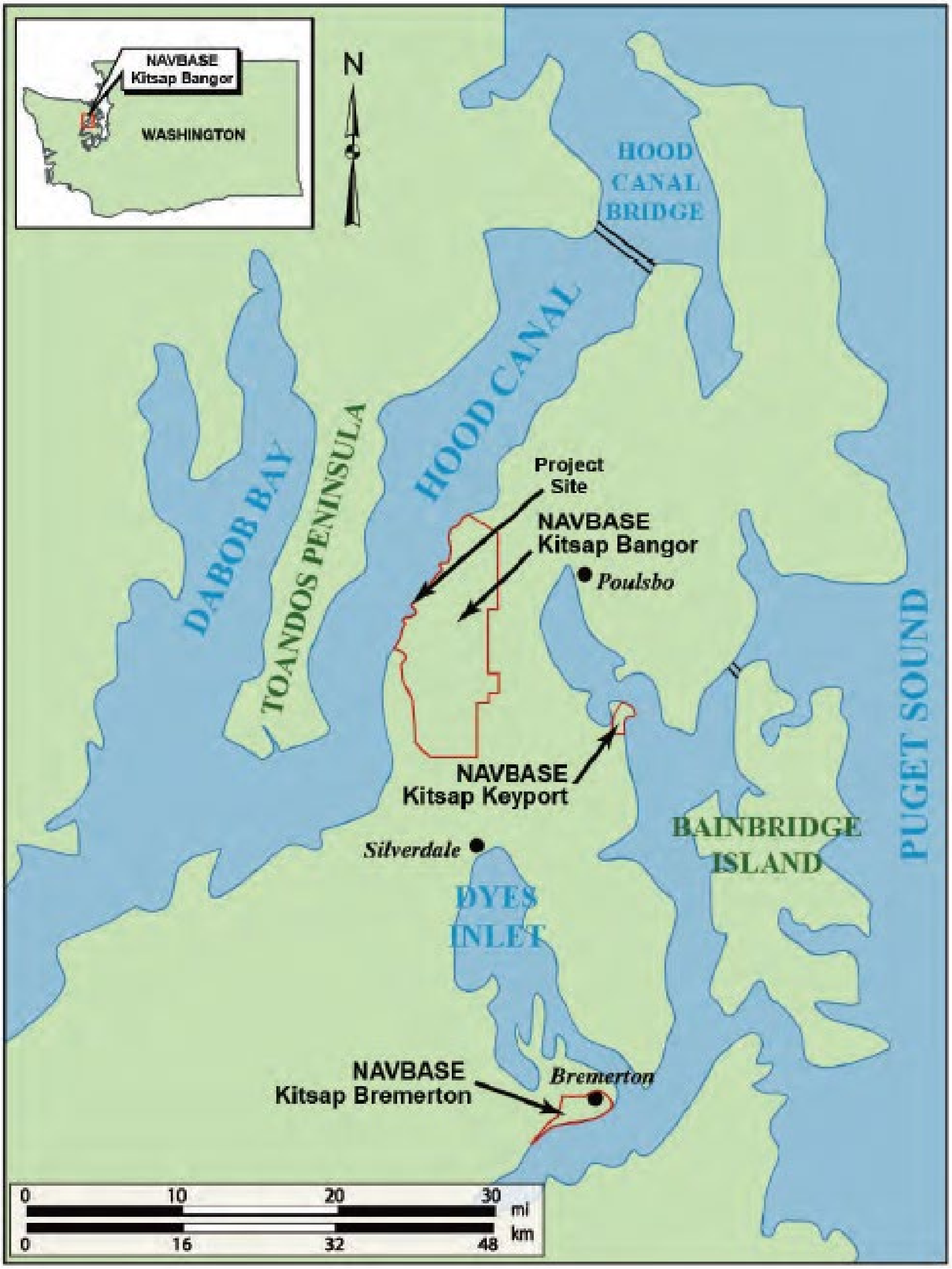

Figure 1: Hood Canal and Navbase Kitsap Bangor

Figure 2: The proposed location of the pier is Keyport/Bangor (K/B) Spit

Structures

The TPP Pier will include an L-shaped pile-supported trestle from shore connecting to a pile-supported main pier section (Figure 3). The trestle will be concrete and approximately 114 feet long and 39 feet wide, including a pedestrian walkway. The main pier section will also be concrete and approximately 299 feet long and 69 feet wide. A fender system will be installed along the west face of the pier with two berthing camels where the blocking vessels will tie up to the pier. Each camel will be 65 feet long by 12 feet wide and constructed of grated material. The camels will serve as both a standoff for the blocking vessels and a platform for boarding the blocking vessels. The camels will be accessed via brows down from the main pier deck. The brow platforms and brows will also be constructed of grated material. Two dolphins will be constructed south and north of the pier and used solely for mooring support. The dolphins will support mooring hardware for the bow and stern lines of the blocking vessels. The dolphins will be centered approximately 46 feet off the ends of the pier and approximately 11 feet landward of the front face of the pier. Access to the mooring dolphins will be provided by brows spanning from the pier deck. The structural system for the mooring dolphins will consist of a 12- by 12-foot cast-in-place concrete pile cap and four 36-inch battered steel pipe piles.

The trestle and pier will require a total of 124 permanent steel piles that are 24, 30, or 36 inches in diameter and 60 temporary steel falsework piles that are 36 inches in diameter. Of these piles, four 36-inch trestle support piles and twenty 36-inch falsework piles will be located above mean higher high water (MHHW). The contractor will need to construct a 140-foot by-20-foot temporary work trestle (falsework piles and timber decking). The permanent trestle piles in the intertidal area will be driven from the deck of the temporary work trestle; the trestle will subsequently be removed. The fender piles and camels will be installed on the outer side of the pier to protect it from accidental damage by vessels. Piles, including all fender and falsework piles, primarily will be driven using vibratory methods. The 36 inch support piles must be "proofed" to ensure load bearing capacity. All other piles would be installed via vibratory hammer unless sediment conditions do not allow for their full advancement. The piles would installed to the required depth using an impact hammer. The 24-inch fender piles and 30-inch camel guide piles will not be impact driven. The contractor will deploy a silt curtain during in-water pile driving activities. The silt curtain will be deployed and positioned in a manner that will avoid potential impacts to benthic plants and animals.

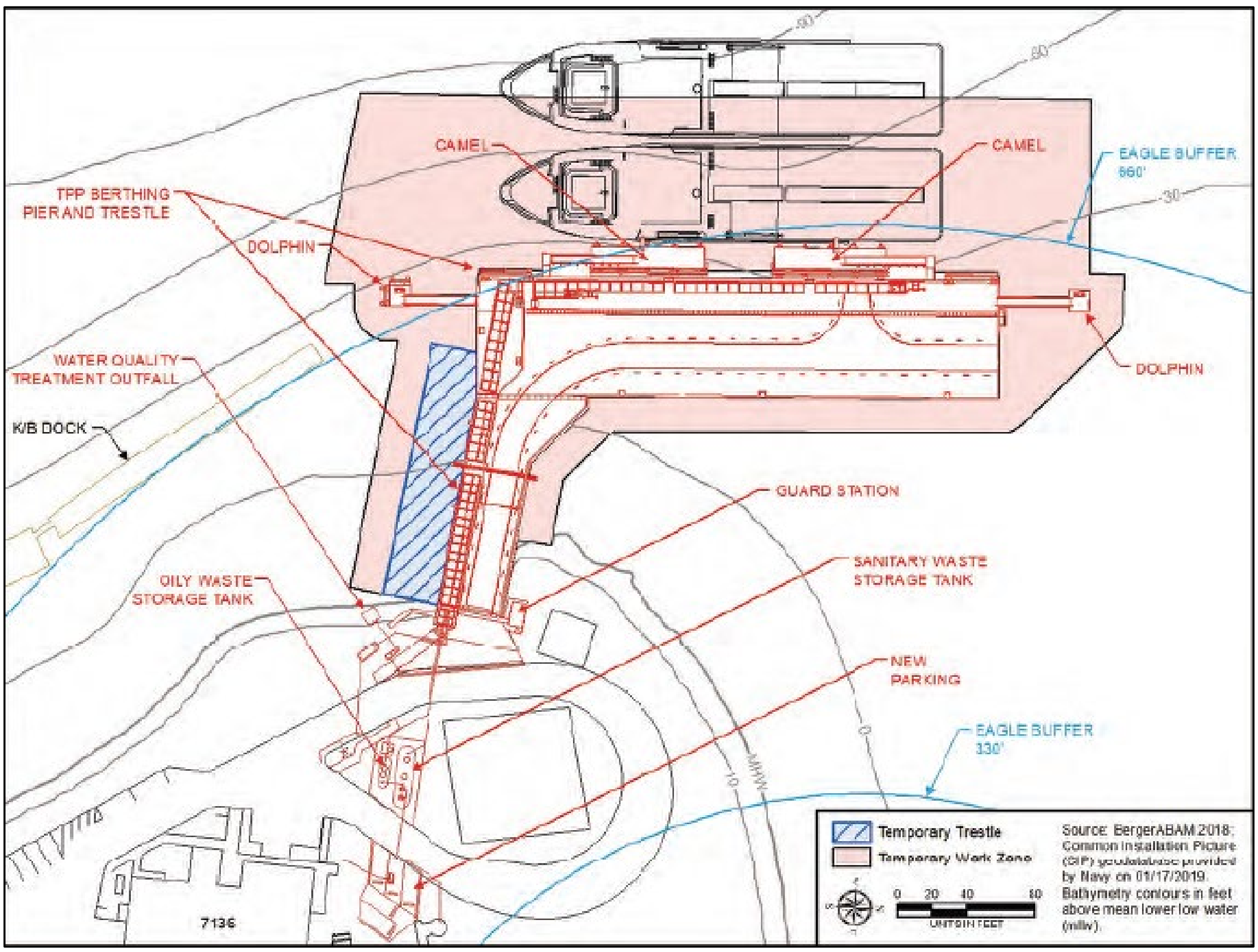

Figure 3: Over water component of the proposed project

Where geotechnical conditions do not allow piles to be driven to the required depth using vibratory methods, an impact hammer may be used to drive some piles for part or all of their length. Pile driving is expected to take place during no more than 90 days over two in-water work seasons (July 16 through January 15). The contractor will only mobilize one derrick barge with one crane. No more than one impact driver or one vibratory driver will operate at the same time. Under expected conditions, the number of impact hammer strikes per day will not exceed 1,600. A total of 787 square feet (sq. ft.) of seafloor will be occupied by all permanent piles combined; of this total, 760 sq. ft. will be shallower than 30 feet below mean lower low water (MLLW). In addition, there will be 283 sq. ft. of seafloor occupied by the temporary falsework piles.

The above structures will create a total of 29,451 sq. ft. of over-water coverage; of this total, 27,382 sq. ft. will be shallower than 30 feet below MLLW. Approximately 1,900 sq. ft. of the complete structure will be grated.

The trestle will have five 30-foot high light standards, and the pier will have three 50-foot high light standards. All of the lights will be light emitting diode (LED) type lights for which illumination levels at the surface will not exceed 30 foot-candles (fc) at 30 feet, 10 fc at 50 feet, and 5 fc at 100 feet. Additionally, Eighty-three LED dimming lighting fixtures will be mounted below the trestle and pier in sections between the pile bents. The range of depths where the lighting will be physically placed is from 5 to 25 feet below MLLW. This physical placement will illuminate the area between 0 feet to 30 feet below MLLW. The lighting will mimic natural daylight and be controlled to vary light intensity throughout the day according to the position of the sun and associated shading conditions.

The elevation of the bottom of the trestle will be 4 feet 9 inches above MHHW. The elevation of the top of the trestle will be 17 feet above MHHW at its highest and 12 feet 10 inches at its lowest. The pier deck slopes to drain, and the elevation of the bottom of the pier will be 4 feet 2 inches above MHHW at its highest and 1 foot 1 inch at its lowest. The elevation of the top of the pier will be 9 feet 9 inches above MHHW at its highest and 9 feet 5 inches at its lowest.

Stormwater from the pier and trestle will be directed to treatment cartridges in compliance with a General Use Level Designation from the Washington State Department of Ecology (WDOE) prior to discharge of the water to Hood Canal.

A shoreline abutment under the pier trestle will be 99 feet 8 inches long and constructed landward of MHHW, Figure 4. The abutment will be constructed of steel sheet piles. Fifty cubic yards of fill will be placed behind the abutment. The shoreline abutment structure constructed for the Proposed Action will be above MHHW but below highest astronomical tide (HAT).[1]

[1] NMFS recognizes HAT as the upland extent of shoreline habitat—critical habitat in areas where it designated—that supports both life history functions of listed PS Chinook and HCSR chum.

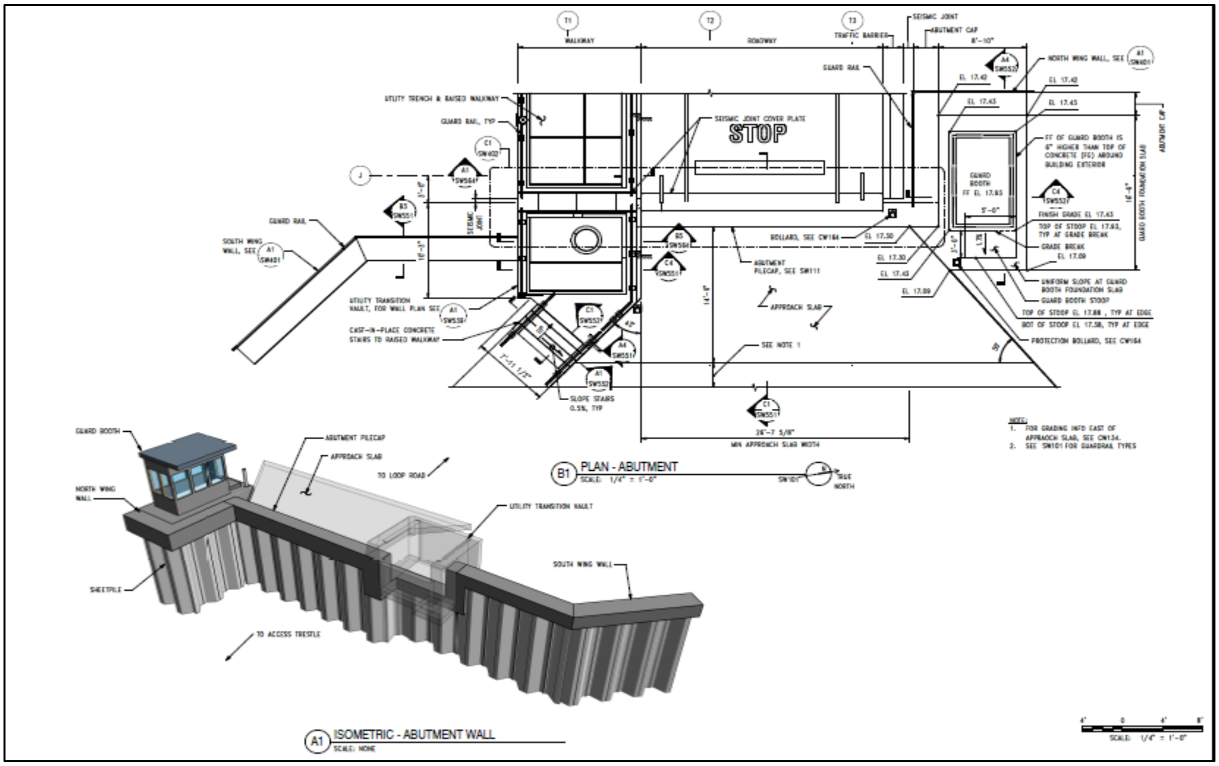

Figure 4: TPP proposed shoreline abutment

Utilities and Upland Features

Potable water, power lines, and communication lines will be provided to the berthing areas on the pier. All utility lines will be contained in utility trenches built into the concrete trestle and pier decks. Sewage and oily waste will first flow to below-deck holding tanks on the pier and then will be pumped ashore via separate double-contained lines to separate holding tanks on shore (Figure 3). Two 20,000-gallon diesel tanks will be installed on shore and fuel will be pumped to fueling facilities at the small craft floats at the K/B Dock through double-contained, insulated lines with leak and fire detection and alarm systems. The diesel tank will be below ground and a fueling access point will be built on the east side of Sea Lion Road (Figure 5). The facility will include a full loop road for tanker trucks to pull entirely off of Sea Lion Road. The diesel fuel line will be installed in a trench running downhill across Sea Lion Road and aligned beneath Shore Boundary Road. All fuel tanks will be enclosed in double-walled secondary containment structures with a capacity of 110 percent of the tank volume.

Other upland facilities to be installed at the site will include an asphalt parking area for approximately five vehicles, an oil-water separator within a 3,000-gallon capacity underground storage tank (UST), one 20,000-gallon sanitary sewer UST, and a guard station (Figure 3). A 38-foot long roadway will be installed to connect the trestle to the existing roadway. Construction of upland facilities will result in total surface disturbance of 33,250 sq. ft.

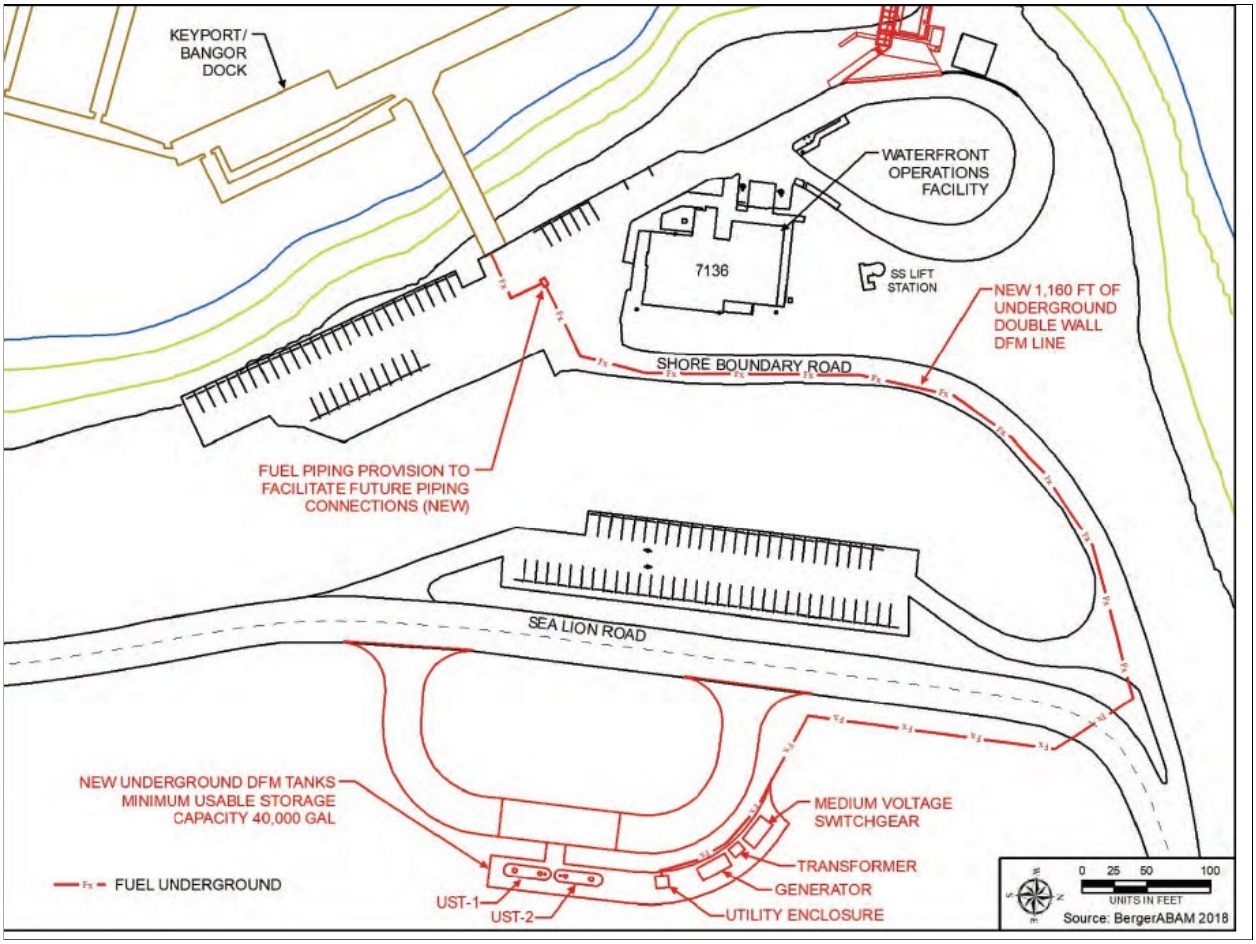

Figure 5: Location of Utilities and Upland Features

Of the 33,250 sq. ft. total, 25,600 sq. ft. will be located in disturbed areas that do not support native vegetation and 7,650 sq. ft. will be located in a currently vegetated area. Construction of the diesel fuel tanks and fueling access point on the east side of Sea Lion Road will require clearing 15,960 sq. ft. of forested area. Of this total, 2,871 sq. ft. will be occupied by the new tanks and fueling access point, 9,889 sq. ft. will be occupied by a stormwater infiltration pond, and 3,200 sq. ft. will be revegetated with native forest species. A total of 3,650 sq. ft. of new impervious surface will be created to support resupplying the tanks with fuel.

Stormwater from all impervious surfaces will be routed to an oil-water separator and then to a surface water treatment system. Water-quality treatment devices will be incorporated before stormwater runoff is released to the receiving body of water (Hood Canal). The Navy will meet the requirements of the Multi-Sector General Permit (MSGP) permit, the Washington State Department of Ecology Stormwater Management Manual for Western Washington and the Kitsap County Stormwater Design Manual.

Long-term lighting at the upland site will be provided by high-mast LED pole lights to provide uniform foot-candle illumination.

Upland construction at the pier site will require a maximum of 5,400 cubic yards of excavation and 1,200 cubic yards of fill, including 50 cubic yards of fill behind the abutment and 1,150 cubic yards for the sanitary sewer and oil/water separator systems.

Vessel Maintenance Facility

The site for the vessel maintenance facility (VMF) and project laydown/parking area will be a 500-by-500-foot (5.7-acre) site located on Sturgeon Street (Figure 6). This entire site will be cleared of native vegetation, except for 0.5 acre that was previously cleared. The VMF will occupy 18,290 sq ft, including a 1,725 sq ft detached wash rack area, and an adjacent storage area will occupy 2,450 sq ft (total of 0.49 acre). Paving will occupy an additional approximately 2.5 acres, resulting in new impervious surface of approximately 3 acres. An additional approximately 5,000 sq ft (0.11 acre) will be occupied by bioretention cells and landscaping associated with the VMF. The total VMF site size will be approximately 3.1 acres. The project laydown and parking area will occupy the remaining approximately 2.6 acres of the site. This area will be cleared of vegetation and covered in gravel. After TPP construction, this site will be left in gravel for use on future projects. The VMF and laydown sites are moderately sloped and construction will require soil excavation and fill to provide adequate flat space: a maximum of 2,200 cubic yards of excavation and 990 cubic yards of fill.

The VMF will include utilities for maintaining and cleaning small (trailerable) boats, including water lines, floor drains with appropriate runoff treatment, and electrical service. The wash water from the wash rack will not be discharged to the Hood Canal. The canopy and curbs along the sides of the wash rack will prevent stormwater from entering into the wash water system. The wash rack is sloped to a central collection drain that will collect wash water used in vessel washing operations. The collected wash water will drain to a containment tank what will provide oil/water separation and sludge deposition. The current Naval Base Kitsap Bangor permit that has been modified for the new wash rack operations.

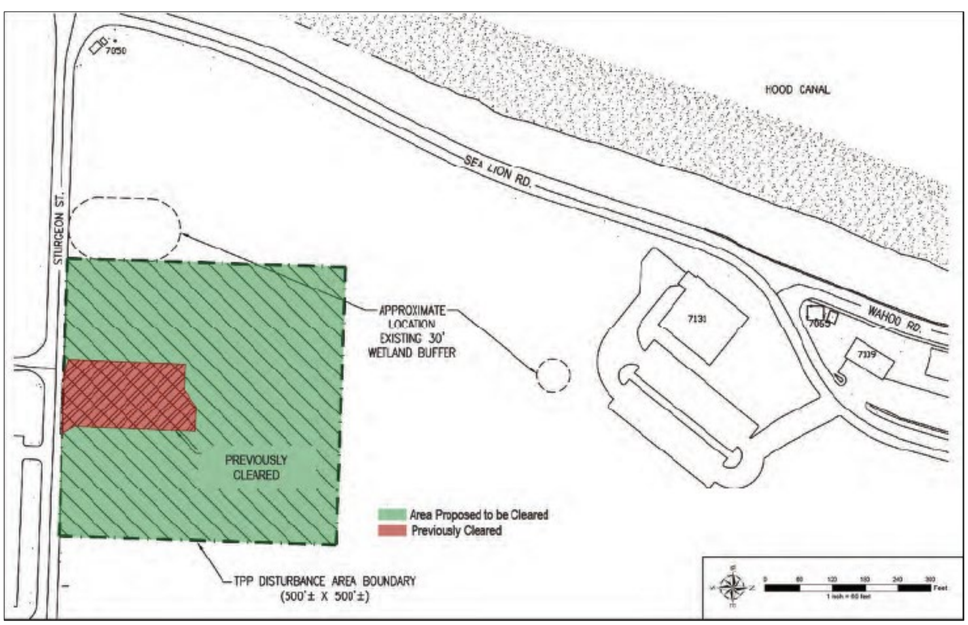

Figure 6: Site of VMF and Laydown/Parking Area

Operations and Maintenance

Operation of the new TPP pier and associated facilities will include periodic cleaning of pier surfaces and long-term maintenance of piles and other pier components. Routine maintenance would be minor and would not result in effects that would require ESA consultation. The Navy does not anticipate any repairs post construction. Any unforeseen repairs would require a separate consultation or could be performed under the Navy programmatic. Berthed vessels will be provided with power, potable water, communications, fire protection, sewage connections, and oily waste collection. Fuel and utilities will be provided by the storage and transmission facilities described above. Wastewater and other wastes will be handled as described above. Motor vehicles will operate as needed at the VMF and on the pier.

Additionally, wastewater (sewage and grey water wastes) from vessels berthed at the pier will be retained in onshore holding tanks and eventually transferred via transmission lines to the existing wastewater infrastructure. Therefore, shipboard and pier wastes will not affect long-term water quality conditions near the project site. The risk of an accidental spill, such as a fuel or oil spill, will be expected to increase slightly due to the addition of vessels berthed at the project site. Spill containment practices will be consistent with those for other Bangor waterfront structures, including the use of in-water containment booms, and the existing fuel spill prevention and response plans that will be implemented to minimize the risk of spills during operations.

The stormwater system will be maintained according to the system StormFilter Inspection and Maintenance Procedures (Engineered Solutions). An inspection would be performed annually before the winter season. If warranted, a maintenance (replacement of the filter cartridges and removal of accumulated sediments) should be performed during periods of dry weather. Similar to other forms of pier maintenance, inspection/maintenance of the stormwater system would be minor and result no effects to ESA listed species.

Vessel transits to and from the new pier would replace the existing operations and no additional vessel trips would be produced by the new pier. Vessel trips and transit locations are not considered a consequence of this actions.

Conservation Measures

The Navy proposes the following conservation measures and best management practices to avoidance and minimization construction and operational impacts.

Avoidance, Minimizations, and Best Management Practices (BMPs)

- The trestle and pier were designed to minimize the amount of disturbance to the seabed and amount of overwater shading as much as practical.
- Under-pier/under-trestle lighting fixtures will be mounted below the trestle and/or pier in sections between the pile bents. The lighting is designed to mimic natural daylight and be controlled to vary light intensity throughout the day according to the position of the sun and associated shading conditions.

- The pier and trestle will be sloped to capture stormwater, which will then be filtered for basic treatment prior to discharge to Hood Canal.

- The camels, camel brows, and camel platforms will be constructed of grated material to minimize shading.

- To reduce the likelihood of any petroleum products, chemicals, or other toxic or deleterious materials from entering the water, fuel hoses, oil or fuel transfer valves, and fittings will be checked regularly for drips or leaks and will be maintained and stored properly to prevent spills from construction and pile driving equipment into state waters.

- To limit soil erosion and potential pollutants contained in stormwater runoff, a Storm Water Pollution Prevention Plan will be prepared and implemented for construction in conformance with the Stormwater Management Manual for Western Washington (WDOE 2019) (also applies to Operations).

- Oil booms will be deployed around in-water construction sites as required by Clean Water Act Section 401 Water Quality Certification for the projects, to minimize water quality impacts during construction.

- Debris will be prevented from entering the water during all demolition or new construction work. During in-water construction activities, floating booms will be deployed and maintained to collect and contain floatable materials released accidentally. Any accidental release of equipment or materials will be immediately retrieved and removed from the water. Following completion of in-water construction activities, an underwater survey will be conducted to remove any remaining construction materials that may have been missed previously. Retrieved debris will be disposed of at an upland disposal site.

- To minimize impacts on marine habitats, limitations will be placed on construction vessel operations, anchoring, and mooring line deployment. A mooring and anchoring plan will be developed by the contractor and approved by the Navy to minimize vessel movement. Barge and other large construction vessel operations will be restricted to an area 100-feet to the west from the proposed pier. No large construction vessels will be allowed to operate to the east or north of the proposed pier, thereby reducing potential temporary impacts to the marine aquatic environment. To provide access for construction workers, small skiffs will operate in a narrow band east, north, and south of the proposed pier. Anchoring in existing eelgrass habitat will be avoided whenever possible and vessel operators will be provided with maps of the construction area with eelgrass beds clearly marked.

- To prevent impacts to marine water quality and habitats, the pier and trestle decks will be graded to drain runoff into water quality control vaults (approximately four dual cartridge vaults) that provide standard water treatment. The water quality control vaults will intercept and treat drainage of all traffic-bearing surfaces on the pier and trestle.

- Pile driving of steel piles will be done using vibratory rather than impact methods whenever feasible.

- Bubble curtains will be used around steel piles being driven by impact methods to attenuate in-water sound pressure of the pile driving activity. The Navy will also consider other equally or more effective noise attenuation methods that may become available.

- During impact pile driving, a soft-start approach will be used to induce marine mammals to leave the immediate area. This soft-start approach requires contractors to initiate noise from hammers at reduced energy, followed by a waiting period.

- To minimize impacts on ESA-listed fish species, in-water construction will be conducted within the Washington State Department of Fish and Wildlife (WDFW)-approved in-water work window for Tidal Reference Area 13 (July 16 through January 15) (USACE 2017).

- Construction in the upper intertidal zone will be conducted at low tide ("in the dry") to minimize impacts to marine water quality and underwater noise.

- To avoid impacts on marine mammals protected by the ESA and Marine Mammal Protection Act, monitoring of injury and behavioral disturbance zones around in-water pile driving locations will be implemented. Pile driving will be stopped whenever a marine mammal enters a shutdown zone, as defined in the marine mammal monitoring plans.

Proposed Mitigation

The Navy proposes to remove 5,031 sq. ft. of beach debris (concrete blocks, anchors, chains, some creosote wood piles, and some type of steel structure) as mitigation (Figure 7).

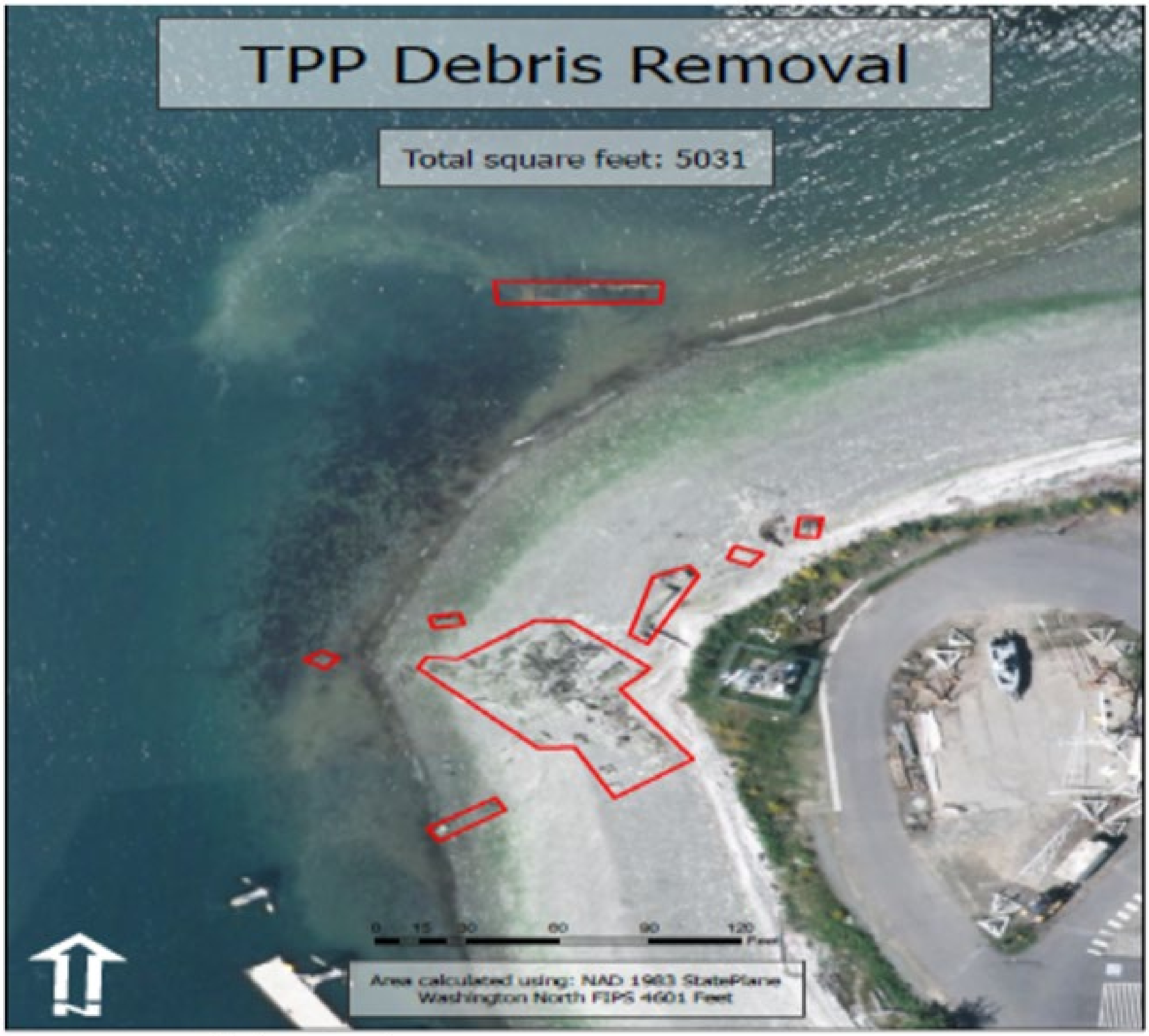

Figure 7: TPP Debris Removal

Additionally, to address enduring impacts to aquatic habitats and as required by the US Army Corps of Engineers (USACE) under the Clean Water Act section 404, the Navy will use the Hood Canal Coordinating Council (HCCC) In-Lieu Fee (ILF) program for compensatory mitigation requirements for the TPP Pier project. The purchase of mitigation credits will address the loss of ecosystem functions due to the modification of water bottoms, water column, and shoreline. NMFS considers this compensatory mitigation a consequence of the action and therefore considers the effects of this action in this Opinion.

Construction Schedule

Total construction time is estimated at 32 months including two in-water construction periods (July 16 through January 15). Construction is currently planned to occur from 2021 to 2023 and require a maximum of 90 in-water construction/pile driving days over the two in-water work windows. Proposed in-water construction activities will require use of marine-based construction equipment (i.e., derrick/supply barges and cranes, barge-mounted pile driving equipment, and tugboats) to support construction of the access trestle and pier and transport materials to and from the project site. Construction materials (including piles, concrete panels, and structural materials) will remain on barges until used for construction. Pier and trestle construction will require one derrick barge with a crane and one support/material barge. An average of six barge round trips (12 openings) per month will be required to support construction during the in-water work season from July 16 to January 15. Outside of this period, an average of two barge round trips (4 openings) per month will be required. It is anticipated that up to two construction barges, each up to 200 feet long and 70 feet wide, will be moored at the construction site for the **entire project duration**, including during times when the in-water work window is closed. Any support boat or barge used during in-water construction activities will be located within the immediate construction zone and in areas away from normal navigational activities.

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, each Federal agency must ensure that its 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 habitats. If incidental take is reasonably certain to occur, section 7(b)(4) requires NMFS to provide an ITS that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

The Navy determined the proposed action is not likely to adversely affect Humpback Whales. Our concurrence is documented in the "Not Likely to Adversely Affect" Determinations section (Section 2.13).

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 "jeopardize the continued existence of" a listed species, which is "to engage in an action that reasonably 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 biological 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 as a whole for the conservation of a listed species" (50 CFR 402.02).

The designation(s) of critical habitat for (species) use(s) the term primary constituent element (PCE) or essential features. The 2016 critical habitat regulations (50 CFR 424.12) replaced this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a "destruction or adverse modification" analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this biological opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

The 2019 regulations define effects of the action using the term "consequences" (50 CFR 402.02). As explained in the preamble to the regulations (84 FR 44977), that definition does not change the scope of our analysis and in this opinion we use the terms "effects" and "consequences" interchangeably.

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

- Evaluate the rangewide status of the species and critical habitat expected to be adversely affected by the proposed action.
- Evaluate the environmental baseline of the species and critical habitat.
- Evaluate the effects of the proposed action on species and their habitat using an exposure-response approach.
- Evaluate cumulative effects.
- In the integration and synthesis, add the effects of the action and cumulative effects to the environmental baseline, and, in light of the status of the species and critical habitat, analyze whether the proposed action is likely to: (1) directly or indirectly 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, or (2) directly or indirectly result in an alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species.
- If necessary, suggest a reasonable and prudent alternative to the proposed action.

For this consultation, NMFS evaluated the proposed action using a Habitat Equivalency Analysis (HEA)[2] and the Puget Sound Nearshore Habitat Values Model (NHVM) that we adapted from Ehinger et al. 2015. We developed an input calculator ("conservation calculator") that serves as a user-friendly interface to simplify model use. Ecological equivalency that forms the basis of HEA is a concept that uses a common currency to express and assign a value to functional habitat loss and gain. Ecological equivalency is traditionally a service-to-service approach where

[2] A common "habitat currency" to quantify habitat impacts or gains can be calculated using Habitat Equivalency Analysis (HEA) methodology when used with a tool to consistently determine the habitat value of the affected area before and after impact. NMFS selected HEA as a means to identify section 7 project related habitat losses, gains, and quantify appropriate mitigation because of its long use by NOAA in natural resource damage assessment to scale compensatory restoration (Dunford et al. 2004; Thur 2006) and extensive independent literature on the model (Milon and Dodge 2001; Cacela et al. 2 2005; Strange et al. 2002). In Washington State, NMFS has also expanded the use of HEA to calculate conservation credits available from fish conservation banks (NMFS 2008, NMFS 2015)), from which "withdrawals" can be made to address mitigation for adverse impacts to ESA species and their designated CH.

the ecological functions and services for a species or group of species lost from an impacting activity are fully offset by the services gained from a conservation activity. In this case, we use this approach to calculate the "cost" and "benefit" of the proposed action, as well as the impacts of the existing environmental baseline, using the NHVM.

The NHVM includes a debit/credit factor of two applied to new structures to account for the fact that impacts on unimpaired habitat have been found to be more detrimental than future impacts to already impaired habitat at sites with existing structures (Roni et al., 2002). To rephrase, given the current condition of nearshore habitat, impacts from new structures on relatively unimpaired habitat would be, for example, more harmful than impacts resulting from the repair or replacement of existing structures, and the model accounts for this difference.

NMFS developed the NHVM based specifically on the designated critical habitat of listed salmonids in Puget Sound, scientific literature, and our best professional judgement. The model, run by inputting project specific information into the conservation calculator, produces numerical outputs in the form of conservation credits and debits. Credits (+) indicate positive environmental results to nearshore habitat quality, quantity, or function. Debits (-) on the other hand indicate a loss of nearshore habitat quality, quantity, or function. The model can be used to assess credits and debits for nearshore development projects and restoration projects; in the past, we have used this approach in the Structures in Marine Waters Programmatic consultation (NMFS 2016b). More recently, on November 9, 2020, NMFS issued a biological opinion (NMFS 2020) for 39 over-, in- and near-shore projects in the marine shoreline of Puget Sound that used the NHVM to establish a credit/debit target of no-net-loss of critical habitat functions.

Use of the NHVM requires an assumption of the amount of time the proposed structure, and thus the resulting habitat impacts, will persist. For this consultation and consistent with our application in NMFS 2020, we have applied an assumption that the TPP will persist for following number of years before requiring an additional action to maintain their structural integrity: 40 years for the overwater structures component of the TPP and 50 years for shoreline bulkhead.

As explained above, model outputs for new or expanded projects account for impacts to an undeveloped environment and are calculated at a higher debit rate (2 times greater) than those calculated for replace/repair projects, that assume that some function has already been lost from the existing structure. In sum, outputs from the NHVM accounts for the following consequences of the action:

- Beneficial aspects of proposed project, including any positive effects that would result from removing debris;
- Minimization incorporated through project design improvements (e.g., credit is given for grating over water structures (OWS));
- Adverse effects that would occur from new OWS for 40 years, and from the new bulkhead structure for 50 years

Appendix 1 has a summary sheet of overall credits of the proposed project as well as remaining debits. Following the summary sheets are detailed model output that describe how impacts of the proposed project for 40 years (for overwater structures) and 50 years (for shoreline stabilization) are determined.

2.2 Rangewide Status of the Species and Critical Habitat

This opinion examines the status of each species that would be adversely 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' "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 function of the PBFs that are essential for the conservation of the species.

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 and distribution of ESA-listed species, and the conservation value of designated critical habitats, in the Pacific Northwest. These changes will not be spatially homogeneous across the Pacific Northwest. The largest hydrologic responses are expected to occur in basins with significant snow accumulation, where warming decreases snow pack, increases winter flows, and advances the timing of spring melt (Mote et al. 2014; Mote et al 2016). Rain-dominated watersheds and those with significant contributions from groundwater may be less sensitive to predicted changes in climate (Tague et al. 2013; Mote et al. 2014).

During the last century, average regional air temperatures in the Pacific Northwest increased by 1-1.4°F as an annual average, and up to 2°F in some seasons (based on average linear increase per decade; Abatzoglou et al. 2014; Kunkel et al. 2013). Recent temperatures in all but two years since 1998 ranked above the 20th century average (Mote et al. 2014). Warming is likely to continue during the next century as average temperatures are projected to increase another 3 to 10°F, with the largest increases predicted to occur in the summer (Mote et al. 2014).

Decreases in summer precipitation of as much as 30 percent by the end of the century are consistently predicted across climate models (Mote et al. 2014). Precipitation is more likely to occur during October through March, less during summer months, and more winter precipitation will be rain than snow (ISAB 2007; Mote et al. 2014). Earlier snowmelt will cause lower stream flows in late spring, summer, and fall, and water temperatures will be warmer (ISAB 2007; Mote et al. 2014). Models consistently predict increases in the frequency of severe winter precipitation events (i.e., 20-year and 50-year events), in the western United States (Dominguez et al. 2012). The largest increases in winter flood frequency and magnitude are predicted in mixed rain-snow watersheds (Mote et al. 2014).

The combined effects of increasing air temperatures and decreasing spring through fall flows are expected to cause increasing stream temperatures; in 2015, this resulted in 3.5-5.3ºC increases in Columbia Basin streams and a peak temperature of 26º C in the Willamette (NWFSC 2015).

Overall, about one-third of the current cold-water salmonid habitat in the Pacific Northwest is likely to exceed key water temperature thresholds by the end of this century (Mantua et al. 2009).

Higher temperatures will reduce the quality of available salmonid habitat for most freshwater life stages (ISAB 2007). Reduced flows will make it more difficult for migrating fish to pass physical and thermal obstructions, limiting their access to available habitat (Mantua et al. 2010; Isaak et al. 2012). Temperature increases shift timing of key life cycle events for salmonids and species forming the base of their aquatic foodwebs (Crozier et al. 2011; Tillmann and Siemann 2011; Winder and Schindler 2004). Higher stream temperatures will also cause decreases in dissolved oxygen (DO), may also cause earlier onset of stratification, and reduced mixing between layers in lakes and reservoirs, which can result in reduced oxygen (Meyer et al. 1999; Winder and Schindler 2004; Raymondi et al. 2013). Higher temperatures are likely to cause several species to become more susceptible to parasites, disease, and higher predation rates (Crozier et al. 2008; Wainwright and Weitkamp 2013; Raymondi et al. 2013).

As more basins become rain-dominated and prone to more severe winter storms, higher winter stream flows may increase the risk that winter or spring floods in sensitive watersheds will damage spawning redds and wash away incubating eggs (Goode et al. 2013). Earlier peak stream flows will also alter migration timing for salmon smolts, and may flush some young salmon and steelhead from rivers to estuaries before they are physically mature, increasing stress and reducing smolt survival (McMahon and Hartman 1989; Lawson et al. 2004).

In addition to changes in freshwater conditions, predicted changes for coastal waters in the Pacific Northwest because of climate change include increasing surface water temperature, increasing but highly variable acidity, and increasing storm frequency and magnitude (Mote et al. 2014). Elevated ocean temperatures already documented for the Pacific Northwest are highly likely to continue during the next century, with sea surface temperature projected to increase by 1.0-3.7oC by the end of the century (IPCC 2014). Habitat loss, shifts in species' ranges and abundances, and altered marine food webs could have substantial consequences to anadromous, coastal, and marine species in the Pacific Northwest (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. A 38 percent to 109 percent increase in acidity is projected by the end of this century in all but the most stringent CO2 mitigation scenarios, and is essentially irreversible over a time scale of centuries (IPCC 2014). Regional factors appear to be amplifying acidification in Northwest ocean waters, which is occurring earlier and more acutely than in other regions and is already impacting important local marine species (Barton et al. 2012; Feely et al. 2012). Acidification also affects 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).

Global sea levels are expected to continue rising throughout this century, reaching likely predicted increases of 10-32 inches by 2081-2100 (IPCC 2014). 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; Reeder 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). 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, and therefore these species are predicted to fare poorly in warming ocean conditions (Scheuerell and Williams 2005; 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).

The adaptive ability of these threatened and endangered species is depressed due to reductions in population size, habitat quantity and diversity, and loss of behavioral and genetic variation. Without these natural sources of resilience, systematic changes in local and regional climatic conditions due to anthropogenic global climate change will likely reduce long-term viability and sustainability of populations in many of these ESUs (NWFSC 2015). 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 the Critical Habitat

This section describes the status of designated critical habitat affected by 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).

Salmonids

For salmon, NMFS's critical habitat analytical review teams (CHARTs) ranked watersheds within designated critical habitat at the scale of the fifth-field hydrologic unit code in terms of the conservation value they provide to each ESA-listed species that they support (NOAA Fisheries 2005). The conservation rankings were high, medium, or low. To determine the conservation value of each watershed to species viability, the CHARTs evaluated 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. No critical habitat in marine areas has been designated for PS steelhead, and so the action area does not include critical habitat for this Distinct Population Segment (DPS).

In designating critical habitat (CH) for PS Chinook and Hood Canal Summer Run chum (HCSR) chum salmon in estuarine and nearshore marine areas5, 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.

Rockfish

NMFS designated critical habitat for PS/GB yelloweye and PS/GB bocaccio rockfish on November 13, 2014 (79 FR 68042). Critical habitat is not designated in areas outside of United States jurisdiction; therefore, although waters in Canada are part of the DPSs' ranges for both species, critical habitat was not designated in that area. The U.S. portion of the Puget Sound/Georgia Basin that is occupied by PS/GB yelloweye rockfish and PS/GB bocaccio can be divided into five areas, or Basins, based on the distribution of each species, geographic conditions, and habitat features. These five interconnected Basins are: (1) The San Juan/Strait of Juan de Fuca Basin, (2) Main Basin, (3) Whidbey Basin, (4) South Puget Sound, and (5) Hood Canal.

Based on the natural history of PS/GB 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; and (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.

Nearshore critical habitat for PS/GB bocaccio at juvenile life stages 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 PBFs 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.

Deep water critical habitat includes marine waters and substrates of the U.S. in Puget Sound east of Green Point in the Strait of Juan de Fuca, and serves both adult PS/GB bocaccio, and both juvenile and adult PS/GB yelloweye rockfish. Deepwater critical habitat is defined as areas at depths greater than 98 feet (30 m) that supports feeding opportunities and predator avoidance.

SRKW Critical Habitat

Critical habitat for the Southern Resident killer whale DPS was designated on November 29, 2006 (71 F54reR 69054). Critical habitat includes approximately 2,560 square miles of inland waters of Washington in three specific areas: (1) the Summer Core Area in Haro Strait and waters around the San Juan Islands; (2) Puget Sound; and (3) the Strait of Juan de Fuca. Based on the natural history of SRKWs and their habitat needs, NMFS identified the following physical or biological features 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.

In 2006, few data were available on SRKWs distribution and habitat use in coastal waters of the Pacific Ocean. Since the 2006 designation, additional effort has been made to better understand the geographic range and movements of SRKWs. For example, opportunistic visual sightings, satellite tracking, and passive acoustic research conducted since 2006 have provided an updated estimate of the whales' coastal range that extends from the Monterey Bay area in California, north to Chatham Strait in southeast Alaska (NMFS 2019b).

On September 19, 2019, NMFS proposed to revise the critical habitat designation for the SRKW DPS under the ESA by designating six new areas along the U.S. West Coast (84 FR 49214). Specific new areas proposed along the U.S. West Coast include 15,626.6 square miles (mi2) (40,472.7 square kilometers (km2)) of marine waters between the 6.1-meter (m) depth contour and the 200-m depth contour from the U.S. international border with Canada south to Point Sur, California). In the proposed rule (84 FR 49214), NMFS states that the "proposed areas are occupied and contain physical or biological features that are essential to the conservation of the species and that may require special management considerations or protection." The three physical or biological features essential to conservation in the 2006 designated critical habitat were also identified for the six new areas along the U.S. West Coast.

Water Quality

Water quality supports SRKW's ability to forage, grow, and reproduce free from disease and impairment. Water quality is essential to the whales' conservation, given the whales' present contamination levels, small population numbers, increased extinction risk caused by any additional mortalities, and geographic range (and range of their primary prey) that includes highly populated and industrialized areas. Water quality is especially important in high-use areas where foraging behaviors occur and contaminants can enter the food chain. The absence of contaminants or other agents of a type and/or amount that would inhibit reproduction, impair immune function, result in mortalities, or otherwise impede the growth and recovery of the SRKW population is a habitat feature essential for the species' recovery. Water quality in Puget Sound, in general, is degraded as described in the Puget Sound Partnership 2018-2022 Action Agenda and Comprehensive (Puget Sound Partnership 2018). For example, toxicants in Puget Sound persist and build up in marine organisms including SRKWs and their prey resources, despite bans in the 1970s of some harmful substances and cleanup efforts. Water quality varies in coastal waters from Washington to California. For example, as described in NMFS (2019b), high levels of DDTs have been found in SRKWs, especially in K and L pods, which spend more time in California in the winter where DDTs still persist in the marine ecosystem (Sericano et al. 2014).

Exposure to oil spills also poses additional direct threats as well as longer term population level impacts; therefore, the absence of these chemicals is of the utmost importance to SRKW conservation and survival. Oil spills can also have long-lasting impacts on other habitat features. Oil spill risk exists throughout the SRKW's coastal and inland range. From 2002-2016, the highest-volume crude oil spill occurred in 2008 off the California coast, releasing 463,848 gallons (Stephens 2017). In 2015 and 2016, crude oil spilled into the marine environment off the California coast totaled 141,680 gallons and 44,755, respectively; no crude oil spills were reported off the coasts of Oregon or Washington in these years (Stephens 2015, Stephens 2017). Non-crude oil spills into the marine environment also occurred off California, Oregon, and Washington in 2015 and 2016 (Stephens 2015, Stephens 2017).The Environmental Protection Agency and U.S. Coast Guard oversee the Oil Pollution Prevention regulations promulgated under the authority of the Federal Water Pollution Control Act. There is a Northwest Area Contingency Plan, developed by the Northwest Area Committee, which serves as the primary guidance document for oil spill response in Washington and Oregon. In 2017, the Washington State Department of Ecology published a new Spill Prevention, Preparedness, and Response Program Annual Report describing the Spills Program as well as the performance measures from 2007 – 2017 (WDOE 2017).

Prey Quantity, Quality, and Availability

Most wild salmon stocks throughout the whales' geographic range are at fractions of their historic levels. Beginning in the early 1990s, 28 ESUs and DPSs of salmon and steelhead in Washington, Oregon, Idaho, and California were listed as threatened or endangered under the ESA. Historically, overfishing, habitat losses, and hatchery practices were major causes of decline. Poor ocean conditions over the past two decades have reduced populations already weakened by the degradation and loss of freshwater and estuary habitat, fishing, hydropower system management, and hatchery practices. While wild salmon stocks have declined in many areas, hatchery production has been generally strong.

Contaminants and pollution also affect the quality of SRKW prey in Puget Sound and in coastal waters of Washington, Oregon, and California. Contaminants enter marine waters and sediment from numerous sources, but are typically concentrated near areas of high human population and industrialization. Once in the environment these substances proceed up the food chain, accumulating in long-lived top predators like SRKWs. Chemical contamination of prey is a potential threat to SRKW critical habitat, despite the enactment of modern pollution controls in recent decades, which were successful in reducing, but not eliminating, the presence of many contaminants in the environment. The size of Chinook salmon is also an important aspect of prey quality (i.e., SRKWs primarily consume large Chinook) so changes in Chinook size may affect the quality of this component critical habitat. In addition, vessels and sound may reduce the effective zone of echolocation and reduce availability of fish for the whales in their critical habitat (Holt 2008).

Passage

Southern Residents are highly mobile and use a variety of areas for foraging and other activities, as well as for traveling between these areas. Human activities can interfere with movements of the whales and impact their passage. In particular, vessels may present obstacles to whale passage, causing the whales to swim further and change direction more often, which can increase energy expenditure for whales and impacts foraging behavior (review in NMFS (2010), Ferrara et al. (2017)

All physical and biological features (or primary constituent elements) of estuarine, and nearshore marine critical habitat for the affected salmonid species and Yelloweye rockfish and bocaccio critical habitat have been degraded throughout the PS region. The causes for these losses of critical habitat value include human development, including diking, filling of wetlands and bays, channelization, nearshore and floodplain development. The continued growth contributes to the anthropogenic modification of the PS shorelines and is the major factor in the cumulative degradation and loss of nearshore and estuarine habitat. The development of shorelines includes bank hardening and the introduction of obstructions in the nearshore, each a source of structure and shade, which can interfere with juvenile salmonid migration, diminish aquatic food supply, and is a potential source of water pollution from boating uses (Shipman et al. 2010; Morley et al. 2012; Fresh et al. 2011).

The degradation of multiple aspects of PS Chinook, HCSR chum salmon, PS steelhead, Yelloweye and bocaccio rockfish, and SRKW 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.

Table 2 provides a summary of critical habitat information for the species addressed in this opinion. More information can be found in the Federal Register notices available at NMFS's West Coast Region website (http://www.westcoast.fisheries.noaa.gov/).

Table 2: Current Status of Designated Critical Habitat

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Puget Sound Chinook salmon	9/02/05 70 FR 52630	Critical habitat for Puget Sound Chinook salmon includes 1,683 miles of streams, 41 square mile of lakes, and 2,182 miles of nearshore marine habitat in Puget Sounds. The Puget Sound 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.
Hood Canal summer-run chum	9/02/05 70 FR 52630	Critical habitat for Hood Canal summer-run chum includes 79 miles and 377 miles of nearshore marine habitat in HC. Primary constituent elements relevant for this consultation include: 1) Estuarine areas free of obstruction with water quality and aquatic vegetation to support juvenile transition and rearing; 2) Nearshore marine areas free of obstruction with water quality conditions, forage, submerged and overhanging large wood, and aquatic vegetation to support growth and maturation; 3) Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.
Puget Sound/Georgia Basin DPS of yelloweye rockfish	11/13/2014 79 FR68042	Critical habitat for yelloweye rockfish includes 414.1 square miles of deepwater marine habitat in Puget Sound, all of which overlaps with areas designated for bocaccio rockfish. No nearshore component was included in the critical habitat listing for juvenile yelloweye rockfish as they, different from bocaccio rockfish, typically are not found in intertidal waters (Love et al., 1991). Yelloweye rockfish are most frequently observed in waters deeper than 30 meters (98 ft.) near the upper depth range of adults (Yamanaka et al., 2006). 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.
Puget Sound/Georgia Basin DPS of bocaccio	11/13/2014 79 FR68042	Critical habitat for bocaccio includes 590.4 square miles of nearshore habitat and 414.1 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 all three 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.

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Southern resident killer whale	11/29/06 71 FR 69054	Based on the natural history of the Southern Residents and their habitat needs, NMFS identified three PBFs, or physical or biological features, essential for the conservation of Southern Residents: 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 Water quality in Puget Sound, in general, is degraded. Some pollutants in Puget Sound persist and build up in marine organisms including Southern Residents and their prey resources, despite bans in the 1970s of some harmful substances and cleanup efforts. The primary concern for direct effects on whales from water quality is oil spills, although oil spills can also have long-lasting impacts on other habitat features In regards to passage, human activities can interfere with movements of the whales and impact their passage. In particular, vessels may present obstacles to whales' passage, causing the whales to swim further and change direction more often, which can increase energy expenditure for whales and impacts foraging behavior. Reduced prey abundance, particularly Chinook salmon, is also a concern for critical habitat.

2.2.2 Status of the Species

Table 3, below provides a summary of listing and recovery plan information, status summaries and limiting factors for the species addressed in this opinion. More information can be found in recovery plans and status reviews for these species. Acronyms appearing in the table include DPS (Distinct Population Segment), ESU (Evolutionarily Significant Unit), MPG (Major Population Group), NWFSC (Northwest Fisheries Science Center), TRT (Technical Recovery Team), PS (Puget Sound), PS/GB (Puget Sound/Georgia Basin).

Table 3: Listing classification and date, recovery plan reference, most recent status review, status summary, and limiting factors for each species considered in this opinion.

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Puget Sound Chinook salmon	Threatened 6/28/05	Shared Strategy for Puget Sound 2007 NMFS 2006	NWFSC 2015	This ESU comprises 22 populations distributed over five geographic areas. Most populations within the ESU have declined in abundance over the past 7 to 10 years, with widespread negative trends in natural-origin spawner abundance, and hatchery-origin spawners present in high fractions in most populations outside of the Skagit watershed. Escapement levels for all populations remain well below the TRT planning ranges for recovery, and most populations are consistently below the spawner-recruit levels identified by the TRT as consistent with recovery.	• Degraded floodplain and in-river channel structure • Degraded estuarine conditions and loss of estuarine habitat • Degraded riparian areas and loss of in-river large woody debris • Excessive fine-grained sediment in spawning gravel • Degraded water quality and temperature • Degraded nearshore conditions • Impaired passage for migrating fish • Severely altered flow regime
Hood Canal summer-run chum	Threatened 6/28/05	Hood Canal Coordinatin g Council 2005 NMFS 2007	NWFSC 2015	This ESU is made up of two independent populations in one major population group. Natural-origin spawner abundance has increased since ESA-listing and spawning abundance targets in both populations have been met in some years. Productivity was quite low at the time of the last review, though rates have increased in the last five years, and have been greater than replacement rates in the past two years for both populations. However, productivity of individual spawning aggregates shows only two of eight aggregates have viable performance. Spatial structure and diversity viability parameters for each population have increased and nearly meet the viability criteria. Despite substantive gains towards meeting viability criteria in the Hood Canal and Strait of Juan de Fuca summer chum salmon populations, the ESU still does not meet all of the recovery criteria for population viability at this time.	• Reduced floodplain connectivity and function • Poor riparian condition • Loss of channel complexity Sediment accumulation Altered flows and water quality

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Puget Sound Steelhead	Threatened 5/11/07	NMFS 2019	NWFSC 2015	This DPS comprises 32 populations and is currently at very low viability, with most of the 32 populations and all three population groups at low viability. Info considered during the most recent status review indicates that the biological risks faced by the PS Steelhead DPS have not substantively changed since the listing in 2007, or since the 2011 status review. Furthermore, the PS Steelhead TRT recently concluded that the DPS was at very low viability, as were all three of its constituent MPGs, and many of its 32 populations. In the near term, the outlook for environmental conditions affecting PS steelhead is not optimistic. While harvest and hatchery production of steelhead in Puget Sound are currently at low levels and are not likely to increase substantially in the foreseeable future, some recent environmental trends not favorable to Puget Sound steelhead survival and production are expected to continue.	• Continued destruction and modification of habitat • Widespread declines in adult abundance despite significant reductions in harvest • Threats to diversity posed by use of two hatchery steelhead stocks • Declining diversity in the DPS, including the uncertain but weak status of summer-run fish • A reduction in spatial structure • Reduced habitat quality • Urbanization • Dikes, hardening of banks with riprap, and channelization
Puget Sound/ Georgia Basin DPS of yelloweye Rockfish	Threatened 04/28/10	NMFS 2017	NMFS 2016	Yelloweye rockfish within the PS/GB are likely the most abundant within the San Juan Basin of the DPS. Yelloweye rockfish spatial structure and connectivity is threatened by the apparent reduction of fish within each of the basins of the DPS. This reduction is probably most acute within the basins of PS proper. The severe reduction of fish in these basins may eventually result in a contraction of the DPS' range.	Over harvest Water pollution • Climate-induced changes to rockfish habitat • Small population dynamics
Puget Sound/ Georgia Basin DPS of Bocaccio	Endangered 04/28/10	NMFS 2017	NMFS 2016	Though Bocaccio were never a predominant segment of the multi-species rockfish population within the Puget Sound/Georgia Basin, their present-day abundance is likely a fraction of their pre-contemporary fishery abundance. Most bocaccio within the DPS may have been historically spatially limited to several basins within the DPS. They were apparently historically most abundant in the Central and South Sound with no documented occurrences in the San Juan Basin until 2008. 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.	Over harvest Water pollution • Climate-induced changes to rockfish habitat • Small population dynamics

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Southern resident killer whale	Endangered 11/18/05	NMFS 2008	Ford 2013	The Southern Resident killer whale DPS is composed of a single population that ranges as far south as central California and as far north as southeast Alaska. The estimated effective size of the population (based on the number of breeding individuals under ideal genetic conditions) is very small — <30 whales, or about 1/3 of the current population size. The small effective population size, the absence of gene flow from other populations, and documented breeding within pods may elevate the risk from inbreeding and other issues associated with genetic deterioration. As of July 1, 2013, there were 26 whales in J pod, 19 whales in K pod and 37 whales in L pod, for a total of 82 whales. Estimates for the historical abundance of Southern Resident killer whales range from 140 whales (based on public display removals to 400 whales, as used in population viability analysis scenarios.	• Quantity and quality of prey • Exposure to toxic chemicals • Disturbance from sound and vessels Risk from oil spills

2.3 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).

As mentioned above, as part of the project the Navy will use the HCCC ILF program for compensatory mitigation requirements of the Clean Water Act for the TPP Pier project. The exact nature of the ILF project is unknown at this time, therefore the **action area** includes all areas covered in the HCCC service area. The **project area** covers the area which will be affected by construction impacts. Within the project area is the designated Department of Defense, (DoD) restricted and danger zone, or the **Navy exclusion zone** (Figure 8, purple polygons).

The project area is marks the furthest reaching effect is the temporary increase in noise and sound pressure resulting from the pile driving activities. Underwater noise levels will extend the farthest from the vibratory driving of the 36-inch steel piles (Figure 8). The current background noise near the construction site is 114 dB. The Marine mammal behavioral threshold is slightly higher at 120 dB. Using the practical spreading loss model for underwater sound we calculated the range at which sound pressure generated by the pile driving would attenuate to levels below current background levels:

$$D = D_O * 10^{((\text{Construction Noise - Threshold Sound Level in dB})/15)},$$

Where:
D = the distance at which transmission loss is estimated,
Do = the distance from the measured sound level.

D = 10 * 10((166-120)/15) = 11.6 km or 7.2 miles

Vibratory pile driving noise is estimated to attenuate to below the marine mammal behavioral disturbance threshold (120 dB) at an underwater distance of 11.6 kilometers (km) from the source. Underwater noise levels are intersected by land before they reach this distance. This area of Hood Canal extending from the proposed TPP site is 11.6 km to the north (to approximately the Lofall) and 9.7 km to the south (a point just north of Seabeck, Wa), an area approximately 21 km long. Increases in sound pressure are expected to be detectable beyond existing background levels out to the distances mentioned above and sound pressure/noise represents and alteration of the physical properties of water quality.

All effects of the proposed action, including noise from submarine support vessels, temporary increases in turbidity levels from pile installation and effects to forage species, and the future ILF project, are encompassed within the extent of the HCCC Service Area. All nearshore area that may be affected by the upland development and construction activities are also included within this area.

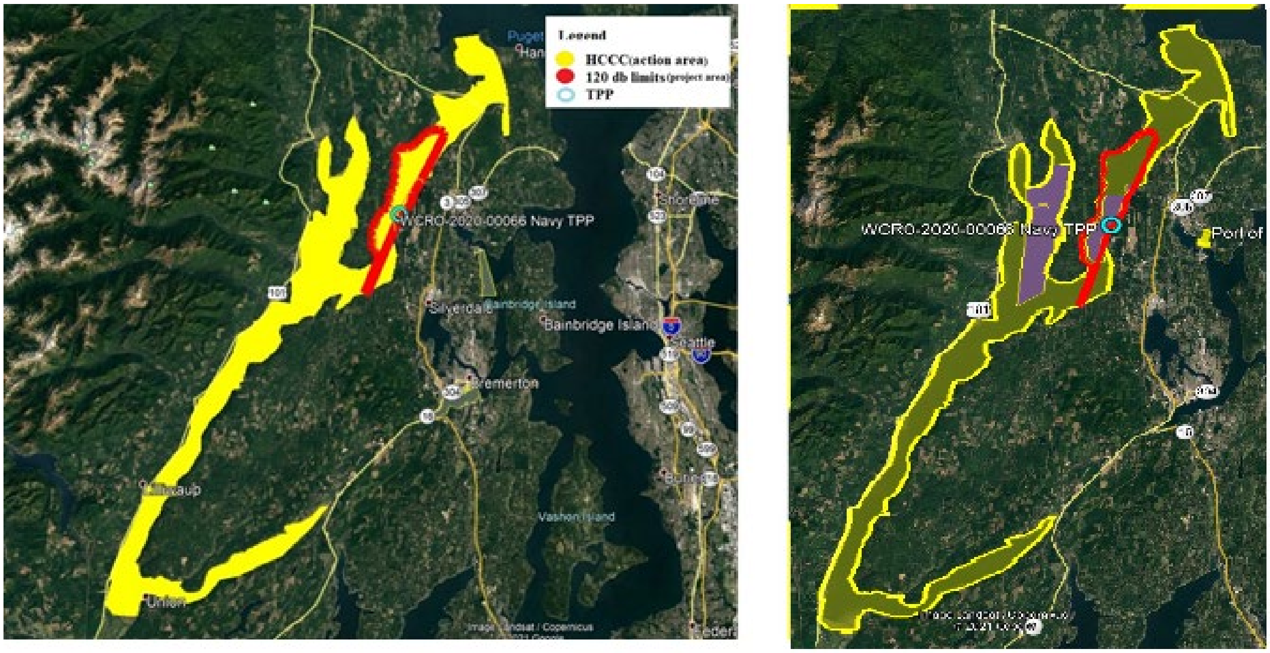

Figure 8: Action area as defined by the HCCC service area. Inset area affected by impact pile driving 36-inch steel piles.

The action area includes some designated critical habitat for PS Chinook, HCSR chum, PSGB yelloweye, and PSGB bocaccio. SRKW critical habitat PBF #2 (prey species of sufficient quantity, quality, and availability to support individual growth, reproduction and development, as well as overall population growth) is indirectly impacted. The action area includes both deepwater and nearshore designated critical habitat. Because the action area includes a designated DoD restricted and danger zone, habitat within this specific zone is excluded from critical habitat designation, even though the area is accessible to listed species.

Effects to habitat features, that are not included in the critical habitat designations, include temporary and permanent diminishment of benthic communities and forage fish (i.e., prey abundance and diversity), migratory obstruction and required energy expenditure, and temporary and permanent increases in predators and predator success upon juvenile salmonids. Timing, duration, and intensity of the effects on DoD exempted areas will be the same as for the critical habitat effects (we assume effects are consistent across designated and non-designated areas). These effects will occur within the Navy's security zones, which is excluded from the critical habitat designation and thus not taken into account in the adverse modification analysis, but we nevertheless consider them as the pathways of exposure creating effects to the species, as discussed below.

2.4 Environmental Baseline

The "environmental baseline" refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. 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 consultations, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402.02).

Many of the factors affecting listed species and critical habitat generally are also present as degrading habitat factors in the baseline of the action area (See section 2.3). For example, water quality is affected by upland sources of pollution. Baseline conditions that are specific to the action area, especially for HCSR chum, include background levels of noise from significant levels of commercial vessel traffic, as well as degraded nearshore habitat due to bank armoring and large in-water navy structures.

Hood Canal is a large fjord that is separated from Puget Sound by the Kitsap Peninsula. Hood Canal averages 3.8-miles wide and 500-feet deep, with a maximum width 10.2 miles and maximum depth of 600 feet (Johnson et al. 2001). The canal stretches 63 miles from its mouth at Admiralty Inlet to the tip of Lynch Cove at Belfair. At the southern extent of Hood Canal, where the Skokomish River enters the Hood Canal, a 90-degree bend to the east occurs (The Great Bend).

Four watersheds, or Water Resource Inventory Areas (WRIA), drain into Hood Canal: Kennedy-Goldbsorough (WRIA 14); Kitsap Basin (WRIA 15); Hood Canal Basin (WRIA 16); and Quilcene Basin (WRIA 17). Hood Canal has several major tributaries including the Skokomish, Big Quilcene, Dosewallips, Duckabush, Dewatto, Hamma, and Union rivers. All four WRIAs encompass the action area (Figure 9).

Within northern Hood Canal, nearshore development is limited with few industrial waterfront sites other than Naval Base Kitsap Bangor. Quilcene has a marina in north Hood Canal. The community of Bridgehaven has nearly 30 private docks and a small marina dock. A few residential docks and small piers occur at Seabeck, approximately 13 miles south of the action area and attracts recreational boaters. Pleasant Harbor, north of Seabeck, represents a larger amount of OWS and significantly more vessel traffic when compared to Seabeck. The Hood Canal Bridge is located approximately 16 miles north of the action area.

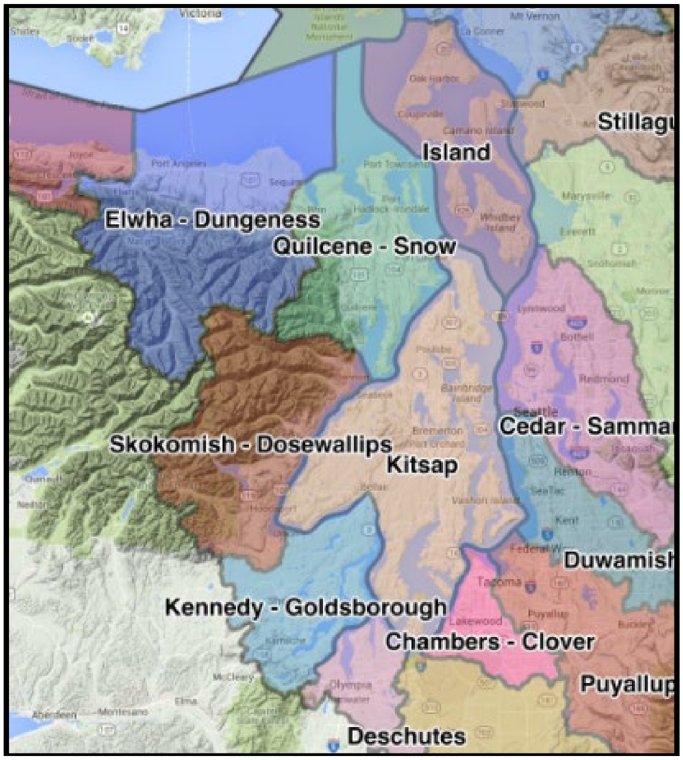

Figure 9: Action area WRIAs

The immediate shores of Hood Canal in the action area lack wetland habitats. The western shore consists of gravel and driftwood and is undeveloped. Low shrubs and 80-foot conifer trees occupy the riparian zone and extend upwards into the steeps bangs of Hood Canal. Unlike the western shore, the eastern shore is more developed due to the presence of Naval Base Kitsap Bangor. Naval Base Kitsap Bangor is a large industrial/military complex with more than 3.6 acres of over-water and in-water structures, approximately 4.20 miles of shoreline. These structures can support multiple nuclear submarines at once and support vessels of different sizes.

Within the action area, there are several sources of artificial light including commercial and residential shoreline development and overwater structures. For example, many homes and docks have lights. Alderbrook Inn has lighting on their T-dock (near Union) and Hoodsport Public Dock does as well. The communities of Bridgehaven and Port Gamble in north HC, and Hoodsport in south HC, are examples of shoreline communities that produce artificial nighttime lighting. Shellfish harvest often happens at night during the winter. While episodic, they set up lighting on the beach during harvest.

The Naval Base Kitsap Bangor waterfront also produces artificial light. The overwater and onshore structures currently comprising the Naval Base Kitsap Bangor waterfront produce lighting through the upper, lower, and deep shore zones with deck mounted lights. These lighting systems are commercial grade, but vary in size, output, orientation, and elevation off the water. This artificial lighting in the upper shore, and extending through the deep shore zones, is continuous in nature, occurring every night with limited—or no—interruptions. Such lighting is known to create a behavioral response in juvenile fish that can impair both migration and survival. Tabor et al (2017) determined that out-migrating juvenile salmonids exposed to artificial nighttime light experience a form of nocturnal phototaxic behavior, moving toward and staying in areas of artificial light. This abnormal behavior can increase the risk of predation especially among juvenile salmonids. Multiple OWS at the Navy's waterfront represent an additional increase in predation risk and decrease in migratory efficiency for salmonids.

The Hood Canal shoreline around Navbase Kitsap Bangor is full of natural points and dips (see Figure 2). Currently, the proposed location of the TPP is on a point in an open, unoccupied habitat free of navigational barriers to nearshore hugging migrating fish. The K/B dock is directly south of the proposed location which may pose a navigational barrier to hugging migrating fish should the fish decide to enter a small dip. Other nearby waterfront areas of the base do have existing OWS. In the marine nearshore, there is 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 1999; Southard et al. 2006; Toft et al. 2007; Ono 2010). In the PS nearshore, 35 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.

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. Hesitating upon first encountering the structure, as discussed, also exposes salmonids to avian predators that may use the floating structures as perches. 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. When juvenile salmonids temporarily leave the relative safety of the shallow water,[3] 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).

Further, swimming around OWS lengthens the salmonid migration route, which has been shown to be correlated to increased mortality. 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). There have also been

[3] Shallow water for the purposes of this consultation refers to the areas with a depth of 20ft or less.

some studies suggesting that the Hood Canal Floating Bridge is a partial barrier to many animal species, including salmon, migrating through Hood Canal (Hood Canal Bridge Assessment Team 2016).

Recreational boating activities, including fishing are common in the Canal. The local fishery includes sport and tribal fishing. The abundance of boats on the water is seasonal and varies with the length of the sport fishing season set by WDFW. There are several fisheries in Hood Canal and ample aquaculture activities, commercial and non-commercial. The aquaculture activities include on-bottom oyster culture and hand harvesting. In addition, extensive commercial (state & tribal) fishery for sea cucumber, urchins, and geoduck exists (not aquaculture, referred to as wild stock fishery) the action area as defined by HCCC service area. Aquaculture activities result in increased nutrient sequestering, invertebrate colonization and periodic events of increased turbidity associated with harvest. There are oyster beds on the upper and lower shore zones throughout the Bangor waterfront which are managed by hand. No shellfish farming is allowed within 20 feet of eelgrass beds (with the exception of long lines and flip bags). The hands-only method is the lowest impact method available and avoids significant increases in turbidity and other potential effects associated with heavy machinery such as dredges. Any increases in turbidity or alterations to the benthic community in the shellfish beds are short in duration and isolated to the immediate area where farmers walked and collected oysters.

Frequent vessel traffic from the mix of users produces sound energy throughout Hood Canal and the action area. Several studies have shown fish to respond physiologically and biologically to increased noise (Mueller 1980; Scholik and Yan 2002; Picciulin et al. 2010). Xie et al. (2008) report on the commonsense knowledge, that adult migrating salmon avoid vessels 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). They postulate that this demonstrates that fish experienced sublethal physiological disturbances in response to the noise propagated from recreational boating activities.

Documented behavioral and physiological responses to disturbance from boat noise divert time and energy from other fitness-enhancing activities such as feeding, avoiding predators, and defending territory. All of these likely disturb salmonids, causing them to at least temporarily leave an area, and experience sublethal physiological stress all of which increases the likelihood of injury and being predated on.

Circulation patterns within Hood Canal are complex due to the configuration of the basin and the tidal regime. Tides in Hood Canal are mixed semidiurnal with one flood and one ebb tidal event characterized by a small to moderate range (one to six feet) and a second flood and second ebb with a larger range (eight to 16 feet) during a 24.8-hour tide cycle. As a result, higher high, lower high, higher low, and lower low water levels occur within each tide day (URS Consultants, Inc.

1994; Morris et al. 2008). Larger tidal ranges promote higher velocity currents and increased flushing of the basin, whereas small to moderate tidal ranges are associated with weaker currents and comparatively smaller volumes of seawater exchanged between Hood Canal and Puget Sound.

Because the tides are mixed semidiurnal, Hood Canal is subject to one major flushing event per tide day, when approximately three percent of the total canal volume is exchanged over a six-hour period. Due to the wide range of tidal heights, the actual seawater exchange volume for Hood Canal ranges from one percent during a minor tide to four percent during a major tide. Northern Hood Canal has 20 parameters listed on the WDOE's 303(d) List of Threatened and Endangered Waters (WDOE 2000) within WRIA 15. Low DO, high fecal coliform, and high levels of heavy metals and chemicals characterize water quality in Hood Canal.

Storm waves are the principal mechanism driving longshore sediment transport within Hood Canal shoreline (Golder Associates 2010). Wave energy and the magnitude of sediment transport in Hood Canal are related to the direction and speed of the regional winds. The general wave environment in Hood Canal is characterized as low energy. The Naval Base Kitsap Bangor shoreline is located in the middle of a 16.5-mile long drift cell (KS 5 in the WDOE digital coastal atlas). Erosional bluffs that range in height from 30 to 55 feet characterize shoreline geomorphology. Feeder bluffs represent a portion of the Naval Base Kitsap Bangor shoreline (MacLennan and Johannessen 2014), some of which are completely or partially armored to protect overwater and road infrastructure at Naval Base Kitsap Bangor, resulting in an impediment to sediment input and transport.

Figure 10: Geomorphic Shore type (MacLennan and Johannessen 2014)

MacLennan and Johannessen (2014) note that existing structures along the Naval Base Kitsap Bangor shoreline, as well as other portions of the Hood Canal shoreline, have armored feeder bluffs, thereby reducing the sediment supply compared to historical (pre-development) levels. This portion of the Hood Canal shoreline corresponds to Drift Cell DC-20 in the West Kitsap County Nearshore Assessment (Judd 2010). MacLennan and Johannessen (2014) identified the shoreline adjacent to the proposed TPP site as modified and accretion, and then further north as a feeder bluff (Figure 10).

A survey of eelgrass and macroalgae was conducted in August 2019 (Navy 2019). A large and continuous patch of native eelgrass was observed in the proposed berthing pier and landward area from an approximate depth range of 0 MLLW to -10 MLLW. Additionally, two other small patches of eelgrass were recorded within the main trestle and shading area. Based on the results of the survey the observed eelgrass appeared healthy with blades two to three feet in length. The topography of the survey area that contained more eelgrass flattens out moving north. The eelgrass was observed to be in higher density patches in the flatter locations of the survey area. Dwarf eelgrass (*Zostera japonica*) was observed infrequently in very small areas outside of the sampling locations. Substrate for all transects was similar: small gravel, sand, and shell hash. Divers observed that the macroalgae community was diverse and abundant throughout much of the survey area (Figure 11).

Eelgrass, an important habitat for juvenile salmonids (Williams *et al.* 2001), is found in lush beds in Hood Canal. Eelgrass is also an important spawning substrate for Pacific herring (*Clupea pallasii*).

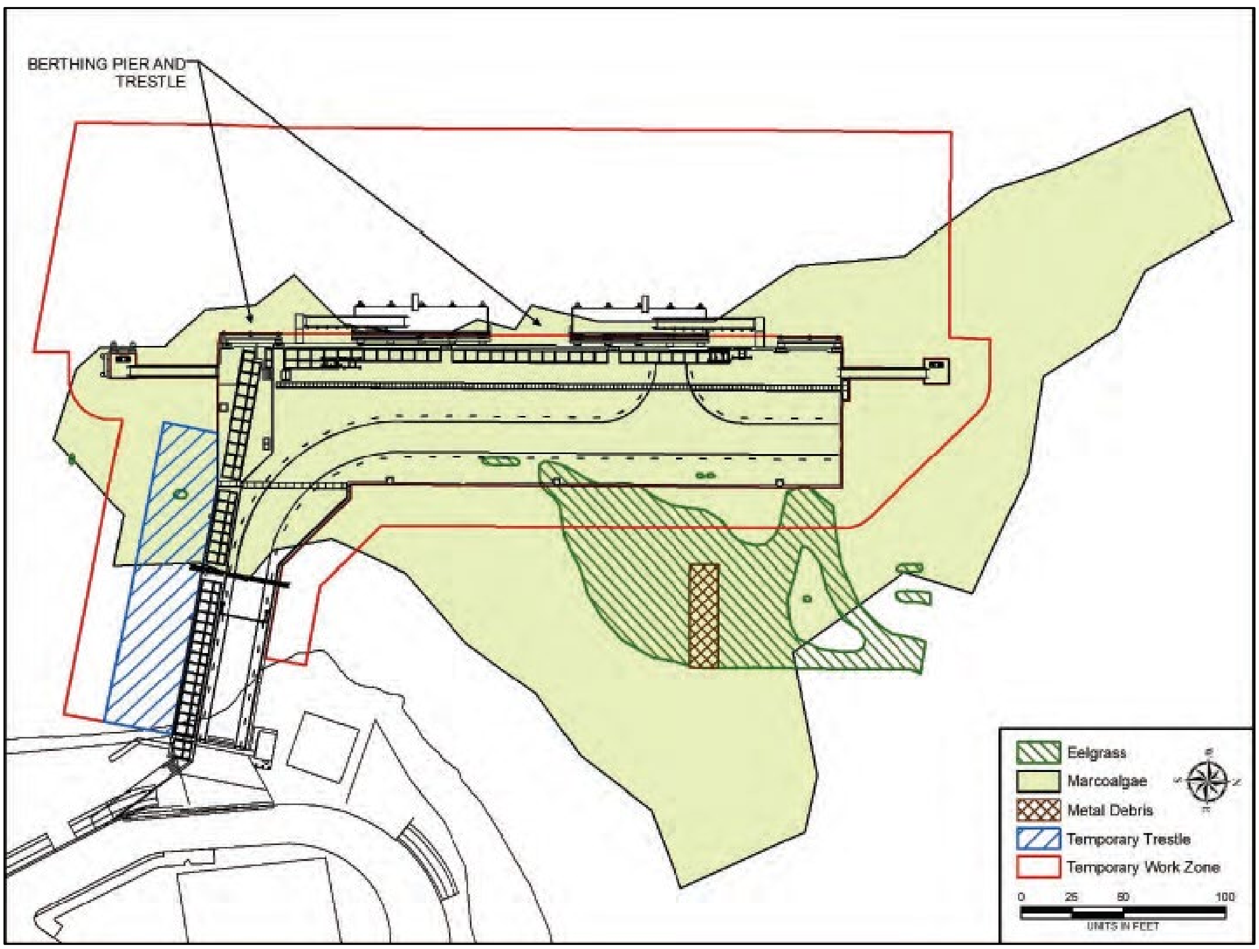

Figure 11: SAV surveyed at proposed TPP site (Navy BE)

The Washington Dept. of Ecology has identified the area along Naval Base Kitsap Bangor as having both continuous and patchy assemblages of kelp (*Saccharina* sp). No kelp was detected in the Navy's 2019 eelgrass survey.

While eelgrass is traditionally located higher in tidal elevation than kelp, both require direct access to over water lighting, typically provided by sunlight, in order to grow and survive. Both these organisms need fairly high light levels to grow and reproduce, so they are found only in shallow waters, mostly less than 65 feet for kelp, and 32 feet for eelgrass (Mumford 2007). Hence, they are totally dependent on the nearshore environment. With Naval Base Kitsap Bangor's extensive system of overwater structures, it is highly likely that submerged aquatic vegetation (SAV) colonization, growth and survival are not possible under much of the Navy's facilities currently in place.

The sand/gravel substratum exhibited within the project area is representative of the majority of Hood Canal nearshore. Sediment consists of solid fragments of organic matter derived from biological organisms in the overlying water column and inorganic matter from the weathering of rock that are transported by water, wind, and ice (glaciers) and deposited at the bottom of bodies of water. Sediments range in size from cobble (2.5-10 inches), to pebble (0.15-2.5 inches), to granule (0.08-0.15 inch), to sand (0.002-0.08 inch), to silt (0.00008-0.0002 inch), and to clay (less than 0.00008 inch).

Benthic organisms are abundant and diverse at Naval Base Kitsap Bangor and are more abundant in the subtidal zone than in the intertidal zone (WDOE 2017). There is no dominant species among mollusks, crustaceans, and polychaetes, but as a larger group, mollusks are dominant in the subtidal zone. Echinoderms comprise only a small percentage (about six percent) of the benthic community along the waterfront. These benthic organisms and the presence of SAV support a diverse assemblage of forage fish along Naval Base Kitsap Bangor.

Different forage fish spawn in Hood Canal year-round. Common fish species identified as forage fish were recorded in the action area during beach seine surveys conducted in 2005 to 2008 (SAIC 2009). Forage fish captured include, in order of abundance (highest to lowest): Pacific herring, surf smelt, and Pacific sand lance (SAIC 2006). Larval forage fish, consisting of large schools with both surf smelt and Pacific sand lance, were also captured during this time. Forage fish occur in each month surveyed, becoming increasingly abundant in the spring months, reaching a peak in June, largely due to the arrival of large schools of herring, before decreasing in abundance again by July. The forage fish presence increases the probability of occurrence of salmon during in-water activity. Adult forage fish 2 grams or larger, and juveniles and larval forage fish smaller than 2 grams, may be exposed to injurious levels of underwater noise. Thus, we expect small-scale, construction-related reduction in salmonid forage. Considering the larger extent of forage fish spawning on Puget Sound beaches (266 miles of known surf smelt spawning beaches and 118 miles of known sand lance spawning beaches[4]), this small-scale reduction likely results in a is relatively minor reduction of available forage for salmonids – though these number do not directly relate to prey available to Hood Canal salmon.

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

Beach and trawl surveys were conducted along Naval Base Kitsap Bangor's waterfront and recorded small numbers of Pacific herring during the winter months and large numbers during the summer months (SAIC 2006; Bhuthimethee et al. 2009). In recent years the herring stock in Hood Canal has been rising. The Hood Canal stocks (considered part of the Other Stocks Complex), particularly Quilcene Bay, are boosting the estimated total spawning biomass for all of the SSS. The Quilcene Bay stock's 4-year mean is 125% above the 25-year mean and now contributes over half of all Southern Salish Sea herring spawning biomass. While the Quilcene Bay and South Hood Canal stocks are considered Increasing or Healthy, the Port Gamble stock was Declining in 2000 and 2004, Depressed in 2008 and 2012, and has now fallen to Critical for 2016. A recent remediation project to remove creosote pilings in the bay may help improve water quality and larval herring survival (WDFW 2019).

Surf smelt are expected to be present within the nearshore areas at this location year-round. A high abundance of surf smelt was recorded during the late spring through early summer and juvenile surf smelt were observed within the nearshore areas during the January through mid-summer months. Juvenile sand lance were also observed from January through mid-summer months within nearshore cove areas mixed in with larval sand lance and surf smelt (SAIC 2006; Bhuthimethee et al. 2009; Frierson et al. 2017). WDFW surveys conducted in December 1995, November 1996, and January 1997 documented sand lance spawning along the shoreline including beaches adjacent to Carderock Pier, Service Pier, Keyport Bangor Dock, Delta Pier, Marginal Wharf, Explosives Handling Wharf #1 (EHW-1), and the Magnetic Silencing Facility Pier. Sand lance spawning areas are located north and south of the proposed TPP based on these surveys conducted in the 1990s (WDFW 2017). All life stages of surf smelt and sand lance are expected to be present along the Naval Base Kitsap Bangor waterfront.

At the northern end of the action area lies the Hood Canal Floating Bridge that carries traffic across the northern outlet of Hood Canal, connecting the Olympic and Kitsap peninsulas and supporting tourism and other economic activities. As a 1.5-mile long floating bridge, its pontoons span over 80% the width of Hood Canal and extend 15 feet underwater. Because of its location, all salmon and steelhead must navigate around or underneath the Hood Canal Bridge on their migration to and from the Pacific Ocean. In September 2020, studies conducted by the Hood Canal Bridge Assessment Team revealed that:

1. The Hood Canal Bridge significantly contributes to early marine mortality of juvenile Hood Canal steelhead by impeding fish passage and facilitating predation.
2. The bridge impacts other fish species such as juvenile Chinook and chum.
3. The bridge significantly impacts water quality parameters (temperature, salinity, currents) in its vicinity. Although bridge effects on water quality dissipate with increasing distance from the bridge and do not appear to propagate throughout Hood Canal, these near-bridge changes in circulation and flow may be linked to impacts on juvenile salmon and steelhead behavior and mortality.
4. Avian and mammalian predators were documented near the bridge. Harbor seal predation on juvenile steelhead was the most frequent source of mortality based on tagged juvenile steelhead mortality patterns.

Interested stakeholders are working with the Washington State Department of Transportation to explore modifications to the bridge that could alleviate these issues, however, it currently depends on funding.

The NMFS biological opinion (NMFS 2020) for 39 over-, in- and near-shore projects in the marine shoreline of Puget Sound that concluded jeopardy and adverse modification for PS Chinook and SRKW and adverse modification of their critical habitat. At the foundation of the jeopardy and adverse modification finding was the loss of nearshore habitat such that survival of juvenile Puget Sound Chinook is reduced to a level that will in turn limit this vital prey resource for SRKW. The Reasonable and Prudent Alternative (RPA) utilized the Habitat Equivalency Analysis methodology and the NHVM (as described above in Section 2.1) to establish a credit/debit target of no-net-loss of critical habitat functions. The RPA was designed to achieve, at a minimum, a reduction of these debits to zero (0) and provides a range of options for achieving that ranged from on-site habitat offsets to purchasing credits from conservation banks, ILF's (including the HCCC) and other approved credits providers. Three of these projects analyzed in this Biological Opinion occurred in the Hood Canal and all were subject to the RPA.

2.5 Effects of the Action

Under the ESA, "effects of the action" are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see 50 CFR 402.17). In our analysis, which describes the effects of the proposed action, we considered 50 CFR 402.17(a) and (b).

The proposed action will have multiple types of effects, ranging from temporary to enduring. The temporary effects associated with construction include water quality, noise in the aquatic habitat, and benthic communities and forage species diminishment. Intermittent effects associated with structures in the aquatic habitat are water quality and scour from propwash. The enduring effects associated with structures in the aquatic habitat are alteration of predator/prey dynamics, migration impediment, and disruption of shore processes. Also included in this section, are any positive effects of project design features, designed to reduce the impact of a structure, and conservation measures (as described in Section 1.3). We analyze these effects on features of habitat first, including critical habitat, and then we identify the listed species that will encounter these effects.

As mentioned previously, vessel transits to and from the new pier would replace the existing operations and no additional vessel trips would be produced by the new pier. Vessel trips and transit locations are not considered a consequence of this actions.

2.5.1 Temporary Effects during Construction

Construction of the new TPP structure, despite the use of BMPs to reduce suspended sediments and vessel grounding, will include (a) water quality reductions; (b) increased noise in the aquatic environment; and (c) reduction of prey/forage (benthic prey, forage fish, prey fishes).

Water Quality

Turbidity: Water quality effects during construction of the TPP pier and abutment and upland clearing are likely to include turbid conditions. Turbid conditions can be created during pile installation and excavation to install the shoreline abutment. In estuaries, state water quality regulations (WAC173-201A-400) establish a mixing zone of 200 feet plus the depth of water over the discharge port(s) as measured during mean lower low water. It is expected that during the days that construction activities occur in the water, elevated suspended sediment levels could occur within this area.

Construction barge/vessel anchoring and anchor dragging: For project-related construction activities, such as barge anchoring, fine-grained particles resuspended from the bottom will be confined to the near-bottom depth layers by natural density stratification of the water column. The subsurface suspended sediment plume will disperse rapidly as a result of particle settling and current mixing. In most cases, suspended sediment/turbidity plumes will not be visible at the surface, with the possible exception of the shallow portions (water depths less than 20 feet) of the construction area (Hitchcock et al., 1999). These changes will be spatially limited and occur intermittently during construction periods at the project site.

Construction related discharge: Construction-related impacts will not violate applicable state or federal water quality standards. BMPs and minimization measures, discussed in Section 1.3 above, will be employed to prevent accidental losses or spills of construction debris or hazardous materials into the waters. Therefore, the proposed project is expected to result in only localized, temporary degradation of the existing water quality.

Noise in aquatic habitat

Noise is expected as a short-term consequence from construction activities during in-water work to build the structure.

Pile Driving. Pile driving can cause high levels of underwater sound; the use of a confined or unconfined bubble curtain results in only an 8 dB reduction. Pile driving can significantly increase sound waves in the aquatic habitat. The sound pressure levels (SPL) from pile driving and extraction will occur contemporaneous with the work and radiate outward; the effect attenuates with distance. Cumulative sound exposure level (SEL) is a measure of the sound energy integrated across all of the pile strikes. The Equal Energy Hypothesis, described by NMFS (2007b), is used as a basis for calculating cumulative SEL (cSEL). 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 to affect the suitability of habitat from a behavioral and physiological sense for listed species.

Construction vessels. Barges and tugs will be used to construct the proposed project and are expected to have adverse effects similar to those articulated for vessel impacts in the Environmental Baseline section of this Opinion. Barges will increase the amount of noise in an area surrounding each construction site and their transit paths.

Benthic Communities and Forage Species Diminishment

Areas where sediment is disturbed by pile driving and in-or near water work and from vessels in shallow water areas to facilitate construction will disturb and diminish benthic prey communities. In areas where suspended sediment settles on the bottom, some smothering can occur which also disrupts the benthic communities. The speed of recovery by benthic communities is affected by several factors, including the intensity of the disturbance, with greater disturbance increasing the time to recovery (Dernie et al., 2003). Additionally, the ability of a disturbed site to recolonize is affected by whether or not adjacent benthic communities are nearby that can re-seed the affected area. Thus we expect recovery to range from several weeks to many months.

When juvenile salmonids are entering the nearshore or marine environment, they must have abundant prey to allow their growth, development, maturation, and overall fitness. As bottom sediments are dislodged, benthic communities are disrupted and in the locations where sediment falls out of suspension and layers on top of adjacent benthic areas. Benthic communities will be impacted and it can take up to three years to fully re-establish their former abundance and diversity. Given that the work will occur across two work windows, we can expect four years in which benthic prey is less available to juveniles, incrementally diminishing the growth and fitness of four separate cohorts of individual juvenile outmigrants from the ESA listed salmonid species that pass through the action area. Juvenile migrants may experience reduce food or increased competition to a degree that impairs their growth, fitness, or survival. Even if several fish from each cohort of each population had diminished foraging success, we anticipate that this would be a transitory condition as they migrate to more suitable forage locations. The level of reduced growth, fitness, or survival would be impossible to detect numerically, and the reduced abundance in juvenile cohorts would probably be insufficient to be discerned as an influence on productivity of the populations.

2.5.2 Intermittent Effects from Use and Maintenance

The use and operation of the TPP will generate several types of episodic habitat effects, which will occur while the structure is present in the environment: (a) water quality reductions from vessel scouring and moorage, and discharge of stormwater from pollution generating impervious surfaces; (b) noise from vessel operation; (c) scour from vessel operation. Each are episodic and persistent effects, co-extensive with new TPP overwater structure for 40 years and shoreline abutment (armoring) for 50 years. As mentioned above, routine maintenance would occur at the TPP and be minor and would not result in effects that would require ESA consultation. The Navy does not anticipate any repairs post construction. Any unforeseen repairs would require a separate consultation or could be performed under the Navy programmatic (WCRO-2016-00018).

Water Quality

The proposed project will result in intermittent reductions in water quality stemming from vessels and/or stormwater runoff. Water-quality treatment devices will be incorporated before stormwater runoff is released to the receiving body of water (Hood Canal). The Navy will meet the requirements of the MSGP permit, the Washington State Department of Ecology Stormwater Management Manual for Western Washington and the Kitsap County Stormwater Design Manual.

Stormwater from the pier and trestle will be directed to treatment cartridges in compliance with a General Use Level Designation from the Washington State Department of Ecology (WDOE) prior to discharge of the water to Hood Canal.

Construction-related impacts will not violate applicable state or federal water quality standards. BMPs and minimization measures, discussed in Section 1.3, above, will be employed to prevent accidental losses or spills of construction debris or hazardous materials into the waters.

Stormwater from all impervious surfaces in the Upland Facilities will be routed to an oil-water separator and then to a surface water treatment system. Stormwater from the wash rack at the VMF will not be discharged to the Hood Canal. The canopy and curbs along the sides of the wash rack will prevent stormwater from entering into the wash water system. The wash rack is sloped to a central collection drain that will collect wash water used in vessel washing operations. The collected wash water will drain to a containment tank what will provide oil/water separation and sludge deposition. The current Naval Base Kitsap Bangor permit that has been modified for the new wash rack operations.

Pollutants in the post-construction stormwater runoff produced at projects that include impervious surface will come from many diffuse sources, but is most likely to occur at large commercial or municipal facilities with larger areas of impervious surface that supports vehicular traffic. The runoff itself comes from rainfall or snowmelt moving over, where it picks up and carries away natural and anthropogenic pollutants, finally depositing them into, coastal waters, (Dressing et al. 2016). Pollutants in post-construction stormwater runoff typically include:

- Excess fertilizers, herbicides, insecticides and sediment from landscaping areas;
- Oil, grease, Polycyclic aromatic hydrocarbons (PAHs) and other toxic chemicals from roads and parking areas used by motor vehicles;
- Bacteria and nutrients from pet wastes and faulty septic systems;
- Metals (arsenic, copper, chromium, lead, mercury, and nickel) and other pollutants from the decay of building and other infrastructure;
- Atmospheric deposition from surrounding land uses; and
- Erosion of sediment and attached pollutant due to hydromodification.

(Buckler and Granato 1999; Colman et al. 2001; Driscoll et al. 1990; Kayhanian et al. 2003; Van Metre et al. 2005). Those pollutants will become more concentrated on impervious surfaces until they either degrade in place or are transported by wind, precipitation, or active site management.

Although stormwater discharge from most proposed projects will be small in comparison to the flow of the nearby waterways, it will have an incremental impact on pollutant levels.

Pollutants travel long distances when in solution, adsorbed to suspended particles, or else they are retained in sediments, particularly clay and silt, which can only be deposited in areas of reduced water velocity until they are mobilized and transported by future sediment moving flows (Alpers et al. 2000a; Alpers et al. 2000b; Anderson et al. 1996). Santore et al. (2001) indicates that the presence of natural organic matter and changes in pH and hardness affect the potential for toxicity (both increase and decrease). Additionally, organics (living and dead) can adsorb and absorb other pollutants such as PAHs. The variables of organic decay further complicate the path and cycle of pollutants.

To limit soil erosion and potential pollutants contained in stormwater runoff, a Storm Water Pollution Prevention Plan will be prepared and implemented for construction in conformance with the Stormwater Management Manual for Western Washington (WDOE 2019) (also applies to Operations).

Scour of nearshore areas from prop wash

The TPP utilizes up to nine naval vessels including 250-foot blocking vessels, 87-foot coastal patrol boat/reaction vessels, 64-foot screening vessels (SV 64), and 33-foot screening vessels (SV-33). Bangor berthing for the TPP mission is required approximately 253 days per year.

This associated boat use adversely affects SAV where it is present, and inhibits its recruitment where not present, by frequently churning water and sediment in the shallow water environment. Additionally, the turbidity from boat propeller wash decreases light levels (Eriksson et al. 2004). Shafer (1999; 2002) provides background information on the light requirements of seagrasses and documents the effects of reduced light availability on seagrass biomass and density, growth, and morphology. Decreased ambient light typically results in lower overall productivity, which is ultimately reflected in lower shoot density and biomass (Shafer 1999; 2002). Areas where sediment is routinely disturbed by prop wash will also experience repeated disruption of benthic prey communities, suppressing this forage source. Consistent with our analytical approach in this Opinion, these impacts are considered co-extensive with the effects of the new OWS itself.

2.5.3 Enduring Effects of In-water, Overwater and Nearshore Structures

In- and overwater structures and nearshore structures influence habitat functions and processes for the duration of the time they are present in habitat areas. The effects include: (a) altered predator/prey dynamics, (b) disrupted migration, and (c) modified shore processes related to bank armoring. These effects are chronic, persistent, and co-extensive with the new TPP overwater structure for 40 years and shoreline abutment (armoring) for 50 years.

To assess the enduring effects of the proposed project, NMFS used the NHVM, as described in Section 2.1, which as currently proposed resulted in a debit (or loss of habitat function) of -2834. The new TPP pier will result in a total of 29,451 sq. ft. of new over-water coverage; of this total, 27,382 sq. ft. will be shallower than 30 feet below MLLW. Approximately 1,900 sq. ft. of the complete structure will be grated. The new abutment under the pier trestle will result in the armoring of 99 feet 8 inches of shoreline above MHHW but below highest astronomical tide (HAT).

Predator/Prey Dynamics

The 2019 eelgrass survey documented a large and continuous patch of native eelgrass in the proposed berthing pier and landward area from an approximate depth range of 0 MLLW to -10 MLLW. Additionally, two other small patches of eelgrass were recorded within the main trestle and shading area (Figure 10, Section 2.4 above).

OWSs adversely affect SAV, if present, and inhibit the establishment of SAV where absent, by creating enduringly shaded areas (Kelty and Bliven 2003). There are ways to reduce the impacts of OWSs, deck height off the water, pier orientation relative to incidental sunlight, compensatory lighting, etc., but they do not fully offset the impacts. Decreased ambient light typically results in lower overall productivity, which is ultimately reflected in lower shoot density and biomass (Shafer 1999; 2002). In contrast to other studies in the Pacific Northwest, Shafer (2002) specifically considers small residential OWS and states, "much of the research conducted in Puget Sound has been focused on the impacts related to the construction and operation of large ferry terminals. Although some of the results of these studies may also be applicable to small, single-family docks, there are issues of size, scale, and frequency of use that may require separate sets of standards or guidelines. Notwithstanding, any overwater structure, however small, is likely to alter the marine environment." Fresh et al. (2006) researched the effects of grating in residential floats on eelgrass. They reported a statistically significant decline in eelgrass shoot density underneath six of the 11 studied floats in northern Puget Sound. We 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 will adversely affect the patches of eelgrass documented in area.

In addition to reduced SAV biomass and shoot density, shading also has been shown to be correlated with reduced density of the epibenthic forage under OWS's (Haas et al. 2002). 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). Though herring spawning has not been recorded in the TPP footprint in over eight years, it is known that eelgrass is a spawning substrate for herring, and herring spawn is Chinook salmon forage species. The likely incremental reduction in epibenthic prey associated with the TPP OWS will reduce forage for listed fish.

Obstructions in Migration Areas

Juvenile Chinook and juvenile HCSR chum migrate along shallow nearshore habitats, and OWS's will disrupt their migration and increase their predation risk. Every juvenile Chinook and juvenile HCSR chum will encounter OWSs during their out-migration. We cannot estimate the number of individuals that will experience migration delays and increased predation risk from the proposed OWSs. Adult Chinook, adult and juvenile steelhead, and adult chum, do not explicitly rely on shallow nearshore habitats; OWS are not considered to be a significant obstruction to their movements.

Overwater structures cause delays in migration for PS Chinook salmon from disorientation, fish school dispersal (resulting in a loss of refugia), and altered migration routes (Simenstad 1999). Juvenile salmonids stop at the edge of the structures and avoid swimming into their shadow or underneath them (Heiser and Finn 1970; Able et al. 1998; Simenstad 1988; Southard et al. 2006; Toft et al. 2013). Swimming around structures lengthens the migration distance and is correlated with increased mortality.

Juvenile salmon, in both the marine nearshore and in freshwater, migrate along the edge of shadows rather than through them (Nightingale and Simenstad 2001; Southard et al. 2006; Celedonia et al. 2008a; Celedonia et al. 2008b; 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 swam around structures through deeper water rather than swimming underneath a structure (Celedonia et al. 2008b). Structure width, light conditions, water depth, and presence of macrophytes influenced the degree of avoidance. Juvenile Chinook salmon were less hesitant to pass beneath narrower structures (Celedonia et al. 2008b).

In the marine nearshore, there is substantial evidence that OWS impede the nearshore movements of juvenile salmonids (Heiser and Finn 1970; Able et al. 1998; Simenstad 1999; Southard et al. 2006; Toft et al. 2007). In the Puget Sound 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. These findings show that overwater-structures can disrupt juvenile salmon migration in the Puget Sound nearshore.

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. Hesitating upon first encountering the structure, as discussed, also exposes salmonids to avian predators that may use the floating structures as perches. 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. 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). Further, swimming around OWS lengthens the salmonid migration route, which has been shown to be correlated to increased mortality. In summary, NMFS anticipates that the increase in migratory path length from swimming around the proposed OWS, as well as the increased exposure to piscivorous predators in deeper water, likely will result in proportionally increased juvenile PS Chinook salmon and HCSR chum mortality. Steelhead are not nearshore dependent and thus the presence of the proposed structure is unlikely to affect their behavior.

Disrupted Shore Processes

The impacts of hard armor along shorelines are well documented.[5] Armoring of the nearshore can reduce or eliminate shallow water habitats through the disruption of sediment sources and sediment transport. Bulkheads, whether new, repaired, or replacement are expected to result in a higher rate of beach erosion water ward of the armoring from higher wave energy compared to a natural shoreline. This leads to beach lowering, coarsening of substrates, increases in sediment temperature, and decreased SAV, leading to reductions in primary productivity and invertebrate density within the intertidal and nearshore environment (Bilkovic and Roggero 2008; Fresh et al. 2011; Morley et al. 2012; Dethier et al. 2016).

In addition to higher rates of beach erosion and substrate coarsening by increased wave energy, bulkheads would also prevent input of sediment from landward of the bulkhead to the beach, further diminishing the supply of fine sediment. Finer material like gravel and sand provide important spawning substrate for sand lance and surf smelt. Therefore, a reduction to this substrate type within the intertidal and nearshore zone as a result of the bulkhead would reduce potential spawning habitat availability and fecundity of both species (Rice 2006; Parks et al. 2013), which are both important prey species of PS Chinook salmon. As a result of deepening of the intertidal zone adjacent to the bulkhead, as well as increased wave energy, the new bulkhead would also be expected to reduce SAV (Patrick et al. 2014). This would be expected to cause a reduction in potential spawning habitat (i.e., eelgrass) for Pacific herring, another forage species of Chinook salmon.

Along with physical loss of habitat, the impacts of nearshore modification include the loss of functions such as filtration of pollutants, floodwater absorption, shading, sediment sources, and nutrient inputs. The greatest impacts to the nearshore are from shoreline armoring; roads and artificial fill are also significant, and these stressors often occur together or with other modifications (Fresh et al. 2011). Shoreline armoring generally reduces the sediment available for transport by disconnecting the sediment source, e.g. a feeder bluff, from the drift cell, potentially causing loss of beach width and height as transport of material outpaces supply. This can occur at the site of the structure or down the drift cell. Structures in the intertidal zone change the hydrodynamics of the waves washing up on the beach. Hard structures reflect waves without dissipating their energy the way a natural beach would, especially if vegetation is present. This energy can lower the beach, make it steeper, and wash away fine sediments. Dikes and fill reduce estuarine wetlands and other habitat for salmon, forage fish, and eelgrass.

When the physical processes are altered, there is also a shift in the biological communities. The number and types of invertebrates, including shellfish, can change; forage fish lose spawning areas; and juvenile salmon and forage fish lose the feeding grounds that they use as they migrate along the shore (Shipman et al. 2010). Native shellfish and eelgrass have specific substrate

[5] Marine Shoreline Design Guidelines at 2-1.

requirements and altered geomorphic processes can leave shellfish beds and eelgrass meadows with material that is too coarse or with too much clay exposed. Shoreline armoring can also physically bury forage fish spawning beaches when structures are placed in or too close to the intertidal zone. When shoreline development removes vegetation, the loss of shading and organic material inputs can increase forage fish egg mortality (Penttila 2007). Surf smelt, for example, use about 10 percent of Puget Sound shorelines for spawning and many bulkheads are built in forage fish spawning habitat, threatening their reproductive capacity (Penttila 2007). The effects of nearshore modification cascade through the Puget Sound food web. The consequences can be seen in the population declines of a variety of species that depend on these ecosystems, from shellfish, herring, and salmon to orcas, great blue heron, and eelgrass.

Armoring of the nearshore can reduce or eliminate shallow water habitats via two distinct mechanisms. First, bulkheads cause a higher rate of beach erosion waterward of the armoring because there is higher wave energy, compared to a natural shoreline. This leads to beach lowering, coarsening of substrates, increases in sediment temperature, leading to reductions in primary productivity and invertebrate density within the intertidal and nearshore environment (Bilkovic and Roggero 2008; Fresh et al. 2011; Morley et al. 2012; Dethier et al. 2016). As a result of deepening of the intertidal zone adjacent to the bulkhead, as well as increased wave energy, bulkheads also reduce SAV (Patrick et al. 2014). We expect reduced SAV to cause a reduction in **potential** spawning habitat (i.e., eelgrass) for Pacific herring, another forage species of Chinook salmon and juvenile PS/GB bocaccio. Reduced SAV also diminishes habitat for larval rockfish, which in their pelagic stage rely on SAV for prey and cover for several months.

Second, bulkheads located within the intertidal zone (below HAT) prevent upper intertidal zone and natural upper intertidal shoreline processes such as accumulation of beach wrack (Sobocinski et al. 2010; Dethier et al 2016). This is an additional mechanism that reduces primary productivity within the intertidal zone and diminishes invertebrate populations associated with beach wrack (Sobocinski et al. 2010; Morley et al. 2012; Dethier et al. 2016). Reductions in forage from bulkheads then affect primary productivity and invertebrate abundance in both the intertidal and nearshore environments. Invertebrates are an important food source for juvenile PS/GB bocaccio and PS Chinook salmon and for forage fish prey species of salmonids.

In addition to loss of shallow areas through higher rates of beach erosion and substrate coarsening by increased wave energy, bulkheads also prevent the input of sediment from sources landward of the bulkhead to the beach, further diminishing the supply of fine sediment. Finer material like gravel and sand provide important spawning substrate for sand lance and surf smelt. Therefore, a reduction to this substrate type within the intertidal and nearshore zone as a result of the bulkhead would reduce potential spawning habitat availability and fecundity of both species (Rice 2006; Parks et al. 2013), which are both important prey species of PS Chinook salmon, and juvenile PS/GB bocaccio, both of which depend on nearshore areas for forage. The loss of material below bulkheads, together with the loss of upland sources of material from above the bulkheads, over time, can affect the migration and growth of juvenile salmonids (primarily PS Chinook salmon) by reducing the amount of available shallow habitat that juveniles rely on for food and cover, and by preventing access to habitat upland of bulkheads at high tides. Both salmonids and juvenile bocaccio are affected the loss of prey communities. Larval rockfish of both species—PS/GB bocaccio and PS/GB yelloweye—are affected by the loss of SAV.

2.5.4 Effects of Compensatory Mitigation

To address enduring impacts to aquatic habitats and as required by the US Army Corps of Engineers (USACE) under the Clean Water Act section 404, the Navy will use the HCCC ILF program for compensatory mitigation requirements for the TPP Pier project. The purchase of mitigation credits will address the loss of ecosystem functions due to the modification of water bottoms, water column, and shoreline.

The purchased credits are expected to achieve a no-net-loss of habitat function as a result of this proposed action, which are needed to help ensure that PS Chinook do not continue to drop below the existing 1-2% percent juvenile survival rates (Kilduff et al. 2014, Campbell et al. 2017) and in turn will not further reduce available SRKW prey. PS Chinook salmon juvenile survival is directly linked to the quality and quantity of nearshore habitat. Campbell et al. 2016 has most recently added to the evidence and correlation of higher juvenile survival in areas where there is a greater abundance and quality of intact and restored estuary and nearshore habitat. Relatedly, there is emerging evidence that without sufficient estuary and nearshore habitat, significant life history traits within major population groups are being lost. And specific to this action area, there appear to be higher rates of mortality in the fry life stage in the more urbanized watersheds. By contrast, in watersheds where the estuaries are at least 50 percent functioning, fry out-migrants made up at least 30 percent of the returning adults, compared to the 3 percent in watersheds like the Puyallup and the Green Rivers, where 95 percent of the estuary has been lost (Campbell et al. 2017).

This also means that for projects that occur in less developed areas and within stretches of functioning habitats, like the TPP, no net loss is even more crucial. It has been long understood that protection and conservation of existing unimpaired systems is more effective and efficient then full restoration of impaired systems (Goetz et al. 2004). The conservation offsets will not result in adding to the needed nearshore restoration, but they will ensure that the proposed action does not cause nearshore habitat conditions to get worse.

2.5.5 Effects on Habitat

As mentioned in Section 2.2.1, critical habitat for PS chinook, HCSR chum, and the two rockfish species occurs within the action area along portions of the shoreline in Hood Canal both north and south of the project site and along the eastern shoreline of the Toandos Peninsula opposite the project site. The SRKW critical habitat PBF #2 is affected anywhere their prey species (Chinook) are effected. However, DoD lands and associated easements and rights-of-way can be exempted from critical habitat designation when there is an approved Integrated Natural Resources Management Plan (INRMP) that outline species protection measurements (33 CFR 334). In both the larger action area (Hood Canal) and the smaller project area (noise impact area), some critical habitat is on exempted DoD lands and some is not. For example, a small turbidity plume would be only on exempted DoD lands but sound from impact pile can travel several miles past DoD lands. In this particular case, the only project impact (temporary, intermittent and permanent) outside of the Navy exclusion zone is the sound from pile driving. While the sound will travel outside of the DoD area, the level of harm to fish in within the DoD area.

Whether or not habitat is designated as critical, the full range of the action area provides accessible habitat to the various listed fishes considered in this opinion, and it is certain that the features of the habitat, will be altered either temporarily, or for the foreseeable future. Given the mixture of critical and non-critical habitat within the action area, in the following section, we will review effects to all habitat features, whether or not the habitat is designated as critical, as this analysis is foundational to our review of the effects of the proposed action on the listed species themselves.

The temporary effects on features of habitat associated with construction are:

1) Sound, which can cause
    a. Migratory pathways obstruction, and
    b. Forage fish impacts,
2) Disturbance of bottom sediments which cause
    a. Water quality impacts and
    b. Disturbance of benthic communities (forage); and,
3) Shade while construction barges are present.

The enduring effects on features of habitat associated with in water structures are:

1. Migratory pathways obstruction caused by the presence of structure;
    a. Shade from the overwater structure which cause
    b. Reductions in aquatic vegetation/cover
    c. Diminished benthic communities/forage; and,
2. Effects from artificial light
3. Stormwater
4. Shoreline stabilization
5. Clean Water Act Compensatory Mitigation

Critical Habitat:
The NMFS reviews the effects on critical habitat affected by the proposed action by examining changes of the project to the condition and trends of physical and biological features identified as essential to the conservation of the listed species. The salmonid PBFs present in the action area are:

> Nearshore marine areas free of obstruction and excessive predation with
> (1) water quality and quantity conditions and foraging opportunities, including aquatic invertebrates and fishes, supporting growth and maturation, and
> (2) natural cover including submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.

Rockfish critical habitat features are distinguished between species and between adults and juveniles, as each species and life history stage has different location and habitat needs. PBFs essential to the conservation of juvenile bocaccio rockfish include:

> Juvenile settlement habitats located in the nearshore with substrates such as sand, rock and/or cobble compositions that also support kelp are essential for conservation because these features enable forage opportunities and refuge from predators and enable behavioral and physiological changes needed for juveniles to occupy deeper adult habitats. Several attributes of these sites determine the quality of the area; these 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 DO to support growth, survival, reproduction, and feeding opportunities.

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 DO 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.

Habitat:
Therefore, habitat features common to each species and life stage are the aquatic habitat generally, and specifically good water quality, abundant prey, and areas in which to avoid predators (cover, and safe passage), and suitable substrate, and we will present our analysis to features of habitat, and then consider the effect with regard to their designation status.

SRKW are different than the other species analyzed in that their critical habitat feature of concern is Chinook and HCSR chum salmon. These species are not exempt from the DoD lands, therefore SRKW critical habitat is being analyzed.

PBFs essential to the conservation of SRKWs include:

> 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 Water quality in Puget Sound, in general, is degraded.

Specifically: Reduced prey abundance, particularly Chinook and HCSR chum salmon, is also a concern for critical habitat. In a recent study, Chinook salmon were observed to be the most common prey species when averaged across SRKW fecal samples collected (51.0%, 67.3%), Puget Sound and outer coast waters, respectively. Chum salmon was the next most common species consumed in two areas of three areas surveyed (Puget Sound, 31.2%, Juan de Fuca/San Juan Islands 31.5%) but virtually nonexistent in outer coast waters (1.2%) (Hansen et al. 2021).

2.5.5.1 Temporary effects on features of habitat associated with construction:

1) Sound

During construction of the TPP, sixty 36-inch temporary falsework steel piles will be installed to provide support for construction equipment and forms. All temporary piles will be installed using vibratory methodology and will be extracted in the same manner at the end of construction. Where geotechnical conditions do not allow piles to be driven to the required depth using vibratory methods, an impact hammer may be used to advance piles to their required depth.

There will be a total of ten 24-inch steel fender piles, fourteen 30-inch steel guide piles, and one hundred 36-inch steel support piles installed for permanent support of the TPP. Steel piles may be driven using a combination of impact and vibratory hammers, although vibratory is the planned method of installation. All will be completed within the 90 days of work within the two in-water work windows.

Steel piles will require no more than 1,600 pile strikes during a work-day. Using a strike rate of 44-45 strikes/minute for steel, less than 45 minutes of impact driving will occur per day. During each day of pile driving, vibratory pile driving will last no more than five hours and impact driving will last no more than 45 minutes in total time each day.

All pile driving will increase sound waves that disrupt the aquatic habitat. The SPL 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 (2007b), is used as a basis for calculating cSEL. 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 with high frequency and impact noise with high amplitude 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. Because work ceases each day, migration values are re-established during the evening, night, and early morning hours.

The current background noise near the construction site is 114 dB. Vibratory pile driving noise is estimated to attenuate to below background levels (114 dB) at an underwater distance of 26 km from the source. However, in all directions from the proposed construction site, underwater noise levels are intersected by land before they reach this distance.

Barges that are used to stage equipment during construction also area a source of noise in the aquatic environment. These and other boats may increase the amount of noise before and after the construction of the TPP, but it will be short term. Proposed in-water construction activities will require use of marine-based construction equipment (i.e., derrick/supply barges and cranes, barge-mounted pile driving equipment, and tugboats) to support construction of the access trestle and pier and transport materials to and from the project site. Construction materials (including piles, concrete panels, and structural materials) will remain on barges until used for construction. Pier and trestle construction will require one derrick barge with a crane and one support/material barge. An average of six barge round trips (12 openings) per month will be required to support construction during the in-water work season from July 16 to January 15. Outside of this period, an average of two barge round trips (4 openings) per month will be required.

A concern for vessel noise is the potential to cause acoustically induced stress (Miksis et al. 2001) which can cause changes in heart rate, blood pressure, and gastrointestinal activity. Stress can also involve activation of the pituitary-adrenal axis, which stimulates the release of more adrenal corticoid hormones. Stress-induced changes in the secretion of pituitary hormones have been implicated in failed reproduction (Moberg 1987, Rivest and Rivier 1995) and altered metabolism (Elasser et al. 2000), immune competence (Blecha 2000) and behavior.

***a. Temporary Sound Obstruction*:**
The proposed action is likely to affect aquatic habitat via pressure waves throughout the project area, and in some locations that will include PS Chinook and HCSR chum critical habitat (in the portions of the action area and project area) and habitat (in the DoD zone), see Figures 12 and 13.

Pile driving will produce noise detectible by the protected species during impact pile driving in the portion of the action area and project area. The increased noise levels will be temporary, lasting less than 45 minutes per day for impact pile driving steel piles.

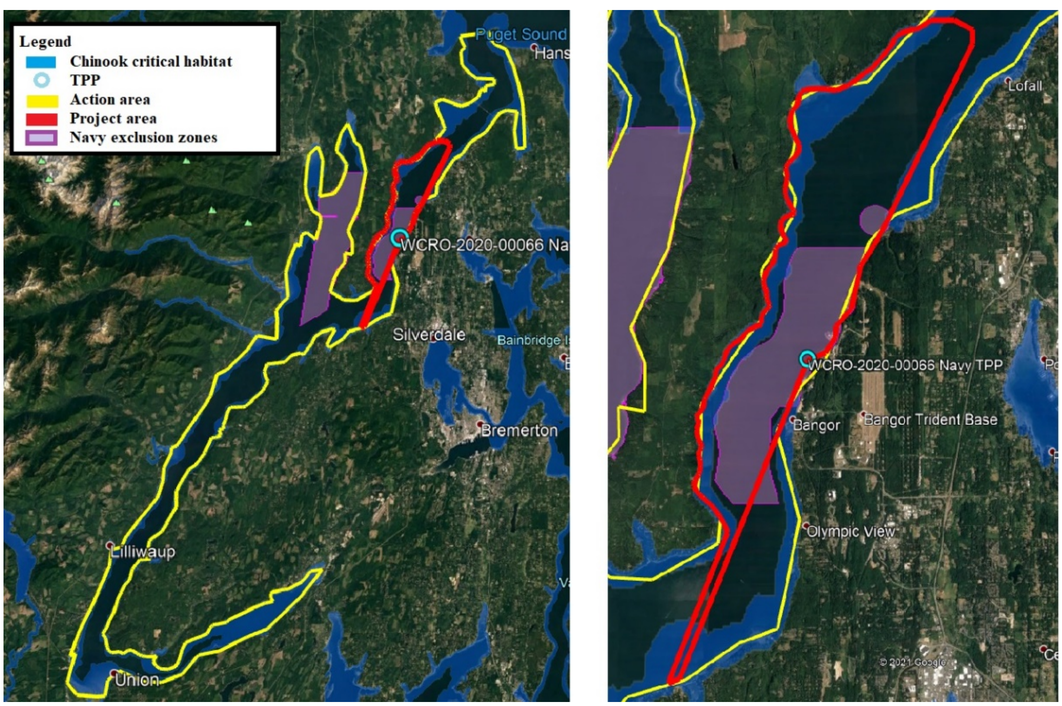

Figure 12: PS Chinook habitat and critical habitat in the action area

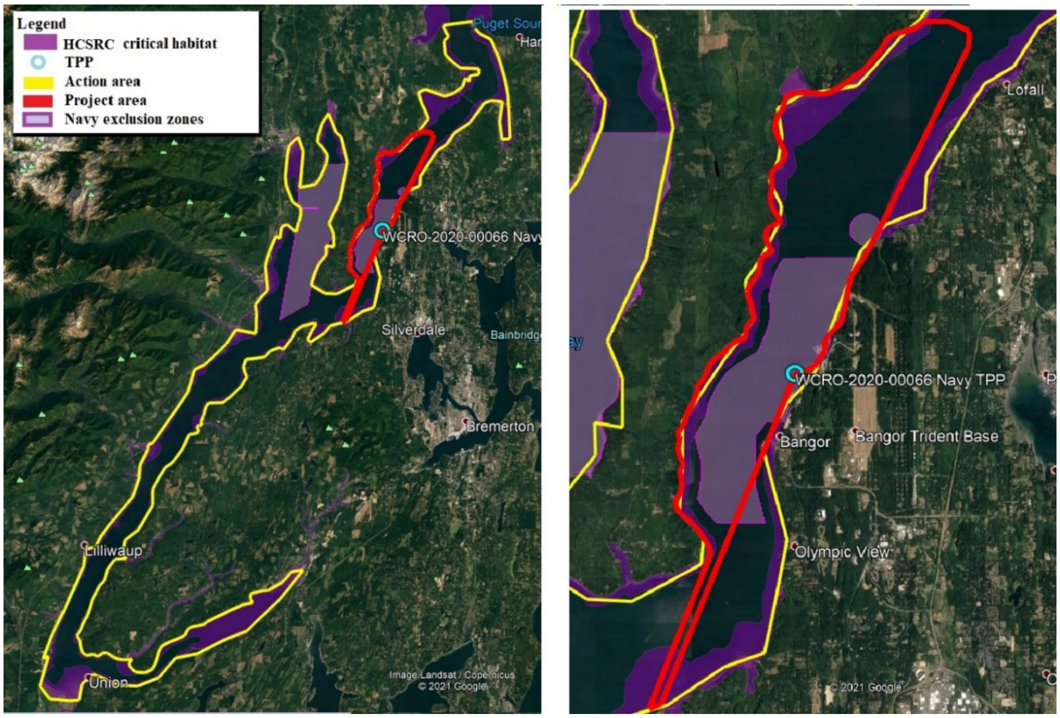

Figure 13: HCSR Chum habitat and critical habitat in the action area.

Because the impact pile driving of steel piles will be conducted during the timeframe when juvenile salmon are least likely to be present and will also be conducted utilizing a noise attenuation device (bubble curtain or other device), migration value impairment will be minimized. The remainder of the pile driving will be with vibratory driver, which also creates sound throughout the action area, but does not create SPL that would diminish the area for migration values.

Sound in Rockfish Aquatic Habitat - Noise caused by the proposed action may affect PS/GB bocaccio nearshore habitat. Habitat may be affected because noise levels detectable to rockfish, beyond background noise levels, and above the cumulative SEL injury threshold will be confined to the immediate project area for an estimated maximum daily duration of less than 45 minutes for impact pile driving. Additionally, noise caused by the proposed action may affect PS/GB bocaccio and yelloweye rockfish deepwater habitat because noise levels detectable to rockfish, beyond background noise levels, and above the cumulative SEL injury threshold will be confined to the immediate project area for an estimated maximum daily duration of less than 45 minutes for impact pile driving.

The proposed action may affect habitat for PS/GB bocaccio and yelloweye in that portion of the project area (Figures 14 and 15).

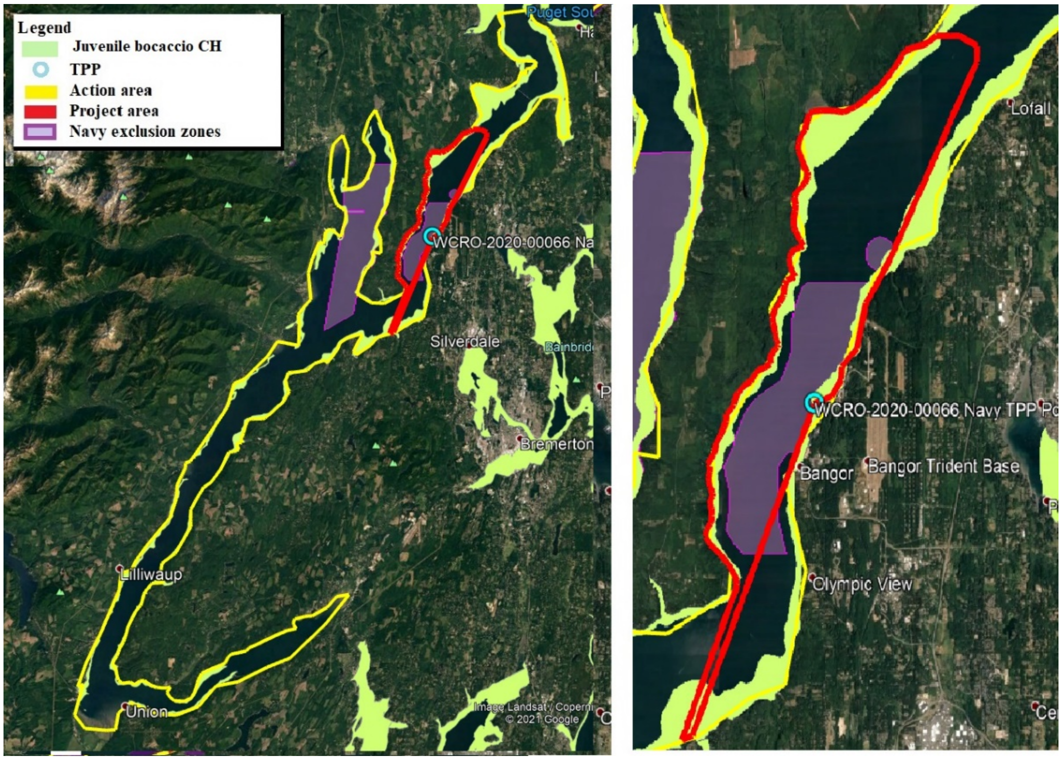

Figure 14: Juvenile Bocaccio habitat and critical habitat in the action area

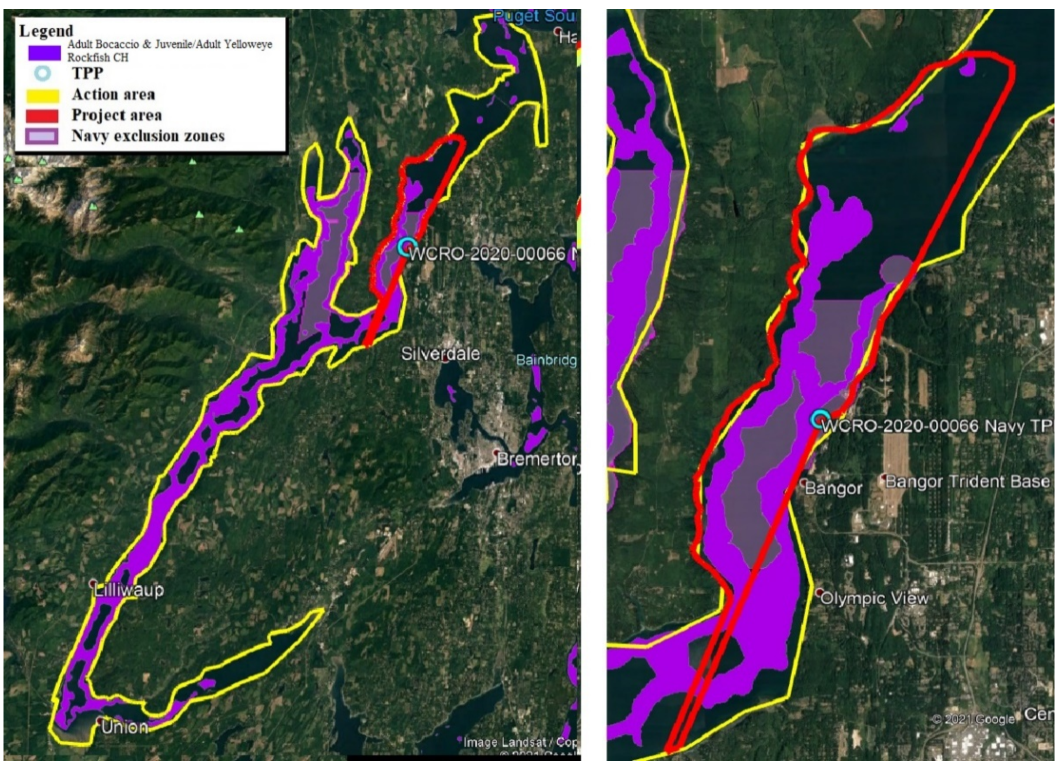

Figure 15: Adult Bocaccio & Juvenile/Adult Yelloweye Rockfish habitat and critical habitat in action area

Construction vessels: Barges used to construct the proposed project are expected to have adverse effects similar to those articulated for vessel impacts in the Environmental Baseline section of this Opinion. Barges will increase the amount of noise in an area surrounding each construction site and their transit paths.

b. Sound Impairment of Salmonid Prey/Forage

Different forage fish spawn in Hood Canal year-round. Common fish species identified as forage fish were recorded at Navbase Kitsap Bangor during beach seine surveys conducted in 2005 to 2008 (SAIC 2009). Forage fish captured include, in order of abundance (highest to lowest): Pacific herring, surf smelt, and Pacific sand lance (SAIC 2006). Larval forage fish, consisting of large schools with both surf smelt and Pacific sand lance, were also captured during this time. Forage fish occur in each month surveyed, becoming increasingly abundant in the spring months, reaching a peak in June, largely due to the arrival of large schools of herring, before decreasing in abundance again by July. The forage fish presence increases the probability of occurrence of salmon during in-water activity. However, the Navy will only work during defined windows when juvenile salmon abundance is minimal. Adult forage fish 2 grams or larger, and juveniles and larval forage fish smaller than 2 grams, may be exposed to injurious levels of underwater noise. However, Halvorsen et al. (2012) determined that fish like sand lance that do not have swim bladders, may be less susceptible to injury from simulated impact pile driving. The majority of potential impacts to sand lance and other forage fish are expected to be limited to minor behavioral disturbance and these responses will not reduce the forage base for ESA-listed species.

2) <u>Disturbance of Bottom Sediments</u>

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.

a. 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.

We anticipate multiple episodes of suspended sediment daily for the 90 days of piling work with each pile installation, creating a small, temporary, turbidity plume at each site. Temporary localized effect on marine vegetation, benthos, and forage fish, with indirect effects on prey availability for listed species is expected to occur. Minor amounts, localized and temporary turbidity from propeller wash is also expected to occur

b. Benthic and Prey Communities/Forage Base

Pile installation activities, with disruption of the sediment, will create at least partial loss of the community in the affected area. The benthic communities in the footprints of the piles will be eliminated when the piles (temporary and permanent) are installed. There will be little potential disturbance from propeller wash and no potential for barge grounding due to the water depths at the site. Intertidal habitats, including clam and oyster beds, will be outside the limited construction zone and will not be impacted by construction. The potential area that will be disturbed by construction activity was estimated by adding the area within 200 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. Construction activities will result in the temporary disturbance of benthic habitat within the construction corridor.

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 TPP 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 Bangor shoreline near the action area is the Pacific sand lance. The closest Pacific sand lance spawning habitat has been documented approximately 300 feet south of the proposed TPP, along an estimated 690-foot length of the shoreline between the Service Pier and the Keyport/Bangor dock. Temporary increase of suspended solids during pile driving and other in-water construction activities (two in-water work seasons) 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 (sand lance) 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. Based on recent nearshore beach seine data, it is reasonable to assume that forage fish, primarily sand lance, utilize the shoreline at the project site. The Pacific sand lance spawning work window in Tidal Reference Area 13 is March 2nd to October 14th, which means that the Navy will be conducting its project during the sand lance 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.

3) <u>Shade from construction barges</u>
It is anticipated that up to two construction barges, each up to 200 feet long and 70 feet wide, will be moored at the construction site for the entire project duration, including during times when the in-water work window is closed (July 16th 2021-January 15th 2023). Any support boat or barge used during in-water construction activities will be located within the immediate construction zone and in areas away from normal navigational activities. Because the fish cannot migrate along the shore they are forced into deeper water around the construction site. This equipment will occupy space in the water column and create overwater cover that may lead to a temporary impediment to fish passage and an increase in cover for predators of juvenile salmon and steelhead. The duration of the effects associated with the smaller vessels will be limited to a maximum of seven months (July – January).

<u>2.5.5.2 Enduring Effects on Habitat</u>

1) <u>Migration Obstruction</u>
Migration values are not expected to be impaired for PS/GB yelloweye rockfish, PS/GB bocaccio, as these species do not rely on the nearshore area for migration.

Salmon habitat will experience enduring incremental diminishment of safe migration for Chinook and Hood Canal Summer run chum salmon. In the marine nearshore, there is substantial evidence that OWS impede the nearshore movements of juvenile salmonids (Heiser and Finn 1970; Able et al. 1998; Simenstad 1999; Southard et al. 2006; Toft et al. 2007). In the Puget Sound 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. These findings show that overwater-structures can disrupt juvenile migration in the Puget Sound nearshore, reducing the value of the habitat for its designated purpose of juvenile salmonid migration in estuarine and nearshore ocean environments.

a. Shade
Structure width, light conditions, water depth, and presence of macrophytes appear to influence the degree of avoidance, with juvenile Chinook salmon appearing less hesitant to pass beneath narrower structures. The TPP will be located at depth of +10MHHW to -40 MHHW and its effects will continue for the life of the structure.

The project will result in an increase of over water structures, including in waters shallower than 30 feet below MLLW. The elevation of the bottom of the trestle and pier will be 4 feet 9 inches and 4 feet 2 inches above the MHHW, respectively. At lower tides, the trestle will cast minimal shadow across the nearshore migratory pathway, and have a corresponding minimally low barrier effect on fish movement. However, at higher tides, a smaller height over water distance will cast a 39-foot wide shadow across these habitats, potentially resulting in delays in nearshore fish migration through the shaded environment. These potential impacts will be localized to 27,382 sq. ft. within the nearshore areas shallower than 30 feet below MLLW.

Shadows cast by overwater structures, such as the trestle, generally create a light/dark interface that allows ambush predators to remain in darkened areas to wait for prey (Helfman 1981). Therefore, fish prey may become more susceptible to predation when moving around the structure if they are unable to locate the predator. Further, shadows from large overwater structures built within nearshore environments can disrupt nearshore migratory behavior. A study conducted at ferry terminals found that juvenile salmon (predominantly pink salmon [*O. gorbuscha*]) will avoid swimming under docks and shaded areas, causing delay in migration by several hours during the daytime at high tide periods and on sunny days (Ono et al., 2010).

The portions of the pier and trestle that occur overwater in the nearshore environment will reduce vegetation and as a result refugia, potentially altering the existing species composition inhabiting the area to more shade-preferring species, as well as potentially affecting the nearshore migratory behavior of juvenile salmonids.

In contrast to other juvenile salmonids, juvenile steelhead outmigrate as age-2 fish at larger sizes. They typically move offshore shortly after entering the marine waters of Puget Sound (Goetz et al., 2015) and do not favor nearshore habitats for outmigration (Moore et al., 2010). In a radio tag study of 582 steelhead smolts, Moore et al. (2013) found that the largest overwater structure in Hood Canal, the Hood Canal Bridge, acted as a barrier to juvenile steelhead outmigration. More recent research (Berejikian 2019) found that this is due to a combination of steelhead encountering the mid-channel sections of the bridge and a hesitance to swim 3.6 meters under the pontoons. Instead of moving towards the shoreline, which would allow them to avoid the need to swim under pontoons, these fish become congregated near the mid-channel of the waterway, south of the bridge, where they were subjected to increased predation by harbor seals.

The project design includes elements like using light transmitting materials (grating) where possible, elevated trestle decking, and potentially the under-pier/under trestle lighting system. The use of these elements, will reduce the long-term barrier effects to nearshore migration or habitat use from operation of the proposed action, but will not eliminate the barrier to juvenile salmonids all together.

To minimize impact of shade the Navy proposes to add eighty-three LED dimming lighting fixtures which will be mounted below the trestle and pier in sections between the pile bents. This is discussed more below.

b. Reductions in aquatic vegetation/cover

Pier and float structures, like the TPP, can adversely affects primary productivity and SAV if present in the shadow zone of the OWS. 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 (by inhibiting and stunting growth) any SAV within the shadow of the 29,451 square foot structure (approximately 1,900 sq. ft. will be grated). 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).

c. Diminished benthic communities/forage

Forage fish such as Pacific herring, Pacific sand lance and surf smelt are present in Hood Canal and the action area, but spawning locations are few. Common fish species identified as forage fish were recorded in the action area during beach seine surveys conducted in 2005 to 2008 (SAIC 2009). Forage fish captured include, in order of abundance (highest to lowest): Pacific herring, surf smelt, and Pacific sand lance (SAIC 2006). Larval forage fish, consisting of large schools with both surf smelt and Pacific sand lance, were also captured during this time. Forage fish occur in each month surveyed, becoming increasingly abundant in the spring months, reaching a peak in June, largely due to the arrival of large schools of herring, before decreasing in abundance again by July.

There is documented herring spawning grounds in the far northern reach of the action area. The Port Gamble and Quilcene Bay stocks spawn in waters in the north and south of the action area, between mid-January and mid-April. Pacific sand lance suitable spawning habitat has been identified in small patches at various sites along the Naval Base Kitsap Bangor waterfront; within the action area, the nearest documented spawning patches to the project site are immediately south of the site, approximately 300 feet. Sand lance spawning activity occurs annually from early November through mid-February. In surveys conducted from May 1996 through June 1997, Penttila (2007) found no surf smelt spawning grounds along the Naval Base Kitsap Bangor waterfront. Surf smelt are believed to spawn throughout the year in the action area, with the heaviest spawn occurring from mid-October through December.

Eelgrass beds along the Naval Base Kitsap Bangor waterfront provides substrate for invertebrates, such as copepods, amphipods, and snails, which might otherwise not be found on soft sediments (Mumford 2007). Copepods and other zooplankton represent the major food base for the food chain in Puget Sound, specifically for small and juvenile fish including Pacific herring, sand lance, surf smelt, and salmonids. The intertidal shallows and eelgrass beds provide important habitat for a variety of marine invertebrates and fishes, including salmonid species.

While across the PS region native eelgrass (*Zostera marina)* is of primary importance as spawning substrate, other SAV is used locally. In nearly all 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. 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). Herring, a 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 the TPP on the SAV that could support herring spawning.

For SRKW discharge events would reduce quality and quantity of prey including juvenile chinook. As PS Chinook salmon are a PBF of SRKW critical habitat, their repeated/chronic exposure to contaminants in successive cohorts, directly through diminished water quality, and via contaminated prey, both described above, results in a diminishment of the forage PBF of SRKW critical habitat. Both quantity and quality of prey will slightly decline, as these fish are likely to have latent health effects that slightly reduce adult abundance, and also reduce the quality of adult fish that do return and serve as prey, due to bioaccumulated contaminant.

Given the total quantity of prey available to Southern Resident killer whales throughout their range numbers in the millions, the reduction in prey related to short-term construction effects from the proposed action is extremely small. Therefore, NMFS anticipates that the short-term reduction of Chinook salmon from temporary effects would have little effect on Southern Resident killer whales. However, episodic and enduring declines of SRKW's prey as a result of the proposed actions are also expected. Sufficient quantity, quality and availability of prey are an essential feature of the critical habitat designated for Southern Residents. Increasing the risk of a permanent reduction in the quantity and availability of prey, and the likelihood for local depletions in prey populations in multiple locations over time, reduces the conservation value of critical habitat for SRKWs.

d. Lighting

Day: Eighty-three LED dimming lighting fixtures will be mounted below the trestle and pier in sections between the pile bents. The range of depths where the lighting will be physically placed is from 5 to 25 feet below MLLW. It is believed the physical placement will illuminate the area between 0 feet to 30 feet below MLLW. The lighting is supposed to mimic natural daylight and be controlled to vary light intensity throughout the day according to the position of the sun and associated shading conditions.

Ono (2010) conducted a test study of the ability of this fiber optic lighting system to mitigate dock impacts on juvenile salmon during the out-migration period in 2008 and 2009 at the WSDOT Port Townsend Ferry Terminal. The Sunlight Direct fiber optic lighting system had a small but significant effect in mitigating dock shading impacts on juvenile salmon behavior. However, the effect of light was not singularly positive. When the lighting system reduced the contrast with the ambient environment, juvenile salmon demonstrated more swimming directionality and swam closer to the dock edge. However, if the system increased the light contrast (i.e., produced a spotlight effect in a non-shaded area), the fish became more disturbed, demonstrating less swimming directionality and increasing their distance from the dock edge.

We could not find any conclusive evidence on whether under trestle lighting can truly mimic daylight in such a manor to not create a barrier to fish.

Night: The trestle will have five 30-foot high light standards, and the pier will have three 50-foot high light standards. All of the lights will be LED type lights for which illumination levels at the surface will not exceed 30 foot-candles (fc) at 30 feet, 10 fc at 50 feet, and 5 fc at 100 feet. The additional use of lighting under and around the TPP has the potential to negatively affect juvenile migration and survival by altering visual cues that salmonids use for migration. Increased levels of light during nighttime causes nocturnal phototaxic behavior in juvenile salmonids when the lighting occurs within their migratory corridor. When the migration area is affected in a manner that alters the preferred corridor, it can decrease safe passage. Kahler et al. (2000) found that pier lighting may increase nocturnal predation on juvenile Chinook and coho salmon by visual predators such as other fish, potentially increasing nighttime predation of smaller fish, including juvenile salmonids. Additionally, nighttime lighting associated could also negatively alter adult sand lance behavior (adult sand lance spawn in intertidal habitats).

e. Stormwater

Stormwater from the TPP project site will be collected in a trench drain on the pier, treated using an in-line canister system designed to meet the basic treatment requirements of the WDOE Stormwater Management Manual for Western Washington (WDOE 2014), and then discharged to Hood Canal. Collection and treatment of pier drainage will be required to remove contaminants resulting from routine vehicle access to the pier. Thus, operations will not intentionally release materials that will have a potential to impact marine water quality and WDOE stormwater standards will be maintained. Additionally, wastewater (sewage and grey water wastes) from vessels berthed at the pier will be retained in onshore holding tanks and eventually transferred via transmission lines to the existing wastewater infrastructure. Therefore, shipboard and pier wastes will not affect long-term water quality conditions near the project site. The risk of an accidental spill, such as a fuel or oil spill, will be expected to increase slightly due to the addition of vessels berthed at the project site.

The TPP is not expected to accumulate the level of stormwater pollutants typically associated with parking lots, because vehicles will be few and sporadic. Typical contaminates in road and parking lot runoff include metals and polyaromatic hydrocarbons. As many pollutants are associated with particulates in stormwater (metals and other contaminants bind to the particulates), the most significant pollutant of concern is total suspended solids (Atchison et al. 2006). Treated stormwater is likely to still contain a low level of contaminants. Two contaminants of notable concern to listed fish and their prey base, which are never fully removed by treatment, are zinc and copper. However, the effects of zinc and copper in the marine environment are understood to be less harmful because the salt in the marine water interacts with these metals, quickly dissolving them.

f. *Shoreline stabilization*

Bank armoring degrades sediment conditions, forage base, and access to shallow water waterward of the structures; access to forage and shallow water habitat upland of the structures is prevented during high tides.

As described above, shoreline armoring coarsens sediments waterward of bulkheads by concentrating marine energy and washing away finer sediments. Because bulkheads will be located within the intertidal zone (below HAT), they would prevent upper intertidal zone and natural upper intertidal shoreline processes such as deposition and accumulation of beach wrack (Sobocinski et al. 2010; Dethier et al 2016).

As a result, this would further reduce primary productivity within the intertidal zone and diminish invertebrate populations associated with beach wrack (Sobocinski et al. 2010; Morley et al. 2012; Dethier et al. 2016). Reductions in forage may result from bulkhead effects on primary productivity and invertebrate abundance in the intertidal and nearshore environments. Invertebrates provide an important food source for juvenile PS/GB bocaccio and PS Chinook salmon and for forage fish prey species of salmonids.

The loss of marine shoreline material, over time, can affect the migration areas of juvenile salmonids by reducing the amount of available shallow habitat that juveniles, both by steepening shore areas waterward of bulkheads, and, particularly during high tides, creating a physical barrier that obstructs water from reaching high shore areas. In this case, almost 100 feet of shoreline could lose material over time.

g. Clean Water Act Compensatory Mitigation

The NMFS NHVM outputs reflect -2834 debits. In a previous opinion (NMFS 2020) NMFS, compared the HCCC ILF calculation with the NHVM calculations and found them to be relatively compatible in the evaluation of habitat function. While the HCCC ILF use plan for the TPP is still in development, for the purposes of this opinion, NMFS will rely on previous experience and assume that the Navy's purchase of credits from the HCCC ILF, the resulting habitat restoration will completely offset the loss of habitat functions reflected in the NHVM debits.

The primary goal of the HCCC ILF program is to increase aquatic resource functions in the Hood Canal watershed. This is accomplished by improving existing mitigation requirements with rigorous site assessment and selection processes that fully link with consensus priorities for conserving and restoring Hood Canal. While mitigation seeks to generally offset the impacts of development projects resulting in no net loss, this Program aspires to add value to mitigation processes by implementing projects in a coordinated and strategic manner, consistent with existing regulations and legal limitations relating to mitigation proportionality. To accomplish this goal the HCCC will provide a viable option to ensure the availability of high-quality mitigation for unavoidable, site-specific impacts to freshwater wetlands and marine/nearshore aquatic resources in the Hood Canal watershed to ensure at a minimum no net loss of aquatic functions and values in Hood Canal. Additionally, HCCC promotes "net resource gain" when practical defined as restoration of ecological processes and a lift in the ecological functions of the Hood Canal watershed.

The purchase of credits provides a high level of certainty that the benefits of a credit purchase will be realized because the NMFS approved ILF considered in this opinion has mechanisms in place to ensure credit values are met over time. Such mechanisms include legally binding conservation easements, long-term management plans, detailed performance standards, credit release schedules that are based on meeting performance standards, monitoring plans and annual monitoring reporting to NMFS, non-wasting endowment funds that are used to manage and maintain the bank and habitat values in perpetuity, performance security requirements, a remedial action plan, and site inspections by NMFS.

In addition, HCCC has a detailed credit schedule and credit transactions and credit availability are tracked on the Regulatory In-lieu Fee and Bank Information Tracking System (RIBITS). RIBITS was developed by the U.S. Army Corps of Engineers with support from the Environmental Protection Agency, the U.S. Fish and Wildlife Service, the Federal Highway Administration, and NOAA Fisheries to provide better information on mitigation and conservation banking and in-lieu fee programs across the country. RIBITS allows users to access information on the types and numbers of mitigation and conservation bank and in-lieu fee program sites, associated documents, mitigation credit availability, service areas, as well information on national and local policies and procedures that affect mitigation and conservation bank and in-lieu fee program development and operation.

Summary of Effects on Habitat and Critical Habitat

The chronic, episodic, and enduring diminishments of habitat created by nearshore in water and overwater structures to water quality, migration areas, shallow water habitat, forage base, and SAV has and will continue to incrementally degrade the function of habitat, for each fish species considered in this analysis. The effects further constrain the carrying capacity for critical life stages (larval and juvenile) for multiple listed species within the action area, reducing conservation values and/or preventing conservation values from being improved.

SRKW critical habitat PBFs of prey base will be impaired. The continued decline and reduced potential for recovery of the PS Chinook salmon as a PBF of SRKW critical habitat is likely to alter the abundance and distribution of migrating salmon and increase the likelihood of localized depletions in prey, with adverse effects on the SRKWs' ability to meet their energy needs. SRKWs could abandon depleted areas in search of more abundant prey, and end up expending substantial effort only to find depleted prey resources elsewhere. Increasing the risk of a permanent reduction in the quantity and availability of prey, and the likelihood for local depletions in prey populations in multiple locations over time, reduces the conservation value of critical habitat for SRKWs.

Multiple habitat features will be adversely affected by the proposed action, and the effects range across areas that are not designated as critical habitat, into areas that are designated critical habitat. The areas of habitat that will be adversely affected will be affected only over 90 days, across two in-water work windows, via sound in aquatic habitat, which will temporarily diminish the migration and forage value of the habitat, but at a time when migration use is expected to be quite low. The Navy is proposing to work within the established forage fish work windows (February 1 – October 14), there **may** be an adverse impact on forage fish which would directly diminish the prey base of salmonids. Enduring effects from the proposed action will occur in areas that are excluded from the critical habitat designations.

In summary, the proposed action, in the 40–50 year useful life period of the project, reduces available nearshore feeding, rearing and safe migration for juvenile salmon impacting juvenile salmon survival rates, limiting the life-history's (fry contribution to returning adults Chinook) (Beechie et al. 2017), and ultimately contribute to low adults salmon returns. This would reduce the potential for recovery of PS Chinook salmon that would likely lead to nutritional stress that results in reduced body size and condition which can also lower reproductive and survival rates. Therefore, poor nutrition from the reduction of prey as a PBF could contribute to additional mortality in this population, and affect reproduction and immune function. This would be a significant reduction in the conservation role of this PBF for SRKWs.

Effects to habitat features that are not included in the critical habitat designations include temporary and enduring diminishment of benthic communities and forage fish (i.e., prey abundance and diversity), increase in migratory obstruction and required energy expenditure, and temporary and enduring increases in predators and predator success upon juvenile salmonids. These enduring effects will be completely offset by the proposed compensatory mitigation credits purchased from the HCCC ILF.

2.5.6 Effects on Listed Species

Effects on listed species is a function of (1) the numbers of animals exposed to habitat changes or direct effects of an action; (2) the duration, intensity, and frequency of exposure to those effects; and (3) the life stage at exposure. This section presents an analysis of exposure and response.

The temporary effects on species associated with construction are:

1) Sound, which can cause
    a. Impact driving – listed fish response
    b. Impact driving – Forage fish response
    c. Vibratory driving – fish response
    d. Construction vessel noise
    e. Disrupted migration
2) Disturbance of bottom sediments which cause
    a. Water quality impacts and
    b. Disturbance of benthic communities (forage); and,
3) Shade while construction barges are present.

The intermittent and enduring effects on species associated with in water structures are:

1) Migratory pathways obstruction caused by the presence of structure;
2) Shade from the overwater structure which cause
    a. Reductions in aquatic vegetation/cover
    b. Reduced benthic communities/forage; and,
    c. Increased predator risk
3) Effects from artificial light
4) Vessel noise
5) Shoreline stabilization
6) Clean Water Act Compensatory Mitigation

As noted above in the effects to habitat and critical habitat, the projects have temporary, episodic, and enduring effects. Our exposure and response analysis identifies the multiple life stages of listed species that use the action area, and whether they would encounter these effects, as different life-stages of a species may not be exposed to all effects, and when exposed, can respond in different ways to the same habitat perturbations.

Species Presence and Exposure

As described in Section 1.3, all work would occur from July 16th through January 15th, 2021-2023 (over two in-water work windows). These work windows are designed to minimize juvenile salmonid exposure to construction effects. However, they will not completely avoid exposure to construction effects and exposure to long-term effects from the existence of the structure will remain.

Each of the following species uses the action area, but is present at differing life history stages, and with variable presence. In order to determine effects on species, we must evaluate when species will be present and the nature (duration and intensity) of their exposure to those effects of the action in their habitat, which were described above. It should be noted; an effect exists even if only one individual or habitat segment may be affected (Fish and Wildlife Service and the National Marine Fisheries Service 1998).

Puget Sound Chinook salmon
The Puget Sound Technical Recovery Team identified two independent populations within Hood Canal, the Skokomish River and Mid-Hood Canal Rivers (Dosewallips, Duckabush, and Hamma Hamma) (Ruckelshaus et al. 2006). These two PS Chinook salmon populations use the action area for a portion of their life histories. The greatest abundance of adult PS Chinook salmon along the Naval Base Kitsap Bangor waterfront occurs from early August to October as the adults return from the ocean to their natal streams and rivers.

Generally, PS Chinook salmon juveniles emigrate from freshwater natal areas to estuarine and nearshore habitats from January through April as fry, and from April through early July as larger subyearlings. Captures of juvenile Chinook salmon were rare in beach seine surveys conducted at Naval Base Kitsap Bangor during the large winter/spring emigration of the more abundant species (e.g., chum and pink salmon) and were only slightly more prevalent in the summer months. Juvenile Chinook salmon were captured in very low numbers (26 fish total) during weekly beach seine surveys conducted from mid-July through early September 2005 (SAIC 2006). However, as juvenile Chinook salmon increase in size they occupy deeper, offshore waters in search of larger prey. By July juvenile PS Chinook salmon are sufficiently large to no longer orient to the shoreline and thus would be less likely to be caught during beach seine surveys. Juvenile PS Chinook salmon are likely present in the action area during the in-water work window, but in the deeper, offshore waters.

Puget Sound Steelhead
Puget Sound steelhead have been observed in five small coastal tributaries on the eastern Toandos Peninsula. In addition, PS steelhead inhabit all eight rivers and at least 26 streams nearer the head of Hood Canal. There are natal rivers or streams for PS steelhead that connect to

the action area, and at least eight demographically independent populations (1 summer/winter run and 7 winter run, with 2 of these winter runs possibly historically including summer-run components) would be expected to migrate through the action area. Adult winter-run steelhead typically enter streams and rivers in Hood Canal from November to April and spawn from February through June.

Juvenile steelhead rarely occur along the Naval Base Kitsap Bangor waterfront in late summer. They were captured in very low numbers (14 fish total) during weekly beach seine surveys conducted from mid-July through early September 2005 (SAIC 2006). Typically, PS steelhead juveniles emigrate from natal rivers as 2-year old smolts from March through June, peaking in April and May. In a study conducted in Hood Canal in 2006 and 2007, acoustically tagged steelhead smolts from four Hood Canal rivers emigrated from their respective natal river mouth to the Hood Canal Bridge over an average of 15 to 17 days (Moore et al. 2010). By mid-July, most juveniles from rivers in Hood Canal would have travelled past the Hood Canal Bridge and would not be present in the action area during in-water work.

Hood Canal Summer-Run Chum Salmon

There are HCSR chum salmon natal rivers that connect to the action area. Most HCSR chum juveniles originate from streams on the western shore of Hood Canal and cross Hood Canal following surface freshwater flows from the tip of Toandos Peninsula to the Naval Base Kitsap Bangor waterfront (Salo et al. 1980). Summer chum salmon in the Duckabush River are part of the Hood Canal summer chum ESU listed as threatened in 1999 by NMFS (NOAA 1999). The Hood Canal summer chum ESU was historically composed of 16 independent populations (Ames et al. 2000). Historically, summer chum stocks in Hood Canal returned in the tens of thousands. By 1980, these returns plummeted to fewer than 5,000 adults and 8 of the 16 stocks were considered extinct. The Duckabush summer chum stock is one of the eight extant stocks within Hood Canal.

Surveys conducted along the shoreline of Naval Base Kitsap Bangor in 2005 through 2008 found large numbers of chum salmon along the Bangor shoreline. However, no chum salmon were collected during weekly beach seine surveys conducted from mid-July through early September 2005 (SAIC 2006). At an average migration rate of 4.4 miles per day, the majority of chum emigrants from southern Hood Canal exit the canal to the north within 14 days after their initial emergence in seawater (WDFW and PNPTT 2000). Juvenile HCSR chum salmon are expected to occur at Naval Base Kitsap Bangor from January through early April, with a peak in late March (Salo et al. 1980, WDFW and PNPTT 2000, SAIC 2006). Summer-run chum adults return to Hood Canal from early August through the first week in October (WDFW and PNPTT 2000).

PS/GB Bocaccio and Yelloweye Rockfish

Due to the habitat characteristics of Hood Canal, the closest adult ESA-listed rockfish are likely several thousand feet away from the Naval Base Kitsap Bangor waterfront, 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 the Naval Base Kitsap Bangor 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 yelloweye rockfish or 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.

SRKW

Southern Resident Killer Whales. Between the three pods that comprise this DPS, identified as J, K, and L, some members of the DPS are present in Puget Sound at any time of the year though data on observations since 1976 generally shown that all three pods are in Puget Sound June through September, which means that all are likely present, in the Sound, during the designated work windows. The whales' seasonal movements are only somewhat predictable because there can be large inter-annual variability in arrival time and days present in inland waters from spring through fall. Late arrivals and fewer days present in inland waters have been observed recent years. The likelihood of exposure to the temporary effects of construction are high (Olson et al. 2018).

The reduction in prey (PS Chinook salmon) from the temporary construction effects of the proposed action is extremely small due to the application of work windows to avoid peak presence of this species at the juvenile life stage and the other reasons discussed above. Given the total quantity of prey available to SRKWs throughout their range, this short-term reduction in prey that results from the temporary construction effects is extremely small. Because the annual reduction is so small, there is also a low probability that any of the Chinook salmon killed from implementation of the proposed action would be intercepted by the killer whales across their vast range in the absence of the proposed action. Therefore, NMFS anticipates that the short-term reduction of Chinook salmon during construction would have little effect on Southern Resident killer whales.

When prey is scarce, SRKW likely spend more time foraging than when prey is plentiful. Increased energy expenditure and prey limitation can cause poor body condition and nutritional stress. Nutritional stress is the condition of being unable to acquire adequate energy and nutrients from prey resources and as a chronic condition, can lead to reduced body size of individuals and to lower reproductive or survival rates in a population (Trites and Donnelly 2003). During periods of nutritional stress and poor body condition, cetaceans lose adipose tissue behind the cranium, displaying a condition known as "peanut-head" in extreme cases (Pettis et al. 2004; Bradford et al. 2012; Joblon et al. 2014). This individual stress and diminished body condition of individuals would lead to an overall decline in the fitness of the species.

NMFS qualitatively evaluated long-term effects on the SRKW from the anticipated reduction in PS Chinook salmon. We assessed the likelihood for localized depletions, and long-term implications for SRKW' survival and recovery, resulting from the proposed action presenting risks to the continued existence of PS Chinook salmon and reducing the ability for the ESU to expand and increase in abundance. In this way, NMFS can determine whether the reduced likelihood for survival and recovery of prey species is also likely to appreciably reduce the likelihood of survival and recovery of Southern Residents. Viability at the population level is a foundational necessity for PS Chinook salmon persistence and recovery.

Hatchery programs, which account for a large portion of the production of this ESU, may provide a short-term buffer, but it is uncertain whether hatchery-only stocks could be sustained indefinitely. The loss of this Chinook salmon population would also preclude the potential for the ESU level future recovery to healthy, more substantial numbers. The weakened ESU demographic structure, with declines in abundance, spatial structure, and diversity, will result in a long-term suppression, if not decline, in the total prey available to Southern Residents. In this consultation, the long-term effects are specifically: fewer populations contributing to Southern Residents' prey base, reduced diversity in life histories, spatial structure, resiliency of prey base, greater ESU level risk relative to stochastic events, and diminished redundancy that is otherwise necessary to ensure there a margin of safety for the salmon and Southern Residents to withstand catastrophic events.

Differences in adult salmon life histories and locations of their natal streams likely affect the distribution of salmon across the Southern Residents' geographic range. The continued decline and reduced potential for recovery of the PS Chinook salmon, and consequent interruption in the geographic continuity of salmon-bearing watersheds in the Southern Residents' critical habitat, is likely to alter the distribution of migrating salmon and increase the likelihood of localized depletions in prey, with adverse effects on the Southern Residents' ability to meet their energy needs. A fundamental change in the prey base within critical habitat is likely to result in Southern Residents abandoning areas in search of more abundant prey or expending substantial effort to find depleted prey resources. This potential increase in energy demands should have the same effect on an animal's energy budget as reductions in available energy, such as one would expect from reductions in prey.

Lastly, the long-term reduction of PS Chinook salmon is likely to lead to nutritional stress in the whales. Nutritional stress can lead to reduced body size and condition of individuals and can also lower reproductive and survival rates. Prey sharing would distribute more evenly the effects of prey limitation across individuals of the population that would otherwise be the case. Therefore, poor nutrition from the reduction of prey could contribute to additional mortality in this population. Food scarcity could also cause whales to draw on fat stores, mobilizing contaminants stored in their fat and affecting reproduction and immune function.

2.5.6.1 Temporary effects on species associated with construction

1) Sound

The pile work includes both impact driving, and vibratory driving, and the characteristics of sound from each of these methods are unique; each produces a different response in exposed species. The sound characteristics are also different between the sizes of piles in the aquatic environment. Finally, the response between species to each type of sound also varies based on their hearing acuity, their size, and their body composition. Based on the best scientific information available, we used the following assumptions for estimating the effects of the pile driving component of the proposed action on juvenile and adult PS chinook, steelhead, HCSR chum, bocaccio and yelloweye rockfish:

- PS Chinook salmon juveniles in the vicinity of pile driving activity during the work window will weigh more than 2 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).

- Densities of PS Chinook juveniles in the PS nearshore average 25 fish per hectare in July and 14 fish per hectare in August (Rice 2011).
- The density of steelhead smolts in the vicinity of pile driving is extremely low and all steelhead smolts in PS are larger than 2 grams.
- Larval and juvenile listed bocaccio may be present in the nearshore during impact pile driving. Exposure of adult rockfish to construction effects is considered very unlikely since they do not occupy the nearshore.
- The tidal reference 13 salmon work window is July 16th – March 1st. The Navy will be working July 16th through January 15th.
- Adults of listed salmonids may be present during piling installation.
- If an impact hammer (e.g., drop, hydraulic, diesel, or sledge hammer) is used to drive or proof steel pilings, the following sound attenuation methods will be employed:
    - Use of a bubble curtain or other noise attenuating devices that distributes air bubbles around 100 percent of the perimeter of the piles over the full depth of the water column.

Sound during pile driving is likely to have a range of direct effects on fish. Behavioral effects are observed at far lower noise levels than those associated with injury. The current background noise near the construction site is 114 dB amd the marine mammal behavioral disturbance threshold is 120 dB. Using the practical spreading loss model for underwater sound we calculated the range at which sound pressure generated by the pile driving would attenuate to levels below current background levels, or detectible levels, at approximately 12 km to the north and 10 km to the south of the project.

RMS SPLs are commonly used in behavioral studies. For analytical purposes, Caltrans (2015) presumes that SPLs in excess of 150 dB RMS (re: 1μPa) are likely to elicit temporary behavioral changes, including a startle response or other behaviors, which may alter their behavior in such a way as to delay migration, increase risk of predation, reduce foraging success, or reduce spawning success, indicative of stress and recommends this value as a threshold for possible behavioral effects. While SPLs of this magnitude are unlikely to lead to permanent injury, depending on a variety of factors (e.g., duration of exposure) they can still indirectly result in potentially lethal effects. NMFS' overall synthesis of the best available science leads us to our findings. Studies in which these effects have been studied for salmonids and rockfish include, Grette 1985 (on Chinook salmon and sockeye), Feist et al. 1996 (on chum), Ruggerone et al. 2008 (on Coho), Popper 2003 (on behavioral responses of fishes), Pearson et al.1992 (on rockfish), and Skalski et al. 1992 (on rockfish).

Although numerous studies have attempted to discern behavior effects to different type of fish species from elevated sound levels that are below harm levels but above ambient levels, relatively few papers have linked this exposure to effects on fish (Popper et al. 2014). Under some conditions, with some species, elevated sound may cause an effect but it is not possible to extrapolate to other conditions and other species (Popper and Hastings 2009). Davidson et al. (2009) indicated that studies have shown that salmonids do not have a wide hearing bandwidth or hearing sensitivity to SPL and are therefore not as likely to be impacted by increased ambient sound.

Impact Driving – Listed Fish Response
Fishes with swim bladders (including salmonids and rockfish) are sensitive to underwater impulsive sounds (*i.e.*, sounds with a sharp sound pressure peak occurring in a short interval of time) such as those produced by impact pile driving. As a pressure wave passes through a fish, the swim bladder is rapidly compressed due to the high pressure, and then rapidly expanded as the "under pressure" component of the wave passes through the fish. 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 SPLs where effects to fish are likely to occur from pile driving activities (Hydroacoustic Working Group, 2008). These thresholds represent the initial onset of injury, and not the levels at which fish will be severely injured or killed. The most harmful level of effects is where a single strike generates peak noise levels greater than 206 dB_{peak}[13] where direct injury or death of fish can occur. Besides peak levels, SEL (the amount of energy dose the fish receive) can also injure fish. These criteria are either 187 dB_{SEL}[14] for fish larger than 2 grams or 183 dB_{SEL} for fish smaller than 2 grams for cumulative strikes (Hydroacoustic Working Group, 2008). In addition, any salmonid within a certain distance of the source will be exposed to levels that 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.

The Washington and California Departments of Transportation have compiled acoustic monitoring data for various pile driving projects within their respective states (WSDOT unpublished data; Illingworth and Rodkin 2007, updated in 2012). Data can vary substantially between locations due to site-specific conditions (e.g. water depth, soft mud, sand, cobble, depth to bedrock, etc.). As a result, the use of site-specific data is critically important. In this opinion NMFS use local data for Hood Canal to do this analysis. The observed increased single strike sound pressure at 10 m for impact driving 36-inch steel piles in a marine environment are; 211 decibel (dB) peak, 194 dB RMS, 181 dB SEL. An 8 dB reduction in pressure is assumed with the mandatory use of a bubble curtain bringing the anticipated increased sound levels to 203 dB peak, 186 dB RMS, and 173 dB ssSEL.

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.

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 attenuated impact driving (and by vibratory driving) can cause a temporary shift in hearing sensitivity, 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 cSELs as low as 184 dB. TTSs 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.

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. Table 4 lists the expected sound levels that could be generated by the largest proposed steel pile driving associated with the project.

Table 4: 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:	**6 m**	**159 m**	**295 m**

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)

Using this calculation and the worst-case scenario of the 36-inch pile sound levels (largest piles with highest expected sound levels), assuming an estimated 1,600 strikes per day, the maximum distance to the 206 dB peak injury threshold is calculated to 6 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 295 meters, respectively.

As indicated above, 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 SPL 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 159 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.

Impact Driving – Forage Fish Response
Forage fish have the same response to impact driving as listed fish. In the action area the closest documented and lance spawning ground is located (approximately) 300 feet south of the project, outside of the zone of physical injury onset, but within 159 meters of the impact driving (Figure 16). Impact driving will occur for 45 minutes a day for 90 days, some of those days (October 15th - January 16th) outside of the forage fish work window, some within the window. There is potential that spawning forage fish and/or eggs will be impacted by pile driving. The proposed action is inconsistent with recovery actions identified in the PS Chinook salmon recovery plan (protecting forage fish spawning areas).

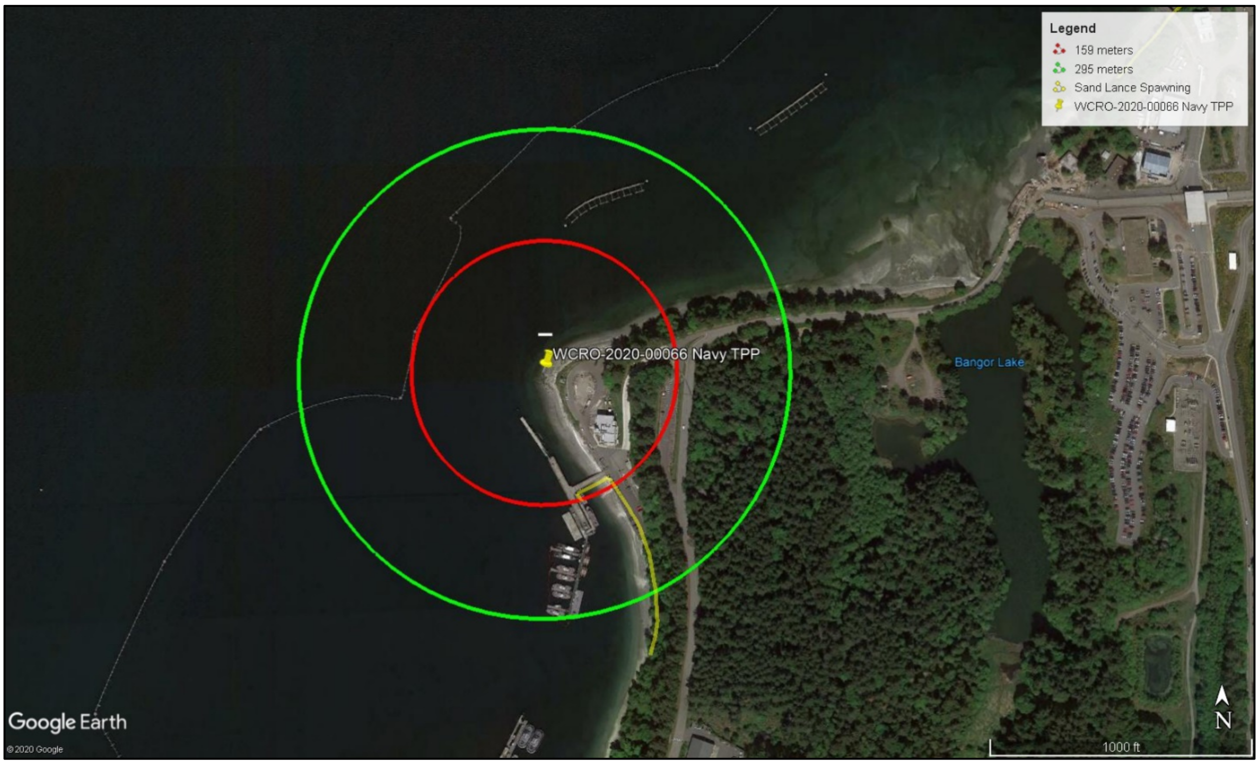

Figure 16: Forage fish and impact pile driving

Vibratory Driving and Removal – Listed Fish Response
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 Compendium 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. This assessment relies on the information in the 2012 update of the Compendium (Appendix 1 to CalTrans 2009). In the proposed action the Navy assumes, based on data from a large wharf construction project in Hood Canal, vibratory installation will take a median time of 10 minutes per pile with five hours estimated as a maximum. Based on previous consultations for similar actions, about 45 to 60 minutes of vibratory work could be required to install a pile, with extended periods without vibratory work occurring between piles.

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, juvenile HCSR chum, juvenile bocaccio, and juvenile yelloweye rockfish 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 rockfish 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.

Construction Vessel Noise
The increase in noise related to construction vessel traffic may also affect Chinook salmon, HCSR chum, steelhead, and rockfish. 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 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. However, construction-related vessel traffic will be limited to two trips, one each construction year, and is accordingly not likely to significantly disrupt feeding, predator avoidance, or other behaviors.

Disrupted Migration
While the timing of the work occurs over a work window designed to reduce the numbers of juvenile salmonids that would be migrating through the action area, it is reasonable to assume that not all fish will be fully avoided, and that the few salmonids will respond to noise in their migratory corridor. The range of responses are described above as direct effects to fish, and while we expect few fish from the various listed species or component populations will be present, the full range of effects will be experienced, making the migration area less suitable for these fishes by increasing the likelihood that they will be injured or killed during their migratory

behavior. This will create a small detrimental effect on the survival rate, in both the work seasons, but this reduction will likely be indiscernible in the cohort adult returners, so productivity should remain at current levels.

Rockfish are present all year. While rockfish species are sensitive to sudden noises, data on the potential impacts to noise are limited. Pearson et al. (1992) found that rockfish exposed to air gun sounds showed startle and alarm responses. The threshold for behavioral responses was observed between 161 and 205 dB. Skalski et al. (1992) found that catch per unit effort in hook-and-line fisheries declined by an average of 52 percent when geophysical survey air guns were shot near aggregations of rockfish. No eelgrass and very little marine macrovegetation is present within the waterway to provide habitat for juvenile rockfish and very little natural structure is present for adults. We have no data to indicate that juvenile rockfish migration to deeper water areas of habitat as they mature will be affected by sound associated with the proposed action.

2) Bottom (Substrate) Disturbance

Construction of TPP will require installation of up to 184 piles total (including 60 temporary piles). Pile installation will disturb bottom sediments within the immediate project construction area during the in-water work period and localized increases in suspended sediment concentrations. Also, installation and operation of the sound attenuation measures (e.g., bubble curtain) will result in some local resuspension of bottom sediments into the water column. In general, the predominately coarse-grained sediments that occur in most areas of the project site are more resistant to resuspension and have a higher settling speed than fine-grained sediments. Resuspension of sediments will be limited to a small area around each pile.

Water Quality Reduction

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).

To consider how the TSS generated from vibratory pile driving might affect the species consulted on in this biological opinion, 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 and rockfish likely will have encountered similar turbidity before.

In summary, the, generally low level expected increase in TSS, and small affected area renders the effects of the increased TSS on juvenile salmonids and rockfish not meaningful.

Benthic Forage Reduction

When juvenile salmonids are entering the nearshore or marine environment, they must have abundant prey to allow their growth, development, maturation, and overall fitness. As pile driving (and removal) dislodges bottom sediments, benthic communities are also disrupted, both in the location where the installation (or removal) occurs, and in the locations where sediment falls out of suspension and layers on top of adjacent benthic areas. As was noted above, benthic communities will be impacted and it can take up to three years to fully re-establish their former abundance and diversity. Given that the work will occur across two in-water work windows, we can expect four years in which benthic prey is less available to juveniles, incrementally diminishing the growth and fitness of four separate cohorts of individual outmigrants that pass through the action area.

When prey is scarce, SRKW likely spend more time foraging than when prey is plentiful. Increased energy expenditure and prey limitation can cause poor body condition and nutritional stress. Nutritional stress is the condition of being unable to acquire adequate energy and nutrients from prey resources and as a chronic condition, can lead to reduced body size of individuals and to lower reproductive or survival rates in a population (Trites and Donnelly 2003). During periods of nutritional stress and poor body condition, cetaceans lose adipose tissue behind the cranium, displaying a condition known as “peanut-head” in extreme cases (Pettis et al. 2004; Bradford et al. 2012; Joblon et al. 2014). This individual stress and diminished body condition of individuals would lead to an overall decline in the fitness of the species.

NMFS qualitatively evaluated long-term effects on the SRKW from the anticipated reduction in PS Chinook salmon. We assessed the likelihood for localized depletions, and long-term implications for SRKW’ survival and recovery, resulting from the proposed action presenting risks to the continued existence of PS Chinook salmon and reducing the ability for the ESU to expand and increase in abundance. In this way, NMFS can determine whether the reduced likelihood for survival and recovery of prey species is also likely to appreciably reduce the likelihood of survival and recovery of Southern Residents. Viability at the population level is a foundational necessity for PS Chinook salmon persistence and recovery.

Hatchery programs, which account for a large portion of the production of this ESU, may provide a short-term buffer, but it is uncertain whether hatchery-only stocks could be sustained indefinitely. The loss of this Chinook salmon population would also preclude the potential for the ESU level future recovery to healthy, more substantial numbers. The weakened ESU demographic structure, with declines in abundance, spatial structure, and diversity, will result in a long-term suppression, if not decline, in the total prey available to Southern Residents. In this consultation, the long-term effects are specifically: fewer populations contributing to Southern Residents' prey base, reduced diversity in life histories, spatial structure, resiliency of prey base, greater ESU level risk relative to stochastic events, and diminished redundancy that is otherwise necessary to ensure there a margin of safety for the salmon and Southern Residents to withstand catastrophic events.

Differences in adult salmon life histories and locations of their natal streams likely affect the distribution of salmon across the Southern Residents' geographic range. The continued decline and reduced potential for recovery of the PS Chinook salmon, and consequent interruption in the geographic continuity of salmon-bearing watersheds in the Southern Residents' critical habitat, is likely to alter the distribution of migrating salmon and increase the likelihood of localized depletions in prey, with adverse effects on the Southern Residents' ability to meet their energy needs. A fundamental change in the prey base within critical habitat is likely to result in Southern Residents abandoning areas in search of more abundant prey or expending substantial effort to find depleted prey resources. This potential increase in energy demands should have the same effect on an animal's energy budget as reductions in available energy, such as one would expect from reductions in prey.

Lastly, the long-term reduction of PS Chinook salmon is likely to lead to nutritional stress in the whales. Nutritional stress can lead to reduced body size and condition of individuals and can also lower reproductive and survival rates. Prey sharing would distribute more evenly the effects of prey limitation across individuals of the population that would otherwise be the case. Therefore, poor nutrition from the reduction of prey could contribute to additional mortality in this population. Food scarcity could also cause whales to draw on fat stores, mobilizing contaminants stored in their fat and affecting reproduction and immune function.

3) <u>Construction Vessel Shading</u>

It is anticipated that up to two construction barges, each up to 200 feet long and 70 feet wide, will be moored at the construction site for the entire project duration, including during times when the in-water work window is closed (July 16^{th} 2021-January 15th 2023). Any support boat or barge used during in-water construction activities will be located within the immediate construction zone and in areas away from normal navigational activities. This equipment will occupy space in the water column and temporarily create overwater cover that impede fish passage and simultaneously increase in cover for predators of juvenile salmon, steelhead, and rockfish. While these vessels are present there is an incremental increase in risk to juvenile salmonids based on their likelihood to lose visual acuity, shift migration movements, and succumb to predators. The duration of these effects will be limited to a maximum of one in-water work period which is timed to occur when fewer juvenile salmon and steelhead would be present in the action area.

2.5.6.2 Intermittent and enduring effects on species associated with in-water structures:

1) Structure and Migration Behavior

Based on the findings of numerous studies, we are reasonably certain that the placement of the TPP will adversely affect juvenile salmonid migration.

In and overwater structures cause delays in migration for PS Chinook salmon from disorientation, fish school dispersal (resulting in a loss of refugia), and altered migration routes (Simenstad 1999). Juvenile salmonids stop at the edge of the structures and avoid swimming into their shadow or underneath them (Heiser and Finn 1970; Able et al. 1998; Simenstad 1988; Southard et al. 2006; Toft et al. 2013). Swimming around structures lengthens the migration distance and is correlated with increased mortality. Anderson et al. (2005) found migratory travel distance rather than travel time or migration velocity has the greatest influence on the survival of juvenile spring Chinook salmon migrating through the Snake River 2005.

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). Finally, juvenile Chinook salmon appeared to move into deeper water to travel beneath or around structures (Celedonia et al. 2008b).

In the PS nearshore, 35 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. Increased energy expenditure during migration can impair growth and fitness at a time when juveniles are maturing for their ocean life history phase. Salo et al. (1980) found that juvenile chum salmon moved offshore around the existing wharves as they migrated north out of Hood Canal. The evidence was circumstantial, but they observed both a change in migratory behavior (moving offshore) and a reduction in catch of juvenile chum (presumably due to an increase in predation of juvenile chum) that appeared to be related to the construction and operation of the piers.

The TPP has potential as a barrier to migrating juvenile salmon due to physical characteristics such as the large number of piles, their close spacing, the low height-over-water design, and the nearshore location of the pier.

2) Structure and Shade

Shade will produce a direct effect on salmonids and rockfish. The reduced light regime under the OWS and associated vessels 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[6] 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 (Brett and Ali 1958; Ali 1960; Protasov 1970). 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 TPP. While the short-term decreased feeding success will likely result in a minor sub-lethal response of incrementally reduced growth in individuals, the decreased visual ability can lead to increased susceptibility among juvenile salmonids to predation, as mentioned above. The proposed under trestle LED lights may or may not alleviate impacts shade from the structure, it remains unknown.

Reduced Subaquatic Vegetation
SAV (kelp and eelgrass) has been documented in the area. An eelgrass survey occurred in 2019. The survey at the proposed TPP site documented a large and continuous patch of native eelgrass in the proposed berthing pier and landward area from an approximate depth range of 0 MLLW to -10 MLLW. Additionally, two other small patches of eelgrass were recorded within the main trestle and shading area. Kelp presence, or lack of presence, was not captured.

Both eelgrass and kelp need fairly high light levels to grow and reproduce, so they are found only in shallow waters, mostly less than 65 feet for kelp, and 32 feet meters for eelgrass (Mumford 2007). A portion of the project will occur in from dry land to -30 MLLW, a depth at which eelgrass could grow. The deeper waters (-30 to – 50 MLLW) could grow kelp. Shade from additional overwater and in-water structures are likely to further reduce SAV. A reduction to the primary production of SAV beds is likely to incrementally reduce the food sources and cover for individual PS Chinook salmon, HCSR chum, and steelhead. The reduction in food source includes epibenthos (Haas et al., 2002) as well as forage fish. The additional shade in the nearshore will likely prevent any disturbed eelgrass and macroalgae from reestablishing in the shaded area. This reduction will be an additional loss of prey which will primarily affect juvenile salmonids that migrate through the action area at a time when their growth, development, maturation, fitness, and energy expenditure require plentiful prey.

With SAV documented in the project footprint during the last survey there is a high likelihood that SAV patches will come and go within the project area within the life of the structure. SAV is important in providing cover and a food base for juvenile PS Chinook, HCSR chum and steelhead. OWS shade SAV for the life of the structure (Kelty and Bliven, 2003). If any juvenile and sub-adult bocaccio are within the action area, they would be expected to be found near the kelp habitat along Naval Base Kitsap Bangor 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 don’t use the nearshore for rearing.

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

Reduced Prey Communities
Forage fish such as Pacific herring, Pacific sand lance, and surf smelt are present in the Hood Canal action area and in the project area, but spawning locations are few. Common fish species identified as forage fish were recorded in the action area during beach seine surveys conducted in 2005 to 2008 (SAIC 2009). Forage fish captured include, in order of abundance (highest to lowest): Pacific herring, surf smelt, and Pacific sand lance (SAIC 2006). Larval forage fish, consisting of large schools with both surf smelt and Pacific sand lance, were also captured during this time. Forage fish occur in each month surveyed, becoming increasingly abundant in the spring months, reaching a peak in June, largely due to the arrival of large schools of herring, before decreasing in abundance again by July.

There is documented herring spawning grounds in the far northern reach of the action area. Additionally, herring must pass through the action area to access the documented spawning location in Lynch Cove, southern Hood Canal. The Port Gamble and Quilcene Bay stocks spawn in waters to the north and south of the vicinity of the proposed TPP pier, between mid-January and mid-April. Pacific sand lance suitable spawning habitat has been identified in small patches at various sites along the Naval Base Kitsap Bangor waterfront; within the project area, the nearest documented spawning patches to the project site are immediately shoreward of the site, approximately 150 feet (WDFW 2011b). The Navy has conducted monthly surveys for spawning forage fish at Bangor using WDFW protocols since 2013. At the TPP proposed project site, the Navy has conducted surveys between February 2017 and December 2020. Surveys were conducted year-round in most months during this timeframe, with the exception of March to August 2019. At the proposed project location, the Navy has collected at least two years of survey data for each month. During the survey period, a total of 112 samples were collected. The only detection of spawning sand lance occurred in Feb 2018, in which 2 eggs were identified. No surf smelt eggs have been detected at the TPP location or at any of the Bangor survey sites. Based on the existing data, the Navy does not anticipate that this is an area of use by spawning sand lance, particularly during the July 16 – January 15 in-water construction window. In surveys conducted from May 1996 through June 1997, Penttila (2007) found no surf smelt spawning grounds along the Naval Base Kitsap Bangor waterfront. Surf smelt are believed to spawn throughout the year in the action area, with the heaviest spawn occurring from mid-October through December.

Piers in areas with forage fish spawning are likely to result in reduced numbers of forage fish. 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).

Eelgrass beds along the Naval Base Kitsap Bangor waterfront provide substrate for invertebrates, such as copepods, amphipods, and snails, which might otherwise not be found on soft sediments (Mumford 2007). Copepods and other zooplankton represent the major food base for the food chain in Puget Sound, specifically for small and juvenile fish including Pacific herring, sand lance, surf smelt, and salmonids. The intertidal shallows and eelgrass beds provide important habitat for a variety of marine invertebrates and fishes, including salmonid species.

Herring, a food source for listed PS Chinook, has three documented spawning location in the action area. 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*.

This reduction in forage fish presence and spawning will be an additional loss of prey, both in terms of prey abundance, and in prey diversity, which will primarily affect juvenile salmonids that migrate through the action area at a time when their growth, development, maturation, fitness, and energy expenditure require abundant prey resources. As generalist predators, rockfish eat a diversity of other animals, from crabs, to worms, to fish and the loss of prey will affect them as well.

Operation impacts of the TPP on the benthic community will be due primarily to the conversion of soft bottom habitat to hard-bottom habitat. Falsework piles will have been removed by the conclusion of the project regaining benthic habitat. The piles will be colonized by hard-bottom species such as mussels (*Mytilus* sp.) and sea anemones that will attach to the piles (the fouling community). The fouling community also will support other species such as amphipods, annelids, gastropods, and predatory sea stars (Cohen et al. 1998). The decrease in soft-bottom habitat and increase in hard substrate habitat will result in a localized change in species composition (Atilla et al. 2003). Impacts due to shading of benthic habitat are unlikely due to the depth of the water at the pier site.

Increased Predation Risk

An implication of juvenile salmon avoiding OWS and associated mooring vessels is that some of them will swim around the structure (Nightingale and Simenstad 2001) meaning they will 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 presence of the new 27,382-square-foot structure is expected to disrupt juvenile salmonid migration and result in juvenile salmonid 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 and chum 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 late winter to late spring, 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. As mentioned above, the proposed under trestle LED lights may or may not alleviate impacts shade from the structure, it remains unknown.

3) <u>Nighttime Lighting</u>
The light pollution that will occur around the TPP has the potential to affect juvenile migration and survival. Light during nighttime causes nocturnal phototaxic behavior in juvenile salmonids when the lighting occurs within their migratory corridor. Most juvenile salmonids remain in the upper and lower shore zones during out migrating to avoid predators and increase their ability to evade if predator interactions occur.

4) <u>Vessel Noise</u>
Although the TPP will not increase vessel traffic, noise associated with moorage (start up of vessels) may affect the listed species. 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 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 noisespecifically 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. However, support vessel traffic will not exceed normal levels for the area, and is not likely to significantly disrupt feeding, predator avoidance, or other behaviors.

5) <u>Shoreline stabilization</u>
Juvenile Chinook and juvenile HCSR chum migrate along shallow nearshore habitats, and bulkheads will degrade nearshore habitats and increase their predation risk. Every juvenile Chinook and juvenile HCSR chum will encounter armored beaches during their out-migration. As described in the effects on habitat, shoreline armoring reduces several nearshore habitat values, including reduced feeding opportunity, increased predation risk, and lack of shallow

habitat areas particularly during high tides. We cannot estimate the number of individuals that will experience these effects from this consultation.

Given that out-migrating juvenile salmonids (particularly Chinook salmon) use shallow-water habitats for rearing, foraging, and migration, bulkheads may potentially reduce growth and fitness of juvenile salmonid during this phase of their life history. In turn, the aggregate impact of this disruption among individuals over each year that these structures are in their habitat for the new 50-year useful life period) and will amount to an overall reduction in survival rate because forcing juveniles into deeper water (when shore processes steepen beaches and truncate access to shallows during high tides), potentially affects their survival by exposing them to greater risk of predation while simultaneously limiting their prey resource availability along the shoreline (shallow littoral zone), thereby decreasing their feeding success and growth rate.

In addition, the alignment of the bulkhead will create or continue shading along the face of the wall, which further camouflages predators holding there from prey moving along the wall in waters lit by the sun. Such shaded areas create hiding areas for predators and prey that conceal them from fish in the lighted zone outside of the area impacted by the shaded area. Such behavior by fish creates a temporal and spatial overlap of predators and prey in the shaded zone, as well as enhancing the success of predator ambush attacks on prey outside of the shaded zone (Kahler et al. 2000, Carrasquero 2001).

Adult Chinook, adult and juvenile steelhead, adult chum, and juvenile PS/GB bocaccio do not migrate along very shallow nearshore habitats. Therefore, bulkheads will not directly affect them. Impacts to SAV and epibenthic communities from shore steepening, and sediment coarsening will affect adult and juvenile Chinook, chum steelhead, and juvenile PS/GB bocaccio by available reducing forage. To the degree that rockfish spawn depends on SAV, their survival will also be reduced.

6) <u>Clean Water Act Compensatory mitigation</u>

The objective of compensatory mitigation is to restore, establish, enhance, or preserve aquatic resources for the purpose of offsetting unavoidable losses to aquatic resources resulting from activities authorized by USACE permits. The USEPA and USACE issued a final rule under 33 CFR Parts 325 and 332 governing compensatory mitigation for authorized impacts to wetlands, streams, and other waters of the U.S. under section 404 of the CWA and other USACE permits. The amount of compensatory mitigation required for a proposed project depends on the size of the project footprint, the quality of habitat at the project site, and the type of compensatory mitigation proposed.

The Navy is currently working with the USACE to identify and develop compensatory mitigation for the loss of aquatic resource, as required by USACE/U.S. EPA Rule on Loss of Aquatic Resources. NMFS assumes that compensatory mitigation (purchase of the credits through the HCCCC ILF and resulting restoration project) will offset the loss of habitat that will occur from the proposed project's overwater coverage of about 31,352 sq. ft. (0.71 acre), shoreline abutment (armoring) of 99 feet 8 inches, and permanently impact of 309 sq. ft. of eelgrass and temporarily impact about 1,701 sq. ft. of eelgrass growing in this area.

Summary of Species Response

Viability
The range of responses to temporary and enduring effects is presented at the individual scale but must be considered collectively at the population or species scale in order to determine the effects on the four viability parameters.

As presented in the above section, there most acute effects will be response to sound, which has the potential to alter behavior, injure, and kill listed juvenile fishes, primarily salmonids due to their size and body structure. However, given the timing of the 90 days of pile installation to avoid outmigration, we expect this effect will not occur among a large number of juveniles from any of the ESUs/DPS.

More likely to be influential to population dynamics are the temporary and enduring reductions in the abundance and variety of prey for juvenile salmonids, coupled with the temporary and enduring increase in predators of juvenile salmonids. The temporary effects have a duration which begins contemporaneously with the enduring effects, and so while the temporary effects will begin to ameliorate promptly back to baseline conditions, the enduring deleterious shifts will cause a reduction in overall habitat values. Due to the reduced carrying capacity with prey diminishment, and the anticipated decrease in survival as predator presence and predation success increases, we can anticipate some injury and death of individuals in all future cohorts of juvenile salmonids that use the action area. The enduring effects on rockfish, however, are less influential because they are unlikely as juveniles to be preyed upon by pinnipeds, and their adult lifestage occurs in deeper waters away from the effects of the structure itself.

We then assess the importance of habitat effects in the action area to the ESUs/DPSs by examining the influence of those effects to the characteristics of 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 TPP 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 most likely to be repeatedly/ chronically exposed to these conditions are juvenile PS Chinook and HCSR chum which typically migrate or rear in the nearshore area. Steelhead are less affected by the habitat detriments associated with the action because by the time they reach the nearshore/marine environment, they are larger fish more adapted to deeper water, and so have lower demand for nearshore migration, predator refugia, and prey base. We do not expect that any effects other than the reduction in food supply would affect rockfish. These long-term habitat changes, which will persist for the life of the structure, 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 salmonid populations that rely on this action area will incur the greatest level of exposure and detrimental response.

We also expect that the HCCC ILF credits and resulting mitigation will result in a net zero loss of function within the Hood Canal.

In summary, the proposed action results in suppression of habitat quality due to the new TPP. We anticipate that a small number of juvenile PS Chinook salmon and HCSR chum, and a very small number of juvenile PS steelhead, PS/GB bocaccio, and PS/GB yelloweye rockfish would be injured or die as a result of the reduced habitat quality. These impacts will be offset with the purchase of HCCC ILF credits and resulting restoration. As such, we anticipate no population-scale effects to these species.

Productivity

The new structure will degrade nearshore habitat conditions. In response to these habitat changes, we expect changes in behavior of individual 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 construction of the TPP will likely have adverse effects on individuals in the early marine life-history stages in the populations of PS Chinook salmon, PS steelhead, and HCSR chum that use the action areas, as well as PS/GB bocaccio, and PS/GB yelloweye rockfish.

The proposed compensatory mitigation is expected to completely replace the lost habitat function, and thus we do not expect any downward pressure on productivity from a decrease in adult spawners.

Spatial Structure

We do not expect the proposed project to affect the spatial structure of any of the five affected ESUs/DPSs. The affected salmonid populations spread across the nearshore and mix when they enter PS (Fresh et al., 2006), and rockfish spread through nearshore habitats with larval drift. This one pier in combination with its compensatory mitigation 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. An implication of juvenile salmon avoiding OWS is that some of them will swim around the structure (Nightingale and Simenstad 2001) meaning they will temporarily utilize deeper habitat.

The proposed action will concentrate the effects on HCSR chum and PS Chinook delta fry. After emergence, delta fry quickly migrate downstream through the estuary into the marine nearshore and pocket estuaries such as those near Naval Base Kitsap Bangor (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 HCSR chum and PS Chinook diversity by differentially affecting specific populations that encounter piers in greater frequency during their early marine life history. The proposed compensatory mitigation is expected to offset this impact. We are not aware of any effects that would result in a reduction in diversity to PS steelhead, PS/GB bocaccio, and PS/GB yelloweye rockfish.

SRKW Response

We review the population level effects on SRKW using the same parameters for viability, namely abundance, productivity, spatial structure, and distribution. This distinct population segment comprises three groups, J, K, and L pods. Abundance is low, (J pod = 22, K pod = 17, L pod =33) as of July 1st, 2020. Productivity is likely to be impaired by the relatively high number of males to females. Spatial distribution has high inter-annual variability, and diversity is at risk because of the low abundance.

These threats were reviewed by Murray et al. (2019), who found a "cumulative effects" model was better at determining population impacts compared to individual threats. The "cumulative effects" model indicated that Chinook salmon abundance was the most sensitive model parameter, however they highlighted the importance of considering threats collectively. Lacy et al. (2017) developed a population viability assessment (PVA) developed a model that attempts to quantify and compare the three primary threats affecting the whales (e.g. prey availability, vessel noise and disturbance, and high levels of contaminants). The Lacy et al. (2017) model also found that Chinook salmon abundance was the most important threat to SRKW population growth; however, . They also emphasized that prey increases alone would likely not be sufficient to recover the whales and that the other threats would need to be addressed as well.

The most recent effort to review the relationships of SRKW vital rates and Chinook salmon abundance was conducted by an Ad Hoc Workgroup through the Pacific Fisheries Management Council (PFMC 2020). However, the Workgroup did not assess the cumulative threats, and found that the small population size limited their ability to detect a quantitative relationship between Chinook salmon abundance and SRKW demographic metrics (e.g. fecundity and survival) to input into their PVA and the relationship is likely not linear or not constant over time (PFMC 2020). Although there are challenges to detecting quantitative relationships and others have cautioned against overreliance on correlative studies (see Hilborn et al. 2012), given the status of the species (endangered with low abundance and productivity), and their strong preference for Chinook salmon prey, the continued existence and potential for recovery of the species is highly dependent on healthy numbers of Chinook salmon throughout its range.

Short-term reduction of Chinook salmon abundance associated with the temporary effects of the proposed action would result in an insignificant reduction in adult equivalent prey resources for SRKW. However, the long-term effects of the action include the suppression of productivity among (i.e., reduced survival of juvenile) PS Chinook populations during a 40-50 year time period, and spatial and temporal depletions in Chinook presence. This in turn limits the number of adult PS Chinook available as prey for SRKW over the long-term, as well as causing SRKW to expend energy to seek prey in other locations due to spatial and temporal depletions. These effects of the proposed action are likely to be experienced by all members of this species relies on published correlations using outdated data, assumes the correlations represent a causative relationship, and models SRKW demographic trajectories assuming that the relationship is constant over time. These assumptions (correlation represent causation, etc.) were previously criticized by a panel of experts and they cautioned against overreliance on correlative studies (Hilborn et al. 2012). The most recent effort to review the relationships of SRKW vital rates and Chinook salmon abundance was conducted by an Ad Hoc Workgroup through the Pacific Fisheries Management Council (PFMC 2020). The small population size limits the ability to detect a relationship to input into a PVA and the relationships are not constant over time (NMFS 2020).

These are consistent with several factors identified in the final recovery plan for Southern Resident killer whales that may be limiting recovery: quantity and quality of prey, toxic chemicals that accumulate in top predators, and disturbance from sound and vessels. It is likely that multiple threats are acting together, and while it is not clear which threat or threats are most significant to the survival and recovery of Southern Residents, all of the threats are important to address. Effects of the proposed action on Southern Residents would be due to the project's adverse effects on Chinook salmon, the whales preferred prey. Given the status of the species (endangered with low abundance and productivity), and their strong preference for Chinook salmon prey, the continued existence and potential for recovery of the species is highly dependent on healthy numbers of Chinook salmon throughout its range.

The reduction in the number of adult PS Chinook available as prey for SRKW over the long-term would likely result in additional stress and a lower likelihood of survival and reproduction for individual whales in response to decreased prey availability, the Southern Residents would likely increase foraging effort or abandon areas in search of more abundant prey. Reductions in prey or a resulting requirement of increased foraging efficiency would increase the likelihood of physiological effects. The Southern Residents would likely experience nutritional, reproductive, or other health effects (e.g., reduced immune function from drawing on fat stores and mobilizing contaminants in the blubber) from this reduced prey availability. These effects would lead to reduced body size and condition of individuals and can also lower reproductive and survival rates. In particular, the reduction in available prey is likely to put further stress on SRKW juveniles, pregnant females, and nursing females, with likely mortality (decrease in abundance) and decreased fecundity (decreased productivity).

Because of this population's small size, it is susceptible to rapid decline due to demographic stochasticity, and genetic deterioration. Small populations are inherently at risk because of the unequal reproductive success of individuals within the population. The more individuals added to a population in any generation, the more chances of adding a reproductively successful individual. Random chance can also affect the sex ratio and genetic diversity of a small population, leading to lowered reproductive success of the population as a whole. For these reasons, the failure to add even a few individuals to a small population in the near term can have long-term consequences for that population's ability to survive and recover into the future. A delisting criterion for the Southern Resident killer whale DPS is an average growth rate of 2.3% for 28 years (NMFS 2008). In light of the current average annual growth rate of 0.1%, this recovery criterion and the risk of stochastic events and genetic issues described above underscore the importance for the population to grow quickly.

Particularly in light of the small population size and the associated risks, the enduring effects of the proposed action could limit survival and impede the recovery of the PS Chinook salmon ESU by reducing the potential for population growth and increasing the likelihood of additional loss of individual whales. Further reductions in Southern Resident prey quantity, or spatial or temporal depletions would reduce the representation of diversity in SRKW life histories, resiliency in withstanding stochastic events, and redundancy to ensure there is a margin of safety for the salmon and Southern Residents to withstand catastrophic events. Long-term prey reductions affect the fitness of individual whales and their ability to both survive and reproduce. Reduced fitness of individuals increases the mortality and extinction risk of Southern Residents and reduces the likelihood of recovery of the DPS.

2.6 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 and 402.17(a)). 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.

Some continuing non-Federal activities are reasonably certain to contribute to climate effects within the action area. However, it is difficult if not impossible to distinguish between the action area's future environmental conditions caused by global climate change that are properly part of the environmental baseline vs. cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described in the environmental baseline (Section 2.4).

The action area, in Hood Canal, is influenced by actions in the nearshore, along the shoreline, in deeper parts of the waterway, and also in tributary watersheds of which effects extend into the action area. Actions in the project area nearshore and along the shoreline 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.

Other 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, rockfish and their habitat.

Future private and public development actions are very likely to continue on the uplands adjacent to the project area, perhaps on the on the opposing bank from the naval base also owned by the Navy, including associated in and over water activities, such as bulkheads and boat docks. As the human population continues to grow, demand for 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 likely allow substantial degradation to occur.

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. Over the 50-year anticipated design life of the TPP, we expect the effects of climate change in the action area will include decreasing salinity, modified temperature regime, increasing acidity, and sea-level rise. It should be noted that the 50-year design life is the target for which the structure could be used with only routine or limited maintenance, after which a broader repair project may become necessary which will trigger a re-initiation.

In June 2005, the Shared Strategy presented its recovery plan for PS Chinook salmon and the HCCC presented its recovery plan for Hood Canal summer-run chum salmon to NMFS who adopted and expanded the recovery plans to meet its obligations under the ESA. Together, the joint plans comprise the 2007 PS Chinook and Hood Canal summer-run chum Recovery Plan.

Several not for profit organizations and state and federal agencies are implementing recovery actions identified in these recovery plans.

2.7 Integration and Synthesis

The Integration and Synthesis section is the final step in our assessment of the risk posed to species and habitat/critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 2.5) to the environmental baseline (Section 2.4) and the cumulative effects (Section 2.6), 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) appreciably diminish the value of designated or proposed critical habitat as a whole for the conservation of the species.

Bocaccio rockfish is endangered. Each of the other species considered in this opinion was listed as threatened with extinction because of declines in abundance, poor productivity, reduced spatial structure and diminished diversity. Systemic anthropogenic detriments in fresh and marine habitats are limiting the productivity for Puget Sound Chinook salmon and Puget Sound steelhead. Hood Canal Summer-run chum, however, has seen notable improvements in freshwater habitat, and with the contribution of conservation hatchery practices, has improving abundance, productivity, and spatial structure in freshwater areas. Bocaccio live only in the marine environment, and the nearshore habitat of juveniles is degraded by bank armoring and impaired sediment processes. Both rockfish are long lived with late sexual maturity, which makes increasing productivity very difficult to enhance by any human endeavor.

The environmental baseline in the action area is a large industrial/military complex with over-water and in-water structures, approximately 4.20 miles of shoreline, a large amount of which is armored, and more than 75 acres of pollution-generating impervious surface landward of HAT. There are multiple existing in-water structures along the waterfront. An attendant feature of the structures is lighting. Within the action area the only source of artificial light is the Naval Base Kitsap Bangor waterfront. All other shoreline areas are currently undeveloped and the only other source of nighttime lighting is the moon and passing vessels. The TPP is potentially a barrier to migrating juvenile salmon due to physical characteristics such as the large number of piles, the low height-over-water design, and the nearshore location of the TPP. Nevertheless, fish surveys have captured large numbers of salmonids along the shoreline immediate to the north of each structure (SAIC 2006, SAIC 2009) suggesting juvenile salmonids are able to migrate around, or through, these structures. Salmonids that migrate under structures of this type have reduced visual acuity, making them vulnerable to piscivorous species such as larger fish and marine mammals.

To this context of species status and baseline conditions, we add the temporary and the enduring effects of the proposed action, together with cumulative effects (which are anticipated to include future nonpoint sources of water quality impairment associated with upland development and stressors associated with climate change), in order to determine the effect of the project on the likelihood of species' survival and recovery. We also evaluate if the project's habitat effects will appreciably diminish the value of designated critical habitat (for SRKW) for the conservation of the 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.

The Navy plans to use the Hood Canal Coordinating Council's In-lieu Fee program for mitigation. While the exact project that will offset TPP has not been chosen yet, we do know the HCCC's mission and the types of projects often covered by the ILF.

The HCCC works with partners and communities to advance a shared regional vision to protect and recover Hood Canal's environmental, economic, and cultural wellbeing. Nearshore areas within Hood Canal support multiple species and stocks of salmon. The nearshore and estuaries in particular, have been termed the life support system for juvenile salmon feeding, rearing, and migrating (Healey, 1982). The HCCC ILF uses a comprehensive strategy to identify, prioritize, and carry out nearshore habitat restoration and protection actions in Hood Canal and the Eastern Strait of Juan de Fuca.

Hood Canal is home to all eight salmon and trout species in Puget Sound. Hood Canal salmon strive to survive while facing multiple changes to their natural environment, including impacts of population growth, climate change, and habitat degradation or loss. HCCC facilitates implementation of three salmonid recovery plans, including summer chum salmon, Skokomish River and Mid-Hood Canal Chapters of the Puget Sound Chinook Salmon Recovery Plan, and the Hood Canal Chapter of the Puget Sound Steelhead Recovery Plan. The Navy's mitigation fees will aid in the different recovery plan goals.

Habitat

Effects to habitat features that are not included in the critical habitat designations include temporary and permanent diminishment of benthic communities and forage fish (i.e., prey abundance and diversity), migratory obstruction and required energy expenditure, and temporary and permanent increases in predators and predator success upon juvenile salmonids. Timing, duration, and intensity of the effects on DoD exempted areas will be the same as for the critical habitat effects (we assume effects are consistent across designated and non-designated areas). These effects will occur within the Navy's security zones, which is excluded from the critical habitat designation and thus not taken into account in the adverse modification analysis, but we nevertheless consider them as the pathways of exposure creating effects to the species, as discussed below.

Impact pile driving will produce daily noise in the aquatic habitat detectable by fish, this habitat alteration will be short-term within the 90 day of pile driving, and largely localized to within areas exempt from critical habitat designation. Therefore, the temporary impacts of sound to critical habitat will not diminish the features of critical habitat in a manner that impairs conservation values of that habitat for PS Chinook salmon, HCSR chum, or rockfish.

Critical habitat for SRKWs is designated in Puget Sound and proposed in certain areas outside Puget Sound. Within Puget Sound, the quality of critical habitat for SRKWs has been negatively affected by reduction of prey availability. Over the past several years, the reduced and declining SRKW status has become a serious concern. PS Chinook salmon, a key part of the prey PBF for SRKW critical habitat, is a concern for this consultation.

The enduring additional overwater cover and shade will result in increased predation of ESA-listed species. Compensatory mitigation, through purchase of HCCC ILF credits is expected to offset the loss of habitat function from the TPP resulting in a net zero loss of habitat function in the Hood Canal. The structure will also impede benthic communities for the foreseeable future (pile placement) and temporarily (pile driving/removal turbidity). The temporary and enduring impacts that disrupt benthic environments will diminish the rockfish larval/juvenile rearing habitats and food sources in the action area; however, when scaled up to the designation scale, the effects are not expected to impact the conservation value because although an effect exists, regardless of their magnitude, even if only one individual or habitat segment may be affected it is likely that very small number of fish will be impacted. Reduced diversity or density of epibenthic mesofauna also reduces prey resources for juvenile salmon – but again will be offset by the proposed compensatory mitigation.

The effects of the proposed actions would primarily impact nearshore habitats for PS Chinook salmon, HCSR chum salmon, and PS/GB bocaccio. For SRKWs, the impact of the proposed action is primarily on the prey PBF. This impact is caused by the loss of nearshore habitat quality that results in a reduction in the abundance of PS Chinook salmon. The remainder of our integration and synthesis for habitat/critical habitat will focus on how the effects of the proposed actions, when added to environmental baseline and cumulative effects, impact the ability of PBFs to support conservation of PS Chinook salmon, HCSR chum salmon, PS/GB bocaccio, and SRKWs.

Modification of nearshore habitat in Puget Sound has resulted in a substantial decrease in critical habitat quality for PS Chinook salmon and PS/GB bocaccio. The effect on critical habitat for HCSR chum salmon is similar, but more of the critical habitat for this species remains in good condition. Shoreline development is the primary cause of this decline in habitat quality. Development includes shoreline armoring, filling of estuaries and tidal wetlands, and construction of overwater structures. Currently, only 31 percent of Puget Sound's shorelines remain undeveloped.

Once developed, shoreline areas tend to remain developed due to the high residential, commercial, and industrial demand for use of these areas. New development continues and as infrastructure deteriorates, it is rebuilt. Shoreline bulkheads, marinas, residential PRFs, and port facilities are quickly replaced as they reach the end of their useful life. Although designs of replacement infrastructure are often more environmentally friendly, replacement of these structures ensures their physical presence will causes adverse on nearshore habitat into the future. This is evidenced by the continued requests for consultation on these types of actions. As a result, shoreline development causes a "press disturbance" in which habitat perturbations accumulate without periods of ecosystem recovery. This interrupts the natural cycles of habitat disturbance and recovery crucial for maintenance of critical habitat quality over time. Although the occasional restoration project will improve nearshore habitat quality, the area impacted by these projects is tiny compared to the developed area. The general trend of nearshore habitat quality is downward and is unlikely to change given current management of these areas. Nearshore habitat modification has caused broad-scale ecological changes, reducing the ability of critical habitat to support PS Chinook salmon juvenile migration and rearing. The loss of submerged aquatic vegetation, including eelgrass and kelp, has reduced cover, an important PBF of critical habitat for PS Chinook salmon. Degradation of sand lance and herring spawning habitat has reduced the quality of the forage PBF. Construction of overwater structures throughout Puget Sound has degraded PS Chinook salmon critical habitat by creating artificial obstructions to free passage in the nearshore marine area. Habitat modification reduces juvenile survival and in some cases, has eliminated PS Chinook salmon life history strategies that rely on rearing in nearshore areas during early life history. Under the current environmental baseline, critical habitat for PS Chinook salmon is not able to support survival and recovery of this species.

These impacts on the survival of juvenile PS Chinook salmon translate to reduction of adult PS Chinook salmon, the prey PBF for SRKW critical habitat. As observed during recent years, the SRKW's population has declined. Under the current environmental baseline and proposed action, critical habitat for SRKWs would be unable to support the conservation of this species. In particular, critical habitat would be unable to produce enough Chinook salmon to ensure survival and recovery of SRKWs.

Changes to nearshore areas in Puget Sound have also reduced the ability of critical habitat to support juvenile life stages of PS/GB bocaccio. Loss of submerged aquatic vegetation has reduced cover available for larval and juvenile rockfish. Changes in physical character of nearshore areas and loss of water quality reduce the amount of prey available for juvenile rockfish. Although loss of nearshore habitat quality is a threat to bocaccio, the recovery plan for this species lists the severity of this threat as low (NMFS 2017a). Other factors, such as overfishing, are more significant threats to PS/GB bocaccio.

For PS/GB bocaccio habitat, the proposed actions would degrade the quality of PBFs in the nearshore. This would likely reduce juvenile survival in some areas of affected critical habitat. However, given the low severity of this threat, in context with other limiting factors for this species, we do not expect the adverse effects of the proposed action to be significant enough to reduce the conversation value of critical habitat for this species.

The adverse effects of the proposed actions would exacerbate limiting factors identified in the recovery plans for PS Chinook salmon and SRKWs. For SRKWs, loss of prey is one of three major threats identified in this species' recovery plan. The proposed actions would degrade the quality of the prey PBF of critical habitat, further reducing available prey (Chinook salmon). By supporting boating and vessel traffic into the future, the proposed actions would also modestly exacerbate the other two major limiting factors, toxic chemicals that accumulate in top predators and impacts from sound and vessels. For PS Chinook salmon, degraded nearshore conditions are listed as a limiting factor. The proposed actions exacerbate this factor by degrading or impeding the development of nearshore critical habitat PBFs essential for the conservation of this species.

In summary, the status of critical habitat for PS Chinook salmon is poor and current quality of PBFs in nearshore areas cannot support conservation of this species. The prey quality and quantity PBF of critical habitat for SRKWs is at a fraction of historical levels. Under the current environmental baseline, the PBFs of critical habitat cannot support the biological requirements of PS Chinook salmon. This is evidenced by low survival of PS Chinook salmon juveniles in nearshore of Puget Sound. The condition of the environmental baseline is such that additional long term and chronic negative impacts on the quality of critical habitat PBFs (nearshore habitat for PS Chinook salmon and prey availability for SRKWs) is likely to impair the ability of critical habitat to support conservation of these species. The net result of the proposed actions would further reduce the quality and further perpetuate poor conditions of nearshore PBFs for PS Chinook salmon and prey availability for SRKWs. The proposed actions would also exacerbate habitat limiting factors identified by the PS Chinook salmon and SRKW recovery plans and are inconsistent with recovery action listed in these plans. Due to demand for future human development, cumulative effects on critical habitat quality are expected to be mostly negative. When the net effects of the proposed actions are added to the environmental baseline and cumulative effects, the proposed actions are likely to appreciably diminish the value of critical habitat as a whole for the conservation of PS Chinook salmon and SRKWs.

Species

Salmonids - Pile driving will temporarily produce sound, turbid conditions, and prey reductions, and shade from the presence of the barges will temporarily modify salmonid visual acuity and migration behavior, and also decrease SAV, impacting cover and forage for salmonids. Although the effects of impact pile driving are expected to be the most acute, these effects are limited to 90 days, and even within that period they are at the most transitory, ceasing each time pile driving has stopped for the day. Because the work window is timed when juvenile salmon migration is largely avoided, we expect that the numbers of fish from each species will be low, and that no particular population among the species of salmonids will be disproportionately affected. Turbidity will be more confined than sound but persist for minutes to hours at each pile site, and salmonids that are present should be able to avoid the individual pulses of suspended sediment. The diminishment in forage base will persist the longest, and we expect multiple listed salmonids from each population of each species will need to modify its forage locations to compensate for the reduction, but that sufficient prey is available throughout the action area.

There will be a long-term (for the life of the project and minor maintenance), decrease in prey base, and increase in predation of juvenile fish from each of the affected salmonid populations, based on modified migration behavior, reduced visual acuity, phototaxic response to associated night lighting, and increased predator abundance. This indicates for the 50-year life of the project, with minor maintenance, there is likely to be an annual reduction in numbers of salmonids within the action area compared to the baseline. This impact is expected to be completely offset with the proposed compensatory mitigation. NMFS concludes that the numbers of listed fish affected by the temporary effects will be small because the activity occurs when few juvenile PS Chinook salmon, PS steelhead and HCSR chum salmon are present, and that the numbers of fish impaired by the enduring effects are unlikely to be discerned among adult returns because the loss will be across several cohorts of the three species and only impact those fish that access the action area, and when the general rate of juvenile to adult survival and ocean survival are considered, the incremental reduction in numbers of juveniles is insufficient to alter the abundance and composition of the adult returning Hood Canal cohort.

Rockfish – As mentioned above, an effect exists even if only one individual or habitat segment may be affected (Fish and Wildlife Service and the National Marine Fisheries Service 1998). Pile driving as a temporary effect in the proposed in-water work window (but not turbidity or shade) will kill or injure individual larval fish from of each of the PS/Georgia Basin DPSs of rockfish (yelloweye rockfish and bocaccio). However, rockfish losses will be limited to the larval life stage and will be few in number as there are very few juvenile or larval yelloweye rockfish, and bocaccio in the action area as a general matter; therefore, adverse effects resulting from the project at this life stage are not likely to adversely influence the abundance of adult fish. The enduring effects of the increased structure (shade, reduced SAV, and reduced forage) are unlikely to discernibly affect abundance of adult rockfish because adult PS/GB yelloweye rockfish, and PS/GB bocaccio do not use nearshore habitat in the action area where the enduring effects will occur/persist).

Accordingly, NMFS expects the very small reduction in numbers of PS Chinook salmon, HCSR chum salmon, PS steelhead, and ESA-listed rockfish by the temporary and enduring effects, even when considered with cumulative effects, are insufficient to alter the productivity, spatial structure, or genetic diversity of any of the species. Therefore, when considered with the environmental baseline in the action area and cumulative effects, the action, as proposed, does not increase risk to the affected populations to a level that would appreciably reduce the likelihood for survival and recovery of the PS Chinook salmon ESU, PS steelhead DPS, or HCSR chum salmon ESU.

SRKW- SRKWs are at risk of extinction in the foreseeable future. NMFS considers SRKWs to be currently among eight of the most at-risk species as part of the Species in the Spotlight initiative because of their endangered status, declining population trend, and they are high priority for recovery based on conflict with human activities and recovery programs in place to address threats. The population has relatively high mortality and low reproduction unlike other resident killer whale populations that have generally been increasing since the 1970s (Carretta et al. 2019). Reduced prey availability is a major limiting factor for this species.

As described in the section on Effects to the Species, the anticipated short-term (or annual) reduction of PS Chinook salmon, their primary prey, associated with the proposed action would result in a potentially minor reduction in prey resources for SRKWs. Over the long-term, however, the proposed action will inhibit recovery of PS Chinook salmon and would result in a greater reduction in prey quantity and affect availability in other ways (i.e., spatially and temporally). Fewer populations contributing to SRKW's prey base will reduce the representation of diversity of life histories, resiliency in withstanding stochastic events, and redundancy to ensure there is a margin of safety for the salmon and SRKWs to withstand catastrophic events. These reductions increase the risk of extinction risk of SRKWs.

The chronic long-term impacts to PS Chinook salmon would reduce prey availability and increase the likelihood for local depletions of prey in particular locations and times. In response, the SRKWs would increase foraging effort or abandon areas in search of more abundant prey.

Reductions in prey or a resulting requirement of increased foraging efficiency increase the likelihood of physiological effects. The SRKWs would likely experience nutritional, reproductive, or health effects (e.g. reduced immune function from drawing on fat stores and mobilizing contaminants in the blubber) from this reduced prey availability. These effects would lead to reduced body size and condition of individuals and can also lower reproductive and survival rates and thereby diminish the potential for SRKWs to recover.

2.8 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, HCSR chum, PS steelhead, PS/GB bocaccio, PS/GB yelloweye rockfish, and SRKW or destroy or adversely modify PS chinook, HCSR chum, PS/GB bocaccio, PS/GB yelloweye rockfish, and SRKW designated critical habitats.

2.9 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 ITS.

2.9.1 Amount or Extent of Take

In the biological opinion, NMFS determined that incidental take is reasonably certain to occur. Harm of PS Chinook salmon (juvenile and adult), PS steelhead (juvenile and adult), HCSR chum salmon (juvenile and adult), PS/Georgia Basin DPSs of yelloweye rockfish and bocaccio (egg, larvae, juvenile, and adult) from temporary construction related actions[7]. Additionally, we expect harm of individual PS Chinook salmon (juvenile and adult), PS steelhead (juvenile and adult), HCSR chum salmon (juvenile and adult), PS/Georgia Basin DPSs of yelloweye rockfish and bocaccio (egg, larvae, juvenile, and adult) and Southern Resident Killer Whales from intermittent and enduring impacts resulting from the construction of the new structures.

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[7] The temporary nature of the construction related effect on SRKW prey resources are not expected to be detectable at the individual SRKW level, and therefore, as described in the effects analysis, we do not anticipate harm to SRKW from these activities.

For this Opinion, even using the best available science, NMFS cannot predict with meaningful accuracy the number of listed species that are reasonably certain to be injured or killed annually by exposure to these stressors. The distribution and abundance of the fish that occur within the action area are affected by habitat quality, competition, predation, and the interaction of processes that influence genetic, population, and environmental characteristics. These biotic and environmental processes interact in ways that may be random or directional, and may operate across far broader temporal and spatial scales than are affected by a proposed action. Thus, the distribution and abundance of fish within the action area cannot be attributed entirely to habitat conditions, nor can NMFS precisely predict the number of fish that are reasonably certain to be injured or killed if their habitat is modified or degraded by the proposed action. Additionally, NMFS knows of no device or practicable technique that would yield reliable counts of individuals that may experience these impacts. Similarly, NMFS is unable to reliably quantify and monitor the number of individual SRKWs that may be harmed by the incidental take identified here. In such circumstances, NMFS uses the causal link established between the activity and the likely extent of timing, duration and area of changes in habitat conditions to describe the extent of take as a numerical level. Many of the take surrogates identified below could be construed as partially coextensive with the proposed action; however, they also function as effective re-initiation triggers. If any of the take surrogates established here are exceeded, they are considered meaningful reinitiation triggers.

TAKE FROM CONSTRUCTION-RELATED AND TEMPORARY EFFECTS

Many of the take surrogates identified below could be construed as partially coextensive with the proposed action; however, they also function as effective re-initiation triggers. If any of the take surrogates established here are exceeded, they are considered meaningful reinitiation triggers and exceeding any of the surrogates would suggest a greater level of effect than was considered by NMFS in its analysis.

Construction Timing and Duration Surrogates

The timing (in-water work window) and duration (days) of in-water work is applicable to construction related stressors described below because the in-water work windows for specific geographic regions are designed avoid the expected peak presence of listed species in the action area. Construction outside of the in-water work window could increase the number of fish that would be exposed to construction related stressors, as would working for longer than planned. Therefore, for all stressors below that identify a timing and duration take surrogate, they will be synonymous with the defined in-water work window and number of in-water workdays.

Impact pile driving will occur outside the forage fish work window, October 15th through January 16th for 45 minutes a day. There is a known forage fish spawning area within the noise injury threshold in the action area. The take surrogate for incidental take associated with pile-driving underwater sound relates to the area within which underwater sound created by the proposed TPP project is expected to harm spawning forage fish by causing auditory and other tissue damage as well as the number of days that pile-driving is expected to occur.

Harm from Pile Driving Activities - Noise

PS Chinook salmon (juvenile and adult), PS steelhead (juvenile and adult), HCSR chum salmon (juvenile and adult), PS/GB DPSs of yelloweye rockfish and bocaccio (egg, larvae, juvenile, and adult) will be exposed to construction-related noise resulting from pile installation activities and construction vessels at the work sites. Disruption of normal feeding and migration, and injury and death can occur from this exposure. The maximum number of individual pile strikes per day (1,600), and time of impact pile driving per day (45 minutes) are the best available surrogates for the extent of take from exposure to pile installation.

The surrogates for take caused by underwater sound generated by pile driving and vessel use are proportional to the anticipated amount of take. These surrogates are also the most practical and feasible indicators to measure. In particular, the number of pile strikes with an impact hammer is directly correlated to the potential for harm due to hydroacoustic impacts, and thus the number of individuals harmed due to pile driving. Each pile strike creates underwater sound and a pressure wave that can kill, injure, or significantly impair behavior of listed species addressed by this Opinion. Numerous strikes occurring in temporal proximity also increase the likelihood of injury, death, or behavior modification due to cumulative exposure to underwater sound. Thus, the number of pile strikes is closely related to the amount of incidental take that would be caused by the proposed action. In some cases, persistent noise can make an affected area inhospitable for normal behaviors such as migrating and foraging. The duration of this disturbance is related to the number of animals potentially affected as well as the intensity of the disturbance. As the duration of noise increases, a larger number of animals migrating or traveling through the affected area are likely to be exposed. Likewise, the longer the noise persists, the longer the affected area may remain incapable of supporting the normal behaviors of salmon, steelhead, and HCSR chum salmon.

Harm from Suspended Sediments

PS Chinook salmon (juvenile and adult), PS steelhead (juvenile and adult), HCSR chum salmon (juvenile and adult), PS/Georgia Basin DPSs of yelloweye rockfish and bocaccio (egg, larvae, juvenile, and adult), will be exposed to suspended sediments during removal of debris in the nearshore, nearshore construction activities during placement of shoreline armoring. Impairment of normal patterns of behavior including rearing and migrating, potential injury such as gill abrasion and cough.

The levels of suspended sediments are expected to be proportional to the amount of injury that the proposed action is likely to cause through physiological stress from elevated suspended sediments and contaminants throughout the duration of the projects' in-water activities. In estuaries, state water quality regulations (WAC173-201A-400) establish a mixing zone of 200 feet plus the depth of water over the discharge port(s) as measured during mean lower low water. As such, NMFS expects that for projects with sediment disturbing activities, that elevated levels of suspended sediment and re-suspended contaminants resulting from construction actions will reach background levels within a 200-foot buffer from the point of suspended sediment generation. Listed fish and their prey resources can be harmed from a wide range of elevated sediment levels and expect that at the point where sediment levels return to background levels that the harm will cease. Thus, the maximum extent of take is defined as within the 200-foot buffer around the outer boundaries of each of the project footprint, where construction will suspend sediment. Elevated suspended sediment levels beyond 200-foot buffer would indicate exceedance of take.

TAKE FROM INTERMITTENT AND ENDURING EFFECTS

Many of the take surrogates identified below could be construed as partially coextensive with the proposed action; however, they also function as effective re-initiation triggers. If any of the take surrogates established here are exceeded, they are considered meaningful reinitiation triggers and exceeding any of the surrogates would suggest a greater level of effect than was considered by NMFS in its analysis.

Harm due to habitat-related effects

PS Chinook salmon (juvenile and adult), PS steelhead (juvenile and adult), HCSR chum salmon (juvenile and adult), PS/Georgia Basin DPSs of yelloweye rockfish and bocaccio (egg, larvae, juvenile, and adult) and SRKW will be exposed to reduction in the quantity and quality of nearshore habitat resulting from the placement of the new structure. For SRKWs, the impact of the habitat-related effects is primarily on the reduction in prey. This impact is caused by the loss of nearshore habitat quality that results in a reduction in the abundance of PS Chinook salmon. Specifically addressed here are the reduction in habitat quality and quantity—including prey resources for PS Chinook and SRKW — that will result from in- and over-water structures and vessels using these structures, and shoreline stabilization.

For In-Water and Over-Water Structures

The physical size (sq. ft.) of an in- or over-water structure is the best available surrogates for the extent of take from exposure to the structure itself and also the accompanying vessel noise accommodated by the structure. This is because the likelihood of avoidance and the distance required to swim around the structure would both increase as the size of a structures and the intensity of its shadow increase, which would increase the number of juveniles that enter deeper water where forage efficiency would be reduced and vulnerability to predators would be increased. The amount of overwater structure directly determines the amount of shaded area, migration obstruction, reduced benthic productivity and SAV distrusting and limiting feeding opportunities available at the project sites (effects further described in Section 2.4.3). The extent of these impacts would increase and decrease depending directly on structure size, in this case 29,451 sq. ft.

Shoreline Armoring and Bulkheads (AKA "Shoreline Abutment")

The physical extent (length and width) of shoreline armoring and bulkheads, and placement on the shore below the high tide line (HTL) and HAT is the best available indicator for the extent of take from decreased habitat function caused by shoreline armoring and bulkhead structures (including stairs). Shoreline armoring restricts natural beach forming processes (natural erosive processes) by disrupting the supply and replenishment of sediments sources are the base of forage fish spawning habitat (effects described in Section 2.5.3). As forage fish reproduction is restricted or reduced, so is the availability of food for listed fish (salmon and bocaccio), limiting and reducing the numbers of listed fish that the action area can support. In turn, this limits the number of juveniles PS Chinook that will survive and return to the Puget Sound as adults that supply prey for SRKW. The loss of natural sediment deposition along the shoreline north and south of a structure that supports forage fish and other intertidal and nearshore habitat function are directly proportional to the physical area, length and width of shoreline armoring and bulkheads, and placement on the shore below the HTL and HAT. As the length and width of a bulkhead increases so does impacts to sediment inputs. Structures that are placed below the HTL and HAT directly eliminate forage fish habitat and feeding habitat for listed species. The further a structure is placed below HTL and HAT, the greater the loss of this habitat and thus impacts. Further, due to the variability of the marine environment and nature of project implementation, the potential exists for a project to exceed the structure's identified physical extent. The TPP project will include 99.8 linear feet of new shoreline armoring and 50 cubic yards of fill between placement and up to HAT.

Shade and lighting

Juvenile salmon and steelhead will also be subject to a small increase in predation, due to project-generated overwater cover and shade that will favor predators and deter SAV growth. Such shading will be caused the presence of two construction-related vessels (barges), and the enduring overwater structure. Incidental take is also reasonably certain to occur as a result of the proposed nighttime lighting that draws juvenile fish into deeper water where predators are more abundant. Therefore, incidental take of these species in the form of harm or death is reasonably certain to occur as a result of the structure and lighting.

The extent of take is as associated with the temporal duration of shade from the in-water construction vessels that are likely to disrupt normal fish foraging and migration behavior, and the take surrogate for incidental take associated with shade also relates to the geographic area of such overwater cover, which creates daytime shade, and increases suitable predator habitat.

The surrogate measures of incidental take identified in this section can be reasonably and reliably measured and monitored and all serve as meaningful reinitiation triggers.

The take surrogates are as follows:

1) **Take from pile driving underwater sound**.

    a) 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:
        1. Sound exceeds 205 dB cumulative SEL at 10 meters
        2. Duration of such sound exceeds 90 days
        3. Duration of such impact driving sound exceeds 45 minutes per day

        There is a causal link between this surrogate and the take because as sound increases over 205 dB cumulative SEL at 10 meters the likelihood of harm increases and the bigger the area within which sound over 205 dB cumulative SEL occurs and, the longer the sound levels occur, the greater the number of fish that will exposed to injurious sound levels.

b) If more than 45 minutes of impact pile driving occur per day over the two in-water work windows, take in the form of reduction of prey will be exceeded.

There is a causal link between this surrogate and the take because if noise impacts continue beyond the allotted time forage fish spawning will not occur.

2) Take from shading

a) If construction vessels (tug boats, skiff boats and two barges) are within the action more than two weeks before or after the two in-water work window, the numbers of fish in the action area are expected to be greater and take will affect a greater number than we have evaluated in the foregoing analysis and the take surrogate will be exceeded.

b) If the size of the overwater structure exceeds 29,451square feet then the amount of displacement from preferred migration areas, the amount of shade, the amount of predator habitat, will all increase, affecting a 545454greater number of listed fish than was considered in this analysis and the take surrogate will be exceeded.

3) Take from artificial nighttime lighting

If artificial nighttime lighting from the proposed action exceeds an area of 29,451 sq. ft., or the Navy increases the number of lights used, or the brightness of the lights (candle-feet), then the area of migration disruption will increase, affecting a larger number of fish that was considered in this analysis, and the take surrogate will be exceeded.

4) Take from suspended sediment

The maximum extent of take is defined as within the 200-foot buffer around the outer boundaries of each of the project footprint, where construction will suspend sediments and re-suspend contaminants. Elevated suspended sediment levels beyond 200-foot buffer, for 90 days would indicate exceedance of take.

5) Take from shoreline stabilization

If the size of the bulkhead exceeds 99 feet 8 inches then the amount of displacement restricted natural beach forming processes increases. Likewise, structures that are placed below the HTL and HAT directly eliminate forage fish habitat and feeding habitat for listed species. The further a structure is placed below HTL and HAT, the greater the loss of this habitat and thus impacts.

For each of the above surrogate measures, or “extents” of take, the Navy, as owner and operator, has continuing jurisdiction to correct the exceedances and thus, to the extent any of the surrogates are coextensive with the proposed action, they nevertheless function as effective reinitiation triggers.

The surrogates described above are each proportional to the amount of take considered to result from the action and each extent serves as a measure that can be monitored. Therefore, if any surrogate is exceeded, reinitiation of consultation will be required. The four surrogates each will function as an effective reinitiation trigger because, unlike the undiscerned number of salmon harassed, injured, or killed, each of the above measures can be measured for compliance.

2.9.2 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.

2.9.3 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).

The Navy shall:

1. Minimize the incidental take of listed salmonid and rockfish species from the effects of pile driving.

2. Minimize the incidental take of listed salmonid, SRKW and rockfish species from the effects of a new OWS and bulkhead.

3. The Navy shall minimize incidental take of listed species resulting from suspended sediment during construction.

4. Monitor, prepare and provide NMFS with plans and reports describing how impacts of the incidental take on listed species in the action area would be monitored and documented.

2.9.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the U.S. Navy or any applicant must comply with them in order to implement the RPMs (50 CFR 402.14). The U.S. Navy 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 ITS (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 Navy must fully comply with the following terms and conditions that implement the RPMs described above:

1. To implement RPM number 1 (pile driving), the Navy shall:
    a. Develop and Implement an Acoustic Monitoring Plan. See monitoring specification under T&C 4, below.

2. To implement RPM number 2 (OWS/bulkhead/lighting), the Navy shall:
    a. Expand the use of grating instead of solid decking on the OWS wherever feasible

3. To implement RPM number 3 the Navy shall:
    a. Comply with Washington State water quality standards by conducting water quality monitoring during construction activities. At point of compliance (per state permit), turbidity levels shall not exceed 5 nephelometric turbidity units (NTUs) more than background turbidity when the background turbidity is 50 NTUs or less, or there shall not be more than a 10 percent increase in turbidity when the background turbidity is more than 50 NTUs.

4. To implement RPM number 4 (monitoring and reporting) the Navy shall:
    a. Monitor to ensure:
        i. Piles amounts do not exceed:
            1. 10 24-inch steel fender piles
            2. 14 30-inch steel guide piles
            3. 100 36-inch steel support piles
            4. 60 36-inch temporary steel falsework piles
        ii. During each day of pile driving, vibratory pile driving will last no more than five hours and impact driving will last no more than 45 minutes in total time each day.
        iii. Steel piles receive no more than 1,600 pile strikes per day, using a strike rate of 44-45 strikes/minutes for steel or 38 strikes/minutes for concrete, less than 45 minutes of impact driving will occur per day.
        iv. Acoustic monitoring that includes:
            1. Acoustic metrics (Peak, SEL, RMS) by pile size during pile driving activities.
                a. Dates of construction related activities such as:
                b. Removal of the falsework piles.
                c. Installation of new steel and concrete piles.
            2. Description of pile driving activities such as:
                a. Number and method of piles removed.
                b. Number of piles installed with an impact pile driver.
        v. OWS does not exceed 29,541 sq. ft.
        vi. Bulkhead length does not exceed 99 feet and 8 inches

    b. Provide Monitoring Report(s) that include:
        i. A description of construction activities conducted and duration of activities. Specifically:

            1. TPP final size/overwater coverage and bulkhead length
            2. The acoustic monitoring report

3. A summary/verification BMPS and conservation measures as described in the proposed action were achieved.
    a. Report to NMFS final use plan and credits purchased from the HCCC.

i. The report(s) shall be submitted to NMFS within 6 months of completion of construction. All reports shall contain the WCRO Tracking number and be sent by electronic copy to NOAA's reporting system email address at: projectreports.wcr@noaa.gov.

2.10 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 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).

The following conservation measures are intended to assist the Navy in avoiding or minimizing the effects to listed species from this action and in fulfilling the Navy's legal obligation to conserve listed species and the ecosystems on which they depend:

1. The NMFS recommends that the Navy investigate sound attenuation technologies that are potentially superior to current standard practices and use the best available underwater sound attenuation technology for any actions involving impact pile driving in the presence of ESA-listed species.
2. The Navy should dim, reduce, or shut off lighting on the TPP when not required for nighttime operations.
3. The Navy's INRMP should include nearshore habitat improvement projects consistent with Recover Plan Objectives for PS Chinook and HCSR Chum. Proposed projects should be guided and coordinated with HCCC and local watershed groups to ensure parity in prioritized recover actions.
4. The Navy should develop and implement a research study to determine the effectiveness of the under trestle LED lights.
5. Limit in-water work to times of year when forage fish are expected to be in fewer numbers and not spawning in the action area (March 2nd – October 14th), or Conduct weekly forage fish surveys, per Washington Department of Fish and Wildlife protocol, along the beach of the project area beginning in late September during the in-water work window, and commence work only if forage fish eggs are not found.

Please notify NMFS if the Navy carries out these recommendations so that we will be kept informed of actions that are intended to improve the conservation of listed species or their designated critical habitats.

2.11 Reinitiation of Consultation

This concludes formal consultation for the U.S. Department of the Navy.

As 50 CFR 402.16 states, reinitiation of consultation is required and shall be requested by the Federal agency or by the Service 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 ITS 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 identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

2.12 "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 of the effects of the action are expected to be discountable, insignificant, or completely beneficial. Beneficial effects are contemporaneous positive effects without any adverse effects to 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.

Humpback Whales

Humpback whales sightings are rare in Hood Canal. In Hood Canal, single humpback whales were observed January 27th and February 4th through February 23rd 2012 (Orca Network, 2018), January 1st through January 31st 2015 in the action area and February 10th 2015 on the west side of Toandos Peninsula, and in January 2016 (Orca Network, 2018).

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). On September 8, 2016, NMFS published a final rule to divide the globally listed endangered humpback whale into 14 DPSs and place four DPSs as endangered and one as threatened (81 FR 62259). There are at least two separate ESA-listed DPSs of humpback whales that may occur in the action area, the Central American DPS and Mexico DPS. Since 2000, humpback whales have been sighted with increasing frequency in the inside waters of Washington (Falcone et. al. 2005).

While humpback sightings in PS and Hood Canal do occur during the proposed work window, the likelihood for exposure to construction-related impacts (sound pressure) is discountable. This is because the Navy will be implementing a marine mammal monitoring program that will include monitoring to identify humpback whales and shut down any pile driving activities before an animal could be exposed. Our understanding is that visual marine mammal monitoring will be conducted before, during, and after pile driving by experienced Marine Mammal Observers, within zones that are estimated to encompass acoustic levels that could exceed injury or behavioral disturbance thresholds. In order to protect marine mammals, pile driving will not start, or will cease if underway, if marine mammals enter the Level A injury zone. In addition to the Level A shutdown protocol, if cetaceans are seen in the Level B monitoring zone, a pile driving shall cease.

Furthermore, anticipated long-term impacts to primary productivity, invertebrates and forage fish, all of which are potential prey of humpbacks, are localized to the intertidal and nearshore areas adjacent to the bulkhead where humpbacks are unlikely to occur.

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

Section 305(b) of the Magnuson-Stevens Act (MSA) directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. Under the MSA, this consultation is intended to promote the conservation of EFH as necessary to support sustainable fisheries and the managed species' contribution to a healthy ecosystem. For the purposes of the MSA, EFH means "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity", and includes the physical, biological, and chemical properties that are used by fish (50 CFR 600.10). 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) of the MSA also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH. Such recommendations may include measures to avoid, minimize, mitigate, or otherwise offset the adverse effects of the action on EFH [CFR 600.905(b)]

This analysis is based, in part, on the EFH assessment provided by the Navy and descriptions of EFH for Pacific Coast groundfish (Pacific Fishery Management Council [PFMC] 2005), coastal pelagic species (CPS) (PFMC 1998), and Pacific Coast salmon (PFMC 2014) contained in the fishery management plans developed by the PFMC 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 1.3 (Proposed Federal Action) and 2.3 (Action Area). The action area for the proposed project includes habitat which has been designated as EFH for various life stages of Pacific coast groundfish, coastal pelagic species, and Pacific salmon (Table 5).

The action area also includes habitat which has been designated as habitat areas of particular concern (HAPC) for groundfish. Estuaries, sea grass beds, canopy kelp, rocky reefs, and other "areas of interest" (e.g., seamounts, offshore banks, Puget Sound and canyons) are designated HAPCs for groundfish. In general, there is a lack of kelp beds in Hood Canal, with only 0.3 to

0.5 percent of the coastline containing kelp. Eelgrass has a patchy distribution along the subtidal and intertidal areas of the project site and is abundant along the subtidal and intertidal areas of the entire Hood Canal arm as well as Dabob Bay. Groundfish HAPCs within the action area include estuaries and sea grass beds.

A survey of eelgrass and macroalgae was conducted in August 2019 (Navy 2019). A large and continuous patch of native eelgrass was observed in the proposed berthing pier and landward area from an approximate depth range of 0 MLLW to -10 MLLW. Additionally, two other small patches of eelgrass were recorded within the main trestle and shading area. Based on the results of the survey the observed eelgrass appeared healthy with blades two to three feet in length. The topography of the survey area that contained more eelgrass flattens out moving north. The eelgrass was observed to be in higher density patches in the flatter locations of the survey area. Dwarf eelgrass (Zostera japonica) was observed infrequently in very small areas outside of the sampling locations. Substrate for all transects was similar: small gravel, sand, and shell hash. Divers observed that the macroalgae community was diverse and abundant throughout much of the survey area.

Three coastal pelagic species are known to occur in the greater Puget Sound: northern anchovy, Pacific mackerel, and market squid and have been documented in Hood Canal. The definition for coastal pelagic species EFH is based on the geographic range and in-water temperatures where these species are present during a particular life stage (67 Federal Register 2343-2383). EFH for these species includes all estuarine and marine waters above the thermocline where sea surface temperatures range from 50 to 68°F. These boundaries include Hood Canal. Coastal pelagic species have value to commercial Pacific fisheries, and are also important as food for other fish, marine mammals, and birds (63 Federal Register 13833). Coastal pelagic species do not have designated HAPCs.

Table 5: 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			
Coastal Pelagic Species					
Engraulis mordax	Anchovy	X	X	X	X
Scomber japonicas	Pacific mackerel	X			
Loligo opalescens	Market squid	X	X	X	
Pacific Salmon					
Oncorhynchus tshawytscha	Chinook salmon	X	X		
Oncorhynchus kisutch	Coho salmon	X	X		
Oncorhynchus gorbuscha	Pink salmon	X	X		

Habitat areas of particular concern (HAPC) are specific habitat areas, a subset of the much larger area identified as EFH, that play an important ecological role in the fish life cycle or that are especially sensitive, rare, or vulnerable.

In estuarine and marine areas, salmon EFH extends from the extreme high tide line in nearshore and tidal submerged environments within state territorial waters out to the exclusive economic zone (200 nautical miles) offshore of Washington (Pacific Fishery Management Council 2014). Within these areas, EFH consists of four major components: (1) spawning and incubation; (2) juvenile rearing; (3) juvenile migration corridors; and (4) adult migration corridors and adult holding habitat. The action area also includes habitat which has been designated as HAPC for Pacific salmon and include marine SAV.

3.2 Adverse Effects on Essential Fish Habitat

Migratory Pathway Obstruction

The proposed placement of the TPP in aquatic habitat will alter outmigration routes of juvenile salmonids due to physical characteristics of the structure. Juveniles will likely alter their migratory route to navigate around the proposed structures and move into even deeper water. Salo et al. (1980) found that juvenile chum salmon moved offshore around the existing wharves as they migrated north out of Hood Canal. When juveniles leave the shallow nearshore it increases their migration route and will likely increase their risk of predation. The total overwater area of the TPP will be 29,451 square-feet. Therefore, we expect this project to degrade the quality of the migratory corridor and impair safe passage.

Effects on Forage, Cover, and Predation

SAV was documented in the project footprint during the last survey. There is a high likelihood that SAV patches will come and go within the action area within the life of the structure. SAV is important in providing cover and a food base for fish. OWS shade SAV for the life of the structure and can adversely affects primary productivity and SAV if present in the structures shadow zone.

Coastal pelagics, like Northern anchovy, use estuarine habitats such as the intertidal zone, eelgrass, kelp, and macroalgae and could therefore be affected by the impacts on their designated EFH. If any juvenile and sub-adult groundfish are within the action area, some would be expected to be found near the kelp habitat along Naval Base Kitsap Bangor nearshore. The presence of new structures in the water column at the site will alter the suitability for recruitment of some groundfish EFH species, with different species preferring different types of habitat. Juvenile rockfish use habitats that include macroalgae-covered rocks or sandy areas with eelgrass or macroalgae as well as manmade in-water structures. Manmade structures also serve as habitat for sub-adult and adult lingcod, rockfish, and greenling, which are potential predators of juvenile rockfish. Operation of the TPP will result in conversion of soft-bottom substrate to hard substrate (piles) reducing the local availability of these habitats to groundfish EFH species.

Water Quality

Construction of TPP will require installation of up to 124 piles (plus an additional 60 temporary piles). Pile installation will temporarily disturb bottom sediments within the immediate project construction area, resulting in localized increases in suspended sediment concentrations that, in turn, will cause increases in turbidity during the work window. Also, installation and operation of the sound attenuation measures (e.g., bubble curtain) will result in some local resuspension of bottom sediments into the water column. In general, the predominately coarse-grained sediments that occur in most areas of the project site are more resistant to resuspension and have a higher settling speed than fine-grained sediments.

Nearshore habitat disturbance and localized turbidity increases could affect the water column and substrate that is used as EFH by eggs and larvae of EFH species. Northern anchovy do not spawn on Puget Sound beaches but instead spawn year-round in the water column. Species that deposit eggs on, or in, the substrate have potential to be damaged directly by construction activities or smothered by sediments settling out of the water column. Should nearshore spawning habitats be disturbed during the eggs' presence, these eggs could be dispersed into the water column, increasing their risk of predation. Elevated turbidity could alter normal dispersal patterns within the water column, potentially reducing survival. Larvae for a number of species for which EFH has been designated could also be affected by increased turbidity. Changes in turbidity throughout in-water construction activities will be relatively small scale and localized and may affect EFH differently depending on varying life histories. Based on the analysis of water quality effects, along with the BMPs and minimization measures included, all effects to EFH from changes in water quality will be minor and localized, and short in duration.

Sediment quality within the project area is generally good based on contaminant levels that are below marine sediment quality standards. The potential for accidental spills or releases of hazardous materials will be minimized through implementation of spill prevention and response plan to clean up fuel or fluid spills.

Benthic Communities
Temporary (vessel disturbance, anchoring, etc.) and enduring (piling placement, structure and vessel shading, etc.) impacts will disrupt benthic environments and larval/juvenile rearing habitats and food sources. Reduced diversity or density of epibenthic meiofauna reduces prey resources. Marine benthos will be removed where it is growing attached to existing piles. The cumulative impact of numerous and contiguous urban marine structures may be detrimental to the long-term success of numerous species, particularly recovery efforts for anadromous fish species that migrate along shorelines. There will be some loss of benthic habitat, some slow recovery, but other areas will rebound after the disturbance.

Hydroacoustic Obstruction of Habitat
Construction-generated noise has the potential to degrade groundfish, salmon, and coastal pelagic EFH by exposing the EFH to noise above behavioral and possibly injurious thresholds. The proposed action will increase cause sound waves that disrupt the aquatic habitat. The SPL from pile driving and extraction will occur contemporaneous with the work and radiate outward; the effect attenuates with distance. Both vibratory noise with high frequency and impact noise with high amplitude 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.

As stated in Section 2.5.1 in the Biological Opinion, the installation of 124 piles will be permanently installed to support extension of the Service Pier, and 60 steel piles that are installed temporarily will be removed at the conclusion of construction. EFH will experience temporary increases in underwater sound levels during construction. It should be noted that 1) while impact piles driving will be used for proofing, the majority of pile driving will occur using a vibratory pile driver; 2) an attenuation device will be used during impact pile driving of steel piles; 3) steel impact pile driving is anticipated to be required primarily for proofing piles and for a maximum estimated duration of 45 minutes throughout a day; and 4) impact pile driving of concrete piles is estimated to last a maximum of 45 minutes in a day. Coastal pelagic, Pacific coast groundfish, and Pacific coast salmon EFH present within this threshold will be exposed to detectable noise in the water column. Pacific coast groundfish and salmon EFH will be exposed to noise above the injurious threshold as these distances would extend over existing eelgrass shoreward of the project area.

Sound could also occur with the interrelated submarine and support vessel use via engine operation. However, given their electric motors and slow speed, submarine noise is not expected to be detectable above background levels Engine noise from support 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 habitat is expected to continue to function with a comparable level of safe passage.

Shoreline Abutment

Shore-parallel walls (bulkheads, seawalls and revetments) are a commonly used method of protecting estuarine shores because they are affordable, provide protection in limited space, and need not alter the water bottoms. They are a response to sediment starvation, but they also contribute to local sand starvation by preventing erosion of the upland that would otherwise provide sediment to the longshore transport system. They also increase wave reflection, which has been hypothesized as creating greater turbulence and scour. If placed across the active beach, their shore-perpendicular tie-back extensions function as sediment traps and create localized erosion and accretion and change beach profile response (Nordstrom and Jackson, 1992). The structures eliminate beach habitat (for dwelling, spawning, and foraging) by replacing the beach during construction or preventing new beach from forming as the shore is displaced landward through erosion. They also create exotic habitat as a hard structure in a sand or gravel environment.

Shore-parallel structures stabilize the land behind them, which makes the continued erosion of adjacent shorelines even more apparent than prior to their construction. Erosional scarps in adjacent headlands provide evidence that erosion occurs near these structures, but the extent to which bulkheads are responsible for accelerating erosion, and the spatial limits of these local effects, are not clear because there are few measurements of topographic changes near bulkheads on estuarine beaches.

Conservation Actions

The proposed project will have temporary and enduring effects on EFH water bottoms and water columns. These effects culminate in short-term (construction-related) and long-term adverse effects on Pacific Coast groundfish, coastal pelagic species, and Pacific Coast salmon EFH. The proposed action incorporates a number of minimization measures to avoid, reduce, and minimize the adverse effects of the action on EFH. To offset the remaining negative habitat effects, the Navy proposes mitigation though the HCCC ILF program. NMFS ran the NHVM which can be found in Appendix 1. The Navy plans to purchase credits (or the HCCC ILF equivalent) to offset the impacts to EFH.

Summary

Table 6. TPP impacts to EFH.

Pacific Coast Groundfish	All waters and substrate in areas less than or equal to 3,500 m to mean higher high water level or the upriver extent of saltwater intrusion Seamounts in depth greater than 3,500 m as mapped in the EFPH assessment geographic information system	HAPC: Estuaries, canopy kelp, seagrass, rocky reefs, and "areas of interest"
Migratory Pathway Obstruction/Shading	No Effect	May adversely affect
Forage, Cover, and Predation	May adversely affect	May adversely affect
Water Quality	May adversely affect	May adversely affect
Benthic Communities	May adversely affect	May adversely affect
Hydroacoustics	May adversely affect	May adversely affect

Pacific coast groundfish species are considered sensitive to overfishing, the loss of habitat, and reduction in water and sediment quality.

Pacific Coast Salmon Species	All waters from the ocean extent of the EEZ to the shore, and inland up to all freshwater bodies occupied of historically accessible to salmon in Alaska, Washington, Oregon, Idaho, and California	HAPC: Marine and Estuarine Submerged Aquatic Vegetation
Migratory Pathway Obstruction/Shading	May adversely affect	May adversely affect
Effects on Forage, Cover, and Predation	May adversely affect	May adversely affect
Water Quality	May adversely affect	May adversely affect
Benthic Communities	May adversely affect	May adversely affect
Hydroacoustic	May adversely affect	May adversely affect

Pacific salmon EFH is primarily affected by the loss of suitable spawning habitat, barriers to fish migration (habitat access), reduction in water quality and sediment quality, changes in estuarine hydrology, and decreases in prey food source

Coastal Pelagic Species	All marine and estuarine waters above the thermocline from the shoreline offshore to 200 nm offshore	HAPC: None
Migratory Pathway Obstruction/Shading	No Effect	NA

Coastal Pelagic Species	All marine and estuarine waters above the thermocline from the shoreline offshore to 200 nm offshore	HAPC: None
Effects on Forage, Cover, and Predation	May adversely affect	NA
Water Quality	May adversely affect	NA
Benthic Communities	May adversely affect	NA
Hydroacoustic	May adversely affect	NA

Coastal pelagic species are considered sensitive to overfishing, loss of habitat, reduction in water and sediment quality, and changes in marine hydrology

3.3 Essential Fish Habitat Conservation Recommendations

Section 305 (b)(4)(A) of the MSA requires NMFS to provide EFH Conservation Recommendations for any federal action or permit that may result in adverse impacts to EFH. Therefore, NMFS recommends the following to ensure the conservation of EFH and associated marine fishery resources:

1. The Navy should:
    c. Adhere to the in-water work window
    d. When conducting in-water work between October 15th, 2019 and January 15th, 2020, the Navy should monitor for spawning forage fish.
    e. Utilize vibratory pile driving whenever sediment conditions allow.
    f. Utilize sound attenuation measure(s) (double walled piles, wooden block, bubble curtain, etc.) for all steel impact pile driving.
    g. Only install
        i. 10 24-inch steel fender piles
        ii. 14 30-inch steel guide piles
        iii. 100 36-inch steel support piles
        iv. 60 36-inch temporary steel falsework piles
    h. During each day of pile driving, vibratory pile driving will last no more than five hours and impact driving will last no more than 45 minutes in total time each day.
    i. Steel piles will receive no more than 1,600 pile strikes during a work-day. Using a strike rate of 44-45 strikes/minute for steel or 38 strikes/minute for concrete, less than 45 minutes of impact driving will occur per day.
    j. Develop and Implement an Acoustic Monitoring Plan. The Acoustic Monitoring Plan will include the submission of a report to NMFS regarding the results of acoustic monitoring.
2. The Navy should use grating instead of solid decking where feasible.

3. The Navy should reduce, dim, or turn off nighttime lighting when not necessary for operations.

4. The Navy should continue to work to complete the INRMP; continued coordination with NMFS should incorporate relevant recovery plan actions.

5. Preserve and enhance EFH by providing new gravel for spawning areas (beach nourishment).

6. Fit all pilings and navigational aids, such as moorings and channel markers, with devices to prevent perching by piscivorous birds and mammals.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, [insert agency name] must provide a detailed response in writing to NMFS within 30 days after receiving an EFH Conservation Recommendation. 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 Conservation Recommendations 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 the measures proposed by the agency for avoiding, minimizing, mitigating, or otherwise offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the Conservation Recommendations, 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 conservation recommendations 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 conservation recommendations accepted.

3.5 Supplemental Consultation

The U.S. Navy 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 Conservation Recommendations (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 is the U.S. Navy. Other interested users could include the U.S. Army Corps of Engineers, the HCCC, the Skokomish Tribe, the Jamestown S'Klallam Tribe, the Washington State Department of Ecology, Kitsap County, industry, municipalities, recreational boaters and fishers, and Non-Governmental Organizations interested in conservation. Individual copies of this opinion were provided to the U.S. Navy. The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. 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 and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

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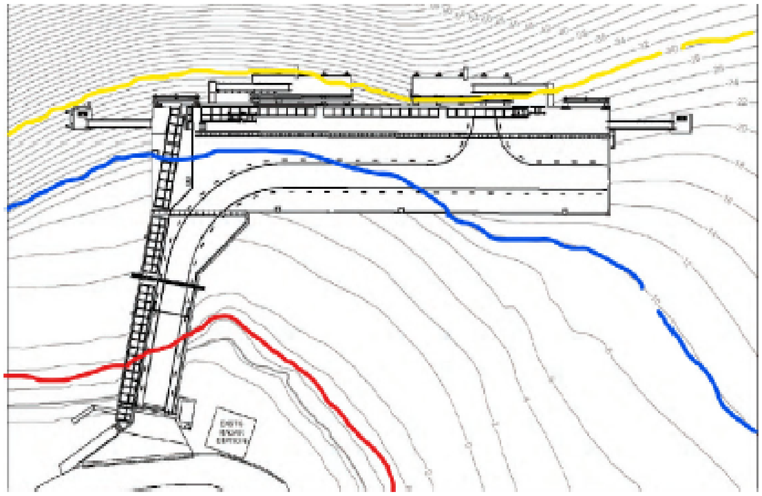
APPENDIX 1. TPP NHVM

Blue cells contain Section Headings				
Rose cells contain questions that need to be answered to fill out calculator.				
Grey cells contain units requested for entry.				
Yellow cells indicate user entry fields.				
Green cells contain additional explanations and resource links.				
Maroon cells contain summary values.				
Action Agency Reference #	USNavy			
FWS or NMFS #	WCRO-2020-00066			
Project Name	Transit Protection Program Pier and Support Facilities			
Prepared on and by:	L. Abernathy 1-15-21			
Puget Sound Nearshore Conservation Calculator				
			Version:	11/5/2020
This calculator estimates conservation points for the Puget Sound nearshore.				

		Conservation Credits/Debits	DSAYs	Notes
Overwater Structures	Debit	-2723	-27.23	
	Credit	2	0.02	Includes credits from creosote removal
	Balance	-2721	-27.21	
Shoreline Armoring	Debit	-127	-1.27	
	Credit from Armor Removal	0	0.00	
	Credit from Creosote Removal	0	0.00	
	Balance	-127	-1.27	
Maintenance Dredging	Balance	0	0.00	
Boatramps, Jetties, Rubble	Debit	0	0.00	
	Credit	14	0.14	Rubble removal
	Balance	14	0.14	
Beach Nourishment	Credit	0	0.00	
Riparian Enhancement/Degradation	Conservation Points	0	0.00	
Total Points		-2834	-28.34	

We included the project details tab to encourage users to detail the metrics needed to fill out the calculator worksheets here.
Record where you found the relevant information (JARPA, BE, other)
If you have to perform calculations like determining the average elevation of the toe of hard armoring, explain details here.



Bottom left off page to Red: USZ
Red to Blue: LSZ
Blue to upper page limits: DSZ
Yellow: end of nearshore -30

USZ	length/nur	width	area		
trestle	38	39	1482		
pilings	17	3	51		

LSZ	length	width	area		
trestle	76	39	2964		LSZ total
pier	299	34	10166		13130
pilings	70	3	210		

DSZ	length	width	area	DSZ solid total			
pier	299	35	10465	11961			
remaining pier	44	34	1496				
pilings	37	3	111		x2		
camel 1	65	12	780		1560	camel x 2	GRATED FLOAT
camel 2	65	12	780				GRATED
Camel brow	50	5	250		500	camel brow x 2	GRATED
Camel Access Platform	14	4	56		112		GRATED
Mooring Dolphins	12	12	144		288	mooring dol. X 2	GRATED
Mooring dolph. Brow	41	5	205		410	mooring dol. brow X :	GRATED
mooring piles	4	3	12		24	mooring piles x 2	

Bulkhead 99'8"

debris removal 5031

approxiamtely 30% of trestle

Guessed 73 piles on pier, 51 piles on trestle

split pier in half (LSZ and DSZ)
34 (trestle) + 36 (1/2 of pier)

OWS tab
8E
10E
12E
13/14E
14/15E
16/17E
23/24/E *need to fix this in calc

DZ solid	DZ grated
11961	1310

TOTAL Owcoverage
29443

North Mooring Dolphin Brow
North Camel Access Platform
Pier to North Camel Brow
North Camel (grated): 65'-0" x

1516

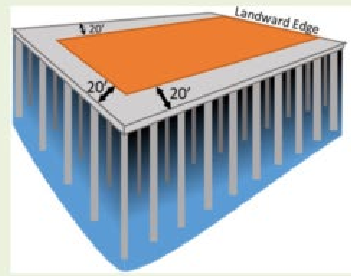
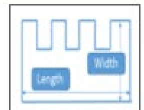
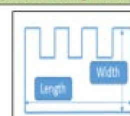
South Mooring Dolphin Brow
South Camel Access Platform
Pier to South Camel Brow
South Camel (grated): 65'-0" x

Impact and Benefit Determination for Overwater Structure Elements

To expand an entry block for data entry click on the + sign on the left. Clicking the 2 will expand all entry blocks. **Version:** 11/5/2020

Entry Block I: Overwater structure Entry for New or Expansion Overwater Structure Elements

Enter new overwater structure elements in this entry block and all areas that are considered expansions with replacements. Enter replacement overwater structure elements in Entry block II below.

SAV	Must enter vegetation scenario for LSZ (See Table 1 on "Summary" Tab)	Enter LSZ SAV scenario 0-3		1	Reference: LSZ SAV Scenarios	Addition of USZ vegetation scenarios planned for next version
	Description	**OWS Element**	**Units**	**Quantity**	**Total Conservation Debits**	**Notes and Examples**
Pier and Ramp to be Installed	Enter dimensions of elevated pier and ramp in respective shore zone. If a pier has partial grating, enter dimensions of grated and ungrated portions into respective fields. Enter central portions of piers wider than 40 feet as floats as there is little side lighting in such structures.	Pier & Ramp USZ fully grated	SqFt	0	0.00	To account for the dark center on wide decks, enter the deck area within 20 feet from the edge as pier, and enter the deck area more than 20 feet from the edge as a float. See Figure below. FYI: Forage fish credit factors do not apply to piers and ramps. Figure by Lee Corum (USFWS) 
		Pier & Ramp USZ solid	SqFt	1482	-50.43	
		Pier & Ramp LSZ fully grated	SqFt	0	0.00	
		Pier & Ramp LSZ solid	SqFt	13130	-627.61	
		Pier & Ramp DZ fully grated	SqFt	1310	-14.46	
	Reference: Delineation of Shore Zones	Pier & Ramp DZ solid	SqFt	11961	-218.97	
Piles	Piles can be steel, concrete, plastic, untreated wood or, outside of DNR land, ACZA-treated and urea coated piles. Installation of creosote wood is not included. Use pile calculator below to determine average pile diameter.	Enter number of piles in USZ		6	-74.78	
		Enter average diameter of piles in USZ.	[inches]	34.55		
		Enter number of piles in LSZ		60	-561.02	
		Enter average diameter of piles in LSZ.	[inches]	34.55		
		Enter number of piles in DZ		58	-234.92	
		Enter average diameter of piles in DZ.	[inches]	34.55		
Grated Float to be Installed	Enter the length and width of the float in the appropriate shore zone (see Table 2). For complex floats, enter longest outside dimensions of float. See Example Complex Float 1	USZ Outside dimensions of new float or expanded portion of float.	Length [feet]	0	Enter length and width of floats for buffer determination. For complex floats, enter the sum of the length of each float and the average width of the floats. **Set length and width to 0 for zones where no structure present.**	 Example Complex Float
			Width [feet]	0		
		LSZ Outside dimensions of new float or expanded portion of float.	Length [feet]	0		
			Width [feet]	0		
		DZ Outside dimensions of new float or expanded portion of float.	Length [feet]	130		
			Width [feet]	24	Reference: Complex Floats	**Buffer Area**
	The area of the float in each respective shore zone is calculated from length and width entered above. For complex floats, the user should directly enter the square footage of the float in the appropriate zone. BMP: Floats should not be located in the USZ and cannot ground out.	Grated Float USZ	SqFt	0	0.00	- For complex floats the calculated SqFt will not match the actual SqFt. Enter SqFt manually in column E.
		Grated Float LSZ	SqFt	0	0.00	-
		Grated Float DZ	SqFt	1560	-33.38	2,840.00 Floats in the DZ in herring spawning & holding areas may have herring factor applied.
...t to be Installed	Solid float have higher adverse effects on the nearshore environment compared to grated floats. We highly encourage applicants to grate overwater structures as much as possible. Because of the higher impacts from solid floats compared to grated floats, resulting conservation debits are higher. Enter the length and width of the float in the appropriate shore zone (see Table 2). For complex floats, enter longest outside dimensions of float. See Example Complex Float 1	USZ Outside dimensions of new float or expanded portion of float.	Length [feet]	0	Enter length and width of floats for buffer determination. For complex floats, enter the sum of the length of each float and the average width of the floats. **Set length and width to 0 for zones where no structure present.**	 Example Complex Float
			Width [feet]	0		
		LSZ Outside dimensions of new float or expanded portion of float.	Length [feet]	0		
			Width [feet]	0		
		DZ Outside dimensions of new float or expanded portion of float.	Length [feet]	0		
			Width [feet]	0	Reference: Complex Floats	**Buffer Area**

Section	Description	OWS Element	Units	Quantity	Conservation Debits		Notes and Examples
Solid Fl[oat]	Area of float in respective shore zone calculated from length and width entered above. For irregularly shaped floats, enter the square footage of the float in the appropriate zone (see Notes for more information on irregularly shaped floats). BMP: Floats should not be located in the USZ and cannot ground out.	Solid Float USZ	SqFt	0	0.00	0	For complex floats the calculated SqFt will not match the actual SqFt. Enter SqFt manually in column E.
		Solid Float LSZ	SqFt	0	0.00	0	
		Solid Float DZ	SqFt	0	0.00	0	Floats in the DZ in herring spawning & holding areas may have herring factor applied.
	Sub-Total: Conservation Debits Owed for Replacement Structure Elements				0.00		

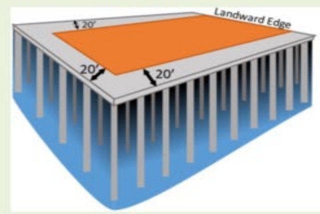
Debit Factors associated with Installation of OWS

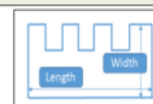
	Site Specific Debit Factors for OWS Installation	Percent more credit		Notes and Examples
For new, expansion, or replacement projects	Is the project located within 5 miles of a Puget Sound Chinook natal estuary zone or within 1 mile of a Hood Canal summer-chum estuary zone? Puget Sound Natal & Pocket Estuaries	Yes	50%	Reference: Application of Credit Factors Projects located within a natal Chinook or HC summer chum estuary zone will owe 50% more debits. If a project is in a pocket estuary and within a natal Chinook or HC summer chum estuary zone, a combined 90% more debits apply.
	Is the project is located within a pocket estuary? Puget Sound Natal & Pocket Estuaries	No	0%	Projects located within a pocket estuary owe 30% more conservation debits. If the pocket estuary is within 5 miles of a natal Chinook estuary, 40% more debits apply.
	Is there observed (as mapped or determined by WDFW) sand lance or surf smelt spawning on the project site? WDFW Forage Fish Spawning Map	Yes	50%	In areas with forage fish spawning, 50% more conservation debits apply to forage fish affecting action elements.
	Is there herring spawning on the project site? WDFW Forage Fish Spawning Map	No	0%	In areas with forage fish spawning, 50% more conservation debits apply to forage fish affecting action elements.

Entry Block III: Overwater Entry Block for Removal of Overwater Structure Elements

Determine benefits from both structures to be removed as part of replacements or from structures in close proximity to be removed as mitigation for new structures.

SAV	Must enter vegetation scenario for LSZ (See table 1)	Enter SAV scenario 0-3		0	Reference: LSZ SAV Scenarios		
	Description	**OWS Element**	**Units**	**Quantity**	**Conservation Credits for removal of Existing Structures**		**Notes and Examples**
Pier and Ramp to be Removed	Enter dimensions of elevated pier and ramp in respective shore zone. If a pier has partial grating, enter dimensions of grated and ungrated portions into respective fields. Enter central portions of piers wider than 40 feet as floats as there is little side lighting in such structures.	Pier & Ramp USZ fully grated	SqFt	0	0.00		To account for the dark center on wide decks, enter the deck area within 20 feet from the edge as pier, and enter the deck area more than 20 feet from the edge as a float. See Figure below. FYI: Forage fish credit factors do not apply to piers and ramps.
		Pier & Ramp USZ solid	SqFt	0	0.00		
		Pier & Ramp LSZ fully grated	SqFt	0	0.00		
		Pier & Ramp LSZ solid	SqFt	0	0.00		
		Pier & Ramp DZ fully grated	SqFt	0	0.00		
	Reference: Delineation of Shore Zones	Pier & Ramp DZ solid	SqFt	0	0.00		
Piles to be removed	Include all piles to be removed including creosote. The amount of creosote is credited separately below. Use pile calculator below to determine average pile diameter.	Enter number of piles in USZ		0	0.00		
		Enter average diameter of piles in USZ.	[inches]	0			
		Enter number of piles in LSZ		0	0.00		
		Enter average diameter of piles in LSZ.	[inches]	0			
		Enter number of piles in DZ		0	0.00		
		Enter average diameter of piles in DZ.	[inches]	0			
Creosote Removal	Creosote removal: Enter tons of creosote to be removed including all in- and over water creosote between HAT and -30 meters. Usually a 70-ft long 12-inch average diameter pile weighs about 1 ton. A volume calculator is provided below.	Tons of Creosote to be removed in USZ	Total in tons	0	0.00		Benefit duration for creosote removal is 100 years. Absent removal of piles, we assume that derelict piles on average break off after 40 years. Thus site specific credit factors apply for 40 years, only.
		Tons of Creosote to be removed in LSZ & DZ	Total in tons	1	2.16		
Grated Float to be Removed	Enter the length and width of the float in the appropriate zone. For complex floats, enter longest outside dimensions of float. See Example Complex Float 1	USZ Outside dimensions of float area	Length [feet]	0	Set length and width to 0 for zones where no structure present.		
			Width [feet]	0			
		LSZ Outside dimensions of float area.	Length [feet]	0			
			Width [feet]	0			
		DZ Outside dimensions of float area.	Length [feet]	0			
			Width [feet]	0		Buffer Area	
	Area of float in respective shore zone calculated from length and width entered above. For irregularly shaped floats, enter the square footage of the float in the appropriate zone. BMP: Floats should not be located in the USZ and cannot ground out.	Grated Float USZ	SqFt	0	0.00	0	For complex floats the calculated SqFt will not match the actual SqFt. Enter SqFt manually in column E.
		Grated Float LSZ	SqFt	0	0.00	0	
		Grated Float DZ	SqFt	0	0.00	0	Floats in herring spawning and holding areas may have herring spawning factor applied.
Solid Float to be Removed	Enter the length and width of the float in the appropriate zone. For complex floats, enter longest outside dimensions of float. See Example Complex Float 1	USZ Outside dimensions of solid float.	Length [feet]	0	Set length and width to 0 for zones where no structure present.		Enter length and width of floats for buffer determination. For complex floats, used sum of length of each float and average width of floats .
			Width [feet]	0			
		LSZ Outside dimensions of solid float	Length [feet]	0			
			Width [feet]	0			
		DZ Outside dimensions of solid float	Length [feet]	0			
			Width [feet]	0		Buffer Area	
	Calculated area of float in respective shore zone sections: LSZ and DZ. Floats should not be located in the USZ. If float has to be placed in USZ use LSZ tab to approximate impact determination. This impact determination assumes 50% float grating with 60% or more open space.	Solid Float USZ	SqFt	0	0.00	0	For complex floats the calculated SqFt will not match the actual SqFt. Enter SqFt manually in column E.
		Solid Float LSZ	SqFt	0	0.00	0	
		Solid Float DZ	SqFt	0	0.00	0	Floats in herring spawning and holding areas may have herring spawning factor applied.
	Sub-Total: Conservation Credits for Removal of Existing Structures				2.16		





Example Complex Float 1

Credit Factors associated with Removal of OWS - modified application for creosote removal

	Site Specific Credit Factors for OWS Removals	Percent more credit		Notes and Examples
Credit Factors for Removals	Is the project located within 5 miles of a Puget Sound Chinook natal estuary zone or within 1 mile of a Hood Canal summer-chum estuary zone? Puget Sound Natal & Pocket Estuaries	Yes	50%	Reference: Application of Credit Factors Projects located within a natal Chinook or HC summer chum estuary zone will receive 50% more credits. If a project is in a pocket estuary and within a natal Chinook or HC summer chum estuary zone, a combined 90% more credits apply.
	Is the project is located within a pocket estuary? Puget Sound Natal & Pocket Estuaries	No	0%	Projects located within a pocket estuary get 30% more removal credits. If the pocket estuary is within a natal Chinook or HC summer chum estuary zone, 40% more credits will be awarded.
	Is there observed (as mapped or determined by WDFW) sand lance or surf smelt spawning on the project site? WDFW Forage Fish Spawning Map	Yes	50%	In areas with forage fish spawning, 50% more removal credits will be awarded to forage fish affecting action elements.
	Is there herring spawning on the project site? WDFW Forage Fish Spawning Map	No	0%	In areas with herring spawning, 50% more removal credits will be awarded to forage fish affecting action elements.

Impact and Benefit Determination for Shoreline Armoring

No mitigation is required for soft or hybrid stabilization.		11/5/2020

Replacements and New Installations

Site Conditions Landward of Hard Armoring up to HAT		
Description	**Quantity in sqft**	**Notes**
Enter SF of impervious area behind hard armoring and below HAT. If HAT is unknown, use area within 30 ft of bulkhead.	1	**The conditions described here need to match the before conditions in the RZ tab if any changes in the RZ are proposed to be evaluated.** Evaluate habitat improvements through tree or shrub planting in the riparian tab separately. This section assesses the value of the habitat rendered inaccessible to fish via armoring. The inputs here are used to determine percentage of each habitat type behind armoring and below HAT. Thus, **if just one habitat type is present it is sufficient to enter a 1 into the respective row.** If there is a 50% split of the area between two habitat types, enter a 1 into each row for respective habitat types. For more complicates scenarios enter respective SqFt.
Enter area with herbaceous vegetation like lawn behind hard armoring and below HAT. If HAT is unknown use area within 30 ft of bulkhead.	0	
Area with shrubs and trees behind hard armoring and below HAT. If HAT is unknown use area within 30 ft of bulkhead.	0	

Armoring to be installed.		
Is this a replacement or repair? Enter "No" if a new structure is being installed	No	
Description	**Quantity**	**Notes**
Pick type of Shoreline Armoring to be installed	linear feet	Consider using soft and hybrid armoring to avoid habitat impacts. For definitions of soft and hybrid armoring see the User Guide.
How many linear feet of proposed armoring will be sloped and/or rock?		
How many linear feet of proposed armoring will be vertical armoring including concrete, sheet pile, or wood?	99.67	
Location: **Slope Distance** of Toe of Armoring Relative to MHHW	linear feet	See user guide for methods of determining slope distance and default slope distances per foot elevation.
Is the toe of the to be installed armoring at or below MHHW? Enter No if it is above.	No	
How many linear feet **slope distance** is the 'to be installed' armoring below or above MHHW. Enter 0 if toe of armoring is at MHHW.	7.79	
Distance between HAT and MHHW [ft slope distance]	10.13	Use 25 ft as default distance between HAT and MHHW if unknown. Source: NMFS determined average of 4 beach profiles, see calculator user guide for more information.
Pick cover type of upper intertidal vegetation waterward of existing or new armoring.		
Must enter USZ vegetation scenario	1	Reference: USZ vegetation scenarios
Conservation points owed for replacement shoreline armoring	-63.42035094	
Additional points owed for new shoreline armoring	-63.42035094	

Removal of Existing Armoring

Old Armoring to be removed		
Description	**Quantity**	**Notes**
Enter duration of site protection	Years	
Replacements: Default for replacement of exiting armoring is 10 years, If armor is non-functioning at time of permit application no removal credit is given for armor removal. Enter 0 below in C 27 and 28. Removals: Enter duration of easement or deed restriction. Enter 10 for none, 50 for in perpetuity.	10	Due to expected sea level rise we cannot provide credit for durations longer than 50 years.
Pick type of Shoreline Armoring to be removed	linear feet	
How many linear feet of proposed armoring will be sloped and/or rock?	0	
How many linear feet of proposed armoring will be vertical armoring including concrete, sheet pile, creosote pile or wall? For creosote removal also enter quantity of creosote proposed to be removed below.	0	
Location: Slope Distance of Toe of Armoring Relative to MHHW	linear feet	
Is the toe of the to be removed armoring at or below MHHW? Enter No if it is above.	Yes	
How many linear feet **slope distance** is the 'to be removed' armoring below or above MHHW. Enter 0 if toe of armoring is at MHHW.	0	See user guide for methods of determining slope distance.
Distance between HAT and MHHW [ft slope distance]	0	Use 25 ft as default distance between HAT and MHHW if unknown. Source: NMFS determined average of 4 beach profiles.
Pick cover type of upper intertidal vegetation waterward of existing armoring.		
Must enter USZ vegetation scenario (See Table 2)	0	
Conservation points gained from old armor removal.	0	
Water Quality Benefits for Creosote removal.	tons of creosote	Conservation points for creosote removal
Enter tons of creosote associated with shoreline armoring to be removed. Usually a 70-ft long 12-inch average diameter pile weighs about 1 ton.	0	Reference: Pile Volume Calculator
Conservation points gained from creosote removal.	0.00	

Crediting and Debiting Factors for Shoreline Armoring

Site Specific Credit and Debit Factors for Shoreline Armoring		Percent more credit/debit	Notes
Is the project located within 5 miles of a Puget Sound Chinook natal estuary zone or within 1 mile of a Hood Canal summer-chum estuary zone? Puget Sound Natal & Pocket Estuaries	Yes	50%	Projects located within a natal Chinook or HC summer chum estuary zone owe/receive 50% more debits/credits. If a project is in a pocket estuary and within a natal Chinook or HC summer chum estuary zone, a combined 90% more debits/credits apply.
Is the project is located within a pocket estuary? Puget Sound Natal & Pocket Estuaries	No	0%	Projects located within a pocket estuary owe/receive 30% more conservation debits/credits. If the pocket estuary is within a natal Chinook or HC summer chum estuary zone, 40% more debits/credits apply.
Is there observed (as mapped or determined by WDFW) sand lance or surf smelt spawning on the project site? WDFW Forage Fish Spawning Map	Yes	50%	In areas with forage fish spawning, 50% more conservation debits/credits apply.
Is the armoring within the same drift cell and updrift of sand lance or surf smelt spawning on the project site? Coastal Atlas Map	Yes	0%	In areas updrift of forage fish spawning, 20% more conservation debits/credits apply if there is no forage fish spawning on site.
Is the project located at a feeder bluff? Coastal Atlas Map	No	0%	For armoring at feeder bluffs, 50% more conservation credits/debits apply.
Herring Spawning - Evaluate effects case by case. WDFW Forage Fish Spawning Map	No	0%	Is there herring spawning on the project site AND does the project affect herring spawning? Depending on the elevation of the shoreline armoring and other projects specific aspects, armoring may or may not affect herring spawning. If there is herring spawning on site, this determination will be made by a NMFS, USFWS, WDFWS, or COE biologist.
Summary Credit/Debit Factor	2.25	2.25	Increases in debits/credits based on special habitat and site conditions. Some credits are multiplied others added depending on underlying biological relationships.

Impact and Benefit Determination for Concrete Boat Ramps, Jetties, Concrete Rubble

To expand an entry block for data entry click on the + sign on the left. Clicking the 2 will expand all entry blocks. **Version:** **11/5/2020**

Entry Block I: Entry for New and Expanded Elements of Existing Structures

Enter new boat ramps, jetties, and breakwaters in this entry block and all areas that are considered expansions of existing or proposed to be replaced structures. Enter replacement structure elements in Entry block II below.

Boat ramp Installation

		Description	Units	Quantity		
Vegetation Conditions	USZ	Must enter USZ vegetation scenario before installation (See summary tab table 2). SAV after is 0.	Enter vegetation scenario 0-3	0	Reference: Delineation of Shore Zones	
	LSZ	Must enter LSZ vegetation scenario before installation (See summary tab table 1). SAV after is 0.	Enter LSZ SAV scenario 0-3	0		Reference: LSZ SAV Scenarios
		Description	**Units**	**Quantity**	**Conservation Points**	**Notes**
Boat ramp Installation		Is this a Boat ramp installation? "No" indicates installation of concrete footings, or similar with no impact on water quality or shore drift (USZ).	yes/no	No		
	USZ	Pick type of upper intertidal vegetation before installation. Select 0 for replacements. Select "Yes" if saltmarsh vegetation cover is:				
		length of boat ramp to be installed	Ft	0		Length is used to estimate area where interruption of longshore drift occurs.
		width of boat ramp to be installed	Ft	0		
		Area of boat ramp, concrete footing, or similar to be installed	SqFt	0.00	0.00	Includes impact to longshore drift from boat ramps and jetties for E10 = yes. If e10 = "no", area of to be installed concrete or similar substrate covering structure can be entered directly in E14.
	LSZ	Area of boat ramp, concrete footings, or similar to be installed	SqFt	0	0.00	No shored drift interruption considered for LSZ.
	DZ	DZ: Area of boat ramp to be installed	SqFt	0	0.00	No shored drift interruption considered for DZ.
		Jetty Installation				
		Description	**Units**	**Quantity**		**Notes**
Vegetation Conditions	USZ	Must enter USZ vegetation scenario before installation (See Ref. tab). SAV after is 0.	Enter vegetation scenario 0-3	0		
	LSZ	Must enter LSZ vegetation scenario before installation (See Ref. Tab). SAV after is 0.	Enter LSZ SAV scenario 0-3	0		Reference: LSZ SAV Scenarios
		Description	**Units**	**Quantity**	**Conservation Points**	**Notes**
Jetty Installation	USZ	length of jetty to be installed	Ft	0		Length is used to estimate area where interruption of longshore drift occurs.
		width of jetty to be installed	Ft	0		
		USZ: Area of jetty to be installed	SqFt	0	0.00	
	LSZ	LSZ: Area of jetty to be installed	SqFt	0	0.00	No shored drift interruption considered for LSZ.
	DZ	DZ: Area of jetty to be installed	SqFt	0	0.00	No shored drift interruption considered for DZ.
		Conservation points owed by installation.		**Total**	**0.00**	

Entry Block II: Entry for Replacement Structures

Enter replacement boat ramps, jetties, and breakwaters in this entry block. Enter to be removed structure elements in Entry block III below.

Boat ramp Replacement

		Description	Units	Quantity	Conservation Points	Notes
Vegetation Conditions	USZ	Must enter USZ vegetation scenario before installation (See summary tab table 2). SAV after is 0.	Enter vegetation scenario 0-3	0	Reference: Delineation of Shore Zones	
	LSZ	Must enter LSZ vegetation scenario before installation (See summary tab table 1). SAV after is 0.	Enter LSZ SAV scenario 0-3	0		
		Description	**Units**	**Quantity**	**Conservation Points**	**Notes**

Jetty Replacement	USZ	length of jetty to be installed	Ft	0		Length is used to estimate area where interruption of longshore drift occurs. Interruption of longshore drift debit is recorded in G47.
		width of jetty to be installed	Ft	0		
		USZ: Area of jetty to be installed	SqFt	0	0.00	
	LSZ	LSZ: Area of jetty to be installed	SqFt	0	0.00	No shored drift interruption considered for LSZ.
	DZ	DZ: Area of jetty to be installed	SqFt	0	0.00	No shored drift interruption considered for DZ.
		Conservation points owed by replacement	**Total**		**0.000**	
Entry Block III: Entry for Removal of old Structures						
Enter square footage of old boat ramps, jetties, and breakwaters proposed to be removed or replaced in this entry block.						
Boat ramp and Concrete Rubble Removal						
Vegetation Conditions	USZ	Must enter USZ vegetation scenario before installation (See table 1). SAV after is 0.	Enter vegetation scenario 0-3	0	Reference: Delineation of Shore Zones	
	LSZ	Must enter LSZ vegetation scenario before installation (See table 1). SAV after is 0.	Enter LSZ SAV scenario 0-3	1		
		Description	**Units**	**Quantity**	**Conservation Points for Removal of Old Structures**	**Notes**
Boat ramp and Concrete rubble Removal		Is this a Boat ramp removal? "No" indicates removal of rubble or concrete pieces.	yes/no	No		Boat ramp has to be in functioning conditions for boat ramp removal credit. Otherwise enter as rubble.
	USZ	length of boat ramp to be removed	Ft	0		
		width of boat ramp to be removed	Ft	0		
		Area of boat ramp, concrete, or rubble to be removed; incl. shoreline drift restored by boat ramp removal	SqFt	0.00	0.00	For the removal of several piece of concrete or rubble you may enter the combined square footage in E62 rather than enter in length and width.
	LSZ	Area of boat ramp, concrete, or rubble to be removed	SqFt	460	6.08	No shored drift interruption considered for LSZ.
	DZ	Area of boat ramp, concrete, or rubble to be removed	Ft	4571	8.06	No shored drift interruption considered for DZ.
Jetty Removal						
Vegetation Conditions	USZ	Must enter USZ vegetation scenario before installation (See table 1). SAV after is 0.	Enter vegetation scenario 0-3	0	Reference: Delineation of Shore Zones	
	LSZ	Must enter LSZ vegetation scenario before installation (See table 1). SAV after is 0.	Enter LSZ SAV scenario 0-3	0		
		Description	**Units**	**Quantity**	**Conservation Points for removal of Old Structures**	**Notes**
Jetty Removal	USZ	length of jetty to be removed	Ft	0		Length is used to estimate impact from interruption of longshore drift.
		width of jetty to be removed	Ft	0		
		USZ: Area of jetty to be removed	SqFt	0	0.00	
	LSZ	LSZ: Area of jetty to be removed	SqFt	0	0.00	No shored drift interruption considered for LSZ.
	DZ	DZ: Area of jetty to be removed	SqFt	0	0.00	No shored drift interruption considered for DZ.
		Conservation points gained from removal	**Total**		**14.14**	

	Site Specific Credit and Debit Factors for Boat ramps, Jetties, and Rubble.		**Percent more Credit/Debit**	**Notes**
Crediting/Debiting Factors	Is the project located within 5 miles of a Puget Sound Chinook natal estuary zone or within 1 mile of a Hood Canal summer-chum estuary zone? Puget Sound Natal & Pocket Estuaries	Yes	50%	Projects located within a natal Chinook or HC summer chum estuary zone owe/receive 50% more debits/credits. If the action is located within a pocket estuary within a natal estuary zone, a combined 90% more debits/credits apply.
	Is the project is located within a pocket estuary? Puget Sound Natal & Pocket Estuaries	No	0%	Projects located within a pocket estuary owe/receive 30% more conservation debits/credits. If the pocket estuary is within a natal Chinook or HC summer chum estuary zone, 40% more debits/credits apply.
	Is there observed (as mapped or determined by WDFW) sand lance or surf smelt spawning WDFW Forage Fish Spawning Map	Yes	50%	In areas with forage fish spawning, 50% more conservation debits apply to forage fish affecting action elements.
	Is the structure within the same drift cell and updrift of sand lance, or surf smelt spawning Coastal Atlas Map	Yes	0%	In areas updrift of forage fish spawning, 20% more conservation debits/credits apply if there is no forage fish spawning on site.
	Is there herring spawning on the project site? WDFW Forage Fish Spawning Map	No	0%	In areas with forage fish spawning, 50% more conservation debits apply to forage fish affecting action elements.