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-2022-02108

February 28, 2025

P. Allen Atkins
Chief, Regulatory Branch
U.S. Army Corps of Engineers, Seattle District
4735 East Marginal Way South, Bldg. 1202
Seattle, Washington 98134-2388

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for Snohomish County's Haller Bridge Pier 4 Scour Protection project on the Stillaguamish River, at Arlington, Snohomish County, Washington (HUC: 171100080303 – Armstrong Creek-Stillaguamish River) (USACE No. NWS-2021-01021-WRD)

Dear Mr. Atkins:

Thank you for the U.S Army Corps of Engineers' (USACE) letter of August 30, 2022, 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 U.S Army Corps of Engineers' (USACE) authorization of Snohomish County's Haller Bridge Pier 4 Scour Protection project on the Stillaguamish River. Thank you, also, for your request for essential fish habitat (EFH) consultation. The NMFS reviewed the proposed action for potential effects on EFH pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), implementing regulations at 50 CFR 600.920, and agency guidance for use of the ESA consultation process to complete EFH consultation.

The enclosed document contains the biological opinion (opinion) prepared by the NMFS pursuant to section 7 of the ESA on the effects of the proposed action. In this opinion, the NMFS concludes that the proposed action would adversely affect but is not likely to jeopardize the continued existence of Puget Sound (PS) Chinook salmon and PS steelhead. The NMFS also concludes that the proposed action is likely to adversely affect designated critical habitat for PS Chinook salmon, but is not likely to result in the destruction or adverse modification of that designated critical habitat. This opinion also documents our conclusion that the proposed action is not likely to adversely affect southern resident (SR) killer whales and their designated critical habitat.

This opinion includes an incidental take statement (ITS) that describes reasonable and prudent measures (RPMs) the NMFS considers necessary or appropriate to minimize the incidental take associated with this action, and sets forth nondiscretionary terms and conditions that the USACE must comply with to meet those measures. Incidental take from actions that meet these terms and conditions will be exempt from the ESA's prohibition against the take of listed species.

Section 3 of this document includes our analysis of the action's likely effects on EFH pursuant to Section 305(b) of the MSA. Based on that analysis, the NMFS concluded that the action would adversely affect designated freshwater EFH for Pacific Coast Salmon. However, as described in Section 3, the NMFS knows of no practical measures, beyond those already proposed by the applicant, that would reduce the action's expected effects. Therefore, the NMFS offers no conservation recommendations pursuant to MSA (§305(b)(4)(A). We also concluded that the action would not adversely affect EFH for Pacific Coast groundfish and coastal pelagic species. Therefore, consultation under the MSA is not required for those EFHs.

Please contact Donald Hubner in the North Puget Sound Branch of the Oregon/Washington Coastal Office at (206) 526-4359, or by electronic mail at Donald.Hubner@noaa.gov if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

Kathleen Wells
Assistant Regional Administrator
Oregon Washington Coastal Office

cc: Ryan Cochoit, USACE
Robert Marchand, Snohomish County

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

Snohomish County's Haller Bridge Pier 4 Scour Protection Project
Snohomish County, Washington
(HUC: 171100080303) (USACE No. NWS-2021-01021-WRD)

NMFS Consultation Number: WCRO-2022-02108

Action Agencies: U.S. Army Corps of Engineers

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?
Chinook salmon (*Oncorhynchus tshawytscha*) Puget Sound (PS)	Threatened	Yes	No	Yes	No
Steelhead (*O. mykiss*) PS	Threatened	Yes	No	N/A	N/A
killer whales (*Orcinus orca*) Southern resident (SR)	Endangered	No	No	No	No

Affected Essential Fish Habitat (EFH) and NMFS' Determinations:

Fishery Management Plan That Describes EFH in the Project Area	Does Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific Coast Salmon	Yes	No
Pacific Coast Groundfish	No	No
Coastal Pelagic Species	No	No

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

Issued By:

Kathleen Wells
Assistant Regional Administrator
Oregon Washington Coastal Office

Date: February 28, 2025

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LIST OF ABBREIVIATIONS

BA – Biological Assessment
BMP – Best Management Practices
CFR – Code of Federal Regulations
dB – Decibel (common unit of measure for sound intensity)
DIP – Demographically Independent Population
DPS – Distinct Population Segment
DQA – Data Quality Act
EF – Essential Feature
EFH – Essential Fish Habitat
ESA – Endangered Species Act
ESU – Evolutionarily Significant Unit
FR – Federal Register
FMP – Fishery Management Plan
HAPC – Habitat Area of Particular Concern
HPA – Hydraulic Project Approval
HUC – Hydrologic Unit Code
ITS – Incidental Take Statement
JARPA – Joint Aquatic Resource Permit Application
mg/L – Milligrams per Liter
MPG – Major Population Group
MSA – Magnuson-Stevens Fishery Conservation and Management Act
NMFS – National Marine Fisheries Service
NOAA – National Oceanic and Atmospheric Administration
NTU – Nephlometric Turbidity Units
OHWM – Ordinary High-Water Mark
PAH – Polycyclic Aromatic Hydrocarbon
PBF – Physical or Biological Feature
PCB- Polychlorinated Biphenyl
PFMC – Pacific Fishery Management Council
PS – Puget Sound
PSTRT – Puget Sound Technical Recovery Team
PSSTRT – Puget Sound Steelhead Technical Recovery Team
PTS – Permanent Threshold Shift
RL – Received Level
RPA – Reasonable and Prudent Alternative
RPM – Reasonable and Prudent Measure
SEL – Sound Exposure Level
SL – Source Level
SR – Southern Resident (Killer Whales)
TSS – Total Suspended Solids
TTS – Temporary Threshold Shift
USACE – U.S. Army Corps of Engineers
VSP – Viable Salmonid Population
WCR – West Coast Region (NMFS)
WDFW – Washington State Department of Fish and Wildlife
WDOE – Washington State Department of Ecology

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.

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.

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 the Oregon Washington Coastal Office.

1.2 Consultation History

On August 30, 2022, the NMFS received a letter from the U.S. Army Corps of Engineers (USACE) that requested consultation for their authorization of Snohomish County's Haller Bridge Pier 4 Scour Protection project on the Stillaguamish River (USACE 2022a). The request included the County's biological assessment (BA), project drawings, and Critical Areas Report and Mitigation Plan (Jacobs 2021a-c).

On March 15, 2024, the NMFS requested additional information and informed USACE that we consider that the proposed action requires formal consultation. On May 6, 2024, the USACE provided the requested information via electronic mail (email) (USACE 2024a & b). On July 31, 2024, the NMFS reminded the USACE of the need for formal consultation, and requested the project's Joint Aquatic Resource Permit Application (JARPA) and Hydraulic Project Approval (HPA). On the same day, the USACE requested formal consultation and provided the project's JARPA via email (USACE 2024c; Snohomish Co. 2021), they also reported that the County had not yet requested their HPA. The NMFS initiated formal consultation on July 31, 2024, after receiving the USACE's request for formal consultation. On August 6, 2024, the NMFS requested more additional information, that was provided by an email from the applicant on September 4, 2024 (Snohomish Co. 2024).

This opinion is based on the information in the documents and other additional information identified above; recovery plans, status reviews, and critical habitat designations for ESA-listed PS Chinook salmon and PS steelhead; published and unpublished scientific information on the biology and ecology of those species; and relevant scientific and gray literature (see Literature Cited).

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 (50 CFR 402.02). Under the 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 USACE proposes to authorize Snohomish County to implement a scour repair and protection project on Pier 4 of the Haller Bridge, on the Stillaguamish River, at Arlington, Washington (Figure 1).

Figure 1. Google Earth imagery of the project site. The left image shows the Haller Bridge project site in relation to Puget Sound, Washington. The right image shows the project site at the confluence of the North and South Forks of the Stillaguamish River, in Snohomish County Washington.

<u>Project Overview</u>

Off the north bank of the Stillaguamish River, flood events have removed much of the previously existing riprap from around Pier 4, and scoured voids into its base such that several of the supporting timber piles are now exposed and no longer connected to the pier (Figure 2).

Figure 2. Photographs of Haller Bridge Pier 4 damage. The left image shows the north side of the pier, looking southeast (upstream). The right image shows the upstream end and north side of the pier, looking west (downstream) (Adapted from Figure 3 in Jacobs 2021a).

The project would reconnect the piles and fill scour voids in the pier with concrete, install a new cast-in-place concrete foundation cap around the base of the pier, and install riprap to repair and enhance the existing riprap around the base of the pier. The size of the permanently affected area would be about 2,575 square feet (Jacobs 2021c). To help offset the permanent impacts of the project's new concrete and riprap, the project would remove two derelict concrete pier structures, and derelict concrete debris and riprap from adjacent in-stream areas (Figure 3). The size of the combined derelict concrete and riprap areas would be about 1,745 square feet (Jacobs 2021c). The Project would require the use of heavy construction equipment within the banks of the river, including excavators, a concrete mixer truck, and dump trucks.

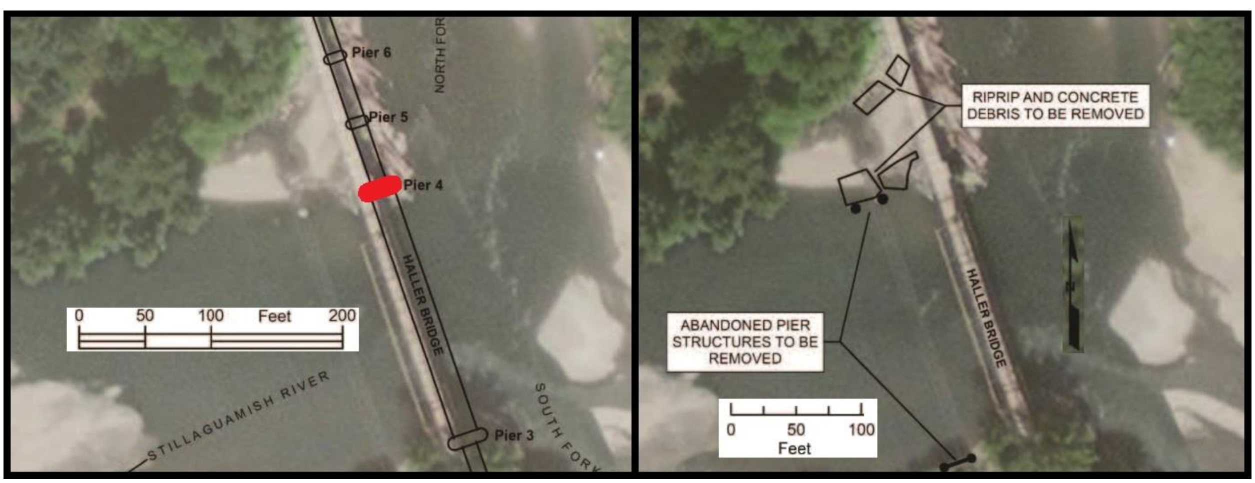

Figure 3. Overhead photographs of the Haller Bridge across the confluence of the North and South Forks of the Stillaguamish River. The left image shows the location of Pier 4 (red oval). The right image shows the location of the in-water concrete and riprap that would be removed as mitigation for the project (Adapted from Figures 2 & 6 in Jacobs 2021a).

To reduce work-related impacts on aquatic resources, any work done below the ordinary high-water mark (OHWM) would be accomplished during the August 1 through August 31 in-water work window for the area. Additionally, the county's contractors would be required to develop and implement a Temporary Erosion and Sediment Control Plan (TESCP) in compliance with County stormwater regulations, as well as comply with the conservation measures and best management practices (BMPs) identified in the project's BA and the provisions of the project's Hydraulic Project Approval (HPA) when issued.

General Timeline

During the last half of July, about 18 days of upland work would be done to install upland BMPs, install the upland portions of the temporary access routes (Figure 4), and mobilize equipment.

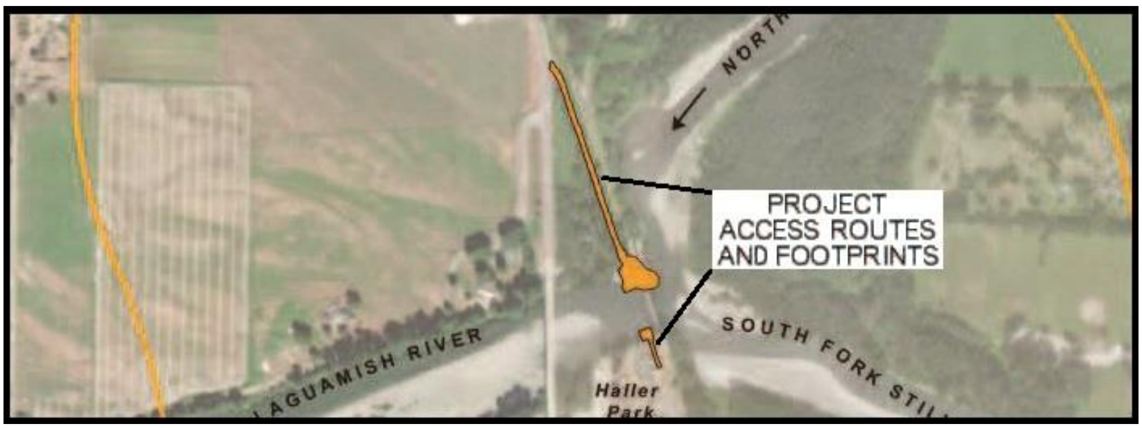

Figure 4. Overhead photograph of the Haller Bridge project areas with the project's access routes and project footprints overlaid in yellow (Adapted from Figure 8 in Jacobs 2021a).

To access Pier 4, a temporary 12-foot wide 300-yard long access route, along the route of old Highway 9, would constructed parallel to the west side of the Centennial Trail, from State Highway 9 to the north bank of the river (Figure 4). Construction of the access routes would require the clearing of some woody vegetation. Geotextile fabric would be temporarily placed along the route to allow for complete removal of the temporary surfacing and fill materials at the end of the project. Whenever feasible, hog fuel (coarse wood chips) would be used as surfacing material. Clearing of the access routes would predominately impact invasive knotweed and blackberry. With the exception of the excavated ramp on the north access route (described below), any native shrubs impacted along the routes would be cut in a manner that would allow them to regrow. No tree removal is planned (Snohomish Co. 2024).

Over the first 4 days or so of the in-water work window (August 1 through about the 4th), the construction crews would install the below-the-OHWM BMPs and extend the north access route below the river's OHWM to reach Pier 4. Part of this work would include excavation of a temporary ramp through the river bank. The ramp would be composed of course aggregates installed over geotextile fabric. The ramp would impact about 1,020 square feet of riparian area with 40-percent vegetation cover (Jacobs 2021c). Although the south access route would not extend below the OHWM, it would require the cutting of about 350 square feet of riverside woody shrubs (Jacobs 2021c).

The below-the-OHWM BMPs would include the installation of turbidity curtains and or sandbag cofferdams to enclose and isolate all in-water work areas. Those curtains/cofferdams would remain in place until the work is complete and turbidity levels within them has returned to background levels. Within the isolated in-water work areas, fish salvage would be conducted by qualified biologist immediately after the isolation is established, and again periodically afterwards as appropriate, and is expected to be limited to the use of nets. All methods used for the capture and relocation of fish and other aquatic organisms would be per the most current WDFW Recommended Fish Exclusion, Capture, Handling, and Electroshocking Protocols and Standards (Snohomish Co. 2024).

Over the next 7 days or so (about August 5 through 11), construction crews would remove the degraded riprap from around Pier 4, prepare the pier's footing for the new foundation cap, and remove abandoned concrete piers and other debris from the mitigation areas. Some of this work is likely to extend below the water's surface along some edge areas (Figure 5). All in-water work areas would be isolated behind turbidity curtains and or sandbag cofferdams, and the excavator would be operated from dry areas out of the water, with only its arm extending into the water.

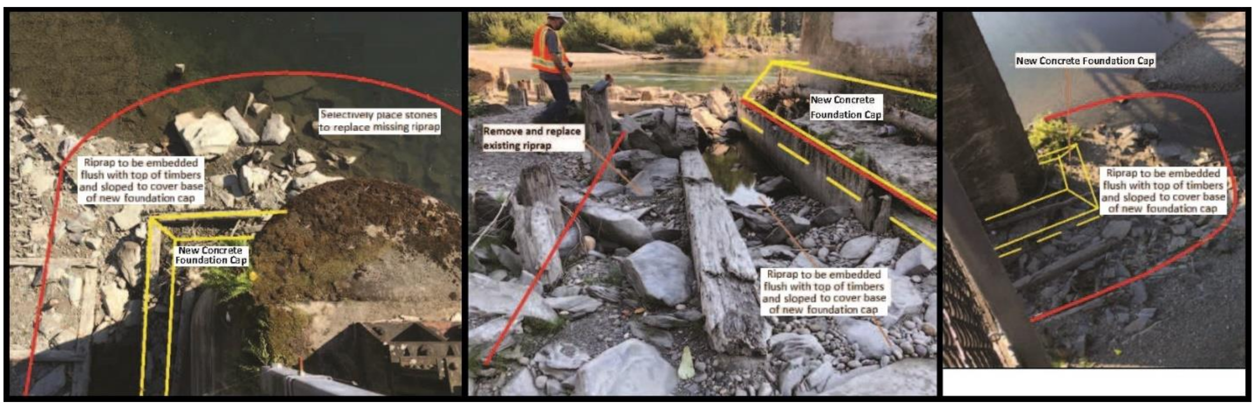

Figure 5. Photographs of Pier 4 showing the proposed concrete foundation cap in yellow and the riprap areas outlined in red (Adapted from Figures 5 in Jacobs 2021a).

Around Pier 4, the construction crews would use an excavator to remove the degraded existing riprap, interspersed derelict timbers, and some native streambed material from a 15- to 25-foot wide arc around the north side and both ends of the pier (Figure 5). Excavation would be to a maximum depth of 5 feet.

During the same time, in the mitigation areas, other construction crews would use some combination of an excavator bucket and a jackhammer attachment to break the abandoned pier structures and large pieces of concrete debris into moveable sized pieces. Work will be performed so that all debris would fall into the isolated work area. The pier structures would be cut down to 2 feet below the streambed, and streambed aggregate would be placed in any holes that are left. On the north bank, the excavator would operate in the dry, but from a position below the river's OHWM. On the south bank, the excavator would remain above the OHWM.

The crews would use the excavators to hoist the concrete pieces, riprap, and other debris from the Pier 4 and mitigation work areas onto dump trucks for transportation to appropriate upland disposal sites.

For about 3 days after the removal of degraded riprap, debris, and other loose material (about August 12 through 14), the construction crews would fill the pier's scour voids and construct the concrete foundation cap. This work would be done completely in the dry, and include BMPs to prevent wet concrete or its residues from entering the water. The crews would pump or pour concrete into the voids under the pier. They would also drill small holes into the outside of the pier column and then epoxy steel reinforcing bars (rebar) into the holes to bond the new concrete foundation cap to the pier. They would then install mortar-tight forms around the pier, then pump or pour concrete into the forms to create the foundation cap. The forms would be removed after the concrete has cured. When complete, the foundation cap would completely encircle Pier 4, extending 4 to 5.5 feet from the base of the column to cover the outer edge of the existing timber crib wall. Around the base of the pier, the cap would slope up to about 3 feet above the base of the existing pier column (Figure 5).

Over the next 3 days or so (about August 15 through 17), the construction crews would use the excavator with a thumb bucket to install a 4- to 5-foot-thick layer of 12- to 48-inch angular rock riprap over the excavated area around Pier 4. At the outer edge, the riprap would be flush with the surrounding native material. From there, it would gradually slope up to cover the base of the new foundation cap (Figure 5). On the south side of Pier 4, the existing riprap remains largely intact. So, the existing riprap would be left in place, and new riprap stones would be selectively placed as needed to repair any eroded portions of the existing riprap and to cover the base of the new foundation cap.

Over the next 6 days or so (about August 18 through 23), the construction crews would remove the below-the-OHWM BMPs and access route to Pier 4. This would include the complete removal of all surfacing and fill materials and the underlying geotextile, and the restoration of the river bank to its pre-construction profile.

Over the next 3 days or so (about August 24 through 26), the construction crews would remove the above-the-OHWM temporary access routes, including the complete removal of all surfacing and fill materials and the underlying geotextile. They would install stabilization measures, and reseed disturbed areas using a seed mix that meets or exceeds Washington State Department of Agriculture Certified Seed Standards and be from within the appropriate genetic zones of the Ecoregion (Snohomish Co. 2024).

About 3 more days of above-the-OHWM work would be done to install native woody vegetation in the disturbed areas.

<u>Other activities that could be caused by the proposed action</u>

The NMFS also considered, under the ESA, whether or not the proposed action would cause any other activities that could affect our trust resources. We determined that the action would extend the useful life of Haller Bridge. Therefore, the action would facilitate the continued presence of the Pier 4's in-water artificial substrate (riprap), and the bridge's shading of the river. Therefore, we have included an analysis of the effects of those impacts in the effects section of this Opinion.

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 the NMFS, and section 7(b)(3) requires that, at the conclusion of consultation, the 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 the NMFS to provide an incidental take statement (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 USACE determined that the proposed action is not likely to adversely affect PS Chinook salmon, PS steelhead, and designated critical habitat for PS Chinook salmon and PS steelhead. They further determined that the proposed action would have no effect on any other species and critical habitats under NMFS jurisdiction. Because the NMFS concluded that the proposed action is likely to adversely affect PS Chinook salmon, PS steelhead, and designated critical habitat for both species, the USACE requested, and the NMFS proceeded with, formal consultation.

Additionally, because of the trophic relationship between PS Chinook salmon and southern resident (SR) killer whales, the NMFS analyzed the action's potential effects on SR killer whales and their designated critical habitat in the "Not Likely to Adversely Affect" Determinations section 2.12 (Table 1).

Table 1. ESA-listed species and critical habitat that may be affected by the proposed action.

ESA-listed species and or critical habitat likely to be adversely affected (LAA)				
Species	**Status**	**Species**	**Critical Habitat**	**Listed / CH Designated**
Chinook salmon (*Oncorhynchus tshawytscha*) Puget Sound	Threatened	LAA	LAA	06/28/05 (70 FR 37160) / 09/02/05 (70 FR 52630)
steelhead (*O. mykiss*) Puget Sound	Threatened	LAA	N/A	05/11/07 (72 FR 26722) / 02/24/16 (81 FR 9252)
ESA-listed species and critical habitat not likely to be adversely affected (NLAA)				
Species	**Status**	**Species**	**Critical Habitat**	**Listed / CH Designated**
killer whales (*Orcinus orca*) southern resident	Endangered	NLAA	NLAA	11/18/05 (70 FR 57565) / 11/29/06 (71 FR 69054)

LAA = likely to adversely affect NLAA = not likely to adversely affect
N/A = not applicable. The action area is outside designated critical habitat, or critical habitat has not been designated.

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 of critical habitat for PS Chinook salmon uses the terms primary constituent element or essential features. The 2016 final rule (81 FR 7414; February 11, 2016) that revised the critical habitat regulations (50 CFR 424.12) replaced those terms 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 primary constituent elements, essential features, or PBFs. In this biological opinion, we use the term PBF to mean primary constituent element 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.

2.2 Range-wide 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.

Listed Species

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

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

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

"Abundance" generally refers to the number of naturally-produced adults that return to their natal spawning grounds.

"Productivity" refers to the number of naturally-spawning adults produced per parent. When progeny replace or exceed the number of parents, a population is stable or increasing. When progeny fail to replace the number of parents, the population is in decline.

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

The summaries that follow describe the status of the ESA-listed species, and their designated critical habitats, that occur within the action area and are considered in this opinion. More detailed information on the biology, habitat, and conservation status and trend of these listed resources can be found in the listing regulations and critical habitat designations published in the Federal Register and in the recovery plans and other sources at: https://www.fisheries.noaa.gov/species-directory/threatened-endangered, and are incorporated here by reference.

Puget Sound (PS) Chinook Salmon

The PS Chinook salmon evolutionarily significant unit (ESU) was listed as threatened on June 28, 2005 (70 FR 37160). We adopted the recovery plan for this ESU in January 2007. The recovery plan consists of two documents: the Puget Sound salmon recovery plan (SSPS 2007) and the final supplement to the Shared Strategy's Puget Sound salmon recovery plan (NMFS 2006). The recovery plan adopts ESU and population level viability criteria recommended by the Puget Sound Technical Recovery Team (PSTRT) (Ruckelshaus et al. 2002). The PSTRT's biological recovery criteria will be met when all of the following conditions are achieved:

- The viability status of all populations in the ESU is improved from current conditions, and when considered in the aggregate, persistence of the ESU is assured;
- Two to four Chinook salmon populations in each of the five biogeographical regions of the ESU achieve viability, depending on the historical biological characteristics and acceptable risk levels for populations within each region;
- At least one population from each major genetic and life history group historically present within each of the five biogeographical regions is viable;
- Tributaries to Puget Sound not identified as primary freshwater habitat for any of the 22 identified populations are functioning in a manner that is sufficient to support an ESU-wide recovery scenario; Production of Chinook salmon from tributaries to Puget Sound not identified as primary freshwater habitat for any of the 22 identified populations occurs in a manner consistent with ESU recovery; and
- Populations that do not meet all the Viable Salmon Population (VSP) parameters are sustained to provide ecological functions and preserve options for ESU recovery.

General Life History: Chinook salmon are anadromous fish that require well-oxygenated water that is typically less than 63º F (17º C), but some tolerance to higher temperatures is documented with acclimation. Adult Chinook salmon spawn in freshwater streams, depositing fertilized eggs in gravel "nests" called redds. The eggs incubate for three to five months before juveniles hatch and emerge from the gravel. Juveniles spend from three months to two years in freshwater before migrating to the ocean to feed and mature. Chinook salmon spend from one to six years in the ocean before returning to their natal freshwater streams where they spawn and then die.

Chinook salmon are divided into two races, stream-types and ocean-types, based on the major juvenile development strategies. Stream-type Chinook salmon tend to rear in freshwater for a year or more before entering marine waters. Conversely, ocean-type juveniles tend to leave their natal streams early during their first year of life, and rear in estuarine waters as they transition into their marine life stage. Both stream- and ocean-type Chinook salmon are present, but ocean-type Chinook salmon predominate in Puget Sound populations. Chinook salmon are further grouped into "runs" that are based on the timing of adults that return to freshwater. Early- or spring-run chinook salmon tend to enter freshwater as immature fish, migrate far upriver, and finally spawn in the late summer and early autumn. Late- or fall-run Chinook salmon enter freshwater at an advanced stage of maturity, move rapidly to their spawning areas, and spawn within a few days or weeks. Summer-run fish show intermediate characteristics of spring and fall runs, without the extensive delay in maturation exhibited by spring-run Chinook salmon. In Puget Sound, spring-run Chinook salmon tend to enter their natal rivers as early as March, but do not spawn until mid-August through September. Returning summer- and fall-run fish tend to enter the rivers early-June through early-September, with spawning occurring between early August and late-October. Yearling stream-type fish tend to leave their natal rivers late winter through spring, and move relatively directly to nearshore marine areas and pocket estuaries. Out-migrating ocean-type fry tend to migrate out of their natal streams beginning in early-March. Those fish rear in the tidal delta estuaries of their natal stream for about two weeks to two months before migrating to marine nearshore areas and pocket estuaries in late May to June. Out-migrating young of the year parr tend to move relatively directly into marine nearshore areas and pocket estuaries after leaving their natal streams between late spring and the end of summer.

Spatial Structure and Diversity: The PS Sound Chinook salmon ESU includes all naturally spawning populations of Chinook salmon from rivers and streams flowing into Puget Sound including the Straits of Juan De Fuca from the Elwha River, eastward, including rivers and streams flowing into Hood Canal, South Sound, North Sound and the Strait of Georgia in Washington. The ESU also includes the progeny of numerous artificial propagation programs (NWFSC 2015; Ford 2022). The PSTRT identified 22 extant populations, grouped into five major geographic regions, based on consideration of historical distribution, geographic isolation, dispersal rates, genetic data, life history information, population dynamics, and environmental and ecological diversity. The PSTRT distributed the 22 populations among five major biogeographical regions, or major population groups (MPGs), that are based on similarities in hydrographic, biogeographic, and geologic characteristics (Table 2).

Hatchery-origin spawners are present in high fractions in most populations within the ESU, with the Whidbey Basin the only MPG with consistently high fractions of natural-origin spawners. Between 1990 and 2019, the fraction of natural-origin spawners has declined in many of the populations outside of the Skagit watershed, and the ESU overall remains at a “moderate” risk of extinction (Ford 2022).

Table 2. Extant PS Chinook salmon populations in each biogeographic region (Ford 2022).

Biogeographic Region	Population (Watershed)
Strait of Georgia	North Fork Nooksack River
	South Fork Nooksack River
Strait of Juan de Fuca	Elwha River
	Dungeness River
Hood Canal	Skokomish River
	Mid Hood Canal River
Whidbey Basin	Skykomish River
	Snoqualmie River
	North Fork Stillaguamish River
	South Fork Stillaguamish River
	Upper Skagit River
	Lower Skagit River
	Upper Sauk River
	Lower Sauk River
	Suiattle River
	Upper Cascade River
Central/South Puget Sound Basin	Cedar River
	Sammamish River
	Green/Duwamish River
	Puyallup River
	White River
	Nisqually River

Abundance and Productivity: Available data on total abundance since 1980 indicate that abundance trends have fluctuated between positive and negative for individual populations, but productivity remains low in most populations, and hatchery-origin spawners are present in high fractions in most populations outside of the Skagit watershed. Further, across the ESU, 10 of 22 MPGs show natural productivity below replacement in nearly all years since the mid-1980s, and the available data indicate that there has been a general decline in natural-origin spawner abundance across all MPGs over the most-recent fifteen years. Further, escapement levels for all populations remain well below the PSTRT planning ranges for recovery (Ford 2022). Based on the current information on abundance, productivity, spatial structure and diversity, the most recent 5-year status review concluded that the PS Chinook salmon ESU remains at "moderate" risk of extinction, that viability is largely unchanged from the prior review, and that the ESU should remain listed as threatened (Ford 2022).

Limiting Factors: Factors limiting recovery for PS Chinook salmon include:

- Degraded floodplain and in-river channel structure
- Degraded estuarine conditions and loss of estuarine habitat
- Riparian area degradation 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

PS Chinook Salmon within the Action Area: The PS Chinook salmon most likely to occur in the action area are summer- and fall-run fish from the North Fork (NF) and South Fork (SF) Stillaguamish River populations (Ford 2022; WDFW 2024a). Both stream- and ocean-type Chinook salmon are present in these populations, with the majority being ocean-types.

The North Fork Stillaguamish River population is considered a native stock with composite production. The estimated numbers of naturally produced spawners is about 400 to 600 fish annually, and the hatchery supplementation program has an annual goal of releasing 200,000 fingerlings (WDFW 2024b). Between 1980 and 2020, total abundance has fluctuated between a bit less than 500 and about 1,800 spawners, with a negative abundance trend since 2000. Natural-origin spawners have declined from about 100 percent in the 1980s to about 25 percent in 2020 (Ford 2022).

The South Fork Stillaguamish River population is considered a native stock with wild production (WDFW 2024b). Between 1980 and 2020, total abundance has fluctuated between a about 50 and 350 spawners, with a negative abundance trend since 2000. Natural origin-spawners have declined from about 100 percent in the 1980s to about 25 percent in 2020 (Ford 2022).

The project reach provides migratory habitat for juvenile and adult life stages for both summer- and fall-run fish. Additionally, the project reach is documented spawning habitat for fall-run fish (WDFW 2024b). Returning adult Chinook salmon typically enter the Stillaguamish River from mid-June through mid-October, with most spawning occurring between mid-September and mid-November. Out-migrating juveniles typically start leaving the river as early as January, with most emigration occurring between early-March and mid-July during the first year of life. However, low numbers of stream-type fish likely to be present in the system year-round.

Puget Sound (PS) steelhead

The PS steelhead distinct population segment (DPS) was listed as threatened on May 11, 2007 (72 FR 26722). In 2013, the Puget Sound Steelhead Technical Recovery Team (PSSTRT) identified 32 demographically independent populations (DIPs) within the DPS, based on genetic, environmental, and life history characteristics. Those DIPs are distributed among three geographically-based MPGs; Northern Cascades, Central and South Puget Sound; and Hood Canal and Strait de Fuca (Myers et al. 2015) (Table 3). Critical habitat for Puget Sound steelhead DPS was designated by NMFS in 2016 (81 FR 9251, February 24, 2016). NMFS adopted the steelhead recovery plan for the Puget Sound DPS in December, 2019.

In 2015, the PSSTRT concluded that the DPS is at "very low" viability; with most of the 32 DIPs and all three MPGs at "low" viability based on widespread diminished abundance, productivity, diversity, and spatial structure when compared with available historical evidence (Hard et al. 2015). Based on the PSSTRT viability criteria, the DPS would be considered viable when all three component MPG are considered viable. A given MPG would be considered viable when: 1) 40 percent or more of its component DIPs are viable; 2) mean DIP viability within the MPG exceeds the threshold for viability; and 3) 40 percent or more of the historic life history strategies (i.e., summer runs and winter runs) within the MPG are viable. For a given DIP to be considered viable, its probability of persistence must exceed 85 percent, as calculated by Hard et al. (2015), based on abundance, productivity, diversity, and spatial structure within the DIP.

General Life History: PS steelhead exhibit two major life history strategies. Ocean-maturing, or winter-run fish typically enter freshwater from November to April at an advanced stage of maturation, and then spawn from February through June. Stream-maturing, or summer-run fish typically enter freshwater from May to October at an early stage of maturation, migrate to headwater areas, and hold for several months prior to spawning in the following spring. After hatching, juveniles rear in freshwater from one to three years prior to migrating to marine habitats (two years is typical). Smoltification and seaward migration typically occurs from April to mid-May. Smolt lengths vary between watersheds, but typically range from 4.3 to 9.2 inches (109 to 235 mm) (Myers et al. 2015). Juvenile steelhead are generally independent of shallow nearshore areas soon after entering marine water (Bax et al. 1978, Brennan et al. 2004, Schreiner et al. 1977), and are not commonly caught in beach seine surveys. Recent acoustic tagging studies (Moore et al. 2010) have shown that smolts migrate from rivers to the Strait of Juan de Fuca from one to three weeks. PS steelhead feed in the ocean waters for one to three years (two years is again typical), before returning to their natal streams to spawn. Unlike Chinook salmon, most female steelhead, and some males, return to marine waters following spawning (Myers et al. 2015).

Table 3. PS steelhead Major Population Groups (MPGs), Demographically Independent Populations (DIPs), and DIP Viability Estimates (Modified from Figure 58 in Hard *et al.* 2015; Ford 2022).

Geographic Region (MPG)	Demographically Independent Population (DIP)	Viability
Northern Cascades	Drayton Harbor Tributaries Winter Run	Moderate
	Nooksack River Winter Run	Moderate
	South Fork Nooksack River Summer Run	Moderate
	Samish River/Bellingham Bay Tributaries Winter Run	Moderate
	Skagit River Summer Run and Winter Run	Moderate
	Nookachamps Creek Winter Run	Moderate
	Baker River Summer Run and Winter Run	Moderate
	Sauk River Summer Run and Winter Run	Moderate
	Stillaguamish River Winter Run	Low
	Deer Creek Summer Run	Moderate
	Canyon Creek Summer Run	Moderate
	Snohomish/Skykomish Rivers Winter Run	Moderate
	Pilchuck River Winter Run	Low
	North Fork Skykomish River Summer Run	Moderate
	Snoqualmie River Winter Run	Moderate
	Tolt River Summer Run	Moderate
Central and South Puget Sound	Cedar River Winter Run	Low
	North Lake Washington and Lake Sammamish Winter Run	Moderate
	Green River Winter Run	Low
	Puyallup / Carbon River Winter Run	Low
	White River Winter Run	Low
	Nisqually River Winter Run	Low
	South Puget Sound Tributaries Winter Run	Moderate

Geographic Region (MPG)	Demographically Independent Population (DIP)	Viability
	East Kitsap Peninsula Tributaries Winter Run	Moderate
Hood Canal and Strait de Fuca	East Hood Canal Tributaries Winter Run	Low
	South Hood Canal Tributaries Winter Run	Low
	Skokomish River Winter Run	Low
	West Hood Canal Tributaries Winter Run	Moderate
	Sequim/Discovery Bay Tributaries Winter Run	Low
	Dungeness River Summer Run and Winter Run	Moderate
	Strait of Juan de Fuca Tributaries Winter Run	Low
	Elwha River Summer Run and Winter Run	Low

Spatial Structure and Diversity: The PS steelhead DPS includes all naturally spawned anadromous steelhead populations in streams in the river basins of the Strait of Juan de Fuca, Puget Sound, and Hood Canal, Washington, bounded to the west by the Elwha River (inclusive) and to the north by the Nooksack River and Dakota Creek (inclusive). The DPS also includes six hatchery stocks that are considered no more than moderately diverged from their associated natural-origin counterparts (USDC 2014). PS steelhead are the anadromous form of *O. mykiss* that occur below natural barriers to migration in northwestern Washington State (Ford 2022). Non-anadromous ‘‘resident’’ *O. mykiss* (a.k.a. rainbow trout) occur within the range of PS steelhead but are not part of the DPS due to marked differences in physical, physiological, ecological, and behavioral characteristics (Hard et al. 2015). As stated above, the DPS consists of 32 DIPs that are distributed among three geographically-based MPG. An individual DIP may consist of winter-run only, summer-run only, or a combination of both life history types. Winter-run is the predominant life history type in the DPS (Hard et al. 2015).

Abundance and Productivity: Available data on total abundance since the late 1970s and early 1980s indicate that abundance trends have fluctuated between positive and negative for individual DIPs. The long-term abundance of adult steelhead returning to many rivers in Puget Sound has fallen substantially since estimates began for many populations in the late 1970s and early 1980s. Despite relative improvements in abundance and productivity for some DIPs between 2015 and 2019, particularly in the Central and South Puget Sound MPG, low productivity persists throughout the 32 DIPs, with most showing long term downward trends (Ford 2022). Since the mid-1980s, trends in natural spawning abundance have also been temporally variable for most DIPs but remain predominantly negative, well below replacement for most DIPs, and most DIPs remain small (Ford 2022). Over the time series examined, the over-all abundance trends, especially for natural spawners, remain predominantly negative or flat across the DPS, and general steelhead abundance across the DPS remains well below the level needed to sustain natural production into the future (Ford 2022). The PSSTRT concluded that the PS steelhead DPS is currently not viable (Hard et al. 2015). The most recent 5-year status review reported an increasing viability trend for the Puget Sound steelhead DPS, but also reported that the extinction risk remains moderate for the DPS, and that the DPS should remain listed as threatened (Ford 2022).

Limiting Factors: Factors limiting recovery for PS steelhead include:

- The continued destruction and modification of steelhead habitat
- Widespread declines in adult abundance (total run size), despite significant reductions in harvest in recent years

- Threats to diversity posed by use of two hatchery steelhead stocks (Chambers Creek and Skamania)
- Declining diversity in the DPS, including the uncertain but weak status of summer run fish
- A reduction in spatial structure
- Reduced habitat quality through changes in river hydrology, temperature profile, downstream gravel recruitment, and reduced movement of large woody debris
- In the lower reaches of many rivers and their tributaries in Puget Sound where urban development has occurred, increased flood frequency and peak flows during storms and reduced groundwater-driven summer flows, with resultant gravel scour, bank erosion, and sediment deposition
- Dikes, hardening of banks with riprap, and channelization, which have reduced river braiding and sinuosity, increasing the likelihood of gravel scour and dislocation of rearing juveniles

<u>PS Steelhead within the Action Area:</u> The PS steelhead most likely to occur in the action area are fish from the Stillaguamish River winter-run DIP, and fish from the Canyon Creek and Deer Creek summer-run DIPs (Ford 2022; WDFW 2024a).

The Stillaguamish River winter-run DIP is considered a native stock with wild production. Between 1985 and 2023, total abundance has fluctuated between about 120 and 2,226 spawners. The total return in 2023 was 310 fish. WDFW rates this small DIP as depressed with a long-term negative trend and a severe short-term decline (WDFW 2024c). The 2022 status review reports that, since the 1980s, the abundance trend for the Stillaguamish River winter-run DIP is strongly downward, with a 15-year trend for 2005 through 2019 showing a 6% annual decline (Ford 2022).

WDFW reports that the Canyon Creek summer-run DIP is a mixed stock that consists of non-native hatchery-origin summer steelhead that have commingled with the native stock, and that the Deer Creek summer-run DIP is a native stock with wild production (WDFW 2024c). However, the NMFS could find no specific information to describe total abundance and trends for either summer-run population.

The project reach provides migratory habitat for juvenile and adult life stages for all three PS steelhead DIPs considered in this opinion, with most of the returning adults and emigrating juveniles from these DIPs required to pass through the project reach twice to complete their life cycles. Additionally, the project reach is documented spawning habitat for winter-run steelhead (WDFW 2024a).

Steelhead may be present in the project area year-round. Returning summer-run adult steelhead typically enter their natal rivers from May to October, whereas winter-run adults typically enter their rivers between early November and the end of April. Spawning generally occurs March through May, and sometimes through late June. Although steelhead smolt typically emigrate to marine waters between April and mid-May (Myers et al. 2015), juvenile steelhead rear in freshwater for 1 to 3 years before emigration.

Critical Habitat

This section describes the status of designated critical habitat that would be affected by the proposed action by examining the condition and trends of physical or biological features (PBFs) that are essential to the conservation of the listed species throughout the designated areas. The PBFs are essential because they support one or more of the species' life stages (e.g., sites with conditions that support spawning, rearing, migration, and foraging).

The project site and surrounding area has been designated as critical habitat for PS Chinook salmon and steelhead.

The NMFS designated critical habitat for PS Chinook salmon on September 2, 2005 (70 FR 52630). That critical habitat is located in 16 freshwater subbasins and watersheds between the Dungeness/Elwha Watershed and the Nooksack Subbasin, inclusively, as well as in nearshore marine waters of the Puget Sound that are south of the US-Canada border and east of the Elwha River, and out to a depth of 30 meters. Although offshore marine is an area type identified in the final rule, it was not designated as critical habitat for PS Chinook salmon. The NMFS designated critical habitat for PS steelhead on February 24, 2016 (81 FR 9252). That critical habitat is located in 18 freshwater subbasins between the Strait of Georgia Subbasin and the Dungeness-Elwha Subbasin, inclusively. No marine waters were designated as critical habitat for PS steelhead.

The PBFs of salmonid critical habitat include: (1) Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development; (2) Freshwater rearing sites with: (i) Water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; (ii) Water quality and forage supporting juvenile development; and (iii) 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 and excessive predation 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 excessive predation with: (i) Water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; (ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels; and (iii) Juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation; (5) Nearshore marine areas free of obstruction and excessive predation with: (i) Water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and (ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and (6) Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation. The PBF for PS Chinook salmon CH are listed in Table 4.

Table 4. Physical or biological features (PBFs) of designated critical habitat for PS Chinook salmon and steelhead, with the corresponding life history events. Although offshore marine areas were identified in the final rule, none was designated as critical habitat.

Physical or Biological Features		
Site Type	**Site Attribute**	**Life History Event**
Freshwater spawning	Water quantity Water quality Substrate	Adult spawning Embryo incubation Alevin growth and development
Freshwater rearing	Water quantity and Floodplain connectivity Water quality and Forage Natural cover	Fry emergence from gravel Fry/parr/smolt growth and development
Freshwater migration	(Free of obstruction and excessive predation) Water quantity and quality Natural cover	Adult sexual maturation Adult upstream migration and holding Kelt (steelhead) seaward migration Fry/parr/smolt growth, development, and seaward migration
Estuarine	(Free of obstruction and excessive predation) Water quality, quantity, and salinity Natural cover Forage	Adult sexual maturation and "reverse smoltification" Adult upstream migration and holding Kelt (steelhead) seaward migration Fry/parr/smolt (Chinook salmon) growth, development, and seaward migration
Nearshore marine	(Free of obstruction and excessive predation) Water quality, quantity, and forage Natural cover	Adult growth and sexual maturation Adult spawning migration Nearshore juvenile rearing
Offshore marine	Water quality and forage	Adult growth and sexual maturation Adult spawning migration Subadult rearing

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

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

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

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

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

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

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

The nearshore marine habitat has been extensively altered and armored by industrial and residential development near the mouths of many of Puget Sound’s tributaries. A railroad runs along large portions of the eastern shoreline of Puget Sound, eliminating natural cover along the shore and natural recruitment of beach sand (SSPS 2007). Degradation of the near-shore environment has occurred in the southeastern areas of Hood Canal in recent years, resulting in late summer marine oxygen depletion and significant fish kills. Circulation of marine waters is naturally limited, and partially driven by freshwater runoff, which is often low in the late summer. However, human development has increased nutrient loads from failing septic systems along the shoreline, and from use of nitrate and phosphate fertilizers on lawns and farms. Shoreline residential development is widespread and dense in many places. The combination of highways and dense residential development has degraded certain physical and chemical characteristics of the near-shore environment (HCCC 2005; SSPS 2007).

The project reach of the Stillaguamish River provides the Freshwater Spawning, Rearing, and Migration PBFs for PS Chinook salmon and for PS steelhead (NOAA 2024; WDFW 2024a).

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 project site is located in Arlington, Washington, at the confluence of the mainstem of the Stillaguamish River with its North and South Forks (Figure 1). As described in section 2.5, work-related direct effects would be limited to the in-water area within about 50 feet upstream and 300 feet downstream of the project site, and indirect effects due to hydrological impacts may extend to the bends in the river nearest to the project site. Based on the satellite imagery on Google Earth (Google Earth 2024), relatively sharp bends exist in the river at about 0.9 mile downstream of the project site on the mainstem, 0.5 mile upstream on the SF, and 0.3 mile upstream on the NF. Therefore, the NMFS estimates that detectable direct and indirect effects would be limited to the waters and substrates of the Stillaguamish River within the distances identified above. Additionally, trophic connectivity between PS Chinook salmon and the SR killer whales that feed on them extends the action area to the marine waters of Puget Sound. The described area overlaps with the geographic ranges of the ESA-listed species and the boundaries of designated critical habitats identified in Table 1. The action area also overlaps with areas that have been designated, under the MSA, as EFH for Pacific Coast salmon, Pacific Coast groundfish, and coastal pelagic species.

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 ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402.02).

Climate Change

Climate change is a factor affecting the environmental baseline, aquatic habitats in general, and the status of the ESA-listed species considered in this opinion. Although its effects are unlikely to be spatially homogeneous across the region, 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. 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 °C higher than the 1850-1900 baseline period, with larger increases over land ~1.6 °C compared to oceans ~0.88 °C (IPCC WGI 2021). The vast majority of this warming has been attributed to anthropogenic releases of greenhouse gases (IPCC WGI 2021). Globally, 2014 through 2018 were the 5 warmest years on record both on land and in the ocean (NOAA NCEI 2022). Events such as the 2013 through 2016 marine heatwave (Jacox et al. 2018) have been attributed directly to anthropogenic warming. Global warming and anthropogenic loss of biodiversity represent profound threats to ecosystem functionality (IPCC WGII 2022). These two factors 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 for 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. Below, 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 continue to 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 outbreaks (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 rainy days over the study period (1984-2015). Consequently, predicted decreases in 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 projected impacts of climate change on instream flows:

The magnitude of low river flows in the western U.S., which generally occur in September or October, and are driven largely by summer conditions and the prior winter's precipitation. Although, low flows are more sensitive to summer evaporative demand than to winter precipitation, interannual variability is greater for winter precipitation. Malek et al. (2018), predicted that summer evapotranspiration is likely to increase in conjunction with declines in snowpack and increased variability in winter precipitation, which suggests that summer flows are likely to become lower, more variable, and less predictable over time.

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 RCP 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°C/decade) and 1976-2015 (0.14-0.27°C/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. mykiss*. 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; Myers 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 an 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 the removal of temperature buffering (Yan et al. 2021). These processes may threaten some habitats that are currently considered refugia.

<u>Marine and Estuarine Environments</u>: Along with warming stream 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 fish, Gliwicz et al. (2018) found that higher ambient temperatures increased the distance at which fish 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 fish 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 effects 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 (Ou et al. 2015; 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 toxin (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 stream flows) 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, Ward et al. 2015; Williams et al. 2016). In some cases, the combined and potentially additive effects of poorer climate conditions for fish and intense anthropogenic impacts caused the population declines that led to these population groups being listed under the ESA (Crozier et al. 2019).

<u>Climate change effects on salmon and steelhead</u>: 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-water 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 inter-gravel temperature and oxygen (e.g., groundwater influence) as well as sensitivity of eggs to thermal stress. 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 ESUs or DPSs with early-returning (i.e. spring- and summer-run) phenotypes associated with longer freshwater holding times (FitzGerald et al. 2020). Rising river temperatures increase the energetic cost of migration and the risk of in-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 (Barnett et al. 2020; Keefer et al. 2018).

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 (Burke et al. 2013; Holsman et al. 2012). It is generally accepted that salmon marine survival is size-dependent, and thus larger and faster growing fish 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 in 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 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 el al. 2014) and Atlantic salmon (Olmos 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 (Gosselin et al. 2021; Healey 2011; Wainwright and Weitkamp 2013). 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 changes 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 reductions in haplotype and nucleotide diversity. Genetic losses in this comparison appeared larger for Chinook 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), though the low levels of remaining diversity present challenges to this effort (Freshwater 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).

Environmental conditions at the project site and the surrounding area

The project site is located in Arlington, Washington, at the confluence of the mainstem, NF, and SF of the Stillaguamish River (Figure 1). Although the action area includes the marine waters of Puget Sound, all detectable effects of the action would be limited to the Stillaguamish River within about 0.9 mile downstream and 0.5 mile upstream of the project site (Section 2.5). Therefore, this discussion focuses on habitat conditions in the Stillaguamish River, and does not discuss Puget Sound habitat conditions.

The Stillaguamish River originates in the Cascade Mountains and drains into Port Susan. The Project site is located at about River Mile 18. According to the applicant's BA (Jacobs 2021a), land uses within the general area around the project site include agriculture, surface mining, suburban development, and public parks. Moderate-sized (25- to 40-acre) patches of mixed-coniferous forest are also present in the area. Within the project footprint, the terrestrial habitat is highly disturbed and dominated by non-native, invasive plant species, including Japanese knotweed, Himalayan blackberry, and English ivy. However, a few small native trees, predominately red alder, black cottonwood, and bigleaf maple, are also present.

Haller Bridge is a former railroad bridge that was built in the early 1900s. It supported the railroad until the line was abandoned around 1970. The 500-foot long by 18-foot wide steel bridge is oriented north to south, is supported by 8 concrete piers (2 end abutments and 6 intermediate piers), and is about 22 feet above the river's OHWM (Snohomish Co. 2024). The bridge now carries a nonmotorized, recreational and pedestrian commuter trail (Centennial Trail) across the river.

Riprap fill that was installed by the railroad to protect the bridge piers created a peninsula that juts out from the north bank of the river and under the bridge. Over time, the riprap has become degraded to the point where the peninsula now consists of a mix of scattered riprap interspersed with native streambed sand and gravel. Scattered derelict riprap, concrete debris, timber piles, and other structural members from historic structures is present around Pier 4. Also, the remnants of concrete bridge piers for the now removed State Route 9 Bridge remain on the north and south banks of the river immediately downstream of Haller Bridge.

A deep mid-channel scour hole exists between Piers 3 and 4. The area immediately surrounding Pier 4 is typically dry in summer and inundated during winter. Large woody material builds up and dislodges on the upstream side of the peninsula between Piers 4, 5, and 6, with the size of the jam depending on flow volumes. A few scattered plants have been observed around Piers 4 and 5 in the summer months. The vegetation includes small patches of Japanese knotweed and young willow shoots. However, the vegetation is typically scoured out during flooding events.

The water at the project site and the surrounding area is categorized by the State's Department of Ecology (WDOE) as a Category 4A waterbody for temperature and bacteria (fecal coliform), and Category 2 for pH (WDOE 2024).

The past and ongoing anthropogenic impacts described above have reduced the action area's ability to support PS Chinook salmon and PS steelhead. However, the project area continues to provide migratory, spawning, and rearing habitat for adults and juveniles of both species considered in this opinion.

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).

As described in Section 1.3, the USACE proposes to authorize Snohomish County to conduct a single-season project to repair a bridge pier in the Stillaguamish River. Although work would be done below the river's OHWM, most of the work would be done in-the-dry, during the river's low-water period. In summary, the project would remove riparian vegetation from about 12 feet of river bank on each side of the river, install about 2,575 square feet of concrete and riprap around the base of Pier 4, remove about 1,745 square feet of derelict concrete and riprap from adjacent areas, and replant impacted riparian vegetation (Figures 1 - 5). All work below the OWHM would be accomplished during the project area's in-water work window of August 1 through 31.

The best available information about the proposed work supports the understanding that demolition and construction would cause direct effects on fish and habitat resources at the project site through exposure to fish salvage, work-related noise, and work-related pollutants. It would also cause indirect effects through, altered substrate and reduced riparian vegetation. Additionally, the USACE's authorization of the project would extend the operational life of Pier 4 and Haller Bridge by several years beyond their existing conditions, which would extend the duration of structure-related indirect effects through altered lighting under the bridge.

The project's brief in-water work window avoids the normal spawning seasons for PS Chinook salmon and steelhead, as well as the normal emigration seasons for the juveniles of both species. It also avoids the in-stream rearing period for ocean-type juvenile Chinook salmon. However, it overlaps with the normal immigration seasons for adults of both species, as well as the years-long rearing periods for juvenile steelhead and for stream-type Chinook salmon, both of which may be present in the project area year-round.

Over the years-long existence of the repaired Pier 4 and the bridge it supports, adult and juvenile PS Chinook salmon and steelhead are likely to be exposed to the action's indirect effects when they annually pass through the project's affected area during their respective annual migration seasons. The PBFs of PS Chinook salmon and steelhead critical habitat would also be exposed to the action's direct and indirect effects.

2.5.1 Effects on Listed Species

Effects on species are a function of exposure and response. The duration, intensity, and frequency of exposure, and the life stage at exposure all influence the degree of response.

The proposed action would cause a mix of work- and structure-related stressors. Several of the stressors would cause impacts in common with each other, such as noise, pollutants, altered substrate, reduced riparian vegetation, and altered lighting all likely to cause areal avoidance; and pollutants, altered substrate, reduced riparian vegetation, and altered lighting also likely to cause forage diminishment. To reduce redundant discussions, the following analysis will assess areal avoidance and forage diminishment separately, after the other stressors have been analyzed.

Fish Salvage

Exposure to fish salvage is likely to adversely affect juvenile PS Chinook salmon and steelhead.

Fish that are within the in-water work area isolation devices would be exposed to removal by nets and possibly to electrofishing. Handling and transfer processes can cause physical trauma and physiological stress responses in exposed fish (Moberg 2000; Shreck 2000). Contact with nets can cause scale and skin damage, and overcrowding of small fish in traps can cause stress and injury. The primary factors that contribute to stress and mortality from handling are: (1) Difference in water temperatures between the source stream and the holding buckets; (2) dissolved oxygen levels; (3) the amount of time that fish are held out of the water; and (4) physical trauma. Stress from handling increases rapidly if water temperature exceeds 18ºC (64ºF), or if dissolved oxygen is below saturation.

Electrofishing can cause stress, physical trauma, and mortality in exposed fish. Dalbey et al. (1996), Emery (1984), and Snyder (2003) describe responses that range from muscular contractions to mortality from exposure to electrofishing. Depending on the pulse train used, and the intensity and duration of exposure, muscular contractions may cause a lactic acid load and oxygen debt in muscle tissues (Emery 1984), it can cause internal hemorrhage and spinal fractures in 12 to 54% of the exposed fish, and acute mortality in about 2% (Dalbey et al. 1996). Severe interruption of motor function can stop respiration, and combinations of lactic acid load and oxygen debt may be irreversible, causing delayed mortality in apparently healthy fish. Obvious physical injuries often reduce long-term growth and survival, whereas uninjured to slightly injured fish showed long-term growth and survival rates similar to unexposed fish of similar age (Dalbey et al. 1996).

The applicant has given no estimate of the maximum number of Chinook salmon and or steelhead that may be handled as part of this project. They also state that they don't intend to use electrofishing (Snohomish Co. 2024). However, without a stated commitment to refrain from its use, this assessment assumes that the possibility of electrofishing exists, and to avoid underestimating potential impacts, assumes that electrofishing would occur.

Based on the timing, location, and sizes of the in-water work areas to be isolated, and to avoid underestimating potential impacts, this assessment assumes that a maximum of 20 juvenile Chinook salmon and or steelhead would be handled during fish salvage, and that the 20-fish total would consist of some mix of either or both species.

The best available information for the region, the 2013 biological opinion completed for restoration activities in the Pacific Northwest Region (NMFS 2013), estimated that up to 5% of salvaged fish may be seriously injured or killed by fish salvage. This equals 1 for 20 fish. The remaining fish would likely experience sub-lethal effects that are unlikely to affect their fitness or survival. Because the applicant has committed to comply with the most current fish salvage protocols and standards from WDFW and U.S. Fish and Wildlife Service (WDFW and USFWS 2012), we believe this expectation is sound. However, in an abundance of caution, this assessment further assumes that a maximum of 2 of the captured fish would be seriously injured or killed by fish salvage activities. Because the fish that may be injured or killed by this stressor would comprise such a tiny subset of their respective cohorts, their potential loss would cause no detectable population-level effects.

Work-related Noise

Work-related noise is likely to adversely affect juvenile PS Chinook salmon and steelhead, but cause only minor effects in adults of both species.

The proposed action would cause elevated levels of fish-detectable in-water noise during demolition and construction. Work-related noise would be caused by the use of a mix of heavy equipment such as excavators with buckets and a jackhammer attachment, as well as various hand-held power tools, such as drills that would be operated in or just above the water.

In fish, the effects of noise exposure vary with the hearing characteristics of the fish, the frequency, intensity, and duration of the exposure, and the context under which the exposure occurs. At low levels, effects may include the onset of behavioral disturbances such as acoustic masking (Codarin et al. 2009), startle responses and altered swimming (Neo et al. 2014), abandonment or avoidance of the affected area (Mueller 1980; Picciulin et al. 2010; Sebastianutto et al. 2011; Xie et al. 2008), and increased vulnerability to predators (Simpson et al. 2016). At higher intensities and or longer exposure durations, the effects may rise to include temporary hearing damage (a.k.a. temporary threshold shift (TTS), Scholik and Yan 2002) and increased stress (Graham and Cooke 2008). At even higher levels, exposure may lead to physical injury that can range from the onset of permanent hearing damage (a.k.a. permanent threshold shift (PTS)) and mortality. The best available information about the auditory capabilities of the fish considered in this opinion suggest that their hearing capabilities are limited to frequencies below 1,500 Hz, with peak sensitivity between about 200 and 300 Hz (Hastings and Popper 2005; Picciulin et al. 2010; Scholik and Yan 2002; Xie et al. 2008).

The NMFS uses two metrics to estimate the onset of injury for fish exposed to high intensity impulsive sounds (Stadler and Woodbury 2009). The metrics are based on exposure to peak sound level and sound exposure level (SEL). Both are expressed in decibels (dB). The metrics are: 1) exposure to 206 dB_{peak}; and 2) exposure to 187 dB SEL_{cum} for fish 2 grams or larger, or 183 dB SEL_{cum} for fish under 2 grams. Further, any received level (RL) below 150 dB_{SEL} is considered "Effective Quiet". The distance from a source where the RL drops to 150 dB_{SEL} is considered the maximum distance from that source where fishes can potentially experience TTS or PTS from the noise, regardless of accumulation of the sound energy (Stadler and Woodbury 2009). When the range to the 150 dB_{SEL} isopleth exceeds the range to the applicable SEL_{CUM} isopleth, the distance to the 150 dB_{SEL} isopleth is typically considered the range at which detectable behavioral effects would begin, with the applicable SEL_{CUM} isopleth identifying the distance within which sound energy accumulation would intensify effects. However, when the range to the 150 dB_{SEL} isopleth is less than the range to the applicable SEL_{CUM} isopleth, only the 150 dB_{SEL} isopleth would apply because no accumulation of effects are expected for noise levels below 150 dB_{SEL}.

The discussion in Stadler and Woodbury (2009) indicate that these thresholds likely overestimate the potential effects of exposure to impulsive sounds. Further, Stadler and Woodbury's assessment did not consider non-impulsive sound, which is believed to be less injurious to fish than impulsive sound. Therefore, application of the criteria to non-impulsive sounds is also likely to overestimate the potential effects in fish. However, these criteria represent the best available information. Therefore, to avoid underestimating potential effects, this assessment applies these criteria to the impulsive and non-impulsive sounds that are expected from the proposed work to gain a conservative idea of the potential effects that fish may experience due to exposure to that noise.

The estimated source levels (SL, sound level at 1 meter from the source) and acoustic signature information used in this assessment are based on the best available information, as described in a recent biological opinion that considered similar activities (NMFS 2023), and in other sources (CalTrans 2015; 2020; CDC 2007; FHWA 2017; Reine et al. 2012; Richardson et al. 1995).

Although much of the noise-causing work would occur in the dry, this assessment treats all noise sources as if they would originate in the water. This approach was taken to avoid underestimating noise impact, because in-water noise levels from upland noise sources are often as loud as if they had originated in the water.

In the absence of location-specific transmission loss data, the NMFS typically uses some variation of the equation RL = SL – #Log(R) to estimate the received sound level at a given range from a source (RL = received level (dB); SL = source level (dB, 1 m from the source); # = spreading loss coefficient; and R = range in meters (m). Numerous acoustic measurements in shallow water environments support the use of a spreading loss coefficient of about 15 for projects like this one. This value is considered the practical spreading loss coefficient, and was used for all sound attenuation calculations in this assessment.

The best available information indicates that impulsive noise levels at or above the 206 dB_{peak} threshold for instantaneous injury would not occur under the proposed action. Application of the practical spreading loss equation to the expected in-water SLs for action-related sound sources suggests that sound levels at or above the 150 dB_{SEL} threshold could extend to about 62 feet (19 m) around use of the jackhammer to break concrete, and 33 feet (10 m) or less for all other sources (Table 5).

Table 5. Estimated in-water source levels for the loudest project-related sound sources, and the source-specific ranges to the applicable effect thresholds for fish.

Source	Acoustic Signature	Source Level	Threshold Range
Jackhammer	Est. < 2 kHz Impulsive	189 dB_{peak}	206 dB_{peak} @ N/A
Assumed daily maximum of 4 hours (14,400 seconds)		169 dB_{SEL}	187 SEL_{CUM} @ 8 m
		169 dB_{SEL}	150 dB_{SEL} @ 19 m
Pneumatic Tools (i.e. impact wrench)	Est. < 2 kHz Impulsive	185 dB_{peak}	206 dB_{peak} @ N/A
Episodic periods, with an assumed daily maximum of 4 hours (14,400 seconds).		165 dB_{SEL}	187 SEL_{CUM} @ 4 m
		165 dB_{SEL}	150 dB_{SEL} @ 10 m
Excavator Bucket Strike (riprap movement)	< 370 Hz Impulsive	184 dB_{peak}	206 dB_{peak} @ N/A
Assumed daily maximum of 4 hours (14,400 seconds) over the life of the project.		167 dB_{SEL}	187 SEL_{CUM} @ N/A
		167 dB_{SEL}	150 @ 14 m
Pumps	Est. < 2 kHz Impulsive	181 dB_{peak}	206 dB_{peak} @ N/A
Episodic periods, with an assumed daily maximum of 4 hours (14,400 seconds) over the life of the project.		161 dB_{SEL}	187 SEL_{CUM} @ 2 m
		161 dB_{SEL}	150 dB_{SEL} @ 5 m
Chipping Gun	Est. < 2 kHz Impulsive	179 dB_{peak}	206 @ N/A
Episodic periods, with an assumed daily maximum of 4 hours (14,400 seconds) over the life of the project.		159 dB_{SEL}	187 @ 2 m
		159 dB_{SEL}	150 @ 4 m
Air Compressor	Est. < 2 kHz Impulsive	178 dB_{peak}	206 dB_{peak} @ N/A
Episodic periods, with an assumed daily maximum of 4 hours (14,400 seconds) over the life of the project.		158 dB_{SEL}	187 SEL_{CUM} @ 2 m
		158 dB_{SEL}	150 dB_{SEL} @ 3 m

Based on the timing and duration of the proposed the in-water work window, relative to the emigration season for juvenile PS Chinook salmon, most juvenile Chinook salmon would be gone from the project area. However, low numbers of stream-type Chinook salmon are expected to remain in the watershed year-round, and some may be in the project area during the proposed work window. Steelhead rear in freshwater for one a year or more before smoltifying. Therefore, it is likely that some rearing juvenile steelhead would be present in the project area during the in-water work window.

Additionally, the work window overlaps with the immigration seasons for returning adult Chinook salmon and steelhead, but it is outside of the normal spawning seasons for the fall-run Chinook salmon and the winter steelhead that spawn in the area.

Because the exact timing of the various work components and how they might overlap with the presence of returning adults is uncertain, and to avoid underestimating impacts due to unexpected extensions of the time required to complete specific components, particularly the breaking and removal of the derelict concrete piers and debris, this assessment assumes that at any time during the daylight work hours of the in-water work window, a mix of impulsive and non-impulsive work-related in-water noise levels above 150 dB_{SEL} would be continuously present within 33 feet (10 m) around the outer boundaries of work on Pier 4 and the project-affected derelict structures and material, and that impulsive in-water noise levels above 150 dB_{SEL} would commonly extend out to 62 feet during concrete breaking.

Simple exposure to the expected noise levels would be non-injurious for juveniles and adults, but would likely cause behavioral disturbances within an area of up to 62 feet around the north and south project areas. In adults, exposure would, at most, cause areal avoidance (discussed separately). For juveniles, behavioral disturbances would include some combination of acoustic masking, startle responses, altered swimming patterns, areal avoidance, and increased risk of predation (the last two discussed later under areal avoidance). The intensity of those effects would increase directly with proximity to the source. The physical responses to the exposure would be non-lethal, but some subset of the exposed juveniles would experience stress and fitness effects that could reduce their long-term survival.

Work-related Pollutants

Exposure to work-related pollutants is likely to adversely affect juvenile PS Chinook salmon and juvenile PS steelhead, but cause only minor effects for adults of both species.
The proposed in-water work would temporarily affect water quality through increased turbidity, which could also reduce dissolved oxygen, and through the introduction of work-related toxic materials.

Turbidity: The in-water work that would be done to remove derelict riprap and concrete, and to install new riprap would mobilize bottom sediments that would cause short-lived turbidity plumes with relatively low concentrations of total suspended sediments (TSS). The intensity of turbidity is typically measured in Nephlometric Turbidity Units (NTU) that describe the opacity caused by the suspended sediments, or by the concentration of TSS as measured in milligrams per liter (mg/L). A strong positive correlation exists between NTU values and TSS concentrations. Depending on the particle sizes, NTU values roughly equal the same number of mg/L for TSS (i.e. 10 NTU = ~ 10 mg/L TSS, and 1,000 NTU = ~ 1,000 mg/L TSS) (Campbell Scientific Inc. 2008; Ellison et al. 2010). Therefore, the two units of measure are relatively comparable.

Water quality is considered adversely affected by suspended sediments when turbidity is increased by 20 NTU for a period of 4 hours or more (Berg and Northcote 1985; Robertson et al. 2006). The effects of turbidity on fish are somewhat species and size dependent. In general, severity typically increases with sediment concentration and duration of exposure, and decreases with the increasing size of the fish. Bjornn and Reiser (1991) report that adult and larger juvenile salmonids appear to be little affected by the high concentrations of suspended sediments that may be mobilized during storm and snowmelt runoff episodes. However, empirical data from numerous studies report the onset of minor physiological stress in juvenile and adult salmon after one hour of continuous exposure to suspended sediment concentration levels between about 1,100 and 3,000 mg/L, or to three hours of exposure to 400 mg/L, and seven hours of exposure to concentration levels as low as 55 mg/L (Newcombe and Jensen 1996). The authors reported that serious non-lethal effects such as major physiological stress and reduced growth were reported after seven hours of continuous exposure to 400 mg/L and 24 hours of continuous exposures to concentration levels as low as about 150 mg/L.

In-water work to remove derelict riprap and concrete would cause the project's most intense turbidity plumes. That work would involve in-water use of excavators with jackhammer attachments to break-up derelict concrete, and buckets to remove derelict riprap and concrete pieces and to install new riprap. That work would be analogous to small-scale shallow mechanical dredging of course gravel substrates. Mechanical dredging in areas with high levels of fine-grained material can cause suspended sediment plumes of around 1,000 mg/L that can extend 200 to 500 feet down-current from the point of dredging, and take hours to return to background levels after work has stopped. For clamshell dredging in areas containing high levels of fine-grained material, LaSalle et. al. (1991) reported suspended sediment concentrations of about 700 mg/L at the surface, 1,100 mg/L near the bottom, and plumes of about 300 feet. Under similar conditions, the USACE (2011) reported suspended sediment concentrations over 500 mg/L. The intensity and duration of the turbidity plume that would be cause by the planned work is uncertain, but it is extremely unlikely that it would be as intense as that described for dredging fine sediments, and the turbidity would be contained within work area isolation devices that would enclose the vast majority of the suspended sediment load.

At most, salmonid exposure to work-related turbidity would cause temporary behavioral effects such as avoidance of the plume, and mild gill flaring and reduced feeding rates that would cause no reduction in fitness or meaningful changes in normal behavior in exposed individuals.

<u>Dissolved Oxygen:</u> Mobilization of anaerobic sediments can decrease dissolved oxygen levels (Hicks et al. 1991; Morton 1976). The impact on dissolved oxygen is a function of the oxygen demand of the sediment, the amount of material suspended in the water, the duration of suspension, and the water temperature (Lunz and LaSalle 1986; Lunz et al. 1988). Reduced dissolved oxygen can affect salmonid swimming performance (Bjornn and Reiser 1991), as well as cause avoidance of water with low dissolved oxygen levels (Hicks 1999). However, the small amount of sediments that would be mobilized by project-related activities suggests that any dissolved oxygen reductions would be too small and short-lived to cause more than minor behavioral effects, such as avoidance of the turbidity plume, in exposed fish. Additionally, the work area isolation devices would enclose the vast majority of the suspended sediment load, which would reduce the potential for fish exposure to reduced dissolved oxygen levels.

At most, salmonid exposure to work-related reduced dissolved oxygen would cause temporary behavioral effects such as avoidance of the affected area that would cause no reduction in fitness or meaningful changes in normal behavior in exposed individuals.

<u>Toxic Materials:</u> Wet cement is caustic (elevated pH) and can produce chemical burns. However, all project-related new concrete would be poured in-the dry, and BMPs would be installed to prevent any contact between uncured concrete and the river, so no project-related impacts on pH are expected.

The operation of construction equipment routinely results in small leaks and spills of fuels, lubricants, and other fluids that can enter the water. Occasionally, larger spills and discharges occur. Many of the fuels, lubricants, and other fluids commonly used in construction equipment are petroleum-based hydrocarbons that contain Polycyclic Aromatic Hydrocarbons (PAHs), Polychlorinated Biphenyls (PCBs), phlalates, other organic compounds, and metals. Although all project-related heavy equipment would be operated from positions above the water level, the excavator arms, buckets, and jackhammer attachments that would enter the water are likely to discharge some of these pollutants into the water.

PS Chinook salmon and other fish can uptake pollutants directly through their gills, and through dietary exposure (Karrow et al. 1999; Lee and Dobbs 1972; McCain et al. 1990; Meador et al. 2006; Neff 1982; Varanasi et al. 1993). Depending on the pollutant, its concentration, and or the duration of exposure, exposed fish may experience effects ranging from avoidance of an affected area, to reduced growth, altered immune function, and mortality (Beitinger and Freeman 1983; Brette et al. 2014; Feist et al. 2011; Gobel et al. 2007; Incardona et al. 2004, 2005, and 2006; McIntyre et al. 2012; Meadore et al. 2006; Sandahl et al. 2007; Spromberg et al. 2015). PAHs can cause reduced growth, increased susceptibility to infection, and increased mortality in juvenile salmonids (Eisler 1987; Meador et al. 2006; Varanasi et al. 1993). Gill tissues are highly susceptible to damage because they actively pass large volumes of water and are thereby exposed to PAHs present in water (USACE 2016). Other effects include damage to the skin, fins, and eyes, as well as damage to internal organs as liver tumors. In freshwater, exposure to dissolved copper at concentrations between 0.3 to 3.2 µg/L above background levels has been shown to cause avoidance of an area, to reduce salmonid olfaction, and to induce behaviors that increase juvenile salmon's vulnerability to predators (Giattina et al. 1982; Hecht et al. 2007; McIntyre et al. 2012; Sommers et al. 2016; Tierney et al. 2010).

The project includes BMPs specifically intended to reduce the risk and intensity of contact between wet concrete and the river, and of discharges and spills. In the unlikely event that any wet concrete would enter the water, it is expected to be very limited, quickly addressed, and the affected water would be largely contained within the work area isolation device. Petroleum-based hydrocarbon residues would enter the water with every dip of an excavator arm, but would be very limited in quantity due to the required inspection and cleaning of equipment before its use each day. Other spills and discharges would likely be infrequent, very small, quickly addressed, and largely contained within work area isolation devices. Therefore, in-water detectable levels of project-related pollutants would likely be infrequent, short-lived, at low concentrations, and largely contained within a work area isolation device.

The exact extent of detectable effects from work-related pollutants is uncertain. However, because all in-water work would be enclosed within work area isolation devices, very little project-related turbidity and or toxic material is expected to enter the river. To avoid underestimating impacts, this assessment assumes that project-related turbidity and or toxic material at concentrations high enough to elicit behavioral effects would extend a maximum of 50 feet upstream and 300 feet downstream of the project areas.

As explained earlier for Work-Related Noise, low numbers of juvenile stream-type Chinook salmon may be in the project area during the proposed in-water work window. It is also likely that juvenile steelhead, and adults of both species would to be present. However, based on the scope and scale of the proposed in-water work, including the protective measures and BMPs, it is extremely unlikely that in-water pollutant concentrations and or duration of exposure would be high enough to cause fitness impacts in juveniles or adults of either species considered here. The most likely sources of meaningful effects on salmonids from work-related pollutants would be detection and avoidance of the affected areas (discussed under areal avoidance) and trophic impacts (discussed under forage diminishment).

Altered Substrate

Project-related artificial substrate is likely to adversely affect juvenile PS Chinook salmon and juvenile PS steelhead, but cause only minor effects for adults of both species.

The project would install a concrete foundation cap and replacement riprap (armoring) over an area of about 2,575 square feet around the base of Pier 4. To help offset the impacts of that installation, the County would remove derelict riprap and derelict concrete pier structures and debris from adjacent areas below the OHWM, totaling about 1,645 square feet (Figures 3 & 5).

Riverine habitats are the product of physical, chemical, and biological processes that interact together to form and maintain the streams (Fischenich 2003). Physical processes involve the interaction of hydrological forces with the substrate and objects in the streambed that drive geomorphic adjustments in the channel, floodplain, and riparian habitats. Chemical processes involve inputs of organic matter, retention and export of nutrients and thermal energy, nutrient cycling in the aquatic food web, linkages to terrestrial food webs, and gas exchange (Beechie *et al*. 2010). Biological processes include aquatic and riparian plant and animal growth, and community development and succession, which establish the biodiversity and influence the life histories of aquatic and riparian organisms (Harman *et al*. 2012).

Hydrological Impacts: Under natural conditions, the physical shape and structure of a stream channel continuously evolves in response to the interaction between the native substrate, the volume and velocity of water flow, sediment loads, and the availability of large wood. Changes in any of these can alter erosion and deposition rates that drive geomorphic adjustments that can change the channel alignment and depth, as well as drive side channel formation or abandonment. It can also alter the exposed substrate (rock, gravel, sand, or mud bottoms), and cause changes in the presence of large wood.

By design, stabilization structures, such as concrete and riprap armoring, replace dynamic natural processes with a set of semi-permanent conditions that alter fundamental channel and aquatic habitat formation processes (Cramer 2012). The project’s new armoring would prevent natural sediment migration, and prevent the possible formation of spawning habitat across an area if about 2,575 square feet around Pier 4. Also, older-style rip rap revetments and concrete structures, redirect water flows and often cause unexpected changes in the stream-forming processes upstream and downstream from the stabilization structure, such as increased erosion, altered sediment recruitment and transport, and reduced formation of complex off-channel and edge habitat features such as undercut banks and alcove habitats (Fischenich 2003; Pracheil 2010).

Due to the complex relationships between the processes that are involved, it is virtually impossible to predict and quantify the exact effects the proposed pier armoring would have on stream hydrology, geomorphology, and habitat forming processes. However, when compared to the river bed without Pier 4 and its proposed armoring, it is very likely that Pier 4 and its protection would continue to alter water flows around the pier, which may impede natural stream-forming processes in adjacent parts of the river. Project-related impacts on stream-forming processes may slightly alter the quantity and quality of spawning gravels within the stream reaches within 0.9 mile of the project area.

Potential impacts related to armoring are typically limited to the stream reach within the nearest bends in the stream. Based on recent Google Earth satellite imagery, relatively sharp bends exist in the river at about 0.9 mile downstream of the project site on the mainstem, 0.5 mile upstream on the South Fork, and 0.3 mile upstream on the North Fork (Google Earth 2024). The best available information supports the expectation that, within those distances, the proposed armoring could slightly alter habitat forming processes in ways that could reduce the affected area's ability to support salmonid spawning and rearing. However, these effects are expected to be relatively small, and the armoring's influence on those processes would likely decrease with distance from the structure and with increasing size of flood events.

Biological Impacts: The proposed armoring would create and or maintain about 2,575 square feet of artificial substrate that is likely to reduce juvenile salmonid use of the affected area, and reduce forage production, which are discussed under Areal Avoidance and Forage Diminishment. The riprap substrate would also prevent the development of spawning habitat in the covered area, and create and or maintain habitat conditions that favor predatory fish species.

Riprap is often preferred by sculpins and trout that prey on juvenile salmonids. Edwards and Cunjak (2007) found that sculpins prefer unembedded rock and cobble substrates similar to riprap, and Peters et al. (1998) similarly found that trout larger than 200mm occur at greater densities along riprap than along natural banks. Therefore, juvenile PS Chinook salmon and juvenile PS steelhead that are in close proximity to the riprap would be at more risk of predation than they would be in the riprap's absence. The response to this exposure would be non-lethal in most cases, because only a subset of the individuals that pass near the riprap are likely to experience attempted predation. Of those exposed to attempted predation, individuals that escape may experience stress and fitness effects that could reduce their long-term survival, and individuals that are eaten would be killed.

In Summary: The proposed armoring is likely to continue altering stream morphology up- and downstream of the project site, and to maintain increased risk of predation for juvenile PS Chinook salmon and PS steelhead that swim near Pier 4's armoring. The numbers of individuals that would be annually exposed to these stressors is unquantifiable with any degree of certainty. However, based on the scope and scale of the project, only low numbers of either species are likely to be exposed annually to these impacts, and only a subset of the exposed individuals would be meaningfully affected.

In the adjacent mitigation areas, the proposed removal of 1,645 square feet of derelict riprap and concrete may act to reduce ongoing substrate-related impacts that are similar to those discussed above.

Reduced riparian vegetation

Project-related reduced riparian vegetation is likely to adversely affect juvenile PS Chinook salmon and juvenile PS steelhead, but cause only minor effects for adults of both species.

Construction of the project's two 12-foot wide temporary access routes would include the cutting and or covering of woody shrubs within the riparian zone on both sides of the river. There is no plan to cut trees. Also, the County reports that all impacted shrubs would be cut in a manner intended to allow regrowth when, after about 1 month of work, the temporary routes are decommissioned, and the associated temporary road materials have been removed. They further plan to replace any destroyed vegetation with native woody riparian species on a 1 to 1 basis, and reseed all disturbed areas.

The project wouldn't cutdown any trees, so it wouldn't impact the input of large wood. However, the damaged shrubs and replacement vegetation would take a year or more to return to pre-construction levels of ecological function.

As discussed under altered substrate, reduced riparian vegetation can alter in-stream physical, chemical, and biological processes that important to riverine habitats. Project-related root loss may increase bank erosion. However, project-related root loss would be very small. The affected area would be comprised of two 12-foot wide sections of riverbank, one on each bank of the mainstem, where no vegetation is expected to be removed. Few if any impacted shrubs are likely to be killed, and those that are would be replaced as part of this project. Therefore, most of the existing root systems are likely to remain intact, and any root-related increased erosion would be too small to cause any meaningful effects on riverine processes. Additionally, any project-related root loss would diminish over time as replacement vegetation matures.

Reduced riparian vegetation may also impact fish through reduced shade and reduced input of organic material of terrestrial origin. The reduced shade from damaged overhanging vegetation may increase the input of thermal energy into the river from solar radiation (insolation; discussed under Altered Lighting), and may cause some avoidance of the affected area (discussed under Areal Avoidance). Reduced input of terrestrial-origin organic material into the river (branches, leaf litter, and insects) may also reduce the diversity and abundance of forage resources for juvenile salmonids (discussed in more detail later).

Reduced overhanging vegetation and the resulting reduction of in-water vegetative debris may also reduce the availability of shelter for juvenile fish from in-water branches. Project-related reduced shelter would be very small. Based the small affected area, the large amount of well-developed riparian vegetation both up and downstream from the project site, and the continuous water flows past the site, any action-related shelter reduction would be too small to cause any meaningful impacts on the fitness and normal behaviors of juvenile salmon that swim past the affected banks. Additionally, available shelter would increase over time as the recovering and replacement vegetation regrows and or matures.

Altered Lighting

Project-related altered lighting is likely to adversely affect juvenile PS Chinook salmon and juvenile PS steelhead, but cause only minor effects for adults of both species.

Reduced riparian vegetation at the riverside ends of both 12-wide access routes would reduce the amount of overhanging vegetation that currently creates natural shading along the riverbank. Additionally, solidifying and armoring the base of Pier 4 would have the effect of extending the useful life of Haller Bridge. As described in the Environmental Baseline section, Haller Bridge is oriented north to south. It is 500 feet long, 18 feet wide (6,000 square feet), and about 22 feet above the river's OHWM (Snohomish Co. 2024). The bridge creates unnatural daytime shade across the river. Given the bridge's orientation, its shadow would sweep across the river from west to east as the sun moves across the sky each day.

The intensity of impacts related to altered lighting is likely to vary based on the brightness and angle of the sun, being most intense mid-day on sunny summer days, and less pronounced to possibly inconsequential on cloudy days.

Project-related increased insolation from reduced riparian vegetation would be very small. Based the small total affected area, the large amount of well-developed riparian vegetation both up and downstream from the project site, and the continuous water flows past the site, any action-related increases in water temperature would be too small to meaningfully increase water temperatures in any part of the river. Additionally, the shade of the bridge, although unnatural, may act to slightly reduce insolation in the area under its shadow, and vegetation-related increased insolation would diminish over time as the recovering and replacement vegetation returns to pre-project levels of development. Therefore, increased insolation would cause no meaningful impacts on list species due to changes in water temperatures.

Reduced vegetation-related over-water shade may cause areal avoidance and alter juvenile migration past the affected bank areas. Also, the bridge's unnatural shade would continue to create conditions that are likely to cause some areal avoidance and altered migration, and impact forage resources through reduced aquatic productivity (all discussed in more detail under Areal Avoidance and or Forage Diminishment).

Areal Avoidance

Project-related areal avoidance is likely to adversely affect juvenile PS Chinook salmon and juvenile PS steelhead. However, it would cause only minor effects for adults of both species because the avoidance wouldn't interfere with their normal migration, or prevent access to any important habitat resources. Therefore, the exposure would cause no meaningful impacts on their fitness or normal behaviors.

Exposure to project-related noise, pollutants, altered substrate, reduced riparian vegetation, and altered lighting are all expected to cause conditions that are likely to cause some degree of areal avoidance and or altered migration in juvenile salmonids at the north and south project areas.

Direct effects would be caused by work-related noise and pollutants. During demolition and construction, work-related in-water noise capable of causing areal avoidance would extend up to 62 feet around ongoing work, and work-related water-borne turbidity and or toxic material at concentrations high enough to elicit areal avoidance would extend a maximum of 50 feet upstream and 300 feet downstream of the project areas. Those effects would only be present during a single August 1 through 31 in-water work window.

Indirect effects would be caused by project-related altered substrate, reduced riparian vegetation, altered lighting, and toxic residues. The project would repair and or install about 2,575 square feet of concrete and riprap around the base of Pier 4. The proposed armoring is likely to cause avoidance of the affected area by juvenile salmonids. Juvenile salmonids tend to aggregate more densely in edge habitats than in the center of rivers where adult salmonids occur in greater numbers (Washington Trout 2006). Although Pier 4 is arguably near the center of the river, seasonal fluctuations in water level result in periods of time when the affected area would constitute the available edge habitat. Studies also show that juvenile salmonids tend to select natural banks over hardened ones, and that the habitat provided by armored banks is typically degraded as compared to natural banks. Juvenile Chinook salmon are consistently more abundant along natural banks with wood, cobble, boulder, aquatic plants, and or undercut bank cover than they are along rip rap banks (Beamer and Henderson 1998; Peters et al. 1998). In a study of 667 bank stabilization structures of various designs in Washington State, fish densities were generally positively correlated with increased amounts of large woody debris and overhead vegetation within 30 cm of the water surface. Fish densities under those conditions were also consistently higher than those at the control sites. Conversely, fish densities at sites that were stabilized by rip rap alone were consistently lower than at control sites (Peters et al. 1998). Therefore, it is likely that some rearing and migrating juvenile Chinook salmon and steelhead will selectively avoid the Pier 4 armoring in favor of more suitable habitat. As a result, juveniles in the adjacent unarmored areas may experience decreased fitness from increased competition, which may reduce the likelihood of survival for some individuals.

Project-related reduced riparian vegetation at the riverside ends of both 12-wide access routes is likely to reduce the natural over-water shade that currently exists, particularly on the south bank (due the angle of the sun relative to the vegetation and the river). Until the that vegetation returns to pre-construction levels of development, increased levels of in-water illumination may cause some juvenile Chinook salmon and or steelhead to avoid the affected areas during rearing and migration past the site. The exact duration of this effect is unknown, but would likely last 1 to 5 years, depending on the time needed for the damaged shrubs and or new plantings to return to current levels of vegetative development,

Haller Bridge would continue to create about 6,000 square feet of unnatural and relatively intense shade that would sweep across the river from west to east as the sun moves across the sky each day. The shade of over-water structures causes areal avoidance that can also negatively affect juvenile salmonid migration. Numerous studies demonstrate that juvenile salmonids, in both freshwater and marine habitats, are more likely to avoid an overwater structure's shadow than to pass through it, including elevated bridges (Celedonia et al. 2008a and b; Kemp et al. 2005; Moore et al. 2013; Munsch et al. 2014; Nightingale and Simenstad 2001; Ono et al. 2010; Southard et al. 2006; Tabor et al. 2006).

Construction equipment would be operated in the dry, but below the OHWM of the river. Spills and discharges from that equipment is reasonably likely to occur, and some residue from those spills and or discharges is likely to persist in the rocks and gravel after clean up, with some of that material diffusing into the water when the areas are inundated. Beitinger and Freeman (1983) report that fish possess acute chemical discrimination abilities and that very low levels of some water-borne contaminants can trigger strong avoidance behaviors. The exact amounts and locations of work-related spills and discharges are uncertain, as is the amount and durations of toxic residues that would persist after project completion, but they are expected to be relatively small and short-lived. To avoid underestimating potential impacts, this assessment assumes that small amounts of toxic residue would be scattered across the north work area that is below the OHWM, that those residues would be detectable to fish in the area directly over the project area, and that detectable residues could persist for 1 to 2 years following project completion.

To summarize the suite of avoidance-inducing stressors, during the August work window, work-related-noise levels capable of causing avoidance would extend about 62 feet around the north and south work sites, and pollutants at concentrations capable of causing avoidance may extend up to 300 feet downstream of the project areas. After construction, the concrete and riprap substrate around the base of Pier 4 is likely to cause areal avoidance in some of the juvenile salmonids that are exposed to it, and the shade of the bridge is likely to cause some avoidance and or migratory delay for some exposed juvenile salmonids, with shade impacts being most intense in the same area as the altered substrate. Both of these stressors would persist for decades. Additionally, reduced riparian vegetation and toxic residues may create avoidance-inducing conditions at the ends of the access routes and across the shallow area extending from the north side of the river, respectively. Neither of these stressors are expected to persist more than 5 years. Where any of these indirect stressors overlap, the likelihood of avoidance would increase. In the adjacent mitigation areas, the removal of 1,645 square feet of derelict riprap and concrete may act to reduce similar ongoing substrate-related impacts.

Project-related avoidance behaviors would cause a mix of responses and impacts in exposed juvenile Chinook salmon and steelhead. In some individuals, it would inhibit normal shoreline obligation and or cause total avoidance of the affected area. For some rearing individuals, this is likely to increase inter- and intraspecific competition for forage and shelter resources in the areas adjacent to the avoided habitat. For some migrating juveniles, project-related areal avoidance would induce some individuals to swim around the affected areas, effectively increasing the time and distance they would remain in open and relatively deep waters. The off-bank migration of these small fish increases their migration distance and time, which has been positively correlated with increased mortality in juvenile Chinook salmon (Anderson et al. 2005), and it increases energetic costs (Heerhartz and Toft 2015).

For both rearing and migrating juveniles, areal avoidance would also increase some individuals' risk of exposure and vulnerability to piscivorous predators. Avoidance of the project-related stressors identified above, would have the effect of causing some exposed individuals to swim farther from the waterline, often in deeper water, which favors predatory fish and increases the risk of predation for migrating juvenile salmonids (Celedonia et al. 2008a; Tabor et al. 2010; Willette 2001).

Based on the best available information, we expect that during construction and over the life of the bridge and its supporting Pier 4, variable but low numbers of the juvenile Chinook salmon and steelhead that pass the project area would be exposed to some mix of the stressors discussed in this subsection, and that small subsets of the exposed individuals are likely to experience impacts on their normal behaviors and or fitness that would be intense enough to meaningfully reduce their long-term survival, with a small subset of those being lost to predation.

Forage Diminishment

Forage diminishment is likely to adversely affect juvenile PS Chinook salmon and juvenile PS steelhead. It is extremely unlikely that adults of either species would be meaningfully affected by this stressor.

Juvenile Chinook salmon and steelhead both rear and migrate in the river at the project area. During rearing and migration, the juveniles of both species would be nearly constantly foraging on available planktonic organisms such as amphipods, copepods, and euphausiids, as well as the larvae of benthic species and fish (NMFS 2006).
Project-related altered substrate, reduced riparian vegetation, altered lighting, and toxic residues are all likely to reduce the quality and or availability of forage organisms at the project site. The project-related 2,575 square feet of new and or repaired concrete and riprap would maintain an area of degraded forage production as compared to natural substrate conditions, and that artificial substrate would remain on the landscape for several decades beyond that of the existing site.

Project-related reduced riparian vegetation at the riverside ends of both 12-wide access routes would slightly reduce the input of terrestrial-origin organic matter, such as insects, leaf litter, and small branches to the river. Terrestrial insects that fall into streams are a forage resource for salmonids, and the decay of dead insects and leaf litter add to the in-stream nutrient cycle that supports the growth of aquatic algae and invertebrates that provide important forage resources for juvenile salmonids. Although the area affected by reduced vegetation would be small, its impacts on forage availability and quality would be additive to those of the other stressors discussed in this subsection. The exact duration of this effect is unknown, but would likely last 1 to 5 years, depending on the time needed for the damaged shrubs and or new plantings to return to current levels of vegetative development.

Depending on its intensity and duration, over-water shade can limit primary productivity and reduce the diversity of the aquatic communities under over-water structures (Nightingale and Simenstad 2001; Simenstad et al. 1999). Therefore, Haller Bridge t's 6,000 square feet of shade is likely to maintain conditions that are likely to reduce the diversity and quantity of forage resources under and adjacent to the bridge, as compared to unshaded substrate conditions. Further, the shade would remain on the landscape for decades beyond that of the existing site.

Work related spills and discharges are reasonably likely to occur below the OHWM of the river, and some toxic residues from those events are likely to persist in the rocks and gravel after clean up. Those residues are likely to include substances that are known to be harmful to fish and other aquatic organisms. The exact locations, amounts and durations of toxic residues that would persist after project completion are uncertain, but they are expected to be relatively small and short-lived. To avoid underestimating potential impacts, this assessment assumes that small amounts of toxic residue would be scattered across the north work area that is below the OHWM, and that those residues would be biologically available at decreasing levels for 1 to 2 years following project completion.

While present, some of those toxic residues are likely to be taken up by benthic infaunal and epifaunal invertebrate organisms that are forage resources for juvenile salmonids. Fish can absorb pollutants through dietary exposure as well as through direct uptake through their gills. Amphipods and copepods uptake pollutants such as PAHs from contaminated sediments (Landrum and Scavia 1983; Landrum et al. 1984; Neff 1982), and pass them to juvenile Chinook salmon and other small fish through the food web. Varanasi et al. (1993) found high levels of PAHs in the stomach contents of juvenile Chinook salmon in the contaminated Duwamish Waterway. They also reported reduced growth, suppressed immune competence, as well as increased mortality in juvenile Chinook salmon that was likely caused by the dietary exposure to PAHs. Meador et al. (2006) demonstrated that dietary exposure to PAHs caused “toxicant-induced starvation” with reduced growth and reduced lipid stores in juvenile Chinook salmon. The authors surmised that these impacts could severely impact the odds of survival in affected juvenile Chinook salmon. Although not specifically addressed by the authors, the biological similarity between Chinook salmon and steelhead suggests that steelhead may be similarly affected. In addition to forage contamination, the project-related toxic residues may also sicken or kill some planktonic and benthic organisms, reducing the number, size, and diversity of available salmonid forage organisms within the affected area. Similar to the impacts of reduced vegetation, the total area affected by toxic residues would be small, but its impacts on forage availability and quality would be additive to those of the other stressors discussed in this subsection.

Based on the best available information, we expect that variable but low numbers of the juvenile Chinook salmon and steelhead that pass the project area would be exposed to some mix of forage diminishment discussed in this subsection, and that small subsets of the exposed individuals are likely to experience impacts on their fitness that would be intense enough to meaningfully reduce their long-term survival.

Summary of Effects on Listed Species

The proposed action would cause a suite of impacts (discussed above in this subsection) that individually and or in combination are likely to adversely affect subsets of the juvenile Chinook salmon and steelhead that pass through the affected area. The annual numbers of either species that would be exposed to the suite of stressors are unquantifiable with any degree of certainty, and are likely to be highly variable over time. Similarly, the intensity of response that any exposed fish may experience are uncertain and likely to be highly individualistic, with only a subset of the exposed individuals being meaningfully affected. With the exception of successful acts of predation, the responses to these impacts would be non-lethal in most cases. Typically, some subset of the exposed fish would experience stress and or reduced fitness that could reduce the likelihood of long-term survival for some individuals.

Exact ratios of juvenile to adult survival are not known for either species. However, even under natural conditions, individual juvenile Chinook salmon have a very low probability of surviving to adulthood (Bradford 1995). This is due natural causes such as natural variability in stream and ocean conditions, predator-prey interactions, and natural climate variability (Adams 1980; Bradford 1995; Quinones et al. 2014). This is also true for steelhead.

The best available information supports the expectation that the annual numbers of action-affected fish would constitute such small components of their respective cohorts that their potential loss would be too low to cause detectable population-level effects.

2.5.2 Effects on Critical Habitat

This assessment considers the intensity of expected effects in terms of the change they would cause in affected Primary 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. Ephemeral effects are those that are likely to last for hours or days, short-term effects would likely last for weeks, and long-term effects are likely to last for months, years or decades.

Critical Habitat for PS Chinook salmon and PS steelhead: The proposed action, including full application of the planned conservation measures and BMPs, is likely to adversely affect designated critical habitat for PS Chinook salmon and PS steelhead as described below.

1. Freshwater spawning sites:
   a. Water quantity – The proposed action would cause no effect on this attribute.
   b. Water quality – The proposed action would cause minor short-term adverse effects on this attribute during demolition and construction. As described in Work-related Pollutants, small amounts of work-related turbidity and or toxic material are expected to enter the river. The use of work area isolation devices is expected to mostly contain these impacts, but to avoid underestimating impacts, this assessment assumes that work-related turbidity and or toxic material at concentrations high enough to elicit behavioral effects would extend a maximum of 50 feet upstream and 300 feet downstream of the project areas.
   c. Substrate – The proposed action would cause minor long-term adverse effects on this attribute. As described in Altered Substrate, the project's new armoring is likely to prevent natural sediment migration, and prevent the possible formation of spawning habitat across an area if about 2,575 square feet around Pier 4. It would also maintain conditions that are likely to slightly alter habitat forming processes up- and downstream of the project site within up to 0.9 mile, which may slightly alter the quantity and quality of spawning gravels. In the adjacent mitigation areas, the removal of 1,645 square feet of derelict riprap and concrete may act to reduce similar ongoing substrate-related impacts.

2. Freshwater rearing sites:
   a. Floodplain connectivity – The proposed action would cause no measurable effect on this attribute.
   b. Forage – The proposed action would cause minor long-term adverse effects on this attribute. As described in Forage Diminishment, the combination of the artificial substrate within an area of about 2,575 square feet around Pier 4, toxic residues from equipment discharges, vegetation-related reduced input of organic material of terrestrial origin, and altered lighting from the bridge are likely to reduce forage quantity and quality in the area around Pier 4. In the adjacent mitigation areas, the removal of 1,645 square feet of derelict riprap and concrete may act to reduce similar ongoing substrate-related impacts.
   c. Natural cover – The proposed action would cause minor long-term adverse effects on this attribute. As described in Reduced Riparian Vegetation, reduced vegetation the at the riverside ends of two 12-wide access routes would reduce the amount of overhanging vegetation that currently creates natural shading along the riverbank and that provides branch and leaf litter that is often used as cover for juvenile salmonids. This impact would last a low number of years, until the vegetation returns to pre-project levels of development.
   d. Water quantity – The proposed action would cause no effect on this attribute.
   e. Water quality – Same as above.
3. Freshwater migration corridors free of obstruction and excessive predation:
   d. Obstruction and excessive predation – The proposed project would cause minor short- and long-term adverse effects on this attribute. As described in Altered Substrate and in Areal Avoidance, the riprap substrate within an area of about 2,575 square feet around Pier 4 would maintain habitat conditions that favor predatory fish species that prey on juvenile PS Chinook salmon, and a suite of numerous project related impacts would create and or maintain conditions that are likely to alter normal migration behaviors for some juvenile Chinook salmon that rear in and or migrate past the project area. In the adjacent mitigation areas, the removal of 1,645 square feet of derelict riprap and concrete may act to reduce similar ongoing substrate-related impacts.
   e. Water quantity – The proposed project would cause no effect on this attribute.
   f. Water quality – Same as above.
   g. Natural Cover – Same as above.

4. Estuarine areas free of obstruction and excessive predation: – Outside of the expected range of detectable effects.

5. Nearshore marine areas free of obstruction and excessive predation: – Outside of the expected range of detectable effects.

6. Offshore marine areas: – Outside of the expected range of detectable effects.

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 the environmental baseline (Section 2.4).

The current conditions of ESA-listed species and designated critical habitat within the action area are described in the Range-wide Status of the Species and Critical Habitat and Environmental Baseline sections above. The non-federal activities in and upstream of the action area that have contributed to those conditions include past and on-going urbanization, agriculture, road construction, water development, forest management, subsistence and recreational fishing, and restoration activities. Those actions were, and continue to be, driven by a combination of economic conditions that characterized traditional natural resource-based industries, general resource demands associated with settlement of local and regional population centers, and the efforts of conservation groups dedicated to restoration and use of natural amenities, such as cultural inspiration and recreational experiences.

The NMFS is unaware of any specific future non-federal activities that are reasonably certain to affect the action area. However, the NMFS is reasonably certain that future non-federal actions such as the previously mentioned activities are all likely to continue and increase in the future as the human population continues to grow across the region. Continued habitat loss and degradation of water quality from development and chronic input from point- and non-point pollutant sources will likely continue and increase into the future.

The intensity of these influences depends on many social and economic factors, and therefore is difficult to predict. Further, the adoption of more environmentally acceptable practices and standards may gradually reduce some negative environmental impacts over time. Interest in restoration activities has increased as environmental awareness rises among the public. State, tribal, and local governments have developed plans and initiatives to benefit ESA-listed PS Chinook salmon and PS steelhead. However, the implementation of plans, initiatives, and specific restoration projects are often subject to political, legislative, and fiscal challenges that increase the uncertainty of their success.

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.

As described in more detail above in Section 2.4, climate change is likely to increasingly affect the abundance and distribution of the ESA-listed species considered in the opinion. It is also likely to increasingly affect the PBFs of designated critical habitats. The exact effects of climate change are both uncertain, and unlikely to be spatially homogeneous. However, climate change is reasonably likely to cause reduced instream flows in some systems, and may impact water quality through elevated in-stream water temperatures and reduced dissolved oxygen, as well as by causing more frequent and more intense flooding events.

Climate change may also impact coastal waters through elevated surface water temperature, increased and variable acidity, increasing storm frequency and magnitude, and rising sea levels. The adaptive ability of listed-species is uncertain, but is likely reduced due to reductions in population size, habitat quantity and diversity, and loss of behavioral and genetic variation. The proposed action will cause direct and indirect effects on the ESA-listed species and critical habitats considered in this opinion well into the foreseeable future. However, the action's effects on water quality, substrate, and the biological environment are expected to be of such a small scale that no detectable effects on ESA-listed species or critical habitat through synergistic interactions with the impacts of climate change are expected.

2.7.1 ESA Listed Species

PS Chinook salmon and PS steelhead are both listed as threatened based on declines from historic levels of abundance and productivity, loss of spatial structure and diversity, and an array of limiting factors as a baseline habitat condition. Both species will be affected over time by cumulative effects, some positive – as recovery plan implementation and regulatory revisions increase habitat protections and restoration, and some negative – as climate change and unregulated or difficult to regulate sources of environmental degradation persist or increase. Overall, to the degree that habitat trends are negative, the effects on viability parameters of each species are also likely to be negative. In this context we consider how the proposed action's impacts on individuals would affect the listed species at the population and ESU/DPS scales.

PS Chinook salmon

The long-term abundance trend of the PS Chinook salmon ESU is slightly negative. Reduced or eliminated accessibility to historically important habitat, combined with degraded conditions in available habitat due to land use activities appear to be the greatest threats to the recovery of PS Chinook salmon. Commercial and recreational fisheries also continue to impact this species. The most recent 5-year status review reported a general decline in natural-origin spawner abundance across all PS Chinook salmon MPGs over the most-recent fifteen years. It also reported that escapement levels remain well below the PSTRT planning ranges for recovery for all MPGs, and concluded that the PS Chinook salmon ESU remains at "moderate" risk of extinction (Ford 2022).

The PS Chinook salmon most likely to occur in the action area would be summer- and fall-run fish from the North Fork (NF) and South Fork (SF) Stillaguamish River populations, which are part of the Whidbey Basin MPG, which is considered at relatively low risk of extinction. However, both populations are relatively small, with negative abundance trends since 2000, and decreasing proportions of natural-origin spawners.

The project site is located on the north bank of the Stillaguamish River at the confluence of the mainstem with the North and South Forks. It provides migratory habitat for returning adults and out-migrating juveniles from these two populations, and spawning habitat for fall-run fish. The environmental baseline within the action area has been degraded by past and ongoing logging, agriculture, urbanization, road building, and recreation in and upstream of the action area.

As discussed in the effects section of this opinion, the proposed action would cause a suite of impacts that individually and or in combination are likely to annually adversely affect highly variable but such low numbers of juvenile Chinook salmon that the action would cause no detectable population level affects.
Based on the best available information, the scale of the action-related effects, when considered in combination with the degraded baseline, cumulative effects, and the impacts of climate change, would be too small to cause detectable effects on any of the characteristics of a viable salmon population (abundance, productivity, distribution, or genetic diversity) for the affected PS Chinook salmon populations. Therefore, the proposed action would not appreciably reduce the likelihood of survival and recovery of this listed species.

<u>PS steelhead</u>

The long-term abundance trend of the PS steelhead DPS is negative, especially for natural spawners. Abundance information is unavailable for about 1/3 of the DIPs. In most cases where no information is available, abundances are assumed to be very low. Although most DIPs for which data are available experienced improved abundance over the last five years, 95% of those DIPs are at less than half of their lower abundance target for recovery. The extinction risk for the Puget Sound steelhead DPS is considered moderate. Reduced or eliminated accessibility to historically important habitat, combined with degraded conditions in available habitat due to land use activities appear to be the greatest threats to the recovery of PS steelhead. Fisheries activities also continue to impact this species (Ford 2022).

The PS steelhead most likely to occur in the action area would be fish from the Stillaguamish River winter-run DIP, and fish from the Canyon Creek and Deer Creek summer-run DIPs. The Stillaguamish River Winter-Run DIP is a small population with a long-term negative trend and a severe short-term decline. WDFW rates the DIP as depressed. No specific information is available to describe the total abundance and trends the Canyon Creek and Deer Creek DIPs.

The project site is located on the north bank of the Stillaguamish River at the confluence of the mainstem with the North and South Forks. It provides migratory habitat for returning adults and out-migrating juveniles from these two populations, and spawning habitat for winter-run fish. The environmental baseline within the action area has been degraded by past and ongoing logging, agriculture, urbanization, road building, and recreation in and upstream of the action area.

As discussed in the effects section of this opinion, the proposed action would cause a suite of impacts that individually and or in combination are likely to annually adversely affect highly variable, but such low numbers of juvenile steelhead that the action would cause no detectable population level affects.

Based on the best available information, the scale of the action-related effects, when considered in combination with the degraded baseline, cumulative effects, and the impacts of climate change, would be too small to cause detectable effects on any of the characteristics of a viable salmon population (abundance, productivity, distribution, or genetic diversity) for the affected PS steelhead DIPs. Therefore, the proposed action would not appreciably reduce the likelihood of survival and recovery of this listed species.

2.7.2 Critical Habitat

Critical habitat was designated for PS Chinook salmon and PS steelhead to ensure that specific areas with PBFs that are essential to the conservation of that listed species are appropriately managed or protected. The critical habitat for PS Chinook salmon will be affected over time by cumulative effects, some positive – as restoration efforts and regulatory revisions increase habitat protections and restoration, and some negative – as climate change and unregulated or difficult to regulate sources of environmental degradation persist or increase. Overall, to the degree that trends are negative, the effects on the PBFs of critical habitat for both species are also likely to be negative. In this context we consider how the proposed action's impacts on the attributes of the action area's PBFs would affect the designated critical habitat's ability to support the conservation of PS Chinook salmon as a whole.

Past and ongoing land and water use practices have degraded salmonid critical habitat throughout the Puget Sound basin. Global climate change is expected to increase in-stream water temperatures and alter stream flows, possibly exacerbating impacts on baseline conditions in freshwater habitats across the region. Rising sea levels are expected to increase coastal erosion and alter the composition of nearshore habitats, which could further reduce the availability and quality of estuarine habitats. Increased ocean acidification may also reduce the quality of estuarine habitats.

In the future, non-federal land and water use and climate change are likely to increase. The intensity of those influences on salmonid critical habitat is uncertain, as is the degree to which those impacts may be tempered by adoption of more environmentally acceptable land use practices, by the implementation of non-federal plans that are intended to benefit salmonids, and by efforts to address the effects of climate change.

The PBFs of salmonid critical habitat that would be affected by the proposed action are freshwater spawning sites, freshwater rearing sites, and freshwater migration corridors free of obstruction and excessive predation. The site attributes of those PBFs that would be affected by the action are water quality, substrate, forage, natural cover, and freedom from obstruction and excessive predation. As described in the effects section, the proposed action would cause long-term minor adverse effects on all of those attributes up to 0.9 mile up- and downstream of the project site.

Based on the best available information, the scale of the proposed action's effects, when considered in combination with the degraded baseline, cumulative effects, and the impacts of climate change, would be too small to cause any detectable long-term negative changes in the quality or functionality of the freshwater PBFs in the action area. Therefore, these critical habitats will maintain their current level of functionality, and retain the current ability for PBFs to become functionally established, to serve the intended conservation role for PS Chinook salmon and PS steelhead.

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 cumulative effects, it is the NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of PS Chinook salmon and PS steelhead, nor is it likely to destroy or adversely modify designated critical habitat for either species.

2.9 Incidental Take Statement

Section 9 of the ESA and federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). "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, the NMFS determined that incidental take is reasonably certain to occur as follows:

Harm of juvenile PS Chinook salmon and juvenile PS steelhead from exposure to:

- Fish Salvage;

- Work-related Noise;
- Altered Substrate;
- Reduced Riparian Vegetation;
- Areal Avoidance; and
- Forage Diminishment.

This opinion assumes that a maximum total of 20 juvenile PS Chinook salmon and or PS steelhead would be handled during fish salvage, that the 20-fish total would consist of some mix of either or both species, and that up to 2 of those fish would be seriously injured or killed.

The NMFS cannot predict with meaningful accuracy the number of PS Chinook salmon and PS steelhead that are reasonably certain to be injured or killed annually by exposure to any of the remaining stressors identified immediately above. The distribution and abundance of the listed fish that occur within the action area are affected by numerous biotic and environmental processes, such as timing in relation to the life stage and typical behaviors of the species under consideration, intra- and inter-specific interactions such as competition and predation, habitat quality, and the interaction of processes that influence genetic, population, and environmental characteristics. These 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. Therefore, the distribution and abundance of listed fish in any given area are likely to vary greatly, and somewhat randomly, over time. Further, the NMFS knows of no device or practicable technique that would yield reliable counts of individuals that may be injured or killed annually by exposure to the proposed action's impacts. In such circumstances, the NMFS uses the causal link established between an 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.

For this action, the timing of in-water work is applicable because working outside of the proposed August 1 through August 31 in-water work window would increase the potential for exposure, and the intensity of adverse responses in PS Chinook salmon and PS steelhead that would be exposed to work-related stressors.

The size, configuration, and methods of construction of the proposed project components are the best available surrogates for the extent of take of juvenile PS Chinook salmon and or juvenile PS steelhead from exposure to action-related stressors, because those stressors are all positively correlated with the type, size, and location of the armoring that would be installed, as well as the size and locations of the access routes and the BMPs that would be employed to reduce the potential for, and intensity of work-related impacts. Any changes in these factors could increase the intensity of their impacts on listed species and critical habitats, above what was considered in the effects section of this opinion.

In summary, the extent of PS Chinook salmon and PS steelhead take for this action is defined as:

- The capture and handling of up to 20 juvenile PS Chinook salmon and or PS steelhead, with up to 2 of those fish being seriously injured or killed.

- In-water work to be completed between August 1 and August 31; and
- The size, configuration, and methods of construction of the proposed project components as described in the proposed action section of this biological opinion.

Exceedance of any of the exposure limits described above would constitute an exceedance of authorized take that would trigger the need to reinitiate consultation.

Although these take surrogates could be construed as partially coextensive with the proposed action, they nevertheless function as effective re-initiation triggers. If any of these take surrogates exceed the proposal, it could still meaningfully trigger re-initiation because the USACE has authority to conduct compliance inspections and to take actions to address non-compliance, including post-construction (33 CFR 326.4).

2.9.2 Effect of the Take

In the biological opinion, the 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 those actions the Director considers necessary or appropriate to minimize the impact of the incidental take on the species (50 CFR 402.02).

The USACE shall require the applicant to:

1. Ensure the implementation of monitoring and reporting to confirm that the take exemption for the proposed action is not exceeded.

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 USACE, and the applicant have 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. The following terms and conditions implement reasonable and prudent measure 1:

    a. The USACE shall require the applicant to develop and implement plans to collect and report details about the take of listed fish. That plan shall:
        i. Require the applicant and or their contractor to maintain and submit records to verify that all take indicators are monitored and reported. Minimally, the records should include:

1. Documentation of fish salvage activities that include:
    a. The identity (name, title, organization), qualification, and contact information of the person(s) conducting fish salvage, and the person completing the report;
    b. The date(s), time, and air and water temperatures during salvage work;
    c. The method(s) of capture and handling procedures that were used; and
    d. The species and quantities of captured fish, and their disposition at release (i.e. alive with no apparent injuries, alive with apparent minor/serious injuries, dead with/without apparent injuries, etc.).
2. Documentation of the timing and duration of in-water work to ensure that all in-water work is completed between August 1 and August 31;
3. Documentation of the size, configuration, and methods of construction of the proposed project components to confirm that they do not exceed the characteristics described in this opinion.

ii. Require the applicant to establish procedures for the submission of the construction records and other materials to the appropriate USACE office, and to submit an electronic post-construction report to the NMFS within six months of project completion. Send the report to: projectreports.wcr@noaa.gov. Be sure to include Attn: WCRO-2022-02108 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).

The NMFS knows of no reasonable measures that the applicant could include to further reduce the project's effects on listed fish, and consequently offers no conservation recommendations.

2.11 Reinitiation of Consultation

This concludes formal consultation for the USACE's authorization of Snohomish County's Haller Bridge Pier 4 Scour Protection Project in the Stillaguamish River, Snohomish County, Washington.

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."

2.12 "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.

The USACE determined that the proposed action would have no effect on southern resident killer whales or their critical habitat (SPR 2021; USACE 2021a). However, because of the trophic relationship between PS Chinook salmon and SR killer whales, the NMFS analyzed the action's potential effects on SR killer whales and their designated critical habitat. Detailed information about the biology, habitat, and conservation status and trends of these whales can be found in the listing regulations and critical habitat designations published in the Federal Register, as well as in the recovery plans and other sources at: https://www.fisheries.noaa.gov/species-directory/threatened-endangered, which are incorporated here by reference.

Under the ESA, "effects of the action" are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (50 CFR 402.02). When evaluating whether the proposed action is not likely to adversely affect listed species or critical habitat, the NMFS considers whether the effects are expected to be completely beneficial, insignificant, or discountable. Completely 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. Effects are considered discountable if they are extremely unlikely to occur.

2.12.1 Effects on Listed Species

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 analyses of effects presented in Section 2.5. As described in Section 2.5, the range of detectable action-related stressors would be limited to the waters and substrates within a maximum of about 0.9 mile up- and downstream of the project site in Stillaguamish River.

SR killer whales

The proposed action will cause no direct effects on SR killer whales or their critical habitat because all construction and its impacts would take place in freshwater, and SR killer whales and their designated critical habitat are limited to marine waters. However, the project may indirectly affect SR killer whales through the trophic web by affecting the quantity and quality of prey available to them. We therefore analyze that potential here but conclude that the effects on SR killer whales would be insignificant for at least two reasons.

First, as described in Section 2.5, the action would annually affect an extremely low number of juvenile Chinook salmon. The project's detectable effects on fish would be limited to an area no more than 300 feet around the project site, where small subsets of each year's juvenile PS Chinook salmon cohorts from the Cedar River and Sammamish River populations could be briefly exposed to project-related impacts during the final portion their freshwater migration life stage, and only very small subsets of the individuals that pass through the area are likely to be detectably affected by the exposure.

The exact Chinook salmon smolt to adult ratios are not known. However, even under natural conditions, individual juvenile Chinook salmon have a very low probability of surviving to adulthood (Bradford 1995). We note that human-caused habitat degradation and other factors such as hatcheries and harvest exacerbate natural causes of low survival such as natural variability in stream and ocean conditions, predator-prey interactions, and natural climate variability (Adams 1980, Quinones et al., 2014). However, based on the best available information, the annual numbers of project-affected juveniles would be too low to influence any VSP parameters for either population, or to cause any detectable reduction in adult Chinook salmon availability to SR killer whales in marine waters.

Second, as described in Sections 1.3, 2.2, and 2.5, the PS Chinook populations that would be affected by the project are small, and in combination make up a very small portion of the adult Chinook that are available to SR killer whales in marine waters. Therefore, based on the best available information, the proposed action is not likely to adversely affect SR killer whales through the trophic web.

2.12.2 Effects on Critical Habitat

This assessment considers the intensity of expected effects in terms of the change they would cause in affected physical or 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. Ephemeral effects are those that are likely to last for hours or days, short-term effects would likely to last for weeks, and long-term effects are likely to last for months, years or decades.

SR killer whale Critical Habitat: Designated critical habitat for SR killer whales includes marine waters of the Puget Sound that are at least 20 feet deep. The expected effects on SR killer whale critical habitat from completion of the proposed action, including full application of the conservation measures and BMP, would be limited to the impacts on the PBFs as described below.

1. Water quality to support growth and development
   The proposed action would cause no detectable effects on marine water quality.

2. Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth
   The proposed actions would cause long-term undetectable effects on prey availability and quality. Action-related impacts would annually injure or kill extremely low numbers of individual juvenile Chinook salmon (primary prey). However, the numbers of affected

juvenile Chinook salmon would be too small to cause detectable effects on the numbers of available adult Chinook salmon in marine waters. Therefore, it would cause no detectable reduction in prey availability and quality.

3. Passage conditions to allow for migration, resting, and foraging
   The proposed action would cause no detectable effects on passage conditions.

Based on this analysis, the NMFS has concluded that the proposed action is not likely to adversely affect ESA-listed SR killer whales and their designated critical habitat.

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

Section 305(b) of the MSA directs federal agencies to consult with the NMFS on all actions or proposed actions that may adversely affect EFH. Under the MSA, this consultation is intended to promote the conservation of EFH as necessary to support sustainable fisheries and the managed species' contribution to a healthy ecosystem. For the purposes of the MSA, EFH means "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity", and includes the physical, chemical, and biological properties that are used by fish (50 CFR 600.10). Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects 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 the NMFS to recommend measures that can be taken by the action agency to conserve EFH. Such recommendations may include measures to avoid, minimize, mitigate, or otherwise offset the adverse effects of the action on EFH [CFR 600.905(b)].

This analysis is based, in part, on the EFH assessment provided by the USACE and the descriptions of EFH contained in the fishery management plan for Pacific Coast salmon developed by the Pacific Fishery Management Council and approved by the Secretary of Commerce (PFMC 2014).

3.1 Essential Fish Habitat Affected By the Project

The project site is located in Arlington, Washington, at the confluence of the Stillaguamish River's mainstem of the with its North and South Forks (Figure 1). The water and substrate of the project area are designated as freshwater EFH for various life-history stages of Pacific Coast Salmon, which within the Stillaguamish River watershed include Chinook, coho, and pink salmon. Due to trophic links between PS Chinook salmon and SR killer whales, the project's action area also overlaps with marine waters that have been designated, under the MSA, as EFH for Pacific Coast Salmon, Pacific Coast Groundfish, and Coastal Pelagic Species. However, the action would cause no detectable effects on any components of marine EFH. Therefore, the action's effects on EFH would be limited to impacts on freshwater EFH for Pacific Coast Salmon, and it would not adversely affect marine EFH for Pacific Coast Salmon, or EFH for Pacific Coast groundfish and coastal pelagic species.

Freshwater EFH for Pacific salmon is identified and described in Appendix A to the Pacific Coast salmon fishery management plan, and consists of four major components: (1) spawning and incubation; (2) juvenile rearing; (3) juvenile migration corridors; and (4) adult migration corridors and holding habitat.

Those components of freshwater EFH for Pacific Coast Salmon depend on habitat conditions for spawning, rearing, and migration that include: (1) water quality (e.g., dissolved oxygen, nutrients, temperature, etc.); (2) water quantity, depth, and velocity; (3) riparian-stream-marine energy exchanges; (4) channel gradient and stability; (5) prey availability; (6) cover and habitat complexity (e.g., large woody debris, pools, aquatic and terrestrial vegetation, etc.); (7) space; (8) habitat connectivity from headwaters to the ocean (e.g., dispersal corridors); (9) groundwater-stream interactions; and (10) substrate composition.

As part of Pacific Coast Salmon EFH, five Habitat Areas of Particular Concern (HAPCs) have been defined: 1) complex channels and floodplain habitats; 2) thermal refugia; 3) spawning habitat; 4) estuaries; and 5) marine and estuarine submerged aquatic vegetation. The project's area of effects is HAPC for spawning, and is also likely to include HAPC for complex channels and floodplain habitats and thermal refugia.

3.2 Adverse Effects on Essential Fish Habitat

The ESA portion of this document (Sections 1 and 2) describes the proposed action and its adverse effects on ESA-listed species and critical habitats, and is relevant to the effects on EFH for Pacific Coast Salmon. Based on the analysis of effects presented in Section 2.5 the proposed action will cause minor short- and long-term adverse effects on freshwater EFH for Pacific Coast Salmon as summarized below.

<u>Freshwater EFH for Pacific Coast Salmon</u>

1. <u>Water quality:</u> The proposed action would cause minor short-term adverse effects on this attribute. As described in Work-related Pollutants, small amounts of work-related turbidity and or toxic material are expected to enter the river during demolition and construction. The use of work area isolation devices is expected to mostly contain these impacts, but to avoid underestimating impacts, this assessment assumes that work-related turbidity and or toxic material at concentrations high enough to elicit behavioral effects would extend a maximum of 50 feet upstream and 300 feet downstream of the project areas. Detectable water quality impacts are expected to persist no more than a low number of hours after work stops. The action would cause no meaningful changes in water temperature or salinity.

2. <u>Water quantity, depth, and velocity:</u> The proposed action would cause long-term minor adverse effects on this attribute. As described in Altered Substrate, the new armoring around Pier 4 would prevent natural erosion-driven changes in water depth around Pier 4, and

slightly alter water velocities in the river reaches within 0.9 mile of the project area. No impacts on water quantity are expected.

3. Riparian-stream-marine energy exchanges: Project-related impacts on riparian vegetation would cause long-term minor adverse effects on this attribute. As described in Reduced Riparian Vegetation, some riparian shrubs are expected to be damaged or destroyed across two 12-foot wide sections of river bank (one on each side of the mainstem). The impacted vegetation is expected to recover and or be replaced with appropriate native vegetation at the end of construction. However, until the recovering vegetation fully returns to its existing level of functionality (likely a low number of years after the end of the project), the river adjacent to those areas may experience slightly increased water temperatures due to minor increases in the input of solar radiation. Also, the vegetation reduction would reduce the input of organic material of terrestrial origin to the river, which is important to the in-stream nutrient cycle. Impacts on riparian-stream energy exchange are unlikely to be detectable beyond about 300 feet downstream of the project area, but they may persist at diminishing intensity for a couple years after project completion.

4. Channel gradient and stability: The proposed action would cause long-term minor adverse effects on this attribute. As described in Altered Substrate, for many years to come, the new Pier 4 armoring would prevent ongoing natural erosion of the riverbed around Pier 4, and slightly alter hydraulically-driven stream forming processes in the river reaches within about 0.9 mile of the project area.

5. Prey availability: The proposed action would cause minor long-term adverse effects on this attribute. The proposed action would cause minor long-term adverse effects on this attribute. As described in Forage Diminishment, the combination of armor-related artificial substrate within an area of about 2,575 square feet around Pier 4, toxic residues from equipment discharges, vegetation-related reduced input of organic material of terrestrial origin, and altered lighting from the bridge are likely to reduce forage quantity and quality in the area around Pier 4. In the adjacent mitigation areas, the removal of 1,645 square feet of derelict riprap and concrete may act to reduce similar ongoing substrate-related impacts.

6. Cover and habitat complexity: The proposed action would cause minor long-term adverse effects on this attribute. As described in Reduced Riparian Vegetation, reduced vegetation the at the riverside ends of two 12-wide access routes would reduce the amount of overhanging vegetation that currently creates natural shading along the riverbank and that provides branch and leaf litter that is often used as cover for juvenile salmonids. This impact would last a low number of years, until the vegetation returns to pre-project levels of development. As described in Altered Substrate, the new armoring would prevent natural habitat forming processes from occurring across an area of about 2,575 square feet around Pier 4, and it may slightly alter hydraulically-driven stream habitat forming processes in the river reaches within about 0.9 mile of the project area.

7. Space: The proposed action would cause no measurable effect on this attribute.

8. Habitat connectivity from headwaters to the ocean: The proposed action would cause no measurable effect on this attribute.

9. Groundwater-stream interactions: The proposed action would cause no measurable effect on this attribute.

10. Substrate composition: The proposed action would cause minor long-term adverse effects on this attribute. As described in Altered Substrate, the project's new armoring is likely to prevent natural sediment migration across an area if about 2,575 square feet around Pier 4, and maintain conditions that are likely to slightly alter habitat forming processes up- and downstream of the project site within up to 0.9 mile, which may slightly alter the quantity and quality of spawning gravels. In the adjacent mitigation areas, the removal of 1,645 square feet of derelict riprap and concrete may act to reduce similar ongoing substrate-related impacts.

Habitat Areas of Particular Concern (HAPCs)

The action's impacts on the spawning, complex channels and floodplain habitats, and thermal refugia HAPCs are all discussed above under combinations of impacts on water quality; water quantity, depth, and velocity; channel gradient and stability; cover and habitat complexity; and substrate composition.

3.3 Essential Fish Habitat Conservation Recommendations

The proposed project includes a comprehensive set of BMPs to minimize demolition-construction-related impacts, and mitigation plans to help offset some of the projects' structure-related impacts on the quantity and quality of Pacific Coast salmon EFH. The NMFS knows of no other reasonable measures that the applicant could include to further reduce the project's effects on the attributes of EFH for Pacific Coast Salmon, and consequently offers no conservation recommendations.

3.4 Supplemental Consultation

The USACE must reinitiate EFH consultation with the 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 the 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 user of this opinion is the USACE. Other interested users could include the applicant, the WDFW, the governments and citizens of Snohomish County and the City of Arlington, and Native American tribes. Individual copies of this opinion were provided to the USACE. 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 the 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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