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-2020-02846

December 17, 2021

Jacalen Printz
Chief, Regulatory Branch
Department of the Army
Corps of Engineers, Seattle District
P.O. Box 3755
Seattle, Washington 98124-3755

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Rivershore Drive Marina Maintenance Dredge (Clark County, Washington, Columbia River, HUC: 1708000309) (NWP-2020-635)

Dear Ms. Printz:

Thank you for your letter of October 7, 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 Rivershore Drive Marina Dredge.

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 or result in the destruction or adverse modification of the critical habitat of:

1. Lower Columbia River (LCR) Chinook salmon
2. Snake River (SR) fall-run Chinook salmon
3. SR spring/summer-run Chinook salmon
4. Upper Columbia River (UCR) spring-run Chinook salmon
5. SR Basin steelhead
6. Middle Columbia River (MCR) steelhead
7. Columbia River chum salmon
8. LCR steelhead
9. UCR steelhead
10. LCR coho salmon

NMFS concludes that the proposed action is not likely to adversely affect Pacific eulachon and this analysis is in Section 2.12 of the biological opinion.

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 EFH pursuant to section 305(b) of the MSA.

Please contact Tom Hausmann, Portland, Oregon, 503-231-2315, tom.hausmann@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: Evan G. Carnes, Chief, St. Helens Section, U.S. Army Corps of Engineers, Seattle District

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

Rivershore Drive Marina Maintenance Dredge
Clark County, Washington, Columbia River, HUC: 1708000309
(NWP-2020-635)

NMFS Consultation Number: WCRO-2020-02846

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

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely to Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely to Destroy or Adversely Modify Critical Habitat?
Lower Columbia River (LCR) Chinook salmon *(Oncorhynchus tschawytscha)*	Threatened	Yes	No	Yes	No
Snake River (SR) fall-run Chinook salmon (*O. tschawytscha*)	Threatened	Yes	No	Yes	No
SR spring/summer run Chinook salmon (*O. tschawytscha*)	Threatened	Yes	No	Yes	No
UCR spring run Chinook salmon (*O. tschawytscha*)	Endangered	Yes	No	Yes	No
SR steelhead *(O. mykiss)*	Threatened	Yes	No	Yes	No
Middle Columbia River (MCR) steelhead *(O. mykiss)*	Threatened	Yes	No	Yes	No
Columbia River chum salmon *(O. keta)*	Threatened	Yes	No	Yes	No
LCR steelhead *(O. mykiss)*	Threatened	Yes	No	Yes	No
Upper Columbia River (UCR) steelhead *(O. mykiss)*	Threatened	Yes	No	Yes	No
LCR coho salmon (*O. kisutch*)	Threatened	Yes	No	Yes	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	No

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

Issued By:

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

Date: December 17, 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 U.S.C. 1531 et seq.), as amended, and implementing regulations at 50 CFR part 402.

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

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

1.2. Consultation History

This biological opinion is in response to the U.S. Army Corps of Engineers – Seattle District (USACE) request for formal consultation on ESA-listed species detailed in Table 1, authorizing the proposed action under Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act, received by NMFS on October 7, 2020. A biological assessment (BA) and supplemental information prepared by the applicant, the Rivershore Drive Marina (RDM), and their agent, Volador Consulting, LLC was included in the USACE submittal. We did not request any additional information and initiated consultation on October 7, 2020.

The USACE determined the proposed action will have no effect on Snake River (SR) sockeye salmon or the Southern Distinct Population segment of green sturgeon or their critical habitats. This opinion does not include an analysis of these species or their critical habitats. The USACE determined that the proposed action is not likely to adversely affect SR spring/summer-run Chinook salmon or Upper Columbia River (UCR) spring Chinook salmon or their critical habitats. We did not concur with these determinations and included these species in the opinion. The USACE determined that the proposed action is likely to adversely affect Lower Columbia River (LCR) Chinook salmon, SR fall-run Chinook salmon, SR Basin steelhead, Middle Columbia River (MCR) steelhead, Columbia River chum salmon, LCR steelhead, UCR steelhead, LCR coho salmon and Pacific eulachon. Our effects analysis determined that the proposed action is not likely to adversely affect Pacific eulachon and we include this analysis in Section 2.12 of this document.

On April 15, 2021 the USACE informed NMFS that RDM was revising their plan for dredge material disposal, and NMFS suspended work on the consultation.

On August 3, 2021, the USACE informed NMFS that the RDM would use clam shell dredging and dispose of the dredge material at the Ross Island restoration site in the Willamette River pending receipt of their Portland Sediment Evaluation Team (PSET) and Oregon Department of Environmental Quality (ODEQ) Sediment Determination Memo (SDM). The USACE provided NMFS with updated drawings on August 3, 2021. These changes eliminated the options of hydraulic dredging and flow lane disposal from the proposed action, which were included in the original BA. On November 29, 2021, the PSET issued their SDM approving sediment disposal at Ross Island. Based on receipt of this new information, the initiation date for formal consultation was revised to November 29, 2021.

This consultation reflects the changes in the proposed action and updated drawings.

1.3. Proposed Federal Action

Under the ESA, "action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (see 50 CFR 402.02).

The USACE proposes to issue a 10-year permit under Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act authorizing dredging and disposal of dredged sediment of the RDM community moorage facility.

RDM proposes to conduct maintenance dredging of a maximum of 32,500 cubic yards (CY) of sediment. RDM will dredge 22,500 CY of sediment during the 2021 in-water work window and then do one additional maintenance dredge of 10,000 CY during the 10-year permit. The dredge area is the 261-foot by 165-foot moorage basin between two 60-foot wide by 350-foot long channels. The proposed dredging would maintain a navigation width from the existing dock to the base of the dredge prism of 50 to 70 feet with two 60-foot wide access channels to the main river channel. The proposed dredging would target a depth of -12-feet Columbia River Datum (CRD).

This project will use a closed lip clamshell dredge from a barge-mounted derrick crane. A clamshell dredge uses a bucket on a crane to dig the sediment to the correct depth and place the sediment on the hull of a barge. The material will be then transported to the Ross Island Sand and Gravel lagoon in Portland, Oregon. The Ross Island lagoon is a state and federally authorized disposal site with an existing USACE permit and ESA Section 7 consultations (NWR-2000-468 and WR-2007-158). Disposal of dredge material at Ross Island will be performed in compliance with the USACE permit the associated NMFS biological opinions.

Minimization Measures

The project has been designed to avoid and minimize impacts to species and habitats that may potentially occur in the vicinity of the project area. This will be accomplished by using the following measures:

1. Work will occur within the approved in-water work window of November 1 to December 31 beginning as early as 2021. Dredging will occur as early in the work window as possible to minimize potential impacts to eulachon.

2. To maintain materials within the river system for downstream benefits, dredged material will be disposed of at the Ross Island restoration project in the Willamette River.

3. Turbidity will be monitored in accordance with the issued 401 certifications.

4. The clamshell bucket will be closed smoothly when at the bottom to minimize suspension of sediment.

5. The contractor will be required to use a tightly sealing bucket and to monitor for spillage during transfer operations.

6. No stockpiling of dredged material on the riverbed.

7. Dredging will be conducted to minimize the likelihood of impingement or entrainment of juvenile salmonids by dredging equipment by working during the in-water work window and controlling dredge bucket cycle time.

8. Regular observation of dredged material aboard the barge or at the placement areas will be conducted. If salmon are observed in the dredged material, clamshell operations will be slowed down to increase the opportunity for juveniles to avoid the bucket.

9. If sediment is placed on a barge for delivery to the placement area, no spill of sediment from the barge will be allowed.

10. The barge will be managed such that the dredged sediment load does not exceed the capacity of the barge.

11. The load will be placed in the barge to maintain an even keel and avoid listing.

12. Hay bales and/or filter fabric may be placed over the barge scuppers to help filter suspended sediment from the barge effluent if needed.

We considered, under the ESA, whether or not the proposed action would cause any other activities and determined that dredging allows for continued boat use of the marina.

Under the MSA, “Federal action” means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a Federal agency (see 50 CFR 600.910).]

2. ENDANGERED SPECIES ACT BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

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

Our determination that the proposed action is not likely to adversely affect Pacific eulachon or its critical habitat is documented in the "Not Likely to Adversely Affect" Determinations section (Section 2.12).

2.1. Analytical Approach

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

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

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

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

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

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

2.2. Rangewide Status of the Species and Critical Habitat

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

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., 2016; Mote et al., 2014). Rain-dominated watersheds and those with significant contributions from groundwater may be less sensitive to predicted changes in climate (Mote et al., 2014; Tague et al., 2013).

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)). Recent temperatures in all but two years since 1998 ranked above the 20th century average (Mote et al., 2014). 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 percent 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; USGCRP, 2009). Earlier snowmelt will cause lower stream flows in late spring, summer, and fall, and water temperatures will be warmer (ISAB, 2007; USGCRP, 2009). Models consistently predict increases in the frequency of severe winter precipitation events (i.e., 20-year and 50-year events), in the western United States (Dominguez et al., 2012). The largest increases in winter flood frequency and magnitude are predicted in mixed rain-snow watersheds (Mote et al., 2014).

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

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

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

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 (Reeder et al., 2013; Tillmann and Siemann, 2011).

Moreover, as atmospheric carbon emissions increase, increasing levels of carbon are absorbed by the oceans, changing the pH of the water. A 38 percent to 109 percent increase in acidity is projected by the end of this century in all but the most stringent CO_2 mitigation scenarios, and is essentially irreversible over a time scale of centuries (IPCC, 2014). Regional factors appear to be amplifying acidification in Northwest ocean waters, which is occurring earlier and more acutely than in other regions and is already impacting important local marine species (Barton et al., 2012; Feely et al., 2012). Acidification also affects 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 to 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 (Reeder et al., 2013; Tillmann and Siemann, 2011). 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; USGCRP, 2009; 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 (Reeder et al., 2013; Tillmann and Siemann, 2011). Siegel and Crozier (2019) observe that a newer study projects nearly complete loss of existing tidal wetlands along the U.S. West Coast, due to sea level rise (Thorne et al., 2018). California and Oregon showed the greatest threat to tidal wetlands (100%), while 68% of Washington tidal wetlands are expected to be submerged. Coastal development and steep topography prevent horizontal migration of most wetlands, causing the net contraction of this crucial habitat.

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 evolutionarily significant units (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 Species

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

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

"Diversity" refers to the distribution of traits within and among populations. These range in scale from DNA sequence variation in single genes to complex life history traits (McElhany et al., 2000).

"Abundance" generally refers to the number of naturally-produced adults (i.e., the progeny of naturally-spawning parents) in the natural environment (e.g., on spawning grounds).

"Productivity," as applied to viability factors, refers to the entire life cycle (i.e., the number of naturally-spawning adults produced per parent). When progeny replace or exceed the number of parents, a population is stable or increasing. When progeny fail to replace the number of parents, the population is declining. McElhany et al. (2000) use the terms "population growth rate" and "productivity" interchangeably when referring to production over the entire life cycle. They also refer to "trend in abundance," which is the manifestation of long-term population growth rate.

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

The summaries that follow describe the status of the ESA-listed species, and their designated critical habitats, that occur within the geographic area of this proposed action and are considered in this opinion. More detailed information on the status and trends of these listed resources, and their biology and ecology, are in the listing regulations and critical habitat designations published in the Federal Register. Additional information (e.g., abundance estimates) that has become available since the latest status reviews and technical support documents also comprises the best scientific and commercial data available and has also been summarized in the following sections.

Table 1. Status of ESA-listed species affected by the proposed action

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 evolutionarily significant unit (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 of extinction within 100 years. From 2011 to 2015 there was little change in the biological status of this ESU, although there were 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 viable salmonid population (VSP) levels identified in the recovery plan, there was an overall improvement in the status of a number of fall-run populations, although most were still far from the recovery plan goals. *Since the 2015 status review, data indicates a mix of recent population abundance increases, decreases, and relatively static numbers of natural-origin and total spawners between 2014 to 2018 compared to the 2009 to 2013 with the direction of "% Change" between 5-year geometric means mixed within run types. Therefore the degree to which abundance has been driven by below-average ocean survival or by a variety of environmental conditions and management actions in freshwater spawning and rearing habitat, appears to vary between populations.*	• 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

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
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 of extinction within 100 years and one is functionally extirpated. The 2015 estimates of natural-origin spawner abundance increased relative to the levels observed in the 2010 review for all three extant populations, and 2015 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. *Recent data indicates a substantial downward trend in the abundance of natural-origin spawners at the ESU level from 2015 to 2019. This is thought to be driven primarily by marine environmental conditions and a decline in ocean productivity. Recent outmigrant year classes have experienced below-average ocean survival during a marine heatwave and its lingering effects. Some of the negative impacts on juvenile salmonids had subsided by spring 2018, but other aspects of the ecosystem (e.g., temperatures below the 50-m surface layer) had not returned to normal. Increased abundance of sea lions in the lower Columbia River could also be a contributing factor.*	• 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 of extinction within 100 years. The 2015 natural-origin abundance increased over the levels reported in the 2010 review for most populations in this ESU, although the increases were not substantial enough to change viability ratings. Relatively high ocean survivals in this period were a major factor in these abundance patterns. While there were 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. *The recent data indicates a substantial downward trend in the abundance of natural-origin spawners from 2014 to 2019. The past 3 years (2017 through 2019) have shown the lowest returns since 1999. This recent downturn in adult abundance is thought to be driven primarily by marine environmental conditions and a decline in ocean productivity. Recent outmigrant year classes have experienced below-average ocean survival during a marine heatwave and its lingering effects. .Some of the negative impacts on juvenile salmonids had subsided by spring 2018, but other aspects of the ecosystem (e.g., temperatures below the 50-m surface layer) had not returned to normal. Increased abundance of sea lions in the lower Columbia River could also be a contributing factor.*	• 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
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.' In 2015 the status of Snake River fall Chinook salmon had clearly improved compared to the time of listing and compared to the 2010 status reviews. The single extant population in the ESU was meeting the criteria for a rating of 'viable' developed by the ICTRT, but the ESU as a whole was not meeting the recovery goals described in the recovery plan for the species, which required 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. *The recent data indicates a substantial downward trend in the abundance of natural-origin spawners from 2013 to 2019. The recent downturn is thought to be driven primarily by marine environmental conditions and a decline in ocean productivity. Recent outmigrant year classes have experienced below-average ocean survival during a marine heatwave and its lingering effects. .Some of the negative impacts on juvenile salmonids had subsided by spring 2018, but other aspects of the ecosystem (e.g., temperatures below the 50-m surface layer) had not returned to normal. Even with this decline, overall abundance has remained higher than before 2005.*	• Degraded floodplain connectivity and function • Harvest-related effects • Loss of access to historical habitat above Hells Canyon and other Snake River dams • Impacts from mainstem Columbia River and Snake River hydropower systems • Hatchery-related effects • Degraded estuarine and nearshore habitat.

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Columbia River chum salmon	Threatened 6/28/05	NMFS 2013	NWFSC 2015	Overall, the status of most chum salmon populations in the 2015 status review 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 from 2010 to 2015, the majority of populations in this ESU remained at a high or very high risk category and considerable progress remained to be made to achieve the recovery goals. *Recent data indicates increasing trends in the abundance of both natural-origin and total spawners when compared to the 2009 to 2013, with the exception of the Upper Gorge Tributaries population, which decreased in abundance. The ocean survival of chum salmon was above average in 2016 through 2018, potentially due to their unique consumption of the types of gelatinous organisms (jellies, salps, larvaceans) that were abundant during the recent warm ocean conditions.*	• Degraded estuarine and nearshore marine habitat • Degraded freshwater habitat • Degraded stream flow as a result of hydropower and water supply operations • Reduced water quality • Current or potential predation • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat in the lower Columbia River • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Juvenile fish wake strandings • Contaminants

Lower Columbia River coho salmon	Threatened 6/28/05	NMFS 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 of extinction within 100 years. 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. Populations in this ESU generally improved in the 2013/14 and 2014/15 return years. *The recent data available at the population level indicate a mix of recent increases, decreases, and relatively static numbers of natural-origin spawners in 2014 to 2018 compared to the 2009 to 2013. The degree to which abundance has been driven by below average ocean survival or by environmental conditions and management actions in freshwater spawning and rearing habitat, appears to vary between populations. Since 2016, observations of coastal ocean conditions indicate that recent outmigrant year classes have experienced below-average ocean survival during a marine heatwave.. Expectations for marine survival are relatively mixed for juveniles that reached the ocean in 2019.*	• 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
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. The 2015 abundance estimate suggested 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. *The recent data indicate a mix of recent increases, decreases, and relatively static numbers of natural-origin and total spawners in 2014 to 2018 compared to the 2009 to 2013 period. In all cases where available, abundance estimates for 2019 were lower than the most recent 5-year geometric means indicating a common driver such as poor ocean conditions.*	• 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
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 were higher over the 2010 to 2015 brood cycle, while natural origin returns to the John Day River decreased. There were improvements in the viability ratings for some of the component populations, but the DPS was not currently meeting the viability criteria in the MCR steelhead recovery plan. In general, the majority of population-level viability ratings remained unchanged from 2010 reviews for each major population group within the DPS. *The recent data indicates a substantial downward trend in the abundance of natural-origin spawners from 2014 to 2019. This recent downturn is thought to be driven primarily by marine environmental conditions and a decline in ocean productivity. Increased abundance of sea lions in the lower Columbia River could also be a contributing factor.*	• 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
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 2015 review. The abundance and productivity viability rating for the Wenatchee River exceeded the minimum threshold for 5% extinction risk. However, the overall DPS status remained unchanged from the 2010 review, remaining at high risk driven by low abundance and productivity relative to viability objectives and diversity concerns. *The recent data indicates a substantial downward trend in the number of natural-origin spawner levels from 2014 to 2019. This downward trend in adult abundance is thought to be driven primarily by marine environmental conditions and a decline in ocean productivity. Increased abundance of sea lions in the lower Columbia River could also be a contributing factor.*	• 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
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 were not meeting the specific objectives in the draft recovery plan based on the updated status information available for the 2015 review, and the status of many individual populations remained 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. *The most recent data available with respect to the adult abundance indicates a substantial downward trend in the abundance of natural-origin spawners at the DPS-level from 2014 to 2019. The 2014 to 2018 5-year genetic stock identification (GSI) geometric means indicate large decreases in natural-origin abundance for most of the MPGs and numbers for 2019 were much lower than the 2014 to 2018 geomean. These data show that SR Basin steelhead MPGs generally increased in abundance after the 1990s, but experienced reductions during the more recent period when ocean conditions were poor. Increased numbers of sea lions in the lower Columbia River in the last 10 years could also be a contributing factor to the recent reductions.*	• 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

2.2.2 Status of Critical Habitat

This section describes the status of designated critical habitat affected by the proposed action by examining the condition and trends of the essential PBFs 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).

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 (NOAA Fisheries, 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 of the population occupying that area to the species. 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.

A summary of the status of critical habitats, considered in this opinion, is provided below.

Table 2. Status of critical habitats

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 field-field hydrologic unit code (HUC5) watersheds with physical and biological features (PBFs) for salmon are in fair-to-poor or fair-to-good condition (NOAA Fisheries, 2005). However, most of these watersheds have some, or high potential for improvement. We rated conservation value of HUC5 watersheds as high for 30 watersheds, medium for 13 watersheds, and low for four watersheds.
Upper Columbia River spring-run Chinook salmon	9/02/05 70 FR 52630	Critical habitat encompasses four subbasins in Washington containing 15 occupied watersheds, as well as the Columbia River rearing/migration corridor. Most HUC5 watersheds with PBFs for salmon are in fair-to-poor or fair-to-good condition. However, most of these watersheds have some, or high, potential for improvement. We rated conservation value of HUC5 watersheds as high for 10 watersheds, and medium for five watersheds. Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.
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 the lower Snake River and Columbia River has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.
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.
Snake River Basin steelhead	9/02/05 70 FR 52630	Critical habitat encompasses 25 subbasins in Oregon, Washington, and Idaho. Habitat quality in tributary streams varies from excellent in wilderness and roadless areas, to poor in areas subject to heavy agricultural and urban development (Wissmar et al. 1994). Reduced summer stream flows, impaired water quality, and reduced habitat complexity are common problems. Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.
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 PBFs for salmon are in fair-to-poor or fair-to-good condition (NOAA Fisheries, 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.

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Columbia River chum salmon	9/02/05 70 FR 52630	Critical habitat encompasses six subbasins in Oregon and Washington containing 19 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PBFs for salmon are in fair-to-poor or fair-to-good condition (NOAA Fisheries, 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 16 watersheds, and medium for three watersheds.
Lower Columbia River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses nine subbasins in Oregon and Washington containing 41 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PBFs for salmon are in fair-to-poor or fair-to-good condition (NOAA Fisheries, 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 Columbia River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses 10 subbasins in Washington containing 31 occupied watersheds, as well as the Columbia River rearing/migration corridor. Most HUC5 watersheds with PBFs for salmon are in fair-to-poor or fair-to-good condition (NOAA Fisheries, 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 coho salmon	2/24/16 81 FR 9252	Critical habitat encompasses 10 subbasins in Oregon and Washington containing 55 occupied watersheds, as well as the lower Columbia River and estuary rearing/migration corridor. Most HUC5 watersheds with PBFs for salmon are in fair-to-poor or fair-to-good condition (NOAA Fisheries, 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.

2.3. Action Area

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

The action area is the 900-foot by 400-foot rectangle around the project area. This 360,000 square foot area encompasses the dredge area, the downstream and lateral extent of turbidity mixing zones where suspended sediment concentrations will return to background levels, and the CR chum salmon spawning alcove downstream from the marina. The action area is the red shaded area in Figure 1.

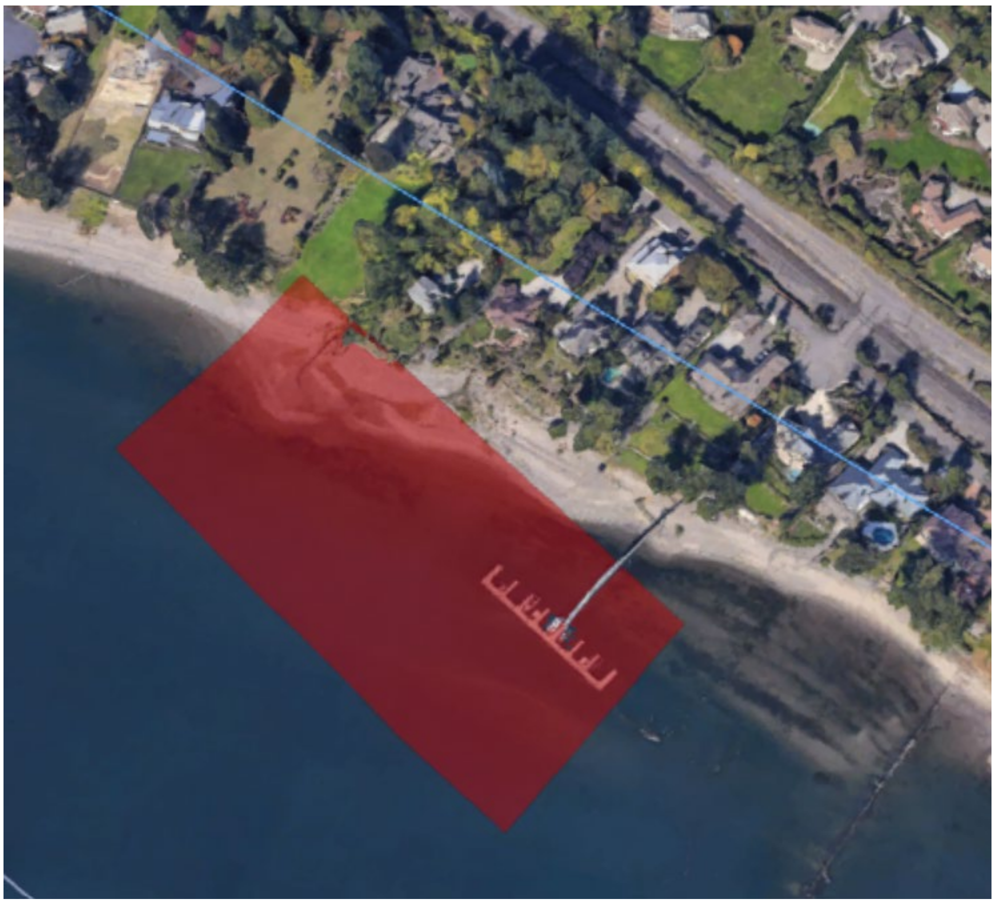

Figure 1. Action area

2.4. Environmental Baseline

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

2.4.1 ESA-Listed Species in the Action Area

The action area is in the Columbia River estuary which extends from the mouth of the Columbia River to Bonneville Dam. The Columbia River estuary habitat is important to the survival of all Columbia Basin salmon and steelhead during rearing and migration because it provides the food-rich environment where they grow and transition to saltwater. Ocean-type fall Chinook and chum salmon spend weeks to months in the estuary and make use of shallow, vegetated habitats such as marshes and tidal swamps. Stream-type coho salmon, spring Chinook salmon, and steelhead spend less time in the estuary and use mostly deeper, main channel estuarine habitats (NMFS, 2013). All Columbia River Basin adult salmon and steelhead return to and migrate upstream through the estuary to reach their natal streams. CR chum salmon spawn in several alcoves in the estuary between the Interstate 205 Bridge and the Bonneville Dam.

2.4.2 Designated Critical Habitat in the Action Area

The action area contains designated critical habitat for all of the ESA-listed species considered in this opinion. More specifically, the action area provides migratory and rearing habitat for these listed species. The current baseline condition of the action area has been impacted by human activities both within and upstream of the action area, and is described in more detail below.

The quality of the habitat available to salmon and steelhead in the estuary has been compromised. Water temperatures above the upper thermal tolerance range for salmon and steelhead are occurring earlier and more often and are likely to continue to climb as a result of global climate change. A variety of toxic contaminants have been found in water, sediments, and salmon tissue in the estuary at concentrations above the estimated thresholds for health effects in juvenile salmon including polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), DDT and copper. Pesticides, pharmaceuticals, personal care products, and brominated fire retardants, all of which have been detected in the Columbia River estuary, appear to pose risks to salmonid development, health, and fitness through endocrine disruption, bioaccumulative toxicity, or other means (NMFS, 2013).

The elimination of vegetated wetlands in the estuary have altered the diet of juvenile salmon in the estuary by reducing the supply of insect prey and macrodetrital inputs to the estuarine food web. Increased microdetrital inputs to the estuary from decaying phytoplankton produced in upstream reservoirs, combined with nutrient inputs from urban, industrial, and agricultural development may support a food web that favors other fish species such as American shad. The presence of native and exotic fish, introduced invertebrates, invasive plant species, and thousands of over-water and instream structures also alter the salmonid food web. Habitat in the estuary supports predation on salmonids by northern pikeminnow, pinnipeds, Caspian terns, and cormorants. Juvenile salmon and steelhead in the estuary are subject to hazards from dredging, ship ballast intake, and beach stranding from ship wakes (NMFS, 2013).

The degraded habitat conditions in the estuary affect the abundance, productivity, spatial structure, and diversity of ESA-listed salmon and steelhead. Estuarine habitat issues limit the viability of Lower Columbia River Chinook, coho, and steelhead and Columbia River chum salmon. Recovery planners estimate that baseline anthropogenic mortality in the estuary, excluding mortality attributable to predation, is between 9 and 50 percent, depending on species and population. For most populations, the estimates range from 10 to 32 percent (NMFS, 2013).

Federal and state agencies permitted the construction of overwater structures (OWSs) and pile dikes in the action area. OWSs are generally an impediment to the outmigration of ocean-type smolts that travel along the shoreline and must swim beneath, through or around the structure and the boats moored at the structure (Kemp et al., 2005). Pile dikes decrease the water velocity propelling smolts along the shoreline, increasing their travel time. All artificial structures can provide predators of listed salmonids with hunting advantages (Celedonia et al., 2008). For example, piscine predators can hide and rest behind pilings and ambush salmon smolts that swim beneath the OWS or through the pile dike. Salmonids that swim around the OWS or pile dike are vulnerable to larger, faster swimming piscine predators in deeper water (Toft et al., 2007). Boats can leak or spill fuel into the water around the OWS. Boat props can kill fish and create suspended sediment in shallow water. At high concentrations, suspended sediment injures fish gills and affects their behavior, making them more vulnerable to predator attacks.

2.5. Effects of the Action

Under the ESA, “effects of the action” are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action (see 50 CFR 402.02). A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see 50 CFR 402.17). In our analysis, which describes the effects of the proposed action, we considered the factors set forth in 50 CFR 402.17(a) and (b).

Effects associated with transportation and disposal of dredged material were described in the Ross Island Sand and Gravel Company’s Removal/Fill Permit Renewal biological opinions (NWR-2000-468 and NWR-2007-158). Those consultations concluded the action is not likely to jeopardize the continued existence of ESA-listed species nor will it result in the destruction or adverse modification of designated critical habitats for those species. Effects associated with those two consultation are considered part of the environmental baseline and are not included in this “Effects of the Action” section.

2.5.1 Effects on Critical Habitat

The action area is migration and rearing habitat for LCR Chinook salmon, SR fall-run Chinook salmon, SR spring/summer-run Chinook salmon, UCR spring-run Chinook salmon, SR Basin steelhead, MCR steelhead, CR chum salmon, LCR steelhead, UCR steelhead and LCR coho salmon. It is also spawning habitat for CR chum salmon. Because these salmon and steelhead species have sufficiently similar estuarine habitat requirements for migration and/or rearing, the following analysis is applicable to all of the salmon and steelhead critical habitat designations. The essential PBFs of migration corridors and rearing habitat are freedom of obstruction and excessive predation, and water quantity and quality, natural cover, side channels, and undercut banks that support foraging, mobility and survival. The PBFs of freshwater spawning sites are: water quantity and quality conditions and substrate supporting spawning, incubation and larval development. The proposed action will affect designated critical habitat as a result of dredging. Dredging stressors on critical habitat PBFs are:

1. Suspended sediment that degrades water quality, migration corridors and spawning substrate.

2. The removal of established benthic food webs that provide forage to rearing and migrating salmon and steelhead.

Our analysis of the effects of the proposed action on salmon and steelhead critical habitat is in Table 3.

Table 3. Effects of the proposed action on salmon and steelhead critical habitat

Action	Stressor	PBF	Exposure			Response	Consequences
			Frequency	Duration	Timing		
Clamshell dredging	Suspended sediment	Water quality - Clamshell dredging creates a suspended sediment plume as the bucket digs into the substrate and as sediment falls from the bucket when it rises through the water column.	Water quality in the project area may be degraded by clamshell dredging suspended sediment plumes two times over the next ten years starting in 2021 or 2022.	Each clamshell dredging event will take up to two weeks. Water quality is degraded during the work day while the dredge is operating and returns to normal when the dredge stops operation. Dredging has no permanent effects to water quality.	The proposed November 1 to December 31 in-water work window overlaps both the presence of juvenile salmon and steelhead in the action area and the migration of adult salmon and steelhead in the action area.	Clamshell dredging is likely to create a sediment plume with a steady source concentration of 550 milligrams per liter that will be transported downstream as it becomes diluted by mixing into the water column. The Washington Department of Ecology (WDOE) 401 certification will require the dredger to monitor turbidity and manage the source concentration such that turbidity returns to background within 300 feet downstream from the dredge and 200 feet laterally from the dredge. The proposed action includes best management practices during dredging to minimize the mass of suspended sediment in the mixing zone. The dredge operator will work in a controlled manner and will not stockpile dredged material on the river bottom surface. As long as the dredger complies with the WDOE 401 certification by controlling the dredge bucket cycle time, the suspended sediment will return to background concentration within 300 feet of the source.	Water quality in the project area will be temporarily degraded as a result of elevated suspended sediment from clamshell dredging. This degradation will occur during dredging activities, which will last for up to two weeks during the in-water work window. This dredging operation will occur two times over the next ten years. Water quality will return to its background condition when dredging stops at the end of the work day. There will not be any long term or permanent changes to the water quality PBF of critical habitat.

Action	Stressor	PBF	Exposure			Response	Consequences
			Frequency	Duration	Timing		
		Migration corridor obstruction	Clamshell dredging plumes may exist two times over the next ten years with the first in 2021 or 2022.	Each clamshell dredging event will take up to two weeks. The migration corridor will be negatively impacted while the dredge is operating and will return to normal when the dredge stops operation. Dredging has no permanent effects to the migration corridor.	The proposed November 1 to December 31 in water work window overlaps both the migration of juvenile salmon and steelhead in the action area and the migration of adult salmon and steelhead in the action area..	The intensity of clamshell dredging plumes is described in the water quality section above. The turbidity plumes will be less than 200 feet wide and less than 300 feet long throughout the water column. Elevated suspended sediment concentrations within the plumes are expected to partially obstruct 60,000 square feet of the action area migration corridor. The suspended sediment concentration in the plumes may range from 100s of milligrams per liter at the clamshell dredge source to 10s of milligrams per liter at the plume margins.	Clamshell dredging may create a partial, temporary migration corridor obstruction in the form of suspended sediment plumes in the water column that overlaps the timing of adult and juvenile salmon and steelhead migration in the Columbia River.
		Spawning substrate – There is a CR chum spawning alcove is approximately 470 feet downstream from the west most dredge material management unit (DMMU)	Clamshell dredging plumes may exist two times over the next ten years with the first plume in 2021 or 2022.	Each clamshell dredging event will take up to two weeks. Suspended sediment is transported downstream towards CR chum spawning alcoves while the dredge is operating .	The two weeks of clamshell dredging may take place anytime between November 1 and December 31 and overlaps the time of year when CR chum salmon construct redds in alcove 1.	Suspended sediment that reaches the alcove has the potential to degrade the quality of spawning substrate, if sufficient quantities of sediment are deposited in localized areas. The fines fraction within gravel/cobble substrate is a primary predictor of spawning habitat quality (Lapointe et al., 2004).	Substrate in the CR chum spawning alcove is unlikely to be impacted by high quantities of suspended sediment. This is because dredging activities are required to be implemented in a manner that ensures suspended sediment returns to background levels at the edge of \the WDOE 300-foot by 200-foot mixing zone.
	Dredge prism removal and new benthic surface layer	Benthic forage supply - Clamshell dredging will remove about 86,000 square feet of benthic forage	Clamshell dredging may be done 2 times over the next 10 years starting in 2021 or 2022.	Benthic forage may begin to return to the dredged area within one year but will likely take several years to return to its pre-	The benthic forage in the dredge site will remain degraded throughout the time of year that juvenile salmon	Dredged benthic food webs recover at different rates depending on the location and condition of the Z-layer and the rate at which nutrients are imported to the Z-layer (ISAB, 2011). We	Clamshell dredging will reduce benthic forage in approximately 86,00 square feet of the action area. Although uncertain, we anticipate that reduction to

Action	Stressor	PBF	Exposure			Response	Consequences
			Frequency	Duration	Timing		
		from the action area.		dredge condition (ISAB, 2011; USACE, 1998).	and steelhead are rearing in and migrating down the Lower Columbia River to the estuary.	estimate that significant benthic forage will not be produced in the proposed action Z-layer for at least one year from the time of the initial dredging and one year after the follow on dredging during the ten year duration of the proposed action permit (ISAB, 2011; USACE, 1998). Young-of-the year salmonids move through an estuary and lower-river habitat searching for shallow habitat where they can feed efficiently, grow, and acclimate to increasing salinity while. If suitable habitat is not available then the juveniles will keep searching for suitable habitat. Juveniles that fail to find suitable estuarine rearing habitat experience higher risk of mortality (ISAB, 2015). NMFS (2013) expresses concern that the carrying capacity of the estuary cannot always support the annual number of natural and hatchery fish dependent upon it for growth before they enter the ocean but until additional studies are conducted, it does not conclude that available forage limits the existence and recovery of ESA listed salmon and steelhead (ISAB, 2015).	last several years following each dredging event.

[1]Collins (1995) developed the empirical equation $C = \rho x 10^{-6} x\ 0.0023 \left(\frac{b}{v_s T}\right)^3$ where C is the steady concentration of suspended sediment around the dredge, ρ is the density of sediment, b is the size of the clamshell bucket, v_s is the Stokes particle settling velocity and T is the dredge cycle time. The Stokes particle settling velocity is a function of the average radius of the sediment particles to be dredged. The PSET Suitability Report shows the marina sediment to be 31 percent gravel, 55% sand (0.000513 m), 12% silt (0.000013 m) and 1.5% clay (.0000012 m). An open 3 cubic yard bucket with a cycle time of 60 seconds would result in a steady suspended sediment concentration of 550 mg/L around the dredge. A sealed bucket would eliminate most spilling so that the suspended sediment concentration is determined exclusively by the cycle time.

2.5.2 Effects on Listed Species

Implementation of the proposed action may affect individuals of ESA-listed species that occur in the action area. More specifically, individual fish will be impacted by construction activities that cause increase suspended sediment, create an entrainment risk, and reduce fish forage base. A summary of these potential effects is provided in Table 4.

Table 4. Salmon and steelhead exposure and response to project effects

Action	Stressor	Life stage	Exposure				Response	Consequences
			Frequency	Duration	Timing	Location		
Dredging	Suspended sediment	Migrating adults	As described in the Effects to Critical Habitat Section, clamshell dredging creates suspended sediment in the project site of the action area two times over the next ten years, starting in 2021 or 2022.	As described in the Effects to Critical Habitat Section, suspended sediment from clamshell dredging will be present during the work day for up to two weeks.	The November 1 to December 31 in water work window for this project overlaps the migration time of adult salmon and steelhead.	Shoreline action area is at the margin of the adult salmon and steelhead migration corridor.	We estimate that the concentration of suspended sediment could reach 100s of milligrams per liter at the clamshell dredge source but will be diluted to 10s of milligrams per liter at the margins of the 300 foot-long by 200-foot wide mixing zone (See Appendix 1 Calculation 1). Adult salmon and steelhead can swim at least 100 feet per minute upstream (Brown and Geist 2002) so if they do swim through the mixing zone during clamshell dredging, they will be exposed to suspended sediment for a few minutes. Wilber and Clark (2013) show that exposure of adults to 10-1,000 milligrams per liter of suspended sediment for less than 2 hours will result in behavioral effects such as reduced visual acuity and altered swimming either toward or away from suspended sediment.	A small number of individual adult Chinook, coho, chum and steelhead spawners may rapidly swim through the action area during clamshell dredging, be exposed to suspended sediment and experience mild behavioral effects. This is particularly true for CR chum salmon that spawn near the project area. Because the plumes constitute a small temporal and spatial fraction of the action area and fish may take action to avoid the plumes we expect at most small alterations in behavior.

Action	Stressor	Life stage	**Exposure**				Response	Consequences
			Frequency	Duration	Timing	Location		
		Juveniles and smolts	As described in the Effects to Critical Habitat Section, clamshell dredging creates suspended sediment in the project site of the action area two times over the next ten years, starting in 2021 or 2022.	Suspended sediment from clamshell dredging will be present during the work day for up to two weeks.	Clamshell dredging creates suspended sediment during the November 1 to December 31 in water work window. Migrating salmon and steelhead smolts are somewhat likely to be in the action area during the in water work window. Although their outmigration peaks in the late spring/early summer, they become widely dispersed by the long migration distance to the ocean and the slow current between dams such that some fish don't reach the Bonneville Dam until October and November (Connor et al., 2005; Connor et al., 2003; ISAB, 2011; Zabel, 2002; Zabel and Anderson, 1997). Rearing juvenile LCR coho salmon and LCR steelhead born in nearby tributaries are somewhat likely to be in the action area during the in-water work window.	Shoreline is preferred migration and rearing habitat for ocean-type smolts (ISAB, 2011; Morrice et al., 2020).	We estimate that the concentration of suspended sediment could reach 100s of milligrams per liter at the clamshell dredge source but will be diluted to 10s of milligrams per liter at the margins of the 300-foot long by 200-foot wide mixing zone. Wilber and Clarke (2001) show that juvenile fish exposed to 10 to 1,000 milligrams per liter for 8 hours would experience sublethal physiological effects such as reduced feeding and behavioral effects such as alarm followed by relocation.	During the work window the density of juvenile fish in the estuary is very low. Individual fish that are exposed to elevated suspended sediment concentrations will be able to minimize their exposure duration by moving a short distance to other shallow water habitat in the action area. Some exposed fish may experience sublethal physiological effects.
		Eggs or embryos in redds	As described in the Effects to Critical Habitat Section,	As described in the effects to Critical Habitat section,	Clamshell dredging creates suspended sediment during the November 1 to	The alcove downstream from the marina is CR	Redds constructed from substrate with a significant fraction of sand are more likely to	It is likely that chum salmon will construct redds and spawn in the alcove in the action area

Action	Stressor	Life stage	Exposure				Response	Consequences
			Frequency	Duration	Timing	Location		
			clamshell dredging creates suspended sediment in the project site of the action area two times over the next ten years, starting in 2021 or 2022.	suspended sediment from clamshell dredging will be present during the work day for up to two weeks.	December 31 in water work window. This work window overlaps the time of year when CR chum salmon spawn in the CR mainstem including alcove 1 but we expect the plume to return to the background suspended sediment concentration before it reaches alcove 1. Thus, much of the sediment introduced into the water column is expected to settle to the channel bottom prior to reaching spawning habitat.	chum spawning habitat	have interstitial spaces plugged by fine sediment suspended that settles out from the water column. As interstitial spaces become plugged, the probability that eggs and embryos in redds receive the quantity of dissolved oxygen they need to survive is reduced.[1] Wilber and Clarke (2001) show that eggs exposed to 10 to 1,000 milligrams per liter suspended sediment for 10 days would experience 26 percent to 76 percent mortality.	during the in-water work window. The amount of sediment that reaches the alcove will be under the control of the dredger. The dredger is required to follow the WDOE 401 turbidity monitoring requirement and stop or reduce cycle time if turbidity exceeds background at the edge of the mixing zone. Under these conditions, suspended sediment is unlikely to reach substrate or redds in the alcove in quantities that could lead to reduced intragravel dissolved oxygen concentrations.
	Entrainment in dredge equipment	Migrating adults	Clamshell dredging may be done two times during the next 10 years starting in 2021 or 2022.	Clamshell dredging may be done for up to two weeks.	Clamshell dredging overlaps the timing of adult salmon and steelhead migration and CR chum spawning.	With the exception of CR chum spawning in alcove 1, shoreline area is at the margin of adult migration corridor	Adult salmonids will likely easily escape entrainment in the clamshell dredge but an adult that is entrained by the dredge and dumped onto the dump scow would likely be killed.	Although we believe that there is a low likelihood that a migrating adult salmon or steelhead will be entrained by a clamshell dredge, the cost of killing even one spawning adult is high.

Action	Stressor	Life stage	Exposure				Response	Consequences
			Frequency	Duration	Timing	Location		
		Juveniles and smolts	Clamshell dredging may be done two times of the next 10 years starting in 2021 or 2022.	Clamshell dredging may be done for up to two weeks.	The November 1 to December 31 in water work window overlaps the time when juvenile salmon and steelhead occupy the project area. Sub-yearling SR fall Chinook salmon in the action area are more likely to be entrained by dredging equipment than other species of rearing salmon and steelhead due to their smaller size, and inferior swimming ability.	Shoreline is preferred migration and rearing habitat for ocean-type smolts (ISAB, 2011; Morrice et al., 2020).	Although we believe that juvenile salmon and steelhead are very unlikely to be entrained in a clamshell dredge when it is operating in a manner that complies with established BMPs, an entrained fish would very likely be crushed and killed by sediment when the bucket is emptied onto the barge.	Juvenile salmon and steelhead in the project area are likely to avoid entrainment in the clamshell dredge but any fish that becomes entrained will likely be killed.
	Reduced benthic forage supply	Juveniles or smolts	As described in the Effects to Critical Habitat section, clamshell dredging will remove 86,000 square feet of material inhabited by benthic forage from the action area two times over the next 10 years with the first in 2021 or 2022 and the second in some later year.	As described in the Effects to Critical Habitat Section, benthic forage may begin to return to the dredged area within one year but the benthic community will likely take several years to return to its pre-dredge biomass (USACE, 1998).	As described in the Effects to Critical Habitat Section, the benthic forage in the dredge site will be essentially absent immediately following dredging and will be depressed throughout the time of year that juvenile salmon and steelhead are migrating down the Lower Columbia River to the estuary for several years thereafter.	Shoreline is preferred migration and rearing habitat for ocean-type smolts (ISAB, 2011; Morrice et al., 2020).	As noted in the Effects to Critical Habitat section, juvenile salmonids move through an estuary and lower-river habitat searching for shallow habitat where they can feed efficiently, grow, and acclimate to increasing salinity while also avoiding predators. If suitable habitat is not available or if it is filled with other fishes, then the juveniles will keep searching for suitable habitat that has sufficient forage. Juveniles that fail to find suitable estuarine rearing habitat experience higher risk of mortality.	We believe that the removal of benthic forage in the project site may result in a small energy deficit for a few individual salmon or steelhead smolts forced to find forage at another location. The area of benthic forage removed by dredging is a fraction of the total benthic forage in the action area and we have not yet determined whether competition for food in the estuary is a limiting factor for juvenile salmon and steelhead (NMFS, 2013). Considering this, we do not believe that dredging will retard the growth of salmon or steelhead smolts.

Action	**Stressor**	**Life stage**	**Exposure**				**Response**	**Consequences**
			Frequency	Duration	Timing	Location		

2.6. Cumulative Effects

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

Some continuing non-Federal activities are reasonably certain to contribute to climate effects within the action area. However, it is difficult if not impossible to distinguish between the action area's future environmental conditions caused by global climate change that are properly part of the environmental baseline *vs.* cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described earlier in the discussion of 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 6 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) have caused many long-lasting environmental changes that harm 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. 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.

2.7. Integration and Synthesis

The Integration and Synthesis section is the final step in assessing the risk that the proposed action poses to species and critical habitat. In this section, we add the effects of the action (Section 2.5) to the environmental baseline (Section 2.4) and the cumulative effects (Section 2.6), taking into account the status of the species and critical habitat (Section 2.2), to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) appreciably diminish the value of designated or proposed critical habitat as a whole for the conservation of the species.

2.7.1 ESA Listed Species

Most of the component populations of LCR Chinook salmon, SR fall-run Chinook salmon, SR spring/summer-run Chinook salmon, UCR spring-run Chinook salmon, SR Basin steelhead, MCR steelhead, CR chum salmon, LCR steelhead, UCR steelhead, LCR coho salmon are at a low level of persistence, or, at high risk of extinction. Individuals from all of the populations of these ESA-listed species may move through or utilize the action area at some point during their life history.

Factoring the current environmental baseline (including those effects associated with disposal of dredge material at the Ross Island lagoon), fish from the component populations that move through and/or use the action area encounter habitat conditions that have been degraded by restricted 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 identified above including habitat access to floodplain and secondary channels, degraded habitat, loss of spawning and rearing space, pollution, 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.

Within this context, the proposed action will create two, two-week disturbances in the water column, redistribute material from the bottom of the Columbia River and maintain modified bathymetry around the OWS during the 10-year permit. These habitat alterations will expose a small number of adult fish, juvenile fish and incubating CR chum salmon embryos to elevated turbidity. Implementation of the proposed action will create a period in which fish have reduced prey as the benthic biological productivity is reduced, and then re-establishes, in the vicinity of the dredge prism. Finally, entrainment of a few juvenile salmon in the clamshell bucket is possible.

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

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 itself is not expected to affect abundance, distribution, diversity, or productivity of any of the component populations of the ESA-listed species, nor further degrade baseline conditions or limiting factors. The effects of the action on individual fish will be too minor to have a measurable impact on the affected populations. Because the proposed action will not reduce the abundance, productivity, spatial structure, or diversity the affected populations, the action, when combined with a degraded environmental baseline and additional pressure from cumulative effects, will not appreciably reduce the survival or recovery any of the listed species considered in this opinion.

2.7.2 Critical Habitat

In the context of the status of designated critical habitat and the specific baseline conditions of PBFs in the action area (described above), the proposed action will not permanently obstruct the passage of migrating fish, reduce cover, remove riparian vegetation, alter flows, destabilize the channel or change its characteristics, alter water temperature, or substantially reduce available forage. However, the proposed action may temporarily effect safe migration corridors, forage, water quality and spawning substrate PBFs within the action area. When considering the cumulative effects of non-federal actions, recovery of aquatic habitat is likely to be slow in most of the action area and cumulative effects from basin-wide activities are likely to have a slightly negative impact on the quality of critical habitat PBFs.

As a whole, the critical habitat for migration, rearing and spawning is functioning moderately under the current environmental baseline in the action area. Given that the proposed action will have low-level but largely temporary effects on the PBFs for migration, rearing and spawning for salmonids, even when considered as an addition to the baseline conditions, the proposed action is not likely to appreciably diminish the value of designated critical habitat for the conservation of subject species of this consultation.

2.8. Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, the effects of other activities caused by the proposed action, and the cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of LCR Chinook salmon, SR fall-run Chinook salmon, SR spring/summer-run Chinook salmon, UCR spring-run Chinook salmon, SR Basin steelhead, MCR steelhead, CR chum salmon, LCR steelhead, UCR steelhead, or LCR coho salmon or destroy or adversely modify their designated critical habitats.

2.9. Incidental Take Statement

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

2.9.1 Amount or Extent of Take

In the 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, SR fall-run Chinook salmon, SR spring/summer-run Chinook salmon, UCR spring-run Chinook salmon, SR Basin steelhead, MCR steelhead, CR chum salmon, LCR steelhead, UCR steelhead, LCR coho salmon 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 exposure to suspended sediment from clamshell dredging.

Due to the overall nature of the proposed action, a definitive number of ESA-listed fish that will be killed, injured or otherwise adversely affected cannot be determined and/or adequately detected. Instead NMFS will use a habitat-based surrogate to account for the amount of take, which is called an “extent” of take. For this proposed action, the potential for exposure to suspended sediment in dredge equipment is proportional to the amount of time that the dredge equipment is operating. Since the potential for ESA listed fish to be exposed to suspended sediment is most directly measured by the amount of time the dredge is actively operating, the extent of take identified for the proposed action has been related to the number of days of dredging per year. For the proposed action, this is up to 15 days of in-water work window (IWWW) dredging per year during two of the next 10 years. Dredging that exceeds 15 days per year or 30 total days over 10 years or that is outside of IWWW, increases the probability of more individuals being exposed to the effects of the action described above. The number of days of dredging per year is a threshold for reinitiating consultation. Exceeding this indicator for extent of take will trigger the reinitiation provisions of this opinion.

2.9.2 Effect of the Take

In the 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.

2.9.3 Reasonable and Prudent Measures

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

1. Ensure completion of 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.

2.9.4 Terms and Conditions

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

The following terms and conditions implement reasonable and prudent measure 1: Monitoring and reporting:

a) Action Monitoring. RDM shall submit a monitoring report to NMFS by March 31 of each year following dredging summarizing:
   i) The hours of dredging each day and the number of dredging days
   ii) The extent and depth of dredging
   iii) Whether turbidity compliance was met
b) Monitoring reports shall be submitted as an attachment to: projectreports.wcr@noaa.gov Attn: Tom Hausmann (WCRO-2020-02846)

2.10. Conservation Recommendations

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

No conservation recommendations are included in this biological opinion.

2.11. Reinitiation of Consultation

Under 50 CFR 402.16(a): "Reinitiation of consultation is required and shall be requested by the Federal agency or by the Service where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and: (1) If the amount or extent of taking specified in the incidental take statement is exceeded; (2) If new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion or written concurrence; or (4) If a new species is listed or critical habitat designated that may be affected by the identified action."

2.12. "Not Likely to Adversely Affect" Determinations

The action area is migration habitat for adult eulachon and eulachon larvae. The essential features of freshwater migration corridors are freshwater and estuarine migration corridors associated with spawning and incubation sites that are free of obstruction and with water flow, quality and temperature conditions supporting larval and adult mobility, and with abundant prey items supporting larval feeding after the yolk sac is depleted. Our analysis of the effects of the proposed action on eulachon critical habitat are summarized below.

Table 5. Effects of the proposed action on eulachon critical habitat

Action	Stressor	PBF	Exposure			Response	Consequences
			Frequency	Duration	Timing		
Clamshell dredging	Suspended sediment	Migration corridor	Clamshell dredging plumes may exist two times over the next ten years with the first in 2021 or 2022.	Each clamshell dredging event will take up to two weeks. Water quality is degraded while the dredge is operating and returns to normal when the dredge stops operation. Dredging has no permanent effects to water quality.	The two weeks may take place anytime between November 1 and December 31. In the Columbia River, eulachon spawning runs typically occur in January, February, and March (NMFS, 2017). Small pilot runs can occur as early as November or December (NMFS, 2017). Eulachon eggs and larvae are transported downstream in the spring and are not present in the action area during the work window (NMFS, 2017).	Clamshell dredge plumes will be less than 200-feet wide and less than 300-feet long throughout the water column. They partially obstruct 60,000 square feet of the action area migration corridor. The suspended sediment concentration in the plumes may range from 100s of milligrams per liter at the clamshell dredge source to 10s of milligrams per liter at the plume margins.	Clamshell dredging creates a temporary obstruction across a very small fraction of the Columbia River corridor during a work window that is very unlikely to overlap the presence of adult or larval eulachon in the action area. The effect is insignificant.
		Water quality	Water quality in the project area may be degraded by clamshell dredging suspended sediment plumes two times over the next ten years starting in 2021 or 2022.	Each clamshell dredging event will take up to two weeks. Water quality is degraded while the dredge is operating and returns to normal when the dredge stops operation. Dredging has no permanent effects to water quality.	The two weeks may take place anytime between November 1 and December 31 and overlap early adult eulachon migration but does not overlap larvae downstream migration in the spring.	As shown in the Effects to Salmon and Steelhead Critical Habitat section, the suspended sediment concentration in the plumes may range from 100s of milligrams per liter at the clamshell dredge source to 10s of milligrams per liter at the plume margins.	Clamshell dredging creates a temporary degradation of water quality in a small fraction of the Columbia River at a time that is very unlikely to overlaps the presence of adult or larval eulachon in the action area. The effect is insignificant.

Action	Stressor	PBF	Exposure			Response	Consequences
			Frequency	Duration	Timing		
	Dredge prism removal and new Z layer	Prey supporting larval feeding	Clamshell dredging will remove 86,000 square feet of benthic forage from the action area two times over the next 10 years.	Benthic forage may begin to return to the dredged area within one year but will likely take several years to return to its pre-dredge condition (ISAB, 2011; USACE, 1998).	The benthic forage in the project site is degraded throughout the time of year that eulachon larvae are migrating down the lower Columbia River to the estuary.	Benthic forage in a fraction of the dredge area will be completely missing during the spring following the dredging and will be progressively replaced during subsequent years until the dredge prism is re-dredged and this cycle repeats.	Clamshell dredging will create two deficits in action area prey consumed by eulachon larvae as they migrate through the action area. The area of benthic forage removed by dredging is a fraction of the total benthic forage in the action area and we have not yet determined whether food in the estuary is a limiting factor for eulachon larvae. Considering this, we do believe that dredging will have an insignificant effect on forage production.

The direct effect stressors of the proposed action to eulachon are suspended sediment, entrainment and reduced benthic forage. Our analysis of the direct effects of the proposed action on eulachon adults and larvae are summarized in Table 6 below.

Table 6. Effect of the proposed action on eulachon

Action	Stressor	Life stage	Exposure			Response	Consequences
			Frequency	Duration	Timing		
Dredging	Suspended sediment	Migrating adults	Clamshell dredging plumes may exist two times over the next ten years with the first in 2021 or 2022.	Each clamshell dredging event will take up to two weeks. Water quality is degraded while the dredge is operating and returns to normal when the dredge stops operation. Dredging has no permanent effects to water quality.	The two weeks may take place anytime between November 1 and December 31 and overlaps early adult eulachon migration.	Clamshell dredge plumes will be less than 200-feet wide and less than 300-feet long throughout the water column. They partially obstruct 60,000 square feet of the action area migration corridor. The suspended sediment concentration in the plumes may range from 100s of milligrams per liter at the clamshell dredge source to 10s of milligrams per liter at the plume margins. Adult eulachon that are exposed to 100s of milligrams per liter of suspended sediment for 8 hours are likely to experience behavioral effects and sublethal physical effects (Wilver and Clark, 2001).	Adult eulachon are unlikely to be present during the work window. If early adult eulachon are present, they are expected to migrate through the small area of suspended sediment rapidly. Considering the expected short exposure duration, the effect will be insignificant.
		Larvae	Clamshell dredging plumes may exist two times over the next ten years with the first in 2021 or 2022.	Each clamshell dredging event will take up to two weeks. Water quality is degraded while the dredge is operating and returns to normal when the dredge stops operation. Dredging has no permanent effects to water quality.	Suspended sediment from clamshell dredging does not overlap the presence of eulachon larvae in the action area.	Clamshell dredge plumes will be less than 200-feet wide and less than 300-feet long throughout the water column. They partially obstruct 60,000 square feet of the action area migration corridor. The suspended sediment concentration in the plumes may range from 100s of milligrams per liter at the clamshell dredge source to 10s of milligrams per liter at the plume margins. Eulachon larvae that are exposed to 10s to 100s of milligrams per liter of suspended sediment for 8 hours are likely to experience less than 25 percent mortality (Wilver and Clark, 2001).	Eulachon larvae will not be exposed to clamshell dredging suspended sediment because their downstream migration time does not overlap dredging activities. As such, the effect is discountable.

Action	Stressor	Life stage	Exposure			Response	Consequences
			Frequency	Duration	Timing		
	Entrainment	Migrating adults	Clamshell dredging will occur two times over the next ten years with the first in 2021 or 2022.	Each clamshell dredging event will take up to two weeks.	The November 1 to December 31 in water work window overlaps the start of adult eulachon migration in the action area.	If entrained in the clamshell, adult eulachon would very likely be crushed and killed by sediment when the bucket is emptied onto the barge.	The risk of adult eulachon entrainment in the clamshell dredge is insignificant. The bucket descends slowly through the water column in the open position so eulachon can escape through the top. The full bucket ascends slowly to minimize suspended sediment so eulachon swimming above the bucket have time to avoid entrainment.
		Larvae	Clamshell dredging will occur two times over the next ten years with the first in 2021 or 2022.	Each clamshell dredging event will take up to two weeks.	The November 1 to December 31 in-water work window does not overlap the downstream migration of eulachon larvae.	Eulachon larvae entrained by a clamshell dredge bucked would undoubtedly be crushed and killed when the sediment is dumped onto the barge.	Eulachon larvae will not be present during the work window, and will not be exposed to or entrained by clamshell dredging. The effect is discountable.
	Reduced benthic forage	Larvae	Clamshell dredging will remove 86,000 square feet of benthic forage from the action area two times over the next 10 years.	Benthic forage may begin to return to the dredged area within one year but will likely take several years to return to its pre-dredge condition (ISAB, 2011; USACE, 1998).	The benthic forage in the project site will be degraded throughout the time of year that eulachon larvae are migrating down the lower Columbia River to the estuary.	Dredging will slightly reduce the benthic forage produced in the action area. At the start of their downstream migration, eulachon larvae consume their yolk sac (NMFS, 2017) When the yolk sac is gone, they enter water column and consume zooplankton that originates in the benthic substrate.	We believe the reduced forage in the dredge site will very slightly reduce prey for eulachon larvae as they migrate downstream. However, this small reduction is not expected to result in reduced growth, fitness, or survival. As such, the effect will be insignificant.

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. The proposed action is in the Columbia River estuary which is a habitat of particular concern (HAPC) for Pacific salmon. 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 disturb benthic habitat and create turbidity. Benthic habitat produces forage for juvenile salmon but the area of disturbance is a small fraction of the estuary. Turbidity degrades water quality but the duration of this effect is two 10-15 day periods over ten years. . Overall, the area (forage) or time (turbidity) of disturbance is relatively small in relation to the Columbia River estuary and will not change the functional characteristics of the habitat.

3.3. Conservation Recommendations

NMFS determined that no conservation recommendations are necessary to avoid, mitigate, or offset the impact of the proposed action on EFH.

3.4. 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 is the USACE. Other interested users could include the RDM. Individual copies of this opinion were provided to the USACE. The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adhere to conventional standards for style.

4.2 Integrity

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

4.3 Objectivity

Information Product Category: Natural Resource Plan

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

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this opinion [*and EFH consultation, if applicable*] 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, if applicable*], and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

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