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-2023-00363

September 19, 2024

Constance Callahan
Chief, Environmental Management Branch
U.S. Coast Guard
1301 Clay Street, Suite 700N
Oakland, California 94612-5203

Re: Reinitiation of Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Maintenance Dredging Project USCG Station Cape Disappointment Baker Bay, Ilwaco, Washington (HUC 170800060500)

Dear Ms. Callahan:

Thank you for your letter of March 24, 2023, 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 USCG Station Cape Disappointment Baker Bay Maintenance Dredging Project at Ilwaco, Washington.

Thank you also for your request for essential fish habitat (EFH) consultation. NMFS reviewed the proposed action for potential effects on EFH pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), implementing regulations at 50 CFR 600.920, and agency guidance for use of the ESA consultation process to complete EFH consultation.

We have concluded that the action would adversely affect EFH designated under the Pacific Coast Salmon, Pacific Coast Groundfish and Coastal Pelagic Species Fishery Management Plans. We have provided one conservation recommendation.

In the biological opinion we concluded that the proposed action is not likely to jeopardize the survival or recovery of:

1. Lower Columbia River Chinook salmon
2. Upper Willamette River Chinook salmon
3. Upper Columbia River spring Chinook salmon
4. Snake River spring/summer Chinook salmon
5. Snake River fall Chinook salmon
6. Lower Columbia River coho salmon
7. Columbia River chum salmon
8. Snake River Sockeye salmon
9. Lower Columbia River steelhead
10. Middle Columbia River steelhead

11. Upper Columbia River steelhead
12. Upper Willamette River steelhead
13. Snake river Basin steelhead
14. Southern DPS eulachon

or result in the destruction or adverse modification of their designated critical habitats.

We also concluded that the proposed action is not likely to adversely affect North American green sturgeon.

Please contact Tom Hausmann, in Portland, Oregon, at 503-231-2315, or 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: Erin Hale, Environmental Protection Specialist, US Coast Guard
Brad Johnson, Regulatory Project Manager, US Army Corps of Engineers

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

Maintenance Dredging Project USCG Station Cape Disappointment
Baker Bay, Ilwaco, Washington

NMFS Consultation Number: WCRO-2023-00363

Action Agency: United States Coast Guard

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 Chinook Salmon (*Onchorhynchus tshawytscha*)	Threatened	Yes	No	Yes	No
Upper Willamette River Chinook	Threatened	Yes	No	Yes	No
Upper Columbia River Spring-run Chinook	Endangered	Yes	No	Yes	No
Snake River Spring-run Chinook	Threatened	Yes	No	Yes	No
Snake River Fall-run Chinook	Threatened	Yes	No	Yes	No
Columbia River Chum Salmon (*O. keta*)	Threatened	Yes	No	Yes	No
Lower Columbia River coho (*O. kisutch*)	Threatened	Yes	No	Yes	No
Snake River Sockeye (*O. nerka*)	Endangered	Yes	No	Yes	No
Lower Columbia River steelhead (*O. mykiss*)	Threatened	Yes	No	Yes	No
Upper Willamette River steelhead	Threatened	Yes	No	Yes	No
Middle Columbia River steelhead	Threatened	Yes	No	Yes	No
Upper Columbia River steelhead	Threatened	Yes	No	Yes	No
Snake River Basin steelhead	Threatened	Yes	No	Yes	No
Southern DPS eulachon (*Thaleichthys pacificus*)	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	Yes
Pacific Coast Groundfish	Yes	Yes
Coastal Pelagic Species	Yes	Yes

Consultation Conducted By: National Marine Fisheries Service
West Coast Region

Issued By:

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

Date: September 19, 2024

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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 at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. A complete record of this consultation is on file at Lacey, Washington.

1.2. Consultation History

In a May 27, 2021 letter (WCRO 2021-00010), NMFS concurred with the U.S. Coast Guard (USCG) determination that a 10-year dredge permit to maintain a 10-foot below mean lower low water (MLLW) depth at Station Cape Disappointment (Station) is not likely to adversely affect ESA-listed salmon and steelhead, eulachon or green sturgeon. In this consultation, the USCG initially proposed to dredge 3726 cubic yards of sediment within the 2021-2022 in-water work window and then dredge a similar volume of sediment every 2 to 5 years for 10 years such that the total volume of dredged sediment would not exceed 20,000 cubic yards.

Subsequent to 2021, sediment from a sand spit next to Jetty A (just downstream from the Station) filled in the Station basin such that they had to dredge 15,050 cubic yards of sediment from the basin in February 2023 alone. This volume caused the USCG to reach the permitted and planned 10-year 20,000 cubic yard dredge material volume limit in just two years. The USCG and the U.S. Corps of Engineers (USACE) determined that the sand spit adjacent to Jetty A was migrating towards the Station and erosion from this spit is filling the Station basin much more rapidly than in the past.

On March 24, 2023, the USCG requested we reinitiate our 2021 consultation on a new 10-year dredge permit consultation under Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act. The new permit is based on increased annual and cumulative dredge volumes and increased dredging frequency.

NMFS reinitiated formal consultation on Jan 9, 2024. We approved an extension of the 2021 permit dredge volume and in-water work window on Feb 28, 2024 so that the USCG could dredge the additional sediment influx.

In May 2024, the USCG dredged about 15,000 cubic yards of sediment out of the basin but noted that the basin was filling in with sediment as they dredged and they would need to dredge again during the November 1-Febrary 28, 2024 in-water work window. On August 6, the USCG changed the requested volume and frequency of their dredging request to 65,000 cubic yards per year during two in-water work windows for 5 years.

Updates to the regulations governing interagency consultation (50 CFR part 402) were effective on May 6, 2024 (89 Fed. Reg. 24268). We are applying the updated regulations to this consultation. The 2024 regulatory changes, like those from 2019, were intended to improve and clarify the consultation process, and, with one exception from 2024 (offsetting reasonable and prudent measures), were not intended to result in changes to the Services' existing practice in implementing section 7(a)(2) of the Act. 89 Fed. Reg. at 24268; 84 Fed. Reg. at 45015. We have considered the prior rules and affirm that the substantive analysis and conclusions articulated in this biological opinion and incidental take statement would not have been any different under the 2019 regulations or pre-2019 regulations.

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 USCG proposes to hire a contractor to dredge up to 65,000 cubic yards of sediment from the Station basin each year for 5 years such that the 5-year cumulative volume of dredge sediment does not exceed 325,000 cubic yards. Each year, the USCG proposes to dredge up to 32,500 cubic yards during the November 1 to February 28 in water work window (IWWW) and then dredge up to 32,500 cubic yards in the summer, during the USACE Federal Navigation Channel (FNC) dredging work window (June 1 to December 15). The USCG proposes to use clamshell or hydraulic dredge equipment and if the dredge sediment is suitable for in-water placement, transport it upstream to a flow lane disposal site between river mile 3 and river mile 105.5, or place it in an unconfined placement site at river mile 3 or at river mile 7. If the sediment is not suitable for in-water placement it will be transported to and placed in an upland site.

All BMPs from the 2021 proposed action will be used in this consultation and are listed here:

- A pre-dredging eelgrass (*Zostera marina* and *Zostera pacifica*) survey will be conducted.
- Vessel operators will follow designated speed zones to and from the project area.
- The potential for grounding will be limited by controlling contractor vessel draft and movements.
- The work area will be surrounded by a full-depth turbidity curtain to reduce effects of suspended sediments.
- During transport and handling of sediment, containment measures will be used to minimize spillage.

- The USCG will require the contractor to conduct a surface debris survey prior to dredging.
- The contractor will use a GPS unit to ensure that material is removed from the correct locations.
- The contractor will not be allowed to excavate beyond the maximum depth.
- No bottom stockpiling or multiple bites of the clamshell bucket will be allowed.
- Over-dredging at the base of a slope will not occur.
- The dredge bucket will not be overfilled.
- To protect sensitive fish species, a barge operations plan will be applied. The barge operations plan must comply with local, state, and federal regulations and will address the following:
    - Bottom scour from propeller wash;
    - Loss of submerged or emergent vegetation from propeller wash and/or excessive wake;
    - Accidental material spillage;
    - Sediment and benthic community disturbance from accidental or intentional barge grounding or deployment of barge spuds or anchors; and
    - Hazardous material spills.
- Dredging will be completed to a stable slope in the boat haul-out area to maintain the integrity of the riprap-armored banks.
- If dewatering is needed, containment measures such as hay bales or silt fencing will be used to avoid stormwater runoff.

We considered, under the ESA, whether or not the proposed action would cause any other activities and determined that it would not.

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

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

The USCG determined the proposed action is not likely to adversely affect green sturgeon or its critical habitat. Our concurrence is documented in the "Not Likely to Adversely Affect" Determinations section (Section 2.11).

2.1. Analytical Approach

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

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

The designation(s) of critical habitat for ESA listed salmon, steelhead and eulachon 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 designated critical habitat, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated critical habitat, and discusses the function of the PBFs that are essential for the species' conservation.

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. Major ecological realignments are already occurring in response to climate change IPCC Working Group II (2022). Long-term trends in warming have continued at global, national and regional scales. Global surface temperatures in the last decade (2010s) were estimated to be 1.09 °C higher than the 1850-1900 baseline period, with larger increases over land ~1.6 °C compared to oceans ~0.88 (IPCC Working Group I, 2021). The vast majority of this warming has been attributed to anthropogenic releases of greenhouse gases (IPCC Working Group I, 2021). Globally, 2014-2018 were the 5 warmest years on record both on land and in the ocean (2018 was the 4th warmest) (NOAA NCEI, 2022). Events such as the 2013-2016 marine heatwave (Jacox et al., 2018) have been attributed directly to anthropogenic warming in the annual special issue of Bulletin of the American Meteorological Society on extreme events (Herring et al., 2018). Global warming and anthropogenic loss of biodiversity represent profound threats to ecosystem functionality (IPCC Working Group II, 2022). These two factors are often examined in isolation, but likely have interacting effects on ecosystem function.

Updated projections of climate change are similar to or greater than previous projections (IPCC Working Group I, 2021). NMFS is increasingly confident in our projections of changes to freshwater and marine systems because every year brings stronger validation of previous predictions in both physical and biological realms. Retaining and restoring habitat complexity, access to climate refuges (both flow and temperature) and improving growth opportunity in both freshwater and marine environments are strongly advocated in the recent literature (Siegel and Crozier, 2020). Climate change is systemic, influencing freshwater, estuarine, and marine conditions. Other systems are also being influenced by changing climatic conditions. Literature reviews on the impacts of climate change on Pacific salmon (Crozier, 2015; Crozier, 2016; Crozier, 2017; Crozier et al., 2019; Crozier and Siegel, 2018; Crozier et al., 2020) have collected hundreds of papers documenting the major themes relevant for salmon. Here we describe habitat changes relevant to Pacific salmon and steelhead, prior to describing how these changes result in the varied specific mechanisms impacting these species in subsequent sections.

Forests

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

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

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

Freshwater Environments

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

Cooper et al. (2018) examined whether the magnitude of low river flows in the western U.S., which generally occur in September or October, are driven more by summer conditions or the prior winter’s precipitation. They found that while low flows were more sensitive to summer evaporative demand than to winter precipitation, interannual variability in winter precipitation was greater. Malek et al. (2018), predicted that summer evapotranspiration is likely to increase in conjunction with declines in snowpack and increased variability in winter precipitation. Their results suggest that low summer flows are likely to become lower, more variable, and less predictable.

The effect of climate change on ground water availability is likely to be uneven. Sridhar et al. (2018) coupled a surface-flow model with a ground-flow model to improve predictions of surface water availability with climate change in the Snake River Basin. Projections using RCP

4.5 and 8.5 emission scenarios suggested an increase in water table heights in downstream areas of the basin and a decrease in upstream areas.

As cited in Siegel and Crozier (2019), Isaak et al. (2018), examined recent trends in stream temperature across the Western U.S. using a large regional dataset. Stream warming trends paralleled changes in air temperature and were pervasive during the low-water warm seasons of 1996-2015 (0.18-0.35°C/decade) and 1976-2015 (0.14-0.27°C/decade). Their results show how continued warming will likely affect the cumulative temperature exposure of migrating sockeye salmon *O. nerka* and the availability of suitable habitat for brown trout *Salmo trutta* and rainbow trout *O. mykiss*. Isaak et al. (2018) concluded that most stream habitats will likely remain suitable for salmonids in the near future, with some becoming too warm. However, in cases where habitat access is currently restricted by dams and other barriers salmon and steelhead will be confined to downstream reaches typically most at risk of rising temperatures unless passage is restored (FitzGerald et al., 2021; Myers et al., 2018).

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

Marine and Estuarine Environments

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

Rising ocean temperatures, stratification, ocean acidity, hypoxia, algal toxins, and other oceanographic processes will alter the composition and abundance of a vast array of oceanic species. In particular, there will be dramatic changes in both predators and prey of Pacific salmon, salmon life history traits and relative abundance. Siegel and Crozier (2019) observe that changes in marine temperature are likely to have a number of physiological consequences on fishes themselves. For example, in a study of small planktivorous fish, Gliwicz et al. (2018) found that higher ambient temperatures increased the distance at which fish reacted to prey.

Numerous fish species (including many tuna and sharks) demonstrate regional endothermy, which in many cases augments eyesight by warming the retinas. However, Gliwicz et al. (2018) suggest that ambient temperatures can have a similar effect on fish that do not demonstrate this trait. Climate change is likely to reduce the availability of biologically essential omega-3 fatty acids produced by phytoplankton in marine ecosystems. Loss of these lipids may induce cascading trophic effects, with distinct impacts on different species depending on compensatory mechanisms (Gourtay et al., 2018). Reproduction rates of many marine fish species are also likely to be altered with temperature (Veilleux et al., 2018). The ecological consequences of these effects and their interactions add complexity to predictions of climate change impacts in marine ecosystems.

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

Climate change effects on salmon and steelhead

In freshwater, year-round increases in stream temperature and changes in flow will affect physiological, behavioral, and demographic processes in salmon, and change the species with which they interact. For example, as stream temperatures increase, many native salmonids face increased competition with more warm-water tolerant invasive species. Changing freshwater temperatures are likely to affect incubation and emergence timing for eggs, and in locations where the greatest warming occurs may affect egg survival, although several factors impact intergravel temperature and oxygen (e.g., groundwater influence) as well as sensitivity of eggs to thermal stress (Crozier et al., 2020). Changes in temperature and flow regimes may alter the amount of habitat and food available for juvenile rearing, and this in turn could lead to a restriction in the distribution of juveniles, further decreasing productivity through density dependence. For migrating adults, predicted changes in freshwater flows and temperatures will likely increase exposure to stressful temperatures for many salmon and steelhead populations, and alter migration travel times and increase thermal stress accumulation for ESUs or DPSs with early-returning (i.e. spring- and summer-run) phenotypes associated with longer freshwater holding times (Crozier et al., 2020; FitzGerald et al., 2021). Rising river temperatures increase the energetic cost of migration and the risk of en route or pre-spawning mortality of adults with long freshwater migrations, although populations of some ESA-listed salmon and steelhead may be able to make use of cool-water refuges and run-timing plasticity to reduce thermal exposure (Barnett et al., 2020; Keefer et al., 2018).

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

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

At the individual scale, climate impacts on salmon in one life stage generally affect body size or timing in the next life stage and negative impacts can accumulate across multiple life stages (Gosselin et al., 2021; Healey, 2011; Wainwright and Weitkamp, 2013). Changes in winter precipitation will likely affect incubation and/or rearing stages of most populations. Changes in the intensity of cool season precipitation, snow accumulation, and runoff could influence migration cues for fall, winter and spring adult migrants, such as coho and steelhead. Egg survival rates may suffer from more intense flooding that scours or buries redds. Changes in hydrological regime, such as a shift from mostly snow to more rain, could drive changes in life history, potentially threatening diversity within an ESU (Beechie et al., 2006). Changes in summer temperature and flow will affect both juvenile and adult stages in some populations, especially those with yearling life histories and summer migration patterns (Crozier and Zabel, 2006; Crozier et al., 2019; Crozier et al., 2010). At the population level, the ability of organisms to genetically adapt to climate change depends on how much genetic variation currently exists within salmon populations, as well as how selection on multiple traits interact, and whether those traits are linked genetically. While genetic diversity may help populations respond to climate change, the remaining genetic diversity of many populations is highly reduced compared to historic levels. For example, Johnson et al. (2018), compared genetic variation in Chinook salmon from the Columbia River Basin between contemporary and ancient samples. A total of 84 samples determined to be Chinook salmon were collected from vertebrae found in ancient middens and compared to 379 contemporary samples. Results suggest a decline in genetic diversity, as demonstrated by a loss of mitochondrial haplotypes as well as reductions in haplotype and nucleotide diversity. Genetic losses in this comparison appeared larger for Chinook from the mid-Columbia than those from the Snake River Basin. In addition to other stressors, modified habitats and flow regimes may create unnatural selection pressures that reduce the diversity of functional behaviors (Sturrock et al., 2020). Managing to conserve and augment existing genetic diversity may be increasingly important with more extreme environmental change (Anderson et al., 2015), though the low levels of remaining diversity present challenges to this effort (Freshwater et al., 2019). Salmon historically maintained relatively consistent returns across variation in annual weather through the portfolio effect (Schindler et al., 2015), in which different populations are sensitive to different climate drivers. Applying this concept to climate change, Anderson et al. (2015) emphasized the additional need for populations with different physiological tolerances. Loss of the portfolio increases volatility in fisheries, as well as ecological systems, as demonstrated for Fraser River and Sacramento River stock complexes (Freshwater et al., 2019; Munsch et al., 2022).

2.2.1 Status of the Species

Table 1 below provides a summary of listing and recovery plan information, status summaries and limiting factors for the species addressed in this opinion. More information can be found in recovery plans and status reviews for these species. Acronyms appearing in the table include DPS (Distinct Population Segment), ESU (Evolutionarily Significant Unit), ICTRT (Interior Columbia Technical Recovery Team), MPG (Multiple Population Grouping), NWFSC (Northwest Fisheries Science Center), TRT (Technical Recovery Team), and VSP (Viable Salmonid Population).

Table 1. Listing classification and date, recovery plan reference, most recent status review, status summary, and limiting factors for each species considered in this opinion.

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Lower Columbia River Chinook salmon	Threatened 6/28/05	NMFS 2013	NMFS 2022a; Ford 2022	This ESU comprises 32 independent populations. Relative to baseline VSP levels identified in the recovery plan (Dornbusch 2013), there has been an overall improvement in the status of a number of fall-run populations although most are still far from the recovery plan goals; Spring-run Chinook salmon populations in this ESU are generally unchanged; most of the populations are at a "high" or "very high" risk due to low abundances and the high proportion of hatchery-origin fish spawning naturally. Many of the populations in this ESU remain at "high risk," with low natural-origin abundance levels. Overall, we conclude that the viability of the Lower Columbia River Chinook salmon ESU has increased somewhat since 2016, although the ESU remains at "moderate" risk of extinction	• Reduced access to spawning and rearing habitat • Hatchery-related effects • Harvest-related effects on fall Chinook salmon • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Contaminant
Upper Columbia River spring-run Chinook salmon	Endangered 6/28/05	Upper Columbia Salmon Recovery Board 2007	NMFS 2022b; Ford 2022	This ESU comprises four independent populations. Current estimates of natural-origin spawner abundance decreased substantially relative to the levels observed in the prior review for all three extant populations. Productivities also continued to be very low, and both abundance and productivity remained well below the viable thresholds called for in the Upper Columbia Salmon Recovery Plan for all three populations. Based on the information available for this review, the Upper Columbia River spring-run Chinook salmon ESU remains at high risk, with viability largely unchanged since 2016.	• 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	NMFS 2022c; Ford 2022	This ESU comprises 28 extant and four extirpated populations. There have been improvements in abundance/productivity in several populations relative to the time of listing, but the majority of populations experienced sharp declines in abundance in the recent five-year period Overall, at this time we conclude that the Snake River spring/ summer-run Chinook salmon ESU continues to be at moderate-to-high risk.	• Degraded freshwater habitat • Effects related to the hydropower system in the mainstem Columbia River, • Altered flows and degraded water quality • Harvest-related effects • Predation
Upper Willamette River Chinook salmon	Threatened 6/28/05	NMFS 2011	NMFS 2016; Ford 2022	This ESU comprises seven populations. Abundance levels for all but Clackamas River DIP remain well below their recovery goals. Overall, there has likely been a declining trend in the viability of the Upper Willamette River Chinook salmon ESU since the last review. The magnitude of this change is not sufficient to suggest a change in risk category, however, so the Upper Willamette River Chinook salmon ESU remains at "moderate" risk of extinction.	• Degraded freshwater habitat • Degraded water quality • Increased disease incidence • Altered stream flows • Reduced access to spawning and rearing habitats • Altered food web due to reduced inputs of microdetritus • Predation by native and non-native species, including hatchery fish • Competition related to introduced salmon and steelhead • Altered population traits due to fisheries and bycatch
Snake River fall-run Chinook salmon	Threatened 6/28/05	NMFS 2017b	NMFS 2022d; Ford 2022	This ESU has one extant population The single extant population in the ESU is currently meeting the criteria for a rating of "viable" developed by the ICTRT, but the ESU as a whole is not meeting the recovery goals described in the recovery plan for the species, which require the single population to be "highly viable with high certainty" and/or will require reintroduction of a viable population above the Hells Canyon Complex (NMFS 2017b). The Snake River fall-run Chinook salmon ESU therefore is considered to be at a moderate-to-low risk of extinction.	• 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	NMFS 2022a; Ford 2022	This species has 17 populations divided into 3 MPGs. 3 populations exceed the recovery goals established in the recovery plan (Dornbusch 2013). The remaining populations have unknown abundances. Abundances for these populations are assumed to be at or near zero. The viability of this ESU is relatively unchanged since the last review (moderate to high risk), and the improvements in some populations do not warrant a change in risk category, especially given the uncertainty regarding climatic effects in the near future.	• 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	NMFS 2022a; Ford 2022	Of the 24 populations that make up this ESUOnly six of the 23 populations for which we have data appear to be above their recovery goals. Overall abundance trends for the Lower Columbia River coho salmon ESU are generally negative. Natural spawner and total abundances have decreased in almost all DIPs, and Coastal and Gorge MPG populations are all at low levels, with significant numbers of hatchery-origin coho salmon on the spawning grounds. Improvements in spatial structure and diversity have been slight, and overshadowed by declines in abundance and productivity. For individual populations, the risk of extinction spans the full range, from "low" to "very high." Overall, the Lower Columbia River coho salmon ESU remains at "moderate" risk, and viability is largely unchanged since 2016.	• Degraded estuarine and near-shore marine habitat • Fish passage barriers • Degraded freshwater habitat: Hatchery-related effects • Harvest-related effects • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat in the lower Columbia River • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Juvenile fish wake strandings • Contaminants

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Snake River sockeye salmon	Endangered 6/28/05	NMFS 2015	NMFS 2022f; Ford 2022	This single population ESU is at remains at “extremely high risk,” although there has been substantial progress on the first phase of the proposed recovery approach—developing a hatchery-based program to amplify and conserve the stock to facilitate reintroductions. Current climate change modeling supports the “extremely high risk” rating with the potential for extirpation in the near future (Crozier et al. 2020). The viability of the Snake River sockeye salmon ESU therefore has likely declined since the time of the prior review, and the extinction risk category remains “high.”	• Effects related to the hydropower system in the mainstem Columbia River • Reduced water quality and elevated temperatures in the Salmon River • Water quantity • Predation
Upper Columbia River steelhead	Threatened 1/5/06	Upper Columbia Salmon Recovery Board 2007	NMFS 2022b; Ford 2022	This DPS comprises four independent populations. The most recent estimates (five-year geometric mean) of total and natural-origin spawner abundance have declined since the last report, largely erasing gains observed over the past two decades for all four populations (Figure 12, Table 6). Recent declines are persistent and large enough to result in small, but negative 15-year trends in abundance for all four populations. The overall Upper Columbia River steelhead DPS viability remains largely unchanged from the prior review, and the DPS is at high risk driven by low abundance and productivity relative to viability objectives and diversity concerns.	• Adverse effects related to the mainstem Columbia River hydropower system • Impaired tributary fish passage • Degraded floodplain connectivity and function, channel structure and complexity, riparian areas, large woody debris recruitment, stream flow, and water quality • Hatchery-related effects • Predation and competition • Harvest-related effects

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Lower Columbia River steelhead	Threatened 1/5/06	NMFS 2013	NMFS 2022a; Ford 2022	This DPS comprises 23 historical populations, 17 winter-run populations and 6 summer-run populations. 10 are nominally at or above the goals set in the recovery plan (Dornbusch 2013); however, it should be noted that many of these abundance estimates do not distinguish between natural- and hatchery- origin spawners. The majority of winter-run steelhead DIPs in this DPS continue to persist at low abundance levels (hundreds of fish), with the exception of the Clackamas and Sandy River DIPs, which have abundances in the low 1,000s. Although the five-year geometric abundance means are near recovery plan goals for many populations, the recent trends are negative. Overall, the Lower Columbia River steelhead DPS is therefore considered to be at "moderate" risk.	• 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
Upper Willamette River steelhead	Threatened 1/5/06	NMFS 2011	NMFS 2016; Ford 2022	This DPS has four demographically independent populations. Populations in this DPS have experienced long-term declines in spawner abundance. Although the recent magnitude of these declines is relatively moderate, continued declines would be a cause for concern. In the absence of substantial changes in accessibility to high-quality habitat, the DPS will remain at "moderate-to-high" risk. Overall, the Upper Willamette River steelhead DPS is therefore at "moderate-to-high" risk, with a declining viability trend.	• Degraded freshwater habitat • Degraded water quality • Increased disease incidence • Altered stream flows • Reduced access to spawning and rearing habitats due to impaired passage at dams • Altered food web due to changes in inputs of microdetritus • Predation by native and non-native species, including hatchery fish and pinnipeds • Competition related to introduced salmon and steelhead • Altered population traits due to interbreeding with hatchery origin fish

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Middle Columbia River steelhead	Threatened 1/5/06	NMFS 2009b	NMFS 2022h; Ford 2022	This DPS comprises 17 extant populations. Recent (five-year) returns are declining across all populations, the declines are from relatively high returns in the previous five-to-ten-year interval, so the longer-term risk metrics that are meant to buffer against short-period changes in abundance and productivity remain unchanged. The Middle Columbia River steelhead DPS does not currently meet the viability criteria described in the Middle Columbia River steelhead recovery plan.	• 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
Snake River basin steelhead	Threatened 1/5/06	NMFS 2017a	NMFS 2022i; Ford 2022	This DPS comprises 24 populations. Based on the updated viability information available for this review, all five MPGs are not meeting the specific objectives in the draft recovery plan, and the viability of many individual populations remains uncertain. Of particular note, the updated, population-level abundance estimates have made very clear the recent (last five years) sharp declines that are extremely worrisome, were they to continue.	• Adverse effects related to the mainstem Columbia River hydropower system • Impaired tributary fish passage • Degraded freshwater habitat • Increased water temperature • Harvest-related effects, particularly for B-run steelhead • Predation • Genetic diversity effects from out-of-population hatchery releases
Southern DPS of green sturgeon	Threatened 4/7/06	NMFS 2018	NMFS 2021	The Sacramento River contains the only known green sturgeon spawning population in this DPS. The current estimate of spawning adult abundance is between 824-1,872 individuals. Telemetry data and genetic analyses suggest that Southern DPS green sturgeon generally occur from Graves Harbor, Alaska to Monterey Bay, California and, within this range, most frequently occur in coastal waters of Washington, Oregon, and Vancouver Island and near San Francisco and Monterey bays. Within the nearshore marine environment, tagging and fisheries data indicate that Northern and Southern DPS green sturgeon prefer marine waters of less than a depth of 110 meters.	• Reduction of its spawning area to a single known population • Lack of water quantity • Poor water quality • Poaching

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Southern DPS of eulachon	Threatened 3/18/10	NMFS 2017c	NMFS 2022j	The Southern DPS of eulachon includes all naturally-spawned populations that occur in rivers south of the Nass River in British Columbia to the Mad River in California. Sub populations for this species include the Fraser River, Columbia River, British Columbia and the Klamath River. In the early 1990s, there was an abrupt decline in the abundance of eulachon returning to the Columbia River. Despite a brief period of improved returns in 2001-2003, the returns and associated commercial landings eventually declined to the low levels observed in the mid-1990s. Although eulachon abundance in monitored rivers has generally improved, especially in the 2013-2015 return years, recent poor ocean conditions and the likelihood that these conditions will persist into the near future suggest that population declines may be widespread in the upcoming return years	• Changes in ocean conditions due to climate change, particularly in the southern portion of the species' range where ocean warming trends may be the most pronounced and may alter prey, spawning, and rearing success. • Climate-induced change to freshwater habitats • Bycatch of eulachon in commercial fisheries • Adverse effects related to dams and water diversions • Water quality, • Shoreline construction • Over harvest • Predation

2.2.2 Status of the Critical Habitat

This section examines the status of designated critical habitat affected by the proposed action by examining the condition and trends of the essential physical and biological features of that habitat throughout the designated areas. These features are essential to the conservation of the ESA-listed species because they support one or more of the species' life stages (e.g., sites with conditions that support spawning, rearing, migration and foraging).

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 to the species of the population occupying that area. Even if a location had poor habitat quality, it could be ranked with a high conservation value if it were essential due to factors such as limited availability, a unique contribution of the population it served, or is serving another important role.

For southern DPS green sturgeon, a team similar to the CHARTs — a critical habitat review team (CHRT) — identified and analyzed the conservation value of particular areas occupied by southern green sturgeon, and unoccupied areas necessary to ensure the conservation of the species (USDC, 2010). The CHRT did not identify those particular areas using HUC nomenclature, but did provide geographic place names for those areas, including the names of freshwater rivers, the bypasses, the Sacramento-San Joaquin Delta, coastal bays and estuaries, and coastal marine areas (within 110 m depth) extending from the California/Mexico border north to Monterey Bay, California, and from the Alaska/Canada border northwest to the Bering Strait; and certain coastal bays and estuaries in California, Oregon, and Washington.

For southern DPS eulachon, critical habitat includes portions of 16 rivers and streams in California, Oregon, and Washington (75 FR 13012). We designated all of these areas as migration and spawning habitat for this species.

A summary of the status of critical habitats, considered in this opinion, is provided in Table 2, below.

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

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

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 PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 16 watersheds, and medium for three watersheds.
Lower Columbia River coho salmon	2/24/16 81 FR 9252	Critical habitat encompasses 10 subbasins in Oregon and Washington containing 55 occupied watersheds, as well as the lower Columbia River and estuary rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 34 watersheds, medium for 18 watersheds, and low for three watersheds.
Snake River sockeye salmon	10/25/99 64 FR 57399	Critical habitat consists of river reaches of the Columbia, Snake, and Salmon rivers; Alturas Lake Creek; Valley Creek; and Stanley, Redfish, Yellow Belly, Pettit and Alturas lakes (including their inlet and outlet creeks). Water quality in all five lakes generally is adequate for juvenile sockeye salmon, although zooplankton numbers vary considerably. Some reaches of the Salmon River and tributaries exhibit temporary elevated water temperatures and sediment loads that could restrict sockeye salmon production and survival (NMFS 2015b). Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.
Upper Columbia River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses 10 subbasins in Washington containing 31 occupied watersheds, as well as the Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 20 watersheds, medium for eight watersheds, and low for three watersheds.
Lower Columbia River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses nine subbasins in Oregon and Washington containing 41 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 28 watersheds, medium for 11 watersheds, and low for two watersheds.
Upper Willamette River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses seven subbasins in Oregon containing 34 occupied watersheds, as well as the lower Willamette/Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. Watersheds are in good to excellent condition with no potential for improvement only in the upper McKenzie River and its tributaries (NMFS 2005). We rated conservation value of HUC5 watersheds as high for 25 watersheds, medium for 6 watersheds, and low for 3 watersheds.

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Middle Columbia River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses 15 subbasins in Oregon and Washington containing 111 occupied watersheds, as well as the Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of occupied HUC5 watersheds as high for 80 watersheds, medium for 24 watersheds, and low for 9 watersheds.
Snake River basin steelhead	9/02/05 70 FR 52630	Critical habitat encompasses 25 subbasins in Oregon, Washington, and Idaho. Habitat quality in tributary streams varies from excellent in wilderness and roadless areas, to poor in areas subject to heavy agricultural and urban development (Wissmar et al. 1994). Reduced summer stream flows, impaired water quality, and reduced habitat complexity are common problems. Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.
Southern DPS of green sturgeon	10/09/09 74 FR 52300	Critical habitat has been designated in coastal U.S. marine waters within 60 fathoms depth from Monterey Bay, California (including Monterey Bay), north to Cape Flattery, Washington, including the Strait of Juan de Fuca, Washington, to its United States boundary; the Sacramento River, lower Feather River, and lower Yuba River in California; the Sacramento-San Joaquin Delta and Suisun, San Pablo, and San Francisco bays in California; tidally influenced areas of the Columbia River estuary from the mouth upstream to river mile 46; and certain coastal bays and estuaries in California (Humboldt Bay), Oregon (Coos Bay, Winchester Bay, Yaquina Bay, and Nehalem Bay), and Washington (Willapa Bay and Grays Harbor), including, but not limited to, areas upstream to the head of tide in various streams that drain into the bays. Several activities threaten the PBFs in coastal bays and estuaries and need special management considerations or protection. The application of pesticides, activities that disturb bottom substrates/ adversely affect prey resources/ degrade water quality through re-suspension of contaminated sediments, commercial shipping and activities that discharge contaminants and result in bioaccumulation of contaminants in green sturgeon; disposal of dredged materials that bury prey resources; and bottom trawl fisheries that disturb the bottom/prey resources for green sturgeon.

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Southern DPS of eulachon	10/20/11 76 FR 65324	Critical habitat for eulachon includes portions of 16 rivers and streams in California, Oregon, and Washington. All of these areas are designated as migration and spawning habitat for this species. In Oregon, we designated 24.2 miles of the lower Umpqua River, 12.4 miles of the lower Sandy River, and 0.2 miles of Tenmile Creek. We also designated the mainstem Columbia River from the mouth to the base of Bonneville Dam, a distance of 143.2 miles. Dams and water diversions are moderate threats to eulachon in the Columbia and Klamath rivers where hydropower generation and flood control are major activities. Degraded water quality is common in some areas occupied by southern DPS eulachon. In the Columbia and Klamath river basins, large-scale impoundment of water has increased winter water temperatures, potentially altering the water temperature during eulachon spawning periods. Numerous chemical contaminants are also present in spawning rivers, but the exact effect these compounds have on spawning and egg development is unknown. Dredging is a low to moderate threat to eulachon in the Columbia River. Dredging during eulachon spawning would be particularly detrimental.

2.3. 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 includes the dredge area, the perimeter around the dredge area where noise and turbidity return to background and any flow lane dredge material disposal sites between river mile 3 and river mile 105.5. Figure 1 shows the dredge area and the perimeter around the dredge area. Flow lane disposal sites are unspecified action areas in the channel where the depth is greater than 20 feet and where deposited dredge material will be transported back downstream, but not into the FNC, by high river flows.

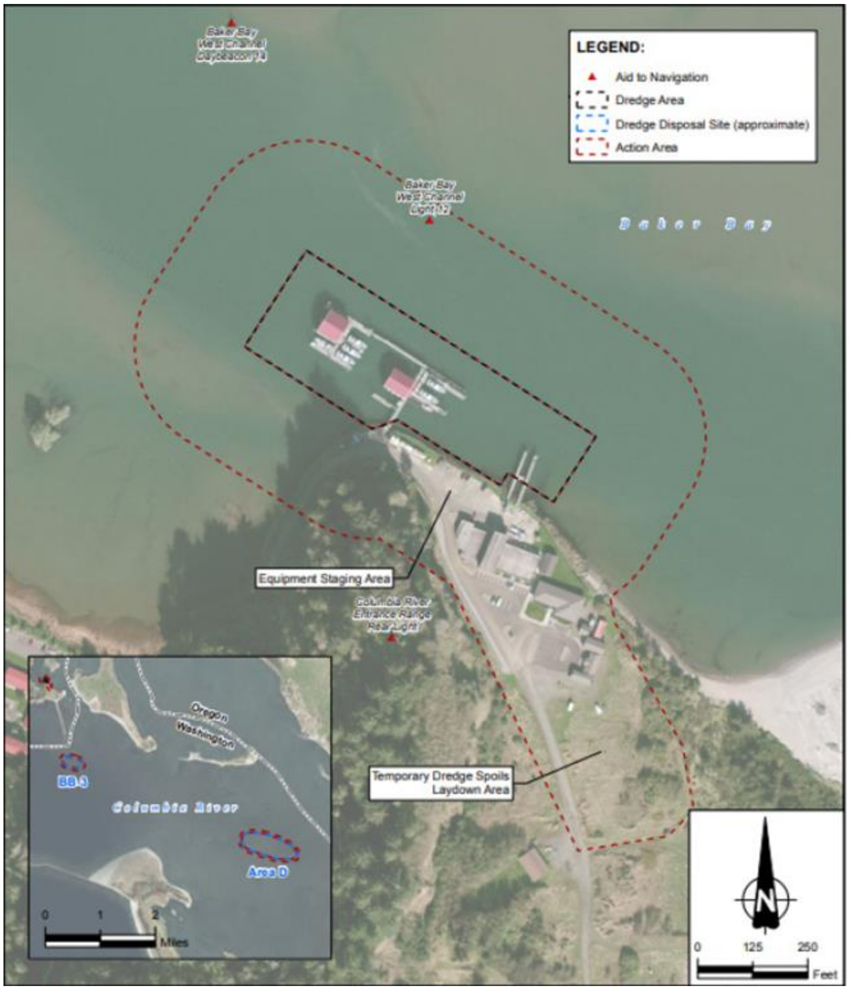

Figure 1. Overhead view of the Station with the dredge area and noise area shown as black and red dotted lines respectively.

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 impacts to listed species or designated critical habitat from federal agency activities or existing federal agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402.02).

Virtually the entire LCR channel and riparian zone has been degraded by the effects of forest management, agriculture, mining, transportation, and urbanization, as well as the use of LCR water for hydropower, consumption, irrigation, heat transfer, transportation and recreation. These economic activities contribute to; degraded water quality, changes in channel morphology, reduced instream roughness and cover, degraded riparian functions, and lost estuarine rearing habitats such as wetlands, and floodplains. Climate change is likely to play an increasingly important role in determining the fate of ESA-listed species and the conservation value of their designated critical habitats in the LCR as described in Section 2.2.

Dams, reservoirs, and levees greatly alter LCR habitat complexity, water quality and water quantity. Dams and levees have disconnected floodplains and off-channel habitat features from the main channel. Dams and reservoirs reduce the supply of large woody debris in the LCR, reduce spring turbidity levels, reduce flow volumes and rates, increase water temperature, and alter food webs (Ferguson et al., 2005; Williams et al., 2005). Dams without adequate fish passage systems extirpated some anadromous fish populations. Today fish passage to habitat above dams is being restored through improvements to fish passage facilities or dam removal such as Marmot Dam on the Sandy River and Powerdale Dam on the Hood River.

Birds, other fish, and marine mammals prey on juvenile or adult salmon in the Columbia River. Caspian terns, double-crested cormorants, glaucous-winged/western gull hybrids, California gulls, and ring-billed gulls are the main avian predators. Avian predators congregate near hydroelectric dams and nest in the LCR on islands made from dredged sediment and other man-made structures. They benefit from dams and reservoirs because low flow velocity increases smolt migration time and suspended sediment deposition in reservoirs reduces turbidity below the dam. Smolt bypass systems in dams concentrate fish at the bypass entry points making them easier for avian predators to catch. The Columbia River Basin also has native and introduced fish species that prey on salmon and steelhead. The primary resident fish predators of salmonids are northern pikeminnow (native), smallmouth bass (introduced), and walleye (introduced). Other predatory resident fish are channel catfish (introduced), Pacific lamprey (native), yellow perch (introduced), largemouth bass (introduced), and bull trout (native). Seals and sea lions have learned to hunt returning adult salmon and steelhead in the LCR and take advantage of the constricted passages past Bonneville Dam and Willamette Falls.

Over the past 120 years the LCR channel has been narrowed, deepened and smoothed. Floodplains have been converted to farmland behind revetments and tide gates. Pile dikes and three jetties at the mouth reduce the physical channel width while upriver dam reservoir management reduces the wetted channel width. Dredging has approximately doubled the controlling depth at the mouth of the Columbia River. Increased depth reduces average friction and decreases the backwater surface slope. Elimination of roughness elements such as floodplain vegetation and large woody debris reduce frictional drag. For discharges below 300,000 cubic feet per second, friction drag from bedload transport is quite low as sand waves typically move only a few feet per day. Helaire, Talke et al. (2019) estimated that today Chezy roughness coefficients range from 55-96 m^2/s compared to 25-50 m^2/s in the late 1800's. So even though estuary discharges are regulated and generally reduced, discharge velocity and bed stress have increased while water levels have decreased.

The environmental baseline includes the anticipated impacts of all Federal actions in the action area that have already undergone formal consultation. The USACE, Bonneville Power Administration (BPA), and Bureau of Reclamation have consulted on large water management actions, such as operation of the Federal Columbia River Power System, the Umatilla Basin Project, and the Deschutes Project. The U.S. Bureau of Indian Affairs (BIA), U.S. Bureau of Land Management, and the U.S. Forest Service (USFS) have consulted on Federal land management throughout Oregon and Washington, including restoration actions, forest management, livestock grazing, and special use permits. The BPA, NOAA Restoration Center, and USFWS have also consulted on large restoration programs that consist of actions designed to address species limiting factors or make contributions that would aid in species recovery.

The action area is adjacent to the Baker Bay West Federal Navigation Channel (BBWFNC) Historically, annual dredging volumes in the BBWFNC averaged 55,000 cubic yards (CY) per year (1985 - 2005). However, since 2005, as the BBW pile dikes have deteriorated, annual dredging volumes have increased to 76,000 CY/year and shoals in the FNC have become more unpredictable requiring emergency dredging. The BBWFNC now must be dredged annually during the August 1 to December 15 work window taking an average of 15 to 45 days. The velocity of the fraction of the discharge that enters the channel between West Sand Island and the Washington shoreline is a function of the tidal cycle. At a discharge of 343,000 cfs and slack tide, the velocity entering the WSI channel is around 3 ft/s. Without the pile dike, the West Sand Island channel expands, which decreases velocity to around 1.3 ft/s. With the pile dike, the mean velocity is 2.4 ft/s. The altered bathymetry, reduced channel friction and reduced sand supply also increases the inundation of tide waves. Tides in the project area are mixed semi-diurnal, with two high tides and two low tides each day. Between the mean higher high water (MHHW) and MLLW, the water surface elevation ranges a total of 7.8 feet. Tides are the primary driver of water velocities in Baker Bay. Tidal currents may exceed 3.3 ft/s during peak ebb or flood. Between the pile dikes and the West Sand Island shoreline, depth-averaged velocities reached 4 ft/s during spring tides. The critical velocity for sediment movement in this area is on the order of 1 ft/s, indicating ample capacity for erosion and sediment transport in the action area.

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 but that are not part of the action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see 50 CFR 402.02).

2.5.1. Effects on Critical Habitat

Salmon and steelhead

The project area is critical migration and rearing habitat for all salmon and steelhead listed in the Status of Species section above. The essential features of estuarine migration corridors are freedom of obstruction and excessive predation, water quantity and quality, natural cover, side channels, and undercut banks which support foraging, mobility and survival. The proposed action stressors on critical habitat PBFs are: 1) Suspended sediment that degrades water quality and 2) the removal of established benthic food webs that provide forage to rearing and migrating salmon and steelhead.

Suspended sediment

Dredging will be done with either a clamshell dredge or a hydraulic dredge. Clamshell dredging creates a higher concentration suspended sediment plume within the turbidity curtain as the bucket digs into the substrate and as sediment falls from the bucket as it rises through the water column. This plume will exist up to 10 times over the next 5 years for up to one week per dredge event. The November 1 to February 28 (winter) and the proposed summer IWWW overlap the presence of juvenile salmon and steelhead in the action area and the migration of adult salmon and steelhead through the action area. The empirical equation $\frac{C}{\rho x 10^{-6}} = .0023 \left(\frac{b}{v_s T}\right)^3$ estimates the suspended sediment source concentration from clamshell dredging, where b is the size of the clamshell bucket, v_s is the Stokes law settling velocity of the sediment particles and T is the dredge bucket cycle time (Collins, 1995). For example, to remove 30,000 cubic yard prism of sediment (10% silt, 40% fine sand and 50% coarse sand with average particle size of .35 mm) in one week with an eight-hour workday would result in a continuous source suspended sediment concentration of 240 milligrams per liter. A hydraulic dredge has a cutter head that digs into and loosens the sediment causing some to enter the water column. Any suspended sediment from hydraulic dredging will be in a small, highly concentrated plume around the cutter head (Wilber and Clarke, 2001).

The proposed action includes best management practices during dredging, including the turbidity curtain, to minimize the source concentration and advection/dispersion of suspended sediment. Water quality returns to its background condition when dredging stops at the end of the work day and dredging does not make any long term or permanent changes to the critical habitat water quality.
Flow lane dredge sediment disposal from a dump scow releases dredge sediment back through the water column. Dump scows hold approximately 2000 cubic yards of sediment so there could be up to $\frac{65{,}000\ yd^3}{2000 \frac{yd^3}{dump}} = 165\ dumps$ over 5 years. For each sediment dump, the sediment is released

for a few minutes and most of the sediment reaches the bottom in seconds. Typical dump scow dimensions are 65 yds by 17 yds, so in 7 yards deep water the plume occupies about $7700\ cy$ of water. The winter and summer in-water work window (IWWW) overlap the presence of juvenile salmon and steelhead and the migration of adult salmon and steelhead. Moritz et al. (2014) simulated the dredged material plume formed when 3,000 cy of dredged sand is dropped into the water column from a hopper dredge. With the centroid of the sand plume is 5 feet below the hull the falling dredged material has a bulk density of $2340\,\frac{grams}{liter}$ and rapidly decreases to about $300\,\frac{grams}{liter}$ as the sediment mixes with water.

Benthic forage

Clamshell or hydraulic dredging will remove about 4.6 acres (0.02 square kilometers) of benthic forage from the action area in the estuary up to 10 times over the next 5 years. Although benthic forage may begin to become reestablished between dredge events, repeated dredging essentially eliminates benthic forage at this location for 5 years (ISAB, 2011; USACE, 1998) and benthic forage in the dredge site will remain absent throughout the time of year that juvenile salmon and steelhead are rearing in the estuary.

Flow lane sediment disposal buries benthic forage up to 10 times over five years. Most sediment deposited in the flow lane is transported as bedload during high flows mainly in the spring. Flow lane sediment disposal will add a thin layer of sediment over the existing benthic forage but will not remove, destroy or disrupt the availability of benthic forage (Moritz et al., 2014) and the effect on critical habitat forage is minor.

Eulachon

The project area is in critical habitat for adult eulachon and eulachon larvae. The essential features of estuarine migration corridors are freedom of obstruction and 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.

Obstruction

Clamshell and hydraulic dredging produce suspended sediment in the eulachon migration corridor for up to one week per dredge events for 10 dredge events over the next 5 years. Five winter IWWW dredge events overlap both adult eulachon migration and very early larvae downstream migration. The turbidity curtain around the dredge site creates an obstruction at the margin of eulachon migration corridors.

Dump scows hold approximately 2000 cubic yards of sediment. Up to 82 dump scow loads will be required to dispose of sediment dredged over 5 winter IWWWs. Flow lane disposal overlaps adult eulachon migration and the beginning of larvae downstream migration. While the sediment falls through the water column it creates a plume volume of extremely high suspended sediment concentration for several minutes as it falls to the bottom that is a partial obstruction of the migration corridor.

Water quality

The effect of dredging and flow lane disposal on eulachon critical habitat water quality is the same as described above for salmon and steelhead critical habitat water quality except only the winter IWWW overlaps the upstream migration of adult eulachon and the downstream migration of larval eulachon so the dredge plume frequency is 5 times over 5 years and the flow lane disposal plume frequency is 82 times over 5 years.

Larval prey

Dredging removes about 4.6 acres of benthic forage that includes prey that support larval eulachon feeding up to 10 times over the next 5 years. Benthic forage that begins to return to the dredged area will be removed by the summer dredge so 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 ocean.

2.5.2 Effects on Listed Species

Salmon and steelhead

The direct effect stressors of the proposed action on salmon and steelhead are entrainment, noise, suspended sediment, and reduced benthic forage supply.

Entrainment

To get a rough estimate of the number of salmonids that could be exposed to entrainment by the proposed dredging, we treat the Lower Columbia River as a 100-mile-long control volume with a cross sectional area of 100,000 square feet[1]. We counted all of the LCR, UCR, MCR, WR and SR abundances (Total =122909) in Ford (2022) and multiplied by either 1/SAR, if SAR was reported in Ford (2022) or 50 if SAR wasn't reported, to estimate the number of smolts that swim through the control volume each year (Total = 6304421). This project is in shallow water so we only consider ocean type juveniles. Stream-type salmonids (salmon and steelhead aged 1+ years) are very unlikely to be within the project area. We assigned each population a letter "o" for ocean type or a letter "s" for stream type and estimated the fraction of ocean type smolts (0.4). We assumed that these fish enter the control volume at a constant rate over 150 days from April through August. We estimated the volume of the control volume by multiplying the cross-section area by the 100-mile length from Portland to the mouth. The volume is just under 2 billion cubic yards. We assumed that all ocean type smolts enter the control volume at Portland and swim to the ocean at a speed of 1.5 feet per second for 8 hours per day such that they spend approximately 12 days in the control volume. The total number of ocean-type juveniles in the control volume at any point in time is 209000. Then the density of stream type smolts is .0001 juveniles per cubic yard.

Dredging 65,000 cubic yards of sediment over 10 days per year requires the pumping of a slurry volume of 325,000 cubic yards that is 80 percent water or 260,000 cubic yards of water per year

[1] We divided the July 16 discharge by the July 16 velocity at Port Westward to get the cross-section area at that point.

or 26,000 cubic yards of water per day. 26,000 cubic yards of water per day times .0001 smolts per cubic yard would expose 2.6 ocean-type smolts per day to entrainment for 5 days or a total of 13 smolts. Of course, salmon and steelhead are not homogeneously distributed through the control volume, they do not enter the control volume as a constant rate from April through August and they don't swim at a constant speed. Nonetheless, it appears that a small number of juvenile fish will be exposed to the dredge and will have to take action to evade entrainment. Dismuke et al. (2012) used acoustic doppler velocimeters to investigate the velocity in the flow field in front of a cutter suction dredge. He found that the volume in front of the inlet where the velocity was higher than the settling velocity of sand grains was generally in the shape of ½ of an ellipsoid. For medium diameter sand particles, the settling velocity is about 0.2 ft/sec (5 cm/sec). For a 24-inch suction inlet diameter, a 72-inch cutterhead diameter rotating at 40 RPM and a 30,000 gallon per minute pump, the ellipsoid dimensions are 22.5 feet wide by 17 feet tall by 16 feet deep. So, a fish approaching the dredge would feel a 0.2 foot per second velocity towards the inlet when it was 11.25 feet to the left or right of the inlet, 17 feet above the inlet or 16 feet in front of the inlet. A fish wouldn't be pulled into the inlet by this low velocity but it is the approach velocity requirement for fixed screen water diversion inlets. If the fish continued to swim towards the inlet it would feel a velocity of 1.2 feet per second right in front of the inlet which is still less than the velocity that a fish could not escape being sucked into the dredge. Therefore, we expect a very small fraction of the 13 fish exposed to the dredge per year to be sucked into and killed by the dredge.

Noise

Dredging and dredge disposal creates underwater noise levels less than 125 dB_{RMS} (re: 1 µPa) for up to 10, 5 day dredging events over the next 5 years. The winter and summer IWWWs overlap the timing of adult salmon and steelhead upstream migration but the shallow water USCG location is at the margins of the adult salmon and steelhead migration corridor. Adult salmon and steelhead are unlikely to be affected by dredging noise levels that are well below the 150 dB_{RMS} threshold for behavioral effects and essentially the same as the background noise level in the estuary.

Salmon and steelhead juveniles are somewhat likely to be in the action area during the winter IWWW (Roegner et al., 2012) and very likely to be in the action area during the summer IWWW. Outmigration peaks in the late spring/early summer but smolts 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). Steelhead, chum and coho salmon are less likely to be in the action area during the winter IWWW because they are more likely to enter the ocean before the start of the work window. Salmon and steelhead juveniles and smolts are unlikely to be affected by dredging noise levels that are well below the 150 dB_{RMS} threshold for behavioral effects and essentially the same as the background noise level in the estuary.

Suspended sediment

Migrating adult salmon and steelhead may be exposed to suspended sediment from up to 10 dredging events over the next 5 year because the winter and summer IWWWs overlap the timing of salmon and steelhead species migration in the estuary but the shallow water location is at the margins of the adult salmon and steelhead migration corridor and adult salmon and steelhead can swim at least 100 feet per minute upstream (Brown and Geist, 2022) so they would likely be exposed to suspended sediment for a few minutes. As shown above, for clamshell dredging the source suspended sediment concentration is around 240 milligrams per liter. Wilber and Clark (2013) show that exposure of adults to 100-1000 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. An adult salmon would have to become trapped within the turbidity curtain to be exposed to suspended sediment from dredging. The proposed action does not include fish salvage within the turbidity curtain but it seems unlikely that a migrating adult salmon would allow itself to be trapped as the curtain is deployed.

The winter and summer IWWW also overlap the presence of juvenile salmon and steelhead in the estuary. The 13 juveniles per year exposed to entrainment would also be exposed to suspended sediment. Wilber and Clarke (2001) show that juvenile fish exposed to 100 to 1000 milligrams per liter for 8 hours would experience sublethal physiological effects such as reduced feeding and behavioral effects such as alarm followed by relocation. Juvenile salmon would have to become trapped within the turbidity curtain as it is deployed to be exposed to suspended sediment from dredging. The proposed action does not include fish salvage within the turbidity curtain, but it is unlikely that many juvenile fish would become trapped because the activity of deploying the curtain will likely drive them away.

Flow lane disposal

Migrating adults and stream type juveniles will be exposed to suspended sediment during flow lane disposal from up to 165 barge loads over 5 years. Adult and stream type juvenile salmon and steelhead will be exposed to suspended sediment for minutes from dump scows. The IWWW overlaps the timing of their migration in the action area and flow lane disposal sites are in their migration corridor. Fish engulfed in 100s to 1000s of grams per liter sediment plume in the water column would likely be injured or killed by the falling sediment (USACE, 2009). Adult and stream type juveniles are strong swimmers and would likely escape entrainment in the falling sediment if they don’t avoid the noise and motion of the barge.

Flow lane disposal sites are in water that is greater than 20 feet deep at MHHW and are at the margin of the rearing and migration corridor of ocean type salmon. Using our entrainment exposure density of $0.0001\,\frac{smolts}{yd^3}$, an average of 0.77 smolts per dump and 127 smolts per year could be exposed to the $7700\ yd^3$ falling sediment plume. Juveniles entrained in the falling sediment plume will almost certainly be crushed and killed (USACE, 2009). Presumably, noise and vessel movement cause most fish avoid the water column under the scow or leave as soon as the sediment begins to fall but flow lane dredge material disposal is a juvenile salmon and steelhead take pathway in the USACE FNC maintenance biological opinion that injures or kills “a few fish”. The dredge disposal take surrogate is 127 times the number of acres dredged. The USACE dredges approximately 7000 acres over 7 months from June 1 to Dec 15 so about 1000 acres per month. Most of this sediment is dumped in the flow lane. 127 times 1000 acres equals

1714 acres. The area of the USCG Station basin is 4.6 acres. The dredge disposal footprint is 127 times 4.6 acres equals 7.9 acres and 7.9/1714 =0.0046. 0.0046 times “a few fish” is less than 1 fish and the effect of USCG dredge sediment disposal is small relative to the USACE FNC dredge sediment disposal at the same time and place.

Flow lane disposal also buries benthic forage beneath a thin layer of sediment. The burial of benthic forage at discrete points in the LCR channel 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 buried by dredging is a very small fraction of the total benthic forage in the estuary and we have not yet been determined that competition for food in the estuary is a limiting factor for juvenile salmon and steelhead (NMFS, 2013) so we do not believe that dredging will affect the growth of salmon or steelhead smolts.

Benthic forage

Juveniles or smolts are exposed to removed benthic forage in the project site up to 10 times over the next 5 years. Any benthic forage that returns to the dredged area after the IWWW dredging will be removed by the summer dredging and benthic forage in the dredge site is essentially absent for 5 years of juvenile salmon and steelhead migrations. Juvenile salmon are likely to be foraging in shallow water along the shoreline and if forage is not available they will keep searching. Juveniles that fail to find suitable estuarine rearing habitat experience higher risk of mortality (ISAB, 2015). NMFS (2013) expressed 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 does not conclude that available forage limits the existence and recovery of ESA listed salmon and steelhead (ISAB, 2015). However, the dredge site is so close to the mouth of the Columbia River that salmon and steelhead reaching this point have completed their physiological transition to salt water and adapted to the foraging patterns for the Columbia River plume (McMichael et al., 2013). 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.

Eulachon

The direct effect stressors of the proposed action to eulachon are entrainment, suspended sediment and reduced benthic forage.

Entrainment

The winter IWWW overlaps adult eulachon migration and early eulachon larvae downstream migration. An average of 68 million adult eulachon migrate and spawn in the Columbia River each year (NMFS, 2017). Using the same entrainment exposure approach described for juvenile salmon above, 280 eulachon per day or 1400 eulachon per year would be exposed to entrainment in a hydraulic dredge. BMPs, the turbidity curtain and the low velocity of water flowing into the dredge make it likely that only a very small fraction of these eulachon will actually be entrained and killed in the dredge. The overlap between the winter IWWW and eulachon larvae downstream migration is just the end of February. There could be trillions of larvae transported downstream each year with millions entrained in the dredge but for the turbidity curtain because they have no ability to evade or escape entrainment. The entrained fraction of total eulachon larvae is still extremely small.

Suspended sediment

The winter IWWW overlaps adult eulachon upstream migration and early eulachon larvae downstream migration. The Station location is at the margins of adult and larval eulachon migration. Clamshell dredging produces a source suspended sediment plume with concentration around 240 milligrams per liter. Adult eulachon that are exposed to 100 to 1000 of milligrams per liter of suspended sediment for 8 hours are likely to experience behavioral effects and sublethal physical effects (Wilver and Clark, 2001). Eulachon larvae that are exposed 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). Since dredging takes place within a turbidity curtain that blocks fish and larvae from entering the dredge area, adult and larval eulachon are very unlikely to be exposed to the dredge suspended sediment; thus, the effect of suspended sediment on Eulachon is insignificant.

Dump scow releases will create suspended sediment will be in the water column for minutes while the fine sediment fraction is dispersed downstream by the river current. Adult eulachon exposed to hundreds of grams per liter suspended sediment will likely be killed (Wilber and Clarke, 2001). However, the risk that adult eulachon will be exposed to suspended sediment from dump scow dredge sediment disposal is small because the sediment plume cross sections are an extremely small fraction of the river cross section.

Reduced benthic forage

Dredging will remove 200,000 square feet of benthic forage from the action area up to 10 times over the next 5 years. Although benthic forage may begin to return to the dredged area within one year it will likely take several years to return to its pre-dredge condition (ISAB, 2011; USACE, 1998) so the benthic forage in the project site is a permanently degraded baseline. The Station location is at the margins of larval migration. At the start of their downstream migration, eulachon larvae consume their yolk sac but when the yolk sac is gone they consume zooplankton that originate in the benthic substrate. Nonetheless, the forage in the dredge site is an insignificant fraction of the benthic forage in the estuary.

Dredge sediment deposited in the flow lane will remain in place until freshet flows in the spring when bedload is transported downstream and adds a thin layer of sediment over but does not remove or destroy benthic ecosystems so eulachon larvae migrating through the flow lane will forage normally. Eulachon larvae will be exposed to but insignificantly affected by flow lane sediment disposal.

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]. 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).

It is reasonably certain that over the additional service life of the project, climate effects such as modified water temperatures, altered river hydrograph, and shifting salinity will all exert more influence on the habitat quality and related carrying capacity. NMFS expects State and private activities near and upriver from the proposed action will contribute to cumulative effects in the action area. Therefore, our analysis considers 1) effects caused by specific future non-federal activities in the action area; and 2) effects in the action area caused by future non-federal activities in the Columbia basin.

Future upland development activities lacking a federal nexus are expected to result in increased pollution-generating impervious surface, runoff, and non-point source discharges. Population growth in Clark and Multnomah Counties are likely to remain high, which will require greater development to support and sustain this trend. State, county, and city regulations should minimize and mitigate for the adverse effects of this development so that the overall environmental quality of the action area remains constant, albeit degraded relative to its restored condition.

The legacy of resource-based industries (e.g., agriculture, hydropower facilities, timber harvest, fishing, and metal and gravel mining) caused long-lasting environmental changes that harmed ESA-listed species and their critical habitats. Stream channel morphology, roughness, and cover, estuarine rearing habitats, wetlands, floodplains, riparian areas, water quality, fish passage, and habitat refugia have been degraded throughout the LCR basin. Those changes reduce the ability of populations of ESA-listed species to sustain themselves in the natural environment by altering or interfering with their behavior in ways that reduce their survival throughout their life cycle.

While widespread degradation of aquatic habitat associated with intense natural resource extraction is no longer common, ongoing land management actions are likely to continue to adversely affect the estuary and delay natural recovery of aquatic habitat in the CR basin including the action area. This trend is somewhat countered by non-federal aquatic habitat restoration occurring in the LCR. The Lower Columbia River Estuary Partnership has over 100 regional partners in the LCR and has completed 284 projects with a total of 35,342 acres of habitat restored (LCREP, 2024). Projects include land acquisitions and conservation easements, adding large logs to streams to create fish habitat, planting trees to shade and cool streams, and removing barriers to fish passage. Still, when considered together, the net cumulative effects are likely to have an adverse effect on ESA-listed fish within the action area.

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

Salmon and steelhead

Eleven of the salmon and steelhead species addressed by this consultation are "threatened." Upper Columbia River spring-run Chinook salmon, and Snake River sockeye salmon are "endangered". The status of the constituent populations range from very high risk to moderate risk of extirpation. The total abundance of all salmon and steelhead species is very low relative to historical levels. Their historic range and spatial structure is curtailed or modified. Multiple limiting factors prevent natural fish production from significantly increasing productivity, abundance and diversity.

The environmental baseline includes developed urban areas, land use practices, degraded estuarine and nearshore habitat, degraded floodplain connectivity and function, altered streamflow and channel complexity, reduced large wood and substrate recruitment, predation, contaminants, and OGV wake wave stranding. The USCG station will likely operate for decades as climate change results in greater variability in Pacific Northwest river systems, more frequent droughts, larger floods and higher temperatures. Estuaries and oceans will have higher water temperatures, decreased salinity and increased acidity. The (non-federal) cumulative effects in the coming decades are expected to be incrementally negative for habitat conditions.

We added the effects of the proposed action on species and habitat to determine the likely changes in abundance, productivity, spatial structure, and genetic diversity of the affected species and the implication for species viability. Endangered UCR spring-run Chinook salmon and SR sockeye salmon along with threatened SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, LCR Chinook salmon, UWR Chinook salmon, LCR coho salmon, CR chum salmon, MCR steelhead, UCR steelhead, SRB steelhead, LCR steelhead and WR steelhead will pass through the action area as adults and juveniles and be exposed to the effects of the proposed action, particularly during the proposed summer work window. However, the direct effects of dredging and dredge material disposal effects of the proposed action, added to the environmental baseline and cumulative effects, are not likely to appreciably reduce the abundance, productivity, spatial structure or diversity of any population of any salmon or steelhead species.

Eulachon

The southern DPS of eulachon is "threatened" with a moderate risk of extirpation. Eulachon abundance is very low relative to historical levels. Their historic range and spatial structure is curtailed or modified. Multiple limiting factors prevent natural fish production from significantly increasing productivity, abundance and diversity.

The environmental baseline includes developed urban areas, land use practices, degraded estuarine and nearshore habitat, degraded floodplain connectivity and function, altered streamflow and channel complexity, reduced large wood and substrate recruitment, predation, contaminants, and OGV wake wave stranding. The USCG station will likely operate for decades as climate change results in greater variability in Pacific Northwest river systems, more frequent droughts, larger floods and higher temperatures. Estuaries and oceans will have higher water temperatures, decreased salinity and increased acidity.

We added the effects of the proposed action on species and habitat to determine the likely changes in abundance, productivity, spatial structure, and genetic diversity of the affected species and the implication for species viability. Eulachon will pass through the action area as adults and larvae and be exposed to the effects of the proposed action, particularly during the proposed summer work window. However, the direct effects of dredging and dredge material disposal, added to the environmental baseline and cumulative effects, are not likely to appreciably reduce the abundance, productivity, spatial structure or diversity of any population of any salmon or steelhead species.

2.7.2 Critical Habitat

Salmon, steelhead and eulachon

Columbia River estuary critical habitat has high conservation value because of the critical function it serves to species using it for migration to and from spawning areas and for juvenile rearing. The critical habitat quality and quantity is limited by water quality, altered hydrology, lack of floodplain connectivity and shallow-water habitat, and lack of complex habitat to provide forage and cover. All of these specific factors of decline are part of the systemic degradation of habitat features across the habitat for these ESA listed species, including the action area. Additionally, when considering cumulative effects, future development, even if limited, together with climate change, has the potential to further diminish Columbia River estuary habitat.

Climate change is likely to adversely affect the overall conservation value of Lower Columbia River Chinook salmon, Upper Willamette River Chinook salmon, Upper Columbia River spring Chinook salmon, Snake River spring/summer Chinook salmon, Snake River fall Chinook salmon, Lower Columbia River coho salmon, Columbia River chum salmon, Snake River Sockeye salmon, Lower Columbia River steelhead, Middle Columbia River steelhead, Upper Columbia River steelhead, Upper Willamette River steelhead, Snake river Basin steelhead, Green sturgeon, or their designated critical habitats. The adverse effects are likely to include, but are not limited to, temporary habitat diminishment, including reduction in benthic forage, turbidity, and noise; and enduring diminishment of fish passage and predation risk. The magnitude and severity of these effects will vary from year to year. The long-term effects of the proposed action will last for decades and will overlap with the effects of climate change. However, the proposed action’s effects are unlikely to exacerbate the effects of climate change in the action area or critical habitat because the dredging effects on the environmental stressors most likely to be affected by climate change will be minor and not meaningful.

The environmental baseline is degraded by past land and waterway management activities including agriculture, forestry, grazing, road building and maintenance, urbanization, dam construction and operation and maintenance, and commercial vessel traffic will continue to degrade aquatic habitat for ESA-listed salmonids and eulachon in the action area. These activities will continue to impact water quality by increasing water temperatures, adding chemicals to the water (stormwater contaminants associated with urbanization and recreational boating), increasing sedimentation, increasing predation on these species. Each of these activities has contributed to a myriad of interrelated factors for the decline in quality and function of critical habitat PBFs essential for the conservation of ESA-listed salmonids and eulachon in the action area and lower Columbia River estuary.

Non-project related land and waterway management activities including agriculture, forestry, grazing, road building and maintenance, urbanization, and reservoir recreation will continue to degrade critical habitat for ESA-listed salmonids and eulachon in the action area. Impacts associated with these activities are ongoing and likely to continue to have a depressive effect on critical habitat features essential to support the LCR Chinook salmon, UWR Chinook salmon, UCR spring Chinook salmon, SR spring/summer Chinook salmon, SR fall Chinook salmon, LCR coho salmon, CR chum salmon, SR Sockeye salmon, LCR steelhead, MCR steelhead, UCR steelhead, UWR steelhead, SR Basin steelhead, and eulachon critical habitat PBFs. Therefore, we expect the quality and function of in the action area will continue to be negatively impacted because of cumulative effects.

Adverse effects to the quality and function of critical habitat PBFs from this project will take place in small, discrete parts of the Columbia River. Any effect on water quality from suspended sediment from dredging or dredge disposal will be temporary. The benthic forage in the small dredge site will be permanently removed. These adverse effect to water quality and forage do not substantially alter the function of the critical habitat at the action area scale, or at the 5^{th}-level HUC scale. When considered with cumulative effects from climate change and upland human population growth, critical habitat conditions in the action area are not likely to experience chronic diminishments that impede meeting larger recovery objectives.

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:

1. Lower Columbia River Chinook salmon
2. Upper Willamette River Chinook salmon
3. Upper Columbia River spring Chinook salmon
4. Snake River spring/summer Chinook salmon
5. Snake River fall Chinook salmon
6. Lower Columbia River coho salmon
7. Columbia River chum salmon
8. Snake River Sockeye salmon
9. Lower Columbia River steelhead
10. Middle Columbia River steelhead
11. Upper Columbia River steelhead
12. Upper Willamette River steelhead
13. Snake river Basin steelhead

14. Eulachon

or destroy or adversely modify their designated critical habitat.

2.9. Incidental Take Statement

Section 9 of the ESA and federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. “Take” is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. “Harm” is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). “Harass” is further defined by 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.

Dredging and dredge material disposal will occur when ESA-listed salmon and steelhead and eulachon will be present in the action area. Those actions are reasonably certain to cause incidental take when juvenile salmon, steelhead, adult eulachon and eulachon larvae are entrained and injured or killed by a suction or mechanical dredge, or when they are injured or killed by contact with dredged material as it falls through the water column during flow lane disposal. This incidental take will occur in the Columbia River, at the USCG Station and at dredge material flow lane disposal sites. Incidental take within those areas that meets the terms and conditions of this incidental take statement will be exempt from the taking prohibition.

2.9.1 Amount or Extent of Take

Take in the form of harm is often impossible to quantify as a number of individuals, because the presence of the individuals (exposure to the harmful conditions) is highly variable over time, and is influenced by factors that cannot be easily predicted. Additionally, the duration of exposure is highly variable based on species behavior patterns, and the wide variability in numbers exposed and duration of exposure creates a range of responses, many of which cannot be observed without research and rigorous monitoring. In these circumstances, we described an “extent” of take which is a measure of the harming condition spatially, temporally, or both. The extent of take is causally related to the amount of harm that would result, and each extent of take provided below is an observable metric for monitoring, compliance, and re-initiation purposes.

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

1. Take in the form of harm of ESA-listed salmonids and eulachon from underwater noise during hydraulic dredging. The extent of take for underwater noise from hydraulic

dredging is a total of 10 days of hydraulic dredging annually. This surrogate indicator of take is both easily observable and causally linked to incidental take by hydroacoustic impacts because the amount of take increases incrementally with each day that underwater noise above the behavioral threshold for fish occurs.

2. Take in the form of harm and injury of ESA-listed salmonids and eulachon from diminished water quality due to turbidity and the resuspension of contaminants while dredging. The extent of take is the volume of dredged material, which shall not exceed 65,000 CY annually and shall not exceed 325,000 CY over the course of the 5-year permit. This metric is easily observed and causally related because dredging a larger amount of material will generate more suspended sediment and resuspend more contaminants within the water column that could injure ESA-listed fishes.

3. Take in the form of injury or death of juvenile salmonids and larval, juvenile, and adult eulachon from entrainment during dredging and material placement activities. The extent of take is the volume of dredged material, which shall not exceed 65,000 CY annually and shall not exceed 325,000 CY over the course of the 5-year permit. This metric is easily observed and causally related because dredging or disposing of a larger amount of material will increase the potential for entrainment of ESA-listed fishes.

4. Take in the form of harm of juvenile salmonids from reduced prey availability. The extent of take is the volume of dredged material, which shall not exceed 65,000 CY annually and shall not exceed 325,000 CY over the course of the 5-year permit. This metric is easily observed and causally related because dredging a larger amount of material will disturb a greater number of benthic invertebrates, in turn limiting forage opportunities for juvenile salmonids.

2.9.2 Effect of the Take

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

2.9.3 Reasonable and Prudent Measures

“Reasonable and prudent measures” refer to those actions the Director considers necessary or appropriate to minimize the impact of the incidental take on the species (50 CFR 402.02). The USCG should ensure that the contractor:

1. Minimize incidental take caused by turbidity, and

2. Complete a monitoring and reporting program to confirm this Opinion is meeting its objective of limiting the extent of take and minimizing take from permitted activities.

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

1 The following terms and conditions implement reasonable and prudent measure 1:
   a Make visual observations for turbid conditions at a point 300 ft. downstream during construction. If turbidity creates a visible plume beyond the edge of the 300-foot mixing zone, stop work until turbidity no longer extends beyond this point of compliance and consider implementing strategies (e.g., deploying a floating silt curtain or working more slowly) to minimize the chance of another exceedance.

2 The following terms and conditions implement reasonable and prudent measure 2:
   a The USACE shall provide a report detailing post construction dimensions of all dredging activities to NMFS annually (by March 31 of any year) that indicates:
      i. the volume of sediment removed and dates of initiation and completion of dredging activities.
      ii. the location(s) of dredging activities from the previous year and the method of dredging (i.e., mechanical or hydraulic).
   b The applicant must submit these monitoring reports to:
   ProjectReports.wcr@noaa.gov
   Reference Project No.: WCRO-2023-00363
   cc: tom.hausmann@noaa.gov

2.10 Reinitiation of Consultation

This concludes formal consultation for Maintenance Dredging Project USCG Station Cape Disappointment, Baker Bay, Ilwaco.

Under 50 CFR 402.16(a): “Reinitiation of consultation is required and shall be requested by the federal agency, where discretionary federal 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.”

2.11 "Not Likely to Adversely Affect" Determinations

Green Sturgeon

The project area is in critical habitat for green sturgeon. The essential features of Columbia River estuary critical habitat are abundant food items for subadult, and adult life stages, a water flow regime necessary for normal behavior, growth, and survival of all life stages, water quality, including temperature, salinity, oxygen content, and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages, a diversity of depths necessary for shelter, foraging, and migration of juvenile, subadult, and adult life stages and sediment quality (i.e., chemical characteristics) necessary for normal behavior, growth, and viability of all life stages. The proposed action affects the abundance of food items in the estuary.
Dredging will remove about 4.6 acres of benthic forage from the action area in the estuary up to 10 times over the next five years. The benthic forage in the dredge site will remain degraded throughout the time of year that green sturgeon are rearing in the estuary. Green sturgeon will move to and feed in other parts of the estuary. The area of benthic forage removed by dredging is a very small fraction of the total benthic forage in the action area so we believe that the effect of removed forage on the growth and energy of green sturgeon is insignificant.

Adult and sub adult green sturgeon in the Columbia River estuary are large, strong swimming fish that will be blocked from entering the dredge area by the turbidity curtain and that will be able escape entrainment in the descending sediment plume at the flow lane disposal site. The risk of entrainment is 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 associated physical, chemical, and biological 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 may result from actions occurring within EFH or outside of it and may include direct, indirect, site-specific or habitat-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 (50 CFR 600.905(b))].

This analysis is based, in part, on the EFH assessment provided by the USCG and descriptions of EFH for Pacific Coast groundfish (Pacific Fishery Management Council (PFMC 2022), coastal pelagic species (CPS) (PFMC 2023), and Pacific Coast salmon (PFMC 2022) 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

The proposed action and action area for this consultation are described in the Introduction section to this document. The action area includes areas designated as EFH for various life-history stages of groundfish, coastal pelagic species and Chinook and coho salmon. Estuaries are habitats of particular concern (HAPC) for groundfish and salmon.

3.2 Adverse Effects on Essential Fish Habitat

NMFS determined that the proposed action would adversely affect EFH as follows:

1. Dredging and flow lane disposal temporarily degrade salmon, groundfish and coastal pelagic species EFH water quality with suspended sediment.
2. Dredging and flow lane disposal temporarily degrade salmon, groundfish and coastal pelagic species EFH with noise.
3. Dredging temporarily degrades salmon, groundfish and coastal pelagic species EFH by creating an entrainment risk.
4. Dredging and flow lane disposal degrade salmon, groundfish and coastal pelagic species EFH by disturbing forage producing benthic ecosystems including eelgrass.

3.3 Essential Fish Habitat Conservation Recommendations

NMFS determined that conservation recommendations are not necessary to avoid, minimize, mitigate, or otherwise offset the impact of the proposed action on EFH.

1. Suspended sediment from dredging is adequately minimized by proposed BMPs and the use of a turbidity curtain around the dredge site. There are no practical measures to minimize suspended sediment from flow lane disposal.
2. Noise from dredge equipment is adequately minimized by proposed BMPs and is well below levels that affect fish behavior.
3. The entrainment risk is adequately minimized by proposed BMPs.
4. The disturbance of benthic ecosystems is adequately minimized by proposed BMPs and by conducting a pre-dredge eelgrass survey of the dredge site, mitigating for any eelgrass sacrificed by dredging by restoring (planting) an equivalent area of eelgrass in the action area and monitoring the survival of the restored eelgrass.

3.4 Supplemental Consultation

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

4 DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

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

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are the USCG and the USACE. Individual copies of this opinion were provided to the USCG. The document will be available at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adhere to conventional standards for style.

4.2 Integrity

This consultation was completed on a computer system managed by 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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