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

Refer to NMFS No:
WCRO-2020-03159

March 31 2021

William D. Abadie
Chief, Regulatory Branch
U.S. Army Corps of Engineers – Portland District
P.O. Box 2946
Portland, Oregon 97208-2946

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 Santosh Slough Maintenance Dredging Project (Columbia County, Oregon, Columbia River, HUC: 170800060500) (NWP-2000-962-6)

Dear Mr. Abadie:

Thank you for your letter of November 16, 2020, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the Northwest Aggregates Santosh Slough Maintenance Dredging Project (NWP-2000-962-6). 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 basin (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*), SR sockeye salmon (*O. nerka*), LCR steelhead (*O. mykiss*), Middle Columbia River (MCR) steelhead, UCR steelhead, SR steelhead, UWR steelhead, or result in the destruction or adverse modification of critical habitats.

As required by section 7 of the ESA, NMFS is providing an incidental take statement with the biological opinion. The incidental take statement describes reasonable and prudent measures NMFS considers necessary or appropriate to minimize the impact of incidental take associated with this action. The take statement sets forth nondiscretionary terms and conditions, including reporting requirements, that the U.S. Army Corps of Engineers or any applicant must comply with to carry out the reasonable and prudent measures. Incidental take from actions that meet these terms and conditions will be exempt from the ESA's prohibition against the take of listed species.

This document also includes the results of our analysis of the action's likely effects on essential fish habitat (EFH) pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (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 Corps 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 Bonnie Shorin at the Oregon Washington Coastal Area Office in Lacey, Washington, 360-995 2750, Bonnie.Shorin@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: Caila Heintz, U.S. Army Corps of Engineers

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 Santosh Slough Maintenance Dredging (NWP-2000-962-6)

NMFS Consultation Number: WCRO-2020-03159

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

Affected Species and NMFS' Determinations:

ESA-Listed Species	ESA Status	Is the action likely to adversely affect the species	Is the action likely to adversely affect the critical habitat?	Is the action likely to jeopardize the species?	Is the action likely to destroy or adversely modify critical habitat
Lower Columbia River (LCR) Chinook salmon (*Oncorhynchus tschawtscha*)	T	Yes	Yes	No	No
Upper Columbia River (UCR) spring-run Chinook salmon	E	Yes	Yes	No	No
Upper Willamette River (UWR) spring-run Chinook salmon	T	Yes	Yes	No	No
Snake River (SR) spring/summer run Chinook salmon	T	Yes	Yes	No	No
SR fall-run Chinook salmon	T	Yes	Yes	No	No
Columbia River (CR) chum salmon (*O. keta*)	T	Yes	Yes	No	No
LCR coho salmon (*O. kisutch*)	T	Yes	Yes	No	No
SR sockeye salmon (*O. nerka*)	E	Yes	Yes	No	No
LCR steelhead (*O. mykiss*)	T	Yes	Yes	No	No
Middle Columbia River (MCR) steelhead	T	Yes	Yes	No	No
UCR steelhead	T	Yes	Yes	No	No
UWR steelhead	T	Yes	Yes	No	No
SR steelhead	T	Yes	Yes	No	No
SDPS green sturgeon(*Acipenser medirostris)*	T	Yes	NA	No	NA
SDPS eulachon *(Thaleichthys pacificus)*	T	Yes	Yes	No	No
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	

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: March 31, 2021

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1. INTRODUCTION

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

1.1 Background

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

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

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

1.2 Consultation History

On May 26, 2020, the U.S. Army Corps of Engineers Portland District (USACE) requested formal consultation to review the effects of authorizing proposed dredging, under Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act, on ESA listed species detailed in Table 1. Included with this request for consultation were materials prepared by the applicant, Northwest Aggregates (NWA), and their agent, Confluence Environmental Company, including a biological assessment and supplemental information.

On October 16, 2020, USACE informed NMFS that NWA would like to modify the action to include suction dredging in the analysis. On November 16, USACE submitted a revised biological assessment which included suction dredging in the proposed action.

On December 16, 2020, after review of the consultation package and supplemental materials, NMFS determined it to be complete, and initiated formal consultation.

On February 4, 2021, in a telephone conversation between the USACE project manager and the NMFS staff biologist, it was determined that the proposed action is outside of designated critical habitat for the Southern DPS of green sturgeon, and the consultation would not include this resource.

On February 12, 2021, and February 17, 2021, the agencies exchanged emails regarding additional project details proscribed by the State of Oregon's section 401 Clean Water Act certification.

Table 1. List of species included in the consultation for the Northwest Aggregates Santosh Slough Maintenance Dredging Project

ESU or DPS Species	Listing Notice	Listing Status	Critical Habitat Listing
Lower Columbia Chinook	6/28/2005 ; 70 FR 37160	Threatened	9/2/2005 ; 70 FR 52630
Lower Columbia Steelhead	1/5/2006 ; 71 FR 834	Threatened	9/2/2005 ; 70 FR 52630
Lower Columbia Coho	6/28/2005 ; 70 FR 37160	Threatened	2/24/2016 ; 81 FR 9252
Columbia River Chum	6/28/2005 ; 70 FR 37160	Threatened	9/2/2005 ; 70 FR 52630
Upper Columbia Chinook	6/28/2005 ; 70 FR 37160	Endangered	9/2/2005 ; 70 FR 52630
Upper Columbia Steelhead	1/5/2006 ; 71 FR 834	Threatened	9/2/2005 ; 70 FR 52630
Middle Columbia Steelhead	1/5/2006 ; 71 FR 834	Threatened	9/2/2005 ; 70 FR 52630
Snake River Sockeye	4/14/2014 ; 79 FR 20802	Endangered	12/28/1993 ; 58 FR 68543
Snake River Spring/Summer Chinook	6/28/2005 ; 70 FR 37160	Threatened	10/25/1999 ; 64 FR 57399
Snake River Fall Chinook	6/28/2005 ; 70 FR 37160	Threatened	10/25/1999 ; 64 FR 57399
Snake River Steelhead	1/5/2006 ; 71 FR 834	Threatened	9/2/2005 ; 70 FR 52630
Upper Willamette River Chinook Salmon	6/28/2005 ; 70 FR 37160	Threatened	9/2/2005 ; 70 FR 52630
Upper Willamette River Steelhead	1/5/2006; 71 FR 834	Threatened	9/2/2005 ; 70 FR 52630
Southern DPS Green Sturgeon	4/6/2005; 70 FR 17386	Threatened	10/9/2009; 74 FR 52299
Southern DPS Eulachon	3/18/2010; 75 FR13021	Threatened	10/20/2011; 76 FR 65323

1.3 Proposed Federal Action

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR 402.02). The EFH definition of a 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, authorizing dredging and upland disposal of dredged sediment. NWA is requesting a 10-year authorization to conduct maintenance dredging of 10,000 cubic yards (CY) per year for a maximum total of 100,000 cubic yards of sediment from the Santosh Slough barge canal. Dredging would occur for a maximum of 30 days per year for ten years. The proposed dredge prism will maintain an operation depth of -8.0 (with 1 foot of overdredge) feet mean-low-low-water (MLLW) in the 1.4 mile long barge access canal to maintain safe barge access to the NWA facility.

The aquatic portion of the action area encompasses the entire canal plus 100 feet into the Multnomah Channel, NWA proposes to remove 10,000 CY accumulated sediment in the first year and an additional 10,000 CY per year over the duration of the 10-year permit. The dredging is intended to allow continued berthing and movement of barges that carry the applicant's commercial product, aggregate, and the 404 permit also covers the unintended discharge of up to

10 CY per year of aggregate from these vessels into the berthing/slip area of the slough during loading. The dredge will modify 16.5 acres of habitat over a 1.4 mile area within the Multnomah Channel.

All resulting dredge material will be deposited upland within reclaim Pit B of the NWA facility. The Portland Sediment Evaluation Team (PSET) reviewed the Sediment Characterization Report for the proposed dredging site and approved the associated dredge material for unconfined, aquatic disposal, despite elevated levels of heavy metals and polycyclic aromatic hydrocarbons.

NWA proposes to dredge using two methods: a closed lip clamshell dredge operated by a derrick crane mounted to a floating barge, and a hydraulic suction dredge. Hereafter, the clamshell dredge and hydraulic suction dredge shall be referred to simply as *dredging equipment*. Dredged sediments will be placed on a barge, dewatered and transported to the reclamation pit at the NWA facility for upland disposal.

Minimization measures as proposed within the biological assessment submitted by NWA and their consultant, have been incorporated into the proposed action to reduce adverse effects to ESA-listed species and their designated critical habitats. These measures include the following:

- All work below the OHW line will be conducted during the periods recommended by ODFW for in-water work. For this project in-water work is proposed to occur between July 1 and October 31, and or between December 1 and January 31, as described in the Oregon Guidelines for Timing of In-Water Work to Protect Fish and Wildlife Resources (ODFW 2008) for activities occurring in Multnomah Channel.
- Water quality monitoring will occur as necessary based on the terms and conditions of the Oregon Department of Environmental Quality 401 Water Quality Certification. These conditions are:
    - Monitoring every 2 hours during daylight hours each day that in-water work is conducted, using a properly calibrated turbidity meter. Measurements are to be taken 100 feet up current (to establish background level of turbidity) and 100 feet down current from the point of disturbance.
    - Work restrictions are based on monitoring results. If turbidity is 5-29 nephelometric turbidity units (NTUs) above background for 4 hours, work must cease so that BMPs are modified, and may resume when NTUs are 0-4 above background. If turbidity is 30-49 NTUs above background for 2 hours, work must cease so that BMPs are modified, and may resume when NTUs are 0-4 above background. If turbidity is 50 NTUs above background, cease work.
- Appropriate Best Management Practices (BMPs) will be employed to minimize sediment loss back into the water and turbidity 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 in contact with the bottom;
    - No stockpiling of dredged material on the riverbed;
    - No riverbed leveling
- Tug boats, barges, and equipment used for dredging activities will not ground on the canal bed 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 effect from potential fuel spills. All of these activities will be conducted in a vehicle staging area placed 150 feet or more from the waterway.
- Adhering to the spill prevention and response plan that has been prepared for this project.
- Dredge vessel personnel will be trained in hazardous material handling and spill response and will be equipped with all necessary response tools.

We considered whether or not the proposed action would cause any other activities and determined that no other associated activities would also be caused by the proposed action.

1.4 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 dredging will occur within the Santosh Slough, a 1.4 mile long manmade barge canal that connects the NWA facility to the Multnomah channel at river mile 4.5, near Scappoose, Oregon in Columbia County (Figure 1.). Specifically, the action area includes the wetted perimeter of the Santosh Slough (also called the Santosh Barge Canal), which is naturally turbid tributary to the Multnomah Channel, and lacks significant flow and thus elevated suspended sediment due to dredging activities is not expected to carry on currents to the Columbia River. The action area is within designated critical habitat for 14 ESA listed fish species, and within EFH for Pacific salmonids.

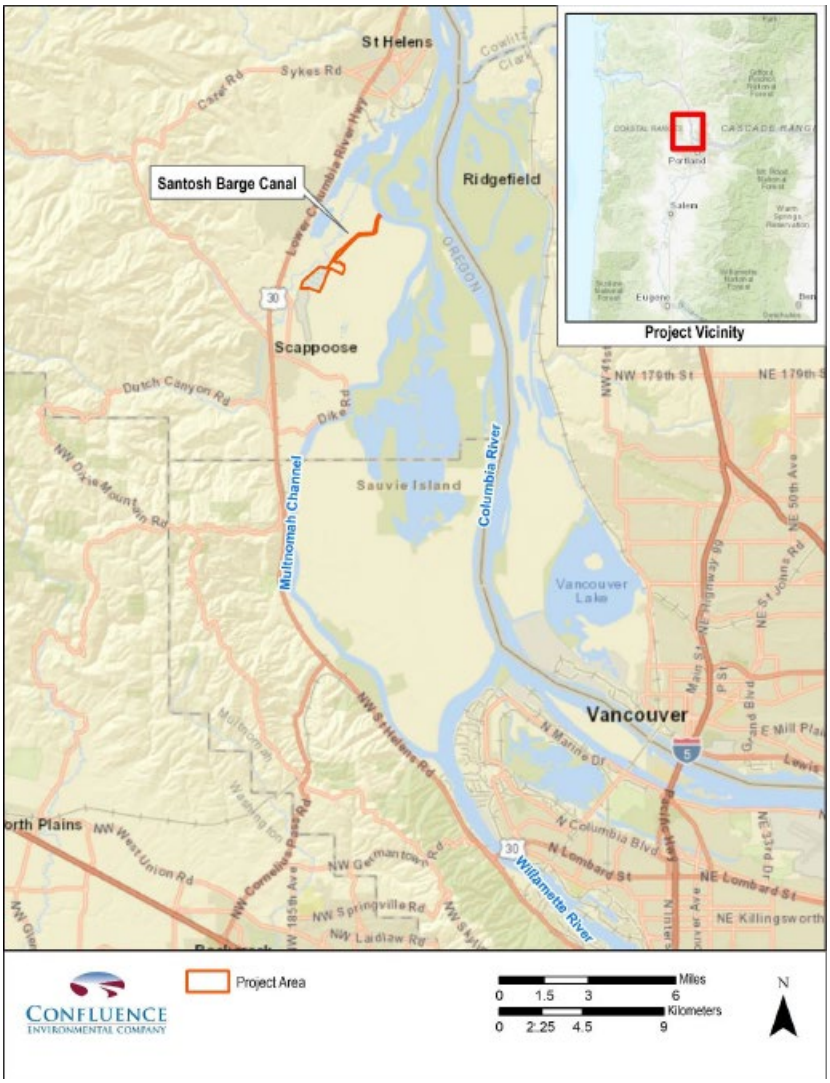

Figure 1. Map of the action area for the NWA Santosh Slough maintenance dredging project. Map courtesy of Confluence Environmental Company.

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

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

2.1 Analytical Approach

This biological opinion includes both a jeopardy analysis and an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "jeopardize the continued existence of" a listed species, which is "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

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

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

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

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

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

2.2 Rangewide Status of the Species and Critical Habitat

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

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 snow pack, 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 foodwebs (Crozier *et al.* 2011; Tillmann

and Siemann 2011; Winder and Schindler 2004). Higher stream temperatures will also cause decreases in dissolved oxygen and may also cause earlier onset of stratification and reduced mixing between layers in lakes and reservoirs, which can also result in reduced oxygen (Meyer *et al.* 1999; 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).

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

2.2.1 Status of the Critical Habitat

This section describes the status of designated critical habitat affected by the proposed action by examining the condition and trends of the essential physical and biological features of that habitat 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 different groups of salmonids that occupy the LCR, on three different dates. For each designation, NMFS used slightly different terminology and descriptions of the physical and biological features (PBFs) of critical habitat. This section presents each of the approaches to terminology used for each of the subsequent designations and attributes those to the specific salmonids covered by each designation. For convenience, many of the PBFs and their essential elements actually overlap from designation to designation.

The 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 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 are referred to as Primary Constituent Elements (PCE) in 70 FR 52630 and in 81 FR 9252, and those terms are used interchangeably in this document. Specific PCEs, and the essential features associated with the PCEs for salmonids designated in 2005, and 2016 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 free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks that support juvenile and adult mobility and survival;

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; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels; and 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, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and

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

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.

Table 2. Critical habitat, designation date, federal register citation, and status summary for critical habitat considered in this opinion

Species	Designation Date and Federal Register 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 PCEs 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 PCEs 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.
Snake River spring/summer-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 (except the Clearwater River) presently or historically accessible to this ESU (except reaches above impassable natural falls and Hells Canyon Dam). 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 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 PCEs 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 this area 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 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

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
		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 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. We rated conservation value of HUC5 watersheds as high for 34 watersheds, medium for 18 watersheds, and low for three watersheds.
Snake River sockeye salmon	10/25/99 64 FR 57399	Critical habitat consists of river reaches of the Columbia, Snake, and Salmon rivers; Alturas Lake Creek; Valley Creek; and Stanley, Redfish, Yellow Belly, Pettit and Alturas lakes (including their inlet and outlet creeks). Water quality in all five lakes generally is adequate for juvenile sockeye salmon, although zooplankton numbers vary considerably. Some reaches of the Salmon River and tributaries exhibit temporary elevated water temperatures and sediment loads that could restrict sockeye salmon production and survival (NMFS 2015b). 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 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 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. 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 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. 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.
Middle Columbia River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses 15 subbasins in Oregon and Washington containing 111 occupied watersheds, as well as the 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. We rated conservation value of occupied HUC5 watersheds as high for 80 watersheds, medium for 24 watersheds, and low for 9 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

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
		habitat complexity are common problems. 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.
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	Status Summary	Limiting Factors
Lower Columbia River Chinook salmon	Threatened 6/28/05	NMFS 2013	NWFSC 2015	This ESU comprises 32 independent populations. Twenty-seven populations are at very high risk, 2 populations are at high risk, one population is at moderate risk, and 2 populations are at very low risk Overall, there was little change since the last status review in the biological status of this ESU, although there are some positive trends. Increases in abundance were noted in about 70% of the fall-run populations and decreases in hatchery contribution were noted for several populations. 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.	• 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 2015	This ESU comprises four independent populations. Three are at high risk and one is functionally extirpated. Current estimates of natural origin spawner abundance increased relative to the levels observed in the prior review for all three extant populations, and productivities were higher for the Wenatchee and Entiat populations and unchanged for the Methow population. However, abundance and productivity remained well below the viable thresholds called for in the Upper Columbia Recovery Plan for all three populations.	• 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	Status Summary	Limiting Factors
Snake River spring/summer-run Chinook salmon	Threatened 6/28/05	NMFS 2017a	NWFSC 2015	This ESU comprises 28 extant and four extirpated populations. All expect one extant population (Chamberlin Creek) are at high risk. Natural origin abundance has increased over the levels reported in the prior review for most populations in this ESU, although the increases were not substantial enough to change viability ratings. Relatively high ocean survivals in recent years were a major factor in recent abundance patterns. While there have been improvements in abundance and productivity in several populations relative to prior reviews, those changes have not been sufficient to warrant a change in ESU status.	• Degraded freshwater habitat • Effects related to the hydropower system in the mainstem Columbia River, • Altered flows and degraded water quality • Harvest-related effects • Predation

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Upper Willamette River Chinook salmon	Threatened 6/28/05	NMFS 2011	NWFSC 2015	This ESU comprises seven populations. Five populations are at very high risk, one population is at moderate risk (Clackamas River) and one population is at low risk (McKenzie River). Consideration of data collected since the last status review in 2010 indicates the fraction of hatchery origin fish in all populations remains high (even in Clackamas and McKenzie populations). The proportion of natural origin spawners improved in the North and South Santiam basins, but is still well below identified recovery goals. Abundance levels for five of the seven populations remain well below their recovery goals. Of these, the Calapooia River may be functionally extinct and the Molalla River remains critically low. Abundances in the North and South Santiam rivers have risen since the 2010 review, but still range only in the high hundreds of fish. The Clackamas and McKenzie populations have previously been viewed as natural population strongholds, but have both experienced declines in abundance despite having access to much of their historical spawning habitat. Overall, populations appear to be at either moderate or high risk, there has been likely little net change in the VSP score for the ESU since the last review, so the ESU remains at moderate risk.	• 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

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Snake River fall-run Chinook salmon	Threatened 6/28/05	NMFS 2017b	NWFSC 2015	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. The extant population is at moderate risk for both diversity and spatial structure and abundance and productivity. The overall viability rating for this population is 'viable.' Overall, the status of Snake River fall Chinook salmon has clearly improved compared to the time of listing and compared to prior status reviews. The single extant population in the ESU is currently meeting the criteria for a rating of 'viable' developed by the ICTRT, 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 Dam complex.	• 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.
Columbia River chum salmon	Threatened 6/28/05	NMFS 2013	NWFSC 2015	Overall, the status of most chum salmon populations is unchanged from the baseline VSP scores estimated in the recovery plan. A total of 3 of 17 populations are at or near their recovery viability goals, although under the recovery plan scenario these populations have very low recovery goals of 0. The remaining populations generally require a higher level of viability and most require substantial improvements to reach their viability goals. Even with the improvements observed during the last five years, the majority of populations in this ESU remain at a high or very high risk category and considerable progress remains to be made to achieve the recovery goals.	• 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

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Lower Columbia River coho salmon	Threatened 6/28/05	NMFS 2013	NWFSC 2015	Of the 24 populations that make up this ESU, 21 populations are at very high risk, 1 population is at high risk, and 2 populations are at moderate risk. Recent recovery efforts may have contributed to the observed natural production, but in the absence of longer term data sets it is not possible to parse out these effects. Populations with longer term data sets exhibit stable or slightly positive abundance trends. Some trap and haul programs appear to be operating at or near replacement, although other programs still are far from that threshold and require supplementation with additional hatchery-origin spawners .Initiation of or improvement in the downstream juvenile facilities at Cowlitz Falls, Merwin, and North Fork Dam are likely to further improve the status of the associated upstream populations. While these and other recovery efforts have likely improved the status of a number of coho salmon populations, abundances are still at low levels and the majority of the populations remain at moderate or high risk. For the Lower Columbia River region land development and increasing human population pressures will likely continue to degrade habitat, especially in lowland areas. Although populations in this ESU have generally improved, especially in the 2013/14 and 2014/15 return years, recent poor ocean conditions suggest that population declines might occur in the upcoming return years	• 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	Status Summary	Limiting Factors
Snake River sockeye salmon	Endangered 6/28/05	NMFS 2015	NWFSC 2015	This single population ESU is at very high risk dues to small population size. There is high risk across all four basic risk measures. Although the captive brood program has been successful in providing substantial numbers of hatchery produced fish for use in supplementation efforts, substantial increases in survival rates across all life history stages must occur to re-establish sustainable natural production In terms of natural production, the Snake River Sockeye ESU remains at extremely high risk although there has been substantial progress on the first phase of the proposed recovery approach – developing a hatchery based program to amplify and conserve the stock to facilitate reintroductions.	• Effects related to the hydropower system in the mainstem Columbia River • Reduced water quality and elevated temperatures in the Salmon River • Water quantity • Predation
Upper Columbia River steelhead	Threatened 1/5/06	Upper Columbia Salmon Recovery Board 2007	NWFSC 2015	This DPS comprises four independent populations. Three populations are at high risk of extinction while 1 population is at moderate risk. Upper Columbia River steelhead populations have increased relative to the low levels observed in the 1990s, but natural origin abundance and productivity remain well below viability thresholds for three out of the four populations. The status of the Wenatchee River steelhead population continued to improve based on the additional year's information available for the most recent review. The abundance and productivity viability rating for the Wenatchee River exceeds the minimum threshold for 5% extinction risk. However, the overall DPS status remains unchanged from the prior review, remaining at high risk driven by low abundance and productivity relative to viability objectives and diversity concerns.	• 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	Status Summary	Limiting Factors
Lower Columbia River steelhead	Threatened 1/5/06	NMFS 2013	NWFSC 2015	This DPS comprises 23 historical populations, 17 winter-run populations and six summer-run populations. Nine populations are at very high risk, 7 populations are at high risk, 6 populations are at moderate risk, and 1 population is at low risk. The majority of winter-run steelhead populations in this DPS continue to persist at low abundances. Hatchery interactions remain a concern in select basins, but the overall situation is somewhat improved compared to prior reviews. Summer-run steelhead populations were similarly stable, but at low abundance levels. The decline in the Wind River summer-run population is a source of concern, given that this population has been considered one of the healthiest of the summer-runs; however, the most recent abundance estimates suggest that the decline was a single year aberration. Passage programs in the Cowlitz and Lewis basins have the potential to provide considerable improvements in abundance and spatial structure, but have not produced self-sustaining populations to date. Even with modest improvements in the status of several winter-run DIPs, none of the populations appear to be at fully viable status, and similarly none of the MPGs meet the criteria for viability.	• 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	Status Summary	Limiting Factors
Upper Willamette River steelhead	Threatened 1/5/06	NMFS 2011	NWFSC 2015	This DPS has four demographically independent populations. Three populations are at low risk and one population is at moderate risk. Declines in abundance noted in the last status review continued through the period from 2010-2015. While rates of decline appear moderate, the DPS continues to demonstrate the overall low abundance pattern that was of concern during the last status review. The causes of these declines are not well understood, although much accessible habitat is degraded and under continued development pressure. The elimination of winter-run hatchery release in the basin reduces hatchery threats, but non-native summer steelhead hatchery releases are still a concern for species diversity and a source of competition for the DPS. While the collective risk to the persistence of the DPS has not changed significantly in recent years, continued declines and potential negative impacts from climate change may cause increased risk in the near future.	• 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
Middle Columbia River steelhead	Threatened 1/5/06	NMFS 2009b	NWFSC 2015	This DPS comprises 17 extant populations. The DPS does not currently include steelhead that are designated as part of an experimental population above the Pelton Round Butte Hydroelectric Project. Returns to the Yakima River basin and to the Umatilla and Walla Walla Rivers have been higher over the most recent brood cycle, while natural origin returns to the John Day River have decreased. There have been improvements in the viability ratings for some of the component populations, but the DPS is not currently meeting the viability criteria in the MCR steelhead recovery plan. In general, the majority of population level viability ratings remained unchanged from prior reviews for each major population group within the DPS.	• Degraded freshwater habitat • Mainstem Columbia River hydropower-related impacts • Degraded estuarine and nearshore marine habitat • Hatchery-related effects • Harvest-related effects • Effects of predation, competition, and disease

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Snake River basin steelhead	Threatened 1/5/06	NMFS 2017a	NWFSC 2015	This DPS comprises 24 populations. Two populations are at high risk, 15 populations are rated as maintained, 3 populations are rated between high risk and maintained, 2 populations are at moderate risk, 1 population is viable, and 1 population is highly viable. Four out of the five MPGs are not meeting the specific objectives in the draft recovery plan based on the updated status information available for this review, and the status of many individual populations remains uncertain A great deal of uncertainty still remains regarding the relative proportion of hatchery fish in natural spawning areas near major hatchery release sites within individual populations.	• 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 green sturgeon	Threatened 4/7/06	NMFS 2018	NMFS 2015c	The Sacramento River contains the only known green sturgeon spawning population in this DPS. The current estimate of spawning adult abundance is between 824-1,872 individuals. Telemetry data and genetic analyses suggest that Southern DPS green sturgeon generally occur from Graves Harbor, Alaska to Monterey Bay, California and, within this range, most frequently occur in coastal waters of Washington, Oregon, and Vancouver Island and near San Francisco and Monterey bays. Within the nearshore marine environment, tagging and fisheries data indicate that Northern and Southern DPS green sturgeon prefer marine waters of less than a depth of 110 meters.	• Reduction of its spawning area to a single known population • Lack of water quantity • Poor water quality • Poaching

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Southern DPS of eulachon	Threatened 3/18/10	NMFS 2017c	Gustafson et al. 2016	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 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).

The action area is located in Columbia County, Oregon, near the confluence of the Multnomah Channel and the Columbia River, and so is influenced by water quality and prey community impacts associated with all upstream uses. Fish habitat in the action area has been adversely affected by a variety of in-water and upland human activities, including habitat losses, introduced species, hatchery production (NMFS 2013), and climate change as described in section 2.2 above. In general, natural habitat conditions throughout the Columbia River basin have declined in the last 150 years, together influencing the downstream conditions in the action area. These multiple watersheds, as in the action area, are characterized by loss of connectivity with floodplains and feeding and resting habitat for juvenile salmonids in the form of low-velocity marshland and tidal channel habitats (Bottom *et al.* 2005). Flood control, irrigation dams, shoreline development, and navigation for commerce have systemically reduced the quality, complexity, and amount of this important rearing and migration habitat for salmon and steelhead. Survival through this reach has declined for both juvenile and adult salmonids resulting in reduced population productivity and abundance. Each of the upland conditions also influence water quality throughout the action area, which is degraded by urban, industrial, and agricultural practices across the basin that contributes multiple pollutants at levels above natural conditions.

More specifically, the environmental baseline includes the impacts from deep-water dredging to maintain the federal navigation channel for large commercial vessel traffic and shallow water dredging to maintain marinas for recreational vessels. Therefore, dredging activities occur across numerous areas and microhabitats within the Lower Columbia River including sloughs area, secondary channels, sloughs, and floodplain wetlands. All of these habitat types provide rearing space 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)

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), sediment transport has decreased by as much as 50 percent (Simenstad *et al.* 1992). Other actions such as the depredation and relocation of large colonial nesting waterbird colonies have reduced the numbers of avian predators that prey upon salmonids in the Columbia River estuary that may improve progress in reaching recovery goals by up to 6 percent (NMFS 2011b). Degraded water quality in the action area results from load of increased fine sediments, elevated water temperatures especially during the winter (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).

Numerous early life history strategies of CR salmonids have been lost as a result of past management actions, and the subsequent loss of habitat complexity, and the degradation of habitat conditions in the remaining habitat areas that are currently considered the environmental baseline (Bottom *et al.* 2005). Comparisons with studies conducted only 3 decades ago suggest striking changes in the estuarine fish assemblage—changes that have unknown but potentially important consequences for juvenile salmon in the Columbia River estuary (Weitkamp, et al 2012).

All ESA-listed Columbia basin salmon and steelhead, may rear and/or migrate through the action area, resulting in effects to individuals of species and rearing and migration critical habitat PBFs. Rearing of juvenile salmonids, is likely to occur within the Santosh Slough, due to its isolation from main stem currents, from mooring structures, and shallower waters composed primarily of sand/silt bathos near shorelines. Upstream migration of adult salmonids and downstream migrations of salmonid smolts are likely to occur in the mainstem LCR. Thus, dredging of Santosh Slough will affect rearing fish. Adult salmonids will move upstream and through the action area within minutes. Juvenile salmonids, depending on the species and age of the fish, may spend hours to months within the action area. Juvenile salmonid foraging primarily occurs in waters less than 25 feet deep, which is a very small proportion of the action area due to historical maintenance dredging of the Columbia River flow lane to depths greater than 30 feet. Deeper waters and greater flows found in the Columbia River flow lane will provide a migration corridor.

The baseline also includes the effects of projects that have proceeded subsequent to section 7 consultation. During the last five years, NMFS has engaged in various Section 7 consultations on Federal projects adversely affecting ESA-listed fish and their habitats in and near the action area, including the operation of the Columbia River System dams, which influences water temperatures, flow regimes, and water volumes over time in the action area. The many Section 7 consultations cover the vicinity (Multnomah County, Oregon; Clark County, Washington) influencing or within the action area (WCR-2019-11648, WCR-2018-10138, WCR-2017-7450, WCR-2017-6622, WCR-2016-5516), including 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. Longer term effects that remain part of the baseline now include hindering quality of downstream migration and reduced benthic production of forage items.

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. While some adverse effects of actions implemented under SLOPES IV can reduce fitness and survival in a small number of individuals, the minimization measures reduce the overall contribution to habitat degradation at large. So the overall effects of these actions do contribute to the present environmental baseline and the effects of existing structures (e.g. increased shading, reduction in prey, increased predation, and possible minor migration delays) are considered in this consultation.

Because ESA-listed species must migrate through the action as juveniles and as adults all are exposed to the degraded conditions of the action area to some extent. Those populations and species that rear in the action area are exposed to the degraded baseline for a significant portion of this sensitive lifestage.

Salmonids in the action area will generally exhibit either a stream-maturing or ocean-maturing life history type. A stream-type life history is exemplified by juvenile salmon and steelhead that typically rear in upstream tributary habitats for over a year. Salmonids exhibiting this life history include LCR Chinook salmon (spring runs), LCR steelhead, LCR coho salmon, MCR steelhead, UWR steelhead, UWR Chinook salmon, SR spring/summer Chinook salmon, UCR Chinook salmon, SR steelhead, SR sockeye, and UCR steelhead. These juvenile fish will migrate through the action area as smolts, approximately 100 to 200 mm in size, move quickly downstream, and pass by the action area within one to two days (Dawley *et al*. 1986). An ocean-type life history is exemplified by juvenile salmon that move out of spawning streams and migrate towards the LCR estuary as sub-yearlings and are actively rearing within the LCR estuary. Fish that exhibit these life histories include LCR Chinook salmon (fall runs), CR chum salmon, and SR fall-run Chinook salmon. These fish are generally smaller in size (less than 100 mm) and more likely to spend days to weeks residing in tidal freshwater habitats characterized by the action area, with peak abundances occurring March through May (Hering *et al.* 2010; McNatt *et al.* 2016).

In addition to variations in outmigration timing, juvenile ESA-listed species also have a wide horizontal and vertical distribution in the CR related to size and life history stage. 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 inshore 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 the bathymetric break – or channel margin – and will be closer to the bottom of the channel (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.

2.4 Effects of the Action

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

Effects of the proposed action are reasonably certain to include: 1) annual temporary, localized reduction in water quality; 2) annual temporary, localized reduction in available prey; and 3) annual, temporary, localized obstruction to safe passage. These changes in the environment will affect PBFs of critical habitat, and the species that are present when these effects occur.

2.4.1 Effects on Critical Habitat

The proposed action will affect designated critical habitat for 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, SR sockeye salmon, LCR steelhead, MCR steelhead, UCR steelhead, SR steelhead, and UWR steelhead. Given the location of the proposed action and life history expression, all of the species considered in this opinion use this area for migration and/or rearing.

Salmonid Critical Habitat

The action area includes the PBFs for freshwater rearing and migration corridor for all salmonids considered in this opinion. These two conservation roles that are served by the action area share many of the same essential features. The essential features in the action area that would be affected by the proposed action include: water quality, substrate, forage, and a migration corridor free of obstruction and predation.

The proposed action will have temporary effects on water quality (due to turbidity) within the slough and possibly at the mouth of the slough where it joins the Columbia River. Such turbid conditions can temporarily obstruct or decrease safe passage, in a small area immediately around the dredging equipment bucket, during the July 1 to October 31 and/or between December 1 and January 31 IWWW.

To the degree that juvenile fish that use the slough as their migration pathway will, passage conditions will be made less safe in the area affected by elevated turbidity. The majority of turbidity produced by the dredging equipment is expected to remain localized within the manmade Santosh Slough, and in proximity to the active dredging equipment due to being isolated from main-stem flows. Due to the coarseness of the predominant sediments being suspended by the dredge (gravels and sands) they are expected to settle out rapidly (within minutes), and in close proximity (several feet) to their source location. Any finer sediments (silts and clays) that happen to be suspended by the dredging equipment will settle out more slowly

(within an hour from the time the work ceases) and be carried further downstream, potentially expanding the turbidity plume. Although most of the sediments responsible for increased turbidity produced by the dredging are expected to settle out quickly, dredging is proposed to occur daily for one month diminishing water quality for that duration. Due to the relative isolation of the Santosh Slough from the main-stem Columbia River, and relatively slack water, the turbidity plume is expected to remain small, and suspended sediment is only expected to enter the main-stem when dredging is occurring in close proximity to the ingress channel. Based on timing of this work, the migration value is briefly diminished for some species, but not others, based on co-occurrence of migration behavior with the anticipated turbid conditions. Within this same turbidity footprint, rearing values are also diminished, and this reduction again affects some, but not all, species, based on timing and life history behaviors.

The proposed action will also temporarily reduce food availability in a limited area within the Santosh Slough, but available forage from littoral sources in the immediate area outside of the Santosh will remain plentiful. Benthic invertebrates provide a primary food source for these juvenile salmonids – dominated by families of midges (Johnson *et al*. 2011), though prey preferences vary by species and juvenile Chinook salmon showed a strong preference for Dipterans in their diet (LCREP 2013). The aquatic invertebrates occupy the upper surface of the river bottom with a life cycle of many weeks to months before emerging into the water column. The proposed dredging operation will disturb benthic habitat and reduce benthic productivity. Recolonization of the benthic habitat by invertebrates is generally rapid for some macroinvertebrates – within weeks to months (McCabe *et al.* 1998), but is dependent upon the frequency of the dredging disturbance, the duration of the disruption at the site, and the availability of upstream benthic communities to serve reseeding of the disrupted area. Because dredging will not occur on the same location within Santosh Slough more than once annually, the low frequency of the disturbance should allow for relatively rapid recolonization (approximately one month) by benthic invertebrates. Rearing habitat would be diminished by reduced prey availability for up to two months each year – the month in which dredging occurs, plus the month during which recolonization occurs. Because the work Oregon authorized work window includes all of July through all of October, plus all of December and January, we assume that work could occur at any time, and thus affect the critical habitat values for all of the following species:

One month of reduction in adult passage values via water quality disruption will affect the critical habitat of these five species:

- LCR Chinook salmon
- SR Spring/Summer Chinook salmon
- SR Fall Chinook salmon
- CR chum
- LCR coho

One month of reduction in juvenile passage values via water quality disruption will affect the critical habitat of these eleven species:

- LCR Chinook salmon
- UCR Chinook salmon
- UWR Chinook salmon

- SR Spring/Summer Chinook salmon
- SR Fall Chinook salmon
- LCR coho
- SR sockeye
- LCR steelhead
- MCR steelhead
- UCR steelhead
- SR steelhead

Two months of reduction in rearing values via water quality and prey diminishment will affect the critical habitat of these seven species:

- LCR Chinook salmon
- UWR Chinook salmon
- SR Fall Chinook salmon
- CR chum
- LCR coho
- LCR steelhead
- UCR steelhead

Eulachon Critical habitat

Eulachon critical habitat includes the entire Lower Columbia River from the mouth to the Bonnevile Dam. During spawning, adult eulachon are found in the lower Columbia River from the mouth of the river to immediately downstream of Bonneville Dam (WDFW and ODFW, 2008), indicating that the entire area contains the essential feature of migration corridors. Eulachon eggs have been collected, and spawning presumed, from river km 56 (river mi 35) to river km 117 (river mi 73) (Romano *et al.,* 2002) indicating that this area contains the spawning and incubation essential feature. The physical or biological features essential for conservation of the southern DPS of eulachon within the Columbia River are therefore:

(1) Freshwater spawning and incubation sites with water flow, quality and temperature conditions and substrate supporting spawning and incubation.

(2) Freshwater and estuarine migration corridors 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.

The features of critical habitat affected by the proposed action are similar to those of salmonid critical habitat, above: water quality, prey, and in this case substrate. Turbid conditions with high suspended sediment are not documented to negatively impact spawning or migrating values, and in fact suspended sediment may obscure the presence of eulachon from predators, in which case periods of suspended sediment may be somewhat beneficial for migration values. To the contrary, though, is the operation of the dredge equipment, which is highly likely to entrain eggs, larvae and adults, particularly with the operation of the suction dredge. Within the 10 years of the permit, if dredging occurs in December or January when eulachon are present, migration values will be diminished for the entire number of days, up to 30, due to entrainment risk.

The purpose of the dredging is to remove sandy substrate and spilled aggregate from the slip/berthing areas within the slough. These are the preferred materials for successful eulachon spawning and the proposed action will remove up to 10,000 CY annually, or 100,000 CY in total, of these preferred spawning substrates. However, it is unlikely that the slough is a preferred spawning location, as spawning sites are typically in tributaries to the Columbia River, and as mentioned above, eggs have been documented in the Columbia River upstream only as far as river mile 73, which is downstream of this proposed action. We therefore consider the modification of substrate annually to be unlikely to alter this feature of habitat in a meaningful way.

Finally, while benthic prey communities will be disrupted co-extensively with the dredged areas annually, and diminished for several weeks after while recolonization occurs, we do not expect this to detriment larval eulachon, which rely on their eggs sacs for nutrition during the early part of their outmigrant period.

When considered together, the effects of the proposed action have a negative effect only on the migration value of the designated critical habitat for up to 30 days each year.

2.4.2 Species Effects

Effects of the action on species is 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 occupy the action area and some individuals of each species are likely to be exposed to the habitat effects of the action, as well as direct exposure to the dredging equipment either as adults or juveniles. As described more fully above, the habitat effects to which these individuals well be exposed are suspended sediment/higher turbidity either as migrants or rearing fish, and reduced prey availability (juveniles only). Rearing and migrating fish could also encounter dredge equipment, creating risk of entrainment.

The exposure of ESA-listed fish species to habitat changes in the action area (i.e., short-term alterations in water quality from the action, short-term changes in benthic forage), and their exposure to potential to entrainment by the dredge equipment depends upon the overlap of timing and location of activity, and when different densities and life history stages of the ESA-listed fish will be present, which is presented below in Table 4. The potential for exposure by ESA-listed fish species is directly related to the amount of time the dredge is actively removing material from the benthos, as approximated by days of operation per year. In this case, dredging will occur for up to 30 days per year over a 10-year period.

The duration of actual exposure of adult and juvenile fishes will depend on whether the exposure is to rearing or migrating fish. The greatest exposure for juvenile salmonids to water quality, and forage effects will occur among rearing fish, during dredging activities in water depths typically less than -25 feet where sub-yearling salmonids (fall Chinook, and LCR chum salmon) tend to rear and forage (Carter et al 2009). Rearing fish have longer duration in the action area, and thus are either exposed to, or displaced by via avoidance behaviors, the reductions in habitat values.

During migration, adult salmonids, and smolting stream-type salmonids (spring Chinook salmon, coho salmon, sockeye salmon and steelhead), will have the greatest risk of exposure to short-term water quality alterations while migrating though or around the dredge sites. These fish are less likely to be exposed to the dredging effects than rearing fish, because Santosh Slough is mostly enclosed by an narrow ingress channel (most effects will not reach the Columbia River), and their migration behavior suggests that they would move quickly through the area because adult salmonid swimming speed is more than 1 kilometer per hour (Dawkins and Quinn 1996; Quinn et al 1997), meaning that even if they are exposed, duration would be most likely measured by hours, to a few days at most).

Green sturgeon and eulachon are also present during the extensive IWWW. Sturgeon are present during the summer months of the work window, at which time they engage in resting and foraging; eulachon are present in the winter months of the work window, present at all life stages.

Table 4. Presence of ESA-listed fish species in the Lower Columbia River by life stage, NMFS' Northwest Fisheries Science Center, and NMFS' Protected Resources Division. Work window months depicted by orange highlight.

		=present								= relatively abundant								= peak occurrence							
Species	**Life Stage**	**Jan**		**Feb**		**Mar**		**Apr**		**May**		**Jun**		**Jul**		**Aug**		**Sep**		**Oct**		**Nov**		**Dec**	
Salmon: Chinook																									
Lower Columbia River	Adult migr. & holding																								
Columbia	Adult spawning																								
	Eggs & pre-emergence																								
	Juvenile rearing																								
	Juvenile emigration																								
Upper	Adult migr. & holding																								
Columbia	Adult spawning																								
	Eggs & pre-emergence																								
	Juvenile rearing																								
	Juvenile emigration																								
Upper	Adult migr. & holding																								
Willamette	Adult spawning																								
	Eggs & pre-emergence																								
	Juvenile rearing																								
	Juvenile emigration																								
Snake River -	Adult migr. & holding																								
Sprng/Summr	Adult spawning																								
	Eggs & pre-emergence																								
	Juvenile rearing																								
	Juvenile emigration																								
Snake River -	Adult migr. & holding																								
Fall	Adult spawning																								
	Eggs & pre-emergence																								
	Juvenile rearing																								
	Juvenile emigration																								
Salmon: Chum																									
Columbia	Adult migration. & holding																								
River	Adult spawning																								
	Eggs & pre-emergence																								
	Juvenile rearing																								
	Juvenile emigration[4]																								
Salmon: Coho																									
Lower	Adult migration. & holding																								
Columbia	Adult spawning																								
	Eggs & pre-emergence																								
	Juvenile rearing																								
	Juvenile emigration																								

		=present	= relatively abundant	= peak occurrence

Species	Life Stage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Salmon: Sockeye													
Snake River	Adult migration. & holding												
	Adult spawning												
	Eggs & pre-emergence												
	Juvenile rearing												
	Juvenile emigration												
Steelhead													
Lower	Adult migration. & holding												
Columbia	Adult spawning												
	Eggs & pre-emergence												
	Juvenile rearing												
	Juvenile emigration												
Middle	Adult migration. & holding												
Columbia	Adult spawning												
	Eggs & pre-emergence												
	Juvenile rearing												
	Juvenile emigration												
Upper	Adult migration. & holding												
Columbia	Adult spawning												
	Juvenile rearing												
	Juvenile emigration												
Snake River	Adult migration. & holding												
	Adult spawning												
	Eggs & pre-emergence												
	Juvenile rearing												
	Juvenile emigration												
Eulachon													
Southern	Adult migr. & holding[1, 2]												
DPS	Adult spawning[2]												
	Egg incubation[3]												
	Larvae emigration												
Sturgeon: Green													
Southern	Juvenile rearing[2]												

Carter et al. 2009 (Seasonal juvenile salmonid presence and migratory behavior in the lower Columbia River).
USGS 2017 (Acoustic Tag Detections of Green Sturgeon in the Columbia River and Coos Bay Estuaries, Washington and Oregon, 2010–11)

Salmonid Exposure and Response

Exposure and response are predicated upon presence of individuals contemporaneously with the project or it consequences.

Adult salmonid presence. Though peak migratory periods vary by species, some adult Columbia River salmonids are reasonably certain to be present in the action area during the July 1 to October 31 and/or between December 1 and January 31 IWWW, and therefore will be exposed to the effects of the action:

- LCR Chinook salmon
- SR Spring/Summer Chinook salmon
- SR Fall Chinook salmon
- CR chum
- LCR coho

Based on the broad-run timing of these species, and the proposed work period of July 1 to October 31 and/or between December 1 and January 31, exposure is extremely unlikely for adult SR sockeye salmon. All other Columbia River species of adult salmonids have at least some overlap with the IWWW, however peak times of presence for most adults do not correspond completely with the July 1 to October 31 and/or between December 1 and January 31 IWWW.

Exposure and Response to Dredging Equipment Operation: Although adult Chinook salmon, coho salmon, chum salmon and steelhead will be present in the action area during the proposed action, only a few adult fish will experience adverse effects from the proposed action due to: (1) the upland disposal of contaminated sediments (eliminating probability of exposure to individual fish); (2) the isolation of the dredging sites within the enclosed Santosh Slough from the main-stem Columbia River; (3) the intermittent nature of the action; and (4) the migratory and avoidance behaviors inherent to adult salmon and steelhead.

Exposure to the habitat disruptions and the dredging equipment are likely to be limited because of the size of the migration corridor in this area. The Lower Columbia River is a massive body of water that presents no current migratory obstacles (beyond high water temperatures that can occur during late summer, and some infrastructure (such as pilings, docks, piers, and wharfs) outside of the proposed work period); thus, migrating adult salmon are typically widely dispersed in the estuary. The 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. Further, the narrow access channel would prevent most adult fish from entering the Santosh Slough dredge area. In the unlikely event these adult fish enter the Santosh Slough, they are not likely to come within proximity of the dredge operation, due to their strong swimming ability. Adult salmonids are capable swimmers able to avoid the dredging equipment and thus avoid entrainment. These conditions, coupled with the adult run-timing previously discussed, result with few adult salmon, of any species, being exposed to dredging equipment operations. Therefore, we anticipate adult salmonids will pass through the action area without experiencing adverse effects of entrainment by dredge equipment operation.

Exposure and Response to Turbid Conditions: Given that adult salmonid migration rates range up to a few miles per hour (Matter and Sandford, 2003), we expect adult ESA-listed salmonids that do encounter the turbidity associated dredge operations will be moving upstream at such a rate as to limit exposure to a matter of minutes. Studies show that salmonids are able to detect and distinguish turbidity and other water quality gradients (Bisson and Bilby 1982), and that larger salmonids are more tolerant to suspended sediment than smaller juveniles (Servizi and Martens 1991, 1992). As salmonids grow and their swimming ability increases, their dependence on shallow nearshore habitat declines rapidly (Groot and Margolis 1991). 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). Larger adult salmon with increased swimming abilities can avoid waters affected by suspended sediment to find refuge and/or passage conditions within unaffected adjacent areas (Sedell *et al.* 1990). Thus, to the extent that any adults are exposed to turbidity generated by project activities, they are expected to respond by avoiding excessively turbid conditions and find passage within unaffected adjacent areas. Specifically, we do not expect these fish to move into the confined Santosh Slough space where dredging will occur. These fish may experience some turbidity near the entrance of the Santosh Slough where sediments are actively settling out. In both cases, we anticipate adult salmonids will pass through the action area without experiencing adverse effects due to the brevity of exposure.

Juvenile salmonid presence. Dredging of the proposed Santosh Slough occurs when juvenile salmonids are present. The level of exposure juvenile salmonids will have to the effects of the action will vary and depend on species and life history stage, along with the location, timing, and depth at which dredging is occurring. Among those exposed, CR chum salmon, and all ESUs including fall Chinook salmon will be more vulnerable due to their smaller age/size when they experience the effects of the action.

Juvenile ESA-listed species migrate in the vicinity of and may rear in the action area at different time periods. Juvenile salmonids are present in the action area year round, peaking during one or two periods from late winter (March) through summer, with lesser presence in the fall, and early winter. Juvenile Chinook salmon and steelhead are present year round; primary timing ranges from spring to early fall, although sub-yearlings presence extends later in the fall. Juvenile chum salmon are present from winter to spring. Juvenile coho salmon are present year-round with primary timing from spring to mid-summer. Juvenile steelhead are present year-round with a primary timing range of spring to mid-summer.

Juvenile ESA-listed species migrate through the action area at different rates depending on species and life history. Numerous early life history strategies of Columbia River salmonids have been lost as a result of past management actions discussed under the environmental baseline (Bottom *et al.* 2005). 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, MCR steelhead, UWR steelhead, UWR spring run Chinook salmon, SR spring/summer Chinook salmon, UCR Chinook salmon, SR steelhead, SR sockeye, and UCR steelhead. These fish will migrate through the action area as smolts. These juveniles tend to be 100 to 200 mm in size, move quickly downstream, and will be through the action area within 1 - 2 days. Ocean-type juvenile salmon

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), CR Chum salmon, 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).

Juvenile ESA-listed species have a wide horizontal and vertical distribution related to size and life history stage. Generally speaking, juvenile salmonids will occupy the 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 nearshore 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, and 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 navigation channel and along 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 either the shallow nearshore or channel, which indicates potential underestimates for nearshore sub-yearlings. 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 2001) with sub-yearlings being closer to the bottom than older 1+ year-old fish (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. Therefore, we anticipate direct overlap with dredging operations of juvenile salmonids.

Exposure and Response to Equipment Operation: Sub-yearling salmonids including LCR Chinook salmon, CR chum salmon, and to a limited extent SR fall Chinook salmon in the action area are more likely to be displaced and entrained by dredging equipment due to their smaller size (<100mm), and inferior swimming ability. The July 1 to October 31 and/or between December 1 and January 31 IWWW for dredging has been established when the density of sub-yearlings will be lowest, thus limiting exposure likelihood. At low densities (number of fish per unit area), the likelihood of a sub-yearling occupying the same area in which the dredging equipment is operating, is extremely low, as the dredging equipment is highly localized to the area in which the bucket or suction head is deployed (<1 cubic meter). However, any sub-yearlings that happen to encounter the dredging equipment during each year of operation, and which are within 1 meter above the substrate actively being dredged, will be subject to an increased likelihood of entrainment. Any fish located in the immediate area around the dredging equipment when in contact with the substrate will be exposed to elevated turbidity (see below). Both entrainment and elevated turbidity can result in injury or death. In the shallower waters, sub-yearlings are closer to the bottom and are less able to escape entrainment. Larger, juvenile smolts (>100mm), that are actively migrating within the mainstem Columbia River, and like adult salmonids are less likely to enter the enclosed Santosh Slough during their migration.

However in the event that a smolt does enter the Santosh Slough their increased swimming abilities, allow for a similar avoidance response to dredging disturbance as adults, which will further minimize but not completely eliminate entrainment and subsequent injury or death of these fish. Considering all these factors, the total number of fish expected to be entrained in a given year is very small when compared to the abundance of any given population.

Exposure and Response to Turbid Conditions: The effects of suspended sediment and turbidity on fish 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 have 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). Juvenile salmonids tend to avoid streams that are chronically turbid, such as glacial streams or those disturbed by human activities, unless the fish traverse these streams along migration routes (Lloyd *et al.* 1987). Depending on the concentrations of suspended solids and the food supply, juvenile fish will either seek refuge in adjacent areas with less turbidity, or remain in the area, taking advantage of additional cover provided by the turbid water. Death or injury to ESA-listed salmonids directly from an increase in turbidity within Santosh Slough is not likely. Given the small area of river affected and the low densities of ESA-listed juvenile salmonids likely to be present and exposed to elevated turbidity, only a few ESA-listed fish in the action area annually are likely to experience any of the beneficial or the adverse effects caused by suspended solids as described above.

Exposure and Response to Reduced Benthic Prey: Sub-yearling salmonids in the action area are also likely to be exposed to a slight reduction in forage, described above in the effects on Critical Habitat. Sub-yearlings are actively feeding as they move downstream. 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 delays natural recolonization, as dredging operations will disturb benthic habitat and reduce benthic productivity temporarily. Because disturbance to the benthos will be localized and infrequent recolonization of the benthic habitat is relatively rapid – within weeks to months (McCabe *et al*. 1998), and prey availability nearby undisturbed sites will remain unaffected, we expect fish to not have measureable diminished growth or fitness. The limited and localized loss of prey is not likely to reduce available forage for rearing salmonids in sufficient degree to have an impact on juvenile fish survival. 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. Reduced forage success, reduced forage availability, displacement, and increased competition will likely combine to temporarily, reduce growth, lipid stores, and ultimately fitness and survival in a small number of sub-yearling juvenile fish annually, and this is most likely among those fish rearing within the project site.

Summary of Salmonid Response to Effects

When adults and juveniles are considered together, it is likely that some individual fish from each ESU will encounter the dredge within their migration corridor, but of these most should not alter their pathway or delay their rate of migration. Adult fish are intent on moving upstream and a small deviation from the migration path will not significantly change overall distribution or risk of predation. Migrating juvenile salmonids will largely avoid the dredging and can move in and out of the turbidity plume. This level of avoidance will be minor and within the normal migration patterns, and thus not likely to increase the risk of predation or otherwise harm these fish, especially adults. However, annually, some juveniles, particularly smaller rearing juveniles, are likely to be entrained.

Salmonid foraging in the action area occurs exclusively among juveniles. Few fish will experience a reduction of food or foraging opportunities due to elevated TSS because of adjacent prey base, and the benthic habitat disturbance will be of limited extent, and temporary in nature. However, because the action is repetitive annually and will occur in shallow water preferred by juvenile salmonids, we expect the forage base to be slightly diminished within the action area relative to unaffected adjacent shallow water habitats, and during episodes of turbid conditions and diminished prey, juveniles that avoid those affected areas could see increased competition and increased energy expenditure to compete for food. Over the course of the 10 year permit, we expect some fish will experience reduced growth, fitness, or survival.

The species most likely to experience the negative effects annually from the dredging activities or their consequences are LCR Chinook salmon, UWR Chinook salmon, CR chum, and LCR coho, based on their size and rearing behaviors.

Eulachon presence

The IWWW includes two months in which eulachon are present at all life stages, December and January. The lower Columbia River and its tributaries support the largest known spawning run of eulachon. The mainstem of the lower Columbia River provides spawning and incubation sites, and a large migratory corridor to spawning areas in the tributaries. Major tributaries of the Columbia River that have supported eulachon runs in the past include, among others, the Cowlitz, Kalama and Lewis Rivers in Washington and the Sandy River in Oregon. For this reason, we assume that this species will be exposed to effects of the proposed action during the 10-year duration of the permit.

Exposure and response to turbid conditions: As described above, suspended sediment could confer a survival advantage by obscuring members of this species from predators. Eulachon spawning generally occurs before spring freshets, and thus this species is presumably adapted to sediment laden freshets which wash eggs and larvae toward the estuarine and marine habitat.

Exposure and response to reduced prey: After absorbing their yolk sac, eulachon larvae and juveniles eat a variety of prey items, including phytoplankton, copepods, copepod eggs, mysids, barnacle larvae, and worm larvae. Eulachon adults do not feed during spawning. Based upon the location of the proposed action and the locations of eulachon spawning, we expect that most

eulachon present in the action will not be consuming prey items at a significant rate and the 60 day diminished prey availability (30 days dredging followed by one month of recovery) will not alter the growth, development, or survival of any individual eulachon.

Exposure and response to dredging equipment: Eulachon spawn by attaching their eggs to substrate (typically sands and gravels), and spawning typically occurs in rivers with tidal influence. In most rivers the eggs may move during incubation, so spawning habitats within rivers may encompass much of the river bottom. Incubation time is temperature –dependent and they incubate for about 2-4 weeks. and after hatching, larval eulachon migrate by passive drift downstream to the ocean. Based on documented spawning areas, we do not expect that spawning occurs within the slough, and entrainment of eggs is unlikely, however as larval migration is by passive drift, dredging, particularly suction dredging, is likely to entrain some larval eulachon, and could also entrain adults on their migration to spawning areas upstream of the slough. Entrainment is expected to kill a small number of individuals at either life stage. We anticipate mortality of adult or larval lifestages because the slough is not a primary spawning area for eulachon, serving instead as a potential migration area.

Green sturgeon presence

While critical habitat is not designate for sturgeon in the action area, this species has documented presence in the Columbia River all the way to the Bonneville Dam, though use appears to be more intense in the lower river areas (USGS 2017). Green sturgeon adults and subadults rely on the Columbia River as a summering habitat, where they rest and forage on the river bottom, returning multiple times to this habitat over the course of their lives (74 FR 52299). Emerging evidence suggests that green sturgeon may also spawn in the Columbia River, based upon the collection of young of year juveniles in locations upstream of action area, but these appear to be from the unlisted Northern DPS (Schreier and Stevens 2020). Green sturgeon have been documented as widely dispersed among channel and non-channel habitats in the lower portion of the Columbia River estuary (USGS 2017), with use ranging from deeper channel habitat to shallow non-channel habitats.

Exposure and response to turbid conditions: Based upon the extensive work window, the 30 days of dredging is very likely to occur during the summer months when green sturgeon have summer foraging, rearing and resting in the Columbia River. Because the dredging will occur in the further upstream in the river, presence of individuals may be less likely, but if present, the slough may be habitat that is utilized, so exposure cannot be ruled out. However, sturgeon's feeding behavior is to disturb the river sediments with their long snout and suck benthic prey into their mouths. Based on comparable behavior of white sturgeon, which are closely related we expect exposure to higher levels of suspended sediment, either among adults or subadults, is unlikely to cause any detrimental response (Kjelland *et al.* 2015).

Exposure and response to benthic prey reduction: Dredging will remove the prey communities that are within the sediments being dredged. Green sturgeon are present during most of the proposed IWWW and their primary behavior is feeding and resting, serving the growth and development of subadults, and providing nutrition to adults, which are very long lived. The limited area of impact, and relatively short diminishment of prey suggest that foraging success is

not likely to be affected in a manner that impairs growth or fitness of subadult or adult green sturgeon.

Exposure and response to dredging equipment: Based on documented presence, it is possible that subadult and adult green sturgeon presence could occur within the slough and be exposed to the dredge equipment. A factor influencing the potential for individuals being exposed to the dredge equipment is the likely timing of the work, as the majority of the IWWW co-occurs with presence of this species. A factor that reduces the likelihood of exposure is the location, near Columbia River Mile 81, which suggests presence may be low. Because presence is possible, and the behavior of green sturgeon is to favor bottom habitat, we cannot rule out the potential that exposure to equipment could occur and result in entrainment or injury. Entrainment is more likely with use of the suction dredge, and entrainment is most likely to capture subadults. Response is expected to be injury and/or death of entrained individuals. Due to the limited presence of green sturgeon in the action area, the total number of individuals injured or killed by the proposed dredging is expected to be extremely small.

2.5 Cumulative Effects

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

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

For this action, state or private activities in the vicinity of the project location are expected to cause cumulative effects in the action area. Additionally, future state and private activities in upstream areas are expected to cause habitat and water quality changes that are expressed as cumulative effects in the action area. Our analysis considers: (1) how future 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.

Approximately six million people live in the Columbia River basin, concentrated largely in urban centers. The effect of that population is expressed as changes to physical habitat and loadings of pollutants contributed to the Columbia River. These changes were caused by residential, commercial, industrial, agricultural, and other land uses for economic development, and are 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. As human population grows, the range of effects described here are likely to intensify.

Resource-based industries (*e.g*., agriculture, hydropower facilities, timber harvest, fishing, and metals and gravel mining) caused many long-lasting environmental changes that harmed ESA-listed species and their critical habitats, such as basin-wide loss or degradation of stream channel morphology, spawning substrates, instream roughness and cover, estuarine rearing habitats, wetlands, floodplains, riparian areas, water quality (*e.g.*, temperature, sediment, dissolved oxygen, contaminants), fish passage, and habitat refugia. Those changes reduced 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. Without those features, the species cannot successfully spawn and produce offspring.

While widespread degradation of aquatic habitat associated with intense natural resource extraction is no longer common, ongoing and future land management actions are likely to continue to have a depressive effect on aquatic habitat quality in the Columbia River basin and within the action area. Additionally, as human population grows, other non-federal uses of the river are likely to increase and intensify, such as recreational boating and fishing, and nonpoint stormwater inputs from upland areas. As a result, recovery of aquatic habitat is likely to be slow in most areas and cumulative effects from basin-wide activities are likely to have a slightly negative impact on population abundance trends and the quality of critical habitat PBFs into the future.

2.6 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.

Species

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, SR sockeye salmon, LCR steelhead, MCR steelhead, UCR steelhead, SR steelhead, and UWR steelhead, are at a low level of abundance or productivity making them threatened or endangered by the risk of extinction. Individuals from

almost all ESA listed populations must move through or utilize the action area at some point during their life history. Each of these species is listed due to a combination of low abundance and productivity, reduced spatial structure, and decreased genetic diversity. These conditions are based in part on 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: altered natural flows, reduced water quality from substantial chemical pollution, loss of functioning floodplains and secondary channels, and loss of vegetated riparian areas and associated shoreline cover. 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 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 30-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. The modified bathymetry within Santosh Slough will be maintained for the duration of the 10-year permit. These habitat alterations will cause displacement of a small number of adult and juvenile fish, as they avoid the dredging operation (entrainment and elevated turbidity), plus a short-term (*weeks - months*) 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 30-day work window. Finally, entrainment of a few juvenile salmonids is reasonably certain to occur during each annual operation.

Based on the applicant's potential to use the full work window, species likely to be exposed at three lifestages (as adult migrant, rearing juvenile, and migrating juvenile) are:

- LCR Chinook salmon
- SR Fall Chinook salmon
- LCR coho

Those species likely to be exposed both as rearing and as migrating juveniles are:

- UWR Chinook salmon
- LCR steelhead
- UCR steelhead

CR chum are exposed as rearing juveniles and again as migrating adults.

However, risk is most clearly related to size and rearing behavior, so among these six species, four (LCR Chinook salmon, UWR Chinook salmon, CR chum, and LCR coho) are those with the

greatest likelihood to experience annual loss of juveniles to entrainment, and reduced fitness, growth, or survival from water quality and prey diminishments.

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 annual decrease in species abundance is likely to be very small, and to be across more than one population and more than one species. This reduction itself, even annually for 10 years is not expected to be sufficient to affect spatial distribution, genetic diversity, abundance, or productivity of any of the component populations of the ESA-listed species, because the reductions are expected to be among a few juveniles, and, as such, their loss will likely be indistinguishable among that cohort as returning adults.

Both eulachon and green sturgeon are at risk of entrainment during dredging, eulachon (both larval and adult lifestages) if dredging occurs during January or December; green sturgeon if dredging occurs during the summer or fall. Of these two species, eulachon are at much greater risk of entrainment, however eulachon abundance is so great that it has been measured in biomass (tons), rather than in individuals, so even if the 30 days of dredging occurred each year during peak eulachon presence, the reduction in abundance would be low relative to total abundance, and insufficient, when added to the baseline and in light of cumulative effects, unlikely to alter viability parameters of the species. Much of the work window overlaps with green sturgeon presence in the Columbia River, but while the co-occurrence of dredging and individual green sturgeon is not discountable, it is also not expected to occur in high numbers. In this case, if entrainment occurs, the number of individual injured or killed would be so low that it would not be expected to alter any of the viability parameters, even when considered in addition to the baseline condition and anticipated cumulative effects.

Critical habitat

In the context of the status of designated critical habitat and the specific baseline conditions of PBFs in the action area, the proposed action will not obstruct the passage of migrating salmonids, reduce cover, remove riparian vegetation, alter flows, destabilize the channel or change its characteristics, alter water temperature, or substantially reduce available forage for migrating or rearing salmonids. However, the proposed action will temporarily diminish safe migration corridors, forage, and water qualify PBFs within the action area each year for 10 years. These diminishments do not appreciably further degrade critical habitat conditions or aggravate limiting factors. As a whole, the critical habitat for migration and rearing is functioning moderately under the current environmental baseline in the action area.

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 but largely temporary 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 for the conservation role of rearing or migration.

Critical habitat values for eulachon migration will be diminished for up to 30 days each year, but only if the timing of dredging occurs during the eulachon migration period. If the dredging does occur within that period, because it is within a limited location of the migration area, and because migration is diffuse throughout the river, we do not expect that, even occurring annually and in the context of cumulative effects, that the critical habitat's value as a migration corridor will be significantly modified.

2.7 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, SR spring/summer run Chinook salmon, UWR spring-run Chinook salmon, SR fall-run Chinook salmon, CR chum salmon, LCR coho salmon, SR sockeye salmon, LCR steelhead, MCR steelhead, UCR steelhead, SR steelhead, UWR steelhead, or destroy or adversely modify their designated critical habitat.

2.8 Incidental Take Statement

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

2.8.1 Amount or Extent of Take

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

The proposed dredging will take place when juvenile and/or adult individuals of LCR Chinook salmon, UCR spring-run Chinook salmon, SR spring/summer run Chinook salmon, SR fall-run Chinook salmon, UWR Chinook salmon, Columbia River chum salmon, LCR coho salmon, SR sockeye salmon, LCR steelhead, MCR steelhead, UCR steelhead, SR steelhead, UWR steelhead, SDPS green sturgeon, and SDPS eulachon are reasonably certain to be present.

Incidental take caused by the adverse effects of the proposed action will include injury or death of a small number of ESA-listed fish due to entrainment during dredging, and behavioral avoidance response effects due to a temporary localized increased turbidity during dredging and disposal. Take by these mechanisms will annually affect juvenile ESA-listed salmon and steelhead via entrainment during dredging, exposure to increased turbidity, and temporary reductions in forage each year for 10 years.

Due to the overall nature of the proposed action, 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 10 annual episodes of:

1. injury or death from entrainment, among juvenile salmonids, all lifestages of eulachon, and subadult green sturgeon;
2. harm from being exposed to elevated turbidity among juvenile salmonids, and
3. harm from reductions in forage among juvenile salmonids, and adult and subadult green sturgeon.

These forms of take are directly related to the amount of time that the dredging equipment is in operation, and the timing of the dredge operation. Since the potential for ESA listed fish to be entrained and experience reduced foraging opportunities is most directly measured by the amount of time the dredge is actively operating and the timing of the operation, the extent of take identified for the proposed action is related to the number of days of dredging per year within a timeframe that anticipates the lowest presence of vulnerable lifestages of listed fish. Therefore, the extent of take is up to 30 days of dredging per calendar year for 10 years during the July 1 to October 31 and/or between December 1 and January 31 IWWW.

Dredging operations that exceed 30 days or are outside of IWWW will increase the likelihood of more listed individuals being exposed to the effects of the action described above. The number of days of dredging per year, and dredging outside of the IWWW are each a threshold for reinitiating consultation. Exceeding this indicator for extent of take will trigger the re-initiation provisions of this opinion.

For harm among juvenile salmonids from elevated sediment, the extent of take is the area of visible turbidity within the slough during dredging, in this case, 100 feet downstream from the area being dredged, which is the point of compliance with the State of Oregon's Clean Water Act 401 certification.

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 any permittee or contractor performing the work described in this document to:

1. Minimize incidental take by minimizing entrainment during dredging;
2. Minimize incidental take by minimizing turbidity; and
3. Ensure 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

The terms and conditions described below are non-discretionary, and the USACE or Northwest Aggregates must comply with them in order to implement the RPMs (50 CFR 402.14). The USACE or Northwest Aggregates 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 reasonable and prudent measure 1, minimize entrainment during dredging:

1a. The USACE shall instruct Northwest Aggregates to 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.

1b. The USACE shall instruct Northwest Aggregates to ensure that during dredging and active pumping of sediment, the suction dredge will remain in contact with the river bottom to the maximum extent possible, and will be raised no more than 1 meter above the bottom so as to reduce the likelihood of pulling fish from the water column into the dredge.

1c. USACE shall ensure in-water work will be performed in accordance with permit conditions, which set timing restriction for in-water work of July 1 to October 31 and/or between December 1 and January 31.

The following terms and conditions implement reasonable and prudent measure 2, minimize turbidity during dredge disposal:

2a. The applicant, Northwest Aggregates, shall ensure turbidity remains at background levels 100 feet downstream from the point of disturbance during dredging and placement operations by adhering to dredge management protocols proposed in the project description, including monitoring and compliance reporting of turbidity levels observed during dredging operations as required by the State of Oregon CWA section 401 certifcation.

i. 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 reasonable and prudent measure 3, monitoring and reporting:

3a. 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:

ii. Hours of dredging for each day dredging occurred;
iii. The number of days dredging occurred each month;
iv. The number of days of dredging occurred for the previous calendar year;
v. The extent and depth of dredging conducted for the calendar year;
vi. Turbidity levels from monitoring and whether turbidity compliance was met.

3b. Monitoring reports developed for this biological opinion and for the State of Oregon shall be submitted annually to:

i. projectsreports.wcr@noaa.gov
ii. Include WCRO-2020-03159 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 two 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 floating silt curtains around the in-water dredge area to minimize the dispersion of suspended sediment thereby reducing turbidity.
2. Work with the applicant and ODFW to identify a subset of the work window in which to work further reduce exposure, such as omitting July from the work window, when peak presence of several salmonid species is expected.

Please notify NMFS if the USACE or the applicant carries out this recommendation 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 Re-initiation of Consultation

This concludes formal consultation for Northwest Aggregates Santosh Slough Maintenance Dredging.

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

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

Section 305(b) of the MSA directs Federal agencies to consult with 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 salmon (PFMC 2014), contained in the fishery management plans developed by the 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 habitat areas of particular concern (HAPC) include, complex channel and floodplain habitats. 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 dredging will temporarily diminish water quality, disturb benthic habitat and create turbidity that will affect forage production and local hydraulic conditions. Overall, the area of disturbance is relatively small in relation to the Columbia River Estuary, partially disconnected/isolated from the main-stem Columbia River, the disturbance will be short-lived, will maintain current conditions, and will not change the functional characteristics of the habitat. These localized and temporary diminishments in EFH will occur in each year of the 10 years of the action.

3.3 Essential Fish Habitat Conservation Recommendations

The effects of the proposed dredging activity will be contained and turbidity minimized by use of the appropriate equipment, and monitoring/controlling discharge of return waters at the material disposal site. To minimize the turbidity and suspended sediment effects on Pacific Coast salmon EFH, including complex channels and floodplain habitats HPAC the USACE should:

1. If turbidity levels are exceeded at 100 feet downstream of the disturbance during monitoring, install a floating silt curtain around the in-water dredge area to minimize the dispersion of suspended sediment thereby reducing turbidity.

Fully implementing these EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in Section 3.2, above, approximately 40 acres of designated EFH and HAPC for Pacific Coast salmon.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, 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 users of this opinion are USACE. Other interested users could include Northwest Aggregates, and their agent Confluence Environmental Company. Individual copies of this opinion were provided to the USACE. The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adheres to conventional standards for style.

4.2 Integrity

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

4.3 Objectivity

Information Product Category: Natural Resource Plan

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

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

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

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

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