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-2021-02367

May 2, 2022

Jacalen Printz
Chief, Regulatory Branch
U.S. Army Corps of Engineers, Seattle Regulatory
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 Northwest Aggregates Port of Vancouver Maintenance Dredging and Dolphin Replacement Project in Clark County, Washington, HUC 17080003010 (NWS-2018-1159)

Dear Ms. Printz:

Thank you for your letter dated December 2, 2021, requesting formal 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 Port of Vancouver Maintenance Dredging and Dolphin Replacement Project (NWS-2018-1159). This consultation was conducted in accordance with the 2019 revised regulations that implement section 7 of the ESA (50 CFR 402, 84 FR 45016).

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

In the attached biological opinion, NMFS concludes that the proposed action is not likely to jeopardize the continued existence of Lower Columbia River (LCR) Chinook salmon (*Oncorhynchus tshawytscha*), Snake River (SR) fall-run Chinook salmon, SR spring/summer-run Chinook salmon, Upper Columbia River (UCR) spring-run Chinook salmon, Upper Willamette River (UWR) Chinook salmon, Columbia River (CR) chum salmon (*O. keta*), LCR coho salmon (*O. kisutch*), LCR steelhead (*O. mykiss*), UCR steelhead, SR Basin steelhead, UWR steelhead, Pacific eulachon (*Thaleichthys pacificus*), or result in the destruction or adverse modification of their designated critical habitats. The U.S. Army Corps of Engineers determined the proposed action was not likely to adversely affect middle Columbia River (MCR) steelhead, SR spring/summer Chinook, SR sockeye (*O. nerka*), designated critical habitats for these three salmonids, and green sturgeon (*Acipenser medirostris*); NMFS concurs with these determinations. Support for these not likely to adversely affect determinations follows the biological opinion, in Section 2.11 of this document.

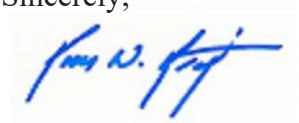
This document also includes the results of our analysis of the action's likely effects on EFH pursuant to section 305(b) of the MSA and includes two conservation recommendations to avoid, minimize, or otherwise offset potential adverse effects on EFH. These conservation recommendations are a subset of the ESA take statement's terms and conditions. Section 305(b) (4) (B) of the MSA requires Federal agencies to provide a detailed written response to NMFS within 30 days after receiving these recommendations.

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

If the response is inconsistent with the EFH conservation recommendations, the U.S. Army Corps of Engineers must explain why the recommendations will not be followed, including the scientific justification for any disagreements over the effects of the action and the recommendations.

Please contact Amanda Gillen at amanda.gillen@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: D. Guy, 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

Northwest Aggregates Port of Vancouver Maintenance Dredging and Dolphin Replacement
Clark County, Washington, HUC 17080003010
(NWS-2018-1159)

NMFS Consultation Number: WCRO-2021-002367

Action Agency: U.S. Army Corps of Engineers – Seattle District

Affected Species and NMFS' Determinations:

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?
Lower Columbia River Chinook salmon (*Oncorhynchus tschawtscha*)	Threatened	Yes	No	Yes	No
Upper Columbia River spring-run Chinook salmon	Endangered	Yes	No	Yes	No
Upper Willamette River Chinook salmon	Threatened	Yes	No	Yes	No
Snake River spring/summer Chinook salmon	Threatened	No	N/A	No	N/A
Snake River fall-run Chinook salmon	Threatened	Yes	No	Yes	No
Columbia River chum salmon *(O. keta*)	Threatened	Yes	No	Yes	No
Lower Columbia River coho salmon (*O. kisutch*)	Threatened	Yes	No	Yes	No
Snake River sockeye salmon (*O. nerka*)	Endangered	No	N/A	No	N/A
Lower Columbia River steelhead (*O. mykiss*)	Threatened	Yes	No	Yes	No
Middle Columbia River steelhead	Threatened	No	N/A	No	N/A
Upper Willamette River steelhead	Threatened	Yes	No	Yes	No
Upper Columbia River steelhead	Threatened	Yes	No	Yes	No
Snake River Basin steelhead	Threatened	Yes	No	Yes	No
Southern DPS Pacific Eulachon (*Thaleichthys pacificus*)	Threatened	Yes	No	Yes	No
Southern DPS Green sturgeon (*Acipenser medirostris*)	Threatened	No	N/A	N/A	N/A

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

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

Issued By:

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

Date: May 2, 2022

TABLE OF CONTENTS

1. INTRODUCTION

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

1.1. Background

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

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

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

1.2. Consultation History

This opinion is in response to the U.S. Army Corps of Engineers, Portland District's (USACE) request for formal consultation to review the effects of authorizing the proposed action under Section 404 of the Clean Water Act, on ESA-listed species and their critical habitats listed in Table 1.

On September 17, 2021, NMFS received a request for informal consultation. A biological evaluation from their agent, Confluence Environmental Company, along with supplemental information was provided with this request.

On November 22, 2021, NMFS emailed the USACE requesting formal consultation. On December 2, 2021, the USACE responded requesting formal consultation.

After an initial review, NMFS determined the consultation package to be complete and initiated formal consultation on December 2, 2021.

Table 1. Listed species and critical habitat affected by the proposed action, species status, and FR notice dates

ESU or DPS Species	Listing Notice	Listing Status	Critical Habitat Listing
Chinook salmon (*Oncorhynchus tshawytscha*)			
Lower Columbia	6/28/2005 70 FR 37160	Threatened	9/2/2005. 70 FR 52630
Upper Columbia	6/28/2005 70 FR 37160	Endangered	9/2/2005 70 FR 52630
Upper Willamette River	6/28/2005 70 FR 37160	Threatened	9/2/2005 70 FR 52630
Snake River Spring/Summer	6/28/2005 70 FR 37160	Threatened	10/25/1999 64 FR 57399
Snake River Fall	6/28/2005 70 FR 37160	Threatened	10/25/1999 64 FR 57399
Coho salmon (*O. kisutch*)			
Lower Columbia	6/28/2005 70 FR 37160	Threatened	2/24/2016 81 FR 9252
Chum salmon (*O. keta*)			
Columbia River	6/28/2005 70 FR 37160	Threatened	9/2/2005 70 FR 52630
Steelhead (*O. mykiss*)			
Lower Columbia River	1/5/2006 71 FR 834	Threatened	9/2/2000 70 FR 52630
Upper Columbia River	1/5/2006 71 FR 834	Threatened	9/2/2005 70 FR 52630
Upper Willamette River	1/5/2006 71 FR 834	Threatened	9/2/2005 70 FR 52630
Snake River Basin	1/5/2006 71 FR 834	Threatened	9/2/2005 70 FR 52630
Pacific Eulachon (*Thaleichthys pacificus*)			
Southern DPS	3/18/10 75 FR 13012	Threatened	10/20/2011 76FR 65324

1.3. Proposed Federal Action

Under the ESA, "action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (see 50 CFR 402.02). Under 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 issue permits under section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act to the Port of Vancouver (Port) authorizing dredging and ancillary activities (dolphin replacement) that would allow Northwest Aggregates, which preforms dredging operations at the Port of Vancouver, to perform maintenance dredging in the Columbia River at river mile 103. Northwest Aggregates operates a barge off-loading facility at their location at the Port in Vancouver, Washington, in Clark County. The dredging action will take place at -15 feet to the Columbia River datum and will remove up to 10,000 cubic yards (cy) of material from the barge berth over a 10-year period using a mechanical dredge with a clamshell

bucket located on a derrick crane mounted barge during a work window of October 1-December 31. This material will include sand and silt deposited by the Columbia River as well as fugitive material (material that enters the water from off-loading of barges, primarily mined material such as rock, coarse sand, and crushed/fractured aggregates). The sediment within the action area consists of Columbia River deposits and 30 years of accumulation of NW Aggregates Material that is incidentally deposited into the river during off-loading. The USACE's Dredged Material Management Program (DMMP) evaluated the project and determined that the sediment exposed by dredging will likely meet the State of Washington antidegradation standard, meaning DMMP testing of the leave surface is not required for the project.

The dredged material will be placed on a flat deck barge lined with silt cloth which will passively dewater on site. The material will then be barged downstream to be deposited at NW Aggregates Santosh Aggregate Plant located in Scappoose, Oregon. Once the material is at the disposal site, the material will be offloaded at the barge slip area and stored in an upland storage area, and further dewatered. It will then be trucked to reclaim pit B which is located onsite. The upland storage area is constructed for dredged material dewatering purposes and is bermed on the canal side to prevent the dredge material and associated water from re-entering the canal. The water associated with the dredged material will be collected and directed to an on-site conveyance system southwest of the canal into pit A. The dredge disposal location is used for mine reclamation purposes.

The purpose of the action is to maintain safe navigation. If left too shallow, material that has accumulated at the river bottom can compromise the draft of incoming barges and create unsafe conditions for barge and tug employees.

The dredge activities will be completed in a 1- to-2-day period roughly every three years during the work window. Dredge quantities are expected to vary between each event, but an estimated 3,000 cy of material will be dredged every 3-years with up to 10,000 cy during the 10-year time frame that this biological opinion covers.

The action also includes a one-time repair of a damaged dolphin located west of the barge dock in an area owned by the Washington State Department of Natural Resources. NW Aggregates will use a construction barge adjacent to the damaged dolphin and will spud into the substrate in order to hold the barge in position. A barge-mounted crane will be used to lift out the 3 steel piles associated with the damaged dolphin. The damaged piles will be taken off site for storage or recycling at an approved upland facility Pile installation will occur immediately after pile removal and will take one standard 10-hour workday to complete. A single 24-inch round non-galvanized steel pipe pile will be driven 30 feet into the river bottom at the location of the damaged dolphin. Two 12-inch non-galvanized steel H-beams will then be driven at 60-degree angles off the center pile to provide support. The 3 piles will be connected with steel plates placed around the pile to protect vessels. Vibratory pile driving will occur for approximately for 3 hours per pile for a total of 3 piles installed over 1 standard 10-hour workday. No pile driving will occur at nighttime. The dolphin is being replaced because the current dolphin is damaged and could create unsafe conditions for the barge employees that use the dolphin to secure barges. The dolphin replacement will be completed within 2 days during the work window with

vibratory pile driving occurring during one of those days and above-water work occurring the next workday.

Minimization measures and best management practices (BMP) proposed by the applicant and described in the biological evaluation submitted by Port of Vancouver and their consultant are considered part of the proposed action to minimize adverse effects to ESA-listed species and their designated critical habitats. These minimization measures and BMP include the following:

Dredging and Disposal

- All work below the ordinary high-water mark will be conducted during the periods recommended by the Washington Department of Fish and Wildlife (WDFW) and the USACE for in-water work. For this project, the proposed in-water work window (IWWW) is between October 1 and December 31.
- Water quality monitoring will occur as necessary based on the terms and conditions of the project water quality certification or equivalent.
- Appropriate BMPs will be employed to minimize sediment loss back into the water and turbidity generation during dredging, including but not limited to the following:
    - Controlling the ascent and descent speeds of the bucket.
    - Eliminating multiple bites while the bucket is on the river bottom.
    - No stockpiling of dredged material on the riverbed; and
    - No riverbed leveling.
- Radio communication will be maintained between the dredging personnel so that issues can be communicated quickly, and responses coordinated if any issues arise with the potential to affect aquatic species.
- Tugboats, barges, and equipment used for dredging activities will not ground on the riverbed or bank.
- The contractor will inspect fuel hoses, oil or fuel transfer valves, and fittings on a regular basis for drips or leaks in order to prevent spills into the surface water.
- Vehicles will be fueled, operated, maintained, and stored in areas that minimize disturbance to habitat and prevent adverse effects from potential fuel spills. All of these activities will be conducted in a vehicle staging area placed 150 feet (ft) or more from the waterway.
- A Spill Prevention and Response Plan will be prepared and implemented.
- Dredge vessel personnel will be trained in hazardous material handling and spill response and will be equipped with all necessary response tools.

Existing Damaged Piling Removal

- Steel piles will be pulled via a barge-mounted crane, removed, and stored or recycled at an appropriate upland location.
- All equipment that will operate over water will be cleaned of accumulated grease, oil, or mud prior to use in or over the water. All leaks will be repaired prior to arriving on site. Equipment will be inspected daily for leaks, accumulations of grease, etc., and any identified problems will be fixed before operating overwater.
- In-water construction will adhere to the Washington State water quality standards.

Proposed Piling Replacement

- The pile will not be placed in beds of submerged aquatic vegetation.
- All equipment that will operate over water will be cleaned of accumulated grease, oil, or mud prior to use in or over the water. All leaks will be repaired prior to arriving on site.
- Equipment will be inspected daily for leaks, accumulations of grease, etc., and any identified problems will be fixed before operating overwater.
- The in-water construction will adhere to the Washington State water quality standards.

We considered, under the ESA, whether or not the proposed action would cause any other activities and determined that it would enable continued barge and tug traffic. The proposed work (dredging and dolphin replacement) is not intended to increase capacity at the port and is for maintenance purposes. The replacement of the damaged dolphin is also not intended to increase capacity and is being replaced for safety purposes.

2. ENDANGERED SPECIES ACT BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

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

The USACE determined the proposed action is not likely to adversely affect the southern DPS green sturgeon, Snake River (SR) sockeye salmon, Middle Columbia River (MCR) steelhead, and designated critical habitat for SR sockeye salmon and MCR steelhead. Our concurrence is documented in the "Not Likely to Adversely Affect Determinations section (Section 2.9).

2.1. Analytical Approach

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

This 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 designations of critical habitat for Lower Columbia River (LCR) Chinook salmon, Snake River (SR) fall-run Chinook salmon, SR spring/summer run Chinook salmon, Upper Columbia River (UCR) spring-run Chinook salmon, Upper Willamette River (UWR) Chinook salmon, Columbia River (CR) chum salmon, LCR coho salmon, LCR steelhead, UCR steelhead, SR Basin steelhead, UWR steelhead, and Pacific eulachon use the term primary constituent element (PCE) or essential features. The 2016 final rule (81 FR 7414; February 11, 2016) that revised the critical habitat regulations (50 CFR 424.12) replaced this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a "destruction or adverse modification" analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

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

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

1. Evaluate the range-wide status of the species and critical habitat expected to be adversely affected by the proposed action.
2. Evaluate the environmental baseline of the species and critical habitat.
3. Evaluate the effects of the proposed action on species and their critical habitat using an exposure-response approach.
4. Evaluate cumulative effects.
5. 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.
6. If necessary, suggest reasonable and prudent alternatives to the proposed action.

2.2. Range-wide Status of the Species and Critical Habitat

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

One factor affecting the status of ESA-listed species considered in this opinion, and aquatic habitat at large, is climate change. Climate change is likely to play an increasingly important role in determining the abundance and distribution of ESA-listed species, and the conservation value of designated critical habitats, in the Pacific Northwest. These changes will not be spatially homogeneous across the Pacific Northwest. The largest hydrologic responses are expected to occur in basins with significant snow accumulation, where warming decreases snowpack, increases winter flows, and advances the timing of spring melt (Mote et al. 2014, Mote et al 2016). Rain-dominated watersheds and those with significant contributions from groundwater may be less sensitive to predicted changes in climate (Tague et al. 2013, Mote et al. 2014).

During the last century, average regional air temperatures in the Pacific Northwest increased by 1-1.4°F as an annual average, and up to 2°F in some seasons (based on average linear increase per decade; Abatzoglou et al. 2014; Kunkel et al. 2013). Warming is likely to continue during the next century as average temperatures are projected to increase another 3 to 10°F, with the largest increases predicted to occur in the summer (Mote et al. 2014).

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

Overall, about one-third of the current cold-water salmonid habitat in the Pacific Northwest is likely to exceed key water temperature thresholds by the end of this century (Mantua et al. 2009). Higher temperatures will reduce the quality of available salmonid habitat for most freshwater life stages (ISAB 2007). Reduced flows will make it more difficult for migrating fish to pass physical and thermal obstructions, limiting their access to available habitat (Mantua et al. 2010; Isaak et al. 2012). Temperature increases shift timing of key life cycle events for salmonids and species forming the base of their aquatic food webs (Crozier et al. 2011; Tillmann and Siemann 2011; Winder and Schindler 2004). Higher stream temperatures will also cause decreases in dissolved oxygen and may also cause earlier onset of stratification and reduced mixing between layers in lakes and reservoirs, which can also result in reduced oxygen (Meyer et al. 1999; Winder and Schindler 2004, Raymondi et al. 2013). Higher temperatures are likely to cause several species to become more susceptible to parasites, disease, and higher predation rates (Crozier et al. 2008; Wainwright and Weitkamp 2013; Raymondi et al. 2013).

As more basins become rain-dominated and prone to more severe winter storms, higher winter stream flows may increase the risk that winter or spring floods in sensitive watersheds will damage spawning redds and wash away incubating eggs (Goode et al. 2013). Earlier peak stream

flows will also alter migration timing for salmon smolts and may flush some young salmon and steelhead from rivers to estuaries before they are physically mature, increasing stress and reducing smolt survival (McMahon and Hartman 1989; Lawson et al. 2004).

In addition to changes in freshwater conditions, predicted changes for coastal waters in the Pacific Northwest as a result of climate change include increasing surface water temperature, increasing but highly variable acidity, and increasing storm frequency and magnitude (Mote et al. 2014). Elevated ocean temperatures already documented for the Pacific Northwest are highly likely to continue during the next century, with sea surface temperature projected to increase by 1.0-3.7ºC by the end of the century (IPCC 2014). Habitat loss shifts in species' ranges and abundances and altered marine food webs could have substantial consequences to anadromous, coastal, and marine species in the Pacific Northwest (Tillmann and Siemann 2011, Reeder et al. 2013).

Moreover, as atmospheric carbon emissions increase, increasing levels of carbon are absorbed by the oceans, changing the pH of the water. Acidification also impacts sensitive estuary habitats, where organic matter and nutrient inputs further reduce pH and produce conditions more corrosive than those in offshore waters (Feely et al. 2012, Sunda and Cai 2012).

Global sea levels are expected to continue rising throughout this century, reaching likely predicted increases of 10-32 inches by 2081-2100 (IPCC 2014). These changes will likely result in increased erosion and more frequent and severe coastal flooding and shifts in the composition of nearshore habitats (Tillmann and Siemann 2011, Reeder et al. 2013). Estuarine-dependent salmonids such as chum and Chinook salmon are predicted to be impacted by significant reductions in rearing habitat in some Pacific Northwest coastal areas (Glick et al. 2007).

Historically, warm periods in the coastal Pacific Ocean have coincided with relatively low abundances of salmon and steelhead, while cooler ocean periods have coincided with relatively high abundances, and therefore these species are predicted to fare poorly in warming ocean conditions (Scheuerell and Williams 2005; Zabel et al. 2006). This is supported by the recent observation that anomalously warm sea surface temperatures off the coast of Washington from 2013 to 2016 resulted in poor coho and Chinook salmon body condition for juveniles caught in those waters (NWFSC 2015). Changes to estuarine and coastal conditions, as well as the timing of seasonal shifts in these habitats, have the potential to impact a wide range of listed aquatic species (Tillmann and Siemann 2011, Reeder et al. 2013).

There is also evidence that salmon migration timings are changing due to the effects of climate change. In a study on Pacific Salmonids in southeast Alaska, adult salmonids were shown to be migrating two weeks earlier than they were 30 years ago (Kovach et al 2014). Phenological changes that affect migration timing could have an effect on work windows for in-water work throughout the Columbia River as well mismatched presence between salmonids and their preferred prey sources.

The adaptive ability of these threatened and endangered species is depressed due to reductions in population size, habitat quantity and diversity, and loss of behavioral and genetic variation. Without these natural sources of resilience, systematic changes in local and regional climatic

conditions due to anthropogenic global climate change will likely reduce long-term viability and sustainability of populations in many of these ESUs (NWFSC 2015). New stressors generated by climate change, or existing stressors with effects that have been amplified by climate change, may also have synergistic impacts on species and ecosystems (Doney et al. 2012). These conditions will possibly intensify the climate change stressors inhibiting recovery of ESA-listed species in the future.

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. Additional information (e.g., abundance estimates) that has become available since the latest status reviews and technical support documents also comprises the best scientific and commercial data available and has also been summarized in the following sections.

2.2.1 Status of Critical Habitat

This section describes the status of designated critical habitat affected by the proposed action by examining the condition and trends of the PBFs that are essential to the conservation of the listed species throughout the designated areas. These features are essential to the conservation of the ESA-listed species because they support one or more of the species' life stages (e.g., sites with conditions that support spawning, rearing, migration and foraging). Table 2, below, summarizes the general status of critical habitat, range-wide, for each species considered in this analysis.

Physical and Biological Features of Salmon and Steelhead Critical Habitat

The NMFS designated critical habitat for three different groups of salmonids that occupy the LCR, on three different dates. For each designation, NMFS used slightly different descriptions of the physical and biological features (PBFs) of critical habitat. In addition, NMFS identified the essential elements of the PBFs using slightly different terminology. This section presents each of the approaches to the terminology used for each of the subsequent designations and attributes those to the specific salmonids covered by each designation, but for convenience, in the remainder of the document, we will refer to them as PBFs, even though the original designations used different terminologies. Many of the PBFs and their essential elements actually overlap across designations.

NMFS designated critical habitat for several Snake River salmonids on October 25, 1999 (64 FR 57399), including Snake River sockeye and separate spring/summer, and fall-run Snake River Chinook salmon ESUs. Snake River Basin steelhead critical habitat was designated in 2005 and is detailed below. The PBFs of critical habitat for Snake River salmonids are (1) Spawning and juvenile rearing areas; (2) juvenile migration corridors; (3) areas for growth and development to adulthood; and (4) adult migration corridors. The essential elements of the spawning and rearing PBFs are: 1) Spawning gravel; (2) water quality; (3) water quantity; (4) water temperature; (5) food; (6) riparian vegetation; and (7) access. The designation also breaks down the migration

corridor for juvenile and adult salmonids as follows: Essential features of the juvenile migration corridors include adequate: (1) Substrate (2) water quality; (3) water quantity; (4) water temperature; (5) water velocity; (6) cover/shelter; (7) food; (8) riparian vegetation; (9) space; and (10) safe passage conditions. The adult migration corridors are the same areas included in juvenile migration corridors. Essential features would include those in the juvenile migration corridors, excluding adequate food.

Subsequently, NMFS designated critical habitat for 10 ESUs and DPSs of Columbia River salmon and steelhead and Snake River steelhead on September 2, 2005 (70 FR 52630), and lower Columbia River coho salmon on February 24, 2016 (81 FR 9252) as shown in Table 2. The PBFs include:

1. Freshwater spawning sites with water quantity and quality conditions and substrate that support spawning, incubation, and larval development.

2. Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility, water quality and forage that support juvenile development, and natural cover such as shade, submerged and overhanging large wood, logjams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

3. Freshwater migration corridors that are free of obstruction, excessive predation, and resting areas that support foraging without excessive predation.

4. Estuarine areas free of obstruction and excessive predation with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; Juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.

5. Nearshore marine areas free of obstruction and excessive predation with water quality and quantity conditions and forage, and natural covers such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and

6. Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes that support growth and maturation.

For most salmon and steelhead, NMFS's critical habitat analytical review teams (CHARTs) ranked watersheds within designated critical habitat at the scale of the fifth-field hydrologic unit code (HUC5) in terms of the conservation value they provide to each ESA-listed species that they support (NMFS 2005). The conservation rankings were high, medium, or low. To determine the conservation value of each watershed to species viability, the CHARTs evaluated the quantity and quality of habitat features, the relationship of the area compared to other areas within the species' range, and the significance to the species of the population occupying that area. Even if a location had poor habitat quality, it could be ranked with a high conservation

value if it were essential due to factors such as limited availability, a unique contribution of the population it served, or is serving another important role.

Physical and Biological Features of Pacific Eulachon Critical Habitat

NMFS designated critical habitat for the southern DPS of Pacific eulachon on October 11, 2011 (76 FR 65324). Critical habitat includes portions of 16 rivers and streams in California, Oregon, and Washington (USDC 2011). We designated all of these areas as migration and spawning habitat for this species. Specific PBFs for Pacific eulachon critical habitat include:

1. Freshwater spawning and incubation sites with water flow, quality and temperature conditions and substrate supporting spawning and incubation, and with migratory access for adults and juveniles. These features are essential to conservation because without them the species cannot successfully spawn and produce offspring.

2. Freshwater and estuarine migration corridors associated with spawning and incubation sites that are free of obstruction and with water flow, quality and temperature conditions supporting larval and adult mobility, and with abundant prey items supporting larval feeding after the yolk sac is depleted. These features are essential to conservation because they allow adult fish to swim upstream to reach spawning areas and they allow larval fish to proceed downstream and reach the ocean.

3. Nearshore and offshore marine foraging habitat with water quality and available prey, supporting juveniles and adult survival. Eulachon prey on a wide variety of species including crustaceans such as copepods and euphausiids (Hay and McCarter 2000, WDFW and ODFW 2001), unidentified malacostracans (Smith and Saalfeld 1955), mysids, barnacle larvae, and worm larvae (WDFW and ODFW 2001). These features are essential to conservation because they allow juvenile fish to survive, grow, and reach maturity, and they allow adult fish to survive and return to freshwater systems to spawn.

Table 2. Status of ESA-Listed Species' Designated Critical Habitat, and citation to Designation Date

Species	Designation Date and FR Citation	Critical Habitat Status Summary
Lower Columbia River Chinook salmon	9/02/05 70 FR 52630	Critical habitat encompasses 10 subbasins in Oregon and Washington containing 47 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PBFs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some, or high potential for improvement. We rated conservation value of HUC5 watersheds as high for 30 watersheds, medium for 13 watersheds, and low for four watersheds.
Upper Columbia River spring-run Chinook salmon	9/02/05 70 FR 52630	Critical habitat encompasses four subbasins in Washington containing 15 occupied watersheds, as well as the Columbia River rearing/migration corridor. Most HUC5 watersheds with PBFs for salmon are in fair-to-poor or fair-to-good condition. However, most of these watersheds have some, or high, potential for improvement. We rated conservation value of HUC5 watersheds as high for 10 watersheds, and medium for five watersheds. Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.
Upper Willamette River Chinook salmon	9/02/05 70 FR 52630	Critical habitat encompasses 10 subbasins in Oregon containing 56 occupied watersheds, as well as the lower Willamette/Columbia River rearing/migration corridor. Most HUC5 watersheds with PBFs for salmon are in fair-to-poor or fair-to-good condition. However, most of these watersheds have some, or high, potential for improvement. Watersheds are in good to excellent condition with no potential for improvement only in the upper McKenzie River and its tributaries (NMFS 2005). We rated conservation value of HUC5 watersheds as high for 22 watersheds, medium for 16 watersheds, and low for 18 watersheds.
Snake River fall-run Chinook salmon	10/25/99 64 FR 57399	Critical habitat consists of river reaches of the Columbia, Snake, and Salmon rivers, and all tributaries of the Snake and Salmon rivers presently or historically accessible to this ESU (except reaches above impassable natural falls, and Dworshak and Hells Canyon dams). Habitat quality in tributary streams varies from excellent in wilderness and roadless areas, to poor in areas subject to heavy agricultural and urban development (Wissmar et al. 1994). Reduced summer stream flows, impaired water quality, and reduced habitat complexity are common problems. Migratory habitat quality in the lower Snake River and Columbia River has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.
Columbia River chum salmon	9/02/05 70 FR 52630	Critical habitat encompasses six subbasins in Oregon and Washington containing 19 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PBFs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 16 watersheds, and medium for three watersheds.
Lower Columbia River coho salmon	2/24/16 81 FR 9252	Critical habitat encompasses 10 subbasins in Oregon and Washington containing 55 occupied watersheds, as well as the lower Columbia River and estuary rearing/migration corridor. Most HUC5 watersheds with PBFs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 34 watersheds, medium for 18 watersheds, and low for three watersheds.

Species	Designation Date and FR Citation	Critical Habitat Status Summary
Upper Columbia River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses 10 subbasins in Washington containing 31 occupied watersheds, as well as the Columbia River rearing/migration corridor. Most HUC5 watersheds with PBFs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 20 watersheds, medium for eight watersheds, and low for three watersheds.
Lower Columbia River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses nine subbasins in Oregon and Washington containing 41 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PBFs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 28 watersheds, medium for 11 watersheds, and low for two watersheds.
Upper Willamette River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses seven subbasins in Oregon containing 34 occupied watersheds, as well as the lower Willamette/Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. Watersheds are in good to excellent condition with no potential for improvement only in the upper McKenzie River and its tributaries (NMFS 2005). We rated conservation value of HUC5 watersheds as high for 25 watersheds, medium for 6 watersheds, and low for 3 watersheds.
Snake River Basin steelhead	9/02/05 70 FR 52630	Critical habitat encompasses 25 subbasins in Oregon, Washington, and Idaho. Habitat quality in tributary streams varies from excellent in wilderness and roadless areas, to poor in areas subject to heavy agricultural and urban development (Wissmar et al. 1994). Reduced summer stream flows, impaired water quality, and reduced habitat complexity are common problems. Migratory habitat quality in the lower Snake River and Columbia River has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.
Southern DPS of eulachon	10/20/11 76 FR 65324	Critical habitat for eulachon includes portions of 16 rivers and streams in California, Oregon, and Washington. All of these areas are designated as migration and spawning habitat for this species. In Oregon, we designated 24.2 miles of the lower Umpqua River, 12.4 miles of the lower Sandy River, and 0.2 miles of Tenmile Creek. We also designated the mainstem Columbia River from the mouth to the base of Bonneville Dam, a distance of 143.2 miles. Dams and water diversions are moderate threats to eulachon in the Columbia and Klamath rivers where hydropower generation and flood control are major activities. Degraded water quality is common in some areas occupied by southern DPS eulachon. In the Columbia and Klamath river basins, large-scale impoundment of water has increased winter water temperatures, potentially altering the water temperature during eulachon spawning periods. Numerous chemical contaminants are also present in spawning rivers, but the exact effect these compounds have on spawning and egg development is unknown. Dredging is a low to moderate threat to eulachon in the Columbia River. Dredging during eulachon spawning would be particularly detrimental.

2.2.2 Status of the Species

Table 3 below provides a summary of listing and recovery plan information, status summaries and limiting factors for the species addressed in this opinion. More information can be found in recovery plans and status reviews for these species. Acronyms appearing in the table include DPS (Distinct Population Segment), ESU (Evolutionarily Significant Unit), ICTRT (Interior Columbia Technical Recovery Team), MPG (Multiple Population Grouping), NWFSC (Northwest Fisheries Science Center), and VSP (Viable Salmonid Population).

Table 3. Listing classification and date, recovery plan reference, most recent status review, status summary, and limiting factors for each species considered in this opinion.

Species	Listing Classification and Date	Recovery Plan Reference; Most Recent Status Review or Viability Assessment	Status Summary	Limiting Factors
Lower Columbia River Chinook salmon	Threatened 6/28/05	NMFS 2013a; NWFSC 2022	This ESU comprises 32 independent populations seven are at or near the recovery viability goals. Ten independent populations either had no abundance information (presumed near zero) or exist at very low abundances. Relative to baseline VSP levels identified in the recovery plan, there has been an overall improvement in the status of a number of fall-run populations, although most are still far from the recovery plan goals. Many of the populations in this ESU remain at "high risk," with low natural-origin abundance levels. Hatchery contributions remain high for a number of populations, and it is likely that many returning unmarked adults are the progeny of hatchery-origin parents, especially where large hatchery programs operate. Increases in abundance were noted in about half of the fall-run populations, and in 75% of the spring-run populations for which data were available. Overall, the viability of the ESU has increased somewhat since the last status review, although the ESU remains at "moderate" risk of extinction (NWFSC 2022).	• Reduced access to spawning and rearing habitat • Hatchery-related effects • Harvest-related effects on fall Chinook salmon • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Contaminant
Upper Columbia River spring-run Chinook salmon	Endangered 6/28/05	Upper Columbia Salmon Recovery Board 2007 NWFSC 2022	This ESU comprises four independent populations. Three are at high risk and one is functionally extirpated. Abundance and productivity remained well below the viable thresholds called for in the Upper Columbia Recovery Plan for all three populations. Based on the information available for the most recent viability assessment review (NWFSC 2022), the Upper Columbia River spring-run Chinook salmon ESU remains at high risk, with viability largely unchanged from the 2015 status review (NWFSC 2022)	• Effects related to hydropower system in the mainstem Columbia River • Degraded freshwater habitat • Degraded estuarine and nearshore marine habitat • Hatchery-related effects • Persistence of non-native (exotic) fish species • Harvest in Columbia River fisheries

Species	Listing Classification and Date	Recovery Plan Reference; Most Recent Status Review or Viability Assessment	Status Summary	Limiting Factors
Upper Willamette River Chinook salmon	Threatened 6/28/05	ODFW and NMFS 2011 NMFS 2016a/ NWFSC 2022	This ESU comprises seven populations. Abundance levels for all but one of the seven DIPs in this ESU remain well below their recovery goals. The Clackamas River DIP currently exceeds its abundance recovery goal, while the Calapooia River population may be functionally extinct, and the Molalla River population remains critically low (there is considerable uncertainty in the level of natural production in the Molalla River). Abundances in the North and South Santiam Rivers have declined since the last review, with natural-origin abundances in the low hundreds of fish. The Middle Fork Willamette River is at a very low abundance, even with the inclusion of natural-origin spring-run Chinook salmon spawning in Fall Creek. Overall, there has likely been a declining trend in the viability of the ESU since the last review (NWFSC 2015). The Upper Willamette River Chinook salmon ESU remains at "moderate" risk of extinction (NWFSC 2022).	• Degraded freshwater habitat • Degraded water quality • Increased disease incidence • Altered stream flows • Reduced access to spawning and rearing habitats • Altered food web due to reduced inputs of microdetritus • Predation by native and non-native species, including hatchery fish • Competition related to introduced salmon and steelhead • Altered population traits due to fisheries and bycatch
Snake River fall-run Chinook salmon	Threatened 6/28/05	NMFS 2017b	This ESU has one extant population. Historically, large populations of fall Chinook salmon spawned in the Snake River upstream of the Hells Canyon Dam complex. Overall, the status of Snake River fall-run Chinook salmon has improved compared to the time of listing. The single extant population in the ESU is currently meeting the criteria for a rating of "viable", but the ESU as a whole is not meeting the recovery goals described in the recovery plan for the species, which require the single population to be "highly viable with high certainty" and/or will require reintroduction of a viable population above the Hells Canyon Complex (NMFS 2017b). The Snake River fall-run Chinook salmon ESU therefore is considered to be at a moderate-to-low risk of extinction, with viability largely unchanged from the prior review (NWFSC 2022).	• Degraded floodplain connectivity and function • Harvest-related effects • Loss of access to historical habitat above Hells Canyon and other Snake River dams • Impacts from mainstem Columbia River and Snake River hydropower systems • Hatchery-related effects • Degraded estuarine and nearshore habitat.

Species	Listing Classification and Date	Recovery Plan Reference; Most Recent Status Review or Viability Assessment	Status Summary	Limiting Factors
Columbia River chum salmon	Threatened 6/28/05	NMFS 2013a NWFSC 2022	Presently, detectable numbers of chum salmon persist in only four of the 17 populations, a fraction of their historical range. A total of three of 17 populations exceed the recovery goals established in the recovery plan (Dornbusch 2013). The remaining populations have unknown abundances, although it is reasonable to assume that the abundances are very low and unlikely to be more than 10% of the established recovery goals. With so many primary populations at near-zero abundance, none of the major population groups could be considered viable. It is notable that during this most recent review period, the three populations (Grays River, Washougal, and Lower Gorge) improved markedly in abundance. The ESU remains at "moderate" risk of extinction, and the viability is largely unchanged from the 2015 review (NWFSC 2022).	• Degraded estuarine and nearshore marine habitat • Degraded freshwater habitat • Degraded stream flow as a result of hydropower and water supply operations • Reduced water quality • Current or potential predation • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat in the lower Columbia River • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Juvenile fish wake strandings • Contaminants
Lower Columbia River coho salmon	Threatened 6/28/05	NMFS 2013a NWFSC 2022	In contrast to the previous status review update (NWFSC 2015), which occurred at a time of near-record returns for several populations, the ESU's abundance has declined during the last five years. Only six of the 23 populations for which we have data appear to be above their recovery goals. This includes the Youngs Bay and Big Creek DIPs, which have very low recovery goals, and the Tilton River and Salmon Creek DIPs, which were not assigned goals but have relatively high abundances. Of the remaining DIPs in the ESU, three are at 50–99% of their recovery goals, seven are at 10–50% of their recovery goals, and seven are at <10% of their recovery goals (this includes the Lower Gorge DIP, for which there are no data, but it is assumed that the abundance is low). Overall, abundance trends for the ESU are generally negative and the status remains at "moderate" risk (NWFSC 2022).	• Degraded estuarine and near-shore marine habitat • Fish passage barriers • Degraded freshwater habitat: Hatchery-related effects • Harvest-related effects • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat in the lower Columbia River • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Juvenile fish wake strandings • Contaminants

Species	Listing Classification and Date	Recovery Plan Reference; Most Recent Status Review or Viability Assessment	Status Summary	Limiting Factors
Upper Columbia River steelhead	Threatened 1/5/06	Upper Columbia Salmon Recovery Board 2007 NWFSC 2022	This DPS comprises four independent populations. All four populations are at high risk of extinction. The proportions of hatchery-origin returns in natural spawning areas remain high across the DPS, especially in the Methow and Okanogan River populations. Tributary habitat actions called for in the Upper Columbia Salmon Recovery Plan are anticipated to be implemented over the next 25 years, and the benefits of some of those actions will require some time to be realized. The most recent estimates (five-year geometric mean) of total and natural-origin spawner abundance have declined since the 2015 report, largely erasing gains observed over the past two decades for all four populations. Recent declines are persistent and large enough to result in small, but negative 15-year trends in abundance for all four populations. The overall DPS viability remains largely unchanged from the 2015 review, and the DPS is at high risk driven by low abundance and productivity relative to viability objectives and diversity concerns (NWFSC 2022).	• Adverse effects related to the mainstem Columbia River hydropower system • Impaired tributary fish passage • Degraded floodplain connectivity and function, channel structure and complexity, riparian areas, large woody debris recruitment, stream flow, and water quality • Hatchery-related effects • Predation and competition • Harvest-related effects

Species	Listing Classification and Date	Recovery Plan Reference; Most Recent Status Review or Viability Assessment	Status Summary	Limiting Factors
Lower Columbia River steelhead	Threatened 1/5/06	NMFS 2013a NWFSC 2022	This DPS comprises 23 historical populations, 17 winter-run populations and six summer-run populations. The majority of winter-run steelhead DIPs in this DPS continue to persist at low abundance levels (hundreds of fish), with the exception of the Clackamas and Sandy River DIPs, which have abundances in the low 1,000s. Although the five-year geometric abundance means are near recovery plan goals for many populations, the recent trends are negative. Summer-run steelhead DIPs were similarly stable, but also at low abundance levels. Summer-run DIPs in the Kalama, East Fork Lewis, and Washougal River DIPs are near their recovery plan goals; however, it is unclear how hatchery-origin fish contribute to this abundance. The decline in the Wind River summer-run DIP is a source of concern, given that this population has been considered one of the healthiest of the summer runs. The juvenile collection facilities at North Fork Dam in the Clackamas River appear to be successful enough to support increases in abundance. Hatchery interactions remain a concern in select basins, but the overall situation is somewhat improved compared to prior reviews. Although a number of DIPs exhibited increases in their five-year geometric means, others still remain depressed, and neither the winter- nor summer-run MPGs are near viability in the Gorge. Overall, the Lower Columbia River steelhead DPS is therefore considered to be at "moderate" risk, and the viability is largely unchanged from the prior review (NWFSC 2022).	• Degraded estuarine and nearshore marine habitat • Degraded freshwater habitat • Reduced access to spawning and rearing habitat • Avian and marine mammal predation • Hatchery-related effects • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat in the lower Columbia River • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Juvenile fish wake strandings • Contaminants

Species	Listing Classification and Date	Recovery Plan Reference; Most Recent Status Review or Viability Assessment	Status Summary	Limiting Factors
Upper Willamette River steelhead	Threatened 1/5/06	NMFS 2011 NMFS 2016a/ NWFSC 2022	This DPS has four demographically independent populations. Populations in this DPS have experienced long-term declines in spawner abundance. The underlying cause(s) of these declines is not well understood. Returning adult winter steelhead do not experience the same deleterious water temperatures as the spring-run Chinook salmon, and prespawn mortalities are not likely to be significant. Although the recent magnitude of these declines is relatively moderate, continued declines would be a cause for concern. Improvements to Bennett Dam fish passage and operational temperature control at Detroit Dam may be providing some stability in abundance in the North Santiam River DIP. It is unclear if sufficient high-quality habitat is available below Detroit Dam to support the population reaching its VSP recovery goal, or if some form of access to the upper watershed is necessary to sustain a "recovered" population. Similarly, the South Santiam River basin may not be able to achieve its recovery goal status without access to historical spawning and rearing habitat above Green Peter Dam (Quartzville Creek and the Middle Santiam River) and/or improved juvenile downstream passage at Foster Dam. Overall, the Upper Willamette River steelhead DPS continued to decline in abundance, and introgression by non-native summer-run steelhead continues to be a concern. Although the most recent counts at Willamette Falls and the Bennett Dams in 2019 and 2020 suggest a rebound from the record 2017 lows, it should be noted that current "highs" are equivalent to past lows. In the absence of substantial changes in accessibility to high-quality habitat, the DPS will remain at "moderate-to-high" risk (NWFSC 2022).	• Degraded freshwater habitat • Degraded water quality • Increased disease incidence • Altered stream flows • Reduced access to spawning and rearing habitats due to impaired passage at dams • Altered food web due to changes in inputs of microdetritus • Predation by native and non-native species, including hatchery fish and pinnipeds • Competition related to introduced salmon and steelhead • Altered population traits due to interbreeding with hatchery origin fish

Species	Listing Classification and Date	Recovery Plan Reference; Most Recent Status Review or Viability Assessment	Status Summary	Limiting Factors
Snake River Basin steelhead	Threatened 1/5/06	NMFS 2017a NWFSC 2022	This DPS comprises 24 populations. Snake River Basin steelhead are classified as summer-run based on their adult run timing patterns. Much of the freshwater habitat used by Snake River Basin steelhead for spawning and rearing is warmer and drier than that associated with other steelhead DPSes. Snake River Basin steelhead spawn and rear as juveniles across a wide range of freshwater temperature/precipitation regimes. Based on the updated viability information available for this review, all five MPGs are not meeting the specific objectives in the draft recovery plan, and the viability of many individual populations remains uncertain. Of particular note, the updated, population-level abundance estimates have made very clear the recent (last five years) sharp declines that are extremely worrisome, were they to continue. Overall, the Snake River Basin steelhead DPS remains at "moderate" risk of extinction, with viability largely unchanged from the 2015 review (NWFSC 2022).	• Adverse effects related to the mainstem Columbia River hydropower system • Impaired tributary fish passage • Degraded freshwater habitat • Increased water temperature • Harvest-related effects, particularly for B-run steelhead • Predation • Genetic diversity effects from out-of-population hatchery releases
Southern DPS of eulachon	Threatened 3/18/10	NMFS 2017c	The Southern DPS of eulachon includes all naturally spawned populations that occur in rivers south of the Nass River in British Columbia to the Mad River in California. Sub populations for this species include the Fraser River, Columbia River, British Columbia, and the Klamath River. In the early 1990s, there was an abrupt decline in the abundance of eulachon returning to the Columbia River. Despite a brief period of improved returns in 2001-2003, the returns and associated commercial landings eventually declined to the low levels observed in the mid-1990s. Although eulachon abundance in monitored rivers has generally improved, especially in the 2013-2015 return years, recent poor ocean conditions and the likelihood that these conditions will persist into the near future suggest that population declines may be widespread in the upcoming return years	• Changes in ocean conditions due to climate change, particularly in the southern portion of the species' range where ocean warming trends may be the most pronounced and may alter prey, spawning, and rearing success. • Climate-induced change to freshwater habitats • Bycatch of eulachon in commercial fisheries • Adverse effects related to dams and water diversions • Water quality, • Shoreline construction • Over harvest • Predation

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 proposed action area includes port facilities, upland disposal facilities, and WDNR property (dolphin replacement site), but the action area circumscribes all locations where the physical, chemical, or biological effects of the project, and actions caused by the project, will occur. In this circumstance, while effects occur throughout the dredge prism and an area of suspended sediment downstream of the dredge operation (the expected area of increased suspended sediment is 300 feet downstream of the dredge operation), the physical effects on water caused by vibratory pile driving noise extend furthest from the project site, and the underwater noise is calculated to be 7.24 miles before attenuating to background levels, however the distance that underwater noise travels will likely to be smaller due to the surrounding landmasses intercepting/limiting the transmission of sound pressure waves (WSDOT 2020a). The upland disposal site for the dredged material will take place at the Santosh Aggregate Plant where ESA-listed species and critical habitat do not occur, and this site is not included in the action area, however the movement of the barge carrying the dredged material to the aggregated plant is considered part of the action, and thus the action area includes that transit route. The transit route includes the Lower Columbia River, Multnomah Channel, and the Santosh Barge Canal. Figure 1 illustrates the project area and the majority of the transit route.

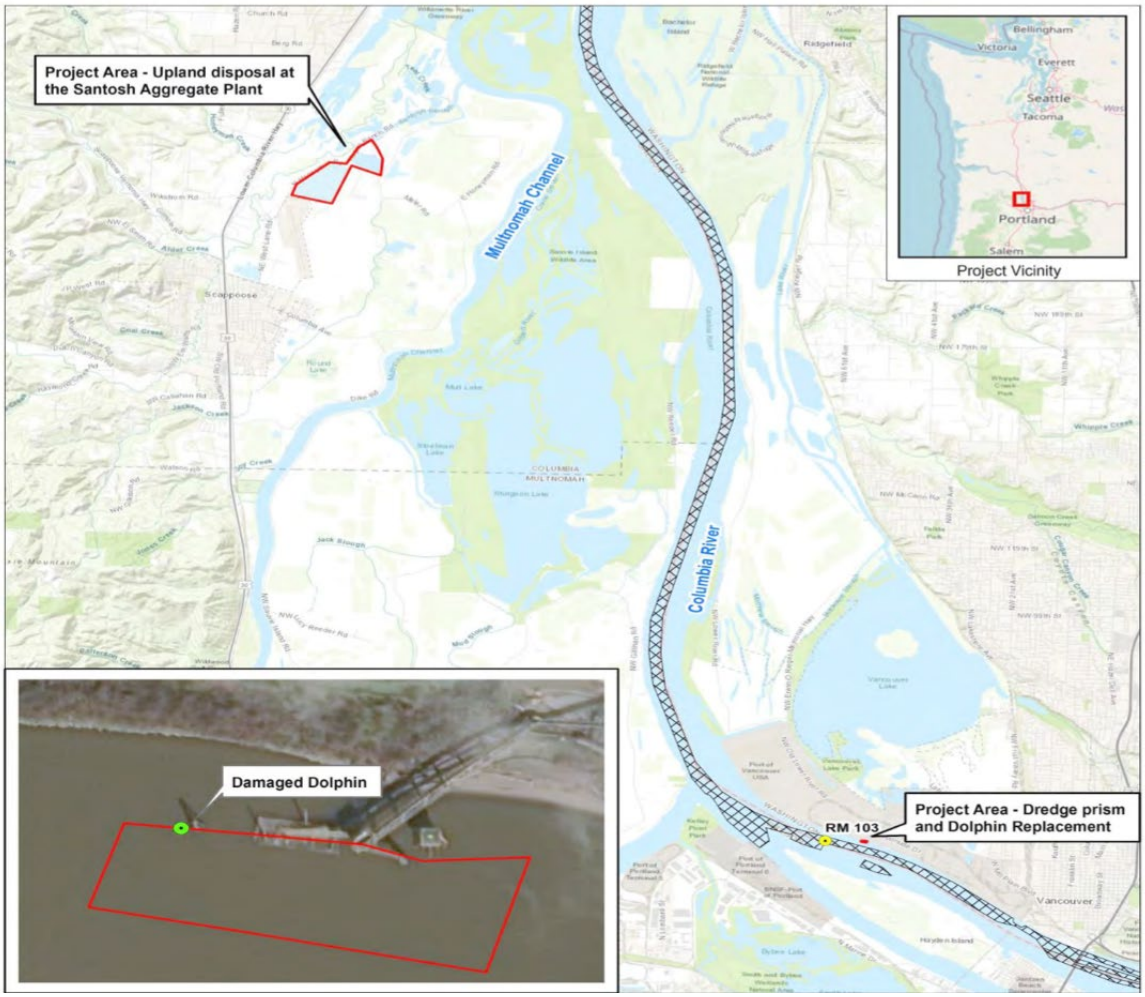


Figure 1. Vicinity of Project and Inset Photo of Project Site

2.4. Environmental Baseline

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

2.4.1 Habitat Conditions in the Action Area

The action area is influenced by degraded water quality, sediment quality, altered river flow, elevated noise, reduced prey communities, and the altered riparian conditions due to an extensive history of anthropogenic changes. Fish habitat in the action area has been adversely affected by a variety of in-water and upland human activities, including habitat losses from all causes (urbanization, roads, diking, etc.), flood control, irrigation and hydroelectric dams, pollution, municipal and industrial water use, introduced species, hatchery production (NMFS 2013), and climate change as described in Section 2.2 above. Analysis of historical habitat distributions in a Geographical Information System indicated that scrub/shrub and forested wetland types have declined in the estuary since the late 19th and early 20th centuries by 55 and 58%, respectively. Diking, filling, and other changes have reduced the total area of all wetland types combined from approximately 155 to 75 square kilometers (km^2) (Bottom et al. 2008).

A portion of the action area around the Port is a highly industrialized corridor of the Columbia River that has characteristics typical of industrial shorelines. Numerous tenants occupy the Port, meaning boat traffic in the area is high. Tidewater Barge Lines is located downriver from the dredging location and transports a variety of cargo throughout the Columbia-Snake River system. At the Port of Vancouver site, Tidewater has a diesel handling facility and a marine equipment maintenance facility. Just downstream of the Port of Vancouver is the confluence of the Columbia River and the Willamette River. The Willamette River is highly urban and industrialized throughout its reach that flows through Portland, Oregon. From its headwaters to its mouth, the river flows through forested areas, urbanized areas (e.g., Salem, Eugene, and smaller towns) and agricultural areas.

Water quality in the action area is degraded by many pollutants. Nutrient loading and other contaminants are known to enter the Columbia River through urban and agricultural runoff as well as atmospheric deposition (EPA 2020). The Environmental Protection Agency (EPA) has established two total maximum daily load (TDML) water quality improvement projects in the mainstem of the LCR for dioxin in 1991 and for total dissolved gas (TDG) in 2002 (Ecology 2002, Ecology 1991). Figure 2 shows the water quality exceedances within the action area according to the Washington State Department of Ecology and the Oregon Department of Environmental Quality (Ecology 2020, ODEQ 2020)

Figure 2. Assessment of Water Quality Conditions in the Lower Columbia River.

Water Quality Parameter	Category
Temperature	Category 5 – polluted waters that require a water improvement project
Dissolved oxygen	Category 5 – polluted waters that require a water improvement project
DDE*	Category 5 – polluted waters that require a water improvement project
PCBs*	Category 5 – polluted waters that require a water improvement project
PAHs*	Category 5 – polluted waters that require a water improvement project
TDG*	Category 5 – polluted waters that require a water improvement project
Dioxin	Category 4A – Impaired waters with an EPA-approved TMDL* in place
Bis (2-Ethylhexyl) phthalate	Category 2 – waters of concern
Bacteria	Category 2 – waters of concern
Arsenic	Category 2 – waters of concern
Ammonia-N	Category 1 – waters that meet tested water quality standards

*Definitions:
DDE = dichlorodipenlyldichloroethylene
PCBs = polychlorinated biphenyls
PAHs = polycyclic aromatic hydrocarbons
TDG = total dissolved gas
TMDL = total maximum daily load

The sediment in the shallow water habitat portion of the action area consists of sand and silt underlain with cemented rock. Specific analysis on the sediment in the immediate project area is limited; however, the Federal Navigation Channel (FNC) has well-researched sediments and is within the action area. The material removed from the FNC is generally clean sand with very little organic matter and generally has low levels of toxins. Chemical analysis of sediment samples collected in the navigation channel by the USACE in 2008 indicates that there were no exceedances of the benthic toxicity screening levels for chemicals of concern (Corps 2011, Confluence 2016). The sediment within the action area consists of Columbia River deposits and 30 years of accumulation of NW Aggregates Material that is incidentally deposited into the river during off-loading.

The flow regime within the LCR is a high-energy flow environment. Downstream currents move the sandy bed toward the ocean in a series of sand waves. The tidal fluctuation of the water surface elevation is approximately 2.5 feet (ft) at Vancouver, Washington (rivermile [RM] 105), and tidal influence is evident up to RM 140, though saline intrusion is only detectable up to approximately RM 30, approximately 73 miles downstream of the action area (Corps 1999). Dams upstream of the action area also limit and reduce downstream sediment transport.

Boat traffic and noise levels are high in the action area because it is located in a highly industrial area. The background sounds levels are mostly influenced by the daily operations at the Port which includes the use of heavy machinery and truck traffic along with boat traffic and vehicle traffic from the adjacent State Route 501.

Benthic and epibenthic diversity is low within this section of the Columbia River (Corps 1999). Midges (Chironomidae) and amphipods (*Corophium*), both food sources for juvenile salmon and other fishes, may be present in the action area. However, due to their preference for shallow, low-current areas the action area is not believed to support a large population of midges and amphipods. Based on the characteristics of the Columbia River, zooplankton, such as Daphnia, and crustaceans are expected to occur in the action area. Other aquatic insects (e.g., Odonata, Trichoptera, Ephemeroptera) are unlikely to occur in the action area because of the lack of aquatic vegetation.

Due to the industrial nature of the action area and the dredge prism, little riparian or aquatic vegetation is present along the shoreline or exposed beach areas. The area contains riprap with some overhanging vegetation along the bank.

Habitat conditions that establish the environmental baseline include the impacts from dredging not only within the action area nearshore but also nearby dredging in the FNC. Dredging activities occur across numerous areas and microhabitats within the Lower Columbia River including sloughs, secondary channels, and floodplain wetlands.

All of these habitat areas provide rearing for ESA-listed fish, and all have been degraded by shore-based development and construction and maintenance of boat moorage facilities. Floodplain and off-channel sloughs have been cut off by dikes and flood control levees, limiting potential refuge areas and forage sites for juvenile salmonids. The dredge sediment disposal in the Lower Columbia River has had adverse effects, including displacement of seasonally flooded wetlands, regular disruption of shallow water benthic prey communities, and most significantly creation of attractive nesting habitat for avian predators feeding on juvenile salmonids (Evans et al. 2012; Sebring et al. 2013). Survival of salmonids migrating through this reach has declined for both juvenile and adult salmonids resulting in reduced population productivity and abundance.

The hydrology and hydrograph of the Columbia River is significantly altered from historical conditions, shifting natural cues that salmonids rely on for spawning and outmigration behavior. River flow is less dynamic (Sherwood et al. 1990) and sediment transport has decreased by as much as 50 percent (Simenstad et al. 1992).

Water quality in the action area is degraded as a result of increased fine sediment loads, elevated water temperatures especially during the summer (Weitkamp 1994), and a host of municipal and industrial discharges, permitted or otherwise (LCREP 2007). These conditions are a result of upstream land uses, all of which influence the LCR and its recovery potential (Fresh et al. 2005).

The baseline also includes the effects of projects that have already undergone Section 7 consultation. During the last five years, NMFS has engaged in several Section 7 consultations on Federal projects adversely affecting ESA-listed fish and their habitats in and near the action area. These include actions within the vicinity (Multnomah County, Oregon; Clark County, Washington) adjacent to or within the action area that are formal consultations (WCR-2019-11648, WCR-2018-10138, WCR-2017-7450, WCR-2017-6622, WCR-2016-5516). Federal projects also include the effects of actions addressed in programmatic consultations (the

SLOPES IV programmatic consultation; NMFS number WCR-2011-05585). In general, those actions caused temporary, construction-related effects (increased noise and turbidity), and longer-term effects like increasing overwater coverage. Current conditions of the baseline hinder the quality of downstream migration and reduce benthic production of forage items.

We note that all actions processed under the SLOPES IV programmatic consultation also include minimization measures to reduce or avoid both short- and long-term effects in the environment. These include requiring grated and translucent materials to allow light penetration, pile caps to prevent piscivorous bird perching, and limits on square footage of new overwater coverage. Actions implemented under SLOPES IV continue to have some effects that can reduce fitness and survival in a small number of individuals and have contemporaneous minimization measures to reduce the level of habitat degradation at large. Overall effects of these SLOPES IV actions do incrementally contribute to the environmental baseline and the effects of existing structures (e.g., increased shading, reduction in prey, increased predation, and possible minor migration delays). The degraded baseline of habitat conditions in the action area limits the area's carrying capacity for listed salmonids, as described more fully below.

2.4.2 Species in the Action Area

All ESA-listed species of Columbia basin salmon and steelhead migrate through the action area, as juveniles and again as adults, and some species rear in the action area as well. Generally speaking, juvenile salmonids will occupy the action area across the width of the river, and to average depths of up to 35 feet (Carter et al. 2009). Smaller-sized fish use the shallow water habitats and larger fish will use the channel margins and main channel. The pattern of use generally shifts between day and night. Juvenile salmon occupy different locations within the CR and are typically in shallower water during the day, avoiding predation by larger fish that are more likely to be in deeper water. These juveniles will venture into the deeper areas of the river away from the shoreline, towards the navigation channel, and along with the bathymetric break – or channel margin – and will be closer to the bottom of the channel at night (Carter et al. 2009). The smaller sub-yearling salmonids will likely congregate along the nearshore areas in shallow water and extend into the channel margins (Bottom et al. 2011). Yet, as Carlson et al. (2001) indicated, there is higher use of the channel margins than previously thought, and considering the parameters above, relative juvenile position in the water column suggests higher potential sub-yearling use in areas of 20 to 30 feet deep.

Upstream migration of adult salmonids and downstream migrations of salmonid smolts are likely to occur in the mainstem LCR in proximity to the dredge sites. A subset of the salmonid species considered in this consultation rear in the action area, and thus are exposed to the degraded baseline for a significant portion of this sensitive life stage. Rearing juvenile salmonids are likely to rely on the periphery of the dredging sites in shallower waters composed primarily of sand/silt bathos near shorelines.

Eulachon also migrate through the action area both as adults and as larval passive out-migrants.

As mentioned above, habitat conditions in the CR have been simplified and degraded. This has contributed to the reduction in survival of both rearing and migrating fish to the degree that

multiple life history strategies have been lost. Exposure of fishes to degraded habitat conditions during migration or rearing may negatively affect the condition of individual fishes. The current environmental baseline may reduce the general fitness of individual fish, reducing their resiliency any additional project-related effects that they are exposed to.

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 above in Section 1.3, The Port of Vancouver proposes to conduct 10-years of routine maintenance dredging and a one-time replacement of a damaged dolphin that would require vibratory pile driving for 1 day. The IWWW for the maintenance dredging and one-time dolphin replacement would be October 1-December 31. Mechanical dredging with a barge-mounted clamshell bucket would be the method of dredging.

Temporary effects of the proposed action are reasonably certain to occur in each year of maintenance dredging and include: (1) reduction in water quality from high levels of suspended sediment; (2) reduction in available prey from disturbed benthic conditions; (3) temporary obstruction to safe passage from degraded habitat conditions in the migration corridor; and (4) increased underwater noise while equipment and construction vessels are operating. The long-term effect is to maintain the depth of the channel to the degree that current vessel use can continue. These changes in the environment will affect PBFs of critical habitat, and the species that are present when these effects occur.

2.5.1 Effects on Critical Habitat

The proposed action will affect designated critical habitat for LCR Chinook salmon, UCR spring-run Chinook salmon, UWR spring-run Chinook salmon, SR fall-run Chinook salmon, CR chum salmon, LCR coho salmon, LCR steelhead, UCR steelhead, SR steelhead, and UWR steelhead, and sDPS eulachon. Given the location of the proposed action and life history expression, the role of the critical habitat is to support migration and/or rearing.

Salmonid Critical Habitat

The essential elements of freshwater rearing sites are substrate, water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility and include water quality and forage that support juvenile development, natural cover such as shade, submerged and overhanging large wood, logjams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks. These features are essential to conservation because without them juveniles cannot access and use the areas needed

to forage, grow, and develop behaviors (e.g., predator avoidance, competition) that help ensure their survival.

The features of freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival. These features are essential to conservation because without them juveniles cannot use the variety of habitats that allow them to avoid high flows, avoid predators, successfully compete, begin the behavioral and physiological changes needed for life in the ocean, and reach the ocean in a timely manner. Similarly, these features are essential for adults because they allow fish in a non-feeding condition to successfully swim upstream, avoid predators, and reach spawning areas on limited energy stores.

Many of these features are degraded or absent in the action area. The Lower Columbia River corridor was identified as having high conservation value by the CHART.

Eulachon Critical Habitat

Eulachon PBFs in the action area is freshwater and estuarine migration corridors associated with spawning and incubation sites that are free of obstruction and with water flow, quality, and temperature conditions supporting larval and adult mobility, and with abundant prey items supporting larval feeding after the yolk sac is depleted. These features are essential to conservation because they allow adult fish to swim upstream to reach spawning areas and they allow larval fish to proceed downstream and reach the ocean.

The habitat features with commonality with critical habitat for salmonids and eulachon are water quality/quantity, migration corridors free of obstruction, and prey base. Features unique to salmonid rearing and migration are sediment, cover, and habitat complexity (e.g., side channels). In the action area, water quality is a feature supporting migration for all species considered in this opinion. The proposed action will alter several of these PBFs due to elevated turbidity, risk of entrainment, and reduced forage.

Water Quality: The proposed action will temporarily degrade water quality (due to turbidity) within the Columbia River each year in which dredging occurs. Due to the coarseness of the predominant sediments being suspended by the dredge and placement operations (gravels and sands), they are expected to settle out rapidly (within minutes), and in close proximity (several feet) to their source location. The finer sediments (silts and clays) suspended by the clamshell dredge will settle out more slowly (within an hour from the time the work ceases) and the longer duration in suspension means the turbidity plume from these materials will be more extensive (i.e., extending approximately 1,000 feet downstream at each in-water dredge site).

Prey Availability: Benthic invertebrates provide the primary food source for these fish dominated by families of midges (Johnson et al. 2011). Loss of forage will occur where frequency and duration of the dredging delay natural recolonization, as dredging operations will disturb benthic habitat and reduce benthic productivity temporarily. Winter dredging leads to shorter benthic community recovery post-dredging (Sánchez-Moyano et al. 2004).

Recolonization rates for benthic fauna after dredging ranges from 15-60 days depending on how deep the river is dredged (Sánchez-Moyano et al. 2004). Recolonization of dredged sites most likely occurs from up-river communities (Victoria et al. 2015). Studies have also shown that dredging of the same area within a short time frame can dramatically increase the amount of time that it takes for recolonization to occur because recolonizing taxa are typically early successional species (Foden et al. 2010). Studies have also shown that deeper dredging can have the same effect as frequent dredging due to changes in sedimentation that make recolonization challenging for benthic communities (Foden et al. 2010). However, there is some evidence that pulses of benthic creatures being pulled up into the water column are beneficial to migrating juvenile salmon when substrate is dredged, though the resulting increase in prey is often short-term (Victoria et al. 2015).

As mentioned, the depth of the dredging project can also be significant factor on benthic community recovery. Most macroinvertebrates live in the first 30 centimeters (cm) of the benthos. If the first 7-13 cm are the only depths that are dredged, rapid recolonization in 15 days is possible. However deeper dredging can result in recovery times that are 60 or more days, because less taxa are available to re-seed the substrate when deeper dredging ensues (Sanchez et al. 2004).

Another study conducted by Bolam et al. (Bolam et al. 2003) looked at the rate of recolonization in highly stressed environments that are adapted to disturbance. The areas classified as highly stressed were those than were shallow, less than 20 meters and in a highly variable environment, such as tidal stress seen in an estuarine environment. The LCR is generally 43 feet throughout its deepest portion and is an estuary subjected to tidal influence. Highly stressed areas typically are held in an early successional phase due to a high degree of disturbance from many factors that can include storms and dredging. These areas have less species diversity but of those species present there is an evolutionary ability to quickly repopulate post disturbance at a rate of 6 months or less (Bolam et al. 2003). Recolonization can happen through vertical migration of still intact benthic organisms after the deposition of dredge spoils, horizontal immigration of post larval taxa, and from larval recruitment from the water column from upriver sites or from tidal pulses (Maurer et al.1981, Bolam et al. 2003a).

In summary, dredging can have an effect on the PBF of critical habitat and can lead to loss of benthic taxa. Recovery time for benthic organisms is not well studied, especially over many years in highly disturbed environments. Benthic taxa recovery should not be expected to recover in a short period of time in the action area. We expect benthic prey communities will be suppressed in the action area up to 6 months of each year before re-establishing their pre-dredge abundance and assemblage complexity.

Passage: Three effects of the project influence passage – turbid conditions (described more fully above as a water quality reduction), operation of dredge equipment, and noise. These effects are described below.

Turbidity conditions: Passage conditions outside of the immediate area where the dredge equipment is operating are made less safe by the elevated turbidity (described more fully in water quality effects, above), though the majority of turbidity produced by the clamshell dredge

is expected to remain localized in proximity to the active clamshell bucket based on the materials likely to be disturbed. Areas with high levels of suspended sediment may create migration obstruction for salmonids (see the salmonid response to turbidity, below in the species effects section), but this is not expected to obstruct up or downstream migration for eulachon.

Operation of equipment/entrainment: Dredging will also temporarily obstruct or decrease safe passage, in a small area immediately around the clamshell bucket equipment depositing dredged material, during October 1 to December 31 IWWW. Subyearling juvenile salmon can become entrained by dredging equipment due to their lower sustained swimming speed and decreased ability to avoid dredging equipment. Subyearling salmon are more likely to be present near the shore increasing the likelihood of encountering dredging equipment. Adherence to in-water work windows will minimize the risk of entrainment.

Operation of equipment/noise: Vibratory pile driving, operation of dredge equipment, and the operation of barges to and from the dredge and disposal sites produce sound waves that fish can detect and respond to. The noise profile associated with these sources may impair migration values by inhibiting migration behaviors among salmonids; eulachon migration value does not appear to be disrupted by noise. This is detailed more completely in the effects to species section, below.

2.5.2. Effects on Species

Effects of the action on species are based on individual fish exposure to the habitat changes described above, or effects occurring to the fish themselves. In this case, fifteen ESA-listed fish species of the upper and lower Columbia basins occur in the action area, and they will be exposed to the habitat effects of the action, as well as direct exposure to the dredging equipment. Deeper waters and greater flows found in the Columbia River flow lane will provide a migration corridor for adults and larger juveniles. Adult salmonids will move upstream and through the action area within several hours, based on an estimated 1.5 kilometer per hour swimming speed (Brett, 1966; Tanaka 2001), limiting their exposure. Juvenile salmonids, depending on the species and age of the fish, may spend hours to months within the action area, which makes the duration of exposure likely to be much longer. However, the area of exposure may be limited. For example, juvenile salmonid foraging primarily occurs in waters less than 20 feet deep, which is a small proportion of the action area due to historical maintenance dredging of the Port of Vancouver to depths greater than 30 feet. Presence overlap with the proposed action by life history stage is provided in more detail Appendix A, which also presents the abundance at which each life stage is likely to be present (relative number of individuals likely to be exposed).

Adult salmonid presence. Though peak migratory periods vary by species (see Appendix A), some adult Columbia River salmonids are reasonably certain to be present in the action area during the IWWW for a brief amount of time, and therefore will be briefly exposed to the effects of the action during their migration to their natal spawning streams:

- Chinook: Adult LCR Chinook are present during the work window and have peak migration during the month of October. Adult UCR Chinook are present but in low numbers during the work window as are adult SR fall Chinook.

- Adult LCR coho salmon presence is at its peak in October and early November, but not expected by December.
- Adult CR chum salmon have peak presence in the Lower Columbia River during November and December.
- UWR adult steelhead, LCR adult, adult SR Basin steelhead are present during the IWWW but in low abundance. UCR steelhead summer DPS is present is abundant numbers although their peak migration period is July-September.

Based on the broad run timing of these species, and the proposed work period of October 1 to December 31, exposure potential for CR chum, LCR coho, and LCR Chinook is high because the IWWW overlaps with peak adult migration and holding (see Appendix A). Adults of the remaining species (SR fall Chinook, UCR Chinook spring Chinook, UWR steelhead, LCR steelhead, SR Basin steelhead, and UCR steelhead) have a lower potential for exposure because they will be migrating through the action area in much lower numbers. Adult UWR Chinook are not expected to be present during the in-water work window.

Exposure and Response to Turbid Condition

The proposed action will temporarily degrade water quality (due to turbidity) within the Columbia River each year in which dredging.

Adult salmonids will typically be in the main river channel at depths of 10 to 20 feet below the water surface and off the bottom (Johnson et al. 2005). Areas of increased turbidity are expected to be small because of the equipment used (clamshell), and the substrate characteristics (mostly coarse sands). This suggests that the potential for adults to encounter areas of high suspended sediment is low. Studies show that salmonids are able to detect and distinguish turbidity and other water quality gradients (Bisson and Bilby 1982), and adult salmon have swimming abilities to more easily avoid waters affected by suspended sediment to find refuge and/or passage conditions within unaffected adjacent areas.

Given that adult salmonid migration rates range up to a few miles per hour (Matter and Sandford, 2003), we expect adults that do encounter the turbidity associated dredge operations will be moving upstream at such a rate as to limit exposure, probably to a matter of minutes or possibly hours, which reduces the duration of exposure. Even if exposed, larger salmonids are more tolerant of suspended sediment than smaller juveniles (Servizi and Martens 1991, 1992). Thus, to the extent that any adult fish are exposed to turbidity generated by project activities, the primary response is expected to be avoidance behavior. A small number of fish may experience some turbidity when within proximity of the clamshell bucket operation within the main-stem Columbia River where sediments are actively settling out, but the brevity of their exposure should result in no significant response. We anticipate adult salmonids will pass through the action area without experiencing adverse effects due to the brevity of exposure and therefore should not experience reduced fitness.

Exposure and Response to Entrainment or Bucket Strikes

Although adult salmon will be present in the action area during the proposed action, and some species may even be present in large numbers due to the overlap of their peak migration with the IWWW, we expect that few adult fish will experience entrainment during the proposed action. This is due to their swimming speed (limiting the potential duration of exposure), the limited footprint of dredging operations at any specific time, relative to the size of the Columbia River migration corridor (limiting the potential areas of exposure), and the behavioral responses of individual fish (expected migratory and avoidance behaviors inherent to adult salmon and steelhead, limiting the likelihood of exposure).

Migrating adult salmon are typically able to widely disperse in the estuary. The spatial extent of action area is less than one percent of the total area of the lower Columbia River, with sufficient space around the dredging for adult fish to safely pass. Adult salmonids are strong swimmers, with strong instincts to reach their natal streams for spawning. Adult salmon are expected to avoid the clamshell bucket and thus avoid entrainment (despite the two months-long overlap with the adult run-timing previously discussed). Therefore, we anticipate adult salmonids will not experience adverse effects of entrainment. As such, we expect no reduced fitness of these adult individuals from this effect.

Exposure and Response to Reduced Prey

Adult salmonids, other than steelhead, do not rely on prey during their natal homing migration. Reduced prey is not likely to have an adverse effect on any salmonid adults.

Exposure and Response to Pile Driving Noise:

Adult ESA-listed fish are not expected to be injured or delay their migration due to possible exposure to noise generated by pile driving. The sound pressure generated by vibratory piling driving for 3 hours per pile over the course of one 10-hour workday will generate 153-165 decibels (dB) of underwater noise 10 meters from the source (WSDOT 2020a). The noise threshold at which fish start to experiences behavior changes associated with vibratory pile driving is 150 dB. Noise above 150 dB can produce a startle effect for salmonids. The stress associated with behavioral changes can increase predation and induce changes in migration. Adult salmonids are likely to respond by avoiding the area (Mueller et al 1998, Knudsen et al 1992, 1994).

Juvenile salmonid presence. Dredging around the port berths in fall through mid-winter overlaps when juvenile salmonids are present but at very low density (Roegner et al. 2012), and at depths ranging from approximately -18 feet to -45 feet MLLW. Currently, salmonids expected in the action area will generally exhibit either a stream-maturing or ocean-maturing life history type. Stream type juvenile salmon and steelhead typically rear in upstream tributary habitats for over a year. These include LCR Chinook salmon (spring runs), LCR steelhead, LCR coho salmon, UWR steelhead, UWR spring-run Chinook salmon, SR spring/summer Chinook salmon, UCR Chinook salmon, SR Basin steelhead, and UCR steelhead. Juveniles likely to be present (see Appendix A) are:

- LCR Chinook salmon are rearing for the full duration of the IWWW. Outmigration occurs throughout the IWWW with abundant numbers of juvenile LCR Chinook expected to be present.
- SR fall and UWR spring-run Chinook are expected to be present in low abundance during the IWWW.
- LCR steelhead are present in low abundance during the entire work window.
- Juvenile species not expected to be present are CR chum, UCR Chinook, UWR steelhead, and SR Basin steelhead.

The duration and intensity of exposure juvenile salmonids to the effects of the action will vary, depending on species and life history stage, along with the location, timing, and depth of the activities. The potential for high numbers of exposed juveniles, and extended duration of exposure, is greatest among those fish that are present as rearing and migrating fish throughout the entire work window. These juveniles are the LCR Chinook, SR fall Chinook, UWR spring-run Chinook, and LCR steelhead.

Juvenile ESA-listed species migrate through the action area at different rates and times depending on species and life history. The migration rate and time will influence the duration of exposure for those fish that have a migration path near the areas being dredged. Stream-rearing fish will migrate through the action area as smolts, and these juveniles tend to be 100 to 200 millimeters (mm) in size. At this size and age, individual fish move quickly downstream (Peake and McKinley 1998) and will be through the action area within 1 - 2 days. This limits the duration of exposure to both the operating dredge equipment and the habitat effects of the dredging (turbidity, reduced forage, migration pathway interruption).

Ocean-type juvenile salmon, however, tend to move out of spawning streams and migrate towards the lower Columbia River estuary as subyearlings and are actively rearing within the Lower Columbia River. These include LCR Chinook salmon (fall runs), and SR fall-run Chinook salmon. These fish are smaller in size (less than 100 mm) and more likely to spend days to weeks in the action area foraging (Carter et al. 2009). The potential for their exposure is therefore significantly greater.

Juvenile ESA-listed species have a wide horizontal and vertical distribution related to size and life history stage. Generally speaking, while juvenile salmonids favor areas where water is 20 feet or shallower in depth, they will occupy the full action area, as well as across the width of the river, and to average depths of up to 35 feet (Carter et al. 2009). Smaller-sized fish use the shallow water and shoreline habitats, and larger fish will use the channel margins and main channel. The pattern of use generally shifts between day and night. Juvenile salmon occupy different locations within the Columbia River, are typically in shallower water during the day, and may avoid predation by larger fish that are more likely to be in deeper water. Apparently, these younger fish will venture into the deeper areas of the river away from the shoreline, moving towards the FNC and along with the bathymetric break – or channel margin – and will be closer to the bottom of the channel. Carlson et al. (2001) notes there is a higher percentage of use along the channel margins than in the shallow water habitat or channel, which indicates potential underestimates for nearshore subyearlings. Juvenile salmon position in open water tends to be about 3 meters below the surface (Carter et al. 2009), a minimum of 2 meters off of

the bottom in shallow areas, 3 to 10 meters off the bottom on the channel margins, and 5 to 15 meters off the bottom in the main channel (Carlson et al. 2001) with subyearlings being closer to the bottom than older 1+-year-old fish (Carter et al. 2009). The smaller subyearling salmonids will likely congregate along the nearshore areas in shallow water and extend into the channel margins (Bottom et al. 2011). Yet, as Carlson et al. (2001) indicated, there is a higher use of the channel margins than previously thought, and considering the parameters above, relative juvenile position in the water column suggests higher potential subyearling use in areas of 20 to 30 feet deep than previously considered. Therefore, we anticipate direct overlap with dredging operations and the presence of juvenile salmonids.

Exposure and Response to Turbid Conditions

Juvenile fish migrating through or rearing within the action area during the IWWW are expected to be exposed to turbid conditions. The intensity of the exposure is related to how close to the operating equipment the fish are, because suspended sediment is the highest nearest the operation, with finer sediments in suspension longer and further from the equipment. The duration of exposure is a maximum of a day or two for migrating juveniles if they engage in no avoidance behavior at all. The duration for rearing juveniles could be much longer because, as smaller fish, their avoidance abilities are weaker, so exposure could last several days or more at the outer edges of the plume. However, elevations in turbidity and TSS generated by pile driving will be localized (i.e., up to 1,000 feet), short-term persisting while the dredge is operating over a 10-hour workday for 1-2 days every three years and similar to the variations that occur naturally such as during high water events or after large rainstorms.

Responses associated with exposure to turbidity range from beneficial to detrimental. Elevated total suspended solids (TSS) have been reported to enhance cover conditions, reduce piscivorous fish/bird predation rates, and improve survival, although elevated TSS has also been reported to cause physiological stress, reduce growth, and adversely affect survival (Newcombe and Jensen 1996). Fish may experience a reduction in predation from piscivorous fish and birds by occupying turbid waters (Gregory and Levings 1998), but longer-term exposure to these conditions can cause physiological stress responses that can increase maintenance energy needs and reduce feeding and growth (Lloyd et al. 1987; Redding et al. 1987; Servizi and Martens 1991).

Newcombe and Jensen (1996) analyzed numerous reports on documented fish responses to suspended sediment in streams and estuaries and identified a scale of ill effects based on sediment concentration and duration of exposure. The effects of suspended sediment on fish increase in severity with sediment concentration and exposure time and can progressively include behavioral avoidance and/or disorientation, physiological stress (e.g., coughing), gill abrasion, and death—at extremely high concentrations. A severity level of six on the Newcombe and Jensen (1996) scale correlates to moderate physiological stress and is associated with a large increase in the coughing rate and an increase in blood glucose levels (Servizi and Martens 1992) and is considered the break point whereby an adverse effect from exposure may occur. Specifically, level six for juvenile salmonids equates to an increase in suspended sediment concentration of about 1,097 milligrams per liter for 1 to 3 hours exposure time (Newcombe and Jensen 1996). Studies also show that salmonids are able to detect and distinguish turbidity and

other water quality gradients (Quinn 1988, Simenstad 1988, Bisson and Bilby 1982), and that larger juvenile salmonids are more tolerant to suspended sediment than smaller juveniles (Servizi and Martens 1991).

To the extent that juvenile salmonids are present in the areas affected with elevated suspended sediment, most are expected to be of sufficient size to enable avoidance of waters with high levels of suspended sediments, limiting their exposure and the likelihood of severe adverse effects. Thus, exposure of migrating juvenile salmon or steelhead to suspended sediment from this project will be for minutes hours to days; for rearing juveniles, exposure could be for days or longer, but is unlikely to approach the suspended sediment concentrations associated with the injury or mortality identified in Newcombe and Jensen's 1996 manuscript (i.e., Level 6). Death or injury to ESA-listed salmonids directly from an increase in turbidity is not likely, however some rearing ESA-listed fish in the action area are likely to experience the direct of effects caused by suspended sediment (gill abrasion, cough, raised cortisol, increased respiration, decreased ability to detect prey or predators). If these fish engage in avoidance, displacement to adjacent rearing habitat may increase competition for food and refuge in the unaffected habitat areas. A small subset of these fish may experience reduced growth as a result and therefore have reduced fitness (Matte et al., 2021).

Exposure and Response to Reduced Benthic Prey

To the degree that some foraging by sub-yearling salmonids in the action area occurs deeper than 25 feet, they are also likely to be exposed to reductions in forage, described above in the effects on critical habitat. Subyearlings are actively feeding as they move downstream, which promotes their growth and maturation. However, juvenile salmonids in the Columbia River use their vision to detect, acquire and subsequently, feed on small invertebrates (i.e., Dipterans, Psychosidadae, and *Corophium*; Roegner et al. 2004), so their ability to effectively feed will decline with elevated turbidity. This inability to detect prey, when coupled with decreased prey availability, will likely reduce growth, lipid stores, and ultimately fitness and survival in the small number of sub-yearling juvenile fish, reducing their fitness as they reach the estuary. The level of foraging in the dredge prism is not expected to be high, however, and occurs more among the larger upriver fish migrating through the action area.

We do not expect significantly reduced forage availability to rearing juvenile salmonids to occur as a result of dredging, however, because the dredge sites are outside the littoral area and at a depth 15 feet deep, slightly deeper than preferred by rearing juveniles. Rearing juveniles may have an occasional presence in waters up to 30 feet deep, but this is expected to be rare due to a lack of habitat complexity (no large wood or current breaks). Also, the benthic invertebrates occupying sediment dredge sites will likely be larger than rearing juveniles gape allows for foraging. For these reasons, we expect only a small number of juveniles from each of the juvenile species rearing or migrating each year during the dredge period will be impaired in their forage success and growth, and therefore fitness of some individuals may be reduced as a result of this effect of the proposed action.

Exposure and Response to Entrainment or Bucket Strike

Larger, juvenile smolts (>100 mm), that are actively migrating within the mainstem Columbia River, have swimming abilities which allow for a better avoidance response to dredging disturbance than the younger, rearing fish, and this ability will further reduce but not completely eliminate entrainment and subsequent injury or death of these fish. Based on the likelihood of exposure among rearing juveniles over a period of 1-2 days roughly every three years over the 10-year period for migrating juveniles, we focus our analysis on SR fall Chinook, UWR Chinook, LCR Chinook, and LCR coho (present for the entire work window) and CR chum (present for approximately half of the work window). Even though clamshell dredging is not documented to have high levels of entrainment and the area in which the bucket is deployed is small (i.e., less than 1 cubic meter), based on their relative abundance at the time of dredging, multiple individuals of these species are likely to be entrained by dredging equipment over the 10-year course of this permit, due to their smaller size (<100 mm) and inferior swimming ability.

Exposure and Response to Increased Sound Pressure Levels

Juvenile LCR chinook, UWR Chinook, SR fall chinook, and LCR steelhead are expected to be present in the action area during vibratory pile driving and potentially exposed to increased sound pressure levels. The fitness of some individuals may be reduced as a result of their exposure to increased sound pressure levels. The pile driving will occur for one standard 10-hour workday during the work window of October 1-Nov 30. Exposure to individual fish will be low due to the short time frame in which pile driving is occurring to fix the damaged dolphin. The noise that will be generated by vibratory piling driving for the one day that vibratory pile driving is expected to occur is between 153-165 dB. At 150dB or higher we would expect behavioral changes such as avoidance and reductions in foraging behavior to occur. Juvenile salmonids may also experience increased predation due to changes in behavior associated with vibratory pile driving that may make juvenile salmon more vulnerable to predation from predatory fish and birds.

Eulachon. Eulachon are present at all times of the work window at all life stages, except for the month of October. Presence occurs both as migrating adults and as eggs and potentially larval fish passively out-migrating through the action area. Both life stages are present with peak adult abundance from late December-mid March. These life stages will be exposed to noise, turbid water quality, and risk of entrainment.

The vast majority of eulachon spawning takes place in Washington State tributaries, including the Cowlitz, Elochoman, Kalama, and others, although some spawning does occur in the Columbia River between river miles 30 and 146, which would encompass the action area. Specific spawning locations in the Columbia River are difficult to predict year to year. Spawning takes place atop sand and fine gravel substrates to which the eggs adhere and mature, often being transported downstream through this maturation process through sediment transport processes that occur along the riverine corridor. Once eggs are hatched, typically after about 30 days, the larvae disperse throughout the water column and are widely distributed as they drift downstream passively.

Exposure and Response to Turbidity

Exposure is likely to eggs or larvae if dredging occurs in late December when these life stages are more likely to be present. The intensity of the exposure is related to how close to the operating equipment the fish are, because suspended sediment is highest nearest the operation, with finer sediments in suspension longer and farther from the equipment. The duration of exposure is a maximum of a day or two for migrating juveniles because they are not capable of avoidance behavior in their juvenile larval state. The increases in turbidity and TSS generated by dredging will be localized (i.e., up to 1,000 feet from the dredge), short-term in duration (i.e., persisting while the dredge is operating over a 10-hour workday for 1-2 days roughly every three years), and similar to the variations that occur naturally such as during high water events or after large rainstorms.

Exposure and Response to Increased Noise

The proposed work window for this project ends in late December which means that there is a possibility that adult eulachon could be exposed to under water noise as a result of vibratory pile driving. However, the decibels produced from the approximately 9 hours of vibratory pile driving over the course of 1 day are not at a level expected to produce adverse effects among individuals of this species. Adult migration behavior is also unlikely to be altered as sound should not impair the instinct of adult eulachon to reach their spawning areas.

Exposure and Response to Decreased Safe Passage (Entrainment Risk)

Dredging could entrain both adults, eggs, or larval eulachon, though outmigration timing significantly reduces the likely abundance of eggs or larvae to be present in the action area during the dredging activities. Any entrained eulachon, regardless of life stage, are expected to be killed by the entrainment. Those eulachon that are present in peak abundance have the greatest risk of being entrained by dredging equipment. However, the short duration of dredging (i.e., 1-2 days), decreases the likelihood of entrainment. Best management practices that include a prescribed IWWW and slowly lowering and raising the bucket of the dredge will further help decrease the risk of eulachon entrainment.

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. Our analysis considers: (1) how future non-Federal activities in the Columbia River basin are likely to influence habitat conditions in the action area; and (2) cumulative effects caused by specific future activities in the vicinity of the project location.

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

environmental conditions in the action area are described in the environmental baseline (Section 2.4). We could expect over the 10-year period of the proposed action that some climate effects, described in the baseline, such as warming water temperatures, or increasing variability of volume (low flows, high flows) to become more pronounced. These effects could increase food web disruptions, migration success, or other stresses on any or all of the listed species that rely on the action area.

Also in this action area, state, or private activities in the vicinity of the project location (e.g., recreational boating, fishing, or other water-based recreation) are expected to increase and be a source of cumulative effects in the action area. Additionally, future state and private activities in upstream areas (particularly intensifying land use, and changes in tree cover) are expected to cause additional habitat and water quality changes that are expressed as cumulative effects in the action area.

Barge and tugboat traffic will be maintained within the action area as a result of 10-year dredging permit and the associated barge and tug traffic that facilitates the disposal of dredge spoils. This will increase the cumulative effects in the action area by increasing the likelihood of vessel strikes, increasing pollution and decreasing water quality.

Approximately six million people live in the Columbia River basin, concentrated largely in urban centers. As human population grows, the range of effects described previously in the baseline are likely to intensify. The effect of future population growth is expressed as likely changes to physical habitat and additional pollutant load contributed to the Columbia River. These changes will be caused by residential, commercial, industrial, agricultural, and other land uses for economic development, and are similar to those described in the Environmental Baseline (Section 2.3). The collective effects of these activities tend to be expressed most strongly in lower river systems where the impacts of numerous upstream land management actions aggregate to influence natural habitat processes and water quality. As such, these effects accrue within this action area, though most are generated from actions upstream of the action area.

The future changes (most likely to include reduced riparian condition, increased water quality impairments, and increased in-river recreation) will reduce the ability of populations of ESA-listed species to sustain themselves in the natural environment by altering or interfering with their behavior in ways that reduce their survival throughout their life cycle. The environmental changes also reduced the quality and function of critical habitat PBFs that are necessary for successful spawning, production of offspring, and migratory access necessary for adult fish to swim upstream to reach spawning areas and for juvenile fish to proceed downstream and reach the ocean. As a result, recovery of aquatic habitat is likely to be slow in most areas, and contemporaneous cumulative effects from basin-wide activities are likely to have a slightly negative impact on fish population abundance trends and the quality of critical habitat PBFs into the future.

2.7. Integration and Synthesis

The Integration and Synthesis section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 2.5) to the environmental baseline (Section 2.4) and the

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

Adults and juveniles from the 15 ESUs/DPSs analyzed in this opinion, use the action area for migration and rearing. We assess the importance of habitat effects in the action area to the ESUs/DPSs by examining the relevance of those effects to the characteristics of VSPs. The characteristics of VSPs are sufficient abundance, population growth rate (productivity), spatial structure, and diversity. Considering the short residence time of juvenile ESA-listed salmonids in the action area, the number of listed species encountering effects of the action is likely to be low. The effects on the growth and survival of individual salmon are unlikely to affect the abundance, productivity, or distribution of the component populations of the ESA-listed salmonids in the action area. Even considering cumulative effects anticipated in the action area, when they are combined with the effects of the action and added to the environmental baseline, the aggregate of impacts to the species will affect too few fish to influence the population viability characteristics of the affected species.

Each species considered in this opinion is threatened by extinction risk. Each of these species is listed due to a combination of low abundance and productivity, reduced spatial structure, and decreased genetic diversity of their constituent independent populations. Most of the component populations of LCR Chinook salmon, UCR spring-run Chinook salmon, SR spring/summer run Chinook salmon, UWR spring-run Chinook salmon, SR fall-run Chinook salmon, CR chum salmon, LCR coho salmon, LCR steelhead, UCR steelhead, SR Basin steelhead, and UWR steelhead, are at a low level of abundance or productivity. Several species have lost multiple historical populations as a result of anthropogenic changes throughout their habitat, and all remaining populations face limiting factors in the habitat they do have, including in the action area. Individuals from almost all of the ESA-listed component populations must move through or utilize the action area at some point during their life history. All individual fish from each population and species reaches the action area having experienced reductions in amount and quality of available habitat, including within the action area.

Factoring the current environmental baseline, the fish from the component populations that move through and/or use the action area will encounter habitat conditions degraded by modified flow regime, reduced water quality from substantial chemical pollution, loss of functioning floodplains and secondary channels, and loss of vegetated riparian areas and associated shoreline cover, and loss of historical estuarine conditions. The significance of the degradation is reflected in the limiting factors including insufficient access to floodplain and secondary channels, degraded habitat, loss of spawning and rearing space, pollution, juvenile fish stranding, and increased predation, highlighting the importance of protecting current functioning habitat and limiting water quality degradation, minimizing entrainment, and reducing potential predation of ESA-listed fish. The consequences of habitat loss throughout the CR basin and within the action area has led to a reduction in habitat variety and complexity, and in turn, a loss of species genetic variety in life history expression (loss of species diversity). The current environmental baseline

has also led to conditions that make species-level adaptation more difficult as habitat conditions change over time, such as the effects of climate change on water temperatures throughout the Columbia River Basin.

The fitness of individual fish that rear or migrate in degraded conditions may already be poor when they reach the action area, which would likely make them more susceptible to detrimental effects when they encounter effects of the proposed action. Within this context, the proposed action will create each year for 10 years, a 2-day period with: (1) physical disturbance in the water column; (2) redistributed material from the bottom; and (3) subsequent reduction of benthic prey in the Columbia River which could take up to 6 months to fully recolonize after each dredge. The modified bathymetry will be maintained for the duration of the 10-year permit. We evaluate the addition of these effects to the baseline determine the aggregate risk to species listed and endangered species survival and recovery, and to the critical habitat's capacity to conserve species.

Salmonid Species: These habitat alterations, when added to the baseline, will cause displacement of a small number of adult and juvenile fish, as they avoid the pile driving operation (elevated underwater noise and turbidity), dredging operation (entrainment and elevated turbidity), plus a period in which fish have reduced prey as the benthic biological productivity is reduced, and then re-establishes, in the vicinity of the dredge prism. These alterations will occur each year of the 10-year permit, during the 2-day work window. Finally, entrainment of a few juvenile salmonids is reasonably certain to occur during operations, which could occur in any of the rearing or migrating ESUs/DPSs but is most likely in the rearing ESUs. However, even when we consider the current status of the threatened and endangered fish populations and degraded environmental baseline within the action area, the proposed action's triennial decrease in species abundance is likely to be very small, and to be across more than one population, and occur among more than one species. This reduction in abundance itself, even when occurring every three years for 10 years permit duration is not expected to be sufficient to measurably affect distribution, diversity, or productivity of any of the component populations of the ESA-listed species, because the reductions are expected to be a small enough number of few juveniles, that their loss will likely be indistinguishable among that cohort as returning adults.

Salmonid Critical Habitat: The habitat modifications, when added to the baseline, will reduce PBFs within the action area each year for 10 years, with the longest duration of effect being the reduction in prey. These diminishments do not appreciably further degrade baseline conditions or aggravate limiting factors, primarily because the reduction in water quality and safe passage is brief and promptly returns to the baseline level, though that level of function is degraded. The effect on forage availability is constrained spatially, but largely ensures that prey communities are slightly depressed throughout the action area. Prey is not currently considered a limiting factor in the Columbia River corridor. As a whole, the migration and rearing PBFs are functioning moderately under the current environmental baseline in the action area. The triennial disruption of the habitat effectuates a continued constraint, but not an increase, on the habitat's natural function by retaining anthropogenic conditions that limit productivity.

Eulachon: Eulachon are present during the November and December portion of the work window. Presence occurs both as migrating adults and as eggs or larval fish passively out-

migrating through the action area. Both adults and juveniles will be exposed to noise, turbid water quality and risk of entrainment. Prey is not a significant feature as larval fish consume their yolk sack while they passively migrate downstream, and do not begin consuming prey until they are lower in the estuary.

The vast majority of eulachon spawning takes place in Washington State tributaries, including the Cowlitz, Elochoman, Kalama, and others. Spawning takes place atop sand and fine gravel substrates to which the eggs adhere and mature, often being transported downstream through this maturation process through sediment transport processes that occur along the riverine corridor. Once eggs are hatched, typically after about 30 days, the larvae disperse throughout the water column and are widely distributed as they drift downstream passively. The proposed work window for this project ends in late December, prior to the peak of eulachon larval outmigration (which occurs from February-May). Dredging could entrain both adults, eggs, and outmigrant larval eulachon, though outmigration timing significantly reduces the likely abundance of larvae to be present in the action area during the dredging activities. Any entrained eulachon, regardless of life stage, are expected to be killed by the entrainment.

Eulachon Critical Habitat: The action area includes eulachon PBFs for migration corridors, spawning and egg/larval development. The proposed action will not have any permanent effects to migration corridors within the Columbia River but will temporarily obstruct or decrease safe passage in a small area immediately around clamshell bucket, during the October 1 to December 31 IWWW due to elevated turbidity and risk of entrainment.

The last element in the integration of effects includes a consideration of the cumulative effects anticipated in the action area. When considering the cumulative effects of non-federal actions, recovery of aquatic habitat from the degraded baseline conditions is likely to be slow in most of the action area, and cumulative effects (from continued or increasing uses of the action area) are likely to have a negative impact on habitat conditions, which in turn may cause slight negative pressure on population abundance trends in the future.

Given that the proposed action will have low-level and periodic effects on the PBFs for migration and rearing for salmonids, even when considered as an addition to the baseline conditions, and together with the cumulative effects, the proposed action is not likely to appreciably diminish the value of designated critical habitat in the action area for the conservation role of rearing or migration of salmonids, nor spawning and migration of eulachon.

Similarly, fitness level consequences to exposed individuals are anticipated at low levels for most effects of the action (water quality, sound, prey). Very few individuals are expected to experience significant fitness consequences (injury or death) from entrainment. None of the populations are expected to experience reductions in abundance that will appreciably alter productivity, spatial structure, or diversity. Therefore, NMFS concludes that the proposed action, even when cumulative effects are considered, is not anticipated to reduce appreciably the numbers, reproduction, or distribution of listed salmonids or eulachon.

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 NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of LCR Chinook salmon, UCR spring-run Chinook salmon, UWR spring-run Chinook salmon, SR fall-run Chinook salmon, CR chum salmon, LCR coho salmon, LCR steelhead, UCR steelhead, SR Basin steelhead, UWR steelhead, or eulachon, or destroy or adversely modify their designated critical habitat.

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 ITS.

2.8.1. Amount or Extent of Take

In the biological opinion, NMFS determined that incidental take is reasonably certain to occur in each year over the 10-year duration of the permits as follows:

1. Incidental take in the form of injury or death due to entrainment during clamshell dredging.
2. Incidental take in the form of harm from increased turbidity and diminished prey availability.
3. Incidental take in the form of harassment from pile driving noise is likely to occur among juvenile salmonids only, during the single authorized replacement of the damaged dolphin.

Due to the highly variable number of individual fish present at any given time, and difficulties in the ability to observe injury or mortality of fish, which may sink out of site, be consumed by predatory species, or have delayed death outside of the action area, a definitive number of ESA-listed fish that will be killed, injured, or otherwise adversely affected cannot be determined. In such circumstances NMFS will use a habitat-based surrogate to account for the amount of take, which is called an "extent" of take. The extent of take is causally related to the harm that occurs, and is an observable measure for monitoring, compliance, and re-initiation purposes.

For this proposed action, the potential for occurrences of injury or death from entrainment, and harm from being exposed to elevated turbidity and reductions in forage for juvenile salmonids, is directly related to the amount of time that the dredge is in operation, the timing of the dredge operation, and the volume of material removed. Thus,

The extent of injury or death from entrainment is a maximum of 2, 10-hour days of dredging, to occur roughly every three years, for 10 years between October 1 to December 31.

The extent of harm from turbid conditions is a maximum of 2 10-hour days of dredging, to occur roughly every three years, for 10 years between October 1 to December 31, but also where the suspended sediment will be present consistent with legal authority. In this case the downstream extent of the CWA authorized mixing zone is 300 feet downstream from the point of disturbance in the CR.

The extent of harm from diminished prey availability is coextensive with the footprint of dredging; therefore, the extent of take is measured as the volume of river bottom where dredging will remove substrate and the benthic prey communities (i.e., 3,000 cubic yards/event but no more than 10,000 cubic yards over the 10-year period).

Harassment from pile driving - Noise from vibratory driving may induce a startle response temporarily making it difficult for juvenile salmon to detect and avoid predators. We cannot estimate the number of fish likely to be consumed by piscivores. We instead describe an extent of take based on the duration of pile driving which will occur for a period of 10 hours.

2.8.2. Effect of the Take

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

2.8.3. Reasonable and Prudent Measures

"Reasonable and prudent measures" are nondiscretionary measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02). The USACE shall require the Port of Vancouver and any permittee or contractor performing the work described in this document to minimize take by:

1. Minimizing entrainment during dredging.
2. Limiting underwater noise during vibratory pile driving.
3. Minimizing the amount of turbidity; and
4. Ensuring completion of an annual monitoring and reporting program to confirm the take exemption for the proposed action is not exceeded, and that the terms and conditions in this incidental take statement are effective in minimizing incidental take.

2.8.4. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the USACE must comply (or must ensure that the Port of Vancouver and their contractor comply) with the following terms and conditions. The USACE or the Port of Vancouver or its contractor has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this ITS (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

The following terms and conditions implement RPM 1, minimize entrainment during dredging:

1. The applicant, Port of Vancouver, shall ensure that during dredging operations, the clamshell bucket is lowered to the bottom as slowly as possible to allow ESA-listed fish the opportunity to escape.
2. Time work, if possible, in the month of October to avoid the greatest number of species being exposed to operating dredge equipment.

The following terms and conditions implement RPM 2, minimize the effects of vibratory pile driving:

1. Minimize duration of vibratory hammer operation.
2. Carry out pile driving operations in October to reduce exposure to species that have peak migration periods in the later part of the IWWW.

The following terms and conditions implement RPM 3, minimize turbidity during dredge disposal:

1. The applicant, Port of Vancouver, shall ensure turbidity remains at background levels downstream (300 feet) during dredging and placement operations by adhering to dredge management protocols including monitoring and compliance reporting of turbidity levels observed during dredging operations.
2. If turbidity levels are exceeded, install a floating silt curtain around the in-water dredge area to minimize the dispersion of suspended sediment thereby reducing turbidity.

The following terms and conditions implement RPM 4, monitoring and reporting:

1. Action Monitoring. The applicant shall submit a monitoring report to NMFS by March 31 of each year summarizing the following for the previous calendar year:
    a. Hours of dredging for each day dredging occurred.
    b. The number of days dredging occurred each month.
    c. The number of days of dredging occurred for the previous calendar year;
    d. The extent and depth of dredging conducted for the calendar year;
    e. Turbidity levels from monitoring and whether turbidity compliance was met.
2. Monitoring reports shall be submitted to:
    a. projectsreports.wcr@noaa.gov
    b. Include WCRO-2021-02367 in the subject line.

2.9. 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 following three conservation recommendations are discretionary measures that NMFS believes are consistent with this obligation and therefore should be carried out by the USACE:

1. Regularly require use of floating silt curtains around the in-water dredge area in the Columbia River to minimize the dispersion of suspended sediment thereby reducing turbidity.
2. The USACE should create and implement a mitigation policy and/or program to offset impacts associated with the regular exercise of its authority allowing impacts to the nation's waters.
3. Perform work during the month of October in order to reduce exposure to out-migrating juveniles, such as eulachon and LCR Chinook.

Please notify NMFS if the USACE or the applicant carries out these recommendations so that we will be kept informed of actions that are intended to improve the conservation of listed species or their designated critical habitats.

2.10. Reinitiation of Consultation

This concludes the formal consultation for the Northwest Aggregates Port of Vancouver Maintenance Dredging and Dolphin Replacement Project.

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 if: (1) the amount or extent of incidental taking specified in the ITS is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion or written concurrence; or (4) a new species is listed or critical habitat designated that may be affected by the action."

2.11. Species and Critical Habitats Not Likely to be Adversely Affected

The USACE determined the proposed action is not likely to adversely affect the following ESA-listed resources: sDPS green sturgeon, MCR steelhead, SR sockeye salmon, and designated critical habitats for MCR steelhead and SR sockeye salmon. NMFS concurs with these determinations, as described below.

Green Sturgeon

Green sturgeons are not likely to be present within the action area during the period in which the action is proposed because they use the estuary habitat only during the summer and early fall months (Moser and Lindley 2007) and are not expected to remain in the action area during the IWWW. Prey reductions associated with the proposed action, while more enduring than other effects of the action, are expected to ameliorate within several months, and achieve their baseline

level before green sturgeon return to the action area. Exposure to effects of the proposed action is discountable.

Middle Columbia River Steelhead, Snake River Sockeye and Snake River spring/summer Chinook Critical Habitat

Designated critical habitat for MCR steelhead and SR sockeye salmon will not be adversely affected because the effects of the proposed action on habitat within the CR will be resolved before these fish use the critical habitat that is present in the action area for migration. As such, the effects are not adverse to any conservation role due to the action's ephemeral nature and timing.

Middle Columbia Steelhead, Snake River Sockeye and Snake River spring/summer Chinook

There is no exposure with temporary effects either for adults or juveniles on these species based on the best available information suggesting their migration and rearing timing will not overlap with the proposed action IWWW.

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

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. Under the MSA, this consultation is intended to promote the conservation of EFH as necessary to support sustainable fisheries and the managed species' contribution to a healthy ecosystem. For the purposes of the MSA, EFH means "those waters and substrate necessary to 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 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 descriptions of EFH for Pacific Coast groundfish (PFMC 2005) and Pacific Coast salmon (PFMC 2014) contained in the fishery management plans developed by the Pacific Fishery Management Council (PFMC) and approved by the Secretary of Commerce.

3.1. Essential Fish Habitat Affected by the Project

As part of the information provided in the request for ESA concurrence, the USACE determined that the proposed action may have an adverse effect on EFH designated for Pacific Coast salmon,

specifically the complex channel and floodplain habitat areas of particular concern (HAPC) The action area also contains the HAPC of coastal estuaries for Pacific Coast groundfish. The effects of the proposed action on EFH are the same as those described above in the ESA portion of this document and NMFS concurs with the findings in the EFH assessment.

3.2. Adverse Effects on Essential Fish Habitat

The proposed action will temporarily diminish water quality, disturb benthic habitat, and modify substrate, and decrease forage production Overall, the area of disturbance is relatively small in relation to the Columbia River estuary and the disturbance will be short-lived. These localized and temporary diminishments in EFH will occur roughly every three years during the 10-year permit. More detail on the adverse effects to habitat features is described in Section 2 of this document.

3.3. Essential Fish Habitat Conservation Recommendations

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

1. Require that the applicant use a floating silt curtain during annual dredging to reduce the likelihood of extensive fine sediments plume.

2. In order to ensure maximum habitat recovery between dredge periods, allow maintenance dredging to occur within the 10-year permit only on a showing that sediments have accumulated or are accumulating in a manner that threatens to impede navigation.

3. Actively restore nearshore habitat areas at or owned by the Port of Vancouver that are not dredged in order to increase the amount of suitable habitat in the LCR for MSA managed Chinook salmon.

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

3.4 Statutory Response Requirement

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

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

3.5 Supplemental Consultation

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

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

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

4.1. Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended user of this opinion is the USACE. Other interested users could include the Port of Vancouver and NW Aggregates. Individual copies of this opinion were provided to the USACE. The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adhere to conventional standards for style.

4.2. Integrity

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

4.3. Objectivity

Information Product Category: Natural Resource Plan

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

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

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

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

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APPENDIX A

Species Presence Chart for the Lower Columbia River Estuary

Species(ESU/DPS)	Lifestage	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Chinook													
Lower Columbia River	Adult (migrating and holding)												
	Adult (spawning)												
	Eggs and Pre-emergence												
	Juvenile (rearing)												
	Juvenile (emigration)												
Chinook		**Jan**	**Feb**	**Mar**	**Apr**	**May**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**
Upper Columbia River Spring	Adult (migrating and holding)												
	Adult (spawning)												
	Eggs and Pre-emergence												
	Juvenile (rearing)												
	Juvenile (emigration)												
Chinook		**Jan**	**Feb**	**Mar**	**Apr**	**May**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**
Snake River Spring/Summer	Adult (migrating and holding)												
	Adult (spawning)												
	Eggs and Pre-emergence												
	Juvenile (rearing)												
	Juvenile (emigration)												
Snake River Fall	Adult (migrating and holding)												
	Adult (spawning)												
	Eggs and Pre-emergence												
	Juvenile (rearing)												
	Juvenile (emigration)												
Chinook													
Upper Willamette River	Adult (migrating and holding)												
	Adult (spawning)												
	Eggs and Pre-emergence												
	Juvenile (rearing)												
	Juvenile (emigration)												
Eulachon		**Jan**	**Feb**	**Mar**	**Apr**	**May**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**
Southern Distinct Population Segment	Adult (migrating and holding)												
	Adult (spawning)												
	Eggs incubation												
	larvae emigration												
Green Sturgeon		**Jan**	**Feb**	**Mar**	**Apr**	**May**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**
Southern Distinct Population Segment	Sub-adult and adult foraging												
Chum		**Jan**	**Feb**	**Mar**	**Apr**	**May**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**
Columbia River	Adult (migrating and holding)												
	Adult (spawning)												
	Eggs and Pre-emergence												
	Juvenile (rearing)												
	Juvenile (emigration)												
Coho		**Jan**	**Feb**	**Mar**	**Apr**	**May**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**
Lower Columbia River	Adult (migrating and holding)												
	Adult (spawning)												
	Eggs and Pre-emergence												
	Juvenile (rearing)												
	Juvenile (emigration)												

Species(ESU/DPS)	Lifestage	Jan		Feb		Mar		Apr		May		June		July		Aug		Sept		Oct		Nov		Dec	
Sockeye		Jan		Feb		Mar		Apr		May		June		July		Aug		Sept		Oct		Nov		Dec	
Snake River	Adult (migrating and holding)																								
	Adult (spawning)																								
	Eggs and Pre-emergence																								
	Juvenile (rearing)																								
	Juvenile (emigration)																								
Steelhead		Jan		Feb		Mar		Apr		May		June		July		Aug		Sept		Oct		Nov		Dec	
Lower Columbia River	Adult (migrating and holding)																								
	Adult (spawning)																								
	Eggs and Pre-emergence																								
	Juvenile (rearing)																								
	Juvenile (emigration)																								
Steelhead		Jan		Feb		Mar		Apr		May		June		July		Aug		Sept		Oct		Nov		Dec	
Middle Columbia River	Adult (migrating and holding)																								
	Adult (spawning)																								
	Eggs and Pre-emergence																								
	Juvenile (rearing)																								
	Juvenile (emigration)																								
Steelhead		Jan		Feb		Mar		Apr		May		June		July		Aug		Sept		Oct		Nov		Dec	
Upper Columbia River	Adult (migrating and holding)																								
	Adult (spawning)																								
	Eggs and Pre-emergence																								
	Juvenile (rearing)																								
	Juvenile (emigration)																								
Steelhead		Jan		Feb		Mar		Apr		May		June		July		Aug		Sept		Oct		Nov		Dec	
Upper Willamette River Summer	Adult (migrating and holding)																								
	Adult (spawning)																								
	Eggs and Pre-emergence																								
	Juvenile (rearing)																								
	Juvenile (emigration)																								
Upper Willamette River Winter																									
	Adult (migrating and holding)																								
	Adult (spawning)																								
	Eggs and Pre-emergence																								
	Juvenile (rearing)																								
	Juvenile (emigration)																								
Steelhead		Jan		Feb		Mar		Apr		May		June		July		Aug		Sept		Oct		Nov		Dec	
Snake River	Adult (migrating and holding)																								
	Adult (spawning)																								
	Eggs and Pre-emergence																								
	Juvenile (rearing)																								
	Juvenile (emigration)																								