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-2021-01919

December 9, 2021

Jacalen Printz, Acting Chief
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 Sadis Dock Repair Project (USACE No. NWS-2021-636, HUC: 171100120400 – Lake Washington)

Dear Ms. Printz:

Thank you for your letter of August 5, 2021, 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 (USACE) authorization of the Sadis Dock Repair Project. This consultation was conducted in accordance with the 2019 revised regulations that implement section 7 of the ESA (50 CFR 402, 84 FR 45016).

Thank you, also, for your request for consultation pursuant to the essential fish habitat (EFH) provisions in Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (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 steelhead. The NMFS also concludes that the proposed action is likely to adversely affect designated critical habitat for PS Chinook salmon but is not likely to result in the destruction or adverse modification of PS Chinook salmon designated critical habitat. This opinion also documents our conclusion that the proposed action is not likely to adversely affect southern resident (SR) killer whales and their designated critical habitat.

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

Section 3 of this document includes our analysis of the action's likely effects on EFH pursuant to Section 305(b) of the MSA. Based on that analysis, the NMFS concluded that the action would adversely affect designated freshwater EFH for Pacific Coast Salmon. Therefore, we have provided 2 conservation recommendations that can be taken by the USACE to avoid, minimize, or otherwise offset potential adverse effects on EFH. We also concluded that the action would not adversely affect EFH for Pacific Coast groundfish and coastal pelagic species. Therefore, consultation under the MSA is not required for EFH for Pacific Coast groundfish and coastal pelagic species.

Section 305(b) (4) (B) of the MSA requires Federal agencies to provide a detailed written response to NMFS within 30 days after receiving this recommendation. If the response is inconsistent with the EFH conservation recommendations, the USACE must explain why the recommendations will not be followed, including the scientific justification for any disagreements over the effects of the action and recommendations. 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 request that in your statutory reply to the EFH portion of this consultation you clearly identify the number of conservation recommendations accepted.

Please contact Heather Spore in the North Puget Sound Branch of the Oregon/Washington Coastal Office at (907) 720-1417, or by electronic mail at Heather.Spore@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: Danette Guy, USACE
Jordan Bunch, USACE

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

Sadis Dock Repair in Lake Washington, King County, Washington
(USACE Numbers: NWS-2021-636)

NMFS Consultation Number: WCR-2021-01919

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	N/A	N/A
Killer whales (*Orcinus orca*) Southern resident (SR)	Endangered	No	No	No	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	Yes

Consultation Conducted By: National Marine Fisheries Service
West Coast Region

Issued By:

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

Date: December 9, 2021

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LIST OF ABBREVIATIONS

ACZA – Ammoniacal Copper Zinc Arsenate (wood preservative)
BE – Biological Evaluation
BMP – Best Management Practices
CFR – Code of Federal Regulations
USACE – Corps of Engineers, U.S. Army
dB – Decibel (common unit of measure for sound intensity)
DIP – Demographically Independent Population
DPS – Distinct Population Segment
DQA – Data Quality Act
EF – Essential Feature
EFH – Essential Fish Habitat
ESA – Endangered Species Act
ESU – Evolutionarily Significant Unit
FR – Federal Register
FMP – Fishery Management Plan
HAPC – Habitat Area of Particular Concern
HUC – Hydrologic Unit Code
HPA – Hydraulic Project Approval
ITS – Incidental Take Statement
mg/L – Milligrams per Liter
MPG – Major Population Group
MSA – Magnuson-Stevens Fishery Conservation and Management Act
NMFS – National Marine Fisheries Service
NOAA – National Oceanic and Atmospheric Administration
OHWL – Ordinary high water line
PAH – Polycyclic Aromatic Hydrocarbons
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
RPA – Reasonable and Prudent Alternative
RPM – Reasonable and Prudent Measure
SAV – Submerged Aquatic Vegetation
SEL – Sound Exposure Level
SL – Source Level
SR – Southern Resident (Killer Whales)
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 the Oregon Washington Coastal Office.

1.2 Consultation History

On July 14, 2021, NMFS received an application from the U.S. Army Corps of Engineers (USACE) requesting clearance for the proposed action under the Restoration and Permitting (RAP) Programmatic. Upon review of the proposed action, we determined that it did not fit the required conditions of RAP. On July 21, 2021, we requested that the applicant either modify their project to conform to RAP or seek individual consultation. The USACE withdrew their request for clearance under the RAP Programmatic on Monday, July 26, 2021.

On August 5, 2021, the NMFS received the USACE's, request for informal consultation (USACE 2021a) along with a biological evaluation (BE) and project plan drawings (Cedarock 2021; Ashley 2021a). That consultation request was assigned the NMFS tracking number WCRO-2021-01919. On September 7, 2021, the NMFS notified the USACE by email that we did not agree with their effects determinations and recommended that they request formal consultation. That same day, the NMFS received an email from the USACE requesting formal consultation for the proposed action (USACE 2021b). On September 22, 2021, NMFS emailed a request for additional information to the USACE regarding the proposed work window and pier design details. That information was provided on September 22, 2021 by the applicant's agent (Ashley 2021b). The NMFS requested a copy of the applicant's Joint Aquatic Resources Permit Application (JARPA) Form and their Washington State Department of Fish and Wildlife Hydraulic Project Approval (HPA) for the project on September 24, 2021 and the JARPA was emailed to NMFS that same day (Sadis 2021). The HPA has not yet been received by the NMFS.

This opinion is based on the information in the applicant's BE, JARPA, and additional information and drawings provided by the applicant's agent; recovery plans, status reviews, and critical habitat designations for ESA-listed PS Chinook salmon and PS steelhead; published and unpublished scientific information on the biology and ecology of those species; and relevant scientific and gray literature (see Literature Cited).

1.3 Proposed Federal Action

Under the ESA, "Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR 402.02), 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 USACE proposes to authorize David A. Sadis (the applicant) to conduct repair and maintenance work at his residential pier in the City of Bellevue on Lake Washington in King County, Washington (Figure 1).

Figure 1. Google Earth photographs of the project site. The left image is a view of the project site on the eastern shore of Lake Washington in relation to Seattle to the west. The right image is zoomed in to show details of the project site, with the dock encircled in red.

The applicant would repair an existing 794 square foot dock at a single-family residence on Lake Washington with no overall change to the size, form, or over-water footprint of the structure. The proposed action replaces the wood-plank decking with ThruFlow grated decking, made of polypropylene, and composed of a minimum of 43 percent open space to increase the light transmittance through the structure (Cedarock 2021). An existing covered moorage (851 square feet) with a roof of cedar shakes is proposed to be replaced with standing seam non-galvanized metal roofing (Ashley 2021a) with no change to the over-water footprint. Pier stringers would be made from lumber treated with ammoniacal copper zinc arsenate (AZCA) and would be added to support the grated decking. Stringers are above-water pier elements and are not in contact with the water. Five existing dock fenders would also be replaced. No in-water work on the existing wood piles, framing, and substructure of the pier would occur as part of the proposed action. Additionally, no work on the existing wood framing of the covered moorage area would occur as part of the proposed action. The proposed action would also include the planting of two native trees, and three native shrubs at the site.

The existing U-shaped pier is constructed of solid wood-plank decking, and is oriented perpendicular to the shore in water that ranges from 2 to 14 feet deep (Figure 2). The pier is approximately 73 feet long, with a 6 foot wide segment extending from onshore to approximately 60 feet beyond the ordinary high water line (OHWL), where that segment widens to 12 feet wide (Figure 2). The parallel segment is approximately 5 feet wide by 48 feet long. The smaller longitudinal segment is approximately 3 feet wide by 26 feet long (Figure 2). The supports of the pier consist of 26 12-inch diameter, untreated wood piles. The opaque moorage cover is approximately 24 feet wide by 36 feet long (Figure 2).

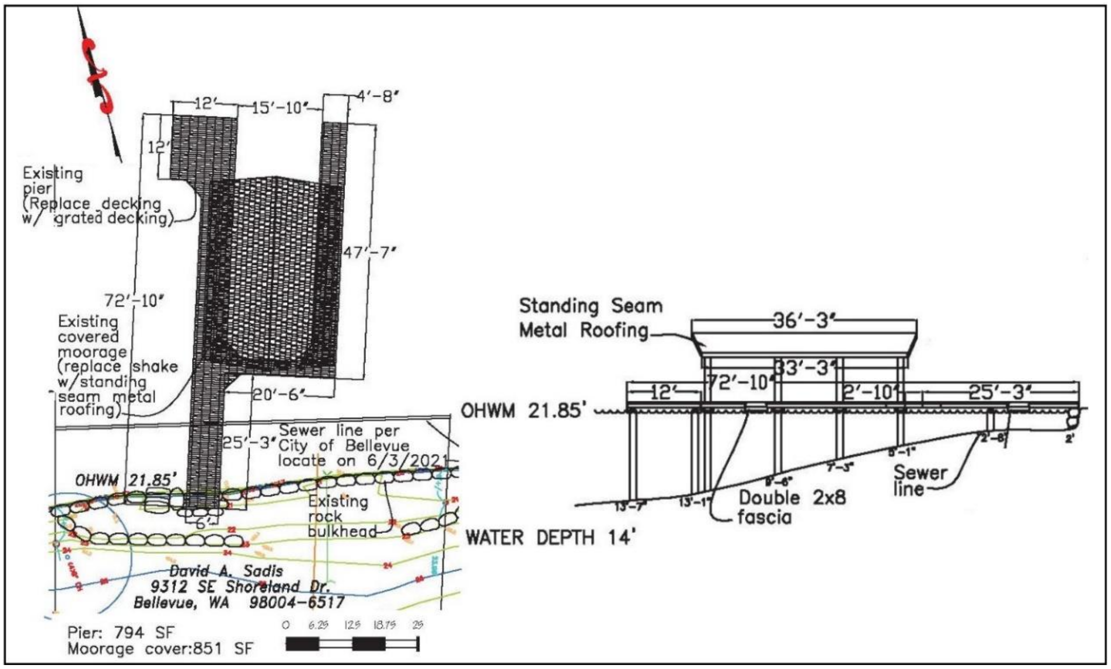

Figure 2. Overhead and profile drawings of the proposed Sadis Dock (Adapted from Cedarock 2021).

All hardware and equipment will be delivered to the site on existing roads and across the upland portion of the site. All material will be prepared on shore and assembled over the water. Existing decking and cedar shingles on the moorage cover will be removed by hand, carried to shore on the dock, and hauled off-site for disposal or recycling at approved facilities. Preparation and staging of new pier and moorage cover materials would occur on the upland portion of the property and hand-carried to the pier. Equipment used during construction would consist of miscellaneous small power-driven hand tools such as drills and skill saws (Cedarock 2021). No clearing, grading, or other disturbance of the upland area would be required. A small boat will be on hand for safety and removal of any debris that may enter the water during construction.

Project-related work would require less than 14 days to complete, and would be completed during the July 16 through April 31 in-water work window for the project area. Additionally, all work would be done in compliance with the best management practices (BMPs) and conservation measures identified in the applicant's BE, JARPA, and in their HPA when it is issued.

The NMFS also considered whether or not the proposed action would cause any other activities. We determined that the action would extend, by several decades, the useful life of the pier. Therefore, the action would perpetuate the continued mooring and operation of about the single residential vessel in and around this structure for decades to come.

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, the NMFS provide an opinion stating how the agency's actions would affect listed species and their critical habitats. If incidental take is reasonably certain to occur, section 7(b)(4) requires 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 USACE determined that the proposed action is not likely to adversely affect PS Chinook salmon, PS steelhead, and designated critical habitat for PS Chinook salmon. They did not address Southern Resident (SR) killer whales or their designated critical habitat (Table 1). Because the NMFS has concluded that the proposed action is likely to adversely affect PS Chinook salmon, PS steelhead, and designated critical habitat for PS Chinook salmon, the NMFS has proceeded with formal consultation. Additionally, because of the trophic relationship between PS Chinook salmon and SR killer whales, the NMFS analyzed the action's potential effects on SR killer whales and their designated critical habitat in the "Not Likely to Adversely Affect" Determinations section (2.12).

Table 1. ESA-listed species and critical habitat 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	N/A	05/11/07 (72 FR 26722) / 02/24/16 (81 FR 9252)
ESA-listed species and critical habitat not likely to be adversely affected (NLAA)				
Species	**Status**	**Species**	**Critical Habitat**	**Listed / CH Designated**
Killer whales (*Orcinus orca*) Southern resident (SR)	Endangered	NLAA	NLAA	11/18/05 (70 FR 57565) / 11/29/06 (71 FR 69054)

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

2.1 Analytical Approach

This 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 nearshore marine 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).

<u>Abundance and Productivity:</u> 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).

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

<u>Limiting Factors:</u> Factors limiting recovery for PS Chinook salmon include:

- Degraded floodplain and in-river channel structure
- Degraded estuarine conditions and loss of estuarine habitat
- Riparian area degradation and loss of in-river large woody debris
- Excessive fine-grained sediment in spawning gravel
- Degraded water quality and temperature
- Degraded nearshore conditions
- Impaired passage for migrating fish
- Severely altered flow regime

PS Chinook Salmon within the Action Area: The PS Chinook salmon that are likely to occur in the action area would be fall-run Chinook salmon from the Cedar River population and from the North Lake Washington / Sammamish River population (NWFSC 2015; WDFW 2021a). Both stream- and ocean-type Chinook salmon are present in these populations, with the majority being ocean-types.

The Cedar River population is relatively small, with a total annual abundance fluctuating at close to 1,000 fish (NWFSC 2015; WDFW 2021b). Between 1965 and 2019, the total abundance for PS Chinook salmon in the basin has fluctuated between about 133 and 2,451 individuals, with the average trend being slightly negative. The 2015 status review reported that the 2010 through 2014 5-year geometric mean for natural-origin spawner abundance had shown a positive change since the 2010 status review, with natural-origin spawners accounting for about 82% of the population. WDFW data suggest that natural-origin spawners accounted for about 71% of a combined total return of 855 fish in 2019 (WDFW 2021b).

The North Lake Washington / Sammamish River population is also small, with a total abundance that has fluctuated between about 33 and 2,223 individuals from 1983 through 2019. Natural-origin spawners make up a small proportion of the total population, accounting for about 30% of the 365 total return in 2019, and the trend is rather flat to slightly negative (NWFSC 2015; WDFW 2021b).

All returning adults and out-migrating juveniles of these two populations, as well as individuals that spawn in the numerous smaller streams across the basin, must pass through the action area to complete their life cycles. Adult Chinook salmon pass through Chittenden Locks (aka Ballard Locks) between mid-June through September, with peak migration occurring in mid-August (City of Seattle 2008). Spawning occurs well upstream of the action area between early August and late October. Juvenile Chinook salmon are found in Lake Washington and Lake Sammamish between January and July, primarily in the littoral zone (Tabor et al. 2006). Outmigration through the ship canal and past the action area to the locks occurs between late-May and early-July, with the peak in June (City of Seattle 2008).

Puget Sound (PS) steelhead: 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.

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

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

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

Geographic Region (MPG)	Demographically Independent Population (DIP)	Viability
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

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 populations that occur in the action area consist of winter-runs from the Cedar River and North Lake Washington / Lake Sammamish DIPs (NWFSC 2015; WDFW 2021a). Both DIPs are among the smallest within the DPS. WDFW reports that the total PS steelhead abundance in the Cedar River basin has fluctuated between 0 and 900 individuals between 1984 and 2018, with a strong negative trend. Since 2000, the total annual abundance has remained under 50 fish (WDFW 2021c). NWFSC (2015) suggests that the returns may have been above 1,000 individuals during the 1980s, but agrees with the steep decline to less than 100 fish since 2000. It is unclear what proportion of the returns are natural-origin spawners, if any, and a total of only 4 adults are thought to have returned in 2018 (WDFW 2021c). The Sammamish River population is even smaller. WDFW reports that the total abundance for PS steelhead in the North Lake Washington / Lake Sammamish basin fluctuated between 0 and 916 individuals between 1984 and the last survey in 1999, with a strong negative trend. Abundance never exceeded 45 fish after 1992, and was only 4 in 1999 (WDFW 2021c). NWFSC (2015) disagrees with WDFW in that returns may have been above 1,500 individuals during the mid-1980s, but NWFSC agrees with the steep decline to virtually no steelhead in the basin since 2000.

All returning adults and out-migrating juveniles of these two populations must pass the action area to complete their life cycles. Adult steelhead pass through Chittenden Locks (aka Ballard Locks) and the Lake Washington Ship Canal between January and May, and may remain within Lake Washington through June (City of Seattle 2008). The timing of steelhead spawning in the basin is uncertain, but occurs well upstream of the action area. Juvenile steelhead enter Lake Washington in April, and typically migrate through the ship canal and past the action area to the locks between April and May (City of Seattle 2008).

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.

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.

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).

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 were 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

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; Tian et al. 2021).

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: Critical habitat has been designated for PS Chinook salmon along the entire length of the Lake Washington Ship Canal, all of Lake Washington, about 950 yards upstream into in the Sammamish River, and well upstream into the Cedar River watershed. The critical habitat in the Lake Washington Ship Canal provides the Freshwater Migration PBF for PS Chinook (NOAA 2021; WDFW 2021b).

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 along the eastern shore of Lake Washington between about 2.5 miles south of the east end of the Route 520 Bridge and 2 miles north of the east end of the I-90 Bridge in Seattle, Washington (Figure 1). As described in section 2.5, work-related water quality effects would be the stressor with the greatest range of direct and indirect effects on fish. Detectable effects would be limited to the waters and substrates within about 300 feet around the project site. However, trophic connectivity between PS Chinook salmon and the SR killer whales that feed on them extends the action area to the marine waters of Puget Sound. The described area overlaps with the geographic ranges of the ESA-listed species and the boundaries of designated critical habitats identified in Table 1. The action area also overlaps with areas that have been designated, under the MSA, as EFH for Pacific Coast salmon, Pacific Coast groundfish, and coastal pelagic species.

2.4 Environmental Baseline

The "environmental baseline" refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultations, and the impact of State or private actions which are contemporaneous with the consultation in process. The 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 sites and the surrounding area: The project site is located the along the eastern shore of Lake Washington between approximately 2.5 miles south of the east end of the Route 520 Bridge and 2 miles north of the east end of the I-90 Bridge in Seattle, Washington (Figure 1). Although the action area includes the marine waters of Puget Sound, all detectable effects of the action would be limited to Lake Washington within about 300 feet around the pier (Sections 2.5 & 2.12). Therefore this section focuses on habitat conditions in Lake Washington, and does not discuss Puget Sound habitat conditions.

Lake Washington is a long, narrow, freshwater lake with steeply sloping sides. It is about 22 miles long, north to south, has an average width of 1.5 miles, and covers about 21,500 acres. The lake has an average depth of about 100 feet, and is just over 200 feet deep at its deepest (City of Seattle 2010). The Lake Washington watershed covers about 300,000 acres (472 square miles), and its major influent streams are the Cedar and Sammamish Rivers. The Cedar River enters at the southern end of the lake and contributes about 57 percent of the lake's water. The Sammamish River enters at the north end of the lake, and contributes about 27 percent of the lake's water (King County 2016). Numerous creeks, including Coal, Forbes, Juanita, May, McAleer, Ravenna, and Thornton Creeks also flow directly into Lake Washington.

The geography and ecosystems in and adjacent to the action area have been dramatically altered by human activity since European settlers first arrived in the 1800s. Historically, the Cedar River did not enter the lake, and Lake Washington's waters flowed south to the Duwamish River via the now absent Black River. In the 1880s, dredging and excavation was started to create a navigable passage between Lake Washington and the marine waters of Shilshole Bay. In 1911, engineers rerouted the Cedar River into Lake Washington to create an industrial waterway and to prevent flooding in Renton. In 1916, the Lake Washington Ship Canal was opened, which lowered water levels in the lake by about nine feet, and stopped flows through the Black River.

The majority of the lake's watershed is now highly developed and urban in nature with 63 percent of the area considered fully developed (King County 2016). The City of Seattle boarders most of the west side of the lake. The cities of Bellevue and Kirkland are along the eastern shoreline, with the Cities of Kenmore and Renton on the north and south ends, respectively.

Water quality in the lake has been impacted by point and nonpoint pollution sources including past sewage discharges. Ongoing sources include stormwater discharges and subsurface runoff containing pollutants from roadways, failing septic systems, underground petroleum storage tanks, and fertilizers and pesticides from commercial and residential sites. It has also been impacted by upstream forestry and agricultural practices. Cleanup efforts since the 1960s and 1970s, including diversion of wastewater away from the lake, have improved conditions, such that water quality in the lake is generally considered good (City of Seattle 2010).

Urban development has converted most of the original lake shoreline from a mix of thick riparian forests, shrub-scrub, and emergent wetlands to residential gardens and lawns, with only small scattered patches of natural riparian growth remaining (Toft 2001). Additionally, as of the year 2000, over 70 percent of the lake's shoreline had been armored by bulkheads and rip rap, and over 2,700 docks had been installed around the lake (Toft 2001). It is almost certain that those numbers have increased since then.

The armored shorelines around most of Lake Washington, have converted the gently sloping gravel shorelines with very shallow waters that are favored by juvenile salmon, into artificially steep substrates with relatively deep water. Numerous piers and docks create harsh over-water shadows that limit aquatic productivity and hinder shoreline migration of juvenile salmon. Additionally, the artificial shorelines and overwater structures provide habitat conditions that favor fish species that prey on juvenile salmonids, especially the non-native smallmouth bass. Other predators in the lake include the native northern pikeminnow and the non-native largemouth bass (Celedonia et al. 2008a and b; Tabor et al. 2010).

The date that the dock at the project site was originally built is unknown. Shoreline vegetation at the site is poor, and consists primarily of lawn with a small of patch of blackberry and one non-native tree. A rock bulkhead lines the property shoreline, extending above and below the OHWL to a depth of approximately 2 feet. Lake substrate at the site is dominated by fine sediment and silts, and submerged aquatic vegetation is largely absent. The depth of the lake under the covered moorage area ranges from 5 feet nearshore to 13 feet at the offshore end of the pier. The upland portion of the site and property consists of a single family residence and garage under construction.

No water or sediment contamination are indicted for this site on the Washington State Department of Ecology (WDOE) Water Quality Atlas Map website (WDOE 2021).

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 3.5-5.3°C increases in Columbia Basin streams and a peak temperature of 26°C in the Willamette (NWFSC 2015). Overall, about one-third of the current cold-water salmonid habitat in the Pacific Northwest is likely to exceed key water temperature thresholds by the end of this century (Mantua et al. 2009).

Higher temperatures will reduce the quality of available salmonid habitat for most freshwater life stages (ISAB 2007). Reduced flows will make it more difficult for migrating fish to pass physical and thermal obstructions, limiting their access to available habitat (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 food webs (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).

The USACE would authorize the applicant to perform over-water work at a private, single family residence. At the project site, the applicant would perform about 2 weeks of work between July 16 and April 30 to re-deck one pier and replace the roofing material on one covered moorage. As part of that work, they would remove solid-wood plank decking and cedar roof shingles. They would install new grated decking and add new intermediate stringers to support the new decking. They would also install new standing seam non-galvanized metal roofing onto the existing moorage cover frame consisting of plywood and wooden framing.

The effects of the proposed work can be characterized as temporary effects associated with construction, and long-term effects associated with the structure and its use. The construction effects include noise, water quality diminishment, modified substrate, and diminished prey base. 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. The USACE's authorization of the construction extends the operational life of the pier by several decades beyond its existing conditions. Over that time, the pier's presence and normal operations would cause effects on fish and habitat resources through over-water shading, pier-related water and forage contamination, elevated vessel noise, and propeller wash.

The action's work window avoids the normal migration season for returning adult PS Chinook salmon, as well as the peak emigration season for juvenile Chinook salmon. As such, adult PS Chinook salmon are extremely unlikely to present during the proposed over-water work, but low numbers of juveniles could be present. The work window also overlaps slightly migration seasons for juvenile and adult PS steelhead. However, PS steelhead are very rare in the Lake Washington watershed, which, combined with the short duration of the proposed work (7-14 days), supports the expectation that it is extremely unlikely that any PS steelhead would be present during project-related work. Therefore, it is extremely unlikely that adult PS Chinook salmon or any life stage of PS steelhead would be exposed to the direct effects of the proposed action. However, low numbers of juvenile Chinook salmon are likely to be exposed to the direct effects of construction, and over the decades-long life of the repaired pier, it is very likely that shoreline-obligated juveniles of both species would pass through the project area during their annual out-migration seasons, where they would be exposed to the action's indirect effects identified above. Adults of both species are much less likely to swim through the project area, and are also much less likely to be measurably affected by exposure to those indirect effects. The PBFs of PS Chinook salmon critical habitat would also be exposed to the action's direct and indirect effects. Similarly, regarding the long-term effects of the proposed action, adult salmonids of either species are not likely to linger in the action area to have sufficient exposure to the habitat effects to produce any detectable response. For this reason, the remainder of this analysis will focus on juvenile PS Chinook and juvenile steelhead.

2.5.1 Effects on Listed Species

Construction-Related Effects

Exposure to construction-related noise, water contamination, and propeller wash is likely to adversely affect juvenile PS Chinook salmon. However, construction-related effects are extremely unlikely to adversely affect adult PS Chinook salmon and/or PS steelhead of any life stage because it is extremely unlikely that they would be present during the proposed work window.

Juvenile Chinook salmon will be exposed to the construction-related noise. Construction-related noise from over-water demolition and construction work would be transmitted into the water, especially when work is done on structural members that are in contact with the pier's piles. Construction-related vessel operations would also cause elevated in-water noise. 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). This overlaps with the frequency range where most of the sound energy from the proposed work would occur. Therefore, the fish can hear and respond to the project's noise.

At low sound 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 ensonified area (Mueller 1980; Picciulin et al. 2010; Sebastianutto et al. 2011; Xie et al. 2008), and increased vulnerability to predators, including by masking their approach (Anderson 1990; Simpson et al. 2016). The responses of fish exposed to elevated noise can range from no effect to a brief acoustic annoyance, temporary hearing damage (a.k.a. temporary threshold shift or TTS, Scholik and Yan 2002), and behavioral changes and stress (Graham and Cooke 2008).

The best available information to estimate the in-water source levels (SL, sound level at 1 meter from the source) for this project is described in recent acoustic assessments for projects with similar sound sources (NMFS 2016a & 2018a), and in other sources (Blackwell and Greene 2006; FHWA 2017; Richardson et al. 1995). The best available information supports the understanding that all of the demolition- and construction-related noise levels, including the operation of small boats, would be well below the peak and accumulated sound levels considered injurious to fish. Further, the episodic and relatively short-duration of construction-related equipment and vessel operations that are likely for this project, combined with the typical migratory behavior of juvenile salmonids in the lake suggest that the probability and duration of exposure to construction-related noise would be low for any individual fish. However, the noise levels are likely to be high enough to cause behavioral disturbances such as avoidance of the area immediately adjacent to the project site (likely less than 50 feet) and increased vulnerability to predators within that distance.

As discussed in more detail below under Pier-related Shade, avoidance of the project site would reduce the fitness of and/or increase the risk of mortality for the exposed juvenile Chinook salmon by delaying their migration past the site, and/or by inducing them to swim around the pier, which would increase their energy expenditure while simultaneously reducing their foraging efficiency (Anderson et al. 2005; Heerhartz and Toft 2015). Swimming around the pier would also place the juvenile Chinook salmon in deeper water, which would increase their vulnerability to predatory fish beyond the increase caused by the elevated noise (Willette 2001).

Construction-related water contamination is likely to adversely affect juvenile PS Chinook salmon. The proposed project includes no in-water work other than the operation of a small safety boat. However, safety boat operations would occasionally increase turbidity through mobilization of lakebed sediments. Demolition and construction work and boat operations may also temporarily introduce toxic materials from equipment-related spills and discharges. Based on previous consultations for similar projects, the NMFS estimates that all detectable water quality impacts would limited to the area well within 300 feet around the applicant's pier.

The best available information, as described in recent biological opinions for similar projects (NMFS 2016b & 2018b), and in other sources (Berg and Northcote 1985; Bjornn and Reiser 1991; Campbell Scientific Inc. 2008; Ellison et al. 2010; Robertson et al. 2006) support the understanding that any turbidity plumes caused by utility boat propeller wash would be episodic, very small, very short-lived, with total suspended sediments (TSS) concentrations that would be too low and short-lived to cause more than very brief behavioral effects such as avoidance of the plume, mild gill flaring (coughing), and slightly reduced feeding rates in any juvenile Chinook salmon that may be exposed to it.

The project includes best management practices (BMPs) specifically intended to reduce the risk and intensity of discharges and spills during construction. In the event of a project-related spill or discharge, the event would likely be very small, and quickly contained and cleaned. Additionally, non-toxic and/or biodegradable lubricants and fluids are strongly encouraged by the State, and are commonly used by many of the local contractors. Based on the best available information, the in-water presence of spill and discharge-related contaminants would be very infrequent, very short-lived, and at concentrations too low to cause more than very brief behavioral effects such as avoidance of the project area.

Although the turbidity and toxics concentrations are unlikely to be directly injurious to exposed juvenile Chinook salmon, the avoidance of the turbidity and/or contaminants would have similar effects on the exposed individuals as those described above under construction-related noise, and may act synergistically with construction noise to increase the likelihood and/or intensity of reduced fitness and increased mortality risk in the exposed individuals.

Construction-related propeller wash is likely to adversely affect juvenile PS Chinook salmon for brief periods during construction, occurring episodically over several hours each day. Spinning boat propellers kill fish and small aquatic organisms (Killgore et al. 2011; VIMS 2011). Spinning propellers also generate fast-moving turbulent water (propeller wash) that can displace and disorient small fish, as well as dislodge benthic aquatic organisms and submerged aquatic vegetation (SAV), particularly in shallow water and/or at high power settings (propeller scour).

The juvenile Chinook salmon that would be within the project area are likely to remain relatively close to the surface and as close to shore as possible, and they would be too small to effectively swim against most propeller wash. Individuals that are struck or very nearly missed by the safety boat’s spinning propeller would be injured or killed by the exposure. At greater distances, the boat’s propeller wash may temporarily displace and disorient fish. Depending on the direction and strength of the thrust plume, displacement could increase energetic costs, reduce feeding success, and may increase the vulnerability to predators for individuals that tumble stunned and/or disoriented in the wash.

Construction-related propeller scour may also slightly reduce SAV and diminish the density and diversity of the benthic community at the project site. However, the disturbances would be brief, the affected areas would likely comprise a tiny portion of the SAV- and invertebrate-supporting substrate in the immediate area, and the disturbed SAV and invertebrates would likely recover within days to weeks after work is complete. Therefore, the effects of propeller scour would be too small to cause any detectable effects on the fitness and normal behaviors of juvenile Chinook salmon and juvenile steelhead in the action area.

The number of juvenile Chinook salmon that would be impacted by the construction-related effects described above is unquantifiable with any degree of certainty. However, the number would be extremely low. This is because the work would occur well before the peak emigration season for juvenile Chinook salmon, and the individuals that would be present in the lake during the work would comprise extremely small subsets of two very small populations. Further, the probability that any individual fish would enter the project area would be very low, and only a subset of the individuals that enter the project area would be measurably affected. Therefore, the proportion of the project year's cohorts that would be killed or experience measurably reduced fitness due to exposure to one or more of the construction-related effects would be too low to cause any detectable population-level effects.

Pier-related Shade:

Pier-related shade is likely to adversely affect juvenile PS Chinook salmon and juvenile PS steelhead. The shade is extremely unlikely to affect the adults of either species because they are not closely associated with shallow water nearshore habitats in the lake and are therefore unlikely to be exposed to this stressor. The shade of the repaired pier and the vessels moored to it would maintain conditions within and adjacent to the pier's footprint that reduce aquatic productivity, alters juvenile salmonid migratory behaviors, and increases juvenile salmonids' exposure and vulnerability to predators.

Although the existing wood plank decking would be replaced with light-penetrating decking, the dock would continue to cast a shadow over the water and the substrate beneath it, and the solid-roofed boat canopy and any boats that would moor along the sides of the pier would add to the size and intensity of the shade. The intensity of shadow effects are likely to vary based on the brightness and angle of the sun. They would be most intense on sunny days, and less pronounced to possibly inconsequential on cloudy days.

Shade limits primary productivity and can reduce the diversity of the aquatic communities under over-water structures (Nightingale and Simenstad 2001; Simenstad et al. 1999). Juvenile salmon feed on planktonic organisms such as amphipods, copepods, and euphausiids, as well as the larvae of many benthic species and fish (NMFS 2006). Because large portions of the repaired structures and moored vessels would cast shadows over water and substrate that would otherwise be supportive of SAV and benthic invertebrates, the shade would continue to reduce the quantity and diversity of natural cover and prey organisms for juvenile salmonids.

If situated alone along a stretch of undisturbed shoreline, the pier's impacts on aquatic productivity might not be expected to measurably affect the fitness of migrating juvenile salmonids. However, because the applicant's pier is situated among many long-standing bankside over-water structures that line Lake Washington, their shadows, in combination with the shadows of the adjacent structures, act to maintain long stretches of migratory habitat with inadequate shelter and forage resources for juvenile salmonids. Therefore, juvenile Chinook salmon and juvenile steelhead within the project area are likely to experience some degree of reduced fitness due to reduced availability of cover and prey that would be attributable to the applicant's pier.

The shade of over-water structures also negatively affects juvenile salmonid migration. Numerous studies demonstrate that juvenile salmonids, in both freshwater and marine habitats, are more likely to avoid an overwater structure's shadow than to pass through it (Celedonia et al. 2008a and b; Kemp et al. 2005; Moore et al. 2013; Munsch et al. 2014; Nightingale and Simenstad 2001; Ono et al. 2010; Southard et al. 2006; Tabor et al. 2006). Swimming around overwater structures increases the migratory distance, which has been positively correlated with increased mortality in juvenile Chinook salmon (Anderson et al. 2005).

Although the pier's shade intensity would be reduced compared to the existing conditions, the shade of the repaired pier and moorage cover is likely to continue to alter the migratory behavior for at least some of the juvenile Chinook salmon that pass through the action area, and inhibit them from migrating along the shoreline, which is typical for juvenile Chinook salmon passing through Lake Washington. The shade would delay the passage under the structure for some, and/or induce some individuals to swim around the structure, effectively forcing them into open and relatively deep waters. The off-bank migration of these small fish increases migration distance and time, and increases the energetic costs (Heerhartz and Toft 2015). Shade-related altered migratory behaviors would mostly affect juvenile PS Chinook salmon, because the juvenile PS steelhead that pass through this waterway are relatively large and shoreline independent, as are the adults of both species.

Additionally, shade and deep water both favor freshwater predatory species, such as smallmouth bass and northern pikeminnow that are known to prey heavily on juvenile salmonids (Celedonia et al. 2008a; Tabor et al. 2010), and deep water increases the risk of predation for migrating juvenile salmonids (Willette 2001). Therefore, juvenile PS Chinook salmon and juvenile PS steelhead that are in close proximity to the pier would be more at risk of predation than they would be in the pier's absence.

In summary, over-water shade from the pier and moorage cover would cause a combination of altered behaviors and increased risk of predation that would reduce fitness or cause mortality for some juvenile PS Chinook salmon and juvenile PS steelhead that pass the site. The annual numbers of either species that would be impacted by this stressor is unquantifiable with any degree of certainty, and the numbers are likely to vary greatly over time. However, the numbers are likely to be very low. This because relatively small subsets of each annual cohort are likely to pass through the project area, and the probability of exposure would be very low for any individual fish that enters the action area, and only a subset of the exposed individuals would be measurably affected. Therefore, for both species, the proportion of any year's cohort that would be killed or experience measurably reduced fitness due to pier-related shade would be too low to cause any detectable population-level effects.

<u>Pier-related Water and Forage Contaminants</u>

Exposure to pier-related pollutants is likely to adversely affect juvenile PS Chinook salmon and juvenile PS steelhead through direct exposure to pollutants in the water column and through indirect exposure to pollutants through the trophic web. Pier-related pollutants are extremely unlikely to affect the adults of either species because they are not closely associated with shallow water nearshore habitats in the lake and are therefore unlikely to be exposed to this stressor.

The normal behaviors of juvenile Chinook salmon in the freshwater emigration phase of their life cycle includes a strong tendency toward shoreline obligation, which means that they are biologically compelled to follow and stay close to streambanks and shorelines, and likely to pass through and forage within the project area. The normal behaviors of out-migrating juvenile steelhead is much less tied to shoreline habitats. However, over the decades-long life of the repaired pier, some out-migrating juvenile steelhead are likely to pass through and forage within the project area. Returning adults of both species are shoreline independent and very unlikely to linger or forage within the project area, and therefore very unlikely to be exposed to or detectably affected by this stressor.

Like most fish, Chinook salmon and steelhead can uptake contaminants directly through their gills, and through dietary exposure (Karrow et al. 1999; Lee and Dobbs 1972; McCain et al. 1990; Neff 1982; Varanasi et al. 1993). Direct exposure to water-borne pollutants can cause effects that range from avoidance behaviors, to reduced growth, altered immune function, and immediate mortality. The intensity of effects depends largely on the pollutant, its concentration, and/or the duration of exposure (Beitinger and Freeman 1983; Brette et al. 2014; Feist et al. 2011; Gobel et al. 2007; Incardona et al. 2004 and 2005; McIntyre et al. 2012; Spromberg et al. 2015).

Beitinger and Freeman (1983) report that fish possess acute chemical discrimination abilities and that very low levels of some water-borne contaminants can trigger strong avoidance behaviors. In freshwater, exposure to dissolved copper at concentrations between 0.3 to 3.2 µg/L above background levels has been shown to cause avoidance of an area, to reduce salmonid olfaction, and to induce behaviors that increase juvenile salmon's vulnerability to predators (Giattina et al. 1982; Hecht et al. 2007; McIntyre et al. 2012; Sommers et al. 2016; Tierney et al. 2010).

Copper: The applicant would install new stringers as decking supports that would be built with ACZA-treated timber. Wet ACZA-treated wood leaches some of the metals used for wood preservation. Of these metals, dissolved copper is of most concern to fish because of its higher leaching rate compared to arsenic and zinc (Poston 2001). Post-treatment BMPs reduce the intensity and duration of copper leaching from ACZA-treated wood, though some leaching still occurs. Copper leaching from ACZA-treated wood is highest when the treated wood is immersed in freshwater, but decreases sharply to low levels during the first few weeks after installation. Above-water treated timber episodically releases very small amounts of copper when it is exposed to waves and stormwater. The dissolved copper concentrations that would be attributable to action-related installation of ACZA-treated timber is uncertain. Exposure to dissolved copper at concentrations between 0.3 to 3.2 µg/L above background levels has been shown to cause avoidance of an area, to reduce salmonid olfaction, and to induce behaviors that increase juvenile salmon's vulnerability to predators in freshwater (Giattina et al. 1982; Hecht et al. 2007; McIntyre et al. 2012; Sommers et al. 2016; Tierney et al. 2010). Detectable concentrations are expected to be very low, episodic, brief, and limited to the areas immediately adjacent to the pier because all treated timber would be installed above the water and not permanently immersed. However, any dissolved copper from the ACZA-treated timber would be additive to the copper from hull paints described below.

Copper-based anti-fouling paints leach copper into the water at fairly constant levels, and can be a significant source of dissolved copper in harbors and marinas with high boat occupancy and restricted water flows (Schiff et al. 2004). This is most notable under conditions of high boat occupancy in enclosed moorages where water flows are restricted. WDOE (2017) reports that dissolved copper concentrations from anti-fouling paints can be above 5 µg/L in protected moorages, but below 0.5 µg/L in open moorages with high flushing rates. The dissolved copper concentrations that would be attributable to action-related copper-based anti-fouling paints are uncertain, but may exceed the threshold for the onset of adverse effects in salmonids. Since there will be only one vessel moored at this residential pier and the pier is located along a section of open shoreline, the concentration of dissolved copper is likely to be low and below 0.5 µg/L. However, the residence is located adjacent to other properties with moored vessels, which may create a localized additive effect over time.

Although neither action-related source of copper is expected to very high, those sources would be additive to each other, and the NMFS expects that action-related dissolved copper concentrations in the area immediately adjacent to the applicant's pier would episodically exceed the threshold for the onset of detectable effects. Therefore, over the life of the applicant's repaired pier, some juvenile Chinook salmon and juvenile steelhead are likely to be exposed to pier-related dissolved copper at levels high enough to measurably alter their normal behaviors and increase their risk of predation.

<u>Petroleum-based fuels and lubricants:</u> The vessels that would utilize the applicant's pier would periodically discharge petroleum-based fuels and lubricants into the water. Petroleum-based fuels and lubricants contain chemicals that are harmful to fish and other aquatic organisms during development and during adulthood (Incardona et al. 2004; Incardona et al. 2005). However, vessel discharges near the project site are likely to occur relatively infrequently, with the majority being very small. Additionally, some of the pollutants may evaporate relatively quickly (Werme et al. 2010), and currents would help to disperse the pollutants. However, over the decades-long life of the repaired pier some juvenile PS Chinook salmon and juvenile PS steelhead are likely to be directly exposed to pier-related petroleum-based pollutants at concentrations capable of causing some combination of behavioral disturbances, reduced growth, increased susceptibility to infection, and increased mortality.

<u>Pier-related Forage Contamination:</u> Pier-related contaminants that settle to the bottom would accumulate on the substrate under and adjacent to the pier and be biologically available for years (Romberg 2005). Amphipods and copepods can uptake PAHs from contaminated sediments (Landrum and Scavia 1983; Landrum et al. 1984; Neff 1982), and pass them to juvenile Chinook salmon and other small fish through the food web. Varanasi et al. (1993) found high levels of PAHs in the stomach contents of juvenile Chinook salmon in a contaminated waterway (Duwamish). They also reported reduced growth, suppressed immune competence, as well as increased mortality in juvenile Chinook salmon that was likely caused by the dietary exposure to PAHs. Meadore et al. (2006) demonstrated that dietary exposure to PAHs caused "toxicant-induced starvation" with reduced growth and reduced lipid stores in juvenile Chinook salmon.

The authors surmised that these impacts could severely impact the odds of survival in affected juvenile Chinook salmon.

Increased levels of contaminants at the project site may also diminish the number, size, and species diversity of prey types available to foraging juvenile salmonids. When juvenile fish encounter areas of diminished prey, competition for those limited resources increases, and less competitive individuals are forced into suboptimal foraging areas (Auer et al. 2020). Further, individuals with an inherently higher metabolism tend to be bolder and competitively dominant, and may outcompete other individuals for resources within a microhabitat, potentially increasing interspecific mortality (Biro and Stamps 2010).
Based on the available information, the NMFS expects that over the decades-long life of the repaired pier, some juvenile Chinook salmon and juvenile steelhead are likely to be exposed to pier-related contaminated forage and/or diminished prey availability capable of causing some combination of reduced growth, increased susceptibility to infection, and increased mortality.

Summary: Juvenile Chinook salmon and juvenile steelhead cohorts would pass through the project area. Some individuals that swim through the area are likely to be exposed to some combination of pier-related contaminated water and pier-related contaminated and/or diminished forage.

The annual numbers of juveniles of either species that may be exposed to pier-related contaminated water and/or forage are unquantifiable with any degree of certainty and are likely to vary greatly over time, but the numbers are expected to be very low. Similarly, the contaminant concentration levels that any individual fish may be directly or indirectly exposed to, and the intensity of any effects that an exposed individual may experience, would be highly variable over time, but typically very low.

Based on the small affected area and the multiple routes available to emigrating juveniles of both species, the PS Chinook salmon and PS steelhead that would annually pass through the project area would be small subsets of their cohorts. Additionally, the majority of their typical emigration seasons are well outside of the typical summer boating season when pier-related contamination levels would be highest. Further, the infrequency and small-scale of discharges combined with the migratory nature of juvenile salmonids in the area suggest that the probability and duration of exposure would be very low for any individual fish. Therefore, the annual numbers of PS Chinook salmon and PS steelhead that may be exposed to pier-related contaminated water and forage would represent extremely small subsets of their respective cohorts, and the numbers of exposed fish that would be meaningfully affected would be too low to cause detectable population-level effects.

Pier-related Noise:

Pier-related noise would adversely affect PS Chinook salmon and PS steelhead. The vessels that would moor at the new pier would cause in-water noise capable of causing detectable effects in fish. Unlike construction noises, vessel noise could occur year-round. Individual vessel operations around a mooring structure typically consist of brief periods of relatively low-speed movement as boats are driven to the pier and tied up. Their engines are typically shut off within minutes of arrival. The engines of departing vessels are typically started a few minutes before the boats are untied and driven away.

Based on satellite imagery of the applicant's pier and on the consulting biologist's personal observations of many residential piers and commercial marinas in the region, the boats most likely to moor at the applicant's pier would be a power boat of approximately 30-35 feet long in the covered moorage area and potentially one or two additional vessels of similar size. As described earlier, exposure to noise may cause a range of physiological effects in fish, which would depend largely on the intensity of the sound and the duration of the exposure. Numerous sources describe sound levels for commercial and recreational vessels (Blackwell and Greene 2006; McKenna et al. 2012; Picciulin et al. 2010; Reine et al. 2014). The best available information about the source levels from vessels close in size to those that would operate at the pier is described in the acoustic assessment done for a similar project (NMFS 2018). In the current assessment, we used vessel noise from a 30-foot long power boat as a surrogate for the type of vessel likely to moor at the applicant's pier.

The expected peak source levels are below the 206 dB_{peak} threshold for instantaneous injury in fish. Application of the practical spreading loss equation to the expected SEL SLs suggests that noise levels above the 150 dB_{SEL} threshold would ensonify an area that extends about 33 feet (10 m) from the representative vessel (Table 5).

Table 5. Estimated in-water source levels for a vessel with noise levels similar to those likely to moor at the applicant's dock, and ranges to effects thresholds for fish.

Source	Acoustic Signature	Source Level	Threshold Range
30 foot Boat w/ 2 4~ 100 HP Outboard Engines.	< 2 kHz Combination	175 dB_{peak}	206 @ N/A
Episodic brief periods measures in minutes		165 dB_{SEL}	150 @ 10 m

It is extremely unlikely that the applicant's vessel would be operated at anything close to full speed while near the pier. However, they may briefly use high power settings while maneuvering. To be protective of fish, this assessment assumes that pier-related in-water vessel noise levels that exceed the 150 dB_{SEL} threshold could routinely extend 33 feet (10 m) around the pier. Vessel noise levels would be non-injurious. However, juvenile Chinook salmon and steelhead that are within the ensonified area, are likely to experience behavioral disturbances, such as acoustic masking, startle responses, altered swimming patterns, avoidance, and increased risk of predation (Scholik and Yan 2002). Further, the intensity of these effects would increase with increased proximity to the source and/or duration of exposure. Response to this exposure would be non-lethal in most cases, but some individuals may experience stress and fitness effects that could reduce their long-term survival, and some individuals that are eaten by predators would experience mortality.

The annual numbers of juvenile PS Chinook salmon and PS steelhead that would be exposed to this stressor are unquantifiable with any degree of certainty and are likely to vary greatly over time. However, they would be very low. Based on the relatively small affected areas, the multiple routes available to emigrating juveniles of both species, and because the majority of their typical emigration seasons are well outside of the typical summer boating season when pier-related vessel operations would be highest, the PS Chinook salmon and PS steelhead that would annually be near the dock would be small subsets of their cohorts. Further, the typically episodic and short-duration of vessel operations at the pier combined with the juvenile salmonids typical migratory behavior in the lake, suggest that the probability and duration of exposure would be very low for any individual fish. Therefore, the PS Chinook salmon and PS steelhead that may be exposed to pier-related elevated noise would represent extremely small subsets of their respective cohorts, and the annual numbers of individuals that would be meaningfully affected by this stressor would be too low to cause detectable population-level effects.

Pier-related Propeller Wash: Pier-related propeller wash would adversely affect juvenile PS Chinook salmon and juvenile PS steelhead, but cause only minor effects in adults of both species. The effects of propeller wash is described above for construction. The only difference between that discussion and this is that the vessels that would moor at the pier would be operated year-round for years to come following the completion of the proposed construction.

Juvenile Chinook salmon and steelhead in the action area are likely to remain close to the surface where they may be exposed to spinning propellers and powerful propeller wash near the pier. Conversely, adults of both species would tend to swim offshore and below the surface, and they would be able to swim against most propeller wash they might be exposed to, without experiencing any measurable effect on their fitness or normal behaviors.

Although the likelihood of this interaction is very low for any individual fish or individual boat trip, it is very likely that over the extended life of the pier, at least some juvenile PS Chinook salmon and juvenile PS steelhead would experience reduced fitness or mortality from exposure to spinning propellers and/or propeller wash at the pier.

The annual numbers of juveniles of either species that would be exposed to this stressor are unquantifiable with any degree of certainty and are likely to vary greatly over time. However, they would be very low. Based on the relatively small affected areas, the multiple routes available to emigrating juveniles of both species, and because the majority of their typical emigration seasons are well outside of the typical summer boating season when pier-related vessel operations would be highest, the juvenile Chinook salmon and steelhead that would annually be around the pier would be small subsets of their cohorts. Further, the typically episodic and short-duration of vessel operations at the pier combined with the juvenile salmonids typical migratory behavior in the lake, suggest that the probability and duration of exposure would be very low for any individual fish. Therefore, the juvenile PS Chinook salmon and juvenile PS steelhead that would be exposed to pier-related propeller wash would represent extremely small subsets of their respective cohorts, and the annual numbers of individuals that would be meaningfully affected by this stressor would be too low to cause detectable population-level effects. Pier-related propeller scour is unlikely to cause any detectable effects on the fitness and normal behaviors of Chinook salmon and steelhead. The expectation that low power settings would be used when maneuvering near the pier would have negligible effects on benthic resources at the sites.

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.

The PBFs for PS Chinook salmon in the action area are those for migration habitat, specifically, 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 that support juvenile and adult mobility and survival. Water quantity, rocks and undercut banks, and side channels are features not relevant to this consultation. We present here the effects listed above for their influence on the affected PBFs.

Migration Areas free from obstruction and excessive predation – The proposed action would cause long-term minor adverse effects on this feature of critical habitat by two of the effects described above: Noise (ephemeral during construction, and long-term episodic over the life of the project) and shade, for the life of the project. The proposed pier's shade intensity would be reduced compared to the existing conditions. However, the continued presence and altered light of the pier and of moored vessels would maintain degraded conditions at the site that prevent normal migration behaviors, slightly increase the migration pathway, and increase the risk of predation for juvenile Chinook salmon. In summary, this feature of critical habitat would be maintained at a slightly degraded level.

Water quantity – The proposed project would cause no effect on this attribute.

Water quality – The proposed action would cause both short- and long-term adverse effects on this attribute. Vessel propeller scour would occur during construction and during the operation of the recreational vessel would cause small areas of short-term increases in turbidity within the project area. The ACZA-treated timber at the pier would maintain persistent low level inputs of contaminants at the pier. The use of the recreational vessel will episodically introduce PAHs for the life of the project. This feature of critical habitat would be maintained at a degraded level.

Natural Cover – The baseline condition is a lack of natural cover due to the presence of the dock and the moorage. Extending the useful life of the pier does not alter and would perpetuate these conditions that act to limit the growth of SAV, especially underneath the opaque moorage cover. However, the conversion of solid plank decking to fully grated decking would increase some light penetration under the affected structures. This feature of critical habitat would be maintained at a slightly less degraded level.

The proposed action will have no effect on the following PBFs because they are not present in the action area: freshwater spawning sites; freshwater rearing sites; estuarine areas free of obstruction and excessive predation; nearshore marine areas free of obstruction and excessive predation; and offshore marine areas.

2.6 Cumulative Effects

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

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

The current conditions of ESA-listed species and designated critical habitat within the action area are described in the Rangewide Status of the Species and Critical Habitat and Environmental Baseline sections above. The non-federal activities in and upstream of the action area that have contributed to those conditions include past and on-going bankside development, vessel activities, and upland urbanization, as well as upstream forest management, agriculture, road construction, water development, 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 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 PBF 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 most likely to occur in the action area would be fall-run Chinook salmon from the Cedar River and the North Lake Washington/Sammamish River populations, both of which are part of the South Puget Sound MPG. Both populations are considered at high risk of extinction due to low abundance and productivity.

The project site is located along the east bank of Lake Washington, which serves as a freshwater migration route to and from marine waters for adult and juvenile PS Chinook salmon from both affected populations. The environmental baseline within the action area has been degraded by the effects of nearby intense bankside development and maritime activities, and by nearby and upstream industry, urbanization, agriculture, forestry, water diversion, and road building and maintenance.

The timing of the proposed work avoids the normal migration season for returning adult PS Chinook salmon, but any work that would occur between December 31 and April 30 overlaps with the early part of emigration season for juveniles. Additionally, over the next several decades, low numbers of out-migrating juveniles that pass through the project sites would be exposed to low levels of contaminated forage and other altered habitat conditions, that both individually and collectively, would cause some combination of altered behaviors, reduced fitness, and mortality in some of the exposed individuals. The annual numbers of individuals that would be detectably affected 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 trend of the PS steelhead DPS is negative, 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 would be winter-run fish from the Cedar River and North Lake Washington/Lake Sammamish DIPs. The abundance trends between 1984 and 2016 was strongly negative for both DIPs, and ten or fewer adult natural-spawners are estimated to return to the DIPs annually.

The project site is located along the east bank of Lake Washington, which serves as a freshwater migration route to and from marine waters for adult and juvenile PS steelhead from both affected DIPs. The environmental baseline within the action area has been degraded by the effects of nearby intense bankside development and maritime activities, and by nearby and upstream industry, urbanization, agriculture, forestry, water diversion, and road building and maintenance.

It is extremely unlikely that any PS steelhead would be directly exposed to the proposed work. However, over the next several decades, low numbers of out-migrating juveniles that pass through the project sites would be exposed to low levels of contaminated forage and other altered habitat conditions, that both individually and collectively, would cause some combination of altered behaviors, reduced fitness, and mortality in some of the exposed individuals. The annual numbers of individuals that would be detectably affected 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 to ensure that specific areas with PBFs that are essential to the conservation of that listed species are appropriately managed or protected. The critical habitat for PS Chinook salmon will be affected over time by cumulative effects, some positive – as restoration efforts and regulatory revisions increase habitat protections and restoration, and some negative – as climate change and unregulated or difficult to regulate sources of environmental degradation persist or increase. Overall, to the degree that trends are negative, the effects on the PBFs of critical habitat for PS Chinook salmon are also likely to be negative. In this context we consider how the proposed action's impacts on the attributes of the action area's PBFs would affect the designated critical habitat's ability to support the conservation of PS Chinook salmon as a whole.

Past and ongoing land and water use practices have degraded salmonid critical habitat throughout the Puget Sound basin. 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 habitat is uncertain, as is the degree to which those impacts may be tempered by adoption of more environmentally acceptable land use practices, by the implementation of non-federal plans that are intended to benefit salmonids, and by efforts to address the effects of climate change.

The PBF for PS Chinook salmon critical habitat in the action area is limited to freshwater migration corridors free of obstruction and excessive predation. The site attributes of that PBF that would be affected by the action are obstruction and excessive predation, water quality, and natural cover. As described above, the project site is located along a heavily impacted waterway, and all three of these site attributes currently function at reduced levels as compared to undisturbed freshwater migratory corridors. The extended life of the pier, along with the continuation of pier-related vessel operations would cause minor long term adverse effects on the identified site attributes. On the positive side, the proposed work would increase light penetration under the repaired structures.

Based on the best available information, the scale of the proposed action’s effects, when considered in combination with the degraded baseline, cumulative effects, and the impacts of climate change, would be too small to cause any detectable long-term negative changes in the quality or functionality of the freshwater migration corridors PBF 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.

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 PS Chinook salmon.

2.9 Incidental Take Statement

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

- Construction-related effects,
- Pier-related shade,
- Pier-related water and forage contamination,
- Pier-related noise, and
- Pier-related propeller wash.

Harm of PS steelhead from exposure to:

- Pier-related shade,
- Pier-related water and forage contamination,
- Pier-related noise, and
- Pier-related propeller wash.

The NMFS cannot predict with meaningful accuracy the number of PS Chinook salmon and PS steelhead that are reasonably certain to be injured or killed annually by exposure to any of these stressors. 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. 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.

For this action, the timing and duration of work are the best available surrogates for the extent of take of juvenile PS Chinook salmon from exposure to construction-related effects. Timing and duration of work are appropriate surrogates because the planned work window was selected to reduce the potential for juvenile Chinook salmon presence at the project site. Therefore, working outside of the planned work window and/or working for longer than planned would increase the number of fish likely to be exposed to these construction-related impacts.

The location, size, and configuration of the repaired overwater structures are the best available surrogates for the extent of take of juvenile PS Chinook salmon and juvenile PS steelhead from exposure to pier-related shade, contaminants, noise, and propeller wash. Location is appropriate because placement of the structures outside of their exisiting footprint would cause impacts on currently unaffected substrates, which would increase the likelihood that juvenile PS Chinook salmon and juvenile PS steelhead would experience unanticipated take due to reduced availability of shelter and forage resources.

Size and configuration are appropriate for pier-related shade because, salmonid avoidance, the distance required to swim around the structures, and exposure to predators would all increase as the size and opacity of a structures increases.

Size and configuration are appropriate for pier-related contamination, noise, and propeller wash because those stressors are all positively correlated with the number of boats that moor at a structure, which is largely a function of the structure's size. As the size of a mooring structure increases, the number of boats that can moor there increases. As the number of boats increase, boating activity increases, which would increase the potential for, and the intensity of exposure to the related pollutants, noise, and propeller wash. Additionally, as the size of the pier increases, the amount of ACZA-treated lumber that would be used for repairs would increase, which would increase the amount of ACZA-related copper that would enter the water at the project site.

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

- About 2 weeks of over-water work at the project site to be completed between July 16 and April 30; and
- The post-construction location, size, and configuration of the applicant's overwater structures as described in the proposed action section of this biological opinion.

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

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

2.9.2 Effect of the Take

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

2.9.3 Reasonable and Prudent Measures

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

The USACE shall require the applicant to:

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

2.9.4 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the Federal action agency must comply (or must ensure that any applicant complies) with the following terms and conditions. The USACE 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 USACE shall require the applicant to develop and implement plans to collect and report details about the take of listed fish. That plan shall:
        i. Require the applicant and/or their contractor to maintain and submit records to verify that all take indicators are monitored and reported. Minimally, the records should include:
            1. Documentation of the timing and duration of over-water work to ensure that no more than about 2 weeks of work is done and that the work is accomplished between July 16 and April 30;
            2. Documentation of the location, size, and configuration of the repaired overwater structures to confirm that they do not exceed the locations and characteristics described in this opinion.
        ii. Require the applicant to establish procedures for the submission of the construction records and other materials to the appropriate USACE office, and to submit an electronic post-construction report to the NMFS within six months of project completion. Send the report to: projectreports.wcr@noaa.gov. Be sure to include Attn: WCRO-2021-01919 in the subject line.

2.10 Conservation Recommendations

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

1. The USACE and the applicant should encourage contracted small boat operator(s) and client vessel operators to use the lowest safe maneuvering speeds and power settings when maneuvering near the pier, with the intent to minimize propeller wash effects and mobilization of sediments at the site.
2. The USACE should encourage the applicant to limit all overwater work to the period between July 16 and December 31 to reduce the likelihood exposing juvenile Chinook salmon to the direct effects of construction.

2.11 Reinitiation of Consultation

This concludes formal consultation for the U.S. Army Corps of Engineers' authorization of the Sadis Dock Repair in Lake Washington, King County, Washington. Under 50 CFR 402.16(a): "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: (1) If the amount or extent of taking specified in the incidental take statement is exceeded; (2) If new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion or written concurrence; or (4) If a new species is listed or critical habitat designated that may be affected by the identified action."

2.12 "Not Likely to Adversely Affect" Determinations

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

As described in Section 1.2 and below, the NMFS has concluded that the proposed action is not likely to adversely affect adversely affect southern resident (SR) killer whales and their designated critical habitat. Detailed information about the biology, habitat, and conservation status and trends of SR killer whales can be found in the listing regulations and critical habitat designations published in the Federal Register, as well as in the recovery plans and other sources at: https://www.fisheries.noaa.gov/species-directory/threatened-endangered, and are incorporated here by reference.

The applicable standard to find that a proposed action is not likely to adversely affect listed species or critical habitat is that all of the effects of the action are expected to be discountable, insignificant, or completely beneficial. Beneficial effects are contemporaneous positive effects without any adverse effects to the species or critical habitat. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur. The effects analysis in this section relies heavily on the descriptions of the proposed action and project site conditions discussed in Sections 1.3 and 2.4, and on the effects analyses presented in Section 2.5.

2.12.1 Effects on Listed Species

SR killer whales are limited to marine water habitats, and would not be directly exposed to any construction-related or pier-related effects, but they could possibly be exposed to indirect effects through the trophic web. As described in Section 2.1 the PS Chinook populations that would be affected by the proposed action are very small. Further, as described in Section 2.5, the proposed action would annually affect too few individuals to cause detectable population-level effects on the affected Chinook salmon populations. Therefore, any project-related reduction in Chinook salmon availability for SR killer whales would be undetectable. Similarly, although some juvenile Chinook salmon would be exposed to contaminated prey at the project site, their individual levels of contamination as well as the total numbers of annually exposed individuals would be too low to cause any detectable trophic link between the contaminants and SR killer whales. Therefore, the action is not likely to adversely affect SR killer whales.

2.12.2 Effects on Critical Habitat

This assessment considers the intensity of expected effects in terms of the change they would cause in affected physical or biological features (PBFs) from their baseline conditions, and the severity of each effect, considered in terms of the time required to recover from the effect. Ephemeral effects are those that are likely to last for hours or days, short-term effects would likely to last for weeks, and long-term effects are likely to last for months, years or decades.

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

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

2. Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth
   The proposed action would cause long-term undetectable effects on prey availability and quality. Action-related impacts would annually injure or kill extremely low numbers of individual juvenile Chinook salmon (primary prey), including exposing some individuals to contaminated prey. However, their numbers and levels of contamination would be too small to cause detectable effects on prey availability, or to create any detectable trophic link between site contaminants and SR killer whales. Therefore, it would cause no detectable reduction in prey availability and quality.

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

Therefore, the proposed action is not likely to adversely affect SR killer whale critical habitat.

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

Section 305(b) of the MSA directs Federal agencies to consult with the NMFS on all actions or proposed actions that may adversely affect EFH. Under the MSA, this consultation is intended to promote the conservation of EFH as necessary to support sustainable fisheries and the managed species' contribution to a healthy ecosystem. For the purposes of the MSA, EFH means "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity", and includes the physical, 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 USACE and the descriptions of EFH contained in the fishery management plan for Pacific Coast salmon developed by the Pacific Fishery Management Council and approved by the Secretary of Commerce (PFMC 2014).

3.1 Essential Fish Habitat Affected By the Project

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

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

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

As part of Pacific Coast Salmon EFH, five Habitat Areas of Particular Concern (HAPCs) have been defined: 1) complex channels and floodplain habitats; 2) thermal refugia; 3) spawning habitat; 4) estuaries; and 5) marine and estuarine submerged aquatic vegetation. The action area provides no known HAPC habitat features.

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 EFH for Pacific Coast Salmon as summarized below.

1. <u>Water quality:</u> – The proposed action would cause minor short- and long-term adverse effects on this attribute. ACZA-treated lumber and continued vessel operations at the residential pier would maintain persistent low level inputs of contaminants at the pier. Potential construction-related spills may impart toxins, such as PAHs, into the lake. The action would cause no measurable changes in water temperature or salinity.

2. <u>Water quantity, depth, and velocity:</u> – No changes expected.

3. <u>Riparian-stream-marine energy exchanges:</u> – No changes expected.

4. <u>Channel gradient and stability:</u> – No changes expected.

5. <u>Prey availability:</u> – The proposed action would cause long-term minor adverse effects on this attribute. The repaired pier and moorage cover would limit SAV growth and reduce the density and diversity of the benthic and planktonic communities under those structures, such as amphipods, copepods, and larvae of benthic species that are important prey resources for juvenile salmonids. Additionally, low-level input of contaminants from pier structures and related vessel operations would contaminate some of the available prey, and slightly diminish the number, size, and species diversity of prey types available to foraging juvenile salmonids. Detectable effects would be limited to the area within about 300 feet around the pier

6. <u>Cover and habitat complexity:</u> – The proposed action would cause long-term minor adverse effects on this attribute. The replacement of the overwater structures would limit SAV growth under those structures. Detectable effects would be limited to the combined 1,645-square foot area under the repaired pier and moorage cover at the single family residence.

7. <u>Water quantity:</u> – 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: – No changes expected.

3.3 Essential Fish Habitat Conservation Recommendations

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

To reduce adverse impacts on water quality and prey availability, the USACE should:

1. Encourage the applicant to limit all overwater work to the period between July 16 and December 31 to reduce the likelihood exposing juvenile Chinook salmon to the direct effects of construction; and
2. Encourage the applicant to require contracted safety boat operators and recreational vessel operators to use the lowest safe maneuvering speeds and power settings when maneuvering near the pier, with the intent to minimize propeller wash effects and mobilization of sediments at the sites.

The NMFS knows of no practical measures that are available to further reduce the action's expected effects on cover and habitat complexity.

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

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the USACE must provide a detailed written response in to the 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 the NMFS' EFH Conservation Recommendations unless the 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 the 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, the 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 USACE must reinitiate EFH consultation with the NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH Conservation Recommendations (50 CFR 600.920(l)).

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

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

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended user of this opinion is the USACE. Other interested users could include the applicant, WDFW, the governments and citizens of King County and the City of Seattle, and Native American tribes. Individual copies of this opinion were provided to the USACE. 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 the NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

4.3 Objectivity

Information Product Category: Natural Resource Plan

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

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

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

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

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