UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
1201 NE Lloyd Boulevard, Suite 1100
PORTLAND, OR 97232-1274

Refer to NMFS No:
WCRO-2020-02164

January 22, 2021

Michelle Walker
Corps of Engineers, Seattle District
Regulatory Branch CENWS-OD-RG
P.O. Box 3755
Seattle, Washington 98124-3755

Re: Endangered Species Act Section 7(a)(2) Biological Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Stillaguamish Tribe of Indians Boat Access Project, Snohomish County, Washington (COE Number: NWS-2019-541, HUC: 171100080303 – Stillaguamish River)

Dear Ms. Walker:

Thank you for your letter of August 10, 2020, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for U.S Army Corps of Engineers (COE) authorization of the Stillaguamish Tribe of Indians (STI) Boat Access Project.

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

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 Sound steelhead. The NMFS also concludes that the proposed action is likely to adversely affect designated critical habitat for both species but is not likely to result in the destruction or adverse modification of those designated critical habitats.

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 COE 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 for Pacific Coast Salmon pursuant to Section 305(b) of the MSA. Based on that analysis, the NMFS concluded that the action would adversely affect designated EFH for Pacific Coast Salmon. However, as described at Subsection 3.3, the NMFS knows of no reasonable measures that the applicant could take, beyond those already proposed, that would reduce the project's minor effects on the attributes of Pacific Coast salmon EFH. Therefore, the NMFS has made no conservation recommendations pursuant to MSA (§305(b)(4)(A)).

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,

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

cc: Amanda Barbieri, COE
Scott Rockwell, STI

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

Stillaguamish Tribe of Indians Boat Access Project
Snohomish County, Washington (COE Number: NWS-2019-541)

NMFS Consultation Number: WCRO-2020-02164

Action Agency: U.S. Army Corps of Engineers

Affected Species and 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	Yes	No

N/A = not applicable. The action area is outside designated critical habitat, or critical habitat has not been designated.

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

Consultation Conducted By: National Marine Fisheries Service
West Coast Region

Issued By:

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

Date: January 22, 2021

TABLE OF CONTENTS

LIST OF ABREIVIATIONS

BA – Biological Assessment
BMP – Best Management Practices
CFR – Code of Federal Regulations
COE – Corps of Engineers, U.S. Army
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
HUC – Hydrologic Unit Code
ITS – Incidental Take Statement
MHWM – Mean High Water Mark
MPG – Major Population Group
MSA – Magnuson-Stevens Fishery Conservation and Management Act
MSL – Mean Sea Level
NMFS – National Marine Fisheries Service
NOAA – National Oceanic and Atmospheric Administration
OHWM – Ordinary High Water Mark
PBF – Physical or Biological Feature
PCE – Primary Constituent Element
PFMC – Pacific Fishery Management Council
PS – Puget Sound
PSTRT – Puget Sound Technical Recovery Team
PSSTRT – Puget Sound Steelhead Technical Recovery Team
RL – Received Level
RPA – Reasonable and Prudent Alternative
RPM – Reasonable and Prudent Measure
SEL – Sound Exposure Level
SL – Source Level
STI – Stillaguamish Tribe of Indians
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 USC 1531 et seq.), and implementing regulations at 50 CFR 402, as amended.

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

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. A complete record of this consultation is on file at Oregon Washington Coastal Office.

1.2 Consultation History

On August 10, 2020, the NMFS received a letter from the U.S. Army Corps of Engineers (COE) requesting informal consultation for the proposed action (COE 2020a). The request included Stillaguamish Tribe of Indians' (STI's) biological assessment (BA) and project drawings for the proposed action (STI 2020a & b). On August 31, 2020, NMFS sent an e-mail to inform the COE that the NMFS was unable to concur with the Corps' determination that the proposed action was not likely to adversely affect listed species and critical habitats under our jurisdiction, and that additional information was required to initiate formal consultation. On September 25, 2020, the COE requested formal consultation and provided sufficient additional information, including STI's detailed response to our questions (COE 2020b). Formal consultation was initiated on that date.

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), whereas 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 COE proposes to authorize the Stillaguamish Tribe of Indians (the applicant) to construct a new permanent boat launch ramp on the main stem Stillaguamish River, and to construct about 300 feet of new gravel road to connect the boat ramp to an existing road in Snohomish County, Washington. The boat ramp and road would be located on the Tribally-owned lands on the right (north) bank of the river, about 70 yards west of the southbound lanes of Interstate 5 (Figure 1).

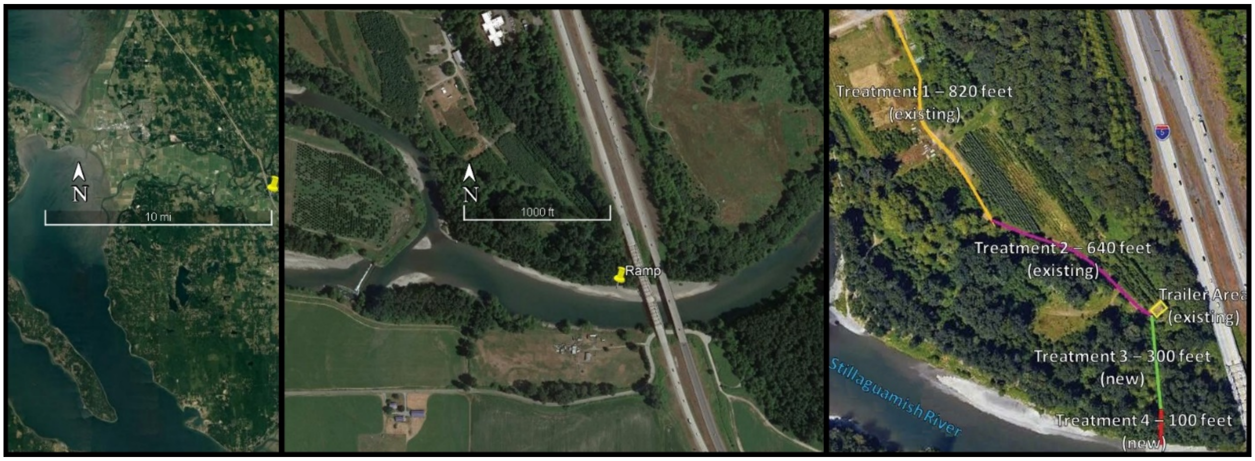

Figure 1. The Stillaguamish Tribe of Indians boat ramp project site on the main stem Stillaguamish River in Snohomish County, Washington. The left image shows the project site relative to Camano Island and the marine waters of Port Susan. The center image shows project site's proximity to the southbound lanes of Interstate 5. The right image shows project components. The new road and ramp that are subject of this consultation are shown as green and red lines (treatments 3 & 4).

The new ramp would transect a natural alluvial berm, perpendicular to the river flow, and terminate on a gravel/cobble bar, at the southern edge of the existing vegetation. It would be about 100 feet long, 16 feet wide, consist of 2 concrete runners separated and surrounded by rock spall, and have a maximum slope of 11% (about 1V:9H) (Figure 2). The ramp's elevation would extend between about 32 and 42 feet above mean sea level (32 to 42 feet MSL), which is about 4 feet below to 6 feet above the river's ordinary high water mark (-4 to 6 feet OHWM) at the site. The lower 33 feet of the ramp (about 530 square feet) would extend below the OHWM.

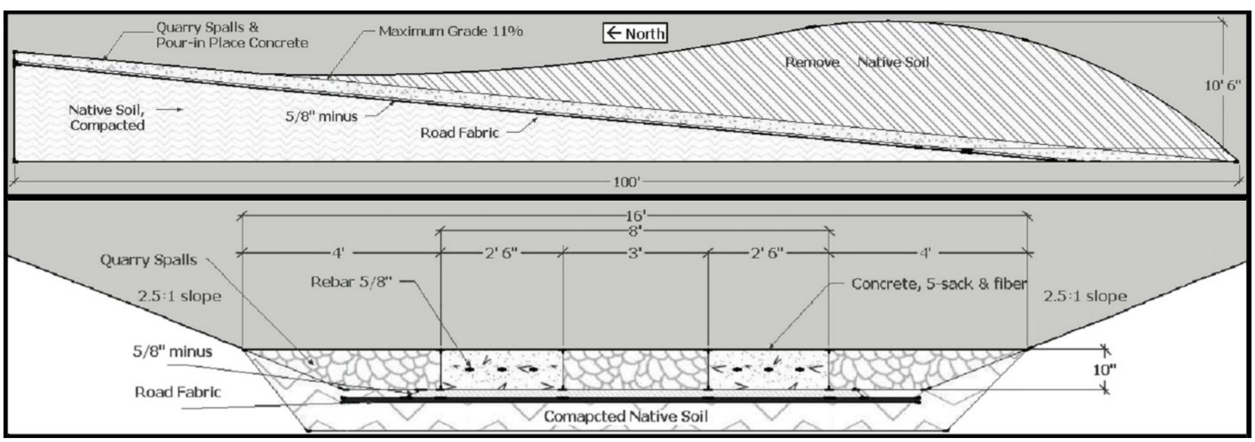

Figure 2. Side and longitudinal cross section drawings of the proposed boat ramp.

The applicant's contractors would operate land-based construction equipment such as an excavator, a bulldozer, and trucks. They would first clear a 400-foot long by 30-foot wide path from the existing trailer parking area to the end of the proposed new boat ramp (Treatment areas

3 & 4 in Figure 1). This would require the removal of the existing vegetation, including about 12 to 16 small diameter hardwood trees and their stumps.

Starting about 71.5 feet north of the OHWM, the contractors would use the excavator and bulldozer to cut 100 feet south through the existing alluvial berm to create a sloped trench down to about -4 feet OHWM (32 feet MSL). The finished trench would be about 12 feet wide at its base, have a maximum slope of about 1V:8.5H, and have sides with maximum slopes of about 2.5V:1H. The contractors would seed the slopes with a grass seed mix appropriate for the site. Suitable excavated material would be used in the construction of the new 300-foot long 12-foot wide gravel access road (Treatment area 3 in Figure 1). Some may also be used for the repair of the existing road sections (Treatment areas 1 & 2 in Figure 1). Excess or unsuitable material would be hauled off-site. After construction of the new access road, the contractors would seed its surface with an appropriate grass seed mix.

To construct the ramp, the contractors would install a geotextile fabric layer along the 12-foot wide bottom of the trench, then install and compact lifts filled with crushed rock over the geotextile (Figure 2). On top of the crushed rock lifts, they would install two 2.5-foot wide, 100-foot long, cast-in-place, rebar-reinforced concrete panels that would be the ramp's primary running surface. Between, and on both sides of the concrete panels, they would install and compact 2.5-inch quarry spalls with a finished elevation identical to that of the concrete panels. The total finished width of the ramp would not exceed 16 feet.

To reduce the project's impacts on listed species and their habitats, the applicant commits to limit ramp construction to the period of July 1 through September 30 (COE 2020a), when the entire construction area would be outside (above) the wetted perimeter of the river, and to require their contractors to comply with all of the best management practices (BMPs) and design features identified on pages 12 and 13 of the applicant's BA for the project. Further, the applicant would require that all construction equipment would remain outside of the wetted perimeter of the river, and that all construction would be limited to daylight hours. Additionally, to compensate for vegetation impacts, the applicant would remove all non-native vegetation within a 396-square foot mitigation area that is located about 200 feet downstream of the proposed ramp location, and to plant 99 live native willow in that area.

The NMFS also considered whether or not the proposed action would cause any other activities. The stated purpose of the new ramp is to support tribal fishing activities. However, those activities, currently occur within the action area, including bankside vehicle use and launching and recovery of fishing boats at a closely adjacent site that lacks a boat ramp. Because those activities would continue to occur within the action area without the proposed action, the NMFS considers that continued tribal bankside vehicle use, launching and recovery of fishing boats within the action area, and the associated fishing are not attributable to the proposed action.

However, the new ramp is likely to require future maintenance and repair work to keep it operational. We believe that future ramp maintenance and repair work would be a consequence of the proposed action because those activities would not occur if the new ramp wasn't constructed. The potential effects of large scale maintenance and repair work such as excavation or installation of additional fill that would require additional permitting by the COE is not considered in this opinion because the additional permitting would trigger additional consultation. However, the effects of routine small scale maintenance and repair work that is unlikely to trigger additional permitting are analyzed in the effects section of this Opinion. That work would likely include episodic removal of relatively small woody debris and small amounts of river sediments that may accumulate on the ramp. It would also likely include minor concrete repairs, and the removal of trash.

Removal of woody debris would be done by hand or with the use of small equipment such as a bobcat, a pickup truck, or a boat to drag the wood slightly downstream of the ramp, where the wood would be left on the riverbank. Episodic sediment removal would likely be accomplished by hand using shovels, or by the use of a small blade-equipped bobcat or similar vehicle that would push the sediments off the downstream end of the ramp. Routine concrete repairs would include hand application of small amounts of concrete or aquatic epoxy to repair of cracks and spalls that may form in the concrete runners. All of this work would be done in compliance with the BMPs identified above, and with the possible exception of relocation of woody debris, all of this work would be done in the dry. The site would be maintained by the Tribe's Natural Resources Department and Facilities Department, and would also be actively patrolled by the Tribe's Police Department and Fish & Wildlife Officers to control and prevent trespass, poaching, theft, vandalism, and littering. Any trash that is found in the area would be removed and properly disposed.

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

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

The COE determined that the proposed action is likely to adversely affect PS Chinook salmon and PS steelhead, is likely to adversely affect designated critical habitat for both species (Table 1).

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

ESA-listed species and 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	LAA	05/11/07 (72 FR 26722) / 02/24/16 (81 FR 9252)

LAA = 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 relies on the definition of "destruction or adverse modification," which "means a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species" (50 CFR 402.02).

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

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

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

- Evaluate the 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 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 Rangewide Status of the Species and Critical Habitat

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

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.

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 geographic area of this proposed action and are considered in this opinion. More detailed information on the status and trends of these listed resources, and their biology and ecology, are in the listing regulations and critical habitat designations published in the Federal Register.

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.

<u>Spatial Structure and Diversity:</u> 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). 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 2014, the fraction of natural-origin spawners has declined in many of the populations outside of the Skagit watershed (NWFSC 2015).

Table 2. Extant PS Chinook salmon populations in each biogeographic region (Ruckelshaus et al. 2002, NWFSC 2015).

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
	North Lake Washington/ 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. Available data now show that most populations have declined in abundance over the past 7 to 10 years. Further, escapement levels for all populations remain well below the PSTRT planning ranges for recovery, and most populations are consistently below the spawner-recruit levels identified by the PSTRT as consistent with recovery (NWFSC 2015). The current information on abundance, productivity, spatial structure and diversity suggest that the Whidbey Basin MPG is at relatively low risk of extinction. The other four MPGs are considered to be at high risk of extinction due to low abundance and productivity (NWFSC 2015). The most recent 5-year status review concluded that the ESU should remain listed as threatened (NMFS 2017).

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

<u>PS Chinook Salmon within the Action Area:</u> The PS Chinook salmon most likely to occur in the action area are summer-run fish from the North Fork (NF) Stillaguamish River population, and fall-run fish from the NF and South Fork (SF) Stillaguamish River populations (NWFSC 2015; WDFW 2020a). Both stream- and ocean-type Chinook salmon are present in these populations, with the majority being ocean-types.

Between 1986 and 2018, the abundance within the NF population has fluctuated between about 486 and 1,408 spawners, with a negative general trend. About 626 total spawners were estimated in 2018 (WDFW 2020b). A hatchery supplementation-based recovery program for NF Chinook salmon began in 1980. Since then, the numbers of natural and hatchery-origin fish have been relatively close, with the higher number alternating between the two groups. However, in 2018 hatchery-origin fish accounted for over 81% of the return (WDFW 2020b). Between 1986 and 2018, the abundance within the SF population has fluctuated between about 15 and 353 spawners, with a negative general trend. About 39 total spawners were estimated in 2018 (WDFW 2020b). Prior to 2012, natural-origin fish accounted for nearly 100% of the population (NWFSC 2015; WDFW 2019b). Since then, hatchery-origin fish have accounted for an ever-increasing proportion of the population, and accounted for all of the return in 2018 (WDFW 2019b).

The project reach provides migratory habitat for juvenile and adult life stages, and most of the returning adults and out-migrating juveniles from these two populations must pass through the action area to complete their life cycles. Additionally, the project reach is documented spawning habitat for fall-run fish (WDFW 2020b). Returning adult Chinook salmon are likely to be present in the action area from mid-June through mid-October, with most spawning occurring upstream of the area from mid-September to mid-November. However, spawning within the action area by fall-run fish could begin as early as August. Out-migrating juveniles are most likely to pass through the area between early-March and mid-July during the first year of life, but stream-type fish may be present in the system year-round.

<u>Puget Sound (PS) steelhead:</u> The PS steelhead distinct population segment (DPS) was listed as threatened on May 11, 2007 (72 FR 26722). The NMFS adopted the recovery plan for this DPS in December 2019. 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 major population groups (MPGs); Northern Cascades, Central and South Puget Sound; and Hood Canal and Strait de Fuca (Myers et al. 2015) (Table 3).

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 DIP 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.

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).

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 River 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 Summer Run and Winter Run	Low
	North Lake Washington and Lake Sammamish Winter Run	Moderate
	Green River Winter Run	Low
	Puyallup River Winter Run	Low
	White River Winter Run	Low
	Nisqually River Winter Run	Low
	South Sound Tributaries Winter Run	Moderate
	East Kitsap Peninsula Tributaries Winter Run	Moderate
Hood Canal and Strait de Fuca	East Hood Canal 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

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 salmon, most female steelhead, and some males, return to marine waters after spawning (Myers et al. 2015).

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 (NWFSC 2015). 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 DIP 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 DIP. However, low productivity persists throughout the 32 DIP, with most showing downward trends, and a few showing sharply downward trends (Hard et al. 2015, NWFSC 2015). Since the mid-1980s, trends in natural spawning abundance have also been temporally variable for most DIP but remain predominantly negative, and well below replacement for at least 8 of the DIP (NWFSC 2015). Smoothed abundance trends since 2009 show modest increases for 13 DIP. However, those trends are similar to variability seen across the DPS, where brief periods of increase are followed by decades of decline. Further, several of the upward trends are not statistically different from neutral, and most populations remain small. Nine of the evaluated DIP had geometric mean abundances of fewer than 250 adults, and 12 had fewer than 500 adults (NWFSC 2015). 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 (NWFSC 2015). The PSSTRT recently concluded that the PS steelhead DPS is currently not viable (Hard et al. 2015). The DPS’s current abundance and productivity are considered to be well below the targets needed to achieve delisting and recovery. Growth rates are currently declining at 3 to 10% annually for all but a few DIPs, and the extinction risk for most populations is estimated to be moderate to high. The most recent 5-year status review concluded that the DPS should remain listed as threatened (NMFS 2017).

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

PS Steelhead within the Action Area: The PS steelhead most likely to occur in the action area are fish from the Stillaguamish River Winter-Run population, and fish from the Canyon Creek and Deer Creek Summer-Run populations (Hard *et al.* 2015; NWFSC 2015; WDFW 2020c).

The Stillaguamish River Winter-Run population is considered a native stock with wild production. Between 1985 and 2019, total abundance has fluctuated between about 120 and 2,226 spawners. The total return in 2019 was 390 fish. WDFW rates this small population as depressed with a long-term negative trend and a severe short term decline (WDFW 2020c). The 2015 status review rated this population's viability as low, with a 95% probability of extinction within 67 years (NWFSC 2015). WDFW reports that the Canyon Creek Summer Run population is a mixed stock that consists of non-native hatchery-origin summer steelhead have commingled with the native stock, and that the Deer Creek Summer Run population is a native stock with wild production (WDFW 2020c). However, the NMFS could find no specific information to describe total abundance and trends for either population.

The project reach provides migratory habitat for juvenile and adult life stages for all three PS steelhead populations considered in this opinion, and most of the returning adults and out-migrating juveniles from these populations must pass through the action area to complete their life cycles. Additionally, the project reach is documented rearing habitat for juvenile winter-run steelhead (WDFW 2020b). Adult steelhead may be present in the action 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. Juveniles are also likely to be present in the action area year-round. Although steelhead smolt typically migrate to marine waters between April and mid-May (Myers et al. 2015), juvenile steelhead rear in freshwater for 1 to 3 years, and the action area is documented rearing habitat.

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 proposed project would affect critical habitat for PS Chinook salmon.

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. 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.

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.

Table 4. Physical or biological features (PBFs) of designated critical habitat for PS Chinook salmon, and 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 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

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 contaminants emitted from motor vehicles (Feist et al. 2011).

Dams constructed for hydropower generation, irrigation, or flood control have substantially affected PS Chinook salmon populations in a number of river systems. The construction and operation of dams have blocked access to spawning and rearing habitat, 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).

Critical Habitat within the Action Area: The Stillaguamish River within the action area has been designated as critical habitat for PS Chinook salmon and for PS steelhead. The critical habitat within action area provides the Freshwater Migration PBF for both species. It also provided the Freshwater Spawning and Rearing PBFs for PS Chinook salmon, and the Freshwater Rearing PBF for PS steelhead (NOAA 2020; WDFW 2020a).

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 on the north bank of the Stillaguamish River, about 7 miles inland from marine waters of Puget Sound, and immediately west of the I-5 corridor (Figure 1). The applicant's BA loosely identifies the aquatic action area to include about 1,200 feet of the north riverbank west of I-5. The NMFS believes that distance would more than contain the lateral extent of the action's potential effects, but would extend the action area to include the river channel along that reach out to 100 feet south of the OHWM, and the riparian area 100 feet north of the forest's southern edge. Therefore, for this action, the NMFS defines the action area as the 1,200 feet of the Stillaguamish River west of I-5, to include the area between a line 100 feet north of the southern edge of the riparian vegetation, and a line 100 feet south of the OHWM. This action area overlaps with the geographic ranges and boundaries of the ESA-listed species and designated critical habitat identified earlier in Table 1. The action area also overlaps with the geographic range of EFH for Pacific Coast salmon that has been designated, under the MSA.

2.4 Environmental Baseline

The "environmental baseline" refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultations, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402.02).

Environmental conditions at the project site and the surrounding area: The project site is located on the north bank of the Stillaguamish River, about 7 miles inland from marine waters of Puget Sound (Figure 1). Aquatic habitats within the Stillaguamish River watershed have been altered and degraded by land management activities since Euro-American settlement began in the 1800s, such as logging, agriculture, urbanization, road building, and recreation. Heavy timber harvests from the 1870s through the early twentieth century removed much of the area's forests. Development since then has converted most of the lowland areas to agricultural and urban uses, and forestry and agricultural practices continue to impact the upper portions of the watershed.

The Stillaguamish River, including the action area, is identified on the Washington State Department of Ecology's (WDOE) Water Quality Atlas website for mercury and elevated temperatures (Category 4A); copper, dissolved oxygen, and pH (Category 2); and arsenic, bacteria, and ammonia (Category 1) (WDOE 2020).

The upland portion of the project area was previously homesteaded and subsequently used as a nursery and a Tribal government facility. Nursery operations have since ceased, most of the government facilities that were located on the floodplain has been demolished and cleared, and a large portion of the area was replanted with conifer species that are periodically thinned to improve stand development. The project area is now largely undeveloped, and consists of wooded floodplain with a single gravel access road that leads to the river slightly south of the project site. The riparian area along the Stillaguamish River consists primarily of mature native hardwood species with extensive under-planting of native conifer, willow, and scrub/shrub and herbaceous species. Two riverine wetlands are also located within the project area, but the area contains little off-channel habitat. Interstate Highway 5 (I-5) runs along the area's east side. The property is currently used by Tribal fishers to access the mainstem Stillaguamish River.

The shoreline at the project site consists of a stable natural gravel/cobble bar that has experienced little change based on aerial photographs that date back to 1933. The vegetation at the proposed boat ramp area is consists primarily of a mixture of native shrubs and immature cottonwood trees, non-native Japanese knotweed, Himalayan blackberry, and reed canarygrass.

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 action area continues to provide migratory habitat for adults and juveniles of both species, low level spawning for Chinook salmon, and low level rearing for juveniles of both species. Further, the area has been designated as critical habitat for both species.

Climate Change: Climate change has affected the environmental baseline of aquatic habitats across the region and within the action area. However, the effects of climate change have not been homogeneous across the region, nor are they likely to be in the future. During the last century, average air temperatures in the Pacific Northwest have increased by 1 to 1.4° F (0.6 to 0.8 °C), and up to 2° F (1.1 °C) in some seasons (based on average linear increase per decade; Abatzoglou et al. 2014; Kunkel et al. 2013). Recent temperatures in all but two years since 1998 ranked above the 20th century average (Mote et al. 2013). Warming is likely to continue during the next century as average temperatures are projected to increase another 3 to 10° F (1.7 to 5.6° C), with the largest increases predicted to occur in the summer (Mote et al. 2014).

Decreases in summer precipitation of as much as 30% by the end of the century are consistently predicted across climate models (Mote et al. 2014). Precipitation is more likely to occur during October through March, less during summer months, and more winter precipitation will be rain than snow (ISAB 2007; Mote et al. 2013 and 2014). Earlier snowmelt will cause lower stream flows in late spring, summer, and fall, and water temperatures will be warmer (ISAB 2007; Mote et al. 2014). Models consistently predict increases in the frequency of severe winter precipitation events (i.e., 20-year and 50-year events), in the western United States (Dominguez et al. 2012). The largest increases in winter flood frequency and magnitude are predicted in mixed rain-snow watersheds (Mote et al. 2014).

The combined effects of increasing air temperatures and decreasing spring through fall flows are expected to cause increasing stream temperatures; in 2015, this resulted in 3.5-5.3ºC increases in Columbia Basin streams and a peak temperature of 26ºC in the Willamette (NWFSC 2015). Overall, about one-third of the current cold-water salmonid habitat in the Pacific Northwest is likely to exceed key water temperature thresholds by the end of this century (Mantua et al. 2009).

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

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

The adaptive ability of these threatened and endangered species is depressed due to reductions in population size, habitat quantity and diversity, and loss of behavioral and genetic variation. Without these natural sources of resilience, systematic changes in local and regional climatic conditions due to anthropogenic global climate change will likely reduce long-term viability and sustainability of populations in many of these ESUs (NWFSC 2015). New stressors generated by climate change, or existing stressors with effects that have been amplified by climate change, may also have synergistic impacts on species and ecosystems (Doney et al. 2012). These conditions will possibly intensify the climate change stressors inhibiting recovery of ESA-listed species in the future.

2.5 Effects of the Action

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

Between July 1 and September 30, the applicant's contractors would construct a small boat launch ramp on the north bank of the Stillaguamish River. That work window would overlap with the upstream migration period of returning adult Chinook salmon, returning adult summer-run steelhead, and with low-level spawning by fall-run Chinook salmon that could begin in the action area as early as August. The work window also overlaps with the last 2 weeks of the out-migrating season for juvenile Chinook salmon, and low numbers of rearing juvenile stream-type Chinook salmon and steelhead may be present in the action area year-round.

Therefore, the planned construction may cause direct effects on individuals of both species, and on the PBFs of their critical habitat through exposure to construction-related noise and water quality impacts. Construction may also cause indirect effects through reduced riparian vegetation. The project may also cause indirect effects through routine ramp maintenance and repair activities, and through ramp-related impacts on hydrological and biological processes.

2.5.1 Effects on Listed Species

Construction-related Elevated Noise

Exposure to construction-related noise is not likely to adversely affect PS Chinook salmon and PS steelhead because it is extremely unlikely that construction-related noise at levels high enough to cause detectable effects on their fitness or normal behaviors would enter the water.

The effects caused by a fish's exposure to noise 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 area of acoustic effect (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 or 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 or 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. The metrics are based on exposure to peak sound level and sound exposure level (SEL), respectively. 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. 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 be affected by the noise, regardless of accumulation of the sound energy (Stadler and Woodbury 2009). Therefore, when there is a difference between the ranges to the isopleths for effective quiet and SELcum, the shorter range shall apply. The discussion in Stadler and Woodbury (2009) makes it clear that the thresholds likely overestimate the potential effects of exposure to impulsive sounds.

The estimated in-water source levels (SL, sound level at 1 meter from the source) used in this assessment are based on the best available information, as described in multiple sources (Dickerson et al. 2001; Reine et al. 2012 & 2014; Richardson et al. 1995). The best available information supports the understanding that the loudest construction related noise source would be excavation and installation of rock spall that could radiate through the substrate and cause in-water noise levels up to about 194 dB_{peak} (below the 206 dB_{peak} threshold for the onset of instantaneous injury in fish) and 169 dB_{SEL}.

It is impossible to estimate the number of impulsive events that may occur from a workday's worth of excavation and rock spall installation, but the number is likely to be enormous. Therefore, the SEL_{cum} threshold would likely exceed that of effective quiet. If not, the use of effective quiet would over-estimate the area of effect. Therefore, use of effective quiet to estimate the range of acoustic effects for this project would be protective of fish.

In the absence of location-specific transmission loss data, variations of the equation RL = SL – #Log(R) are often used 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). Acoustic measurements in shallow water environments support the use of a value close to 15 for projects like this one (CalTrans 2015). This value is considered the practical spreading loss coefficient. Application of the practical spreading loss equation to the expected SL suggests that noise levels above the 150 dB_{SEL} threshold could extend to about 62 feet (19 m) around the excavation and rock spall installation work.

Based on the applicant's project description and drawings as compared to the Google Earth overhead photograph of the site that was taken on July 15, 2018, ramp construction would stop about 60 feet inland from the wetted river channel. As such, little if any in-water area would be ensonified by construction-related noise at or above the 150 dB_{SEL} threshold. Therefore, the NMFS considers it extremely unlikely that any individuals of either species, including PS Chinook salmon eggs, would be exposed to construction-related noise at levels high enough to cause detectable effect on their fitness or normal behaviors.

Construction-related Degraded Water Quality

Exposure to construction-related water quality impacts is not likely to adversely affect PS Chinook salmon and PS steelhead because it is extremely unlikely that in-water concentrations of construction-related turbidity and pollutants would be high enough to cause detectable effects on their fitness or normal behaviors.

Water quality at the site may be temporarily affected by increased turbidity caused by the planned excavation, and possibly by the introduction of toxic materials that could be introduced to the water through construction-related spills and discharges. However, at its closest, the construction would be about 60 feet inland from the wetted river channel. Further, work would occur during the dry season, and the project includes appropriate protective measures and BMP to reduce erosion and the likelihood and severity of spills, and to clean up any spills that might occur. Therefore, the NMFS considers it extremely unlikely that any individuals of either species, including PS Chinook salmon eggs, would be exposed to construction-related turbidity, sedimentation, and/or toxicants at levels high enough to cause detectable effect on their fitness or normal behaviors.

Construction-related Reduced Riparian Vegetation:

Construction-related removal of riparian vegetation is not likely to adversely affect PS Chinook salmon and PS steelhead because the impacts on shade and on the input of woody material and other terrestrial matter would be too small to cause detectable effects on their fitness or normal behaviors.

Ramp construction would include the removal of vegetation along a 400-foot long by 30-foot wide path from the existing trailer parking area to the southern edge of the forest, including the removal of about 12 to 16 hardwood trees and their stumps. Reduced riparian vegetation can alter in-stream chemical and biological functions. Chemical processes involve inputs of thermal energy and organic matter, as well as linkages to terrestrial food webs, the retention and export of nutrients and nutrient cycling in the aquatic food web, 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). Many terrestrial insects are forage for salmonids, terrestrial vegetative matter often provides cover, and terrestrial organic matter is also important to nutrient cycling in aquatic food webs that support the aquatic algae and invertebrates that are important resources for juvenile salmonids.

Removal of riparian vegetation at the ramp construction site is extremely unlikely to cause any detectable shade-related effects because the project reach is located on the north side of the river, and the sun is always to the south of the site. The removal of riparian vegetation is likely to slightly reduce the input of terrestrial-origin leaf litter, insects, and woody debris to the river. However, the small size of the affected area, the input of terrestrial material upstream and downstream of the project reach, and the diluting effects of flowing water support the expectation that the project's impacts on aquatic food webs would be too small to cause detectable effects on the fitness or normal behaviors for any life stage of Chinook salmon and steelhead in the action area.

Further, although not considered in the take assessment above, the applicant plans to replace non-native vegetation with 99 live native willows within a 396-square foot mitigation area about 200 feet downstream of the ramp. Over time, the mitigation planting may offset some or all of the impacted biological processes discussed above.

<u>Routine Ramp Maintenance and Repair:</u>

Ramp maintenance and repair activities are not likely to adversely affect PS Chinook salmon and PS steelhead because their impacts would be too small to cause detectable effects on their fitness or normal behaviors.

Routine ramp maintenance and repair is likely to include the episodic removal of woody debris and accumulated sediments, minor concrete repairs, and trash removal. Based on the small scale of the maintenance work to be done, the expectation that the work would comply with all project BMPs, and that all but some of the wood removal would be done in the dry, the NMFS considers it extremely unlikely that any individuals of either species, including PS Chinook salmon eggs, would be exposed to any work-related stressors at levels high enough to cause detectable effects on their fitness or normal behaviors.

<u>Ramp-related Hydrological Impacts:</u>

Ramp-related hydrological impacts are not likely to adversely affect PS Chinook salmon and PS steelhead because the impacts on aquatic habitat formation processes would be too small to cause detectable effects on their fitness or normal behaviors.

The new ramp would create a permanent 16-foot wide hardened structure into the riverbank, and the sloped sides of the excavated gravel/cobble bar would extend the width of the affected area below the OHWM to 20 feet of more. Hardened streambank structures often create conditions that can alter the fundamental processes that are responsible for the formation and continuation of natural aquatic habitats (Cramer 2012). They can alter sediment recruitment and transport, and may discourage the formation of complex off-channel habitats within the affected stream reaches.

Due to the complex relationships between the processes that are involved, it is virtually impossible to accurately predict and quantify the exact effects that the new boat ramp would have on stream hydrology, geomorphology, and habitat forming processes in the Stillaguamish River. However, the projects small size, location on the accretion side of the channel, and the site’s long history of geomorphic stability support the understanding that the project is extremely unlikely to cause detectable impacts on channel forming processes within the action area.

Ramp-related Biological Impacts:

Ramp-related biological impacts are likely to adversely affect PS Chinook salmon and PS steelhead through increased vulnerability to predators and reduced forage success.

The boat ramp would create a notched inlet into an otherwise natural riverbank. Below the OHWM, the notch would extend about 33 feet north of the riverbank, and be comprised of a 16-foot wide central concrete and gravel strip with a 1V:8.5H slope, bordered by gravel banks with 2.5V:1H slopes on each side. The ramp's driving surface would harden the bank and create an artificial substrate. The sides would artificially steepen the bank, and increase the water depth along the water's edge at the site.

With the possible exception of out-migrating steelhead, juvenile salmonids rearing and migrating within the action area would be in a shoreline obligated stage of their life cycle. This means that they are biologically compelled to follow the shoreline and to aggregate in edge habitats. Conversely, adult salmonids and steelhead smolts tend to occur near the center of rivers. Additionally, studies also show that juvenile salmonids tend to select natural banks over hardened ones (Beamer and Henderson 1998; Peters et al. 1998), and that the habitat provided by hardened banks is typically degraded as compared to natural banks (Heerhartz and Toft 2015). Therefore, most rearing and migrating juvenile salmonids within the action area are likely to selectively avoid the ramp area in favor of undisturbed habitat.

Avoidance of the ramp would temporarily place the exposed individuals in deeper water than they would have been in if the riverbank was unaltered. This would increase their exposure and vulnerability to predators, while also reducing their own foraging success. Predatory fish such as sculpins and trout tend to prefer the conditions that are created by steepened nearshore aquatic substrates (Edwards and Cunjak 2007; Peters et al. 1998). This supports the expectation that the post-construction numbers of sculpin and trout at the site are likely to be higher than those along the unaltered riverbank. Further, predatory attacks tend to be more successful in deeper water than in the very shallow water. Willette (2001) found that piscivorous predation of juvenile salmon increased fivefold when the juvenile salmon were forced to leave shallow nearshore habitats. Additionally, foraging in deeper water typically has higher energetic costs for juvenile salmon than foraging in shallow shoreline waters (Heerhartz and Toft 2015).

Juveniles that remain within the footprint of the ramp may experience decreased fitness and reduced likelihood of survival due to the suboptimal forage resources that are likely to exist there, and from the increased energetic costs that are caused by foraging in suboptimal habitat (Heerhartz and Toft 2015). They would also be exposed to increased risk of predation as described above.

Based on the information above, the NMFS believes that over the life of the new boat ramp, a very low number of juvenile PS Chinook salmon and PS steelhead are likely to experience mortality, or reduced fitness that could reduce their overall likelihood of survival due to some combination of ramp-related biological impacts. The annual numbers of juvenile PS Chinook salmon and PS steelhead that may be affected by these stressors is unquantifiable with any degree of certainty. However, based on the ramp's design, it is likely to be extremely low.

Only a small subset of any year's cohort are likely to interact with the ramp. Further, at any given time, the numbers of predatory fish near the ramp are likely to be very low. This, combined with the very small affected area suggests that the probability that any individual juvenile Chinook salmon or steelhead would be exposed to a predator interaction that would be attributable to the ramp would be extremely low. Similarly, the very small size of the affected area suggest that the number of individuals that may be measurably affected by forage-related effects would also be extremely small. Based on this information, the number of juvenile PS Chinook salmon and PS steelhead that would experience mortality or measurably reduced fitness attributable to the ramp 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 episodically cause minor short term adverse effects on this attribute over the life of the ramp. The project would cut a sloped trench through an existing alluvial berm that currently prevents direct runoff to the river. The new ramp would episodically allow very small amounts of fine sediments and vehicle- and boat-related pollutants to flow directly to the river with stormwater runoff, which may slightly reduce water quality within 100 feet or less from the ramp.
    c. Substrate – The proposed action would cause minor long term adverse effects on this attribute. The new ramp would episodically allow very small amounts of fine sediments and vehicle- and boat-related pollutants to flow directly to the river, where the sediments may slightly increase gravel embeddedness, and the pollutants could slightly reduce substrate quality within 100 feet or less from the ramp.

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. The artificial substrate of the ramp is likely to reduce forage quality and availability within its 528-square foot below-OHWM footprint.

c. Natural cover – The proposed action would cause minor long term adverse effects on this attribute. The action's removal of a 30-foot wide swath of riparian vegetation along the OHWM would permanently reduce natural cover along that stretch of riverbank.
d. Water quantity – Same as above.
e. Water quality – Same as above.

3. Freshwater migration corridors free of obstruction and excessive predation:
   a. Free of obstruction and excessive predation – The proposed action would cause minor long term adverse effects on this attribute. The project would create a small artificially deepened inlet below the OHWM that may slightly alter migration and slightly increase exposure and vulnerability to predators for juvenile PS Chinook salmon and PS steelhead that encounter the ramp during migration.
   b. Water quantity – Same as above.
   c. Water quality – Same as above.
   d. Natural Cover – Same as above.

4. Estuarine areas free of obstruction and excessive predation – None in the action area.

5. Nearshore marine areas free of obstruction and excessive predation – None in the action area.

6. Offshore marine areas – None in the action area.

2.6 Cumulative Effects

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02 and 402.17(a)). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

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

The current conditions of ESA-listed species and designated critical habitats within the action area are described in the Status of the Species and Critical Habitats 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 bankside development, forest management, agriculture, urbanization, water development, road construction, 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 low-level inputs of non-point source pollutants will likely continue into the future. Recreational and commercial use of the waters within the action area are also likely to increase as the human population grows.

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 within many of the watersheds that flow into the action area. 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 our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 2.5) 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 the 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 PS Chinook salmon that occur in the action area would be summer- and fall-run Chinook salmon from the NF and SF Stillaguamish River populations. These fish are part of the Whidbey Basin MPG, which is considered at relatively low risk of extinction. However, the abundance is relatively low, and abundance trends are slightly negative in both populations.

The project site is located on the north bank of the Stillaguamish River, about 7 miles inland from Puget Sound. It provides migratory habitat for most of the returning adults and out-migrating juveniles from these two populations, and low-level spawning by fall-run fish also occurs in the action area. 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.

Project-related work is expected to cause no more than minor effects in exposed individuals. However, over the next several decades, out-migrating juveniles that pass close to the project site are likely to be exposed to low levels of structure-related increased predation and reduced forging success as a result of this action. These stressors, both individually and collectively, are likely to cause a range of effects that would include some combination of altered behaviors, reduced fitness, and mortality in exposed individuals. However, the annual numbers of individuals that are likely to be impacted by action-related stressors would be extremely low.

Based on the best available information, the scale of the direct and indirect effects of the proposed action, 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.

PS Steelhead

The long-term abundance trends have been predominantly negative or flat across the PS steelhead DPS, especially for natural spawners. Growth rates are currently declining at 3 to 10% annually for all but a few DIPs. The extinction risk for most DIPs is estimated to be moderate to high, and the DPS is currently considered “not viable”. 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.

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. 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, and the 2015 status review estimated the population’s probability of extinction within 67 years at 95%. 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, about 7 miles inland from Puget Sound. It provides migratory habitat for most of the returning adults and out-migrating juveniles from these three populations, as well as documented rearing habitat. 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.

Project-related work is expected to cause no more than minor effects in exposed individuals. However, over the next several decades, out-migrating juveniles that pass close to the project site are likely to be exposed to low levels of structure-related increased predation and reduced forging success as a result of this action. These stressors, both individually and collectively, are likely to cause a range of effects that would include some combination of altered behaviors, reduced fitness, and mortality in exposed individuals. However, the annual numbers of individuals that are likely to be impacted by action-related stressors would be extremely low.

Based on the best available information, the scale of the direct and indirect effects of the proposed action, 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 those listed species are appropriately managed or protected. The critical habitats for both species 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 those listed species as a whole.

Critical Habitat for PS Chinook Salmon and PS Steelhead

Past and ongoing land and water use practices have degraded salmonid critical habitat throughout the Puget Sound basin. Hydropower and water management activities have reduced or eliminated access to significant portions of historic spawning habitat. Timber harvests, agriculture, industry, urbanization, and shoreline development have adversely altered floodplain and stream morphology in many watersheds, diminished the availability and quality of estuarine and nearshore marine habitats, and reduced water quality across the region.

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 practices and climate change are likely to increase. The intensity of those influences on salmonid critical habitats 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 above, the proposed action would cause long-term minor adverse effects on all of those attributes within 100 feet or less from the ramp.

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 affected freshwater PBFs in the action area. Therefore, this critical habitat will maintain its current level of functionality, and retain its 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 of those 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). "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this incidental take statement (ITS).

2.9.1 Incidental Take Statement

In the biological opinion, NMFS determined that incidental take is reasonably certain to occur as follows:

Harm of juvenile PS Chinook salmon from exposure to:
- ramp-related biological impacts.

Harm of PS steelhead from exposure to:
- ramp-related biological impacts.

The distribution and abundance of the fish that occur within an action area are affected by habitat quality, competition, predation, and the interaction of processes that influence genetic, population, and environmental characteristics. These biotic and environmental processes interact in ways that may be random or directional, and may operate across far broader temporal and spatial scales than are affected by the proposed action. Thus, the distribution and abundance of fish within the action area cannot be attributed entirely to habitat conditions, nor can the NMFS precisely predict the number of fish that are reasonably certain to be injured or killed if their habitat is modified or degraded by the proposed action.

Therefore, 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 by exposure to ramp-related biological impacts. Additionally, the NMFS knows of no device or practicable technique that would yield reliable counts of individuals that may experience these impacts. In such circumstances, the NMFS uses the causal link established between the activity and the likely extent and duration of changes in habitat conditions 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.

The size and configuration of the applicant's boat launch ramp is the best available surrogate for the extent of take of juvenile PS Chinook salmon and PS steelhead despite the low density and random distribution of these fish in the action area. This is because that surrogate is positively correlated with the amount of altered substrate and artificially deepened water that would be present at the site. Any increase in the ramp's footprint below the OHWM would cause a comensurate decrease in forage availability and qualtity at the site, and a comensurate increase in the migratory alteration. Any steepening of the side slopes would cause a comensurate increase in juvenile salmonids' exposure and vulnerability to predators. As either of those measures increase, the intensity of the effects of exposure would increase for juvenile PS Chinook salmon and PS steelhead that encounter the ramp.

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

- The size and configuration of the ramp as described in the proposed action section of this biological opinion, including the slopes of the ramp and the sides of the trench.

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 reinitiation triggers. If the size and configuration of the structure exceeds the proposal, it could still meaningfully trigger reinitiation because the Corps 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" are nondiscretionary measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02).

The COE 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

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

1. The following terms and conditions implement reasonable and prudent measure 1:
    a. The COE 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 the timing and duration of ramp construction to ensure that it is accomplished between July 1 through September 30; and
            2. Documentation of the final dimensions of the ramp and trench to confirm that it does not exceed the dimensions and/or 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 COE office, and to submit an electronic post-construction report with the above information to NMFS within six months of project completion. Send the report to: projectreports.wcr@noaa.gov. Be sure to include Attn: WCRO-2020-02164 in the subject line.

2.10 Reinitiation of Consultation

This concludes formal consultation for the U.S. Army Corps of Engineers' authorization of the Stillaguamish Tribe of Indians Boat Access Project in Snohomish County, Washington.

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

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, biological, and chemical properties that are used by fish (50 CFR 600.10). Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside of it and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) of the MSA also requires 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 COE and 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 on the north bank of the Stillaguamish River, about 7 miles inland from Puget Sound (Figure 1). The waters and substrate of the Stillaguamish River 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 (WDFW 2020a). 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 action area contains habitat features of the spawning HAPC for Chinook and pink salmon.

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 habitat, 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 the attributes of EFH for Pacific Coast Salmon as summarized below.

1. Water quality: – The proposed action would episodically cause minor short term adverse effects on this attribute. The action would cause no changes in water temperature and salinity, but project would cut a sloped trench through an existing cobble and gravel bar that currently prevents direct runoff to the river. The new ramp would allow very small amounts of fine sediments and vehicle- and boat-related pollutants to flow directly to the river with stormwater runoff. Detectable effects would be limited to the area within less than 100 feet from the end of the ramp.

2. Water quantity, depth, and velocity: – The proposed action would cause minor long term adverse effects on this attribute. The project would create a small artificial inlet into a natural alluvial berm that would slightly deepen the water, and may slightly alter flow velocities.

3. Riparian-stream-marine energy exchanges: – The proposed action would cause minor long-term adverse effects on this attribute. The project would permanently remove a 30-foot wide section of riparian vegetation at the project site.

4. Channel gradient and stability: – No changes expected.

5. Prey availability: – The proposed action would cause minor long-term adverse effects on this attribute. The artificial substrate of the ramp is likely to reduce forage quality and availability within its 528-square foot below-OHWM footprint.

6. Cover and habitat complexity: – The proposed action would cause minor long-term adverse effects on this attribute. As described above at 3, the project would permanently remove a 30-foot wide section of riparian vegetation at the project site that provides over-water cover for juvenile salmonids.

7. Water quantity: – No changes expected.

8. Space: – No changes expected.

9. Habitat connectivity from headwaters to the ocean: – No changes expected.

10. Groundwater-stream interactions: – No changes expected.

11. Connectivity with terrestrial ecosystems: – No changes expected.

12. Substrate composition: – The proposed action would cause minor long term adverse effects on this attribute. The new ramp would episodically allow very small amounts of fine sediments and vehicle- and boat-related pollutants to flow directly to the river, where the sediments may slightly increase gravel embeddedness, and the pollutants could slightly reduce substrate quality in the area within less than 100 feet from the end of the ramp.

3.3 Essential Fish Habitat Conservation Recommendations

The proposed project includes design features that are expected to reduce its impacts on the quantity and quality of Pacific Coast salmon EFH. It also includes a comprehensive set of BMPs to minimize construction-related effects. The NMFS knows of no other reasonable measures that the applicant could include to further reduce the project's minor effects on the attributes of Pacific Coast salmon EFH described above. Therefore, the NMFS makes no conservation recommendations pursuant to MSA (§305(b)(4)(A)).

3.4 Statutory Response Requirement

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

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

3.5 Supplemental Consultation

The COE 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 NMFS' EFH Conservation Recommendations (50 CFR 600.920(l)).

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

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

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are the COE and the Stillaguamish Tribe of Indians. Other interested users could include WDFW, the governments and citizens of Snohomish County. Individual copies of this opinion were provided to the COE. The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adheres to conventional standards for style.

4.2 Integrity

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

4.3 Objectivity

Information Product Category: Natural Resource Plan

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

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

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

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

5. REFERENCES

Abatzoglou, J.T., Rupp, D.E. and Mote, P.W. 2014. Seasonal climate variability and change in the Pacific Northwest of the United States. *Journal of Climate* 27(5): 2125-2142.

Bax, N. J., E. O. Salo, B. P. Snyder, C. A. Simenstad, and W. J. Kinney. 1978. Salmonid outmigration studies in Hood Canal. Final Report, Phase III. January - July 1977, to U.S. Navy, Wash. Dep. Fish., and Wash. Sea Grant. Fish. Res. Inst., Univ. Wash., Seattle, WA. FRI-UW-7819. 128 pp.

Beamer, E.M., and R.A. Henderson. 1998. Juvenile Salmonid Use of Natural and Hydromodified Stream Bank Habitat in the Mainstem Skagit River, Northwest Washington. Skagit System Cooperative Research Department, P.O. Box 368, 11426 Moorage Way, La Conner, WA 98257-0368. 1998. 52 pp.

Beechie, T.J., D.A. Sear, J.D. Olden, G.R. Pess, J.M. Buffington, H. Moir, P. Roni, and M.M. Pollock. 2010. Process-based Principles for Restoring River Ecosystems. BioScience 60(3):209-222.

Brennan, J. S., K. F. Higgins, J. R. Cordell, and V. A. Stamatiou. 2004. Juvenile Salmon Composition, Timing, Distribution, and Diet in Marine Nearshore Waters of Central Puget Sound, 2001-2002. Prepared for the King County Department of Natural Resources and Parks, Seattle, WA. August 2004. 164 pp.

CalTrans. 2015. Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish. Including Appendix 1 - Compendium of Pile Driving Sound Data. Division of Environmental Analysis California Department of Transportation, 1120 N Street Sacramento, CA 95814. November 2015. 532 pp.

Codarin, A., L.E. Wysocki, F. Ladich, and M. Picciulin. 2009. Effects of ambient and boat noise on hearing and communication in three fish species living in a marine protected area (Miramare, Italy). Marine Pollution Bulletin 58 (2009) 1880–1887.

Corps of Engineers, US Army (COE). 2020a. ESA Consultation request – NWS-2019-541 – Stillaguamish Tribe of Indians Boat Access (Snohomish County). Letter to request informal consultation under the Endangered Species Act and the Magnuson-Stevens Fishery Conservation and Management Act. August 10, 2020. 3 pp.

COE. 2020b. Formal Consultation request for NWS-2019-541 Stillaguamish Tribe Boat Access. Email with 3 attachments to provide additional information. September 25, 2020. 8 pp.

Cramer, M. L. (managing editor). 2012. Stream Habitat Restoration Guidelines. Co-published by the Washington Departments of Fish and Wildlife, Natural Resources, Transportation and Ecology, Washington State Recreation and Conservation Office, Puget Sound Partnership, and the U.S. Fish and Wildlife Service. Olympia, Washington.

Crozier, L.G., Hendry, A.P., Lawson, P.W., Quinn, T.P., Mantua, N.J., Battin, J., Shaw, R.G. and Huey, R.B., 2008. Potential responses to climate change in organisms with complex life histories: evolution and plasticity in Pacific salmon. *Evolutionary Applications* 1(2): 252-270.

Crozier, L. G., M. D. Scheuerell, and E. W. Zabel. 2011. Using Time Series Analysis to Characterize Evolutionary and Plastic Responses to Environmental Change: A Case Study of a Shift Toward Earlier Migration Date in Sockeye Salmon. *The American Naturalist* 178 (6): 755-773.

Dickerson, C., Reine, K. J., and Clarke, D. G. 2001. Characterization of underwater sounds produced by bucket dredging operations. DOER Technical Notes Collection (ERDC TN-DOER-E14), U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Dominguez, F., E. Rivera, D. P. Lettenmaier, and C. L. Castro. 2012. Changes in Winter Precipitation Extremes for the Western United States under a Warmer Climate as Simulated by Regional Climate Models. *Geophysical Research Letters* 39(5).

Doney, S. C., M. Ruckelshaus, J. E. Duffy, J. P. Barry, F. Chan, C. A. English, H. M. Galindo, J. M. Grebmeier, A. B. Hollowed, N. Knowlton, J. Polovina, N. N. Rabalais, W. J. Sydeman, and L. D. Talley. 2012. Climate Change Impacts on Marine Ecosystems. *Annual Review of Marine Science* 4: 11-37.

Edwards, P., and R. Cunjak. 2007. Influence of water temperature and streambed stability on the abundance and distribution of Slimy Sculpin (*Cottus cognatus*). Environmental Biology of Fishes 80:9–22.Feist, B.E., E.R. Buhle, P. Arnold, J.W. Davis, and N.L. Scholz. 2011. Landscape ecotoxicology of coho salmon spawner mortality in urban streams. Plos One 6(8):e23424.

Feist, B.E., E.R. Buhle, P. Arnold, J.W. Davis, and N.L. Scholz. 2011. Landscape ecotoxicology of coho salmon spawner mortality in urban streams. Plos One 6(8):e23424.

Forest Ecosystem Management Assessment Team (FEMAT). 1993. Forest ecosystem management: An ecological, economic, and social assessment. Report of the Forest Ecosystem Management Assessment Team. 1993-793-071. U.S. Gov. Printing Office.

Goode, J.R., Buffington, J.M., Tonina, D., Isaak, D.J., Thurow, R.F., Wenger, S., Nagel, D., Luce, C., Tetzlaff, D. and Soulsby, C., 2013. Potential effects of climate change on streambed scour and risks to salmonid survival in snow-dominated mountain basins. *Hydrological Processes* 27(5): 750-765.

Graham, A.L., and S.J. Cooke. 2008. The effects of noise disturbance from various recreational boating activities common to inland waters on the cardiac physiology of a freshwater fish, the largemouth bass (*Micropterus salmoides*). Aquatic Conservation: Marine and Freshwater Ecosystems. 18:1315-1324.

Hard, J.J., J.M. Myers, E.J. Connor, R.A. Hayman, R.G. Kope, G. Lucchetti, A.R. Marshall, G.R. Pess, and B.E. Thompson. 2015. Viability criteria for steelhead within the Puget Sound distinct population segment. U.S. Dept. of Commerce, NOAA Tech. Memo. NMFS-NWFSC-129. May 2015. 367 pp.

Harman, W., R. Starr, M. Carter, K. Tweedy, M. Clemmons, K. Suggs, and C. Miller. 2012. A function-based framework for stream assessment and restoration projects. U.S. Environmental Protection Agency, Office of Wetlands, Oceans, and Watersheds, EPA 843-K-12-006, Washington, D.C., 2012.

Hastings, M.C., and A. N. Popper. 2005. Effects of sound on fish. Final Report # CA05-0537 – Project P476 Noise Thresholds for Endangered Fish. For: California Department of Transportation, Sacramento, CA. January 28, 2005, August 23, 2005 (Revised Appendix B). 85 pp.

Heerhartz, S.M. and J.D. Toft. 2015. Movement patterns and feeding behavior of juvenile salmon (*Oncorhynchus* spp.) along armored and unarmored estuarine shorelines. Enviro. Biol. Fishes 98, 1501-1511.

Hood Canal Coordinating Council (HCCC). 2005. Hood Canal & Eastern Strait of Juan de Fuca summer chum salmon recovery plan. Version November 15, 2005. 339 pp.

Hunter, M.A. 1992. Hydropower flow fluctuations and salmonids: A review of the biological effects, mechanical causes, and options for mitigation. Washington Department of Fisheries. Technical Report No. 119. Olympia, Washington.

Independent Scientific Advisory Board (ISAB, editor). 2007. Climate change impacts on Columbia River Basin fish and wildlife. In: Climate Change Report, ISAB 2007-2. Independent Scientific Advisory Board, Northwest Power and Conservation Council. Portland, Oregon.

Isaak, D.J., Wollrab, S., Horan, D. and Chandler, G., 2012. Climate change effects on stream and river temperatures across the northwest US from 1980–2009 and implications for salmonid fishes. *Climatic Change* 113(2): 499-524.

Kondolf, G.M. 1997. Hungry water: Effects of dams and gravel mining on river channels. Environmental Management 21(4):533-551.

Kunkel, K. E., L. E. Stevens, S. E. Stevens, L. Sun, E. Janssen, D. Wuebbles, K. T. Redmond, and J. G. Dobson. 2013. Regional Climate Trends and Scenarios for the U.S. National Climate Assessment: Part 6. *Climate of the Northwest U.S. NOAA Technical Report NESDIS 142-6*. 83 pp. National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Service, Washington, D.C.

Lawson, P. W., Logerwell, E. A., Mantua, N. J., Francis, R. C., & Agostini, V. N. 2004. Environmental factors influencing freshwater survival and smolt production in Pacific Northwest coho salmon (*Oncorhynchus kisutch*). *Canadian Journal of Fisheries and Aquatic Sciences* 61(3): 360-373

Mantua, N., I. Tohver, and A. Hamlet. 2009. Impacts of Climate Change on Key Aspects of Freshwater Salmon Habitat in Washington State. *In* The Washington Climate Change Impacts Assessment: Evaluating Washington's Future in a Changing Climate, edited by

Mantua, N., I. Tohver, and A. Hamlet. 2010. Climate change impacts on streamflow extremes and summertime stream temperature and their possible consequences for freshwater salmon habitat in Washington State. *Climatic Change* 102(1): 187-223.

McElhany, P., M.H. Ruckelshaus, M.J. Ford, T.C. Wainwright, and E.P. Bjorkstedt. 2000. Viable Salmonid Populations and the Recovery of Evolutionarily Significant Units. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-42. June 2000. 156 pp.

McMahon, T.E., and G.F. Hartman. 1989. Influence of cover complexity and current velocity on winter habitat use by juvenile coho salmon (*Oncorhynchus kisutch*). *Canadian Journal of Fisheries and Aquatic Sciences* 46: 1551–1557.

Meyer, J.L., M.J. Sale, P.J. Mulholland, and N.L. Poff. 1999. Impacts of climate change on aquatic ecosystem functioning and health. *JAWRA Journal of the American Water Resources Association* 35(6): 1373-1386.

Moore, M. E., F. A. Goetz, D. M. Van Doornik, E. P. Tezak, T. P. Quinn, J. J. Reyes-Tomassini, and B. A. Berejikian. 2010. Early marine migration patterns of wild coastal cutthroat trout (Oncorhynchus clarki clarki), steelhead trout (Oncorhynchus mykiss), and their hybrids. PLoS ONE 5(9):e12881. Doi:10.1371/journal.pone.0012881. 10 pp.

Mote, P.W., J.T. Abatzglou, and K.E. Kunkel. 2013. Climate: Variability and Change in the Past and the Future. In Climate Change in the Northwest: Implications for Our Landscapes, Waters, and Communities, edited by M.M. Dalton, P.W. Mote, and A.K. Snover, 41-58. Island Press, Washington, DC.

Mote, P.W, A. K. Snover, S. Capalbo, S.D. Eigenbrode, P. Glick, J. Littell, R.R. Raymondi, and W.S. Reeder. 2014. Ch. 21: Northwest. *In* Climate Change Impacts in the United States: The Third National Climate Assessment, J. M. Melillo, T.C. Richmond, and G.W. Yohe, Eds., U.S. Global Change Research Program, 487-513.

Mueller, G. 1980. Effects of Recreational River Traffic on Nest Defense by Longear Sunfish. Transactions of the American Fisheries Society. 109:248-251.

Myers, J.M., J.J. Hard, E.J. Connor, R.A. Hayman, R.G. Kope, G. Lucchetti, A.R. Marshall, G.R. Pess, and B.E. Thompson. 2015. Identifying historical populations of steelhead within the Puget Sound distinct population segment U.S. Department of Commerce. NOAA Technical Memorandum NMFS-NWFSC-128. 149 pp.

National Marine Fisheries Service (NMFS). 2006. Final Supplement to the Shared Strategy's Puget Sound Salmon Recovery Plan. Prepared by NMFS Northwest Region. November 17, 2006. 47 pp.

NMFS. 2017. 2016 5-Year Review: Summary and Evaluation of Puget Sound Chinook Salmon, Hood Canal Summer-run Chum Salmon, and Puget Sound Steelhead. NMFS West Coast Region, Portland, Oregon. April 6, 2017. 98 pp.

National Oceanographic and Atmospheric Administration (NOAA). 2020. Environmental Response Management Application – Pacific Northwest. On-line mapping application. Accessed on June 26, 2020 at: https://erma.noaa.gov/northwest/erma.html#/layers=1+44000&x=122.20290&y=47.68411&z=12&view=881&panel=layer

Neo, Y.Y., J. Seitz, R.A. Kastelein, H.V. Winter, C. Cate, H. Slabbekoorn. 2014. Temporal structure of sound affects behavioural recovery from noise impact in European seabass. Biological Conservation 178 (2014) 65-73.

Northwest Fisheries Science Center (NWFSC). 2015. Status review update for Pacific salmon and steelhead listed under the Endangered Species Act: Pacific Northwest. December 21, 2015. 356 pp.

Pacific Fishery Management Council (PFMC). 2014. Appendix A to the Pacific Coast salmon fishery management plan, as modified by amendment 18 to the pacific coast salmon plan: identification and description of essential fish habitat, adverse impacts, and recommended conservation measures for salmon. PFMC, Portland, OR. September 2014. 196 p. + appendices.

Peters, R.J., B.R. Missildine, and D.L. Low. 1998. Seasonal Fish Densities Near River Banks Stabilized With Various Stabilization Methods - First Year Report of the Flood Technical Assistance Project. U.S. Fish and Wildlife Service, North Pacific Coast Ecoregion, Western Washington Office, Lacey, WA. December 1998. 39 pp.

Picciulin, M., L. Sebastianutto, A. Codarin, A. Farina, and E.A. Ferrero. 2010. In situ behavioural responses to boat noise exposure of *Gobius cruentatus* (Gmelin, 1789; fam. Gobiidae) and *Chromis chromis* (Linnaeus, 1758; fam. Pomacentridae) living in a Marine Protected Area. Journal of Experimental Marine Biology and Ecology 386 (2010) 125–132.

Raymondi, R.R., J.E. Cuhaciyan, P. Glick, S.M. Capalbo, L.L. Houston, S.L. Shafer, and O. Grah. 2013. Water Resources: Implications of Changes in Temperature and Precipitation. *In* Climate Change in the Northwest: Implications for Our Landscapes, Waters, and Communities, edited by M.M. Dalton, P.W. Mote, and A.K. Snover, 41-58. Island Press, Washington, DC.

Reine, K. J., D. G. Clarke, and C. Dickerson. (2012). Characterization of underwater sounds produced by backhoe dredge excavating rock and gravel. DOER Technical Notes Collection (ERDC TN-DOER-E36). Vicksburg, MS: U.S. Army Engineer Research and Development Center. December 2012. 28 pp.

Reine, K.J., D. Clarke, and C. Dickerson. 2014. Characterization of underwater sounds produced by hydraulic and mechanical dredging operations. J. Acoust. Soc. Am., Vol. 135, No. 6, June 2014. 15 pp.

Richardson, W. J., C. R. Greene, C. I. Malme Jr., and D. H. Thomson. 1995. Marine Mammals and Noise. Academic Press, 525 B Street, Ste. 1900, San Diego, California 92101-4495.

Ruckelshaus, M., K. Currens, W. Graeber, R. Fuerstenberg, K. Rawson, N. Sands, and J. Scott. 2002. Planning ranges and preliminary guidelines for the delisting and recovery of the Puget Sound Chinook salmon evolutionarily significant unit. Puget Sound Technical Recovery Team. April 30, 2002. 19 pp.

Scholik, A.R., and H.Y. Yan. 2002. Effects of boat engine noise on the auditory sensitivity of the fathead minnow, Pimephales promelas. Environmental Biology of Fishes. 63:203-209.

Schreiner, J. U., E. O. Salo, B. P. Snyder, and C. A. Simenstad. 1977. Salmonid outmigration studies in Hood Canal. Final Report, Phase II, to U.S. Navy, Fish. Res. Inst., Univ. Wash., Seattle, WA. FRI-UW-7715. 64 pp.

Sebastianutto, L., M. Picciulin, M. Costantini, and E.A. Ferrero. 2011. How boat noise affects an ecologically crucial behavior: the caser of territoriality in *Gobius cruentatus* (Gobiidae). Environmental Biology of Fishes. 92:207-215.

Shared Strategy for Puget Sound (SSPS). 2007. Puget Sound Salmon Recovery Plan – Volume 1. Shared Strategy for Puget Sound, 1411 4th Ave., Ste. 1015, Seattle, WA 98101. Adopted by NMFS January 19, 2007. 503 pp.

Simpson, S.D., A.N. Radford, S.L. Nedelec, M.C.O. Ferrari, D.P. Chivers, M.I. McCormick, and M.G. Meekan. 2016. Anthropogenic noise increases fish mortality by predation. Nature Communications 7:10544 DOI: 10.1038/ncomms10544 www.nature.com/naturecommunications February 5, 2016. 7 pp.

Spence, B.C., G.A. Lomnicky, R.M. Hughes, and R.P. Novitzki. 1996. An ecosystem approach to salmonid conservation. ManTech Environmental Research Services, Inc. Corvallis, Oregon. National Marine Fisheries Service, Portland, Oregon.

Stadler, J.H., and D.P. Woodbury. 2009. Assessing the effects to fishes from pile driving: Application of new hydroacoustic criteria. 8 pp.

The Stillaguamish Tribe of Indians (STI). 2020a. Stillaguamish Tribe Fishing Access – Biological Assessment – Permit Application #NWS-2019-541. Prepared by STI. July 17, 2020. 35 pp. Enclosed with USACE 2020a.

STI. 2020b. [Vicinity Map and Project Drawings] Stillaguamish Tribe Main-stem River Access – SW1/4 of SE1/4, S6, T31, R05E. July 17, 2020. 7 pp. Enclosed with USACE 2020a.

Tillmann, P. and D. Siemann. 2011. Climate Change Effects and Adaptation Approaches in Marine and Coastal Ecosystems of the North Pacific Landscape Conservation Cooperative Region. National Wildlife Federation.

U.S. Department of Commerce (USDC). 2014. Endangered and threatened wildlife; Final rule to revise the Code of Federal Regulations for species under the jurisdiction of the National Marine Fisheries Service. U.S Department of Commerce. Federal Register 79(71):20802-20817.

Wainwright, T. C., and L. A. Weitkamp. 2013. Effects of climate change on Oregon Coast coho salmon: habitat and life-cycle interactions. *Northwest Science* 87(3): 219-242.

Washington State Department of Ecology (WDOE). 2020. Washington State Water Quality Atlas. Accessed on October 26, 2020 at: https://fortress.wa.gov/ecy/waterqualityatlas/StartPage.aspx.

Washington State Department of Fish and Wildlife (WDFW). 2020a. SalmonScape. Accessed on October 23, 2020 at: http://apps.wdfw.wa.gov/salmonscape/map.html.

WDFW. 2020b. WDFW Conservation Website – Species – Salmon in Washington – Chinook. Accessed on October 23, 2020 at: https://fortress.wa.gov/dfw/score/score/species/chinook.jsp?species=Chinook

WDFW. 2020c. WDFW Conservation Website – Species – Salmon in Washington – Steelhead. Accessed on October 23, 2020 at: https://fortress.wa.gov/dfw/score/score/species/steelhead.jsp?species=Steelhead

Willette, T.M. 2001. Foraging behaviour of juvenile pink salmon (*Oncorhynchus gorbuscha*) and size-dependent predation risk. *Fisheries Oceanography*. 10:110-131.

Winder, M. and D. E. Schindler. 2004. Climate change uncouples trophic interactions in an aquatic ecosystem. *Ecology* 85: 2100–2106.

Xie, Y.B., C.G.J. Michielsens, A.P. Gray, F.J. Martens, and J.L. Boffey. 2008. Observations of avoidance reactions of migrating salmon to a mobile survey vessel in a riverine environment. Canadian Journal of Fisheries and Aquatic Sciences. 65:2178-2190.