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-2022-00383

March 9, 2023

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

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Cowlitz Falls Debris Barrier Coating and Cathodic Protection Project (NWS-2021-640)

Dear Mr. Tillinger:

Thank you for your letter of March 28, 2022, 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 Cowlitz Falls Debris barrier Coating and Cathodic Protection Project located in Lake Scanewa at the Cowlitz Falls Reservoir near Morton, Lewis County, Washington (46.4714 N latitude, -122.0956W longitude).

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

NMFS determined that the action, as proposed, is not likely to jeopardize the continuing existence or adversely modify the critical habitat of the federally threatened Lower Columbia River Chinook salmon (*Oncorhynchus tshawytscha*), Lower Columbia River coho salmon (*Oncorhynchus kisutch*), and Lower Columbia River steelhead (*Oncorhynchus mykiss*).

Please contact Amy Kocourek of the Oregon Washington Coastal Office, Washington Coast/Lower Columbia Branch at 360-999-7301 or amy.kocourek@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: Danette Guy, Project Manager

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

Cowlitz Falls Debris Barrier Coating and Cathodic Protection Project

NMFS Consultation Number: WCRO-2022-00383

Action Agency: U.S. Army Corps of Engineers

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely to Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely to Destroy or Adversely Modify Critical Habitat?
Lower Columbia River Chinook salmon (*Oncorhynchus tshawytscha*)	Threatened	Yes	No	Yes	No
Lower Columbia River Coho (*Oncorhynchus kisutch*)	Threatened	Yes	No	Yes	No
Lower Columbia River Steelhead (*Oncorhynchus mykiss*)	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

Consultation Conducted By: National Marine Fisheries Service
West Coast Region

Issued By:

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

Date: March 9, 2023

TABLE OF CONTENTS

1. INTRODUCTION

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

1.1. Background

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

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

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

1.2. Consultation History

The USACE provided a consultation initiation package to NMFS on February 17, 2022. The initiation package includes a biological assessment (BA) and four pages of drawings. The applicant for this consultation is the Lewis County Public Utility District, which owns and operates the Cowlitz Falls Dam. NMFS conducted an initial review of the provided materials. On April 4, 2022, NMFS requested more specific information on the timing of the project as the request for consultation was after the indicated start of project. NMFS received clarification from USACE on April 5, 2022 indicating that the project timeline has shifted by a year and that the desired project timeline would begin in January 2023. NMFS initiated ESA and EFH consultation on April 5, 2022. On June 3, 2022, NMFS and USACE negotiated a mutually agreeable consultation due date of September 10, 2022 in order to accommodate other pre-existing consultations with USACE.

On November 4, 2022, NMFS noted that the BA described fish handling but gave a “not likely to adversely affect” effects call. The cover letter from USACE noted that USACE had confirmed that the effects calls in the BA were accurate. NMFS alerted USACE that this effects call was incorrect as fish handling implies take. On November 7, 2022, USACE provided concurrence with this revised effects call of “likely to adversely affect” listed fish as well as their critical habitats.

On February 7, 2023, USACE confirmed by email that the two reservoir drawdowns described in the proposed action would take place specifically for the debris barrier maintenance.

On March 8, 2023, NMFS and USACE coordinated and confirmed a two-week extension for the first reservoir drawdown and excavation in the debris barrier work area. This step in the overall process was originally proposed to take place January- March. We modified the timing for this component of the proposed action to January- mid-April. This was necessary in order to keep the overall project timeline on track given that the ESA consultation would be completed late in the planned window for reservoir drawdown and debris barrier work area excavation.

The project would take place in an area where Lower Columbia River Chinook salmon, Lower Columbia River coho, and Lower Columbia River steelhead could be affected, triggering ESA consultation. Additionally, the project would take place in critical habitat for these three listed species. Consultation on Essential Fish Habitat (EFH) was triggered as EFH for Pacific salmon (Chinook salmon and coho) is designated within the project area.

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

1.3. Proposed Federal Action

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

Under Section 404 of the Clean Water Act, the Corps is proposing to permit Lewis County Utility District to perform maintenance on the existing debris barrier in Lake Scanewa, at the Cowlitz Falls Reservoir near Morton in Lewis County, Washington. The project would begin in January 2023 and be completed in late October 2023. The purpose of this project is to make updates to the debris barrier that would extend the service life, facilitate maintenance and access, and improve safety.

Lewis County Utility District and/ or their contractor would temporarily remove the existing debris barrier from the dam and tow it upstream to an existing mooring station. Work would be performed on the debris barrier at the mooring station, and once completed, the debris barrier would be towed back to the dam and re-installed.

To prepare the work site and create space necessary for working under the hull in the moorage area, the mooring area would be excavated during a drawdown specific to this work. Up to 1,000 yards of accumulated sediment would be removed from an approximate 0.4-acre area. Excavated material would be disposed of at an upland disposal site. A turbidity curtain would be installed to separate the work area from the rest of the reservoir. No in-water work is planned in the reservoir.

Work on the debris barrier would take place when the reservoir is lowered during the drawdown. While moored, the current corrosion resistant powder coating would be removed from the debris barrier and a new corrosion prevention system would be applied. In addition, the cathodic protection system would be replaced.

It is anticipated that the temporary dry work area below the OHWM of the reservoir would be approximately 1.0 acre and fully contained to prevent pollutants from entering the reservoir or the dry reservoir bottom. Blasting and painting would occur in stages with best management practices (BMPs) placed around and below the work area to capture all construction debris. The contractor would not allow any construction debris to fall onto the ground surface by installing a plastic covering on the ground and surrounding the work area in an encapsulated tent. Silt fence, sandbags, and/or a temporary berm would be temporarily installed between the work area and the reservoir to prevent any unanticipated stormwater runoff from entering the reservoir.

Once the work is completed, the debris barrier would be towed back to the dam and reinstalled.

Best management practices include conducting work in the agency-approved in-water work window identified by the Hydraulic Project Approval and the following conservation measures which have been committed for implementation:

Best Management Practices:

1. All applicable permits for the project will be obtained prior to construction, and all work will be performed according to the requirements and conditions of these permits.
2. The contractor will inspect fuel hoses, oil or fuel transfer valves, and fittings on a regular basis for drips or leaks in order to prevent spills or runoff of deleterious materials into the surface water.
3. The contractor will conduct all refueling at least 150 feet from the reservoir.
4. The contractor shall be responsible for the preparation of a Spill Prevention, Control, and Countermeasure (SPCC) Plan to be used for the duration of the project. The SPCC Plan shall be submitted to the project engineer prior to the commencement of any construction activities. A copy of the SPCC Plan, and any updates, will be maintained at the work site by the contractor.
5. The contractor or responsible representative will clean equipment to remove noxious weeds/seeds, aquatic invasive species, and petroleum products prior to mobilizing to the site.
6. The contractor or responsible representative will not use concrete, asphalt, steel or other human made materials for shoreline stabilization or in the active reservoir.
7. All exposed or disturbed areas, including upland staging areas, would be stabilized to prevent erosion.

Above Reservoir OHWM Best Management Practices:

1. Upland work to create site access and staging areas will disturb the minimum amount of vegetation possible; these areas will be stabilized at the end of the project as specified according to the project drawings and specifications.
2. A line of riparian vegetation will be maintained between the laydown and staging area and the reservoir. The laydown and staging areas will be surrounded by silt fence to capture surface runoff.
3. The contractor will develop a Stormwater Pollution Prevention Plan (SWPPP). Soil erosion and sedimentation control measures will be employed during construction of the staging and access.

Below Reservoir OHWM Best Management Practices:

1. Work will occur during the agency-approved work windows for the project as negotiated during the regulatory permitting process for the project.
2. No work will be performed in-water in the reservoir. During a drawdown timed specifically for this work, expected to be between January and mid-April 2022 (timing is seasonally dependent), sediment will be excavated down approximately five feet below the surface of the existing reservoir substrate. A berm/silt fence will be installed downstream of the dewatered work area to minimize the downstream transport of sediments from construction activities into the reservoir. Approximately 1,000 cubic yards of material excavated will be removed permanently from below the OHWM and placed in the upland "excavated material disposal area" behind the locked gate on the road to the work area.
3. During work inside of the debris barrier from July to August 2022, a turbidity curtain will be installed to separate the work area from the rest of the reservoir. Once the reservoir has been drawn down in early September 2022, a berm/silt fence will be installed downstream of the dewatered work area to minimize the downstream transport of sediments from construction activities into the reservoir.
4. Fish rescue will be conducted by a qualified fish biologist in the Action Area during reservoir drawdowns. Any fish rescued during these operations will be transported to the adjacent area of the reservoir.
5. Materials will not be stockpiled below the OHWM or other sensitive areas.

Project scheduling and construction sequencing is proposed as follows:

- Reservoir Drawdown and Mooring Area Material Excavation: January- mid-April 2023
- Clear and Prepare Upland Staging Area: June-July 2023
- Unhook Debris Barrier and Transport to Moorage Site: early- to mid-July 2023
- Construction (inside debris barrier work): July – August 2023
- Reservoir Drawdown: early September 2023
- Construction (outside debris barrier work): August – October 2023
- Construction End: middle October 2023
- Fill Reservoir: middle October 2023
- Transport Debris Barrier to Dam and Connect to Dam: late October 2023

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.

2.1. Analytical Approach

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

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

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

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

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

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

2.2. Rangewide Status of the Species and Critical Habitat

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

One factor affecting the status of ESA-listed species considered in this opinion, and aquatic habitat at large, is climate change. Climate change is likely to play an increasingly important role in determining the abundance and distribution of ESA-listed species, and the conservation value of designated critical habitats, in the Pacific Northwest. These changes will not be spatially homogeneous across the Pacific Northwest. Major ecological realignments are already occurring in response to climate change (IPCC WGII, 2022). Long-term trends in warming have continued at global, national and regional scales. Global surface temperatures in the last decade (2010s) were estimated to be 1.09 °C higher than the 1850-1900 baseline period, with larger increases over land ~1.6 °C compared to oceans ~0.88 (IPCC WGI, 2021). The vast majority of this warming has been attributed to anthropogenic releases of greenhouse gases (IPCC WGI, 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 WGII 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 WGI, 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, 2016, 2017, Crozier and Siegel 2018, Siegel and Crozier 2019, 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 (Alizedeh 2021).

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

Freshwater Environments

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

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. 2020, Myers et al. 2018).

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

Marine and Estuarine Environments

Along with warming stream temperatures and concerns about sufficient groundwater to recharge streams, a recent study projects nearly complete loss of existing tidal wetlands along the U.S.

West Coast, due to sea level rise (Thorne et al. 2018). California and Oregon showed the greatest threat to tidal wetlands (100%), while 68% of Washington tidal wetlands are expected to be submerged. Coastal development and steep topography prevent horizontal migration of most wetlands, causing the net contraction of this crucial habitat.

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

Perhaps the most dramatic change in physical ocean conditions will occur through ocean acidification and deoxygenation. It is unclear how sensitive salmon and steelhead might be to the direct effects of ocean acidification because of their tolerance of a wide pH range in freshwater (although see Ou et al. 2015 and 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, Williams et al. 2016, Ward et al. 2015). 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. 2020). 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 (Keefer et al. 2018, Barnett et al. 2020).

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 (Holsman et al. 2012, Burke et al. 2013). 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 salmon populations from Oregon to the Yukon (Dorner et al. 2018, Kilduff et al. 2014). In addition, Chinook salmon have become smaller and younger at maturation across their range (Ohlberger 2018). Other Pacific salmon species (Stachura el al. 2014) and Atlantic salmon (Olmos et al. 2020) also have demonstrated synchrony in productivity across a broad latitudinal range.

At the individual scale, climate impacts on salmon in one life stage generally affect body size or timing in the next life stage and negative impacts can accumulate across multiple life stages

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

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

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 70 FR 37160	NMFS 2013	NMFS 2022; 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
Lower Columbia River coho salmon	Threatened 6/28/05 70 FR 37160	NMFS 2013	NMFS 2022; Ford 2022	Of the 24 populations that make up this ESU, only 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
Lower Columbia River steelhead	Threatened 1/5/06 71 FR 834	NMFS 2013	NMFS 2022; 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

2.2.2 Status of the Critical Habitat

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

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

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.
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.
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.

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 Cowlitz Falls Project (dam), the site upriver from the dam where maintenance work on the debris barrier will be performed, the route along the Cowlitz River where the debris barrier will be towed to and from the maintenance site, upland staging areas and a dredged material disposal site, and a 0.5-mile radius extension surrounding the maintenance site to representing the extent to which general construction noise can typically travel before reaching background levels. The action area encompasses the Cowlitz River from the Cowlitz Falls Project upriver to approximately Lake Scanewa and includes a portion of the lake based on the extent of potential noise disturbance. The Cowlitz River flows into Lake Scanewa from the north and the Cispus River flows into Lake Scanewa from the east.

2.4. Environmental Baseline

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

Water Quality
The Cowlitz River is rated as Category 5 for temperature, meaning that it is on the 303(d) list (Ecology 2022). In 2005, between 7/28/2005 and 9/15/2005, the 7-day mean of daily maximum values (7DADmax) exceeded the criterion for this waterbody (17.5°C) on 21 of 50 days (42%) (Ecology 2022). The maximum exceedance during this period was 19.09°C for the 7-day period centered on 7/31/2005 (Ecology 2022). While stream temperatures generally cool in the fall as water levels increase, high temperatures may remain a problem for early-returning salmon (LCFRB 2004; 2010). The Cowlitz River is also rated as a Category 5 for polychlorinated biphenyls (PCBs), methyl mercury, and dioxin (Ecology 2022).

Habitat Condition and Dynamics
Forestry is the dominant land use in the Upper Cowlitz basin, with over 70% of the land managed as public or private commercial forestland. According to LCFRB 2010, the Cispus Basin, Upper Mainstem Cowlitz Basin, and many headwater tributaries are in National Forest Lands, with a portion of the northern basin lying within Mt. Rainier National Park. These lands are heavily forested with relatively intact landscape conditions that support functioning watershed processes. Streams are unaltered, road densities are low, and riparian areas and uplands are characterized by mature forests. Existing legal designations and management policy are expected to continue to offer protection to these lands. Much of the Tilton, reservoir tributary

basins, and the lower portion of the Upper Mainstem Basin are managed for commercial timber production and have experienced intensive past forest practices activities. Proper forest management is critical to fish recovery. Past forest practices have reduced fish habitat quantity and quality by altering stream flow, increasing sediment, and reducing riparian zones. In addition, forest road culverts have blocked fish passage in small tributary streams. Much of the mainstem Cowlitz (between Lake Scanewa and Packwood) and the Tilton River (near Morton, WA) are used for agriculture and residential development. Dike building and bank stabilization have heavily impacted fish habitat in these areas.

Habitat Access

The system of dams on the mainstem Cowlitz River, beginning with Mayfield Dam at River Mile 52, block all volitional access to the upper basin, consisting of up to 300 or more miles of habitat for anadromous species (LCFRB 2010). Juvenile and adult fish are currently trucked around the system of dams and reservoirs (LCFRB 2010, Tacoma Public Utilities 2022). Tacoma Power and Lewis County PUD currently operate the facilities in accordance with licenses with the Federal Energy Regulatory Commission (FERC), which rely on an adaptive management approach to implementing passage improvements. Partners in the relicensing process must ensure that adequate measures are taken to restore self-sustaining natural production of ESA-listed salmonids in the Upper Cowlitz Basin.

Listed Populations' Relationship to Recovery

Within the action area and/or upriver of the action area, there are multiple populations of listed salmon and steelhead each with a unique role unto species' recovery.

- Chinook salmon spring run Upper Cowlitz River population
- Chinook salmon spring run Cispus River population
- Chinook salmon fall run Upper Cowlitz population ("Tule")
- Coho early and late Upper Cowlitz River population
- Coho early and late Cispus River population
- Steelhead winter run Upper Cowlitz River population
- Steelhead winter run Cispus River population

In order to meet recovery goals, abundance for most of these populations must increase substantially. Extinction risks are significant for all of these populations and most have not progressed significantly towards recovery target numbers. Image 1, below, highlights populations present or potentially present at the action area, the role of the populations unto recovery such as core population, genetic legacy population, primary population, or stabilizing population, the most recent abundance estimate for each population (Ford 2022), and recovery target abundance numbers (NMFS 2013).

Population	Core or genetic legacy population?**	Contribution to Recovery**	Net Baseline persistence probability**	Target Persistence Probability**	Historical abundance	Baseline abundance^	Target	Current abundance. 2015-2019 Five-year geometric mean of raw natural-origin spawner abundance, with 5-year geometric mean of raw total spawner counts (including hathcery origin fish) in parenthesis. Colors indicate the relative proportion of the recovery target currently obtained: red = <10%, orange = 10% > x < 50%, yellow = 50% > x < 100%), green = >100%.
			(table 7.4 in Recovery Plan)					
Lower Columbia River ESU Chinook salmon spring-run Upper Cowlitz River population	Core, genetic legacy	Primary	VL	H+	22,000	300	1800	171 [5,435]*
Lower Columbia River ESU Chinook salmon spring-run Cispus River population	Core, genetic legacy	Primary	VL	H+	7,800	150	1800	N/A
Lower Columbia River ESU Chinook salmon fall-run Upper Cowlitz River population ("Tule")	no	Stabilizing	VL	VL	28,000	0	N/A	1,761 [2,188]*
Lower Columbia River ESU Coho early and late Upper Cowlitz River population	n/a; none designated	Primary	VL	H	18,000	<50	2,000	631
Lower Columbia River ESU Coho early and late Cispus River population	n/a; none designated	Primary	VL	H	8,000	<50	2000*	N/A
Lower Columbia River DPS Steelhead winter-run Upper Cowlitz River population	Core, genetic legacy	Primary	VL	H	1,400	<50	500	199
Lower Columbia River DPS Steelhead winter-run Cispus River population	Core, genetic legacy	Primary	VL	H	1,500	<50	500	N/A

Note that current abundance is the 2015-2019 five-year geometric mean of raw natural-origin spawner abundance, with 5-year geometric mean of raw total spawner counts (including hatchery origin fish) in parenthesis (Ford 2022). Colors indicate the relative proportion of the recovery target currently obtained: red = <10%, orange = 10% > x < 50%, yellow = 50% > x < 100%), green = >100%. Note that Upper Cowlitz and Cispus River populations for all three species have been managed as one unit; the current abundance for the (combined) populations is provided under Upper Cowlitz and "N/A" is listed for Cispus. This is due to the trap and haul system currently in place for Cowlitz River salmonids.
** Status is equivalent to persistence probability. VL = very low, L = low, M = moderate, H = high, VH = very high.*
*** C = Core populations, meaning those that historically were the most productive. G = Genetic legacy populations, which best represent historical genetic diversity.*

Figure 1. Role, status, and abundance of listed salmonid populations likely to be present 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 (see 50 CFR 402.02). A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see 50 CFR 402.17). In our analysis, which describes the effects of the proposed action, we considered the factors set forth in 50 CFR 402.17(a) and (b).

Construction-related effects of the action on habitat and species from this project would be temporary. These temporary effects include: 1) handling of adult and juvenile fish when removing fish from the work area during reservoir drawdowns, 2) elevated suspended sediment and turbidity above background levels when reservoir levels are brought back up and water floods the newly excavated area, and 3) temporary loss of foraging opportunities from excavating existing substrate which is likely to contain benthic invertebrates.

2.5.1 Effects on Listed Species

Chinook salmon, coho, and steelhead from several populations (Figure 1) are likely be present within the Project Area during certain times of the year. The following sections detail the life history strategies of the three listed species considered in this opinion, and highlights which life history phase(s) would be present in the action area (and potentially exposed to effects) during the winter reservoir draw down and fish salvage effort (January through mid-April) and the subsequent fall reservoir drawdown and fish salvage effort (September and October).

Spring Chinook salmon

Lower Columbia River spring Chinook salmon spawn primarily in upstream, higher elevation portions of large subbasins. Adults enter the lower Columbia River from March through June, well in advance of spawning in August and September (NMFS 2013). Their migration into tributary headwaters requires several months. Spring Chinook salmon spawn in September and October and their eggs incubate approximately September through November. Fry emerge and early rearing takes place approximately late September through the end of January. Fry and smolt rearing and migration takes place approximately late January through early to late spring of the following year. This extended freshwater residency is characteristic of Chinook salmon that inhabit watersheds where temperature and flow conditions provide suitable habitat conditions throughout the year. Most stream-type juveniles emigrate from fresh water as yearlings, typically in the spring of their second year. However, some juveniles from Lower Columbia River spring Chinook salmon populations migrate downstream from their natal tributaries in the fall and early winter into larger rivers, including the mainstem Columbia River, where they are believed to over-winter before outmigrating the next spring as yearling smolts (LCFRB 2010a).

Spring Chinook salmon from the Upper Cowlitz and Cispus River populations are likely to be present in the action area. Both populations are identified as core, genetic legacy, and primary populations for recovery. The target abundance for each of these two populations is an annual return of 1,800 adult natural-origin spawners. Both populations are currently at less than ten percent of their respective recovery target abundance, with a combined 2015-2019 5-year geometric mean of raw natural-origin spawner abundance of only 171 fish. Return numbers for these two populations are combined due to the current trap-and-haul system used to transport fish around Cowlitz river dams lacking volitional fish passage structures.

Effects of fish handling on spring Chinook salmon:

Adult Upper Cowlitz and Cispus River spring Chinook salmon are not likely to be present in the action area during the winter reservoir drawdown and fish salvage efforts (January through mid-April) as they would arrive or migrate through the action area in late spring. However, adults from these populations are likely to be present during the September-October reservoir drawdown and fish salvage effort and would be exposed to effects of the fish salvage efforts including handling and possibly injury or death.

Juvenile Upper Cowlitz and Cispus River spring Chinook salmon are likely to be present during both the winter and fall reservoir drawn-down and fish salvage efforts. As mentioned previously they are stream-type salmon and generally rear in the river for a full year. Juveniles from these populations are likely to be rearing in their natal stream, including the reservoir, through the spring of the year following their emergence. One generation, or cohort, of juvenile fish from these populations is likely to be exposed to effects of both the winter (January through mid-

April) and fall (September-October) fish salvage efforts including handling and possibly injury or death.

Effects of elevated suspended sediment and turbidity on spring Chinook salmon: Elevated suspended sediment and turbidity is likely to occur when the reservoir level is brought back up following the drawdowns in January- mid-April and September-October, particularly after the work area is excavated. Elevated suspended sediment and turbidity may also occur during the drawdown if a heavy rain event were to occur and wash exposed sediment from the work area into the remaining water of the reservoir.

Adult Upper Cowlitz and Cispus River spring Chinook salmon are not likely to be present in the action area during the winter reservoir drawdown (January through mid-April) as they would arrive or migrate through the action area in late spring. However, adults from these populations are likely to be present during the September-October reservoir drawdown and are likely to be exposed to elevated suspended sediment and turbidity, causing altered swimming behavior with fish either attracted to or avoiding the area of turbidity (Wilber and Clarke 2001). Avoiding the area will cause short-term energy expenditure and possible physiological stress.

Juvenile Upper Cowlitz and Cispus River spring Chinook salmon are likely to be present during both the winter and fall reservoir drawn-down. Effects of elevated suspended sediment and turbidity on these juveniles include diminished egg-to-fry survival (Jensen et al. 2009), alarm reactions, physiological stress, impaired and/or disrupted feeding behavior, diminished reaction distances linked with impaired foraging, and diminished growth (Crouse et al. 1981).

Effects of temporary loss of foraging opportunities on spring Chinook salmon: A temporary loss of foraging opportunities is anticipated as a consequence of excavating sediment within the debris barrier work area. As the work area is a shallow alcove at the edge of the reservoir, it likely provides foraging habitat. During the January through mid-April drawdown, the top approximately five feet of sediment would be removed from an approximately 0.4 acre area where work on the debris barrier would later be performed. Benthic invertebrates present in the top layer of sediment would be removed and the remaining sediment would have fewer or no benthic invertebrates until recolonized. When the reservoir would be brought back up following the January through mid-April drawdown, fish would have access to this newly excavated area however the value of this area as foraging habitat would be diminished until benthic invertebrates re-colonize the sediment. Most studies show recolonization by benthic invertebrates within months to a year and it is generally observed that shallower habitats (less than 20 meters deep) recover faster (Wilber and Clarke 2017).

Adult spring Chinook salmon would be present during this period of benthic invertebrate recolonization but this exposure would have no significant response, as adult salmon generally do not feed while migrating to their spawning habitats or while spawning.

Juvenile spring Chinook salmon would be present during this period and would be exposed to diminished prey resources, energy expenditure to avoid the area, and increased intraspecific competition for prey resources. This could cause reduced growth, fitness, or decreased survival among a small number of the present cohort of juveniles.

Fall Chinook salmon
Fall Chinook salmon ("tule" stock) spawn in moderate-sized streams and large river mainstems, including most tributaries of the lower Columbia River. Most Lower Columbia River fall Chinook salmon enter freshwater from August to September and spawn from late September to November, with peak spawning activity in mid-October (NMFS 2013). These fish display an "ocean-type" life history. Juveniles typically begin emigrating downstream as subyearlings at 1 to 4 months of age and enter salt water in late summer or autumn. Juvenile trapping indicates that individual populations display different combinations of two basic temporal patterns: an early fry outmigration downstream into intertidal areas in the early spring, followed by a component that rears for a longer period in natal tributary habitat and outmigrates in late spring/early summer (NMFS 2013; Cooney and Holzer 2011).

Fall Chinook salmon from the Upper Cowlitz River population are likely to be present in the action area. This population is identified as a stabilizing population for recovery. The Recovery Plan does not give a target abundance for this population. The current abundance (5-year geometric mean of raw natural-origin spawner abundance) for this population is 1,761 adult returning spawners.

Effects of fish handling on fall Chinook salmon:
Adult fall Chinook salmon from the Upper Cowlitz River population are not likely to be exposed to effects during the January through mid-April reservoir drawdown and fish salvage effort as they would not yet have entered freshwater. However, these fish are likely to be exposed to effects during the September-October reservoir drawdown and fish salvage effort as they are migrating upriver to spawning sites and spawning during this time. The action area is not known to provide spawning habitat but individuals are likely to move through the action area en route to spawning habitats upriver. These individuals are likely to be exposed to effects of the fish salvage efforts including handling and possibly injury or death.

Juvenile fall Chinook salmon from the Upper Cowlitz River population are likely to be exposed to effects of the January through mid-April reservoir drawdown and fish salvage effort as the fry typically emerge from eggs in early spring (February through April) and begin downstream migration March through June. Juveniles from spawning habitats near the action area are likely to be exposed to effects of the proposed action including fish salvage efforts including handling and possibly injury or death. This is more likely towards the latter end of the January through mid-April reservoir drawdown and fish salvage effort. Juvenile fall Chinook salmon from the Upper Cowlitz River population are not likely to be exposed to effects of the September-October reservoir drawdown and fish salvage effort, as these juveniles are likely to have already migrated downstream.

Effects of elevated suspended sediment and turbidity on fall Chinook salmon:
Elevated suspended sediment and turbidity is likely to occur when the reservoir level is brought back up following the drawdowns in January- mid-April and September-October, particularly after the work area is excavated. Elevated suspended sediment and turbidity may also occur during the drawdown if a heavy rain event were to occur and wash exposed sediment from the work area into the remaining water of the reservoir.

Adult fall Chinook salmon from the Upper Cowlitz River population are unlikely to be present during the January- mid-April drawdown. They are likely to be present during the September-October drawdown, and would be exposed to increased sediment and turbidity associated with this fall drawdown and subsequent raising of the reservoir back to full pool level. Effects of increased sediment and turbidity on adult fall Chinook salmon include increased energy expenditure to avoid the area (Wilber and Clarke 2001).

Juvenile fall Chinook salmon are likely to be present during the January- mid-April drawdown and would likely have migrated downstream prior to the fall drawdown. During the January-mid-April drawdown and subsequent raising of the reservoir back to full pool level, juvenile fall Chinook salmon are likely to be exposed to effects of increased sediment and turbidity including diminished egg-to-fry survival (Jensen et al. 2009), alarm reactions, physiological stress, impaired and/or disrupted feeding behavior, diminished reaction distances linked with impaired foraging, and diminished growth (Crouse et al. 1981).

Effects of temporary loss of foraging opportunities on fall Chinook salmon:
A temporary loss of foraging opportunities is anticipated as a consequence of excavating sediment within the debris barrier work area. As the work area is a shallow alcove at the edge of the reservoir, it likely provides foraging habitat. During the January through mid-April drawdown, the top approximately five feet of sediment would be removed from an approximately 0.4 acre area where work on the debris barrier would later be performed. Benthic invertebrates present in the top layer of sediment would be removed and the remaining sediment would have fewer or no benthic invertebrates until recolonized. When the reservoir would be brought back up following the January through mid-April drawdown, fish would have access to this newly excavated area however the value of this area as foraging habitat would be diminished until benthic invertebrates re-colonize the sediment. Most studies show recolonization by benthic invertebrates within months to a year and it is generally observed that shallower habitats (less than 20 meters deep) recover faster (Wilber and Clarke 2017).

Adult fall Chinook salmon are likely to be present for a portion of the time during which benthic invertebrates would be recolonizing the excavated debris barrier work area, but are not likely to be affected as adult salmon generally do not feed while migrating to their spawning habitats or while spawning.

Juvenile fall Chinook salmon are likely to be present for a portion of the time during which benthic invertebrates would be recolonizing the excavated debris barrier work area, and would be exposed to diminished prey resources, energy expenditure to avoid the area, and increased intraspecific competition for prey resources.

Coho
Lower Columbia River coho salmon (*Oncorhynchus kisutch*) are typically categorized into early- and late-returning stocks (NMFS 2013). Early-returning (Type S) adult coho salmon enter the Columbia River in mid-August and begin entering tributaries in early September, with peak spawning from mid-October to early November. Late-returning (Type N) coho salmon pass through the lower Columbia from late September through December and enter tributaries from

October through January. Most spawning occurs from November to January, but some occurs as late as March.

Coho salmon construct redds in gravel and small cobble substrate in pool tailouts, riffles, and glides, with sufficient flow depth for spawning activity (NMFS 2013). Eggs incubate over late fall and winter for about 45 to 140 days, depending on water temperature, with longer incubation in colder water. Fry may thus emerge from early spring to early summer. Juveniles typically rear in freshwater for more than a year. After emergence, coho salmon fry move to shallow, low-velocity rearing areas, primarily along stream edges and inside channels. Juvenile coho salmon favor pool habitat and often congregate in quiet backwaters, side channels, and small creeks with riparian cover and woody debris. Side-channel rearing areas are particularly critical for overwinter survival, which is a key regulator of freshwater productivity.

Coho present in the action area are Upper Cowlitz and Cispus River populations of the listed LCR ESU coho. These populations contain both early and late run timings. Both populations are designated as Primary for recovery. Their abundances must increase from a net baseline persistence probability of “very low” to “high” in order to meet recovery objectives. For the Upper Cowlitz River population, the current abundance is 686 returning adult natural origin spawners, which is approximately 34 percent of the recovery target number (2,000) (Ford 2022). For the Cispus River population, the current abundance is 1,546 returning adult natural origin spawners, which is about 77 percent of the recovery target number of 2,000 fish (Ford 2022).

Effects of fish handling on coho:
During the January- mid-April reservoir drawdown and fish salvage effort, early-returning (Type S) adult coho are unlikely to be present in the action area as they would have already spawned and died. However, late-returning (Type N) adult coho are likely to be present at this time as they would be migrating through the action area en route to spawning habitat upriver. The action area is not characterized as spawning habitat so the likelihood of adult coho lingering in the action area is low. Type N adult coho would be exposed to effects of the January- mid-April reservoir drawdown and fish salvage effort, including handling and possible injury or death.

During the September-October reservoir drawdown and fish salvage effort, both the early returning (Type S) and late-returning (Type N) adult coho are likely to be present in the action area. These fish are likely to be exposed to effects of the September-October reservoir drawdown and fish salvage effort, including handling and possible injury or death.

As juvenile coho typically rear in freshwater for more than a year, they are likely to be present in the action area during both the January through mid-April and September-October reservoir drawdown and fish salvage efforts. Juvenile are likely to be exposed to the effects of handling including possible injury or death.

Effects of elevated suspended sediment and turbidity on coho:
Elevated suspended sediment and turbidity is expected to occur after each reservoir drawdown when the reservoir level is brought up to full pool level, as well as possibly during each drawdown should heavy rains occur and wash sediment from the debris barrier work site into the remaining water of the reservoir. Adult type N coho are likely to be exposed to these effects

during the January through mid-April reservoir drawdown, and adult coho from both Type N and Type S are likely to be exposed to these effects during the September-October drawdown. Juveniles from type N and type S stocks are likely to be exposed to effects of the winter and fall reservoir drawdowns. Effects of elevated sediment and turbidity on adult coho include increased energy expenditure to avoid the area (Wilber and Clarke 2001). Effects on juvenile coho include diminished egg-to-fry survival (Jensen et al. 2009), alarm reactions, physiological stress, impaired and/or disrupted feeding behavior, diminished reaction distances linked with impaired foraging, and diminished growth (Crouse et al. 1981).

Effects of temporary loss of foraging opportunities on coho:
A temporary loss of foraging opportunities is anticipated as a consequence of excavating sediment within the debris barrier work area. As the work area is a shallow alcove at the edge of the reservoir, it likely provides foraging habitat. During the January through mid-April drawdown, the top approximately five feet of sediment would be removed from an approximately 0.4 acre area where work on the debris barrier would later be performed. Benthic invertebrates present in the top layer of sediment would be removed and the remaining sediment would have fewer or no benthic invertebrates until recolonized. When the reservoir would be brought back up following the January through mid-April drawdown, fish would have access to this newly excavated area however the value of this area as foraging habitat would be diminished until benthic invertebrates re-colonize the sediment. Most studies show recolonization by benthic invertebrates within months to a year and it is generally observed that shallower habitats (less than 20 meters deep) recover faster (Wilber and Clarke 2017).

Adult coho are not likely to be affected by the temporary loss of foraging opportunities as they do not typically feed while migrating or spawning.

Juvenile coho are likely to be present in the action area while benthic invertebrates are recolonizing, and are likely to experience diminished prey resources, energy expenditure to avoid the area, and increased intraspecific competition for prey resources.

Steelhead
Steelhead present in the action area are Cascade winter-run Upper Cowlitz River and Cispus River populations of the listed Lower Columbia River DPS Steelhead. Both populations are identified as core, genetic legacy, and primary populations for recovery and both must go from “very low” net baseline persistence probability to “high” in order to meet recovery objectives. The Upper Cowlitz River population’s current abundance is 199 fish, which is about 40% of the Recovery target of 500 returning natural-origin adult spawners (Ford 2022). Ford 2022 did not have a current abundance number for the Cispus River population; there is high uncertainty regarding whether this population is meeting recovery targets and it is assumed that this population is at less than ten percent of the recovery goal abundance target.

Most winter-run steelhead re-enter freshwater between December and May as sexually mature fish and peak spawning for winter-run steelhead occurs in late April and early May (NMFS 2013). Steelhead may enter streams and arrive at spawning grounds weeks or even months before spawning (NMFS 2013) which means that adult steelhead are likely to be present in the action area during the January through mid-April reservoir drawdown and fish salvage efforts.

Rates of iteroparity (repeat spawning) for winter steelhead in the Columbia Basin are reported as high as 8 to 17 percent (NMFS 2013).

Steelhead fry emergence generally occurs from March into July with peak emergence time generally in April and May (NMFS 2013). Steelhead typically rear in streams for some time, with smolts migrating at ages ranging from 1 to 4 years and most steelhead smolts migrating after 2 years in freshwater (NMFS 2013). In the lower Columbia River, outmigration of steelhead smolts (of both summer and winter life-history types) generally occurs from March to June, with peak migration usually in April or May. For this project, timing of steelhead fry emergence followed by their (typically) 2 years of rearing in freshwater means that newly emerged fry as well as 1- and 2- year old juvenile steelhead are likely to be present in the action area and exposed to effects of the reservoir drawdown and fish salvage effort.

Effects of fish handling on steelhead:
Reservoir drawdown and fish salvage would take place when adult steelhead, newly emerged fry, and rearing juvenile steelhead are likely to be present and exposed to effects of the action. The planned reservoir drawdowns themselves have the potential to strand and isolate fish species below the OHWM of the reservoir where the debris barrier would be moored. The majority of the work area would be dewatered naturally but any areas identified to contain standing water would be surveyed for fish and if present, fish rescue would be performed by a qualified biologist to relocate the fish back into deeper waters of the reservoir. Fish rescue to remove any stranded fish from the work area during draw down is a measure to reduce injury or death, however handling itself can stress, injure or kill some fish, and any fish inadvertently missed during rescue efforts would die from stranding. Effects of fish handling on steelhead include possible injury or death.

Effects of elevated suspended sediment and turbidity on steelhead:
Fish are not expected to be exposed to high levels of suspended sediment during work as this will occur after the mooring areas would have been allowed to naturally dewater during the reservoir drawdown. Heavy equipment would be used for excavating the mooring area and would be staged in the uplands. Excavation of the mooring site would require a track hoe and/or front loader to remove the sediment and transport it to the upland disposal site. Impacts to listed fish could include some sediment and bank disturbance while heavy equipment accesses the reservoir but this area would be stabilized to reduce the potential for erosion. The mooring area is approximately 1.5 acres and approximately 0.4 acres would be excavated. When the area is re-wetted, or if heavy rains occur while work is ongoing, increased sediment levels in water where fish are present would be expected. While exposure to high levels of sediment can result in injury in certain circumstances, here there is no constraint of fish to remain in the affected area. Expected response of fish would be avoidance behavior. If such avoidance behavior results in juveniles of the species moving to deeper water, some increased risk of predation results. Avoidance can also prevent smaller juveniles from accessing preferred habitat with available prey and refugia. In a small number of displaced individuals, bioenergetic expenditure could exceed nutritional intake, resulting in reduced growth, especially if the density of individuals creates a territorial response (Grant and Imre 2005, Matte et al. 2020).

Effects of temporary loss of foraging opportunities on steelhead:
Excavation would result in the removal/disturbance of the existing substrate which may contain benthic invertebrates that provide forage for ESA listed fish species. This disturbance would result in short-term loss of foraging opportunities for listed fish. However, these benthic species are expected to recolonize the disturbed area over six months (McCabe et al. 1996; McCabe et al. 1998). The temporary loss of foraging opportunities is unlikely to affect adult steelhead as they rarely eat while they are in freshwater (NMFS 2013). Juvenile steelhead typically rear in freshwater for two years so they would be present throughout the period in which benthic invertebrates would be recolonizing the work area following excavation. Effects of temporarily diminished foraging opportunities on juvenile steelhead include diminished prey resources, energy expenditure to avoid the area, and increased intraspecific competition for prey resources.

2.5.2 Effects on Critical Habitat

The Action Area contains freshwater rearing and freshwater migration PCEs and the proposed action is likely to have a temporary adverse effect on these PCEs. The proposed action will permanently remove 1,000 cubic yards of sediment in designated critical habitat for Chinook salmon, coho, and steelhead which may affect benthic invertebrate prey and disrupt existing substrate conditions in freshwater rearing sites and migration corridors. As described more fully above, the effects of the proposed action are a limited period of increased turbidity, and a longer, but also limited period when prey availability is reduced. Here we evaluate how these habitat changes influence the conservation potential of the critical habitat.

1. Freshwater Spawning Sites
The action area does not contain spawning habitat. Spawning values will not be adversely affected.

2. Freshwater Rearing Sites
Both water quality and prey will be reduced in freshwater rearing areas. Approximately 0.4 acres of rearing habitat would be temporarily unavailable. Water quality and prey availability within this site would be temporarily reduced for approximately 1 year. The limited spatial and temporal extent of the water quality reduction together with the timing of the work, indicate that rearing conditions are largely retained, and the temporal reduction will not diminish rearing values overall.

3. Freshwater Migration Corridors
The mooring area below the OHWM is located off the main reservoir in an area excavated for the construction of the dam in 1994. It is not considered an integral habitat component in the reservoir; however, it may be used for migration during certain times of the year when the reservoir is at full pool level. The permanent excavation of 1,000 cubic yards of sediment and lowering the reservoir bottom by 5 feet in this area would change habitat conditions, however the habitat is anticipated to return to a similar state within about 1 year. The lowering of this area by 5 feet would not meaningfully change the way fish use this area. It would continue to function as a shallow protected alcove and provide resting and foraging habitat for juvenile salmonids during migration. Temporary proposed actions would not alter the existing freshwater migration corridors value since the reservoir would be lowered and construction would occur in the dry. Permanent elements of the propose actions would alter the existing freshwater migration

corridor's value through excavation of sediment; however this area is anticipated to have similar function for listed salmonids following excavation.

2.6. Cumulative Effects

"Cumulative effects" are those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02 and 402.17(a)). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. Cumulative effects upstream and downstream of the Cowlitz Falls Dam area include urban development, agriculture, and timber harvest. These effects are likely to occur over time.

The Washington Salmon Recovery Funding Board is funding (in part) a project in process in the Upper Cowlitz basin upriver from the action area. In the Cispus River, the Cowlitz Tribe is partnering with the USDA Forest Service to restore salmon and steelhead habitat by building in-stream structures in 1,900' lineal feet of the main stem Cispus River and Yellowjacket Creek to scour pools, sort gravels, support floodplain forest succession, and provide cover for adult and juvenile fish. The main stem structures will be positioned to encourage development of a multi-thread channel network, providing side channel and off-channel habitat throughout a range of flows for spring Chinook salmon, winter steelhead, and coho. Tribe or contract crews will plant locally adapted native trees and shrubs to accelerate riparian restoration. The project site is located south of Randle, Washington, in eastern Lewis County. It is adjacent to the Cispus Learning Center, an outdoor education facility that hosts kindergarten through 12th-grade students year-round. The project started in 2019, is currently active, and is in Phase III. More details can be found on the Washington State Recreation and Conservation Office project details page (RCO 2022). As this project is upriver from the action area it will enhance water quality in the action area and enhance habitat for listed fish that would migrate through the action area en route to or migrating downstream from this restored habitat upriver.

Because the action area is within the reservoir, we expect that, other than recreation, most activities that occur in the action area will have some federal nexus such as Corp permitting or FERC authorization. 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).

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

As specified in the Environmental Baseline section (Section 2.4), several populations of these listed species are anticipated to be present in the action area and/or upriver of the action area and passing through the site during adult migration or juvenile emigration, or juvenile rearing. Also specified in the Environmental Baseline section are the roles that each of these populations plays unto recovery of their species. Of note is that the current abundance of spring-run Upper Cowlitz and Cispus River populations of LCR Chinook salmon is at less than ten percent of the recovery target number. Both of these populations are core as well as genetic legacy populations and must go from "very low" to "high plus" persistence probability in order to meet recovery objectives. Also of note is that the winter-run Cispus River steelhead population of LCR steelhead is at very low abundance.

Fish from these populations face a series of dams without volitional fish passage. The Mossyrock and Mayfield dams block fish passage on parts of the Cowlitz River (Tacoma Public Utilities 2022). A trap-and-haul program collects upstream migrating fish downstream of Mayfield Dam and transports them by truck to sites on the Tilton, Cowlitz, and Cispus Rivers to continue their journey. Juvenile salmon and steelhead migrating downstream from the upper Cowlitz River are collected upstream of Riffe Lake and transported downstream to stress relief ponds at the Cowlitz Salmon Hatchery, then released into the lower river to continue their journey. According to Ford 2022 these populations have very limited abundances therefore only a small number of listed fish would potentially be present in the action area; however death or injury to individuals from these populations may be significant as the total abundance of these populations is so limited.

To this poor baseline we add the effects of the proposed action. With the exception of injury or death associated with fish salvage, these are largely minor and/or temporary effects on ESA listed species:

- reduced growth of a small number of fish due to increased competition and reduced benthic invertebrate prey resources caused by excavation within the work area prior to completing the debris barrier maintenance and displacement from preferred areas during high turbidity;
- a small reduction in total abundance from increased predation during salmonid avoidance of areas of higher turbidity;
- injury or death among a small number of fish captured during fish salvage.

The action will add short-term sublethal and potentially some lethal effects to LCR coho, LCR Chinook salmon, LCR steelhead, largely among juveniles from the seven geographically relevant populations that comprise the species. The most acute effects will occur during reservoir drawdown and fish salvage, and turbidity when water re-enters the work site. Timing of the project is intended to minimize exposure of vulnerable life stages, and we therefore conclude that fish injured or killed, when all sources of injury or death associate with the project are taken together, will be at levels low enough that the small reduction in abundance will not be discernible among returns of these cohorts i.e., productivity is unlikely to be appreciably affected. Therefore, even assuming that the proposed action would impact population viability parameters, at most this would consist of a small contribution to maintaining those parameters in their current state. Because the abundance and productivities of these population are below recovery targets, maintaining the existing parameters presumably delays reaching recovery targets. The contribution of the proposed action to that delay, if any, is extremely small for the reasons described above: the primarily sublethal nature of the effects and small percentage of individuals within the affected populations likely to be exposed to the effects of the proposed action. Because the effects of the proposed action are not expected to measurably affect population trends among the salmonids exposed to the action that contribute to the viability of the of these species, the overall effects of the action will not jeopardize the existence of LCR coho salmon, LCR Chinook salmon, and LCR steelhead, or appreciably reduce the likelihood of both the survival and recovery of these ESUs and DPS in the wild.

2.7.2 Critical Habitat

The action area contains designated critical habitat for LCR coho salmon, LCR Chinook salmon, and LCR steelhead. Project effects on PBFs of critical habitat for these three species are temporary and when we add them to the baseline, because they shortly revert to baseline levels, the conservation values of the habitat for rearing and migration are not considered diminished. The action area is not identified as having habitat suitable for spawning. The baseline condition of rearing and migration habitat is impaired by degraded water quality, bank armoring, channelization, and loss of riparian cover. Considering future population growth and climate change, there will continue to be private and state actions that will produce cumulative effects associated with development (e.g., associated impervious surfaces, further reduced riparian cover as forest lands are transitioned into housing or agriculture). The effects of human population growth will place additional pressures on PBFs of critical habitat, but the precise effect of these pressures cannot be accurately predicted. Within the action area, the overall conservation value of the critical habitat is expected to remain unchanged from its currently constrained condition when the consequences of the proposed action are added to the baseline condition. As such, we do not expect this condition to permanently diminish the conservation value of any PBFs of critical habitat.

2.8. Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, the effects of other activities caused by the proposed action, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of LCR Chinook salmon, LCR coho salmon, and LCR steelhead, or destroy or adversely modify their designated critical habitat.

2.9. Incidental Take Statement

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

2.9.1 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 create a range of responses, many of which cannot be observed without research and rigorous monitoring. In these circumstances, we describe 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 will 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. Harm to juvenile LCR Chinook salmon, adult and juvenile LCR coho salmon, and adult and juvenile LCR steelhead associated with fish handling during reservoir drawdown and fish salvage efforts. The extent of take for fish handling is the extent of the temporary dry work area below the ordinary high-water mark of the reservoir (1.0 acre). This surrogate is causally linked to incidental take because increasing the area of fish salvage efforts increases the numbers of fish potentially exposed to handling.

2. Harm to adult and juvenile LCR Chinook salmon, LCR coho salmon, and LCR steelhead associated with temporary loss of foraging habitat from isolating the work site (1.0 acres) and excavating within the work site (0.4acre). Adult and juvenile life history phases of LCR Chinook salmon, LCR coho salmon, and LCR steelhead will have diminished foraging opportunities during the project while they are physically barricaded out of the work site. Additionally, foraging opportunities will be diminished short-term after the project is completed and fish are again able to access the site while benthic invertebrates recolonize the newly excavated areas within the work site. The extent of take for loss of foraging habitat is the physical area of the work site (1.0 acre). This surrogate is causally linked to incidental take as this habitat will be unavailable to listed species during the project and for a short period of time after the project is completed.

3. Harm to LCR Chinook salmon, LCR coho salmon, and LCR steelhead associated with suspended sediment related to excavation of the worksite. Excavation will take place while the reservoir is drawn down and sediment will be released when reservoir levels are brought back up and water returns to the site. The extent of take for sediment release is the physical extent of the area where material will be excavated (0.4 acres). This surrogate is causally linked to incidental take because the potential for harm increases as extent or intensity of turbidity increases.

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" are measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02). The USACE and their applicant shall minimize incidental take by:

1. Ensuring completion of a monitoring and reporting program to confirm that the take exemption for the proposed action is not exceeded, and that the terms and conditions in this incidental take statement are effective in minimizing incidental take.

2. Ensuring that equipment is thoroughly cleaned before being brought to the site. Use of vegetable-based fuels and lubricants for equipment is preferred.

3. Ensuring that any depressions made that could strand fish are smoothed before crews leave the site and/or as part of the post-work stabilization.

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 U.S. Army Corps of Engineers 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 (monitoring):
   a) Reporting: USACE and the applicant shall monitor and report on the following items, at a minimum:
      (1) Turbidity monitoring. Document the size and duration of any visible turbidity plum, including monitoring location and time.

(2) Fish Isolation Structures. Report the as-built areas of temporary fish isolation structures (i.e., temporary berm).
(3) Fish salvage. Report the number and life history phase of all fish salvaged (e.g., juvenile vs adult), making note of injured individuals. Document number of and life history phase of individuals, by species, killed during salvage.
(4) Submit reports to NMFS addressing turbidity monitoring, fish isolation structures, and fish salvage no later than January 31, until project construction is substantially completed.
(5) Submit monitoring reports to NMFS through the following e-mail addresses: projectreports.wcr@noaa.gov with a cc to Amy.Kocourek@noaa.gov.

2.10. Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, "conservation recommendations" are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02).
To further reduce the effects of land use on critical habitat and degraded water quality on listed species, USACE should encourage the applicant to improve riparian habitat in the work area by planting native trees and shrubs in suitable areas. Riparian plantings would mature to provide additional cover and shading, particularly since these plantings would be on the south side of the river.

2.11. Reinitiation of Consultation

This concludes formal consultation for the Cowlitz Falls Debris barrier Coating and Cathodic Protection Project.

Under 50 CFR 402.16(a): "Reinitiation of consultation is required and shall be requested by the Federal agency or by the Service where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and: (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."

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

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. Under the MSA, this consultation is intended to promote the conservation of EFH as necessary to support sustainable fisheries and the managed species' contribution to a healthy ecosystem. For the purposes of the MSA, EFH means "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity", and includes the physical, biological, and chemical properties that are used by fish (50 CFR 600.10). Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside of it and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) of the MSA also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH. Such recommendations may include measures to avoid, minimize, mitigate, or otherwise offset the adverse effects of the action on EFH [CFR 600.905(b)].

This analysis is based, in part, on the EFH assessment provided by the USACE and their applicant and descriptions of EFH for Pacific Coast salmon (PFMC 2014); contained in the fishery management plans developed by the PFMC and approved by the Secretary of Commerce.

3.1. Essential Fish Habitat Affected by the Project

The proposed action and action area are described in the Introduction of this document. The action area is designated as EFH for various life-history stages of Chinook salmon (*O. tshawytscha*) and coho salmon (*O. kisutch*).

3.2. Adverse Effects on Essential Fish Habitat

1. Temporary isolation of 1.0 acre of rearing and foraging habitat from the Cowlitz River Lake Scanewa Reservoir for use as work site.

2. Excavation of 0.4 acres (up to 1,000 cubic yards) t of sediment which will degrade habitat temporarily until benthic invertebrates recolonize the area.

3. Short-term water quality reductions associated with increased sediment load when reservoir levels are brought back up and water re-enters the excavated area.

These effects are described more fully in Section 2 of this document. All adverse effects would apply to salmon essential fish habitat. No habitat area of particular concern are identified in the action area or would be affected by these adverse effects.

3.3. Essential Fish Habitat Conservation Recommendations

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

1. Take care when removing temporary berms, silt fence, and sediment curtain materials to minimize river bed disturbance and suspended sediments.
2. Return flow to the work area at a slow, measured pace to minimize bed disturbance and downstream release of suspended sediments.

3. Minimize the volume of material excavated below the ordinary high water line to minimize sediment release and shorten duration of temporary foraging habitat loss.

Fully implementing these EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in Section 3.2, above, approximately 1 acre of designated EFH for Pacific Coast salmon.

3.4. Statutory Response Requirement

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

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

3.5. Supplemental Consultation

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

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

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

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion is the USACE. Other interested users could include the applicant (Lewis County PUD), the Cowlitz

Tribe, citizens of affected areas, the Lower Columbia Fish Recovery Board, and other interest groups such as American Rivers or the Audubon Society. Individual copies of this opinion were provided to the USACE. The document will be available at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adhere to conventional standards for style.

4.2 Integrity

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

4.3 Objectivity

Information Product Category: Natural Resource Plan

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

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

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

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

5. REFERENCES

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