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-2024-00351

July 2, 2024

Captain John W. Hale
Naval Base Kitsap
120 South Dewey Street, Building 443
Bremerton, Washington 98314-5022

Re: Endangered Species Act Section 7(a)(2) Biological Opinion , Section 7(a)(4) Conference Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Tang Road Repairs Project, Naval Base Kitsap - Bangor, Kitsap County, Washington (6th Field HUC 171100180108).

Dear Captain Hale:

Thank you for your letter of February 2, 2024, 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 the Tang Road Repairs Project. In this opinion, NMFS concludes that the proposed action is not likely to jeopardize the continued existence of Puget Sound (PS) Chinook salmon, Hood Canal summer-run (HCSR) chum, PS steelhead, Puget Sound/Georgia Basin (PS/GB) bocaccio, PS/GB yelloweye rockfish, and Southern Resident (SR) killer whale.

Per 50 CFR § 402.10, we have also completed a conference concurrence (ESA Section 7(a)(4)) evaluating the effects of the proposed program of activities on sunflower sea star (*Pycnopodia helianthoides*),[1] as it is currently a species proposed for listing under the ESA. A concurrence issued at the conclusion of the conference may be adopted as the final concurrence when the species is listed or critical habitat is designated, but only if no significant new information is developed (including that developed during the rulemaking process on the proposed listing or critical habitat designation) and no significant changes to the federal action are made that would alter the content of the concurrence. Hereafter, the combination of the biological opinion and conference concurrence are referred to as a singular "Opinion."

We conclude that the proposed action is not likely to adversely affect the continued existence of sunflower sea star.

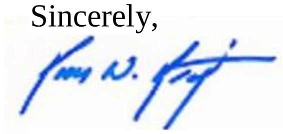
As required by section 7 of the Endangered Species Act, the NMFS provided an incidental take statement with the biological opinion. The incidental take statement describes reasonable and prudent measures the NMFS considers necessary or appropriate to minimize incidental take associated with this action. The take statement sets forth nondiscretionary term and conditions. Incidental take from actions that meet the term and condition will be exempt from the Endangered Species Act take prohibition.

[1] https://www.federalregister.gov/documents/2023/03/16/2023-05340/proposed-rule-to-list-the-sunflower-sea-star-as-threatened-under-the-endangered-species-act

NMFS also reviewed the likely effects of the proposed action on essential fish habitat (EFH) pursuant to Section 305(b) of the Magnuson–Stevens Fishery Conservation and Management Act [16 U.S.C. 1855(b)], and concluded that the action would likely adversely affect the EFH of Pacific Coast salmon, Pacific Coast groundfish and coastal pelagic species. Therefore, we have included the results of that review in Section 3 of this document.

Please contact Tyler Yasenak of the Oregon/Washington Coastal Area Office at (206) 207-0092, or by email at tyler.yasenak@noaa.gov 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: Rebecca Johnson, Natural Resource Manager
Amy Fowler, Marine Biologist

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

Tang Road Repairs Project, Naval Base Kitsap – Bangor

NMFS Consultation Number: WCRO-2024-00351

Action Agency: U.S. Navy

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely to Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely to Destroy or Adversely Modify Critical Habitat?
PS Chinook salmon (*Oncorhynchus tshawytscha*)	Threatened	Yes	No	N/A	N/A
Hood Canal summer-run Chum (*O. keta*)	Threatened	Yes	No	N/A	N/A
PS steelhead (*O. mykiss*)	Threatened	Yes	No	N/A	N/A
PS/GB bocaccio (*Sebastes paucispinis*)	Endangered	Yes	No	N/A	N/A
PS/GB yelloweye rockfish (*S. ruberrimus*)	Threatened	No	No	N/A	N/A
SR killer whale (*Ocinus orca*)	Endangered	No	No	No	No
Sunflower Sea Star[2] (*Pycnopodia helianthoides*)	Proposed Threatened	No	No	N/A	N/A

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

Consultation Conducted By: National Marine Fisheries Service, West Coast Region

Issued By:

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

Date: July 2, 2024

[2] Conference Opinion

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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 U.S.C. 1531 et seq.), as amended, and implementing regulations at 50 CFR part 402.

We also completed an essential fish habitat (EFH) consultation on the proposed action, in accordance with section 305(b)(2) of the Magnuson–Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801 et seq.) and implementing regulations at 50 CFR part 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 at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. A complete record of this consultation is on file at NMFS Lacey Office.

1.2. Consultation History

This biological opinion is based on the information provided in the February 2, 2024, biological assessment (BA) and supporting documents. The U.S. Navy (Navy) requested formal consultation on February 22, 2024. On February 22, 2024, NMFS initiated formal consultation. On April 16, 2024 and May 14, 2024, NMFS requested additional information regarding project effects. The Navy responded to these requests on April 17, 2024 and May 15, 2024, respectively.

On May 9, 2024, NMFS Engineering and Physical Sciences Branch certified that the project will meet NOAA fish passage standards. A complete record of this consultation is on file at the Oregon Washington Coastal Office located in Lacy, Washington.

The Navy concluded that the proposed action is likely to adversely affect (LAA) PS Chinook salmon (*Oncorhynchus tshawytscha*), and HCSR chum salmon (*O. keta*), and PS steelhead (*O. mykiss*).

The Navy concluded that the proposed action is not likely to adversely affect (NLAA) PS/GB Bocaccio (*Sebastes paucispinis)*; however, due to the potential for this species to be in the nearshore, NMFS has concluded that the proposed action is likely to adversely affect this species.

The Navy further concluded that the proposed action is not likely to adversely affect PS/GB yelloweye rockfish (*S. ruberrimus*) and sunflower sea star (*Pycnopodia helianthoides*). NMFS concurs with these Navy determinations.

Finally, the Navy determined the proposed action would have *no effect* on Southern Resident DPS killer whales (*Orcinus orca*) and Mexico DPS and Central America DPS humpback whales (*Megaptera novaeangliae*) and *no effect* on designated critical habitat for Puget Sound ESU Chinook salmon, Hood Canal summer-run ESU chum salmon, Puget Sound/Georgia Basin DPS bocaccio, and Puget Sound/Georgia Basin DPS yelloweye rockfish within the Action Area. A no effect call does not trigger consultation and these species will not be considered within this document.

On June 25, 2024, the Navy revised its effect call on SR killer whales (*Ocinus orca*), to Not Likely to Adversely Affect and NMFS has concurred in this document that the proposed action is not likely to adversely affect SR killer whale.

NMFS also reviewed the likely effects of the proposed action on EFH, and concluded that the action would adversely affect the EFH of Pacific Coast salmon, Pacific Coast groundfish and coastal pelagic species.

Updates to the regulations governing interagency consultation (50 CFR part 402) were effective on May 6, 2024 (89 Fed. Reg. 24268). We are applying the updated regulations to this consultation. The 2024 regulatory changes, like those from 2019, were intended to improve and clarify the consultation process, and, with one exception from 2024 (offsetting reasonable and prudent measures), were not intended to result in changes to the Services' existing practice in implementing section 7(a)(2) of the Act. 89 Fed. Reg. at 24268; 84 Fed. Reg. at 45015. We have considered the prior rules and affirm that the substantive analysis and conclusions articulated in this biological opinion and incidental take statement would not have been any different under the 2019 regulations or pre-2019 regulations.

1.3. Proposed Federal Action

Under the ESA, "action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies (see 50 CFR 402.02). 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 proposed action consists of repairs to an existing mechanically stabilized earth (MSE) wall along Tang Road, replacement of a fish passage barrier with a fish passing culvert, and the restoration of the pocket estuary and salt marsh associated within Hunter's Marsh. The repairs to Tang Road include the proposed steel sheet pile wall; the roadway replacement; and rebuilding Explosive Handling Wharf (EHW-1) pier revetments. The estuary restoration would be accomplished via excavation of the existing freshwater-dominated Hunter's Marsh and the subsequent placement of habitat features and salt-tolerant plantings.

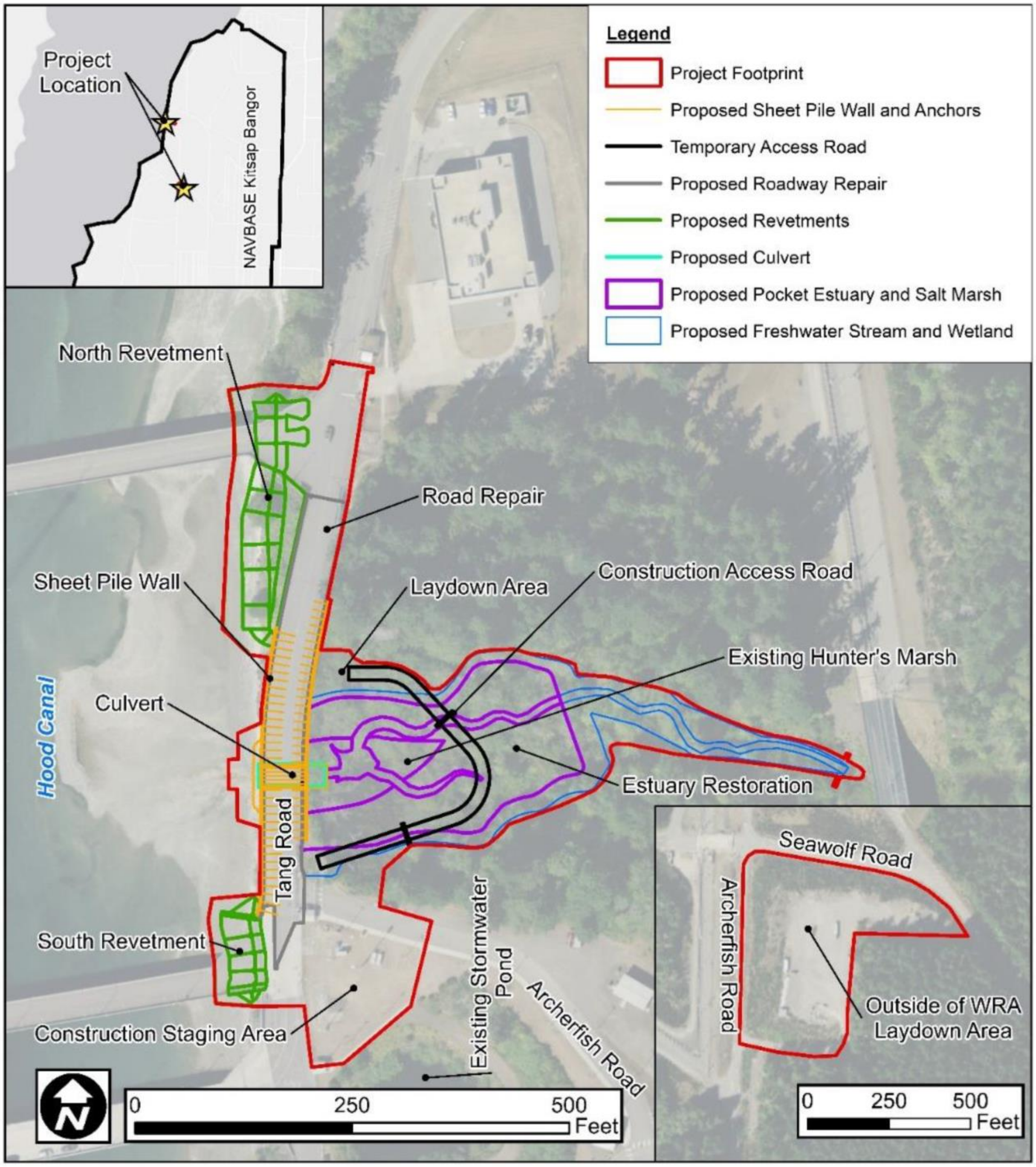

Figure 1. Project Overview.

The project is needed because Tang Road's asphalt pavement surface shows signs of failure, as observed by pavement cracks during routine inspections. Additionally, due to the hydrostatic buildup from the beaver dam impoundment, water is seeping through the existing MSE seawall causing sediment migration out of the wall and from sinkholes, further degrading the roadway and revetment subbase materials.

The purpose of the project is as follows:

- Repair Tang Road MSE seawall and repair/replace the existing riprap shore protection under pier revetments.
- Repair/replace the asphalt and concrete surface of the roadway and reroute utilities.
- Complete removal of the beaver dam impoundment and relieve hydrostatic pressure on the Tang Road embankment.

To relieve the hydrostatic buildup of Hunter's Marsh, the Navy proposes to replace the existing undersized culvert with a 25-foot wide by 10-foot high box culvert and remove approximately 8 feet of accumulated sediment from Hunter's Marsh.

Mobilization and Site Preparation

Prior to the construction of the main elements of the proposed action, the laydown areas along Archerfish and Seawolf Roads and Tang Roads would be prepared to stage equipment and materials (Figure 1). Additionally, the existing fencing on and along Tang Road would be removed from the roadway and sidewalks and disposed off-site. If necessary (due to ongoing beaver and associated beaver dam management), the beaver dam would be breached to allow for the draining of Hunter's Marsh. Once the dam is breached, temporary isolation (sandbags) and dewatering systems (sump/bypass lines) would be placed in Hunter's Marsh to prepare the site for a temporary access road and control any turbid waters exiting the site. Additionally, any resident fishes within Hunter's Marsh would be excluded following 2023 Washington State Department of Transportation (WSDOT) Fish Exclusion Methods (WSDOT 2023). Contained waters may need to be treated before being discharged to a constructed outfall with a splash pad into Hood Canal and would be monitored and treated following the project BMPs and stormwater plans.

Once the dewatering and isolation measures are in place, temporary erosion and sediment control (TESC) measures (e.g., silt fence) would be placed around the limits of the work on the landward side of Tang Road. Once the TESC measures are placed, the temporary access road into Hunter's Marsh would be constructed using off-site sourced fill material and would span the length of Hunter's Marsh. Two 12-inch temporary drainage culverts would be placed under the access road to assist in water management during construction. A temporary laydown area (0.04 acres) would also be constructed in the northeast corner of Hunter's Marsh. The restoration area would be cleared and grubbed to prepare the site for the proposed restoration and would be replanted with native shrubs, salt tolerant plants, and emergent vegetation post project.

Construction Access and Laydowns

Materials laydowns areas would be required to store construction material, load and unload trucks, and conduct other construction support activities. Laydown locations have been identified, with one located along Archerfish and Seawolf Roads, one along Tang and Archerfish Roads, and one within Hunter's Marsh to assist with the dewatering of the marsh. The laydown area along Archerfish and Seawolf Roads would be located in upland locations and outside of environmentally sensitive area.

Material and equipment laydowns would be conducted consistent with BMPs established in the BA (including consistency with erosion and sediment control and water quality protection and monitoring plans for the project), and consistent with conditions of permits issued for the project. All currently vegetated disturbed areas would be revegetated upon project completion consistent with the requirements of permit authorizations.

In-Water Work Area Isolation

To minimize impacts to water quality and ESA-listed species, work below the high tide line (HTL) of Hood Canal would be restricted to one in-water work window (July 16 to January 15). All work below the HTL of Hood Canal would be conducted in the dry during low tide to minimize impacts to ESA-listed species.

A temporary stream diversion would be installed prior to in-water work activities within Hunter's Marsh to divert flow through or around the work area. The temporary stream diversion would be sized to convey at minimum the expected two-year seasonal peak flow rate during the period of construction. A sandbag and plastic sheeting cofferdam would be installed by hand at the upstream end of the diversion to isolate flow from the construction area and discharge to a riprap outlet into Hood Canal. Once isolated, fish exclusion, capture, handling, and relocation measures would be conducted to remove all fishes from the impact area. Due to the approximately 5-foot water surface drop at the culvert inlet, no ESA-listed species are anticipated to be handled as part of this work. The temporary stream diversion would have a fish screen and be pumped up and over Tang Road during construction. The contractor would reposition and maintain the temporary stream diversion as needed to perform construction activities. Work below the HTL would be completed, and temporary stream diversion would be removed prior to the end of the in-water work window.

Temporary Cofferdam Installation at Culvert Outlet

Prior to the demolition of the existing culvert, Tang Road would be closed, and a vibratory pile drive would be mobilized on the road to install temporary steel sheet piles below the HTL on Hood Canal along a distance of approximately 97 linear feet of Hood Canal shoreline to construct a temporary cofferdam. No impact pile driving would be conducted for this project. The temporary steel sheet piles would connect to the periods when the tide does not exceed +8.00 feet above mean lower low water (MLLW) to ensure that construction is conducted in the dry during low tide. The steel sheet piles would be installed from the roadway and take approximately one workday to complete during a single low tide cycle. The steel sheet piles would be sealed to the MSE wall through watertight methods to be determined by the contractor but are recommended to consist of a removable steel sheet pile section with an applied waterproof sealant. Contractor would apply the sealant on the falling tide, such that it would be dried/cured prior to contact with marine waters.

Culvert Replacement

The proposed action includes the replacement of an existing culvert that crosses under Tang Road. The existing culvert would be replaced with a culvert that is designed consistent with the

Washington Department of Fish and Wildlife's (WDFW) current guidance for Water Crossing Design (Barnard et al. 2013).

Once the temporary cutoff cofferdam is installed, the demolition of the existing culvert would begin. The following list describes the general construction sequence with a detailed description of the activities to follow:

General Culvert Replacement Sequence

- Demolish the existing roadway.
- Excavate into roadway base, removing sections of the MSE wall as it progresses.
- Bridge the existing utilities in the roadway.
- Setup sumps once the excavation reach the existing culvert.
- Demolish the existing culvert.
- Prepare the base course for the precast culvert.
- Place the new culvert.
- Backfill the culvert and replace MSE wall panels.
- Replace utilities in-kind.
- Finish subgrade of the roadway.
- Finish repaving the roadway.
- Reinstall roadway controls (e.g., guardrails and light poles).

The roadway demolition would begin by removing the asphalt and concrete road base via contractor determined means and methods. Asphalt may be stored in an upland laydown area for reuse, while the concrete would be taken off site for disposal. Once the roadway is removed, excavations into the subgrade would commence with sections of the MSE wall removed in line with the excavations. During this time, existing utilities in the subgrade of the roadway (e.g., storm sewer, water, communications, etc.) would be braced by a temporary utilities bridge through the rest of this phase of work. The excavations would result in a 1.2 to 1 slope down to the required depth for tidal reconnections and width for installing the new wider precast culvert. Once the excavation reaches beach level, a sump would be placed along the landward side of the temporary cofferdam to dewater the culvert excavation site. Pumped water would be required to meet state water quality standards prior to being discharged to Hood Canal.

Following demolition, the proposed culvert subgrade would be prepared. A four-sided 25-foot by 10-foot by 77-foot precast concrete box culvert would be placed on top of the base course. The culvert would arrive at the site as a three-sided culvert with the top placed on site to complete the box. Prior to the top placement, the culvert bottom would be lined (to a nominal depth of 2 feet) with cobble and streambed gravel/silt mix to mimic natural stream bed conditions and reduce scour from tidal ebbs and flows. The culvert would act as a bottomless culvert, with the culvert base being placed approximately 8 feet below the HTL at 5.15 feet MLLW and approximately 3 feet below the existing beach level of approximately 8 feet MLLW. Once the culvert bottom is lined, the completed box structure would be backfilled, and MSE wall sections would be replaced in-kind as the roadway is backfilled. Prior to final compaction and finishing, the excavated sections of the utilities would be replaced in kind.

Revetment Repair

Concurrent with the temporary cofferdam installation at the start of the in-water work window, the existing revetments under the north and south trestles of the EHW-1 and the existing revetment along the northwest section of Tang Road would be repaired. The current revetments have experienced settlement, erosion, and loss of riprap from wave action. The proposed action would repair the deficiencies of the revetments by embedding the toe of the revetment, placing a revetment crest, applying underlying filter stone, and placing larger riprap pieces to withstand the anticipated wave action for the site. The north revetment (including along Tang Road) would constitute approximately 263 linear feet of shoreline, while the south revetment would occur along approximately 98 linear feet of Hood Canal shoreline. The revetment would not be significantly expanded from the original footprint, with approximately 88 cubic yards of material being installed below the HTL. Revetment repairs would correspond to periods where the tide does not exceed +8.00 feet above MLLW for the north revetment and +7.00 feet above MLLW for the south revetment so mechanized work can be completed in the dry, during low tide. Tidal inundation of the excavation is expected and will be minimized via the placement of turbidity curtains around the excavation.

The revetment construction means and methods would ultimately be determined by the contractor, but typical methods involve using a small, soft tracked excavator that would be lowered on the beach from Tang Road. The excavator would remove the existing revetments and prepare the site for the proposed revetment refurbishments. The excavated material would be removed from the beach via an excavator staged on Tang Road and brought to an approved upland location for temporary storage. No equipment would be operated during high tides. The shore work and excavator lifting would only occur from the roadway or revetment above the HTL (barges would not be used given the tight clearances between the EHW-1 trestle pilings). Turbidity curtains would be installed around the revetments during construction to reduce turbidity that may be caused by the active excavation activities. Once the existing revetments are removed, a base layer of filter rock would be placed and the riprap would be placed on top of the filter rock. The embedded portion of the revetments would be covered with the native beach material matching the existing grade up to the proposed riprap prism. Once the revetments are constructed, the turbidity curtains would be removed and the stockpiled beach material taken to an approved upland laydown area for disposal.

MSE Wall Repair

Upon completion of the culvert replacement, the MSE wall repairs would commence. The proposed action includes driving steel sheet pile within 2 feet of the existing wall via two vibratory pile drivers, on both the seaward and landward sides of the road, and operated from the roadway. No impact pile-driving methods would be used to achieve the desired wall stability. The seaward sheets would be driven in the dry when the tide does not exceed +10.00 feet above MLLW, within the areas where the HTL reaches the existing wall elevation. For the areas that the existing wall elevation is above the HTL, sheets may be driven during any tide condition. Approximately 132 linear feet of steel sheet pile would be installed below the HTL of Hood Canal. Installation of steel sheet pile wall is recommended to start on the seaward side of the MSE and begin at the intersection with the new culvert to ensure a full sheet aligns with the culvert and there is a tight connection at this junction. Pile production would proceed to the north and to the south of the finished culvert outlet on both sides for a period of approximately 23 days with all steel sheet pile vibratory driving occurring in the daytime. Similarly, the steel sheet piles on the landward side of the roadway are recommended to start at the culvert inlet and work north and south, respectively. Vegetation and debris will be cleared and grubbed within the limits of the sheet pile wall on both sides to minimize potential void space during backfilling as described below. Additionally, to maintain the isolation of the pocket estuary during the driving of steel sheet piles that intersect the temporary cofferdam, a temporary steel sheet pile section would need to be installed to act as a cutoff wall through the pocket estuary construction phase. This temporary section of steel sheet pile wall would need to be connected to the existing MSE wall by contractor means the methods. As the estuary restoration is completed, this connection of this temporary cofferdam section to the MSE wall would need to be removed temporarily to clear space for steel sheet pile driving of the permanent seawall. The sequence would include removing the connection of the temporary steel sheet pile wall section to the MSE wall, driving the permanent steel sheet pile, and then reconnecting and resealing the temporary cofferdam section to the permanent steel sheet pile. This activity would need to be completed within one low tide cycle to maintain cutoff from high tide inundation.

As part of the steel sheet pile wall installation, the void space between the steel sheet piles and MSE wall would be filled with structural fill (e.g., injected grout) and the anchored tiebacks would be installed from equipment staged on Tang Road. The grout would be placed in the dry, while the upstream bypass, dewatering sumps, and the temporary Hood Canal cofferdam are still in place to minimize the potential for uncured rout to contact site waters. Final concrete pile caps would be cast-in-place and epoxied to the top of the steel sheets piles to complete the wall repair.

Roadway Repair

Upon completion of the culvert replacement and MSE wall repair, the roadway would be replaced in-kind. The roadway would consist of an asphalt surface and two concrete V-gutters from the north to south pier. The roadway would be crowned and consist of an asphalt concrete surface placed by a paver. The V-gutters for drainage would be cast-in-place and replace the existing catch inlets in-kind. Two non-curbed walkways would be built on the outside of the roadways with most of the security fences, lighting, guardrails, and gates replaced in-kind after the roadway repair is completed. Two final sections of fencing would be placed after the access road to Hunter's Marsh and the temporary cofferdam in Hood Canal are removed. The stormwater from the roadway would be conveyed to an existing stormwater pond for treatment prior to discharge to Hood Canal.

Hunter's Marsh Pocket Estuary and Salt Marsh Restoration

The pocket estuary and salt marsh restoration associated with Hunter's Marsh would include five general zones of habitat improvements (Figure 2).

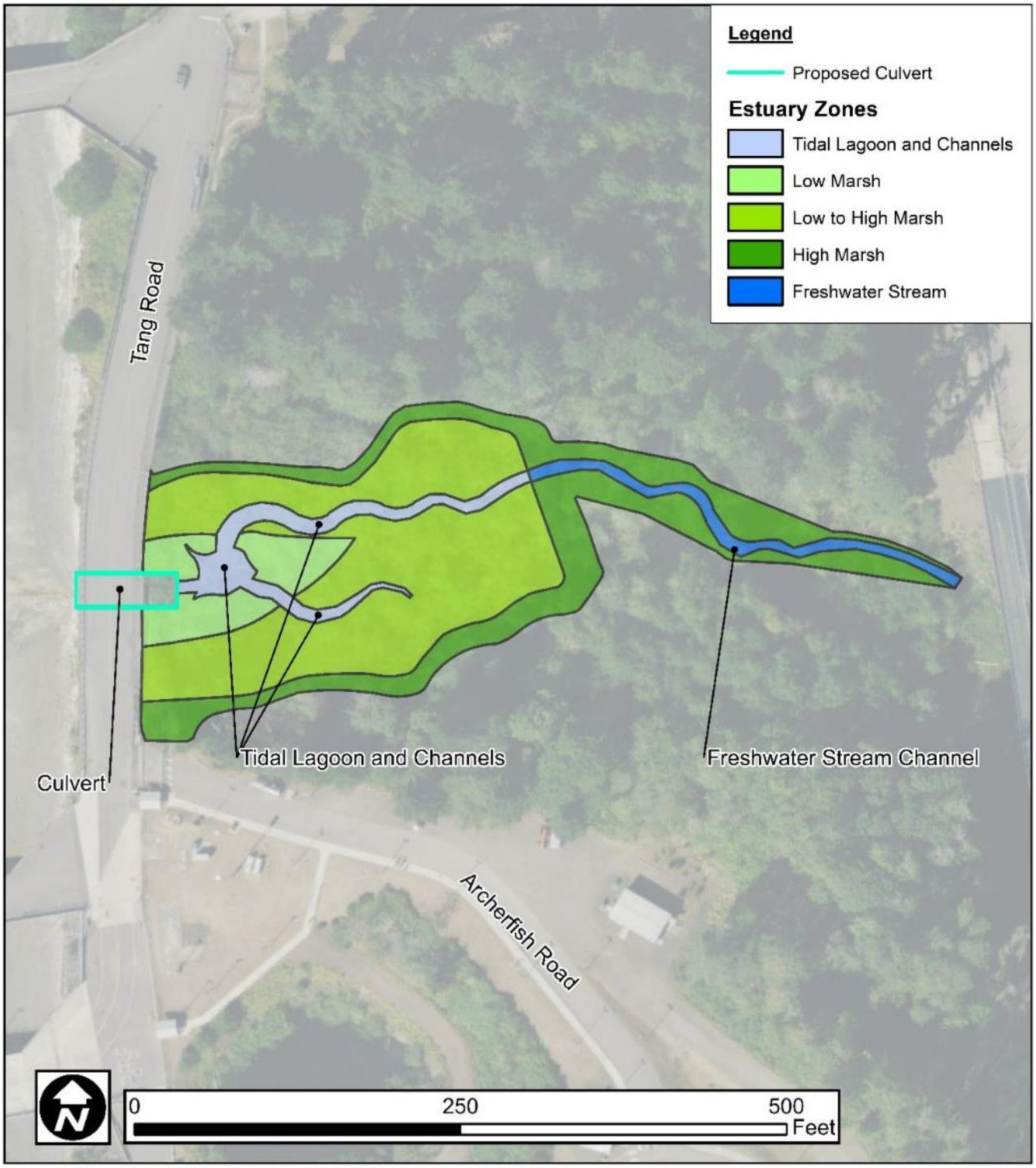

Figure 2. Pocket Estuary Restoration Zones.

The pocket estuary restoration zones are described below and are described in the Estuary Design Report (WSP 2023a).

Tidal lagoon and channels: This area would be frequently inundated and for such prolonged durations that vegetation would not become established from 1 foot below the culvert elevation (+7.14 feet MLLW to +9.14 feet MLLW).

Low Marsh: This area would be constructed above the tidal lagoon and channels (+9.14 feet MLLW) approximately up to mean higher water (MHHW) (+11.07 feet MLLW), where tides would shallowly flood for short durations, and vegetation tolerant to high salinity levels would be planted and allowed to establish.

Low to high Marsh: This area would be constructed between the MHHW (+11.07 feet MLLW) to the highest astronomical tide (HAT) (+12.89 feet MLLW). This area may not be inundated by daily tides; however, it would still be considered a saline-driven habitat where salinity levels would still generally be over 0.5 parts per trillion. This area is the transition zone between salt tolerant vegetation to those that are low to moderately salt tolerant.

High Marsh: This area would be the upper fringe of the pocket estuary, above the Hat level (+12.89 feet MLLW), and may only be inundated during surge events, wave action, or salt spray. This area would be dominated with low to moderately salt tolerant vegetation up to non-salt tolerant species along the outer fringes of this zone.

Freshwater stream: This area would be constructed from the upper edge of the low marsh to the existing stream alignment at the easternmost portion of the Hunter's Marsh work. The stream restoration would restore habitat availability and function with Hunter's Marsh and within a portion of its inlet stream to Hunter's Marsh.

The pocket estuary restoration builds on the culvert replacement described above and includes the creation of a tidal lagoon and channels, low to high marsh zones; placement of habitat features; and planting of native vegetation.

The larger span culvert would allow for a greater tidal exchange by lowering the invert elevation of the existing culvert. The existing Hunter's Marsh area would be dewatered via sumps installed and operated during the site preparation phase and would be excavated to form the pocket estuary zones described above. The marsh would need to be excavated to match beach elevation due to multiple years of accumulated sediment that is currently approximately 8 feet higher in elevation that Hood Canal's MHHW. Excavated materials would be brought to an upland disposal location along Archerfish Road and Seawolf Road. Upon excavation of each of the zones, the freshwater stream channel bed would have cobbles and a gravel/silt mix placed in lifts. Large woody material (LWM) would be sourced as documented in the construction contract. It is assumed trees scheduled to be removed that meet LWM standard would be used on site with additional LWM coming from off-site sources. LWM would be placed within the active channel to encourage natural geomorphic processes and provide cover and habitat diversity within the stream channel. The tidal lagoons, channels, and low marsh would also have LWM scattered throughout the areas to reduce erosion and scour along the fringes and to provide cover and habitat complexity in the pocket estuary. Once the excavations and LWM have been placed, the site would have approximately 1 foot of topsoil placed in planting areas and trees, shrubs, and emergent plugs would be placed into their corresponding zones based on their salinity tolerance. It is anticipated that in the short-term post-project condition, there would be excess sediment outflow from the restored pocket estuary as plants are establishing and the pocket estuary soils are inundated and stabilized. In the long-term, it is not anticipated that the fine sediment accumulation in the pocket estuary from the impoundment would produce excess sediment leaving the site. The proposed pocket estuary excavation would remove a majority of this accumulated material adjacent to the culvert inlet and it is unlikely to result in long-term sediment outflows greater than the conservatively estimated 45 cubic yards of sediment outflow based on the Sediment Transport Study (WSP 2023b). Additionally, outside of the proposed excavation area, existing topography is predominantly low gradient with a vegetation community that consists of a well-established emergent layer dominated by a dense rush (*Juncus spp*.) and shrub layer consisting of predominantly willow (*Salix spp*.) which would slow and detain water that sheet flows into the pocket estuary and restored stream channel.

Site Demobilization and Temporary Cofferdam Removal

Upon completion of the pocket estuary restoration, the temporary cofferdam would be removed via a vibratory pile driver operated from the completed roadway on Tang Road. The work would be done in the dry and timing would correspond to periods where the tide does not exceed +8.00 feet above MLLW and would occur during the approved in-water work window. Once the sheets are removed, the culvert outlet would be graded to match the existing beach slope and tidal exchange would be allowed to enter the restored pocket estuary. The final roadway fencing would be replaced, and the main project elements would be complete. The construction access road into the marsh and the in-marsh construction laydown would be restored and planted with native vegetation. The upland laydown area near the stormwater pond would be decompacted via ripping and smoothing prior to being seeded with grass similar to the pre-existing condition and all equipment and materials would be taken off site.

Stormwater Runoff Treatment

The existing roadway does not provide flow control/treatment for all the existing stormwater generated from Tang Road. The sinkholes and settlement of the roadway from the piping of fines through the wall has allowed stormwater to exit the roadway as sheet flow and channelized into Hood Canal and Hunter's Marsh. As part of the proposed action, the roadway would be repaired, with the road being crowned to flow to a V-gutter on both the east and west sides of the roadway. The sidewalks would also be sloped to flow to the V-gutters and would be collected at catch basins along the southern portion of the roadway. The catch basins are piped to a stormwater pond to the south of the project area and provides flow control and settlement of suspended solids. The stormwater pond is a wet-pond and provides settling of suspended solids only, with the overflow pipe leading to a riprapped splash pad that outlets to Hood Canal.

Post-Project Site Restoration

Project construction would occur within the existing Hunter's Marsh. Construction areas and the laydown within the marsh and upland laydown would be cleared and grubbed and any vegetation that would remain would be clearly marked and protected. Construction of the proposed action would result in temporary impacts to upland and riparian/wetland vegetation within the project area. Vegetation temporarily removed for construction in upland and riparian/wetland areas would be replanted with native species appropriate for the area and resodded for the laydown south of Archerfish Road and east of Tang Road.

Project Timeline and Sequencing

The construction schedule anticipates construction to last six months, occurring during one in-water work window, and would occur in one phase of construction. Navy operations constraints would require overnight work for all construction activities. Contractor schedules, weather, materials, and equipment could influence the duration of construction, including the addition of double shifts during the road closure.

Best Management Practices (BMPs)

BMPs would be used during all construction activities to eliminate or minimize potential environmental effects. BMP measures include erosion and sediment control, structural erosion control, sediment retention, water quality/quantity control, and stormwater treatment during project construction and operations. These BMPs would be included in the TESC plan; Spill Prevention, Control and Countermeasures (SPCC) Plan; Water Quality Monitoring and Protection Plan (WQMPP); and Stormwater Pollution Prevention Plan (SWPPP) for the project. Many of the BMPs listed below are standard and would generally apply to many project construction activities; however, actual site conditions would require additional measures or use other methods, as necessary, in the field. Changes in BMPs types or methods are not likely to change the effects to species. However, if any change does result in a new effect to listed species not previously addressed, the Navy would reinitiate consultation with the Services.

The proposed project would further avoid and/or minimize effects to natural resources in the project area through the measures described as follows:

General Measures and Conditions:

- Construction impacts would be confined to the minimum area necessary to complete the project.
- The contractor would clearly flag the boundaries of clearing limits to prevent disturbance outside of the limits. The contractor shall install high-visibility fencing or silt fence in accordance with proper installation techniques.
- All silt fence, high-visibility fence, and BMPs would be removed upon completion of the project.
- Work below the HTL of Hood Canal would be conducted within the marine in-water work window (July 16 to January 15).
- All work would be performed according to the requirements and conditions of the regulatory permits issued by pertinent agencies.
- Vibratory pile driving would be restricted to daytime hours with crepuscular period restrictions (2 hours after sunset to 2 hours before sunrise).
- Lighting used during overnight work would be directed away from Hood Canal.
- A WQMPP for conducting water quality monitoring, to satisfy the monitoring and reporting requirements of the Water Quality Certification that would be issued for the

project. The WQMPP would identify the timing and methodology for water quality sampling during construction of the project, as well as methods of implementation and reporting.
- Excess or waste materials would not be disposed of or abandoned waterward of the HTL or allowed to enter waters of the United States. Waste materials would be disposed of in an appropriate manner consistent with applicable local, state, and federal regulations.

Vegetation Removal/Clearing and Grubbing Minimization Measures
- The approved impact areas would be clearly marked in the field.
- Existing riparian vegetation outside of the work area would not be removed or disturbed.
- Equipment would be cleaned prior to use on site to avoid invasive species introduction.

Spill Prevention, Control, and Countermeasures
- The contractor would be required to prepare a SPCC plan and SWPPP prior to beginning construction. All pollutants that may occur because of project construction would be handled and disposed of in a manner that does not contaminate soil or water. The contractor would develop and follow an SPCC plan that includes the following elements:
    - Project-specific information.
    - Spill Prevention, control, and containment methods.
    - Response protocols and reporting procedures for construction-related leaks or spills.
    - Contingency plan and provisions.
    - Waste disposal methods and locations.
    - Proper management of oil, gasoline, and solvents used din the operation and maintenance of construction equipment.
- Equipment would be fueled and maintained at least 150 feet from the HTL of any surface waters, using secondary containment to minimize potential for spills or leaks entering the waterway.
- All equipment to be used for construction activities would be cleaned and inspected prior to arriving at the project area, to ensure no potential hazardous materials are exposed, no leaks are present, and the equipment is functioning properly. Daily inspection and cleanup procedures would be identified.
- Should a leak be detected on heavy equipment used for the project, the equipment would be immediately removed from the area and not used again until adequately repaired. Where off-site repair is not practicable, the SPCC plan and SWPPP would document measures to be implemented to prevent and/or contain accidental spills in the work/repair area to ensure no contaminants escape containment to surface waters and cause a violation of applicable water quality standards.
- Process water generated on site during construction, demolition, or washing activities would be contained and treated to meet applicable water quality standards before entering or reentering surface waters.
- No paving, chip sealing, or stripe painting would occur during periods of rain or wet weather.

Below HTL Work Minimization Measures

- Seasonal restrictions would be applied to work conducted below the HTL, it would follow the approved marine in-water work window (July 16 to January 15), and Water Quality Standards for Surface Waters of the State of Washington (Washington Administrative Code [WAC] Chapter 173-201A). While there would be work below HTL, work would be implemented during the low tide cycles to avoid in-water work.
- Construction equipment would not enter any waterbody without authorization from USFWS and NMFS. Equipment would be operated as far from the water's edge as possible.
- Excavation activities shall be accomplished in the dry. If not possible, either the in-water work area would be isolated from the rest of the waterbody and surrounding riparian areas, or flows would be diverted around the area of construction using appropriate features. If isolation takes place, all surface water flowing towards the excavation shall be diverted through use of cofferdams and/or berms. Cofferdams and berms would be constructed of sandbags, clean rock, steel sheeting, or other non-erodible material. All isolation and/or diversion techniques would be conducted using approved methods.
- Excavated material would be removed to a location that would prevent its reentry into waters of the United States or State and disposed of properly at an approved upland location or landfill.

Work Area Isolation and Fish Handling Measures

- The Hunter Marsh culvert is a fish passage barrier so there would be no anadromous fish species present in Hunter's Marsh during construction. Therefore, no ESA listed fish species would be handled during the dewatering of the marsh and installation of the temporary diversion. Any resident fishes within Hunter's Marsh would be removed from the work area prior to any work activities in the marsh after approval by the Services. Fish exclusion activities would follow the 2023 updated WSDOT protocol that has been approved by NMFS and USFWS (WSDOT 2023).
- The intake pump within the fish-bearing inlet stream would have a fish screen installed, operated, and maintained. Screening techniques would follow the specifications in the most recent NMFS Anadromous Salmonid Passage Facility Design Manual (NMFS 2023) and NMFS Fish Screening Criteria for Anadromous Salmonids (NMFS 1997).

Site Erosion and Sediment Control Measures

- The contractor would designate at least one employee as the Erosion and Sediment Control (ESC) lead. The ESC lead would be responsible for the installation and monitoring of erosion control measures and maintaining spill containment and control equipment. The ESC lead would also be responsible for ensuring compliance with all state and federal erosion and sediment control requirements.
- Erosion control devices (e.g., silt fence) would be installed as needed to protect surface waters and other aquatic areas. Actual locations would be specified in the field, based upon site conditions.
- Silt fences would be inspected immediately after each rainfall, and at least daily during prolonged rainfall. Sediment would be removed as it collects behind the silt fences and prior to their final removal. All silt fencing and staking would be removed upon project completion.

- Material that would be temporarily stored for use in project activities shall be covered with plastic or other impervious material to prevent sediments from being washed from the storage area to surface waters.
- All temporary and permanent erosion and sediment control measures would be inspected on a regular basis, maintained, and repaired to ensure continued performance of their intended function.
- A TESC Plan would be developed and implemented for all project requiring clearing, vegetation removal, grading, ditching, filling, embankment compaction, or excavation. The BMPs in the plan would be used to control sediments from all vegetation removal or ground-disturbing activities.
- Where site conditions support vegetative growth, native vegetation indigenous to the location would be planted in areas temporarily disturbed by construction activities. Revegetation of construction areas would occur after the project is completed. Upland, wetland, and riparian vegetation would be replanted with species native to geographic region. Planted vegetation would be maintained and monitored to meet regulatory permit requirements.

Stormwater Quality and Quantity Minimization Measures

- The Navy would ensure that projects within 200 feet of surface water would install and maintain BMPs as stated in the contract to ensure that no foreign materials, such as pavement slurry from asphalt grinding equipment, is sidecast, and to control and prevent sediments from entering aquatic systems.
- The contractor shall comply with Ecology's State Water Quality Standards (WAC 173-201) or permit modifications. Permit modifications are limited to an extended temporary area of mixing granted by Ecology in a 401 Water Quality Certification. The mixing zone of Hood Canal should not extend more than 150 feet from project activities.
- The contractor would be required to prepare and implement a SWPPP to minimize impacts associated with clearing, vegetation removal, grading, filling, compaction, or excavation. The BMPs in the SWPPP would be used to control sediments from all vegetation removal or ground-disturbing activities. Additional temporary control measures would be required beyond those described in the SWPPP if it appears pollution or erosion would result from weather, nature of the materials, or progress on the work.

We considered, under the ESA, whether or not the proposed action would cause any other activities and determined that it would not.

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 to 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 provide 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 reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

The Navy determined, and NMFS concurs, the proposed action is not likely to adversely affect PS/GB Basin yelloweye rockfish and sunflower sea star. NMFS also determined that the project is not likely to adversely affect SR killer whale. This is documented in the "Not Likely to Adversely Affect" Determinations section (Section 2.12).

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 also relies on the regulatory 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 PS Chinook salmon, HCSR chum, PS steelhead, and PS/GB Basin Bocaccio. The 2016 final rule (81 FR 7414; February 11, 2016) that revised the 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 ESA Section 7 implementing regulations define effects of the action using the term "consequences" (50 CFR 402.02). As explained in the preamble to the final rule revising the definition and adding this term (84 FR 44976, 44977; August 27, 2019), that revision 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 range wide 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 critical 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 also evaluated the project effects in part by using a Habitat Equivalency Analysis (HEA) 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 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 actions, 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 are more harmful than impacts resulting from the repair or replacement of existing structures, and the model accounts for this difference. This project includes a repair, therefore the factor of two does not apply.

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 2016a). As explained above, model outputs for new or expanded projects account for impacts to a "pristine" 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 projects, including any positive effects that would result from removing a structure, or piece of a structure, prior to the end of the remaining "useful life period";

- Minimization incorporated through project design improvements (e.g., credit is given for removal of, or replacement of creosote piles with steel piles as steel piles typically have less impact on water quality);
- Adverse effects that would occur for the duration of a new "useful life period" that would result from the proposed expanded, new, or repaired or replaced structure (or components of an existing structure).

2.2. Rangewide Status of the Species and Critical Habitat

This opinion examines the status of each species that is likely to 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" for the jeopardy analysis. The opinion also examines the condition of designated critical habitat, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated critical habitat, and discusses the function of the PBFs that are essential for the species' conservation.

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. Major ecological realignments are already occurring in response to climate change (IPCC WGII 2022). Long-term trends in warming have continued at global, national and regional scales. Global surface temperatures in the last decade (2010s) were estimated to be 1.09 ℃ higher than the 1850-1900 baseline period, with larger increases over land ~1.6 ℃ compared to oceans ~0.88 (IPCC WGI, 2021). The vast majority of this warming has been attributed to anthropogenic releases of greenhouse gases (IPCC WGI 2021) Globally, 2014-2018 were the 5 warmest years on record both on land and in the ocean (2018 was the 4th warmest) (NOAA NCEI 2022). Events such as the 2013-2016 marine heatwave (Jacox et al. 2018) have been attributed directly to anthropogenic warming in the annual special issue of Bulletin of the American Meteorological Society on extreme events (Herring et al. 2018). Global warming and anthropogenic loss of biodiversity represent profound threats to ecosystem functionality (IPCC WGII 2022). These two factors are often examined in isolation, but likely have interacting effects on ecosystem function.

Updated projections of climate change are similar to or greater than previous projections (IPCC WGI 2021). NMFS is increasingly confident in our projections of changes to freshwater and marine systems because every year brings stronger validation of previous predictions in both physical and biological realms. Retaining and restoring habitat complexity, access to climate refuges (both flow and temperature) and improving growth opportunity in both freshwater and marine environments are strongly advocated in the recent literature (Siegel and Crozier 2020). Climate change is systemic, influencing freshwater, estuarine, and marine conditions. Other systems are also being influenced by changing climatic conditions. Literature reviews on the impacts of climate change on Pacific salmon (Crozier 2015, 2016, 2017, Crozier and Siegel

2018, Siegel and Crozier 2019, 2020) have collected hundreds of papers documenting the major themes relevant for salmon. Here we describe habitat changes relevant to Pacific salmon and steelhead, prior to describing how these changes result in the varied specific mechanisms impacting these species in subsequent sections.

Forests

Climate change will impact forests of the western U.S., which dominate the landscape of many watersheds in the region. Forests are already showing evidence of increased drought severity, forest fire, and insect outbreak (Halofsky et al. 2020). Additionally, climate change will affect tree reproduction, growth, and phenology, which will lead to spatial shifts in vegetation. Halofsky et al. (2018) projected that the largest changes will occur at low- and high-elevation forests, with expansion of low elevation dry forests and diminishing high-elevation cold forests and subalpine habitats.

Forest fires affect salmon streams by altering sediment load, channel structure, and stream temperature through the removal of canopy. Holden et al. (2018) examined environmental factors contributing to observed increases in the extent of forest fires throughout the western U.S. They found strong correlations between the number of dry-season rainy days and the annual extent of forest fires, as well as a significant decline in the number of dry-season precipitation, combined with increases in air temperature, will likely contribute to the existing trend toward more extensive and severe forest fires and the continued expansion of fires into higher elevation and wetter forests (Alizedeh 2021).

Agne et al. (2018) reviewed literature on insect outbreaks and other pathogens affecting coastal Douglas-fir forests in the Pacific Northwest and examined how future climate change may influence disturbance ecology. They suggest that Douglas-fir beetle and black stain root disease could become more prevalent with climate change, while other pathogens will be more affected by management practices. Agne et al. (2018) also suggested that due to complex interacting effects of disturbance and disease, climate impacts will differ by region and forest type.

Freshwater Environments

The following is excerpted from Siegel and Crozier (2019), who present a review of recent scientific literature evaluating effects of climate change, describing the project impacts of climate change on instream flows:

Cooper et al. (2018) examined whether the magnitude of low river flows in the western U.S., which generally occur in September or October, are driven more by summer conditions or the prior winter's precipitation. They found that while low flows were more sensitive to summer evaporative demand than to winter precipitation, interannual variability in winter precipitation was greater. Malek et al. (2018), predicted that summer evapotranspiration is likely to increase in conjunction with declines in snowpack and increased variability in winter precipitation. Their results suggest that low summer flows are likely to become lower, more variable, and less predictable.

The effect of climate change on ground water availability is likely to be uneven. Sridhar et al. (2018) coupled a surface-flow model with a ground-flow model to improve predictions of surface water availability with climate change in the Snake River Basin. Projections using Representative Concentration Pathways 4.5 and 8.5 emission scenarios suggested an increase in water table heights in downstream areas of the basin and a decrease in upstream areas.

As cited in Siegel and Crozier (2019), Isaak et al. (2018), examined recent trends in stream temperature across the Western U.S. using a large regional dataset. Stream warming trends paralleled changes in air temperature and were pervasive during the low-water warm seasons of 1996-2015 (0.18-0.35℃/decade) and 1976-2015 (0.14-0.27℃/decade). Their results show how continued warming will likely affect the cumulative temperature exposure of migrating sockeye salmon (*O. nerka*) and the availability of suitable habitat for brown trout (*Salmo trutta*) and rainbow trout (*O. mykis*). Isaak et al. (2018) concluded that most stream habitats will likely remain suitable for salmonids in the near future, with some becoming too warm. However, in cases where habitat access is currently restricted by dams and other barriers salmon and steelhead will be confined to downstream reaches typically most at risk of rising temperatures unless passage is restored (FitzGerald et al. 2020, Meyers et al. 2018).

Streams with intact riparian corridors and that lie in mountainous terrain are likely to be more resilient to changes in air temperature. These areas may provide refuge from climate change for a number of species, including Pacific salmon. Krosby et al. (2018), identified potential stream refugia throughout the Pacific Northwest based on a suite of features thought to reflect the ability of streams to serve as such refuges. Analyzed features include large temperature gradients, high canopy cover, large relative stream width, low exposure to solar radiation, and low levels of human modification. They created and index of refuge potential for all streams in the region, with mountain area streams scoring highest. Flat lowland areas, which commonly contain migration corridors, were generally scored lowest, and thus were prioritized for conservation and restoration. However, forest fires can increase stream temperatures dramatically in short time spans by removing riparian cover (Koontz et al. 2018), and streams that lose their snowpack with climate change may see the largest increases in stream temperature due to removal of temperature buffering (Yan et al. 2021). These processes may threaten some habitats that are currently considered refugia.

Marine and Estuarine Environments

Along with warming streams temperatures and concerns about sufficient groundwater to recharge streams, a recent study projects nearly complete loss of existing tidal wetlands along the U.S. West Coast, due to sea level rise (Thorne et al. 2018). California and Oregon showed the greatest threat to tidal wetlands (100%), while 68% of Washington tidal wetlands are expected to be submerged. Coastal development and steep topography prevent horizontal migration of most wetlands, causing the net contraction of this crucial habitat.

Rising ocean temperatures, stratification, ocean acidity, hypoxia, algal toxins, and other oceanographic processes will alter the composition and abundance of a vast array of oceanic species. In particular, there will be dramatic changes in both predators and prey of Pacific salmon, salmon life history traits and relative abundance. Siegel and Crozier (2019) observe that changes in marine temperature are likely to have a number of physiological consequences on fishes themselves. For example, in a study of small planktivorous fishes, Gliwicz et at. (2018) found that higher ambient temperatures increased the distance at which fishes reacted to prey. Numerous fish species (including many tuna and sharks) demonstrate regional endothermy, which in many cases augments eyesight by warming the retinas. However, Gliwicz et al. (2018) suggest that ambient temperatures can have a similar effect on fishes that do not demonstrate this trait. Climate change is likely to reduce the availability of biologically essential omega-3 fatty acids produced by phytoplankton in marine ecosystems. Loss of these lipids may induce cascading trophic effects, with distinct impacts on different species depending on compensatory mechanisms (Gourtay et al. 2018). Reproduction rates of many marine fish species are also likely to be altered with temperature (Veilleux et al. 2018). The ecological consequences of these effect and their interactions add complexity to predictions of climate change impacts in marine ecosystems.

Perhaps the most dramatic change in physical ocean conditions will occur through ocean acidification and deoxygenation. It is unclear how sensitive salmon and steelhead might be to the direct effects of ocean acidification because of their tolerance of a wide pH range in freshwater (although see Ou et al. 2015 and Williams et al. 2019), however, impacts of ocean acidification and hypoxia on sensitive species (e.g., plankton, crabs, rockfish, groundfish) will likely affect salmon indirectly through their interactions as predators and prey. Similarly, increasing frequency and duration of harmful algal blooms may affect salmon directly, depending on the toxins (e.g., saxitoxin vs domoic acid), but will also affect their predators (seabirds and mammals). The full effects of these ecosystem dynamics are not known but will be complex. Within the historical range of climate variability, less suitable conditions for salmonids (e.g., warmer temperatures, lower streamflows) have been associated with detectable declines in many of these listed units, highlighting how sensitive they are to climate drivers (Ford 2022, Lindley et al. 2009, Williams et al. 2016, Ward et al. 2015). In some cases, the combined and potentially additive effects of poorer climate conditions for fishes and intense anthropogenic impacts caused the population declines that led to these population groups being listed under the ESA (Crozier et al. 2019).

Climate change effects on salmon and steelhead

In freshwater, year-round increases in stream temperature and changes in flow will affect physiological, behavioral, and demographic processes in salmon, and change the species with which they interact. For example, as stream temperatures increase, many native salmonids face increased competition with more warm-tolerant invasive species. Changing freshwater temperatures are likely to affect incubation and emergence timing for eggs, and in locations where the greatest warming occurs may affect egg survival, although several factors impact intergravel temperature and oxygen (e.g., groundwater influence) as well as sensitivity of eggs to thermal stress (Crozier et al. 2020). Changes in temperature and flow regimes may alter the amount of habitat and food available for juvenile rearing, and this in turn could lead to a restriction in the distribution of juveniles, further decreasing productivity through density dependence. For migrating adults, predicted changes in freshwater flows and temperatures will likely increase exposure to stressful temperatures for many salmon and steelhead populations, and alter migration travel times and increase thermal stress accumulation for evolutionarily significant units (ESUs) or distinct population segments (DPSs) with early returning (i.e., spring- and summer-run_ phenotypes associated with longer freshwater holding times (Crozier et al. 2020, FitzGerald et al. 2020). Rising river temperatures increase the energetic cost of migration and the risk of *en route* or pre-spawning mortality of adults with long freshwater migrations, although populations of some ESA-listed salmon and steelhead may be able to make use of cool-water refuges and run-timing plasticity to reduce thermal exposure (Keefer et al. 2018, Barnett et al. 2020).

Marine survival of salmonids is affected by a complex array of factors including prey abundance, predator interactions, the physical condition of salmon within the marine environment, and carryover effects from the freshwater experience (Holsman et al. 2012, Burk et al. 2013). It is generally accepted that salmon marine survival is size dependent, and thus larger and faster growing fishes are more likely to survive (Gosselin et al. 2021). Furthermore, early arrival timing in the marine environment is generally considered advantageous for populations migrating through the Columbia River. However, the optimal day of arrival varies across years, depending on the seasonal development of productivity in the California Current, which affects prey available to salmon and the risk of predation (Chasco et al. 2021). Siegel and Crozier (2019) point out the concern that for some salmon populations, climate change may drive mismatches between juvenile arrival timing and prey availability in the marine environment. However, phenological diversity can contribute to metapopulation-level resilience by reducing the risk of a complete mismatch. Carr-Harris et al. (2018), explored phenological diversity of marine migration timing in relation to zooplankton prey for sockeye salmon (*O. nerka*) from the Skeena River of Canada. They found that sockeye migrated over a period of more than 50 days, and populations from higher elevation and further inland streams arrived in the estuary later, with different populations encountering distinct prey fields. Carr-Harris et al. (2018) recommended that managers maintain and augment such life-history diversity.

Synchrony between terrestrial and marine environmental conditions (e.g., coastal upwelling, precipitation and river discharge) has increased the spatial scale causing the highest levels of synchrony in the last 250 years (Black et al. 2018). A more synchronized climate combined with simplified habitats and reduced genetic diversity may be leading to more synchrony in the productivity of populations across the range of salmon (Braun et al. 2016). For example, salmon productivity (recruits/spawner) has also become more synchronized across Chinook salmon populations from Oregon to the Yukon (Dorner et al. 2018, Kilduff et al. 2014). In addition, Chinook salmon have become smaller and younger at maturation across their range (Ohlberger 2018). Other Pacific salmon species (Stachura et al. 2014) and Atlantic salmon (Olmose et al. 2020) also have demonstrated synchrony in productivity across a broad latitudinal range.

At the individual scale, climate impacts on salmon in one life stage generally affect body size or timing in the next life stage and negative impacts can accumulate across multiple life stages (Healey 2011, Wainwright and Weitkamp 2013, Gosselin et al. 2021). Changes in winter precipitation will likely affect incubation and/or rearing stages of most populations. Changes in the intensity of cool season precipitation, snow accumulation, and runoff could influence migration cues for fall, winter and spring adult migrants, such as coho and steelhead. Egg survival rates may suffer from more intense flooding that scours or buries redds. Changes in hydrological regime, such as a shift from mostly snow to more rain, could drive changed in life history, potentially threatening diversity within an ESU (Beechie et al. 2006). Changes in summer temperature and flow will affect both juvenile and adult stages in some populations especially those with yearling life histories and summer migration patterns (Crozier and Zabel 2006, Crozier et al. 2010, Crozier et al. 2019).

At the population level, the ability of organisms to genetically adapt to climate change depends on how much genetic variation currently exists within salmon populations, as well as how selection on multiple traits interact, and whether those traits are linked genetically. While genetic diversity may help populations respond to climate change, the remaining genetic diversity of many populations is highly reduced compared to historic levels. For example, Johnson et al. (2018), compared genetic variation in Chinook salmon from the Columbia River Basin between contemporary and ancient samples. A total of 84 samples determined to be Chinook salmon were collected from vertebrae found in ancient middens and compared to 379 contemporary samples. Results suggest a decline in genetic diversity, as demonstrated by a loss of mitochondrial haplotypes as well as reduction in haplotype and nucleotide diversity. Genetic losses in this comparison appeared larger for Chinook salmon from the mid-Columbia than those from the Snake River Basin. In addition to other stressors, modified habitats and flow regimes may create unnatural selection pressures that reduce the diversity of functional behaviors (Sturrock et al. 2020). Managing to conserve and augment existing genetic diversity may be increasingly important with more extreme environmental change (Anderson et al. 2015), through the low levels of remaining diversity present challenges to this effort (Freshwater et al. 2019). Salmon historically maintained relatively consistent returns across variation in annual weather through the portfolio effect (Schindler et al. 2015), in which different populations are sensitive to different climate drivers. Applying this concept to climate change, Anderson et al. (2015) emphasized the additional need for populations with different physiological tolerances. Loss of the portfolio increases volatility in fisheries, as well as ecological systems, as demonstrated for Fraser River and Sacramento River stock complexes (Freshwater et al. 2019, Munsch et al. 2022).

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). Critical habitat is not designated for PS steelhead in marine waters or nearshore marine waters adjacent to this action for PS/GB yelloweye rockfish.

For most salmon and steelhead, NMFS's critical habitat analytical review teams (CHARTs) ranked watersheds within designated critical habitat at the scale of the fifth-field hydrologic unit code (HUC5) in terms of the conservation values they provide to each ESA listed species that they support (NMFS 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.

A summary of the status of critical habitats, considered in this opinion, is provided in Table 1.

Table 1. Critical habitat, designation date, federal register citation and status summary for 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 stream miles, 41 square mile of lakes, and 2,182 miles of nearshore marine habitat in Puget Sound. The Puget Sound Chinook salmon ESU has 61 freshwater and 19 marine areas within its range. Of the freshwater watersheds, 41 are rated as high conservation value, 12 low conservation value, and 8 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 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 bocaccio	11/13/14 79 FR 68042	Critical habitat for bocaccio includes 590.4 square miles of nearshore 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 (*Zoster* spp.) 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.

<u>Status of the Species</u>

Puget Sound Chinook Salmon viability parameters:
Abundance across the Puget Sound Chinook salmon ESU has generally increased since the last status review, with only two of the 22 populations (Cascade River and North and South Fork

Stillaguamish Rivers) showing a negative percentage change in the five-year geometric mean natural-origin spawner abundances since the prior status review. Across the Puget Sound Chinook salmon ESU, ten of 22 Puget Sound populations show *natural* productivity below replacement in nearly all years since the mid-1980s. We can see a declining trend in the proportion of natural-origin spawners across the ESU starting approximately in 1990 and extending through 2018. Overall, the Puget Sound Chinook salmon ESU remains at “moderate” risk of extinction, and viability is largely unchanged from the prior review. Ford 2022.

Puget Sound Steelhead viability parameters:
The long-term abundance of adult steelhead returning to many Puget Sound rivers has fallen substantially since estimates began for many populations in the late 1970s and early 1980s; however, in the nearer term, there has been a relative improvement in abundance and productivity. Overall, the risk posed by hatchery programs to naturally spawning populations has decreased during the last five years with reductions in hatchery production. Overall, recovery efforts in conjunction with improved ocean and climatic conditions have resulted in an increasing viability trend for the Puget Sound steelhead DPS, although the extinction risk remains “moderate.” Ford 2022.

Hood Canal Summer Run Chum viability parameters:
Smoothed trends in estimated total and natural population spawning abundances for both populations have generally increased over the 1980 to 2017 time period. However, since 2016, abundances for both populations have sharply decreased. This newest information is important in considering summer-run chum salmon abundance and productivity trends, and the co-managers theorize it to be related to Pacific Decadal Oscillation (PDO) effects on ocean conditions. Trends in population productivity, have decreased over the past three-to-four years, but had been above replacement rates in five prior years. Spatial structure and diversity viability parameters, as originally determined by the TRT, have improved, and nearly meet the viability criteria for both populations.

Puget Sound/Georgia Basin Bocaccio viability parameters:
The PS/GB bocaccio DPS includes all PS/GB bocaccio from inland marine waters east of the central Strait of Juan de Fuca and south of the northern Strait of Georgia. The waters of Puget Sound and Straits of Georgia can be divided into five interconnected basins that are largely hydrologically isolated from each other by relatively shallow sills (Burns 1985; Drake et al. 2010). The PS/GB bocaccio DPS exists at very low abundance and observations are relatively rare. No reliable range-wide historical or contemporary population estimates are available for the PS/GB bocaccio DPS. It is believed that prior to contemporary fishery removals, each of the major Puget Sound/Georgia Basin areas likely hosted relatively large, though unevenly distributed, populations of PS/GB bocaccio. They were likely most common within the South Sound and Main Basin, but were never a predominant segment of the total rockfish abundance within the region (Drake et al. 2010). The best available information indicates that between 1965 and 2007, total rockfish populations have declined by about 70 percent in the Puget Sound region, and that PS/GB bocaccio have declined by an even greater extent (Drake et al. 2010; Tonnes et al. 2016; NMFS 2017). Since the last 5-year status review (Tonnes et al. 2016), substantial new biological information pertinent to the status of this DPS is available from Remote Operated Vehicle surveys, scuba-based Young-of-Year surveys, recreational fisheries bycatch data, and a comprehensive catch reconstruction (Lowry et al. 2024). While progress has been made toward meeting several threats-based criteria, the full suite of criteria related to

multiple threats has not yet been met. For some threats, such as bycatch and derelict fishing gear, significant progress has been made to reduce population-level impacts. For others, such as toxic contaminants and ocean acidification, fundamental science is still needed to develop appropriate conservation responses. Overall, though recent data have provided better insights into historical bycatch and current population trends, this DPS remains at high risk of extinction (Lowry et al. 2022).

In addition to the above, Table 2 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, ESU, Multiple Population Grouping (MPG), Northwest Fisheries Science Center (NWFSC), and Technical Recovery Team (TRT).

Table 2. 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; Ford 2022	This ESU comprises 22 populations distributed over 5 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 range 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 Coordinating 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 tow 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 met 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 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.

Table 2. Continued

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: Ford 2022	This DPS comprises 32 populations. The DPS is currently at very low viability, with most of the 32 populations and all three population groups at low viability. Information considered during the most recent status review indicates that the biological risks faced by the Puget Sound steelhead DPS have not substantively changed since the listing in 2007, or since the 2011 status review. Furthermore, the Puget Sound steelhead TRT recently affirmed 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 Puget Sound 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 reduction 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 bocaccio	Endangered 04/28/10	NMFS 2017	NMFS 2016b	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 change to rockfish habitat • Small population dynamics

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). The action area for this project includes the upland area east north of Tang Road (to include Hunter's Marsh), and aquatic area to the west including 150 feet waterward where turbidity may be elevated (Figure 3). The project area is within the action area and is the immediate location of the proposed construction (including access and staging areas within the site).

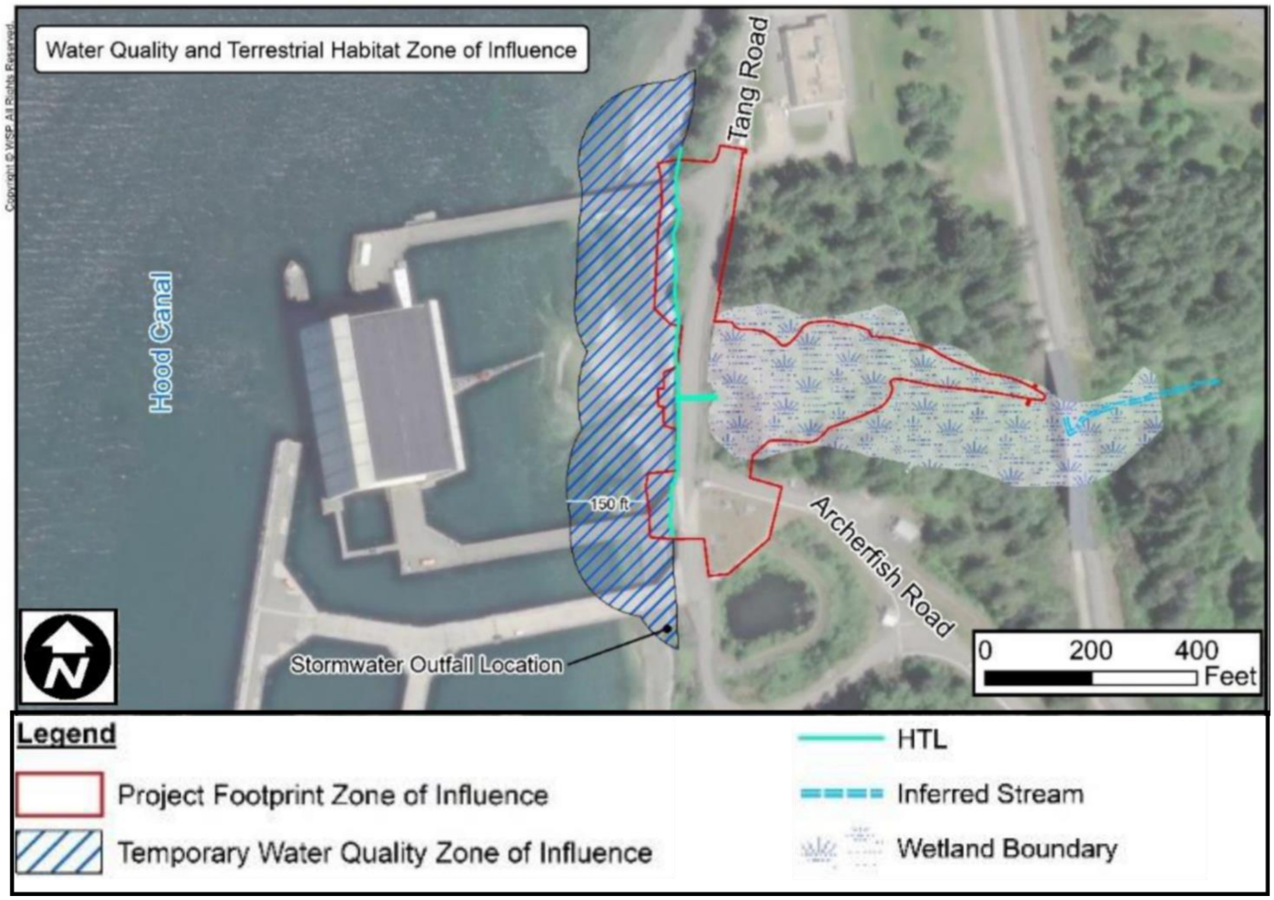

Figure 3. Action Area at the Tang Road project site.

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 impacts to listed species or designated critical habitat from federal agency activities or existing federal 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 degraded 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 significant levels of commercial vessel traffic, as well as degraded nearshore habitat due to bank armoring and large in-water navy structures.

Tang Road is bound along the western embankment to the north and south by existing riprap revetments located at existing piers, to the west by an MSE seawall at Hood Canal, and to the east by Hunter's Marsh (Figure 1). Hunter's Marsh is a wetland area impounded by beaver dams at an existing 48-inch culvert crossing Tang Road and is intermittently managed for beaver activity. Ongoing inspections of the site and an active U.S. Department of Agriculture (USDA) contract is responsible for identifying habitation and subsequent trapping of beavers within Hunter's Marsh. The impoundment, trash rack, and inlet structure results in an approximately 5-foot water surface drop that is an impassable migration barrier to adult salmon from Hood Canal that might otherwise forage in Hunter's Marsh or spawn in the tributaries. (WSP 2023a, Bhuthimethee et al. 2009).

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 of 10.2 miles and maximum depth of 600 feet (Johnson and O'Neil 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.

Within northern Hood Canal, nearshore development is limited with few industrial waterfront sites other than Naval Base Kitsap (NBK)-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 6 miles south of the action area and attracts recreational boaters. Pleasant Harbor, north of Seabeck, represents a larger amount of over water structures (OWS) and significantly more vessel traffic when compared to Seabeck. The Hood Canal Bridge is located approximately 10 miles north of the action area.

The immediate shores of Hood Canal in the action area lack wetland habitats. The western shore consists of gravel and driftwood and is underdeveloped. Low shrubs and 80-foot conifer threes occupy the riparian zone and extend upwards to the steep banks of Hood Canal. Unlike the western shore, the eastern shore is more developed due to the presence of NBK-Bangor. NBK-Bangor is a large industrial/military complex with more than 3.6 acres of over-water and in-water structures and approximately 4.2 miles of shoreline. These structures can support multiple nuclear submarines at once and support vessels of different sizes.

Hood Canal has 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 the T-dock (near Union) and HoodSport Public Dock does as well. The communities of Bridgehaven and Port Gamble in north Hood Canal, and Hoodsport in South Hood Canal, 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 NBK-Bangor waterfront also produces artificial light. The overwater and onshore structures currently comprising the NBK-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 fishes 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.

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 the Washington Department of Fish and Wildlife. 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. 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. In addition, extensive, non-aquaculture commercial (state and tribal) fisheries exist in Hood Canal for sea cucumber, urchins, and geoduck.

Frequent vessel traffic from the mix of users produces sound energy throughout Hood Canal and the action area. Documented behavioral and physiological response 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 2014) 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 NBK-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 NBK-Bangor shoreline (MacLennan and Johannessen 2014), some of which are completely on partially armored to protect overwater and road infrastructure at NBK-Bangor, resulting in an impediment to sediment input and transport. MacLennan and Johannessen (2014) note that existing structures along the NBK-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.

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*). The Washington Department of Ecology has identified the area along NBK-Bangor as having both continuous and patchy assemblages of kelp (*Saccharina* spp.).

While eelgrass is traditionally located higher in tidal elevation than kelp, both require direct access to natural overhead 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 NBK-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 (0.0008-0.002 inch), and to clay (less than 0.0008 inch).

Benthic organisms are abundant and diverse at NBK-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 fishes along NBK-Bangor.

Different forage fishes spawn in Hood Canal year-round. Common fish species identified as forage fishes were recorded in the action area during beach seine surveys conducted in 2005 to 2008 (SAIC 2009). Forage fishes captured include, in order of abundance (highest to lowest): Pacific herring, surf smelt (*Hypomesus pretiosus*), and Pacific sand lance (*Ammodytes hexapterus*) (SAIC 2006). Larval forage fishes, consisting of large schools with both surf smelt and Pacific sand lance, were also captured during this time. Forage fishes occur during 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.

Three beaches were surveyed for forage fishes at NBK Bangor in 2020, two of which include areas to the north and south of the project location (Navy 2023). Surf smelt spawning was not detected at any of the three beaches during these surveys. Pacific sand lance spawning was detected at Carlson Spit in November 2017 and January 2018; at Keyport/Bangor Spit approximately 1.5 miles south of the Tang Road site in February 2018; and between Marginal Wharf and the Magnetic Silencing Facility in November 2017, which is approximately 0.5 miles south of the Tang Road site (Navy 2022). While forage fish eggs have been detected at NBK-Bangor locations, none have been detected within the Tang Road Action Area.

Beach and trawl surveys were conducted along NBK-Bangor's waterfront and recorded small numbers of Pacific herring during the winter months and large numbers during the summer months (SAIC 2006; Bluthimethee 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 stocks. The Quilcene Bay stock's 4-year mean is 125 percent 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 late spring through early summer and juvenile surf smelt were observed within the nearshore areas from 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 Navy overwater structures (Carderock Pier, Service Pier, Keyport Bangor Dock, Delta Pier, Marginal Wharf, Explosive Handling Wharf #1, and the Magnetic Silencing Facility Pier). Sand land spawning areas are located north and south of the proposed project based on these surveys conducted in the 1990s (WDFW 2019). All life stages of surf smelt and sand lance are expected to be present along NBK-Bangor waterfront.

At the northern end of Hood Canal 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 percent of the width of Hood Canal and extended 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 (Hood Canal Assessment Team 2020):

1. The Hood Canal Bridge significantly contributes to early marine mortality of juvenile Hood Canal steelhead by impeding fish passage and facilitation predation.
2. The bridge impacts other fish species such as juvenile Chinook and chum salmon.
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.

The specific populations of ESA-listed fish in the action area include:

- Three independent populations of Puget Sound Chinook 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
- At least eight demographically independent populations (1 summer/winter run and 7 winter run of PS steelhead are expected to migrate through the action area.
- HCSR chum juveniles originating 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 NBK-Bangor waterfront (Salo et al. 1980) and the Duckabush River.
- 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 NBK-Bangor nearshore that may be seasonally used by juvenile

and sub-adult bocaccio. It is possible that larval rockfish would occur within the action area during project activities.

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 but that are not part of the 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 402.02).

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

- Disturbance of bottom sediments which can cause
  - Water quality impacts;
  - Disturbance of benthic communities; and
  - Degradation to forage fishes.

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

- Persistent shoreline armoring which can cause
  - Marine migration pathways obstruction;
  - Reductions in aquatic vegetation/cover; and
  - Diminished benthic communities/marine forage.
- Repaired stormwater treatment which can cause
  - Reduction of pollution entering hood canal.
- Improved fish passage and pocket estuary restoration which can cause
  - Increased opportunity for freshwater migration;
  - Increased forage opportunities; and
  - Increased availability of refugia.

Within the category of temporary effects, ephemeral effects are those that are likely to last for hours or days; short-term effects would likely last for weeks; long-term effects are likely to last for months, years or decades.

2.5.1 Effects on Habitat

As mentioned in Section 2.2, critical habitat for PS Chinook, HCSR chum, and PS/GP bocaccio occurs adjacent to NBK-Bangor shoreline. 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 outlines species protection measures (33 CFR 334). Both the action area and project area are within exempted DoD lands.

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. 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.

This assessment considers the intensity of expected effects in terms of the change they would cause in affected Physical and Biological Features (PBFs) from their baseline conditions, and the severity of each effect, considered in terms of the time required to recover from the effect. Again, while PBFs are elements of critical habitat, which is exempt within the action area, this analysis is foundational to our review of the habitat effects for the listed species themselves.

The PBFs for PS Chinook, HCSR chum salmon and PS steelhead (freshwater/estuarine PBFs, 1-4, only) within the action area are as follows (PBF 6 is not present in the action area and are not discussed in this document):

1. Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development.
2. Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile development; and natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.
3. Freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.
4. Estuarine areas free of obstruction and water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh-and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.
5. Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.

The PBFs for PS/GB bocaccio within the action area are as follows:

1. Quantity, quality, and availability of prey species to support individual growth, survival, reproduction, and feeding opportunities.
2. Water quality and sufficient levels of dissolved oxygen to support, survival reproduction, and feeding opportunities.

As outlined above, effects to habitat features include temporary diminishment of benthic communities and forage fishes (i.e., prey abundance and diversity), migratory obstruction and required energy expenditure, and potential temporary and permanent increase in predators and predation upon juvenile salmonids. Timing, duration, and intensity of the effects on habitat are considered in the analysis.

NMFS reviews the effects on habitat affected by the proposed action by examining changes to the condition trends of PBFs identified as essential to the conservation of the listed species.

The action area contains freshwater, estuarine PBFs (PBFs 1-4) of PS Chinook, HCSR chum salmon and PS steelhead and nearshore marine PBFs (PBF 5) of only PS Chinook and HCSR chum salmon habitat. PBFs of freshwater habitat include water quantity and quality, floodplain connectivity, forage supporting juvenile development, natural cover, and aquatic vegetation. PBFs of estuarine and nearshore habitat include complexity, absence of artificial obstruction, natural cover, adequate water, and high water-quality. The nearshore environment supports various life stages of PS Chinook and HCSR salmon including growing, and sexually maturing adults, migrating spawners, and rearing and growing juveniles. The proposed project would adversely affected water quality, including forage and aquatic vegetation.

The action area for the proposed action contain nearshore habitat for PS/GB bocaccio. Habitat features for PS/GB bocaccio differ between adults and juveniles as each life history stage has different location and habitat needs. The proposed action would adversely affected nearshore bocaccio habitat designated specifically for juveniles, but is unlikely to adversely affect deepwater critical habitat.

Temporary effects on features of habitat associated with construction

While there is freshwater habitat within the action area, the pre-project condition is that ESA listed species are completely excluded from this habitat as it is upstream of a fish passage barrier. Therefore, there are no temporary effects associated with this habitat that would affect these species.

Water quality impacts
Sheet pile installation and excavator operation are likely to cause short-term and localized degradation in water quality by disturbing sediment. Low weight/soft tracked equipment would be used to prevent compaction of the beach during revetment repair. However, the equipment operating on the beach may disturb beach sediment resulting in turbidity and total suspended solids within the water column by tidal action or precipitation. Turbidity curtains will be installed around the revetments during construction to reduce turbidity that may be caused by this activity. We anticipate multiple days of benthic disturbance for the sheet pile installation and revetment repair work that may create a small, temporary turbidity plume. While work is intended to occur when the tide is out (effectively working in the dry), rain events and returning tide may suspend sediments, which would be expected to settle out of the water column within 150 ft of the activity. However, the reduction in water quality, being limited spatially and temporally, while adverse, is not expected to impair the conservation role of promoting juvenile growth, maturation, or survival, feeding or reproduction, for any species' designated habitat.

Disturbance of benthic communities
The intrusion of the construction equipment onto the beach would also contribute to temporary localized effects on marine vegetation and the benthic community, with indirect effects on prey availability for listed species is expected to occur. The benthic communities in the footprint of the construction activity would be disturbed when work is in progress. Suspended sediments

would settle in the area adjacent to the disturbance, which can disrupt benthic prey species. Intertidal habitats, including eelgrass beds, would be outside the construction area and would not be impacted by construction. The reduction in benthic prey communities may reduce available forage, but as above, this adverse effect is spatially and temporally limited and is not expected to reduce the feeding, growth, and survival conservation role for which the habitat was designated for any species.

Degradation to forage fish quality
Forage fishes that occur in the immediate project vicinity during in-water construction would be exposed to increased levels of turbidity. Pacific herring, surf smelt, and Pacific sand lance utilize the shoreline at the project location. Therefore, forage fishes could be present and potentially affected by bottom disturbing construction activities. Forage fishes, as with benthic communities, are a prey resource, particularly for PS Chinook salmon (chum salmon eat a wider variety of food) (Davis et al. 2009). This reduction, while adverse, is not expected to be at a scale or duration that would reduce the conservation role for PS Chinook designated habitat.

To summarize, short-term effects to estuarine and near shore habitat for PS Chinook and HCSR chum salmon include temporary degradation of water quality, temporary disturbance of the benthic community (affecting cover and forage invertebrates) and the minor, localized short-term reduction of forage fishes. Short-term effects to PBFs for PS/GB bocaccio include temporary degradation of water quality and temporary decline in prey availability and quality. For these designated habitats, the short-term effects are adverse, but the brevity of their duration prevents a diminishment of the conservation role of the habitat in the action area.

Enduring Effects on Habitat

Migration Obstruction
Migration habitat values are not expected to be impaired for PS/GB bocaccio, as this species does not rely on the nearshore area for migration.

There is substantial evidence that in-water structures 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). The continues presence of the sea wall would expose migrating salmonids to deep waters, and the associated risks of passing the wall during high tides. Juvenile PS Chinook and HCSR chum salmon have relatively high reliance on shallow nearshore areas, and therefore salmon habitat would experience enduring incremental diminishment of safe migration for PS Chinook and HCSR chum.

Reductions in aquatic vegetation/cover
Shoreline armoring can have lasting effects on food web of the adjacent marine habitat. Areas with substantial shoreline armoring tend to have a decrease in contribution of organic material entering the ecosystem. This is attributed, in part, to both the decline in shoreline vegetation and a reduction of submerged aquatic vegetation (SAV). Eelgrass shoot density and canopy structure are often depressed adjacent to in-water structures (Burdick and Short 1999).

Diminished benthic communities/forage
Altered beaches tend to have less wrack (organic material (e.g., kelp, eelgrass and driftwood) and other debris deposited at high tide). With the decline in wrack and SAV density, the ecosystem diversity declines. Natural beaches in Puget Sound are dominated by oligochaetes, nematodes, amphipods, insects, and collembolans. This diversity declines adjacent to sea walls as crustaceans become dominant (Dugan et al. 2008, Sobocinski et al. 2010, Munsch et al. 2017). For example, in the Duwamish watershed, armored shorelines had a fraction of the epibenthic assemblages observed in nearby unarmored sites (Morley et al. 2012). This effect would also be an incremental diminishment of forage that, while spatially limited, would be persistent and thus could slightly reduce the conservation role for salmonid and bocaccio feeding necessary for survival, growth, development and maturation.

Improved storm water management
The road is primarily a low-speed haul road with limited truck traffic from Navy operations. Stormwater currently sheet flows to both Hunter's Marsh and Hood Canal without flow control treatment. The project would replace existing pollution-generating impervious surfaces in-kind, with the traveled road width remaining consistent with the pre-construction road width and traffic not increasing as part of the proposed action. Stormwater drainage from roadway would be routed to an existing stormwater pond that provides treatment in the form of detention for suspended solids. Dense particles (such as most *N*-(1,3-dimethylbutyl)-*N′*-phenyl-*p*-phenylenediamine (6PPD) containing tire particles) would settle out in the pond (WDOE 2022). However, 6PPD converts to the highly toxic 6PPDQ in fresh water (Li et al. 2023), thus, despite BMPs with water storage and sediment trapping designed to manage all but the smallest particles, any contaminants dissolved into the water will pass through the pond and be discharged into Hood Canal at a rate consistent with current levels. This effect would maintain inputs of dissolved contaminants but reduce the levels of suspended solids to which that salmonids and juvenile rockfish are exposed.

Nearshore Calculator Assessment

When the marine-facing structural elements of the proposed action are evaluated in the nearshore calculator, the debit output is minus 368. The calculator does not incorporate temporary or water quality effects associated with the project. The calculator is not designed to evaluate freshwater elements. Here the NMFS then must evaluate the positive effects associated with the re-establishment of access and recreation of estuarine conditions using best professional judgment. NMFS describes it evaluation of the positive impacts below.

Restoration of fish passage
The existing stream in the project area was historically accessible to anadromous species, but is currently inaccessible to all life stages of these species due to the water surface drop at the culvert inlet and the small 48-inch culvert. After the 25-foot wide and 10-foot high culvert is installed, it is anticipated that adult and juvenile salmonids will be able to access the restored pocket estuary and the stream. There is a security bridge that parallels Tang Road approximately 643 feet upland. All habitat below the security bridge will be accessible to fishes for migration, refugia and forage. This includes 1.69 acres of restored pocket estuary and 375 linear feet of freshwater stream between the estuary and security bridge. Pocket estuaries serve as a nursery

role for salmonids and a number of other fish species including surf smelt, an important salmonid prey species. (Beamer 2005)

The stream does not cross this security roadway by traditional means, as vertical slats descend from the bridge and is embedded into the substrate. The slats are meant to stop human intruders and it is unclear to the extent that salmonids would be able to pass this structure. The adverse effects associated with the construction of this bridge were mitigated by the removal of fish blockage (replaced culverts with a bridge) at Cattail Lake approximately 1.25 miles to the north, creating Cattail Estuary. While it's likely that these slats would act as (at least) a partial barrier to upstream fish passage, it is reasonable to assume that athletic fishes (such as PS steelhead) would be able to make it upstream of the structure. Any fishes that are able to pass this bridge would gain access to an additional 2,300 linear feet of stream habitat.

Summary of Effects on Habitat: Because the project has both long term impacts (quantified as a calculator debit of minus 368) as well as long term habitat improvements in the form of restored estuarine conditions and access to that improved habitat, NFMS has determined that conservation values of critical habitat will not have a net long-term adverse effects to the above mentioned PBFs as the long-term adverse effects are offset by the beneficial elements.

The temporary diminishment in water quality from both turbidity and benthic disturbance is brief and would return to baseline water quality conditions rather quickly. As the project also include improved stormwater management, fish passage and pocket estuary restoration, we also find long term effects would improve water quality, freshwater migration, rearing and forage within the newly accessible habitat for ESA listed salmonid species. The conservation value of the habitat in the action area is retained.

2.5.2 Effects on Listed Species

Listed species will be present and exposed to both the temporary and long-term effects to habitat presented above. Response is influenced by the duration of exposure, the species, and lifestage exposed, and the fitness of the exposed individuals.

Species Presence and Exposure

Puget Sound Chinook: 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 NBK-Bangor waterfront occurs from early August to October as the adults return from 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 sein surveys conducted at NBK-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 fishes total) during weekly beach sein surveys conducted from mid-July through early September 2005 (SAIC 2006). However, as juvenile Chinook salmon increase in size they occupy deeper, offshore water 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 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 runs 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 NBK-Bangor waterfront in late summer. They were captured in very low numbers (14 fishes 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: 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 NBK-Bangor waterfront (Salo et al. 1980). Summer chum salmon in the Duckabush River are part of the HCSR chum ESU listed as threatened in 1999 by NMFS (NOAA 1999). The HCSR chum ESU was historically composed of 16 independent populations (Ames et al. 2000). Historically, summer-run 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 NBK-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).

Rockfish: Due to the habitat characteristics of Hood Canal, the closest adult ESA-listed rockfish are likely several thousand feet away from the NBK-Bangor waterfront, within waters deeper than 120 feet, outside of the action area. If any juvenile and sub-adult bocaccio were 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 NBK-Bangor nearshore that may be seasonally used by juvenile and sub-adult bocaccio. It is possible that larval rockfish would 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.

Temporary Effects on Listed Species Associated with Construction

Water Quality and Disturbance of Bottom Sediments – Project activities, such as low weight/soft tracked equipment on the beach, revetment manipulation and sheet pile driving would disturb bottom sediments. Disturbance of bottom sediments may suspend sediment from the 725 linear feet of disturbed shoreline, which would expose listed fishes to the turbidity. Turbidity curtains will be installed around the revetments during construction to reduce the extent of turbidity that may be caused by this activity. Juvenile PS Chinook, juvenile HCSR chum and larval and juvenile PS/GB bocaccio are likely to be exposed since they are shoreline oriented. Steelhead are not nearshore dependent and are less likely to be present to experience this effect pathway.

Salmon can detect and avoid areas of high turbidity, and exposure of PS Chinook and HCSR chum is therefore expected to be limited for these species (the response to elevated turbidity being behavioral/avoidance only). Larval bocaccio have limited mobility, and their exposure, if present, could be minutes to hours depending on their proximity to the sediment, tide, wind, waves, and the settle rate of the sediment.

Reduced Forage – The reduction of benthic organisms (including forage fish spawn) would reduce the abundance of prey resources, forcing juvenile PS Chinook, HCSR chum and PS/GB bocaccio (larval rockfish would not be affected by this pathway) to temporarily forage more broadly over a greater area. However, because prey base is not identified as limited in the nearshore environment, we consider the response of these fishes to be within their normal behaviors with only a slight increase in expended energy to locate prey, and thus the reduction of benthic resources would be too small to cause detectable effects on the fitness, growth or normal behavior of ESA-listed fish species in the action area.

Enduring Effects on Listed Species

Extended useful life of sea wall – In-water structures in the nearshore influence habitat functions and processes for the duration of the time they are present within the habitat. The effects of this time extension include: 1) altered food web, 2) disrupted migration, and 3) arrested pathway of pollution. These effects are chronic, persistent, and co-extensive with the useful life of replaced and repaired structures.

Forage – Shoreline armoring can have lasting effects on food web of the adjacent marine habitat. As described in Section 2.5.1, the presence of seawalls affects the presence or density of eelgrass beds and the diversity of the benthic community overall. Eelgrass beds are important foraging habitat for juvenile PS Chinook, PS steelhead, HCSR chum and PS/GB bocaccio and its presence helps to facilitate their foraging success. PS steelhead are less reliant on nearshore environment than PS Chinook and HCSR chum, but they are observed in eelgrass beds. In a recent study, harpacticoid copepods dominated juvenile Chinook salmon diet (Kennedy et al. 2018). These copepods were found in abundance in eelgrass blades. Furthermore, the presence of shoreline structures reduced the amount of organic material that enters marine waters, thus limiting the nutrients that supports a diverse prey base for juvenile fishes. With the decreased diversity and abundance of prey resources, juvenile fishes would need to forage over a greater area. Over the extended period that this sea wall will be in place, a small number of salmonids and juvenile bocaccio will encounter this condition each year. We expect that a subset of that small number would be harmed due to degraded foraging conditions, expressed as reduced growth or fitness.

The proposed project would establish fish passage and the restoration of the pocket estuary. The 1.69 acres of pocket estuary would provide a nursery role for juvenile salmonids and forage fishes (Beamer 2005). This habitat would directly benefits salmonids by providing refugia and foraging habitat for juveniles, and then increasing survival success of prey species for adults.

Migration – In marine nearshore, there is substantial evidence that in-water structures impede the nearshore movement of juvenile salmonids (Heiser and Finn 1970; Able et al. 1998; Simenstad 1999; Southard et al. 2006; Toft et al. 2007). Juvenile salmonids stop at the edge of the structure due to loss of shallow-water habitat or because the structure interrupted their movement. During high tides, juvenile salmonids swimming adjacent to a sea wall are forced to utilize deeper habitat, thereby exposing them to increased piscivorous predation. Hesitating upon first encounter the structure also exposes salmonids to predators, such as great blue heron (*Ardea herodias*), that would take advantage of areas of high fish density (Sherker 2020). Over the extended period that this project will be in place, a small number of salmonids will encounter this condition each year. We expect that a subset of that small number would be injured or killed due to lack of shallow water refugia in which to avoid predators. We do not expect the seawall to affect migration patterns of bocaccio.

The installation of the fish passage culvert would provide salmonids with access to the newly restored pocket estuary as well as approximately 375 of freshwater stream habitat (downstream of the security bridge). It is likely that this bridge would be at least a partial barrier to anadromous fishes; however, it is not unreasonable for salmonids to be able to move upstream of this structure (as described in Section 2.5.1). Therefore, salmonids would gain migration access to at least 375 linear feet of freshwater habitat for foraging, refugia and spawning. This could be expanded to an additional 2,300 linear feet of stream habitat if fishes can make it upstream of the bridge.

Water Pollution – The road’s stormwater system would be repaired to divert the existing sheet flow into Hood Canal to an existing stormwater pond. The stormwater would be treated via flow control without enhanced treatment for dissolved contaminants. While this system will remove suspended solids, dissolved contaminants would be discharged directly into Hood Canal and may cause physiological responses to juvenile and adult salmonids and juvenile rockfish. Receiving waterbodies typically receive these contaminants in mixtures, and are known to interact with each other (Niyogi et al. 2004). These mixtures are absorbed at gill (olfaction) mediums likely resulting in physiological consequences (Niyogi et al. 2004). Individual contaminant concentration and some mixture concentrations have been tested with a variety of salmonids and trout species. Tested endpoints range from lethal to sublethal effects, which include reduced growth, fecundity, avoidance, reduced stamina, and neurophysiological and histological effects on the olfactory system. For example, mixtures containing copper and zinc were found to have greater than additive toxicity to a wide variety of aquatic organisms, including freshwater fishes (Eisler 1998), and other metal mixtures also yielded greater than additive toxic effects at low dissolved metal concentrations (Playle 2004). Considering that the stormwater leaving the site post-construction is not treated for heavy metal and other dissolved contaminants, it is anticipated that listed fishes would experience these adverse effects. However, the existing roadway is utilized minimally for Navy operations and security rounds and vehicles generally travel at low speeds and volumes, suggesting that the contribution of tirewear particles will be relatively low, with limited exposure of listed fish to 6PPD and 6PPD-Q. The production of contaminants that could enter the stormwater pond from vehicle related pathways would be substantially less than the level of a normally traveled public roadway. It is anticipated that given the low vehicle volumes, low vehicle speeds and the reduction of suspended solids that the effects would be sublethal, minor, and localized to the outfall location.

Summary of Effects on Listed Species: Construction activities can lead to short-term effects that would affect only those cohorts of fishes present during the in-water work. The presence of low weight/soft tracked equipment on the beach and vibratory pile driving (in the dry) may lead to increased turbidity and disrupted benthic communities. Disturbed sediments may result in turbidity in proximity to the disturbance. However, all in-water work would be conducted during low tide, in the dry, or behind a coffer dam to minimize such suspension. Temporary localized effects on marine vegetation, benthos, and forage fishes, with indirect effects on prey availability for listed species is expected to occur. The benthic communities in the footprint of the construction activity would be disturbed when work is in progress. The utilization of cofferdams may expose fishes to handling; however, these fishes will be upstream of a fish passage barrier and would not be ESA listed species. These effects only occur during construction activities and would quickly stabilize after construction is complete.

In addition to the short-term construction-related effects that would affect only those cohorts of fishes present during the work, the proposed action has long-term effect on the marine nearshore environment that multiple cohorts of fishes would experience over the useful life of the structure, which is estimated to be 75 years. These long-term effects result in potential delayed marine migration, potential reduction in SAV density and food supply. The species most likely to be repeatedly/chronically exposed to these conditions are juvenile PS Chinook and HCSR chum salmon which typically migrate or rear in the nearshore area. Steelhead are less affected by the habitat detriment associated with the action because by the time they reach the marine environment, they are larger fish more adapted to deeper water, and so have lower demand for nearshore migration, predator refugia, and prey base. The reduction in food supply and SAV would adversely affect juvenile PS/GB bocaccio, if present, in the nearshore.

These long-term habitat changes, which would persist for the life of the structure, result in incremental increases in stress, reduction in foraging success, alteration of migration patterns (juveniles hesitating at structure's edge), and impairment of predator avoidance in the marine environment. Effects to individual fishes would occur among an undetermined percentage of all future cohorts of all populations that use the nearshore area of the project's action area. We anticipate that a small number of juveniles of each species would be injured or killed because of the 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. However, the project has elements of fish passage and habitat restoration which will give fishes access to estuary and fresh water stream habitats. This access will provide new refugia, forage, migration, and spawning opportunities. As indicated above, the long-lasting habitat impacts that fish will experience are reflected by the negative output of the calculator at minus 368, but these impacts appear to be fully balanced by the positive effects of re-establishing access to an area that will regain its function as a pocket estuary, providing valuable rearing and resting areas for smolts.

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]. 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 earlier in the discussion of environmental baseline (Section 2.4).

Anticipated climate effects on distribution of Pacific salmon include a wide variety of climate impacts. Rising temperatures during late spring and summer may also impact Pacific salmon juveniles in estuary habitats. Most Puget Sound estuaries already surpass optimal summer rearing temperatures, and the expectation of additional warming would further degrade already degraded habitat (Crozier et al. 2019).

Climate change has also become an increasing driver for infrastructure development and changes to protect against sea level rise in coastal areas. These flood protection projects would likely include, filling, raising of habitat, dikes, dune, revetments, flood gates, pump stations, and sea walls; all habitat modifications that would be detrimental to salmon. Over the useful life of the existing sea wall covered in this Opinion, we expect the effect of climate change in the action area would include decreasing salinity, modified temperature regime, increasing acidity, and sea-level rise.

Other non-federal cumulative effects reasonably certain to occur outside of navy-controlled property, but with potential to affect the action area, include future upland activities such as commercial and recreational use of Hood Canal. Water quality in the vicinity is influenced by upland uses that contribute point and nonpoint sources of water pollution. The human population in the PS region increased from about 1.29 million people in 1950 to about 4.2 million in 2020, and is expected to reach nearly 5 million by 2040 (Puget Sound Regional Council 2020). Planned growth consistent with county land use and growth management plans, would, in the long-term, result in additional effects to ecological functions, surface water quality, and nearshore habitat. As human population continues to grow, demand for agricultural, commercial, and residential development and supporting public infrastructure is also likely to grow. We believe the majority of environmental effects related to future growth would 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 contaminated to area waters. Land use changes and development of the built environment that existing regulations minimize future potential adverse effects on salmon habitat, as currently constructed and implemented, they still allow systemic, incremental, and additive degradation to occur. We consider human population growth to be the main driver for most of the future negative effects on salmon, steelhead, and bocaccio and their habitats.

2.7. Integration and Synthesis

The Integration and Synthesis section is the final step in assessing the risk that the proposed action poses to species and critical habitat. 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.

Three species considered in this opinion (PS Chinook salmon, HCSR chum salmon and PS steelhead) are listed as threatened with extinction. The fourth (bocaccio) is listed as endangered. These listing are because of declines in abundance, poor productivity, and reduced structure and diminished diversity. The declines and poor productivity for the salmonids are based in part on habitat systemic habitat loss and degradation, including conditions in the action area. The environmental baseline in the action area is a mix of commercial fishing and vessel infrastructure as well as commercial development landward of the HAT, that degrade habitat conditions for listed species in their nearshore marine life stage. Within the action area there are sources of noise and shade (vessels), water quality impairment (nonpoint sources), and artificial light (navy overwater structures). These conditions do not provide optimal conditions for individuals of the listed species' growth, fitness, development/maturation or survival, particularly if present in high numbers. Bocaccio are endangered largely due to historic overfishing of a species that is long lived with late fecundity, inhibiting productivity. Habitat conditions, including in the action area, also impair survival of spawn and juveniles of the species.

These species also face risks from cumulative effects that are likely in the future. The greatest risks associated with climate change for the salmonid species would likely occur during incubation, when eggs are vulnerable to high mortality due to increased flooding and variability in seasonal flow (Ward et al. 2015). Crozier et al. (2019) identified early life stages, such as incubating eggs, as highly sensitive when exposed to more variable hydrologic regimes. Crozier et al. (2019) also predicted that 8 percent of spawning habitat would change from snow-dominated to transitional, and 16 percent change from transitional to rain-dominated. These projections suggest that winter flooding would become more common, directly affecting incubating eggs. Stream temperature ranks high in the extent of change expected, which could increase pre-spawn mortality in low-elevation tributaries (Bowerman et al. 2017). Systemic anthropogenic detriments in fresh (for PS Chinook salmon, HCSR chum salmon and PS steelhead) and marine habitats are limiting the productivity for these species.

To this context of species status and baseline conditions, and cumulative effect, we add the effects of the proposed action, 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 would appreciably diminish the value of designated critical habitat for the conservation of the 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 significantly delay development of such features.

2.7.1 Habitat

When the temporary and long-term effects are added to the baseline, and considering the status of critical habitat rangewide for PS Chinook salmon, HCSR chum salmon, and PS/GB bocaccio, we find that the temporary adverse effects, even those that can occur along 725 linear feet of shoreline, are of insufficient duration to reduce the conservation value of the critical habitat. Because water quality promptly regains its baseline level the role it provides for young salmonid growth, fitness and survival is not diminished. Sediment conditions and prey resources regain their baseline level more slowly, but prey is not known to be limiting in the action area, and again, even when added to the baseline, we do not find that the conservation role for juvenile salmonids or bocaccio is reduced despite the temporary reduction of this PBF. When long term effects are evaluated, there are incremental reductions in prey base (and migration value for Chinook and chum) that over time could inhibit growth, fitness, or survival of several individuals from each species, but the long-term effects also include benefits to water quality, sediment quality, prey and freshwater migration/rearing which can provide improved growth, fitness, and survival of individuals contemporaneously. When taken together, we consider the long-term adverse effects balanced by the long-term beneficial effects. We expect the overall conservation value, despite adverse effects being added to the baseline, would be retained, thus the project's adverse effects are not likely to impair conservation values of habitat in the action area.

2.7.2 ESA Listed Species

As detailed in Section 2.5.2, the adverse effects that are added to the baseline will result in a variety of responses among exposed salmonids and bocaccio, ranging from behavioral responses such as avoidance by salmonids (of suspended sediment) to reduced fitness (due to energy expense in foraging among salmon PS Chinook salmon, HCSR chum salmon and juvenile bocaccio) to reduced fitness, injury or death (from susceptibility to predation and water quality reductions). These responses occur in response to both temporary and long term effects. Given that the long-term effects also include habitat gains that are likely to incrementally improve growth, fitness, and survival of the same populations and cohorts of these populations, we believe that when taken together, even when cumulative effects are considered, productivity, abundance, spatial structure, and diversity of the four species will not be altered by the effects of the proposed action.

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, the effects of other activities caused by the proposed action, and the 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 salmon, PS steelhead, and PS/GB bocaccio.

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 fishes or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). "Harass" is further defined by guidance as to "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering." "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 as follows:

Harm of PS Chinook salmon, HCSR chum salmon, PS steelhead and PS/GB bocaccio from exposure to:

- suspended sediments;
- increased predation (reduced cover and shallow water habitat); and
- reduced prey availability from benthic disturbance.

The distribution and abundance of listed species that occur within an 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 the proposed action. Thus, the distribution and abundance of fishes within the action area cannot be attributed entirely to habitat conditions, nor can the NMFS precisely predict the number of listed species that are reasonably certain to be injured or killed during construction activities or after their habitat is modified or degraded by the proposed action.

Therefore, the NMFS cannot predict with meaningful accuracy the number of PS Chinook salmon, HCSR chum salmon, PS steelhead, or PS/GB bocaccio that are reasonably certain to be injured or killed annually by the exposure to the stressors identified above. Additionally, the NMFS knows of no device or practicable technique that would yield reliable counts of individuals that may experience these impacts. In such circumstances, the NMFS uses a causal link established between the activity and the likely extent and duration of changes in habitat conditions as surrogates to describe the extent of take as a numerical level of habitat disturbance. The most appropriate surrogates for take are action related parameters that are directly related to the magnitude of the expected take.

In summary, the extent of PS Chinook salmon, HCSR chum salmon, PS steelhead, and PS/GB bocaccio take for this action is defined as:

- The extent of take in the form of harm from water quality reductions associated with suspended sediments during sea wall and revetment replacement is 725 linear feet that may be disturbed during sea wall replacement and riprap manipulation. A larger linear distance would likely increase the amounts of contaminated turbidity and expose more listed fishes to this degraded habitat condition;
- The extent of take in the form of harm from extended useful life of the sea wall and revetment is the 725 linear feet of new sea wall and revetment. A larger linear distance would further increase predation and reduce habitat quality that would otherwise support rearing and migration of juvenile listed fish species.

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" refer to actions the Director considers necessary or appropriate to minimize the impact of the incidental take on the species (50 CFR 402.02).

The Navy shall be required to:

1. Ensure the implementation of monitoring and reporting to confirm that the take exemption for the proposed action is not exceeded.
2. Monitor the fish passage and pocket estuary for their effectiveness as mitigation.

2.9.4 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the Federal action agency must comply (or must ensure that any applicant complies) with the following terms and conditions. The 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.

1. To implement the RPM 1, Implement a monitoring and reporting system to confirm that the take exemption for the proposed action is not exceeded, the Navy shall develop and implement a plan to collect and report details about the take of listed species. That plan shall:
    a. Require the contractor to maintain and submit logs to verify:
        i. The dates and description(s) of the construction activities;
        ii. The extent of any turbidity plume and measures taken to maintain it within 150 feet;
        iii. The extent of benthic disturbance within the in-water construction area; and
        iv. The linear feet of sea wall and revetment that is replaced.
    b. Require the contractor to establish procedures for the submission of activity logs and other material to the Navy, and
    c. Require the Navy to submit an electronic annual construction update and post-construction report to NMFS within six months of project completion. Send the report to: projectreports.wcr@noaa.gov. Be sure to include Attn: WCRO-2024-00351 in the subject line.

2. To implement RPM 2, Monitor the fish passage and pocket estuary for their effectiveness as mitigation, the Navy shall develop and implement a 5-year monitoring and adaptive management plan. That plan shall:
    a. Be submitted to and approved by NMFS prior to project completion;
    b. Be designed to accomplish the following:
        i. Ensure fish passage meets NMFS guidelines (NMFS 2022);
        ii. Ensure fish passage to the pocket estuary;
        iii. Ensure the pocket estuary provides high quality nearshore habitat conditions for ESA-listed salmonids; and
        iv. Ensure the longevity of fish passage and high quality habitat in the pocket estuary.
    c. Require the Navy to submit the electronic annual monitoring report to NMFS at the end of each calendar year. Send the report to: projectreports.wcr@noaa.gov. Be sure to include Attn: WCRO-2024-00351 in the subject line.

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).

1. The NMFS recommends that the Navy assess their stormwater systems that outfall into ESA listed fish bearing waterbodies to incorporate biorentention and or filtration elements to capture pollutants such as 6PPD.

2.11. "Not Likely to Adversely Affect" Determinations

This assessment was prepared pursuant to section 7(a)(2) of the ESA, implementing regulations at 50 CFR 402 and agency guidance for preparation of letters of concurrence.

As described in Section 2 and below, the Navy's BA had concluded that the proposed action would not likely to adversely affect PS/GB yelloweye rockfish (*Sebastes ruberrimus*), sunflower sea star (*Pycnopodia helianthoides*) or SR killer whale (*Orcinus orca*). The NMFS has concluded that the proposed action would be not likely to adversely affect PS/GB yelloweye rockfish or sunflower sea star.

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. The effects analysis in this section relies heavily on the descriptions of the proposed action and project site conditions discussed in Sections 1.3 and 2.4, and on the effects analysis presented in Section 2.5.

<u>Habitat for PS/GB Yelloweye Rockfish</u>

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 outlines species protection measures (33 CFR 334). Both the action area and project area are within exempted DoD lands.

<u>Effects on PS/GB Yelloweye Rockfish</u>

Unlike PS/GB bocaccio, larval and juvenile PS/GB yelloweye rockfish do not typically utilize the nearshore environment and are more likely to be found in areas with greatest depth. It is unlikely that juvenile yelloweye rockfish would occur within SAV habitats or the action area because they do not use the nearshore for rearing. Larval rockfish presence typically peaks twice, once in spring and once in late summer. 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). Still, we find the likelihood of larval or juvenile PS/GB yelloweye rockfish to be occupying the action areas to be low. Similarly, the presence of adult PS/GB yelloweye in the action area is extremely unlikely. Suitable habitat for the adult lifestage is extremely limited in the area that affects fish based on preferred habitat depths and features such as rugosity. Although, given the ability of this species to move throughout the marine environment, we cannot conclude that they would not ever occur within the action area, either during construction action or over a proposed structure's useful life. However, we expect exposure of all life stages of PS/GB yelloweye rockfish to project effects to be extremely unlikely and therefore discountable.

All effects on PS/GB yelloweye rockfish and their critical habitat being discountable, NMFS concurs that the action is not likely to adversely affect this species or its critical habitat.

Effects on Critical Habitat for SR Killer Whale

This assessment considers the intensity of expected effects in terms of the change that would cause in the affected PBFs from their baseline conditions, and the severity of each effect, considered in terms of the time required to recover from the effect. Designated habitat for SR killer whales include marine waters of the Puget Sound that are at least 20 feet deep. The expected effects on SR killer whale habitat from completion of the proposed action, including full application of the conservation measures and BMPs, would be limited to the impacts on the PBFs as described below.

Based on the natural history of SR killer whales and their habitat needs, NMFS identified the following PBFs essential to conservation: 1) Water quality to support growth and development; 2) Prey species of sufficient quantity, quality and availability to support individual and population growth as well as reproduction and development; and 3) Passage conditions to allow for migration, resting, and foraging. Prey species and passage PBFs occur in the action area and would be adversely affected.

Because the proposed action has adverse effects on PS Chinook salmon, we understand the proposed action will have short- and long-term effects on prey availability and quality for SR killer whales. However, based on our analysis above, the short term effects associated with construction will occur only among one cohort of PS salmon, and the long term detrimental effects are offset by long term beneficial effects. Thus, we construe the action-related adverse impacts would affect only extremely low numbers of individual PS Chinook salmon (primary prey), and that this number would be too small to cause detectable effects on prey availability or quality. Therefore, after the initial disturbance stabilizes, the quantity and quality of prey fish available to SR killer whales might incrementally improve. We consider these effects at a low enough level that the effects are insignificant on CH for SR killer whales

Effects on SR Killer Whale

SR killer whales are typically observed in marine water habitats greater than 20 feet deep, and we would therefore expect them not be directly exposed to any project-related effects such as turbidity, and to stormwater chemicals at extremely low concentration. As described above, there is a small chance that they are exposed a brief and slight trophic web reduction. As described in Section 2.2 the number of PS Chinook salmon that would be affected by the proposed action is extremely small and is driven by temporary effects only, as long-term negative effects are offset by long term beneficial effects. Because, as described in Section 2.5, the proposed action would affect too few individuals to cause detectable population-level affects to their prey, we extrapolate that as the likelihood that any individual juvenile Chinook salmon is affected by this project to become prey for SR killer whale is very low (Gamble et al. 2018), any project-related reduction in Chinook salmon availability for SR killer whales would be undetectable. The effect on SR killer whales is considered insignificant.

Because the short-term are not appreciable at the scale of an individual whale or their habitat, we consider the effects to be insignificant for both the species or their habitat. Accordingly, the action is not likely to adversely affect SR killer whales or their habitat.

Effects on Critical Habitat for Sunflower Sea Star

Sunflower sea star critical habitat is not yet proposed.

Effects on Sunflower Sea Star

The sunflower sea star *Pycnopodia helianthoides* could occur in the action area as this species occupies nearshore intertidal and subtidal marine waters shallower than 450 m (~1400 ft) deep from Adak Island, AK, to Bahia Asunción, Baja California Sur, MX. They are occasionally found in the deep parts of tide pools. The species is a habitat generalist, occurring over sand, mud, and rock bottoms both with and without appreciable vegetation. From 2013 to 2017, the sunflower sea star experienced a range-wide epidemic of sea star wasting syndrome (SSWS) (Gravem et al. 2021; Hamilton et al. 2021; Lowry et al. 2022). While the cause of this disease remains unknown, prevalence of the outbreak has been linked to a variety of environmental factors, including temperature change, sustained elevated temperature, low dissolved oxygen, and decreased pH (Hewson et al. 2018; Aquino et al. 2021; Heady et al. 2022; Oulhen et al.2022). Sunflower sea stars have been infrequently observed at low densities in Termination Point-Oak Head (Toandos Peninsula). Citizen science surveys have identified sunflower sea star within the action area; however, sighting frequency and densities have been low (REEF 2024).

Given regionally documented low sea star density, we conclude it is extremely unlikely that any sunflower sea star would be exposed to the construction disturbance/temporary effects based on their sparse distribution and, therefore, the exposure to turbidity or altered benthic conditions would be discountable.

Little is known about specific effects of toxic contaminants on sunflower sea stars, or how stress from exposure to such chemicals affects susceptibility to sea star wasting syndrome. Laboratory challenge tests have exposed larval stages of various marine invertebrates to hydrocarbons, heavy metals, pesticides, and other contaminants commonly found in stormwater runoff. Documented impacts range from developmental abnormalities to behavioral augmentation, and mortality is common at concentrations as low as several parts per million (Hudspith et al. 2017). For juvenile and adult marine invertebrates, including sea stars and other echinoderms, a variety of sublethal behavioral and physiological effects from these toxic contaminants have been documented, but mortality is also possible. Given that the amount of stormwater runoff from this site is expected to be low with a very small amount of contaminants, we do not expect discernible effect to the health of any individual sunflower sea stars as a result of this action, and this effect is expected to be insignificant.

Furthermore, as habitat generalists, we expect sea stars would be able to successfully use much of the habitat that is being made accessible by the project. Thus, any short effects on sunflower sea stars from project-induced changes in habitat would be insignificant and long-term benefits could be incrementally beneficial.

Accordingly, as all effects to this species are considered discountable, insignificant, or beneficial we determine that the action is not likely to adversely affect sunflower sea star.

2.12. Reinitiation of Consultation

This concludes ESA consultation for the Tang Road Repair Project.

Under 50 CFR 402.16(a): "Reinitiation of consultation is required and shall be requested by the federal agency, where discretionary federal involvement or control over the action has been retained or is authorized by law and: (1) If the amount or extent of taking specified in the incidental take statement is exceeded; (2) If new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) If 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 written concurrence; or (4) If a new species is listed or critical habitat designated that may be affected by the identified action."

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

Section 305(b) of the 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 fishes for spawning, breeding, feeding, or growth to maturity", and includes the associated physical, chemical, and biological properties that are used by fishes (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 may result from actions occurring within EFH or outside of it and may include direct, indirect, site-specific or habitat-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 (50 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 2023b), coastal pelagic species (CPS) (PFMC 2023a), and Pacific Coast salmon (PFMC 2022) 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 project occurs within EFH for various federally managed fish species within habitat that has been designated as EFH for various life stages of Pacific coast groundfish, coastal pelagic species, and Pacific Coast salmon.

Of the 83 managed groundfish species, less than half are likely to occur in the nearshore of Puget Sound. EFH for Pacific coast groundfish is defined as aquatic habitat necessary to allow for groundfish production to support long-term sustainable fisheries or groundfish and for groundfish contributions to a healthy ecosystem. This definition includes all waters from the MHHW line, and the upper extent of saltwater intrusion in river mouths along the coasts of Washington, Oregon, and California seaward to the boundary of the Exclusive Economic Zone.

Three coastal pelagic species are known to occur in the greater Puget Sound: northern anchovy, Pacific mackerel, and market squid. 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. Coastal pelagic species have value to commercial Pacific fisheries, and are also important as food for other fishes, marine mammals, and birds (63 Federal Register 13833).

Three salmon species are known to occur in the greater Puget Sound: coho, Chinook salmon, and pink. 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 (PFMC 2022). 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.

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. Coastal pelagic species do not have designated HAPCs. The action area does not include EFH which has been designated as HAPC for groundfish and salmon. As described in Section 2.4 (Environmental Baseline), estuaries and submerged aquatic vegetation (SAV), including canopy kelps and eelgrass beds, provide habitats that are biologically productive and provide a significant contribution to the marine and estuarine food webs for these fisheries. In general, there is a steady decline of kelp forests in Puget Sound, which are impacted by sediment, toxic pollution and shoreline alterations. Due to its resilience, eelgrass in Puget Sound is more stable overall, but has a patchy distribution along the subtidal and intertidal areas of the project sites and is impacted by warmer waters and over water shading. Both kelp and eelgrass are present along the NBK-Bangor shoreline. Large eelgrass beds are in waters adjacent of the project area (but would not be disturbed by this project).

3.2. Adverse Effects on Essential Fish Habitat

Migratory Pathway Obstruction

The proposed replacement of the Tang Road sea wall in aquatic habitat would continue to alter outmigration patterns of juvenile salmonids due to physical characteristics of the structure. The sea wall may contribute to migration delay of salmonids and increased densities at the edges of the structure. Although the total length of sea wall would not change, we expect this action to continue to impair the quality of the migratory corridor and hinder safe passage.

Effects on Forage, Cover, and Predation

SAV was documented in the proximity of the project area. There is a high likelihood that SAV patches would come and go within the action area over the life of the structure. SAV is important in providing protective cover and a food base for juvenile fishes, including salmon. Shading and wave energy rebound within the nearshore habitat for the life of the structures can adversely affect primary productivity and SAV. The presence of the wall reduces favorable habitat that supports productive forage fish spawning due to the loss of shallow intertidal area and other favorable characteristics such as wrack development. The subsequent change in sediment composition further affects forage fish spawning productivity. Coastal pelagics, like northern anchovy, use estuarine habitats such as the intertidal zone, eelgrass, kelp, and other macroalgae and could therefore be affected by the impacts on their designated EFH. Any juvenile and sub-adult groundfish within the action area would also be expected near the eelgrass and kelp habitats within the nearshore.

The continuing presence of shoreline armoring can also alter the suitability for EFH species through changes in predation pressures. The presence of the sea wall may cause juvenile fishes to linger increasing their density at certain locations. This would enable predators to take advantage of these high-density locations to increase their predation success. Also, during high tides, small fishes would need to swim in deeper water than they would normally prefer, exposing them to greater predation from larger fishes. This is further exacerbated by the fact that habitat along sea walls lack of complexity (absence of large woody debris) and provide no cover.

Water Quality

Repair of the Tang Road sea wall and revetment would require vibratory sheet pile driving (in the dry) and low weight/soft tracked equipment to maneuver along 725 linear feet of beach habitat in front of the wall. This activity would temporarily disturb bottom sediments within the immediate project construction area, resulting in localized increases in suspended sediment concentrations that, in turn, would cause increases in turbidity during the work window.

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 or contaminant exposure. Changes in water quality throughout construction activities would 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 would be minor and localized, and short in duration.

The potential for accidental spills or releases of hazardous materials would be minimized through implementation of spill prevention and response plan to clean up fuel or fluid spills.

Benthic Communities

Temporary (operation of low weight/soft tracked equipment on sediments) and enduring (extended useful life of sea wall) impacts would disrupt benthic environments and larval/juvenile rearing habitats and food sources. Reduced diversity or density of epibenthic meiofauna reduces prey resources. 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 would be some degradation of benthic habitat, but it would rebound after the disturbance.

Fish Passage

The proposed project would 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. Furthermore, the project will increase fish passage and provide fishes access to a pocket estuary and a fresh water stream. While the action may result in some adverse effects, the increased access to estuary and freshwater habitat would be increased.

Conclusion

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

Based on information provided in the biological assessment and the analysis of effects presented here and in the ESA portion of this document, NMFS determined that the proposed actions would have adverse effects on each EFH by perpetuating the existence of shoreline armoring (constituting loss of habitat) and the reduction of in water and sediment quality. While some qualities would improve, such as fish passage and estuary refugia, others would persist.

3.3. Essential Fish Habitat Conservation Recommendations

NMFS determined that the following conservation recommendations are necessary to avoid, minimize, mitigate, or otherwise offset the impact of the proposed action on EFH.

1. Upon completion of fish passage culvert, monitor the potential fish passage upstream of the security bridge.

Fully implementing these EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in Section 3.2, above, for Pacific Coast salmon, Pacific Coast groundfish, and coastal pelagic species.

3.4. Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the Navy 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 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 are the Navy. Individual copies of this opinion were provided to the Navy. The document will be available at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adhere 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 part 600.

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

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

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

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