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-2021-02062

February 23, 2024

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

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Vallene Float Repair Project on the Sammamish River, King County, Washington (USACE No. NWS-2021-599; HUC 171100120304 – Bear Creek-Sammamish River)

Dear Mr. Tillinger:

Thank you for the U.S. Army Corps of Engineers (USACE) letter of August 20, 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 the USACE authorization of the Vallene Float Repair Project on the Sammamish River. Thank you, also, for your request for consultation pursuant to the essential fish habitat (EFH) provisions in Section 305(b) of the Magnuson–Stevens Fishery Conservation and Management Act [16 U.S.C. 1855(b)] for this action.

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. This opinion also documents our conclusion that the proposed action is not likely to adversely affect designated critical habitat of PS Chinook salmon, and southern resident (SR) killer whales and their designated critical habitat.

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

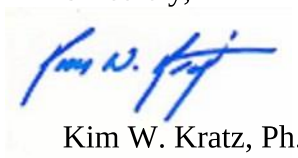
Section 3 of this document includes our analysis of the action's likely effects on EFH pursuant to Section 305(b) of the MSA. Based on that analysis, the NMFS concluded that the action would adversely affect designated freshwater EFH for Pacific Coast Salmon. However, as described in Section 3, the NMFS knows of no practical measures, beyond those already proposed by the applicant, that would reduce the action's expected effects. Therefore, the NMFS offers no conservation recommendations pursuant to MSA (§305(b)(4)(A).

We also concluded that the action would not adversely affect EFH for Pacific Coast groundfish and coastal pelagic species. Therefore, consultation under the MSA is not required for those EFHs.

Section 305(b)(4)(B) of the MSA requires that an action agency provide a detailed response in writing to the NMFS within 30 days after receiving an EFH Conservation Recommendation. However, because the NMFS has offered no EFH Conservation Recommendations, no EFH response is required from the COE for this action.

Please contact Brad DeFrees in the North Puget Sound Branch of the Oregon/Washington Coastal Office at (301) 427-8332, or by electronic mail at brad.defrees@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: Ryan Cochoit, USACE
Colleen Anderson, 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

Vallene Float Repair Project, King County, Washington
(USACE No. NWS-2021-599; HUC 171100120304 – Bear Creek-Sammamish River)

NMFS Consultation Number: WCRO-2021-02062

Action Agencies: U.S. Army Corps of Engineers

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely To Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Chinook salmon (*Oncorhynchus tshawytscha*) Puget Sound (PS)	Threatened	Yes	No	No	No
Steelhead (*O. mykiss*) PS	Threatened	Yes	No	N/A	N/A
killer whales (*Orcinus orca*) Southern resident (SR)	Endangered	No	No	No	No

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

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

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

Issued By:

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

Date: February 23, 2024

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LIST OF ABBREIVIATIONS

ACZA – Ammoniac Copper Zinc Arsenate
BE – Biological Evaluation
BMP – Best Management Practices
CFR – Code of Federal Regulations
dB – Decibel (common unit of measure for sound intensity)
DIP – Demographically Independent Population
DPS – Distinct Population Segment
DQA – Data Quality Act
EFH – Essential Fish Habitat
ESA – Endangered Species Act
ESU – Evolutionarily Significant Unit
FR – Federal Register
FMP – Fishery Management Plan
HAPC – Habitat Area of Particular Concern
HUC – Hydrologic Unit Code
ITS – Incidental Take Statement
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
PAH – Polycyclic Aromatic Hydrocarbon
PBF – Physical or Biological Feature
PS – Puget Sound
PSTRT – Puget Sound Technical Recovery Team
PSSTRT – Puget Sound Steelhead Technical Recovery Team
RL – Received Level
RPM – Reasonable and Prudent Measure
SAV – Submerged Aquatic Vegetation
SEL – Sound Exposure Level
SL – Source Level
SR – Southern Resident (Killer Whales)
USACE – U.S. Army Corps of Engineers
VSP – Viable Salmonid Population
WCR – West Coast Region (NMFS)

1. INTRODUCTION

This Introduction section provides information relevant to the other sections of this document and is incorporated by reference into Sections 2 and 3, below.

1.1 Background

The National Marine Fisheries Service (NMFS) prepared the biological opinion (opinion) and incidental take statement (ITS) portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531 et seq.), as amended, and implementing regulations at 50 CFR part 402.

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

On July 5, 2022, the U.S. District Court for the Northern District of California issued an order vacating the 2019 regulations that were revised or added to 50 CFR part 402 in 2019 ("2019 Regulations," see 84 FR 44976, August 27, 2019) without making a finding on the merits. On September 21, 2022, the U.S. Court of Appeals for the Ninth Circuit granted a temporary stay of the district court's July 5 order. On November 14, 2022, the Northern District of California issued an order granting the government's request for voluntary remand without vacating the 2019 regulations. The District Court issued a slightly amended order two days later on November 16, 2022. As a result, the 2019 regulations remain in effect, and we are applying the 2019 regulations here. For purposes of this consultation and in an abundance of caution, we considered whether the substantive analysis and conclusions articulated in the biological opinion and incidental take statement would be any different under the pre-2019 regulations. We have determined that our analysis and conclusions would not be any different.

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

1.2 Consultation History

On August 20, 2021, the NMFS received a letter from the U.S. Army Corps of Engineers (USACE) that requested informal consultation for their authorization of the Vallene Float Repair Project on the Sammamish River (USACE 2021). The request included the Biological Evaluation (BE) and the project drawings.

On August 2, 2022, the NMFS informed the USACE that we considered that the proposed action is likely to adversely affect PS Chinook salmon, PS steelhead, and Pacific coast salmon EFH, and not likely to adversely affect designated critical habitat for PS Chinook salmon, and southern resident killer whales and their critical habitat. On the same day, we informed the USACE that formal consultation was required for this action, and requested additional information. The additional information was received from the USACE on August 3, 2022 (USACE 2022). After further review of the proposed action, the NMFS requested additional information on December 1, 2023. The USACE provided this information via email and requested formal consultation for the proposed action on December 12, 2023 (USACE 2023). The NMFS considers that formal ESA consultation and EFH consultation was initiated for the proposed action on that date.

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

1.3 Proposed Federal Action

Under the ESA, “action” means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR 402.02). Under the MSA, federal action means any action authorized, funded, or undertaken, or proposed to be authorized, funded or undertaken by a federal agency (50 CFR 600.910).

The USACE proposes to authorize the repair of an existing residential pier structure located along the north bank of the Sammamish River, approximately 1.3 miles upstream from its confluence with Lake Washington at 8331 NE 175th Street, Kenmore, WA 98028 (47.75254 N latitude, -122.22951 W longitude) (Figure 1).

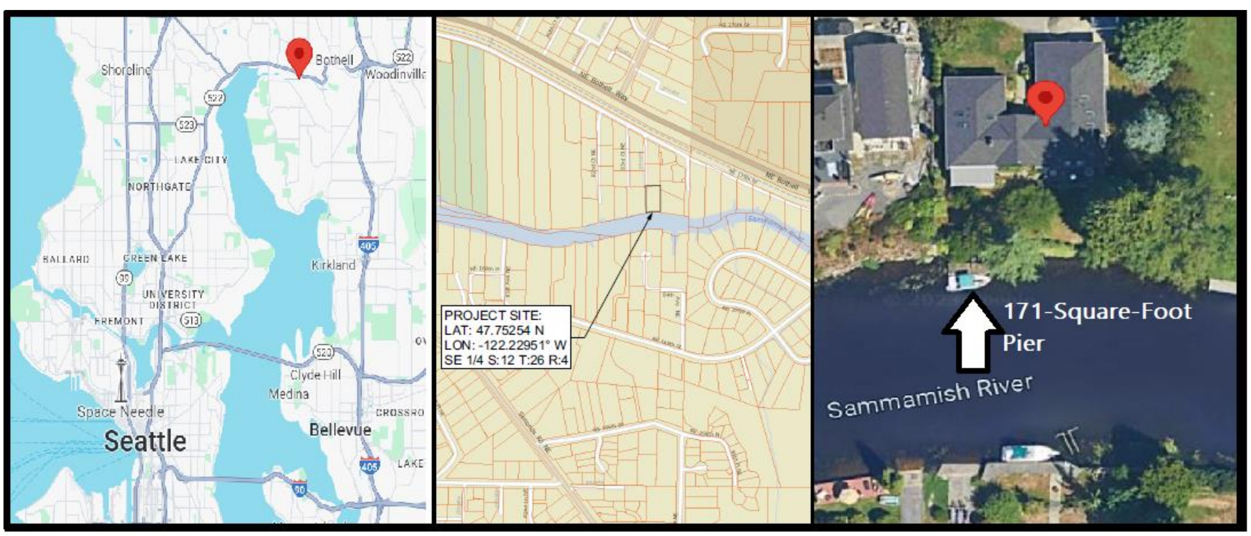

Figure 1. The project site on the north bank of the Sammamish River, in Kenmore, Washington, 1.3 miles east of the River’s confluence with Lake Washington. The aerial photo depicts the float structure with a moored vessel (Adapted from Google Maps 2023 and Sheet 1 of 4 in Ecco Design Inc. 2021).

Project Overview and Construction Details

The existing pier structure that would be repaired consists of a 171-square-foot, solid-wood-decked float (approximately 27 feet long and 6 feet wide) that is attached to an aluminum ramp (approximately 12 feet long and 2 feet wide). The aluminum ramp runs from the shoreline to the float, which is approximately 8 feet off shoreline (Figure 2). A swim ladder and swim step (approximately 4 feet long and 1 foot wide) are connected to the western and eastern sides of the float, respectively. The total over-water area of the float, ramp, swim ladder, and swim step is 196 square feet. The float is supported by a total of 4 galvanized steel piles that are 2 inches in diameter, as well as 10 float tubs located underneath the float that are 4 feet long and 2 feet wide. There is no creosote-treated wood associated with the pier structure.

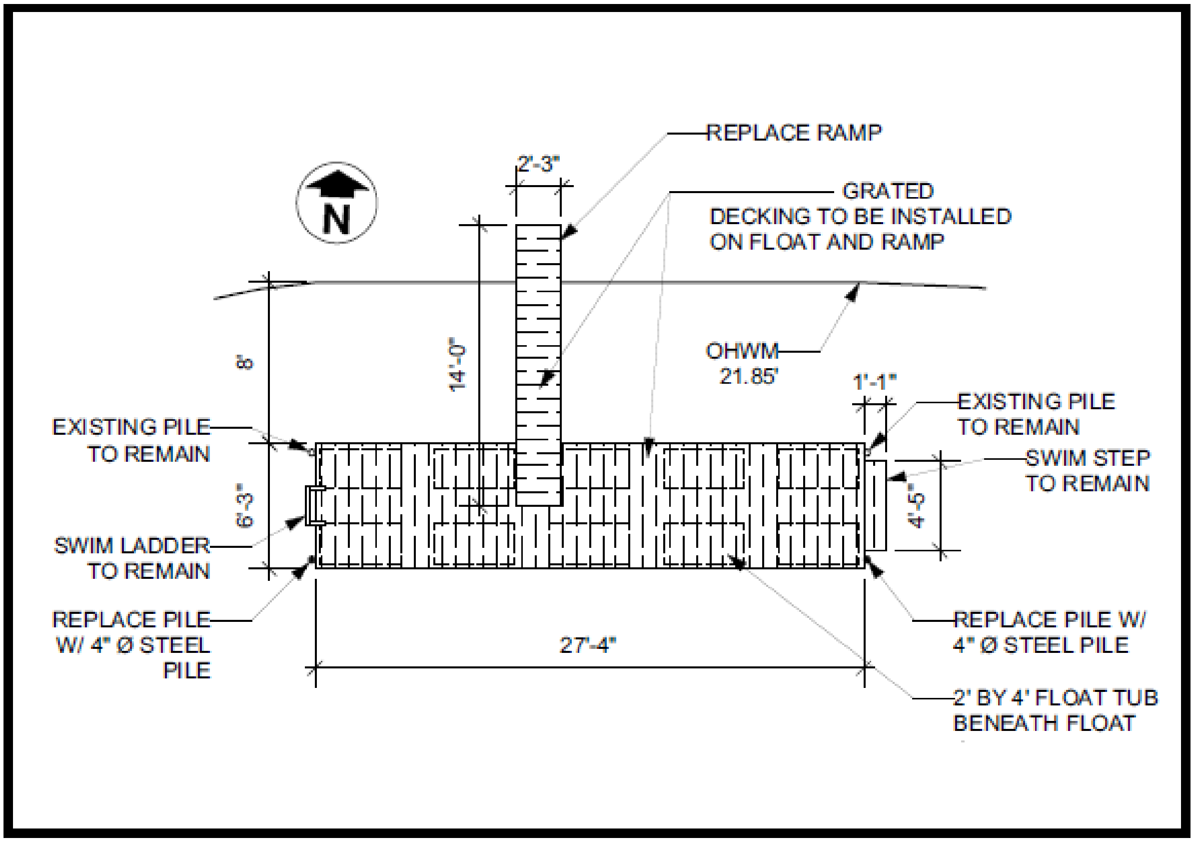

Figure 2. Overhead drawing of the existing configuration of the float and ramp with depictions of proposed replacements. The existing Ordinary High Water Mark (OHWM) of the Sammamish River is depicted north of the float (Adapted from Sheet 3 of 4 in Ecco Design Inc. 2021).

The applicant proposes to replace the two southernmost steel piles with 4-inch-diameter epoxy-coated steel piles (Figure 2). The applicant also proposed to replace the 171-square-foot wooden-decked float and aluminum ramp with a new float and ramp. The new float and ramp would have grated polymer decking with a 42% open surface. The replacement components would be the same dimensions as the current structure. The float structure would be framed with timber treated with ammoniac copper zinc arsenate (ACZA). All AZCA-treated timber would be limited to above-water applications but would be located close to the water surface. The float tubs utilized under the float structure would be foam filled and made of high density polyethylene (HDPE).

Once started, the project is estimated to take approximately three consecutive days to complete. In-water work would either occur within the July 16 to July 31, or the November 16 to February 1 in-water work windows for the area. All work would be done in compliance with the conservation measures identified in the applicant's BE and Hydraulic Project Approval (HPA) (WDFW 2021).

The float and ramp would be fabricated offsite in an upland facility and transported to the site via barge. The barge would be equipped with a crane or hoist and a vibratory pile extractor/driver to complete the project. The two southernmost 2-inch-diameter piles would be removed by vibratory or direct pull extraction. The two new 4-inch-diameter epoxy-coated steel piles would then be installed by a vibratory hammer. The pile installation work is estimated to take approximately 20 minutes per pile and would be completed in one day. The float would be set in place and connected to the piles with pile hoops. The ramp would be set on top of the float (Figure 3).

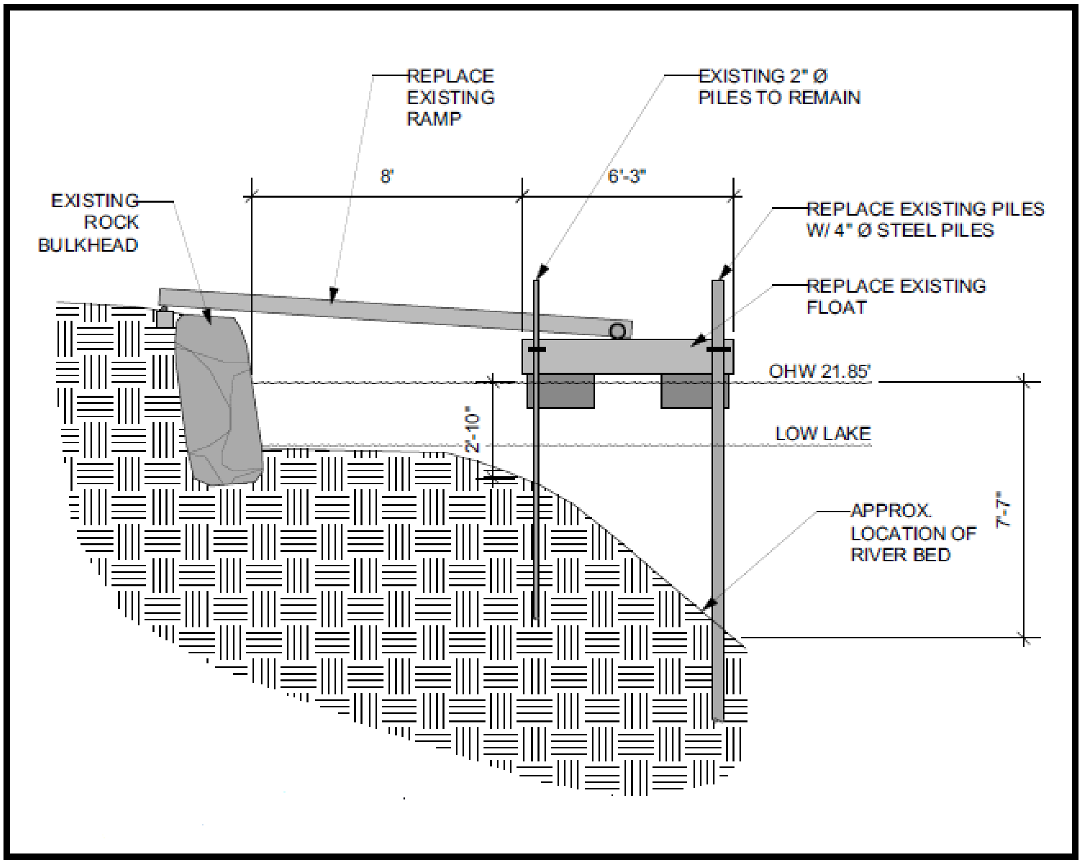

Figure 3. Side-profile drawing of the existing configuration of the float and ramp with depictions of proposed replacements. The existing OHWM of the Sammamish River is also depicted (Adapted from Sheet 4 of 4 in Ecco Design Inc. 2021).

The swim ladder and swim step would remain on site and be attached to the new float. All other steel components for the structure would be epoxy-coated or non-galvanized steel. The applicant would also plant 3 native shrubs along the shoreline of their property, to the east of the ramp.

The repaired structure would maintain the same approximate overwater footprint as the current structure. The removed piles would be placed on the barge or other dry storage site after removal. Removed piles would be hauled off site and disposed of at a licensed upland facility. Staging areas for the project would be situated in a manner to prevent contaminants from entering the water. Equipment washouts would take place off site after the work is completed. All materials for the project would be stockpiled on the barge. Equipment would be run during normal work hours, between 7:00 am to 6:00 pm. The river bottom may be disturbed during pile removal, but no excavation or dredging would occur. The work area would be surrounded by a floating boom with a full-depth sediment curtain to prevent floating debris and suspended sediment from leaving the work site.

The NMFS also considered, under the ESA, whether or not the proposed action would cause any other activities that could affect our trust resources. We determined that the action would extend, by several decades, the useful life of the pier structure. Assuming historical usage of the pier structure continues, the NMFS estimates a maximum of 1 vessel could moor to the structure. Therefore, the action would facilitate the mooring and operation of about 1 vessel per day at the pier structure for decades to come. Consequently, we have included an analysis of the effects of that vessel operation and moorage in the effects section of this Opinion.

2. ENDANGERED SPECIES ACT BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

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

The USACE initially 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 further determined that the proposed action would have no effect on any other species and critical habitats under NMFS jurisdiction. Because the NMFS concluded that the proposed action is likely to adversely affect PS Chinook salmon and PS steelhead, the USACE requested, and the NMFS 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).

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

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

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

2.1 Analytical Approach

This biological opinion includes both a jeopardy analysis and an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of “jeopardize the continued existence of” a listed species, which is “to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species” (50 CFR 402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

This biological opinion also relies on the regulatory definition of “destruction or adverse modification,” which “means a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species” (50 CFR 402.02).

The designation of critical habitat for PS Chinook salmon uses the terms primary constituent element or essential features. The 2016 final rule (81 FR 7414; February 11, 2016) that revised the critical habitat regulations (50 CFR 424.12) replaced those terms with “physical or biological features” (PBFs). The shift in terminology does not change the approach used in conducting a “destruction or adverse modification” analysis, which is the same regardless of whether the original designation identified primary constituent elements, essential features, or PBFs. In this biological opinion, we use the term PBF to mean primary constituent element or essential feature, as appropriate for the specific critical habitat.

The ESA Section 7 implementing regulations define effects of the action using the term “consequences” (50 CFR 402.02). As explained in the preamble to the final rule revising the definition and adding this term (84 FR 44976, 44977; August 27, 2019), that revision does not change the scope of our analysis, and in this opinion, we use the terms “effects” and “consequences” interchangeably.

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

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

2.2 Range-wide Status of the Species and Critical Habitat

This opinion examines the status of each species that is likely to be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' "reproduction, numbers, or distribution" for the jeopardy analysis. The opinion also examines the condition of 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.

<u>Listed Species</u>

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

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

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

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

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

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

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

Puget Sound (PS) Chinook Salmon

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

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

- Populations that do not meet all the Viable Salmon Population (VSP) parameters are sustained to provide ecological functions and preserve options for ESU recovery.

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

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

Yearling stream-type fish tend to leave their natal rivers late winter through spring, and move relatively directly to nearshore marine areas and pocket estuaries. Out-migrating ocean-type fry tend to migrate out of their natal streams beginning in early-March. Those fish rear in the tidal delta estuaries of their natal stream for about two weeks to two months before migrating to marine nearshore areas and pocket estuaries in late May to June. Out-migrating young of the year parr tend to move relatively directly into marine nearshore areas and pocket estuaries after leaving their natal streams between late spring and the end of summer.

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

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

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

<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. Further, across the ESU, 10 of 22 MPGs show natural productivity below replacement in nearly all years since the mid-1980s, and the available data indicate that there has been a general decline in natural-origin spawner abundance across all MPGs over the most-recent fifteen years. Further, escapement levels for all populations remain well below the PSTRT planning ranges for recovery (Ford 2022). Based on the current information on abundance, productivity, spatial structure and diversity, the most recent 5-year status review concluded that the PS Chinook salmon ESU remains at “moderate”

risk of extinction, that viability is largely unchanged from the prior review, and that the ESU should remain listed as threatened (Ford 2022).

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

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

PS Chinook Salmon within the Action Area: The PS Chinook salmon most likely to occur in the action area would be fall-run Chinook salmon from the Sammamish River population (Ford 2022; WDFW 2024a). Both stream- and ocean-type Chinook salmon are present in this population, with the majority being ocean-types.

The Sammamish River population is a small mixed stock population with composite production (WDFW 2024b). Between 1980 and 2020, total abundance has fluctuated between about 300 and 1,500 spawners, with the average abundance trend (based on natural-origin spawning abundance) being negative, and natural origin spawners fluctuating between about 10 and 50 percent (Ford 2022).

The project reach provides migratory habitat for juvenile and adult life stages, with juveniles also likely foraging while en route. Documented spawning habitat also occurs within the project reach (WDFW 2024a). Juvenile rearing is documented to occur approximately 0.75 miles downstream from the project reach (WDFW 2024a), but is also likely to occur within the project reach. The population spawns primarily in Issaquah Creek, Bear Creek, and Cottage Lake Creek. Spawning also occurs in larger tributaries of the Sammamish River such as North, Swamp, and Little Bear Creeks, and in the main stem of the Sammamish River (within the project reach).

Returning adults and out-migrating juveniles from all of these areas must pass the action area to complete their life cycles. Adult Chinook salmon pass through Chittenden Locks mid-June through September, with peak migration occurring in mid-August (City of Seattle 2008). Spawning occurs 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). Juveniles emigrate through the ship canal and the locks between late-May and early-July, with the peak emigration 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). In 2013, the Puget Sound Steelhead Technical Recovery Team (PSSTRT) identified 32 demographically independent populations (DIPs) within the DPS, based on genetic, environmental, and life history characteristics. Those DIPs are distributed among three geographically-based MPGs; Northern Cascades, Central and South Puget Sound; and Hood Canal and Strait de Fuca (Myers et al. 2015) (Table 3). Critical habitat for Puget Sound steelhead DPS was designated by the NMFS in 2016 (81 FR 9251, February 24, 2016). The NMFS adopted the steelhead recovery plan for the Puget Sound DPS in December, 2019.

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

Geographic Region (MPG)	Demographically Independent Population (DIP)	Viability
Northern Cascades	Drayton Harbor Tributaries Winter Run	Moderate
	Nooksack River Winter Run	Moderate
	South Fork Nooksack River Summer Run	Moderate
	Samish River/Bellingham Bay Tributaries Winter Run	Moderate
	Skagit River Summer Run and Winter Run	Moderate
	Nookachamps River Winter Run	Moderate
	Baker River Summer Run and Winter Run	Moderate
	Sauk River Summer Run and Winter Run	Moderate
	Stillaguamish River Winter Run	Low
	Deer Creek Summer Run	Moderate
	Canyon Creek Summer Run	Moderate
	Snohomish/Skykomish Rivers Winter Run	Moderate
	Pilchuck River Winter Run	Low
	North Fork Skykomish River Summer Run	Moderate
	Snoqualmie River Winter Run	Moderate
	Tolt River Summer Run	Moderate
Central and South Puget Sound	Cedar River Summer Run and Winter Run	Low
	North Lake Washington and Lake Sammamish Winter Run	Moderate
	Green River Winter Run	Low
	Puyallup River Winter Run	Low
	White River Winter Run	Low
	Nisqually River Winter Run	Low
	South Sound Tributaries Winter Run	Moderate
	East Kitsap Peninsula Tributaries Winter Run	Moderate
Hood Canal and Strait de Fuca	East Hood Canal Winter Run	Low
	South Hood Canal Tributaries Winter Run	Low
	Skokomish River Winter Run	Low
	West Hood Canal Tributaries Winter Run	Moderate
	Sequim/Discovery Bay Tributaries Winter Run	Low
	Dungeness River Summer Run and Winter Run	Moderate
	Strait of Juan de Fuca Tributaries Winter Run	Low
	Elwha River Summer Run and Winter Run	Low

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

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

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

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

Limiting Factors: Factors limiting recovery for PS steelhead include:

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

PS Steelhead within the Action Area: The PS steelhead most likely to occur in the action area would be winter-run steelhead from the North Lake Washington and Lake Sammamish DIP (Ford 2022; WDFW 2024a), which is among the smallest populations within the PS steelhead DPS.

The North Lake Washington and Lake Sammamish DIP is extremely small, and of unknown stock origin. The total annual abundance has fluctuated between 0 and about 916 individuals between 1984 and 1999, with a steep negative trend until 1994, after which it flattened no more than 10 returning adults. Abundance was only 4 adults during the last survey, which was done in 1999 (Ford 2022; WDFW 2024c).

Adult and juvenile steelhead primarily use the project site for freshwater migration, with juveniles also likely foraging while en route. The population spawns upstream of the project reach in Issaquah Creek. Therefore, returning adults and out-migrating juveniles must pass the action area to complete their life cycles. Returning adult steelhead typically pass through Chittenden Locks (aka Ballard Locks) and the Lake Washington Ship Canal between January and May, and may remain within Lake Washington / Lake Union through June (Seattle 2008). The timing of steelhead spawning across the basin is uncertain, but it occurs well upstream of the project area. Juvenile steelhead typically leave their natal streams and enter Lake Washington / Lake Union in April. They emigrate through the ship canal and through the locks between April and May (Seattle 2008).

Critical Habitat

This section is left blank because the project site is outside of designated critical habitat and, as described in the "Not Likely to Adversely Affect" Determinations section (2.12), the proposed action is extremely unlikely to cause detectable effects on any designated critical habitat under NMFS jurisdiction.

2.3 Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02).

The project site is located in the City of Kenmore, along the north bank of the Sammamish River, approximately 1.3 miles upstream from its confluence with Lake 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. The affected area would be limited to the waters and substrates within about 300 feet around float replacement work and barge operations at the project site. The action area also includes the staging area for the project, which will take place on the construction barge. Additionally, trophic connectivity between PS Chinook salmon and the SR killer whales that feed on them extends the action area to the marine waters of Puget Sound. The described area overlaps with the geographic ranges of the ESA-listed species and the boundaries of designated critical habitats identified in Table 1. The action area also overlaps with areas that have been designated, under the MSA, as EFH for Pacific Coast salmon, Pacific Coast groundfish, and coastal pelagic species.

2.4 Environmental Baseline

The "environmental baseline" refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultations, and the impact of State or private actions which are contemporaneous with the consultation in process. The 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).

<u>Climate Change</u>

Climate change is a factor affecting the environmental baseline, aquatic habitats in general, and the status of the ESA-listed species considered in this opinion. Although its effects are unlikely to be spatially homogeneous across the region, climate change is likely to play an increasingly important role in determining the abundance and distribution of ESA-listed species and the conservation value of designated critical habitats in the Pacific Northwest. Major ecological realignments are already occurring in response to climate change (IPCC WGII 2022). Long-term trends in warming have continued at global, national, and regional scales. Global surface temperatures in the last decade (2010s) were estimated to be 1.09 °C higher than the 1850-1900 baseline period, with larger increases over land ~1.6 °C compared to oceans ~0.88 °C (IPCC WGI 2021). The vast majority of this warming has been attributed to anthropogenic releases of greenhouse gases (IPCC WGI 2021). Globally, 2014 through 2018 were the 5 warmest years on record both on land and in the ocean (NOAA NCEI 2022). Events such as the 2013 through 2016 marine heatwave (Jacox et al. 2018) have been attributed directly to anthropogenic warming. Global warming and anthropogenic loss of biodiversity represent profound threats to ecosystem functionality (IPCC WGII 2022). These two factors likely have interacting effects on ecosystem function.

Updated projections of climate change are similar to or greater than previous projections (IPCC WGI 2021). The NMFS is increasingly confident in our projections of changes to freshwater and marine systems because every year brings stronger validation of previous predictions in both physical and biological realms. Retaining and restoring habitat complexity, access to climate refuges (both flow and temperature), and improving growth opportunity in both freshwater and marine environments are strongly advocated for in the recent literature (Siegel and Crozier 2020).

Climate change is systemic, influencing freshwater, estuarine, and marine conditions. Other systems are also being influenced by changing climatic conditions. Literature reviews on the impacts of climate change on Pacific salmon (Crozier 2015; 2016; 2017; Crozier and Siegel 2018; Siegel and Crozier 2019; 2020) have collected hundreds of papers documenting the major themes relevant for salmon. Below, we describe habitat changes relevant to Pacific salmon and steelhead, prior to describing how these changes result in the varied specific mechanisms impacting these species in subsequent sections.

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

Forest fires affect salmon streams by altering sediment load, channel structure, and stream temperature through the removal of canopy. Holden et al. (2018) examined environmental factors contributing to observed increases in the extent of forest fires throughout the western U.S. They found strong correlations between the number of dry-season rainy days and the annual extent of forest fires, as well as a significant decline in the number of dry-season rainy days over the study period (1984-2015). Consequently, predicted decreases in dry-season precipitation, combined with increases in air temperature, will likely contribute to the existing trend toward more extensive and severe forest fires and the continued expansion of fires into higher elevation and wetter forests (Alizedeh 2021).

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Environmental conditions at the project site and the surrounding area

The project site is located in the City of Kenmore, along the north bank of the Sammamish River, approximately 1.3 miles upstream from its confluence with Lake Washington (Figure 1). Although the action area includes the marine waters of Puget Sound, all detectable effects of the action would be limited to the Sammamish River within about 300 feet around the project site (Section 2.5). Therefore, this discussion focuses on habitat conditions in the Sammamish River, and does not discuss Puget Sound habitat conditions.

The Sammamish River is about 14 miles long, and drains several tributary creeks and Lake Sammamish into the north end of Lake Washington. The Sammamish River drainage area is about 242 square miles, including the surface of Lake Sammamish (King County 2009).

The geography and ecosystems within the Sammamish River watershed have been dramatically altered by human activity since European settlers first arrived in the 1800s. Heavy timber harvests from the 1870s through the early twentieth century removed almost all of the area's forests. Development since then has converted most of the lowland areas to urban, agricultural, and industrial uses, and forestry and agricultural practices continue to impact the upper portions of the watershed (WRIA 8 2005).

Completion of the Lake Washington Ship Canal in 1916 dried the Sammamish River marshes and lowered the water level in Lake Sammamish (WRIA 8 2005). Between 1962 and 1964, COE dredging channelized the Sammamish River into its current configuration. This deepened the river by five feet, hardened its banks, and dramatically reduced floodplain connectivity along most of its length (Martz et al. 1999).

Urban and residential runoff and sewage discharges have reduced water quality across the watershed. The waters of the Sammamish River that include the project site are identified on the current Washington State Department of Ecology (WDOE) 303(d) list of threatened and impaired water bodies for exceedance of water quality thresholds for dissolved oxygen, temperature, and bacteria (Category 5) (WDOE 2024). Other water quality listings at the project site include ammonia (Category 1) (WDOE 2024).

Riparian vegetation along the river banks is limited to narrow bands of trees and shrubs that are scattered along the length of the river, with riparian vegetation being completely absent along much the river's length. Along its length, about 26 bridges cross the river, and many docks and piers line its banks, creating harsh over-water shadows that limit aquatic productivity and reduce the river's value as rearing and migration habitat for juvenile salmonids. Additionally, those over-water 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 & b; Tabor et al. 2010).

At the project site, the river is about 100 feet wide. Minimal submerged aquatic vegetation (SAV) is reported at the project site (USACE 2021). The substrate consists of sand and gravel. The shoreline at the project site consists of terrestrial vegetation, including western red cedar, white pine, blue atlas cedar, and non-native shrubs. There is no known presence of creosote treated timber at the site. Additionally, the applicant's float likely provides habitat conditions that favor piscivorous fish such as smallmouth bass that prey on juvenile salmonids. The surrounding area is developed with various single family residences and nearby over-water structures, including docks/floats and moored vessels. A park with approximately 0.5 miles of unarmored shoreline is located 0.1 miles downstream from the project site along the north bank.

The past and ongoing anthropogenic impacts described above have impacted PS Chinook salmon and PS steelhead and their habitat resources at the project site and surrounding areas. However, adult and juvenile PS Chinook salmon and PS steelhead continue to migrate and or rear through the project area annually.

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 (see 50 CFR 402.02). 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 the factors set forth in 50 CFR 402.17(a) and (b).

As described in Section 1.3, the USACE would authorize the repair of an existing residential pier structure with in- and over-water work occurring for approximately three consecutive days. In-water work would occur between July 16 and July 31, or between November 16 and February 1.

The project would replace an existing pier structure, consisting of a 171-square-foot, solid-wood-decked float with a swim ladder and swim step that is attached to an aluminum ramp. The total over-water area of the float, ramp, swim ladder, and swim step is 196 square feet. The float is supported by a total of 4 galvanized steel piles, as well as 10 float tubs located underneath the float. The repair would replace the two southernmost steel piles with 4-inch-diameter epoxy-coated steel piles (Figure 2). The wooden decking and the aluminum ramp would be replaced with grated polymer decking with a 42% open surface. The replacement components would be the same dimensions as the current structure. Work would primarily be done by hand or from a construction barge, and would include the removal of the wooden deck and two piles, the vibratory installation of new steel piles, and the installation of the grated decking.

The potential effects of the proposed action can be generally characterized as direct and indirect work-related effects, and long-term indirect effects associated with the structure and its use. The work-related effects would include noise, water contamination, propeller wash, and forage diminishment. The USACE's authorization of the project would also have the additional effect of extending the operational life of the applicant's pier structure by several decades beyond that of the existing structure. Over that time, the pier's presence and normal operations would cause effects on fish and habitat resources through pier-related altered lighting, pollutants, elevated noise, forage diminishment, and propeller wash.

As described in Section 2.2, PS Chinook salmon and PS steelhead inhabit the action area. The planned July in-water work window overlaps with the beginning of the general migration window of adult PS Chinook salmon. However, adult PS Chinook salmon are unlikely to be present within the action area during July as warm water temperatures in Lake Washington and the Washington Ship Canal during July and August generally create a thermal barrier against the onset of migration upstream into the Sammamish River. Additionally, adult Chinook salmon migration in nearby streams is documented to begin in September. The planned November to February in-water work window overlaps with the migration of adult PS steelhead through the action area, with spawning occurring well upstream of the project site. However, PS steelhead are very rare in the Sammamish River watershed, therefore it is unlikely that any PS steelhead would be present during project-related work.

The action's work window avoids the normal emigration season for juveniles of both species, as well as the spawning season for Chinook salmon within the project area. Extremely low numbers of stream-type rearing juvenile PS Chinook salmon may be present in the action area during both work windows, but make up a very small subset of any year's cohort. Juvenile PS steelhead are likely to be well upstream of the project area during the November to February in-water work window and are not likely to be present during the July in-water work window. Additionally, very little juvenile salmonid rearing occurs in the river stretch, and the duration of work would be very brief. Therefore, it is extremely unlikely that any juvenile salmonids would be exposed to construction-related effects. It is also unlikely that any PS Chinook salmon redds at or downstream from the project site would be exposed to construction-related effects due to proposed best management practices (BMPs) and the action's work window.

However, both species could be exposed to the action's long-term indirect effects which would occur year-round. It is very likely that shoreline-obligated juveniles of both species would pass through the project area during their annual emigration seasons, where they would be exposed to the action's indirect effects identified above. Spawning adult PS Chinook salmon and redds at or downstream from the project site would also be exposed to these long-term indirect effects.

2.5.1 Effects on Listed Species

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

Construction-related Direct Effects

Construction-related direct effects (i.e. construction-related noise, water contamination, turbidity, and propeller wash) are unlikely to adversely affect PS Chinook salmon and PS steelhead because it is extremely unlikely that individuals of either species would be present during the proposed work window.

These construction-related direct effects are also unlikely to adversely affect Chinook salmon redds as spawning will occur outside of the work windows and the use of a full-depth sediment curtain adjacent to the project site would prevent any suspended solids from impacting riverbed substrate within the action area. Additionally, due to a very small quantity of piles (two) to be removed, the project is not expected to produce extended or significant amounts of turbidity.

Pier-related Altered Lighting

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

Upon project completion, the applicant's pier would continue to extend 14 feet from the shoreline and have an overwater footprint of 196 square feet. The water depths under the replaced pier would range to about 8 feet at its offshore end. Although the project would fully grate the pier's surface, the pier and the moored vessel would continue to create unnatural daytime shade over the water and aquatic substrate. Additionally, artificial illumination on the moored vessel would create occasional unnatural nighttime lighting conditions.

Shade: As stated above, the project site would continue to cast shadows over water and aquatic substrate. 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. That shade would create conditions under and adjacent to the pier's footprint that reduce aquatic productivity, alter juvenile salmonid migratory behaviors, and increase juvenile salmonids' exposure and vulnerability to predators as compared to unshaded similar habitat will be maintained.

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 the pier and moored vessels would continue to 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 impacts on aquatic productivity from shade related to the applicant's pier might not measurably affect the fitness of migrating juvenile salmonids. However, because the applicant's pier is situated among many bankside over-water structures that also impact aquatic productivity through shade, the combined impacts of shade would act to maintain a long stretch of migratory habitat with diminished shelter and forage resources for juvenile salmonids. Therefore, over the life of the applicant's pier, at least some juvenile Chinook salmon and juvenile steelhead that migrate through the project area would experience some degree of reduced fitness due to diminished shelter and forage resources that would be attributable to the shadow caused by 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 shade of the new grated pier would be reduced compared to the solid surface of the existing pier, the pier's shade is likely to continue to alter the migratory behavior for at least some of the juvenile Chinook salmon that pass through the project area, and inhibit some from migrating along the shoreline, which is typical behavior for juvenile Chinook salmon at this life stage. The shade would delay the passage under the pier for some, and or induce some individuals to swim around it, effectively forcing them to remain in open and relatively deep waters. Swimming around the pier would increase the migration distance and time for affected fish, and the off-bank migration is likely to increase their energetic costs (Heerhartz and Toft 2015). 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). Shade-related altered migratory behaviors would mostly affect juvenile PS Chinook salmon because most of the juvenile PS steelhead that pass through this part of the waterway are relatively large and shoreline independent, as are the adults of both species. However, shade-related increased exposure to predatory fish species would affect the juveniles of both species.

<u>Artificial Illumination:</u> The vessel moored at the pier would have a lighting system that would cause nighttime artificial illumination of river waters. Nighttime artificial illumination of the water's surface attracts fish (positive phototaxis) in marine and freshwater environments. It often shifts nocturnal behaviors toward more daylight-like behaviors, and it can affect light-mediated behaviors such as migration timing (Becker et al. 2013; Celedonia and Tabor 2015; Ina et al. 2017; Tabor and Piaskowski 2002; Tabor et al. 2017).

Tabor and Piaskowski (2002) report that juvenile Chinook salmon in lacustrine environments typically feed and migrate during the day, and are inactive at night, residing at the bottom in shallow waters. They tend to move off the bottom and become increasingly active at dawn when light levels reach 0.8 to 2.1 lumens per square meter. Tabor et al. (2017) found that sub-yearling Chinook, coho, and sockeye salmon exhibit strong nocturnal phototaxic behavior when exposed to levels of 5.0 to 50.0 lumens per square meter, with phototaxis positively correlated with light intensity. Celedonia and Tabor (2015) found that juvenile Chinook salmon in the Lake Washington Ship Canal were attracted to artificially lit areas at 0.5 to 2.5 lumens per square meter. The authors also reported that attraction to artificial lights may delay the onset of morning migration by up to 25 minutes for some juvenile Chinook salmon migration through the Lake Washington Ship Canal.

Moored vessels are likely to be episodically illuminated at night, and may illuminate the water surface at levels above 0.5 lumens. However, most incidences of boat-related nighttime illumination would likely occur during the summer boating season after most juvenile salmon have departed the river. Based on the available information, vessel-related artificial illumination is likely to episodically cause very brief periods of phototaxis for juvenile Chinook salmon and juvenile steelhead that are within about 20 feet of the pier structure.

Summary: Pier-related altered lighting 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, and the intensity of any effects that an exposed individual may experience are unquantifiable with any degree of certainty. However, the best available information about the size of the affected population, combined with the ample width of the river for emigrating juvenile salmonids support the understanding that the subsets of the juvenile PS Chinook salmon and juvenile PS steelhead that would annually emigrate through the project area would be small and variable over time, and extremely small subsets of their respective cohorts. Therefore, the annual numbers of juvenile PS Chinook salmon and juvenile PS steelhead that would be meaningfully affected by pier-related altered lighting would be too low to cause detectable population-level effects.

Pier-related Pollutants

Pier-related pollutants are 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 and reduced prey availability. PS Chinook salmon eggs may also be adversely affected by pier-related pollutants. This stressor would cause minor effects in adults of both species.

The new steel piles would be epoxy coated, and therefore very unlikely to leach zinc into the water. The timber used to frame the float would be treated with Ammoniacal Copper Zinc Arsenate (ACZA), which contains copper, as does the anti-fouling paint that may coat the hulls any vessels that would moor at the pier. Additionally, vessel operation at the pier is likely to result in the discharge of petroleum-based fuels and lubricants into the water.

PS Chinook salmon and PS steelhead can uptake contaminants directly through their gills, and through dietary exposure (Karrow et al. 1999; Lee and Dobbs 1972; McCain et al. 1990; Meador et al. 2006; Neff 1982; Varanasi et al. 1993). Direct exposure to water-borne pollutants can cause effects in exposed fish that range from avoidance behaviors, to reduced growth, altered immune function, and immediate mortality in exposed individuals. 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, 2005, and 2006; Mcintyre et al. 2012; Meadore et al. 2006; Sandahl et al. 2007; 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). Exposure to petroleum-based chemicals such Polycyclic Aromatic Hydrocarbons (PAHs) can cause reduced growth, increased susceptibility to infection, and increased mortality in juvenile salmonids (Meador et al. 2006; Varanasi et al. 1993). PAHs bioconcentrate to high levels in fertilized fish eggs, and have been shown to cause complete heart failure and extra-cardiac defects that often lead to mortality at or soon after hatching. In larval fish, PAH exposure has been shown to cause abnormal development of the heart, eye and jaw structure, and energy reserves (Harding et al. 2020; NWFSC 2022).

Copper: Any timber installed as part of the repair and replacement to the pier structure would be treated with ACZA. 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. 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 but expected to be very low, episodic, brief, and limited to the area immediately adjacent to the repaired pier because all treated timber would be installed above the water.

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 expected to be extremely low based on the open nature of the mooring and the expectation that no more than 1 boat would moor at the site at any time.

Neither action-related copper source is expected to cause very high concentrations. However, those sources would be additive to each other and to the numerous nearby moorage structures. Therefore, the NMFS expects that action-related dissolved copper would episodically cause copper concentrations to exceed the threshold for the onset of detectable effects in the area immediately adjacent to the applicant's pier, and that over the life of the 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. Similarly, chronic exposure is likely to cause varying reduced long-term survival in some of the exposed Chinook salmon eggs within the action area.

Petroleum-based fuels and lubricants: The vessel 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.

Vessel discharges would likely 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, those discharges would occur repeatedly over the decades-long life of the pier. Additionally, the action-related petroleum-based pollutants would be additive to the background pollutant concentrations in the Sammamish River that result from the high levels of vessel operation on the river and from outfalls that discharge stormwater from the surrounding roads. Therefore, over the decades-long life of the pier, some juvenile PS Chinook salmon and juvenile PS steelhead are likely to be directly exposed to pier-related petroleum-based pollutants at concentrations high enough to measurably alter their normal behaviors and reduce their fitness. Similarly, chronic exposure is likely to cause varying reduced long-term survival in some of the Chinook salmon exposed eggs within the action area.

The annual numbers of juveniles of either species or Chinook salmon eggs that may be exposed to pier-related contaminated water, the contaminant concentration levels that any individual fish may be directly exposed to, and the intensity of any effects that an exposed individual may experience are unquantifiable with any degree of certainty. However, the numbers of individuals that would be detectably affected are expected to be very low and highly variable over time. Further, the majority of their typical emigration seasons are well outside of the typical summer boating season when pier-related contamination levels would be highest. Therefore, the annual numbers of juveniles of either species or Chinook salmon eggs that may be exposed to pier-related contaminated water 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

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

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

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

The discussion in Stadler and Woodbury (2009) indicate that these thresholds likely overestimate the potential effects of exposure to impulsive sounds. Further, Stadler and Woodbury’s assessment did not consider non-impulsive sound, which is believed to be less injurious to fish than impulsive sound. Therefore, application of the criteria to non-impulsive sounds is also likely to overestimate the potential effects in fish. However, these criteria represent the best available information. Therefore, to avoid underestimating potential effects, this assessment applies these criteria to the non-impulsive sounds that are expected from dock-related noise to gain a conservative idea of the potential effects that fish may experience due to exposure to that noise. Elevated in-water noise at levels capable of causing detectable effects in exposed fish would be caused by vessel operations at the applicant’s pier, which would provide mooring for one vessel. The applicant reports that any vessel moored at the pier would be up to 25 feet in length.

The estimated in-water source levels (SL, sound level at 1 meter from the source) used in this assessment are based on numerous sources that describe sound levels for ocean-going ships, tugboats, and recreational vessels (Blackwell and Greene 2006; McKenna et al. 2012; Picciulin et al. 2010; Reine et al. 2014; Richardson et al. 1995). The best available information about the source levels from vessels close in size to those that would operate at the marina is also described in the acoustic assessment done for a similar project (NMFS 2018). In this assessment, we used vessel noise from a tugboat and a 23-foot long power boat as surrogates for the vessel likely to moor at the applicant’s pier. All of the expected peak source levels are below the 206 dB_{peak} threshold for instantaneous injury in fish.

In the absence of location-specific transmission loss data, variations of the equation RL = SL – #Log(R) are often used to estimate the received sound level at a given range from a source (RL = received level (dB); SL = source level (dB, 1 m from the source); # = spreading loss coefficient; and R = range in meters (m). Numerous acoustic measurements in shallow water environments support the use of a value close to 15 for projects like this one (CalTrans 2015). This value is considered the practical spreading loss coefficient, and was used for all sound attenuation calculations in this assessment.

Application of the practical spreading loss equation to the expected SEL SLs suggests that noise levels above the 150 dB_{SEL} threshold would extend between about 33 feet (10 m) and 72 feet (22 m) from the representative vessels (Table 4).

Table 4. Estimated in-water source levels for vessels with noise levels similar to those likely to moor at the applicant's pier, and ranges to effects thresholds for fish.

Source	Acoustic Signature	Source Level	Threshold Range
Tugboat	< 2 kHz Combination	185 dB_{peak}	206 @ N/A
Episodic periods measured in minutes to hours		170 dB_{SEL}	150 @ 22 m
23 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

Individual vessel operations around mooring structures typically consist of brief periods of relatively low-speed movement as boats are driven to the piers 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. Therefore, it is extremely unlikely that vessels would be run at anything close to full speed while near the piers. However, they may briefly use high power settings while maneuvering.

To be protective of fish, this assessment estimates that pier-related in-water vessel noise levels above the 150 dB_{SEL} threshold could routinely extend 72 feet (22 m) around the marina. Vessel noise levels would be non-injurious. However, juvenile Chinook salmon and steelhead that are within the 150 dB_{SEL} isopleth, are likely to experience behavioral disturbances, such as acoustic masking, startle responses, altered swimming patterns, avoidance, and increased risk of predation. Elevated noise levels within the action area could also drive adult Chinook salmon away from preferred spawning habitats. 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 individuals that are eaten by predators would obviously be killed.

The annual numbers of PS Chinook salmon and PS steelhead that would be impacted by this stressor, and the intensity of any effects that an exposed individual may experience are unquantifiable with any degree of certainty. However, for the same reasons expressed for altered lighting, the juvenile PS Chinook salmon and juvenile PS steelhead that would annually emigrate through the project area would comprise small and variable subsets of each year's cohort. Further, the typically episodic and short-duration of vessel operations at the dock, combined with the knowledge that the peak boating season occurs after the juveniles have left the ship canal suggests 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 elevated noise 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.

Work-related and Pier-related Forage Diminishment

Work-related and Pier-related forage diminishment is likely to adversely affect juvenile PS Chinook salmon and juvenile PS steelhead. It is extremely unlikely that adults of either species would be exposed to this stressor.

In addition to direct uptake of contaminants through their gills, fish can absorb contaminants through dietary exposure (Meador et al. 2006; Varanasi et al. 1993). Amphipods and copepods uptake contaminants such as PAHs from contaminated sediments (Landrum and Scavia 1983; Landrum et al. 1984; Neff 1982), and pass them to juvenile Chinook salmon and other small fish through the food web. Varanasi et al. (1993) found high levels of PAHs in the stomach contents of juvenile Chinook salmon in the contaminated Duwamish Waterway. They also reported reduced growth, suppressed immune competence, as well as increased mortality in juvenile Chinook salmon that was likely caused by the dietary exposure to PAHs. Meador et al. (2006) demonstrated that dietary exposure to PAHs caused "toxicant-induced starvation" with reduced growth and reduced lipid stores in juvenile Chinook salmon. The authors surmised that these impacts could severely impact the odds of survival in affected juvenile Chinook salmon.

While not specifically documented, the sediments at the project site are likely contaminated due to the history of anthropogenic disturbance and development within the action area. Based on findings from similar projects in the Sammamish River, the NMFS assumes that the sediments at the project site likely contain legacy contaminants that include PAHs, Polychlorinated Biphenyls, and various metals. Although located near shore, the extraction of the two existing steel piles at or below the mudline would mobilize small amounts of those contaminated subsurface sediments, which would settle onto the top layer of the substrate, where the contaminants would remain biologically available for years. Similarly, any work involving pile removal or installation is likely to mobilize contaminated sediments. Also, as identified above under pier-related altered lighting and pollutants, the continued presence of the repaired pier and its related operations are likely to cause adverse impacts on forage resources at the project site.

Romberg (2005) discusses the spread of contaminated sediments that were mobilized by the removal of creosote-treated piles from the Seattle Ferry Terminal, including digging into the sediment with a clamshell bucket to remove broken piles. Soon after the work, high PAH levels were detected up to 800 feet away, on the surface of a clean sand cap that had been installed less than a year earlier. Contaminant concentrations decreased with distance from the pile removal site, and over time. However, PAH concentrations remained above pre-contamination levels 10 years later. Lead and mercury values also increased on the cap, but the concentrations of both metals decreased to background levels after 3 years.

Given the dramatic difference in the scale of disturbance between the planned pile removal and the one described by Romberg (2005), the proposed project's sediment mobilization would be extremely less intense. Most of the mobilized sediment, and therefore the highest concentrations of contaminants, would settle onto the top layer of the substrate within 10s of feet around the pile removal. However, barge and recreational vessel propeller wash could spread sediments as far as 300 feet around the project site. The contaminated sediments that settle to the bottom would remain biologically available to juvenile PS Chinook salmon and juvenile PS steelhead for years after project completion. While present, some of those contaminants are likely to be taken up by invertebrate prey organisms within the affected area.

The normal behaviors of juvenile Chinook salmon in the freshwater out-migration phase of their life cycle include 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 years-long presence of available contaminants at the site, some out-migrating juvenile steelhead are likely to pass through and forage within the project area.

Additionally, increased contaminant levels from construction activities and pier-related vessel operation is likely to kill some prey organisms, reducing the number, size, and diversity of prey species that are available to foraging juvenile salmonids that pass through the affected area. 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).

The exact number of years that detectable amounts of construction-related contaminants would be biologically available at the site is uncertain, but is expected to be very low. Similarly, the annual numbers of juvenile PS Chinook salmon and juvenile PS steelhead that may be exposed to construction-related contaminated forage are uncertain. However, for the same reasons expressed for altered lighting, the juvenile PS Chinook salmon and juvenile PS steelhead that would annually emigrate through the project area would comprise small and variable subsets of each year’s cohort.

Similarly, the amounts of contaminated prey that individual fish may consume, or the intensity of effects that exposed individuals may experience are uncertain and likely to be highly variable. However, the small amount of sediment that would be mobilized suggests that the number of years that detectable contaminants would be present would be very low. Further, the affected area would be relatively small. This suggests that the probability of trophic connectivity to the contamination would be very low for any individual fish, and that the numbers of juvenile PS Chinook salmon and juvenile PS steelhead that would be annually exposed to project-related contaminated prey would be too small to cause detectable population-level effects.

Pier-related Propeller Wash

Pier-related propeller wash is likely to adversely affect juvenile PS Chinook salmon and juvenile PS steelhead, but cause only minor effects in adults of both species. It is unlikely to affect any PS Chinook salmon redds located within the action area because propeller thrust from boats would not likely contact the substrate due to adequate water depths at the mooring and waterway areas. Additionally, the fine substrate (sand and gravel) identified at the project site is unlikely to support spawning. However, smolt PS Chinook salmon are likely to be adversely affected to the same degree as juvenile PS Chinook salmon.

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 SAV, particularly in shallow water and or at high power settings (propeller scour).

Juvenile Chinook salmon and steelhead 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. Conversely, adults of both species would tend to stay below the surface. Further, 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. Juveniles that are struck or very nearly missed by the spinning propellers of boats at the pier would be injured or killed by the exposure. At greater distances, the boats' propeller wash may 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. Although the likelihood of this interaction is very low for any individual fish or individual boat trip, it is very likely that over the decades-long 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 applicant's pier.

The annual numbers of juvenile PS Chinook salmon and PS steelhead that would be exposed to propeller wash, and the intensity of any effects that an exposed individual may experience are unquantifiable with any degree of certainty. However, for the same reasons expressed for altered lighting, the juvenile PS Chinook salmon and juvenile PS steelhead that would annually emigrate through the project area would comprise small and variable subsets of each year's cohort. Further, the typically episodic and short-duration of vessel operations at the pier, combined with the knowledge that the peak boating season occurs after the juveniles have left the river suggests 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 marina-related propeller wash 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.

The relatively deep water under the vessel supporting portion of the pier (8 feet), combined with the expectation that low power settings would typically be used when a vessel maneuver near the pier, suggests that propeller scour would cause little to no measurable effects on benthic resources at the site. Therefore, it is extremely unlikely that pier-related benthic propeller scour would cause any detectable effects on the fitness and normal behaviors of Chinook salmon and steelhead.

2.5.2 Effects on Critical Habitat

This section is left blank because the project site is outside of designated critical habitat and, as described in the "Not Likely to Adversely Affect" Determinations section (2.12), the proposed action is extremely unlikely to cause detectable effects on any designated critical habitat under NMFS jurisdiction.

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 discussion of the environmental baseline (Section 2.4).

The current conditions of ESA-listed species and designated critical habitat within the action area are described in the Range-wide Status of the Species and Critical Habitat and Environmental Baseline sections above. The non-federal activities in and upstream of the action area that have contributed to those conditions include past and on-going 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 input from point- and non-point pollutant sources will likely continue and increase into the future. Recreational and commercial use of the waters within the action area are also likely to increase as the human population grows.

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

2.7 Integration and Synthesis

The Integration and Synthesis section is the final step in assessing the risk that the proposed action poses to species and critical habitat. In this section, we add the effects of the action (Section 2.5) to the environmental baseline (Section 2.4) and the cumulative effects (Section

2.6), taking into account the status of the species and critical habitat (Section 2.2), to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) appreciably diminish the value of designated or proposed critical habitat as a whole for the conservation of the species.

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

Climate change may also impact coastal waters through elevated surface water temperature, increased and variable acidity, increasing storm frequency and magnitude, and rising sea levels. The adaptive ability of listed-species is uncertain, but is likely reduced due to reductions in population size, habitat quantity and diversity, and loss of behavioral and genetic variation.

The proposed action will cause direct and indirect effects on the ESA-listed species considered in this opinion well into the foreseeable future. However, the action's effects on water quality, substrate, and the biological environment are expected to be of such a small scale that no detectable effects on ESA-listed species through synergistic interactions with the impacts of climate change are expected.

2.7.1 ESA Listed Species

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

PS Chinook salmon

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

The PS Chinook salmon most likely to occur in the action area would be fall-run Chinook salmon from the Sammamish River population, which is part of the South Puget Sound MPG. The population is considered at high risk of extinction due to low abundance and productivity.

The project site is located in the City of Kenmore, along the north bank of the Sammamish River, approximately 1.3 miles upstream from its confluence with Lake Washington (Figure 1), which serves as a freshwater migration route to and from marine waters for adult and juvenile PS Chinook salmon from the affected population, as well as spawning habitat. 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 seasons for PS Chinook salmon, as well as the spawning season within the project area. However, low numbers of out-migrating juveniles that annually pass through the project area over the next several decades would be exposed to low levels of diminished 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. Additionally, redds located within the area of effect could be intermittently exposed to low levels of pier-related pollutants, which could reduce the likelihood of survival for extremely low numbers of Chinook salmon eggs and or alevin. However, the annual numbers of individuals that would be meaningfully affected by action-related stressors would be too low to cause any population-level effects.

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

The PS steelhead most likely to occur in the action area would be winter-run fish from the North Lake Washington/Lake Sammamish DIP. The abundance trend between 1984 and 2016 was strongly negative for the DIP, and ten or fewer adult natural-spawners are estimated to return to the DIP annually.

The project site is located in the City of Kenmore, along the north bank of the Sammamish River, approximately 1.3 miles upstream from its confluence with Lake Washington (Figure 1), which serves as a freshwater migration route to and from marine waters for adult and juvenile PS steelhead from the affected DIP. 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.

Based on the rarity of PS steelhead in the watershed, combined with the small project area and the relatively short duration of the project's in-water work, it is extremely unlikely that any steelhead would be directly exposed to work-related effects. However, over the next several decades, extremely low numbers of emigrating juveniles are likely to pass through the project site where they would be exposed to slightly altered habitat conditions and slightly diminished forage resources that individually and collectively would cause some combination of altered behaviors, reduced fitness, and mortality in some of the exposed individuals. However, the annual numbers of individuals that would be meaningfully affected by action-related stressors would be too low to cause any population-level effects.

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 DIP. Therefore, the proposed action would not appreciably reduce the likelihood of survival and recovery of this listed species.

2.7.2 Critical Habitat

This section is left blank because the project site is outside of designated critical habitat and, as described in the "Not Likely to Adversely Affect" Determinations section (2.12), the proposed action is extremely unlikely to cause detectable effects on any designated critical habitat under NMFS jurisdiction.

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, and as described in the "Not Likely to Adversely Affect" Determinations section (2.12), the proposed action is extremely unlikely to cause detectable effects on any designated critical under NMFS jurisdiction.

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 Amount or Extent of Take

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

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

- Pier-related altered lighting,
- Pier-related pollutants,
- Pier-related noise,
- Work-related and pier-related forage diminishment, 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 listed fish that occur within the action area are affected by numerous biotic and environmental processes, such as timing in relation to the life stage and typical behaviors of the species under consideration, intra- and inter-specific interactions such as competition and predation, habitat quality, and the interaction of processes that influence genetic, population, and environmental characteristics. These processes interact in ways that may be random or directional, and may operate across far broader temporal and spatial scales than are affected by the proposed action. Therefore, the distribution and abundance of listed fish in any given area are likely to vary greatly, and somewhat randomly, over time. Further, the NMFS knows of no device or practicable technique that would yield reliable counts of individuals that may be injured or killed annually by exposure to the proposed action’s impacts. In such circumstances, the NMFS uses the causal link established between an activity and the likely extent and duration of changes in habitat conditions as surrogates to describe the extent of take as a numerical level of habitat disturbance. The most appropriate surrogates for take are action-related parameters that are directly related to the magnitude of the expected take.

For this action, the timing of in-water work is applicable because the proposed in-water work window avoids the expected presence of PS Chinook salmon in the project area. Therefore, working outside of the proposed work window would likely increase the number of juvenile PS Chinook salmon that would be exposed to work-related stressors. Note that in addition to any work done on structural components that are in the water, this opinion considers any work that includes the use of any vessel (i.e. barge) to constitute in-water work, even if the structural component being worked on is above the water's surface.

The pile removal method and the extent of the visible turbidity plumes around that work are the best available surrogates for the extent of take of juvenile PS Chinook salmon and juvenile PS steelhead from diminished forage. The method of removal is appropriate because the intensity of surface sediment contamination would be positively correlated with the amount of contaminated subsurface sediments that would be brought to the surface, which is positively correlated with the extraction method. The proposed pulling of piles with a vibratory pile extractor within full-depth sediment curtains would minimize sediment mobilization compared to other methods such as the use of excavators or water-jetting. As the amount of mobilized contaminated sediments increase, the amount of biologically available contaminants would increase, as would the intensity of prey contamination and prey mortality. The lateral extent of the visible turbidity plumes around pile extraction is appropriate because the size the affected areas would be positively correlated with the extent of the plume, and the amount of prey diminishment and or exposed juvenile salmonids would be positively correlated with the size the affected area. In summary, any increase in the amount of mobilized sediment or the in the size of the affected area would increase the intensity of the exposure and or the number of exposed juvenile PS Chinook salmon and juvenile PS steelhead.

The size and configuration of the pier are the best available surrogates for the extent of take of juvenile PS Chinook salmon and juvenile PS steelhead from exposure to pier-related altered lighting, pollutants, noise, and propeller wash. Size and configuration are appropriate for altered lighting because salmonid avoidance and the distance required to swim around the pier would both increase as the size and opacity of the dock increase.

Size and configuration are also appropriate for pier-related pollutants, 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. As boating activity increases, the potential for, and the intensity of exposure to the related pollutants, noise, and propeller wash would also increase for juvenile PS Chinook salmon and juvenile PS steelhead. Additionally, as the size of the pier increases, the amount of AZCA-treated lumber that would be used for repairs would increase, which would increase the amount of ACZA-realted 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:

- In-water work to be completed between July 16 and July 31, or between November 16 and February 1;
- Pile removal, installation, and repair work as described in the proposed action section of this biological opinion;
- Visible turbidity plumes extending up to 300 feet from project-related work ; and
- The post-construction size and configuration of the applicant's pier structure as described in the proposed action section of this biological opinion.

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

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

2.9.2 Effect of the Take

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

2.9.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" 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, and the applicant have a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this ITS (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

1. The following terms and conditions implement reasonable and prudent measure 1:

   a. The USACE shall require the applicant to develop and implement plans to collect and report details about the take of listed fish. That plan shall:
      i. Require the applicant and or their contractor to maintain and submit records to verify that all take indicators are monitored and reported. Minimally, the records should include:
         1. Documentation of the timing and duration of in-water work to ensure that all in-water work is completed between July 16 and July 31, or between November 16 and February 1;
         2. Documentation of the number, type, and size of installed piles and the method of installation;
         3. Documentation of the number and method of pile extraction;
         4. Documentation of the lateral extent of the turbidity plumes, and measures taken to maintain them within 300 feet; and
         5. Documentation of the size, and configuration of the replacement over-water structures to confirm that they do not exceed the characteristics described in this opinion.
      ii. Require the applicant to establish procedures for the submission of the construction records and other materials to the appropriate USACE office, and to submit an electronic post-construction report to the NMFS within six months of project completion. Send the report to: projectreports.wcr@noaa.gov. Be sure to include Attn: WCRO-2021-02062 in the subject line.

2.10 Conservation Recommendations

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

The proposed project includes design characteristics that would limit the impacts of the planned in-water features on listed fish and on the quantity and quality of aquatic habitat features. It also includes a comprehensive set of BMPs to minimize work-related effects. The NMFS knows of no other reasonable measures that the applicant could include to further reduce the project's effects on listed fish, and consequently offers no conservation recommendations.

2.11 Re-initiation of Consultation

This concludes formal consultation for the USACE's authorization of the Vallene Float Repair Project in the Sammamish River, 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 2 and below, the NMFS has concluded that the proposed action is not likely to adversely affect designated critical habitat for PS Chinook salmon, as well as SR killer whales and their designated critical habitat. Detailed information about the biology, habitat, and conservation status and trends of PS Chinook salmon and SR killer whales be found in the listing regulations and critical habitat designations published in the Federal Register, as well as in the recovery plans and other sources at: https://www.fisheries.noaa.gov/species-directory/threatened-endangered, which are incorporated here by reference.

Under the ESA, "effects of the action" means the direct and indirect effects of an action on the listed species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action (50 CFR 402.02). 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 that are extremely unlikely to occur.

2.12.1 Effects on Listed Species

The effects analysis in this section relies heavily on the descriptions of the proposed action and project site conditions discussed in Sections 1.3 and 2.4, and on the analyses of effects presented in Section 2.5. As described in Section 2.5, the range of detectable action-related stressors would be limited to the waters and substrates within about 300 feet around project activities in the Sammamish River.

SR killer whales

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

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

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

Second, as described in Sections 1.3, 2.2, and 2.5, the only PS Chinook population that would be affected by the project would be the Sammamish River population that migrates through the Sammamish River, which is a small population. Total abundance between 1980 and 2020 has fluctuated between about 300 and 1,500 spawners for the population (Ford 2022). Consequently, the population makes up a very small portion of the adult Chinook that are available to SR killer whales in marine waters. Therefore, based on the best available information, the proposed action is not likely to adversely affect SR killer whales.

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.

PS Chinook salmon Critical Habitat: Designated critical habitat for PS Chinook salmon includes 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, from the high tide line and out to a depth of 30 meters.

Based on the analysis of effects presented in Section 2.5, the proposed action would cause minor short- and long-term adverse effects on Chinook salmon-supportive habitat features within 300 feet of the project site. However, the nearest PS Chinook salmon critical habitat ends in the downstream end of the Sammamish River, about 1 mile downstream from the project site. Therefore, the proposed action is extremely unlikely to cause detectable effects on any PBFs of PS Chinook salmon critical habitat.

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

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

2. Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth
   The proposed actions would cause long-term undetectable effects on prey availability and quality. Action-related impacts would annually injure or kill extremely low numbers of individual juvenile Chinook salmon (primary prey), during the final portion their freshwater migration lifestage. However, the numbers of affected juvenile Chinook salmon would be too small to cause detectable effects on the numbers of available adult Chinook salmon in marine waters. Therefore, it would cause no detectable reduction in prey availability and quality.

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

For the reasons expressed immediately above, the NMFS has concluded that the proposed action is not likely to adversely affect designated critical habitat for PS Chinook salmon, and SR killer whales and their designated critical habitat.

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

Section 305(b) of the MSA directs Federal agencies to consult with the NMFS on all actions or proposed actions that may adversely affect Essential Fish Habitat (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 the City of Kenmore, along the north bank of the Sammamish River, approximately 1.3 miles upstream from its confluence with Lake Washington (Figure 1). The waters and substrate of the Sammamish River are designated as freshwater EFH for various life-history stages of Pacific Coast Salmon, which within the Sammamish River 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 project area provides the spawning habitat HAPC.

3.2 Adverse Effects on Essential Fish Habitat

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

Freshwater EFH for Pacific Coast Salmon

1. Water quality: The proposed action would cause short-term and long-term minor adverse effects on this attribute. Demolition and construction would cause short-term adverse effects on water quality that would persist no more than a low number of hours after work stops. ACZA-treated timber and continued vessel operations would maintain persistent low level inputs of contaminants at the applicant's dock. Detectable water quality impacts would be limited to the area within 300 feet around the pier. The action would cause no measurable changes in water temperature or salinity.

2. Water quantity, depth, and velocity: No changes expected.

3. Riparian-stream-marine energy exchanges: No changes expected.

4. Channel gradient and stability: No changes expected.

5. Prey availability: The proposed action would cause long-term minor adverse effects on this attribute. Despite the increased light penetration under the replacement float, the pier and moored vessel would still cast over-water shade that would limit SAV growth and reduce the density and diversity of the benthic and planktonic communities under the replacement structures that are important prey resources for juvenile salmonids. Additionally, any contaminants that are mobilized during pile extraction, combined with low-level input of contaminants from moored recreational vessels would contaminate some of the available prey and or slightly diminish the number, size, and diversity of prey organisms available at the project site. Detectable effects would be limited to the area within about 300 feet around the marina structure.

6. Cover and habitat complexity: The proposed action would cause minor long-term adverse effects on this attribute. The shade-limited SAV growth identified above would reduce cover availability for juvenile salmon under and adjacent to the pier. Detectable effects would be limited to just slightly more than the 196-square-foot area under the replaced pier.

7. Space: No changes expected.

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

9. Groundwater-stream interactions: No changes expected.

10. Substrate composition: No changes expected.

Habitat Areas of Particular Concern (HAPCs)

Spawning habitat is the only HAPC likely to be affected by the proposed action. All effects on that HAPC are identified above at 1 - 4, and 10 under Freshwater EFH for Pacific Coast Salmon.

3.3 Essential Fish Habitat Conservation Recommendations

The proposed project includes design characteristics that would limit structural impacts on the attributes of freshwater EFH for Pacific Coast Salmon. It also includes a comprehensive set of BMPs to minimize work-related effects. The NMFS knows of no other reasonable measures that the applicant could include to further reduce the project's effects on EFH for Pacific Coast Salmon, and consequently offers no conservation recommendations.

3.4 Supplemental Consultation

The USACE must reinitiate EFH consultation with the NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for the NMFS' EFH Conservation Recommendations [50 CFR 600.920(l)].

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

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

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended user of this opinion is the USACE. Other interested users could include the applicant, the Washington State Department of Fish and Wildlife, 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 at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adhere to conventional standards for style.

4.2 Integrity

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

4.3 Objectivity

Information Product Category: Natural Resource Plan

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

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

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

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

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