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-2019-03126

November 20, 2020

Michelle Walker
Chief, Regulatory Branch
Seattle District, Corps of Engineers
PO Box 3755
Seattle, Washington 98124-3755

Re: Endangered Species Act Section 7(a)(2) Biological Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Discovery Clean Water Alliance, Phase 5A Project – Columbia River Outfall and Effluent Pipeline, Vancouver, Clark County, Washington (COE NWS-2017-25) Hydrologic Unit codes: 170800030103 (Lower Salmon Creek), 170800030104 (Lake River-Frontal Columbia), and 170800030200 (Hayden Island-Columbia River)

Dear Ms. Walker:

Thank you for your letter of November 26, 2019 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 Discover Clean Water Alliance Phase 5 Project. This consultation was conducted in accordance with the 2019 revised regulations that implement section 7 of the ESA (50 CFR 402, 84 FR 45016).

In this opinion, NMFS concludes that the proposed action is not likely to jeopardize the continued existence or result in adverse modification of designated critical habitat for the following species:

- *Oncorhynchus tshawytscha:* Lower Columbia River (LCR) Chinook salmon Upper Willamette River (UWR) Chinook salmon, Upper Columbia River (UCR) spring-run Chinook salmon, Snake River (SR) spring/summer-run Chinook salmon, SR fall-run Chinook salmon,
- *O. kisutch*: LCR coho salmon
- *O. keta*: Columbia River chum salmon
- *O. nerka*: Snake River (SR) sockeye salmon
- *O. mykiss*: LCR steelhead, UWR steelhead, Middle Columbia River steelhead, UCR steelhead, Snake River Basin (SRB) steelhead
- *Thaleichthys pacificus*: Southern distinct population of eulachon (hereafter referred to as eulachon),
- *Acipenser medirostris:* Southern distinct population of green sturgeon (hereafter referred to as green sturgeon).

As required by section 7 of the Endangered Species Act, the National Marine Fisheries Service provided an incidental take statement with the biological opinion. The incidental take statement describes reasonable and prudent measures the National Marine Fisheries Service considers necessary or appropriate to minimize incidental take associated with this action. The take statement sets forth nondiscretionary terms and conditions. Incidental take from actions that meet the term and condition will be exempt from the Endangered Species Act take prohibition.

NMFS also reviewed the likely effects of the proposed action on essential fish habitat (EFH), pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1855(b)), and concluded that the action would adversely affect the EFH of Pacific Coast salmon and Pacific Coast Groundfish. Therefore, we have included the results of that review in Section 3 of this document.

Please contact Scott E. Anderson (scott.anderson@noaa.gov, 360-753-5828) 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: James Carsner, USACE

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

Discovery Clean Water Alliance, Phase 5A Project-Columbia River Outfall and Effluent Pipeline Vancouver, Clark County, Washington (COE NWS-2017-25)

NMFS Consultation Number: WCRO-2019-03126

Action Agency: United States Army Corps of Engineers

Affected Species and NMFS' Determinations:

ESA-Listed Species	ESA Status	Is Action Likely to Adversely Affect Species?	Is the Action likely to Jeopardize Species?	Is the action likely to adversely affect Critical Habitat?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Lower Columbia River Chinook salmon	T	Yes	No	Yes	No
Upper Willamette River Chinook salmon	T	Yes	No	Yes	No
Upper Columbia River spring-run Chinook salmon	E	Yes	No	Yes	No
Snake River spring/summer run Chinook salmon	T	Yes	No	Yes	No
Snake River fall-run Chinook salmon	T	Yes	No	Yes	No
Columbia River chum salmon	T	Yes	No	Yes	No
Lower Columbia River coho salmon	T	Yes	No	Yes	No
Snake River sockeye salmon	E	Yes	No	Yes	No
Lower Columbia River steelhead	T	Yes	No	Yes	No
Upper Willamette River steelhead	T	Yes	No	Yes	No
Middle Columbia River steelhead	T	Yes	No	Yes	No
Upper Columbia River steelhead	T	Yes	No	Yes	No
Snake River Basin steelhead	T	Yes	No	Yes	No
Southern green sturgeon	T	Yes	No	Yes	No
Eulachon	T	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: November 20, 2020

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.), and implementing regulations at 50 CFR 402, as amended.

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

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

Updates to the regulations governing interagency consultation (50 CFR part 402) were effective on October 28, 2019. We are applying the updated regulations to the consultation. As the preamble to the final rule adopting the regulations noted, "[t]his final rule does not lower or raise the bar on section 7 consultations, and it does not alter what is required or analyzed during a consultation. Instead, it improves clarity and consistency, streamlines consultations, and codifies existing practice." We have reviewed the information and analyses relied upon to complete this biological opinion in light of the updated regulations and conclude the opinion is fully consistent with the updated regulations.

1.2 Consultation History

This biological opinion is based on the information provided in the October 22, 2019, biological evaluation (BE) and supporting documents. At that time, the U.S. Army Corps of Engineers (COE) requested formal consultation. We requested further information on unregulated contaminants in effluent on October 23, 2019. On November 25, 2019, NMFS received the requested information and initiated formal consultation. A complete record of this consultation is on file at the Oregon Washington Coastal Office located in Lacey, Washington. The COE concluded that the proposed action is likely to adversely affect:

- Lower Columbia River (LCR) Chinook salmon (*Oncorhynchus tshawytscha),* Upper Willamette River (UWR) Chinook salmon, Upper Columbia River (UCR) spring run Chinook salmon, Snake River (SR) spring/summer-run Chinook salmon, SR fall-run Chinook salmon,

- LCR coho salmon (*O. kisutch)*
- Columbia River chum salmon (*O. keta*),
- Snake River (SR) sockeye salmon (*O. nerka*)
- LCR steelhead, UWR steelhead, Middle Columbia River steelhead, UCR steelhead, Snake River Basin (SRB) steelhead (*O. mykiss)*
- Southern distinct population of eulachon (*Thaleichthys pacificus*) (hereafter referred to as eulachon),
- Southern distinct population of green sturgeon (*Acipenser medirostris*), (hereafter referred to as green sturgeon),

NMFS concurred with the COE's determinations.

NMFS also reviewed the likely effects of the proposed action on EFH, and concluded that the action would adversely affect the EFH of Pacific Coast salmon and Pacific Coast Groundfish.

1.3 Proposed Federal Action

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

The COE proposes to permit the construction/placement of a new 1.3 mile long treated wastewater effluent pipeline and outfall diffuser, which will discharge effluent from the existing Salmon Creek Treatment Plant (SCTP) to the Columbia River at river mile (RM) 95.85 (Figure 1). Its permit authorities are under Section 404 of the Clean Water Act and Section 10 of the River's and Harbors Act. The discharge of effluent via this pipe and outfall diffuser are under the authority of the EPA and State of Washington via the National Pollution Discharge Elimination System of the Clean Water Act. The purpose of the COE's action is to improve future compliance with Washington State water quality standards by ensuring adequate mixing and dilution of treated water discharged into the Columbia River. But for the proposed action, discharges would likely violate Washington state's water quality standards.

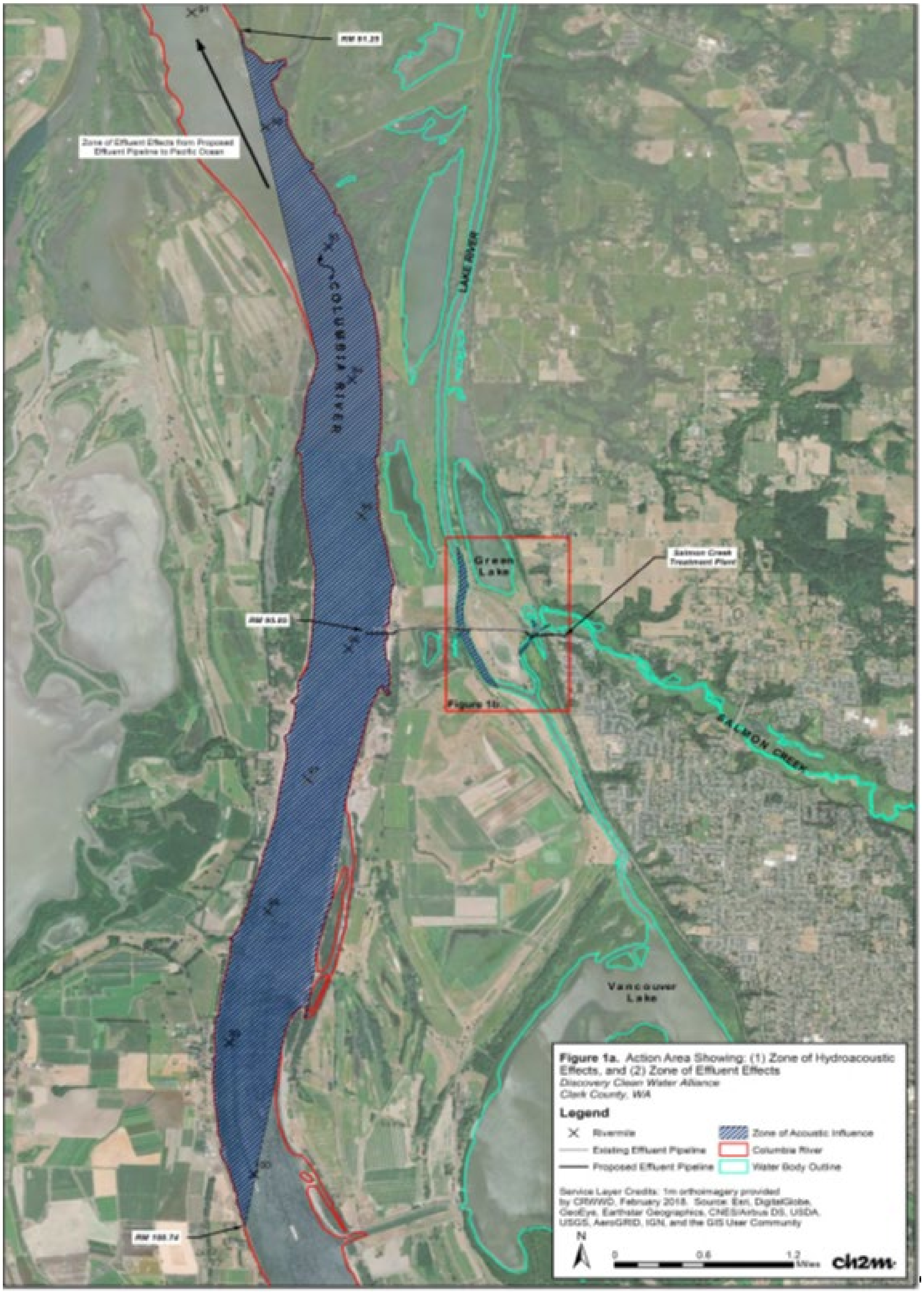

Figure 1. Aerial Image of Project Location and Boundaries (Columbia River Outfall and Effluent Pipeline Biological Assessment, 2019).

The project's major elements include the following:

- Construction of a new effluent pipeline and replacement of the existing outfall diffuser. The new 48-inch diameter, High Density Polyethyline (HDPE) 7,272-foot-long effluent pipeline will lie below ground immediately south of, and roughly parallel to the existing 30-inch effluent pipeline. The new pipe will cross under Salmon Creek and Lake River, parallel to the existing pipe. The replacement outfall diffuser will be improved to comply with future Washington State water quality standards by ensuring adequate mixing and dilution of treated water discharged into the Columbia River. The replacement diffuser will lie beneath the riverbed, except for 10 vertical risers and duckbill valves that will protrude above the mean riverbed elevation. The new diffuser will be moved into deeper water (-40 feet) and will be located 767 feet from shore. The volume of effluent will not change as a result of this project.

- Connection of the existing 30-inch effluent pipeline to the new outfall just west of NW Lower River Road with butterfly valves. The existing 30-inch pipeline from the SCTP nearly to the Columbia River shoreline will serve as a back-up pipeline if maintenance is required on the new 48-inch effluent pipeline.

- Removal of an 870-foot portion of the existing 30-inch-diameter outfall and effluent pipeline from the Columbia River (close to to NW Lower River Road), with the remaining existing 30-inch pipeline left in service. The existing effluent outfall diffuser in the Columbia River will also be removed.

- Maintaining, repairing, or improving existing on-site access roads, developing a new temporary access road, temporary staging areas for equipment and construction employee parking, and temporary work platforms to access in-water work.

- Replacing the four existing effluent pumps at the SCTP's effluent pump station. The new vertical line shaft pumps will fit into the four existing pump slots and will be sized to accommodate future SCTP effluent discharges through Facilities Plan Phases 5 and 6. No in-water work will be required.

- Removal of a 20-foot by 200-foot (4000 sf) section of nearshore riprap protection from the existing outfall pipe, and restoration of the area to natural Columbia River nearshore conditions.

- Installation of a 4-inch air vent tap in the Columbia River. This pipeline will be buried in the same trench as the 48 inch pipeline below OHWE, and below scour depth. The air pipe will be at least 10 feet below the riverbed elevation. It will closely follow the effluent pipeline through the riparian area until it diverges to an air release valve in a buried 6 inch x 8 inch concrete vault near the former Lower River Road. The air vent line below OHWE will be about 425 linear feet, and will not involve any additional excavation or fill volume.

- Install a 4 inch tap for air release adjacent to and west of Burlington Northern Railroad. The 4inch ductile iron air venting pipe will connect to an air release valve in a buried 6 foot x 8 foot concrete vault at a protected and accessible location above ordinary high water elevation for maintenance. The vent pipe will run in a an existing unimproved access road, and no large trees will be removed. The pipe will be installed in a trench with about 2 foot bottom width (1:1 side slopes), 5 foot depth, 6 feet of aggregate bedding, aggregate pipe zone material, native soil backfill, and surfacing to match existing ground surface. The ground surface will not be inundated during construction. The vault surface above OHWE will be flush with the ground surface and drivable. The new manhole for the air release valve will be adjacent to an existing air release valve and vault for the existing 30 inch effluent pipeline running under the southern side of the BNSF railroad bridge. The temporary wetland impact will be stabilized to the pre-construction surface condition; that is, to the unimproved dirt/gravel road. The additional trench excavation and backfill for the air vent line below OHWE will be about 48 linear feet.

Salmon Creek:
The first 391 feet of new pipeline leaving the SCTP will be installed by open trench in the Salmon Creek riparian area approximately 56 feet upslope from the existing 30-inchdiameter pipeline. The entire length of the pipeline will be underground, except for the hatch cover of a single air valve vault, creating approximately 52 square feet (sf) of impervious surface area. The trench will be backfilled with imported and native material. The existing stormwater management facility will be repaired and revegetated after pipeline completion. Aside from 52 sf air valve vault hatch, no permanent pollution-generating impervious surfaces will be constructed or reconstructed.

A temporary work trestle will be installed across Salmon Creek to enable large equipment to access the west side of the BNSF Railway. The work trestle will be constructed west to east by driving approximately 61 temporary steel piles (24-inch diameter) to form pile bents (four piles per bent) supporting a 32-foot wide deck of wooden timbers. Each clear span between bents will be approximately 28 feet long to allow fish, watercraft, and debris passage. The piles will be driven and proofed using an impact hammer with sound attenuation if the water depth is greater than 3.28 feet (Stadler 2017). The deck will be curbed and sealed to prevent unintentional discharges to the creek. Also, the deck may have a removable section to allow occasional non-motorized vessels to pass through the channel, if required by the U.S. Coast Guard. The work trestle will be completely removed after pipeline construction is completed. Because the work trestle will be used for two work seasons, the trestle is expected to be in place for approximately 17 months.

The Salmon Creek pipeline undercrossing would begin at the east side (left bank) of Salmon Creek where an exit pit will be excavated by trackhoe to receive the bored pipeline from the SCTP and casing pipe under the BNSF Railway right of way. The 20 feet wide x 20 feet long x 15 feet deep exit pit will be in upland riparian area near the toe of the railroad embankment. The pit sides will be shored with sheet piles, and the pit dewatered during pipe work.

In-water construction within Salmon Creek will be performed by open trenching within sheet pile cofferdam isolation areas to minimize turbidity. If needed, applicant will be prepared for fish salvage operations. Fish removal operations could include herding fish with nets, netting fish and placement into buckets for transfer to other areas of the creek, as well as electroshocking. The first step will be to install a temporary floating silt curtain around the in-water work area. The total width of Salmon Creek is approximately 150 feet. The sheet pile cofferdam will enclose roughly half the channel width at a time, maintaining free and open flow for fish passage and non-motorized vessels. Steel sheets, each approximately two feet wide, will be inserted into about half of the creekbed width by a vibratory hammer, and braced. The half cofferdam at the left bank will be about 0.16 acre (6,969 sf) with a perimeter of 245 feet, requiring about 125 sheet piles. The half cofferdam at the right bank will be up to 0.54 acre (23,522 sf) with a perimeter of up to 635 feet, requiring about 320 sheet piles. The sheet piles will be driven at least 20 feet below riverbed elevation with a vibratory hammer, without proofing (no impact hammering). Each pile will take about 30 minutes to drive, and about 15 piles will be driven per day over a one-month period. Each half cofferdam will be in Salmon Creek for a minimum of 5 months. Only one half cofferdam would be in the river at a time.

Dewatering will be performed within the cofferdams as necessary. Dewatering pumps may need to operate during pipeline construction to keep the tie-in box dry. Dewatering water will be discharged to a Baker tank/sediment bag/vegetative strip, or equivalent. About 600,000 gallons or more of water may be withdrawn from the work isolation areas. Most of this volume will be from groundwater, not the actively flowing stream; and clean or filtered water will return to the river or infiltrate to ground, meeting all water quality standards.

The pipe trench will be excavated within the cofferdam. The contractor will excavate approximately 2,053 cubic yards (cy) of stream bottom from the trench averaging 12 feet deep for pipe installation. The trench may need to be shored with a trench box to stabilize the trench sides for worker safety and to minimize excavation volume. A crane or backhoe will excavate the trench, working from the shoreline, dewatered creekbed, or trestle. The contractor will store excavated native, saturated substrate temporarily in the temporary construction easement for dewatering and later reuse. Pipe construction is expected to take up to 4 months.

The pipe segments will be connected end-to-end on land, then lowered or pulled into the trench. Excess excavated material will be disposed at an approved off-site disposal area. Upon completion of the first half of the stream undercrossing by the effluent pipeline, the half-width cofferdam will be removed. The second cofferdam will be installed for the remaining half-channel and pipeline construction will proceed with the same construction methods as the first cofferdam section.

Western shoreline of Salmon Creek to eastern shoreline of Lake River:
This segment of pipeline construction is entirely above the OHWE of waterways (i.e., outside the action area), except for discharge of water from trench dewatering. The pipeline will be constructed using the open trench method. The pipeline trench surface will be strip-excavated, prior to trench excavation, and topsoil salvaged and stockpiled. The trench will be shored by trench box, as necessary, for worker safety and to minimize excavation volume. Trench dewatering will be performed, as necessary and depending on depths to groundwater. Dewatering water would be discharged to a Baker tank/sediment bag/vegetative strip, or

equivalent, prior to discharge. The trench will be backfilled with pipe zone material and native soil up to trench surface, then the disturbed area will be seeded with appropriate pasture grasses and forbs.

Lake River:

The total width of Lake River in the crossing area is approximately 370 feet. The Lake River pipeline undercrossing construction will be similar to the Salmon Creek undercrossing. The first step will be to install a temporary floating silt curtain around the in-water work area. Temporary work trestles will be installed to enable large equipment to access the pipeline trench. The work trestles will be constructed from each bank by driving 78 temporary steel pipe piles (24 inches in diameter) to form pile bents (4 piles per bent) supporting 32-foot-wide decks of wooden timbers. The piles will be driven and proofed using an impact hammer with sound attenuation if the water depth is greater than 3.28 feet (Stadler, 2017). The total substrate area covered the piles would be 244 sf. Each clear span between bents will be at least 28 feet long to allow fish, watercraft, and debris passage. The deck of the trestles will be curbed and sealed to prevent unintentional discharges to the creek. The work trestles will be in Lake River for up to five months, and will be completely removed after pipeline construction is completed.

Open trenching will occur within sheet pile cofferdam isolation areas to manage turbidity and minimize effects on fish and habitat. Similar to the Salmon Creek crossing, the sheet pile cofferdam will enclose roughly half the channel width at a time, maintaining fish passage. Steel sheets, each approximately two feet wide, will be inserted into about half of the creekbed width by a vibratory hammer to a depth of at least 20 feet below the riverbed elevation, and braced. No proofing of sheet piles will be required. Each temporary work isolation area will be approximately 185 feet in length, by 75 feet wide. The half cofferdam at the left bank will be about 0.32 acre (13,939 sf) with a perimeter of 445 feet, requiring about 225 sheet piles. The half cofferdam at the right bank will be about 0.32 acre (13,939 sf) with a perimeter of 445 feet, requiring about 225 sheet piles. Each pile will take about 30 minutes to drive, and about 15 piles will be driven per day over a one-month period. A cofferdam will be in Lake River for up to five months.

Columbia River:

The improved diffuser will be placed at the terminus of the outfall pipe in the Columbia River. The new diffuser location in deeper water is expected to ensure adequate mixing and dilution of treated water discharged into the Columbia River for compliance with future water quality standards. The replacement diffuser will be about 200 feet upstream of the existing outfall diffuser, will extend about 200 feet farther into the river channel than the existing diffuser, approximately 767 feet from shore. The terminus (diffuser) will be placed at about 40 feet in depth CRD (Columbia River Datum). The construction of the Columbia River outfall diffuser will involve excavation by open trench proceeding from the onshore vertical angle point to the end of diffuser in the river.

The contractor will conduct nearshore construction from the land or barge, unless the excavator has insufficient reach. If the excavator's reach is insufficient and the shallow water cannot be reached by barge, the contractor may need to access the shallow water via temporary work trestles/platforms extending offshore, one at the new pipeline and one where the existing pipeline will be removed. Two pile-supported work trestles/platforms will be installed during trench construction in the Columbia River. The general construction method and materials will be similar to those used to construct the temporary work trestles at Lake River. The temporary work trestles/platforms will be constructed east to west by driving up to 142 temporary steel piles (24 inches diameter) to form pile bents (four piles per bent) supporting 32-foot- wide timber decks. The total area of substrate covered by the 24 inch piles would be 445 sf. Pile driving at this location is expected to take up to 20 days. Each clear span between bents will be about 28 feet long to allow fish and debris passage. The piles will be driven and proofed using an impact hammer with sound attenuation. The deck will be curbed and sealed to prevent unintentional discharges to the river. A temporary floating log boom, about 400 feet long, will be installed upriver of the work platforms to protect their piles from floating debris. The work trestles/platforms and log boom will be completely removed after pipeline construction is completed.

Construction in deeper water will be accessed by equipment mounted on barges. The barges will be anchored and moored using spud piles. The contractor will excavate approximately 588 cy of Columbia River stream bottom from a 13-foot-deep, on average, trench for pipe installation. The contractor will excavate the nearshore and deep water outfall trench using an excavator or clamshell dredge and an ecology bucket. A partial turbidity curtain will be placed in shallow water (up to 20 feet deep) if the current allows.

Steel pipe piles below the riverbed will support and stabilize the outfall diffuser. The contractor will use vibratory-driven pipe piles in pairs spaced at about 15 feet on-center, and will place a precast concrete pile cap with a saddle over each pair of 12-inch pipe piles to support the outfall pipe (Figure 2). A total of 22 pipe piles will be vibrated about 55 feet into the riverbed for 11 pipe supports. The 22 piles will remove about 17 sf of benthic habitat in the Columbia River.

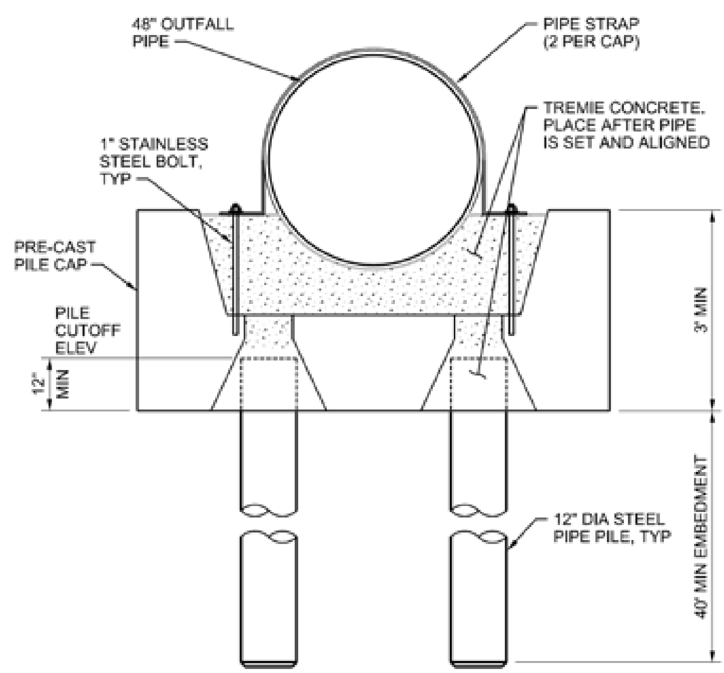

Figure 2. Columbia River Pile Support Infrastructure

Riverbed elevations (sand wave crests and troughs) at the outfall diffuser ports pose risks of burial by sand and riverbed erosion that increases the exposure length of diffuser risers. The diffuser design accounts for natural changes in riverbed elevation informed by coastal engineering analysis to predict bedform heights at the diffuser site. The riser ports will be elevated above predicted sand waves, and strengthened to withstand exposure to river currents and large woody debris. Divers and remotely operated underwater equipment will help position each stick of pipe in the open trench, fit it to the previously installed pipe, and tighten the mechanical couplings to seal the joint. A pipe strap bolted or embedded into the pile cap will connect pipe sections to the pile caps. The contractor will position the pipe segments with the attached diffuser riser using cranes and divers in much the same way that conveyance pipe segments are positioned and joined.

After the contractor places the new outfall pipe and diffuser in the trench, the contractor will backfill the trench with imported bedding and pipe zone material to cover the top of the pipeline, riprap will be placed above the granular backfill, but below the riverbed surface. About 385 cy of the trench backfill will be imported: pipe/diffuser, granular bedding 101 cy), pipe zone material (101 cy), and angular stone (riprap) (113 cy) for pipe stability and protection. Riprap will be buried and is intended to protect the pipe from vessel anchors and other potential disturbances that otherwise could expose or damage the outfall pipe. Spoil material from the pipe trench excavation (i.e., native riverbed sand/sediment) will backfill the upper portion of the pipeline trench up to riverbed grade, covering the granular imported backfill materials and restoring the riverbed.

Much of the excavated sediment will be temporarily sidecast next to the pipe trench, then returned to the trench as backfill to restore the pre-construction contours. Any excess sediment will be used to backfill the existing 30" pipe trench to achieve pre-construction contours. If excess sediment still remains it will be used to fill 2 existing scour holes near the existing 30 inch outfall diffuser. The ultimate disposal scenario will be determined by Section 10/404 permitting. The highest priority will be to backfill construction trenches to pre-construction contours.

Some sidecasting of trench spoils downstream of the trench excavation may be possible to limit the need to raise the dredged material through the water column. However, sidecasting of all spoils may not be possible because the existing effluent outfall, which is downstream of the proposed outfall, must remain operational (unburied by sand) while the new outfall is being constructed. The existing outfall diffuser will be removed, and the riverbed backfilled with native sediment. Construction of the new outfall must precede demolition of the existing outfall because the latter must remain operational through construction. Sidecasting along the new outfall alignment must be avoided in the -5 to -20 feet elevation range to avoid burying the existing outfall while still operational, which is at -14 to -20 feet elevation and 200 feet downstream. The project may also use flow lane disposal, where excavated sediment would be released from a barge mounted excavator or dredge closer to deeper water (20 ft).

After the new outfall is operational, the existing navigation marker, outfall pipe, and riprap armoring will be removed. The trench void from outfall removal will be backfilled with the excavated sand from the trench; however, there will be a deficit of backfill equal to the pipe volume plus riprap armoring volume plus the smaller scour hole caused by the diffuser (i.e., about 617 cubic yards). The balance of fill at the pipe removal trench will be generated as excess sand from the trench excavation for the new outfall, which will be longer and bigger than the existing outfall, and that will be temporarily sidecast upstream of the existing outfall.

The riverbed surfaces at the construction trenches and smaller scour hole will be actively or passively restored roughly to the prevalent riverbed contours. Any excess sediment will be used to backfill the existing 30" pipe trench to achieve pre-construction contours. If excess sediment remains it will be used to fill 2 existing scour holes near the existing 30 inch outfall diffuser. Finally, after backfilling, any remaining sediment will be disposed of in-water using flow-lane disposal.

The work platforms at Columbia River will be in place only during the time to construct the new pipeline and remove the existing pipeline, which will happen sequentially. Therefore, the work platforms will be in place for up to five months, which is the length of the in-water work period for the Columbia (i.e., October extension, plus November to February). Fish passage will not be obstructed in the Columbia River.

Construction is expected to occur over about 17 months of work and two in-water work periods. Pile driving is expected to occur over two work periods, with 3-4 weeks of pile driving per work window. Actual construction timing will depend on weather, streamflow, contractor logistics, equipment, and allowable in-water work periods, and other regulatory constraints. Work windows in each water body vary. Most in-water work will be performed within a combined work window of August 1 through December, with the exception of Lake River where the in water work is permitted from June 1 through October 31.

Site Restoration:
Emergent floodplain wetlands will be restored at the pipeline receiving pit and within half-cofferdams by returning pre-project grades and revegetating with native species by seeding and vegetative propagation. Outside the creek channel, the contractor will replace the salvaged topsoil over the trench.

The wetland seed mixtures will consist of perennial native wetland grasses, sedges, and rushes such as spike bentgrass, slough grass, slender hairgrass, and tufted hairgrass; or similar locally endemic species; and shrubs if they existed prior to disturbance. Riparian pasture outside wetland will be seeded for the first growing season after construction with perennial non-native pasture grasses, such as orchardgrass, perennial ryegrass, tall fescue, subclover, Dutch white clover, and New Zealand white clover; with at least one grass and one legume.

The streambank will be restored using bioengineering techniques for post-construction riverbank stabilization. Native restoration-sized plant materials will be planted in streambank restoration areas within the permanent and temporary construction easements. The soil reinforcement method will follow Washington Department of Fish and Wildlife *Integrated Streambank Protection Guidelines* (Cramer, et al. 2003). After trench backfilling, the riverbanks will be reconstructed using encapsulated soil wraps, which involve wrapping a slowly biodegradable erosion blanket around stacked layers (lifts) of native soil. The soil layers will be seeded with native plant species, and native trees and shrubs will be established, either as cuttings in hydric soil, rooted cuttings, or seedlings.

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).]

We considered whether or not the proposed action would cause any other activities and determined that it would cause the following activities: discharge of treated effluent into the Columbia River. While the project will not increase effluent volume, but will continue to discharge effluent into the Columbia River. Effects of that discharge on ESA-listed species and Critical Habitat, as well as effects on EFH are discussed below.

1.4 Action Area

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

The action area includes the Columbia River from the point of effluent discharge to the Pacific Ocean, and portions of Lake River and Salmon Creek. The Columbia River portion of the action area supports all Columbia River salmonid evolutionarily significant units (ESU)/distinct population segments (DPS), eulachon (smelt), and green sturgeon (Table 2). The Lake River and Salmon Creek portions of the action area contain designated critical habitat for coho and chum salmon. EFH has been designated for Pacific Coast (Chinook and coho) salmon that encompasses the action area. Specific information about the action area is found in the Environmental Baseline section in Part 2 of this document.

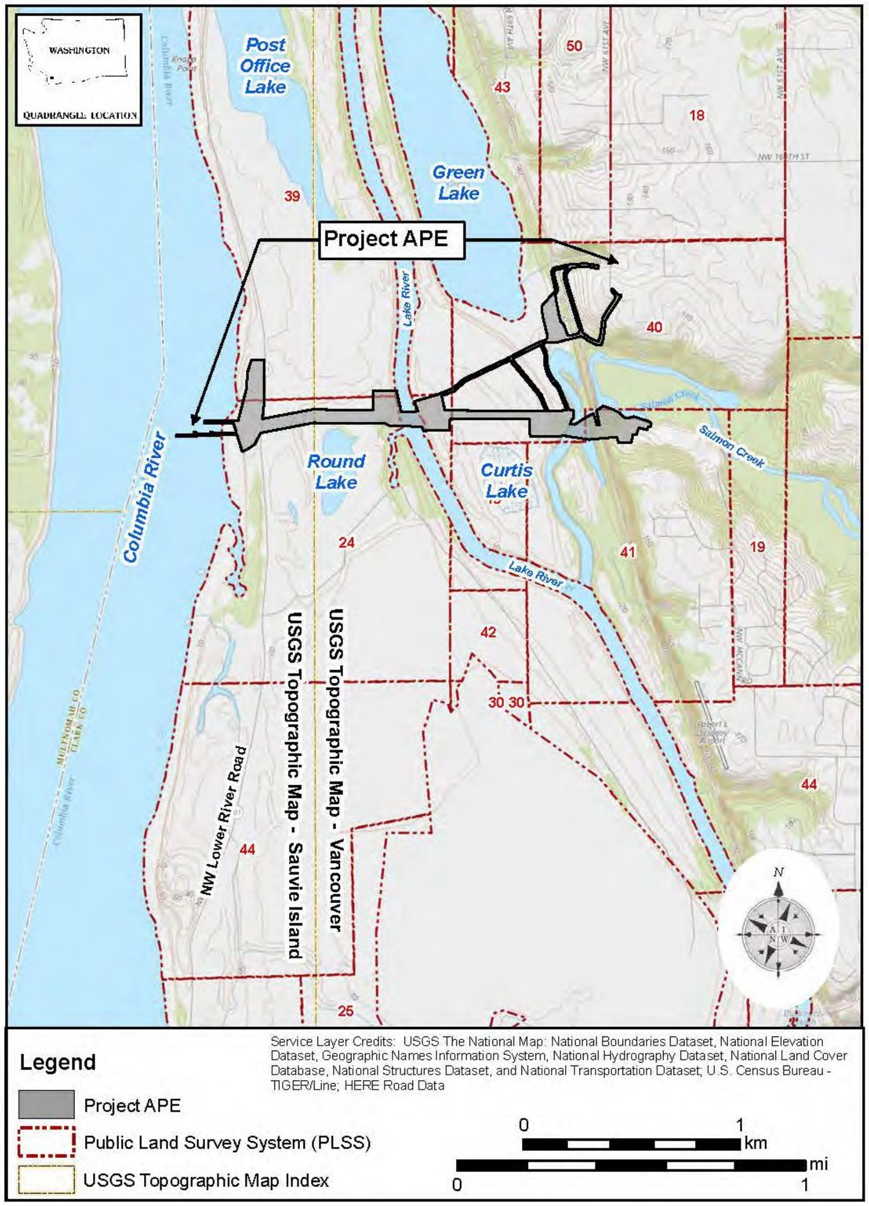

Figure 3. Project Site (Columbia River Outfall and Effluent Pipeline BA, 2019)

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

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

2.1 Analytical Approach

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

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

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

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

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

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

indirectly result in an alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species.

- If necessary, suggest a reasonable and prudent alternative to the proposed action.

2.2 Rangewide Status of the Species and Critical Habitat

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

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

During the last century, average regional air temperatures in the Pacific Northwest increased by 1-1.4°F as an annual average, and up to 2°F in some seasons (based on average linear increase per decade; Abatzoglou et al. 2014; Kunkel et al. 2013). Warming is likely to continue during the next century as average temperatures are projected to increase another 3 to 10°F, with the largest increases predicted to occur in the summer (Mote et al. 2014). Decreases in summer precipitation of as much as 30 percent by the end of the century are consistently predicted across climate models (Mote et al. 2014). Precipitation is more likely to occur during October through March, less during summer months, and more winter precipitation will be rain than snow (ISAB 2007; Mote et al. 2013; Mote et al. 2014). Earlier snowmelt will cause lower stream flows in late spring, summer, and fall, and water temperatures will be warmer (ISAB 2007; Mote et al. 2014). Models consistently predict increases in the frequency of severe winter precipitation events (i.e., 20-year and 50-year events), in the western United States (Dominguez et al. 2012). The largest increases in winter flood frequency and magnitude are predicted in mixed rain-snow watersheds (Mote et al. 2014).

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

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

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

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

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

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

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

2.2.1 Status of Critical Habitat

Table 1. Critical Habitat designations and critical habitat status for species with critical habitat considered in this opinion.

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

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Columbia River chum salmon	9/02/05 70 FR 52630	Critical habitat encompasses six subbasins in Oregon and Washington containing 19 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 16 watersheds, and medium for three watersheds.
Lower Columbia River coho salmon	2/24/16 81 FR 9252	Critical habitat encompasses 10 subbasins in Oregon and Washington containing 55 occupied watersheds, as well as the lower Columbia River and estuary rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 34 watersheds, medium for 18 watersheds, and low for three watersheds.
Snake River sockeye salmon	10/25/99 64 FR 57399	Critical habitat consists of river reaches of the Columbia, Snake, and Salmon rivers; Alturas Lake Creek; Valley Creek; and Stanley, Redfish, Yellow Belly, Pettit and Alturas lakes (including their inlet and outlet creeks). Water quality in all five lakes generally is adequate for juvenile sockeye salmon, although zooplankton numbers vary considerably. Some reaches of the Salmon River and tributaries exhibit temporary elevated water temperatures and sediment loads that could restrict sockeye salmon production and survival (NMFS 2015b). Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.
Upper Columbia River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses 10 subbasins in Washington containing 31 occupied watersheds, as well as the Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 20 watersheds, medium for eight watersheds, and low for three watersheds.
Lower Columbia River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses nine subbasins in Oregon and Washington containing 41 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 28 watersheds, medium for 11 watersheds, and low for two watersheds.
Upper Willamette River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses seven subbasins in Oregon containing 34 occupied watersheds, as well as the lower Willamette/Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. Watersheds are in good to excellent condition with no potential for improvement only in the upper McKenzie River and its tributaries (NMFS 2005). We rated conservation value of HUC5 watersheds as high for 25 watersheds, medium for 6 watersheds, and low for 3 watersheds.
Middle Columbia River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses 15 subbasins in Oregon and Washington containing 111 occupied watersheds, as well as the Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of occupied HUC5 watersheds as high for 80 watersheds, medium for 24 watersheds, and low for 9 watersheds.

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Snake River basin steelhead	9/02/05 70 FR 52630	Critical habitat encompasses 25 subbasins in Oregon, Washington, and Idaho. Habitat quality in tributary streams varies from excellent in wilderness and roadless areas, to poor in areas subject to heavy agricultural and urban development (Wissmar et al. 1994). Reduced summer stream flows, impaired water quality, and reduced habitat complexity are common problems. Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.
Southern DPS of green sturgeon	10/09/09 74 FR 52300	Critical habitat has been designated in coastal U.S. marine waters within 60 fathoms depth from Monterey Bay, California (including Monterey Bay), north to Cape Flattery, Washington, including the Strait of Juan de Fuca, Washington, to its United States boundary; the Sacramento River, lower Feather River, and lower Yuba River in California; the Sacramento-San Joaquin Delta and Suisun, San Pablo, and San Francisco bays in California; tidally influenced areas of the Columbia River estuary from the mouth upstream to river mile 46; and certain coastal bays and estuaries in California (Humboldt Bay), Oregon (Coos Bay, Winchester Bay, Yaquina Bay, and Nehalem Bay), and Washington (Willapa Bay and Grays Harbor), including, but not limited to, areas upstream to the head of tide in various streams that drain into the bays, as listed in Table 1 in USDC (2009). The CHRT identified several activities that threaten the PBFs in coastal bays and estuaries and necessitate the need for special management considerations or protection. The application of pesticides is likely to adversely affect prey resources and water quality within the bays and estuaries, as well as the growth and reproductive health of Southern DPS green sturgeon through bioaccumulation. Other activities of concern include those that disturb bottom substrates, adversely affect prey resources, or degrade water quality through re-suspension of contaminated sediments. Of particular concern are activities that affect prey resources. Prey resources are affected by: commercial shipping and activities generating point source pollution and non-point source pollution that discharge contaminants and result in bioaccumulation of contaminants in green sturgeon; disposal of dredged materials that bury prey resources; and bottom trawl fisheries that disturb the bottom (but result in beneficial or adverse effects on prey resources for green sturgeon).
Southern DPS of eulachon	10/20/11 76 FR 65324	Critical habitat for eulachon includes portions of 16 rivers and streams in California, Oregon, and Washington. All of these areas are designated as migration and spawning habitat for this species. In Oregon, we designated 24.2 miles of the lower Umpqua River, 12.4 miles of the lower Sandy River, and 0.2 miles of Tenmile Creek. We also designated the mainstem Columbia River from the mouth to the base of Bonneville Dam, a distance of 143.2 miles. Dams and water diversions are moderate threats to eulachon in the Columbia and Klamath rivers where hydropower generation and flood control are major activities. Degraded water quality is common in some areas occupied by southern DPS eulachon. In the Columbia and Klamath river basins, large-scale impoundment of water has increased winter water temperatures, potentially altering the water temperature during eulachon spawning periods. Numerous chemical contaminants are also present in spawning rivers, but the exact effect these compounds have on spawning and egg development is unknown. Dredging is a low to moderate threat to eulachon in the Columbia River. Dredging during eulachon spawning would be particularly detrimental.

2.2.2 Status of the Species

Table 2, below provides a summary of listing and recovery plan information, status summaries and limiting factors for many of the species addressed in this opinion. More information can be found in recovery plans and status reviews for these species. These documents are available on the NMFS West Coast Region website (http://www.westcoast.fisheries.noaa.gov/). 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 2. Listing classification and date, recovery plan reference, most recent status review, status summary, and limiting factors for fish species considered in this opinion.

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Lower Columbia River Chinook salmon	Threatened 6/28/05	NMFS 2013	NWFSC 2015	This ESU comprises 32 independent populations. Twenty-seven populations are at very high risk, 2 populations are at high risk, one population is at moderate risk, and 2 populations are at very low risk Overall, there was little change since the last status review in the biological status of this ESU, although there are some positive trends. Increases in abundance were noted in about 70% of the fall-run populations and decreases in hatchery contribution were noted for several populations. Relative to baseline VSP levels identified in the recovery plan, there has been an overall improvement in the status of a number of fall-run populations, although most are still far from the recovery plan goals.	• Reduced access to spawning and rearing habitat • Hatchery-related effects • Harvest-related effects on fall Chinook salmon • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Contaminant
Upper Columbia River spring-run Chinook salmon	Endangered 6/28/05	Upper Columbia Salmon Recovery Board 2007	NWFSC 2015	This ESU comprises four independent populations. Three are at high risk and one is functionally extirpated. Current estimates of natural origin spawner abundance increased relative to the levels observed in the prior review for all three extant populations, and productivities were higher for the Wenatchee and Entiat populations and unchanged for the Methow population. However, abundance and productivity remained well below the viable thresholds called for in the Upper Columbia Recovery Plan for all three populations.	• Effects related to hydropower system in the mainstem Columbia River • Degraded freshwater habitat • Degraded estuarine and nearshore marine habitat • Hatchery-related effects • Persistence of non-native (exotic) fish species • Harvest in Columbia River fisheries

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Snake River spring/summer-run Chinook salmon	Threatened 6/28/05	NMFS 2017a	NWFSC 2015	This ESU comprises 28 extant and four extirpated populations. All expect one extant population (Chamberlin Creek) are at high risk. Natural origin abundance has increased over the levels reported in the prior review for most populations in this ESU, although the increases were not substantial enough to change viability ratings. Relatively high ocean survivals in recent years were a major factor in recent abundance patterns. While there have been improvements in abundance and productivity in several populations relative to prior reviews, those changes have not been sufficient to warrant a change in ESU status.	• Degraded freshwater habitat • Effects related to the hydropower system in the mainstem Columbia River, • Altered flows and degraded water quality • Harvest-related effects • Predation

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

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Snake River fall-run Chinook salmon	Threatened 6/28/05	NMFS 2017ba	NWFSC 2015	This ESU has one extant population. Historically, large populations of fall Chinook salmon spawned in the Snake River upstream of the Hells Canyon Dam complex. The extant population is at moderate risk for both diversity and spatial structure and abundance and productivity. The overall viability rating for this population is 'viable.' Overall, the status of Snake River fall Chinook salmon has clearly improved compared to the time of listing and compared to prior status reviews. The single extant population in the ESU is currently meeting the criteria for a rating of 'viable' developed by the ICTRT, but the ESU as a whole is not meeting the recovery goals described in the recovery plan for the species, which require the single population to be "highly viable with high certainty" and/or will require reintroduction of a viable population above the Hells Canyon Dam complex.	• Degraded floodplain connectivity and function • Harvest-related effects • Loss of access to historical habitat above Hells Canyon and other Snake River dams • Impacts from mainstem Columbia River and Snake River hydropower systems • Hatchery-related effects • Degraded estuarine and nearshore habitat.
Columbia River chum salmon	Threatened 6/28/05	NMFS 2013	NWFSC 2015	Overall, the status of most chum salmon populations is unchanged from the baseline VSP scores estimated in the recovery plan. A total of 3 of 17 populations are at or near their recovery viability goals, although under the recovery plan scenario these populations have very low recovery goals of 0. The remaining populations generally require a higher level of viability and most require substantial improvements to reach their viability goals. Even with the improvements observed during the last five years, the majority of populations in this ESU remain at a high or very high risk category and considerable progress remains to be made to achieve the recovery goals.	• Degraded estuarine and nearshore marine habitat • Degraded freshwater habitat • Degraded stream flow as a result of hydropower and water supply operations • Reduced water quality • Current or potential predation • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat in the lower Columbia River • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Juvenile fish wake strandings • Contaminants

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Lower Columbia River coho salmon	Threatened 6/28/05	NMFS 2013	NWFSC 2015	Of the 24 populations that make up this ESU, 21 populations are at very high risk, 1 population is at high risk, and 2 populations are at moderate risk. Recent recovery efforts may have contributed to the observed natural production, but in the absence of longer term data sets it is not possible to parse out these effects. Populations with longer term data sets exhibit stable or slightly positive abundance trends. Some trap and haul programs appear to be operating at or near replacement, although other programs still are far from that threshold and require supplementation with additional hatchery-origin spawners .Initiation of or improvement in the downstream juvenile facilities at Cowlitz Falls, Merwin, and North Fork Dam are likely to further improve the status of the associated upstream populations. While these and other recovery efforts have likely improved the status of a number of coho salmon populations, abundances are still at low levels and the majority of the populations remain at moderate or high risk. For the Lower Columbia River region land development and increasing human population pressures will likely continue to degrade habitat, especially in lowland areas. Although populations in this ESU have generally improved, especially in the 2013/14 and 2014/15 return years, recent poor ocean conditions suggest that population declines might occur in the upcoming return years	• Degraded estuarine and near-shore marine habitat • Fish passage barriers • Degraded freshwater habitat: Hatchery-related effects • Harvest-related effects • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat in the lower Columbia River • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Juvenile fish wake strandings • Contaminants

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Snake River sockeye salmon	Endangered 6/28/05	NMFS 2015	NWFSC 2015	This single population ESU is at very high risk dues to small population size. There is high risk across all four basic risk measures. Although the captive brood program has been successful in providing substantial numbers of hatchery produced fish for use in supplementation efforts, substantial increases in survival rates across all life history stages must occur to re-establish sustainable natural production In terms of natural production, the Snake River Sockeye ESU remains at extremely high risk although there has been substantial progress on the first phase of the proposed recovery approach – developing a hatchery based program to amplify and conserve the stock to facilitate reintroductions.	• Effects related to the hydropower system in the mainstem Columbia River • Reduced water quality and elevated temperatures in the Salmon River • Water quantity • Predation
Upper Columbia River steelhead	Threatened 1/5/06	Upper Columbia Salmon Recovery Board 2007	NWFSC 2015	This DPS comprises four independent populations. Three populations are at high risk of extinction while 1 population is at moderate risk. Upper Columbia River steelhead populations have increased relative to the low levels observed in the 1990s, but natural origin abundance and productivity remain well below viability thresholds for three out of the four populations. The status of the Wenatchee River steelhead population continued to improve based on the additional year's information available for the most recent review. The abundance and productivity viability rating for the Wenatchee River exceeds the minimum threshold for 5% extinction risk. However, the overall DPS status remains unchanged from the prior review, remaining at high risk driven by low abundance and productivity relative to viability objectives and diversity concerns.	• Adverse effects related to the mainstem Columbia River hydropower system • Impaired tributary fish passage • Degraded floodplain connectivity and function, channel structure and complexity, riparian areas, large woody debris recruitment, stream flow, and water quality • Hatchery-related effects • Predation and competition • Harvest-related effects

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Lower Columbia River steelhead	Threatened 1/5/06	NMFS 2013	NWFSC 2015	This DPS comprises 23 historical populations, 17 winter-run populations and six summer-run populations. Nine populations are at very high risk, 7 populations are at high risk, 6 populations are at moderate risk, and 1 population is at low risk. The majority of winter-run steelhead populations in this DPS continue to persist at low abundances. Hatchery interactions remain a concern in select basins, but the overall situation is somewhat improved compared to prior reviews. Summer-run steelhead populations were similarly stable, but at low abundance levels. The decline in the Wind River summer-run population is a source of concern, given that this population has been considered one of the healthiest of the summer-runs; however, the most recent abundance estimates suggest that the decline was a single year aberration. Passage programs in the Cowlitz and Lewis basins have the potential to provide considerable improvements in abundance and spatial structure, but have not produced self-sustaining populations to date. Even with modest improvements in the status of several winter-run DIPs, none of the populations appear to be at fully viable status, and similarly none of the MPGs meet the criteria for viability.	• Degraded estuarine and nearshore marine habitat • Degraded freshwater habitat • Reduced access to spawning and rearing habitat • Avian and marine mammal predation • Hatchery-related effects • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat in the lower Columbia River • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Juvenile fish wake strandings • Contaminants

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Upper Willamette River steelhead	Threatened 1/5/06	NMFS 2011	NWFSC 2015	This DPS has four demographically independent populations. Three populations are at low risk and one population is at moderate risk. Declines in abundance noted in the last status review continued through the period from 2010-2015. While rates of decline appear moderate, the DPS continues to demonstrate the overall low abundance pattern that was of concern during the last status review. The causes of these declines are not well understood, although much accessible habitat is degraded and under continued development pressure. The elimination of winter-run hatchery release in the basin reduces hatchery threats, but non-native summer steelhead hatchery releases are still a concern for species diversity and a source of competition for the DPS. While the collective risk to the persistence of the DPS has not changed significantly in recent years, continued declines and potential negative impacts from climate change may cause increased risk in the near future.	• Degraded freshwater habitat • Degraded water quality • Increased disease incidence • Altered stream flows • Reduced access to spawning and rearing habitats due to impaired passage at dams • Altered food web due to changes in inputs of microdetritus • Predation by native and non-native species, including hatchery fish and pinnipeds • Competition related to introduced salmon and steelhead • Altered population traits due to interbreeding with hatchery origin fish
Middle Columbia River steelhead	Threatened 1/5/06	NMFS 2009b	NWFSC 2015	This DPS comprises 17 extant populations. The DPS does not currently include steelhead that are designated as part of an experimental population above the Pelton Round Butte Hydroelectric Project. Returns to the Yakima River basin and to the Umatilla and Walla Walla Rivers have been higher over the most recent brood cycle, while natural origin returns to the John Day River have decreased. There have been improvements in the viability ratings for some of the component populations, but the DPS is not currently meeting the viability criteria in the MCR steelhead recovery plan. In general, the majority of population level viability ratings remained unchanged from prior reviews for each major population group within the DPS.	• Degraded freshwater habitat • Mainstem Columbia River hydropower-related impacts • Degraded estuarine and nearshore marine habitat • Hatchery-related effects • Harvest-related effects • Effects of predation, competition, and disease

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

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Southern DPS of eulachon	Threatened 3/18/10	NMFS 2017c	Gustafson et al. 2016	The Southern DPS of eulachon includes all naturally-spawned populations that occur in rivers south of the Nass River in British Columbia to the Mad River in California. Sub populations for this species include the Fraser River, Columbia River, British Columbia and the Klamath River. In the early 1990s, there was an abrupt decline in the abundance of eulachon returning to the Columbia River. Despite a brief period of improved returns in 2001-2003, the returns and associated commercial landings eventually declined to the low levels observed in the mid-1990s. Although eulachon abundance in monitored rivers has generally improved, especially in the 2013-2015 return years, recent poor ocean conditions and the likelihood that these conditions will persist into the near future suggest that population declines may be widespread in the upcoming return years	• Changes in ocean conditions due to climate change, particularly in the southern portion of the species' range where ocean warming trends may be the most pronounced and may alter prey, spawning, and rearing success. • Climate-induced change to freshwater habitats • Bycatch of eulachon in commercial fisheries • Adverse effects related to dams and water diversions • Water quality, • Shoreline construction • Over harvest • Predation
					•

2.3 Environmental Baseline

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

The action area is located in a portion of the mainstem of the Lower Columbia River that is tidally influenced, and its current conditions is influenced by multiple factors occurring upstream and upland, in addition to features of the specific site. Historically, the mainstem LCR was less than 20 feet deep, and supported vegetated wetlands within the floodplain that supplied the estuary with an abundance of macrodetritus, the base-level food source for juvenile salmonids (NMFS 2011a). Subsequent modifications to the LCR have reduced the quality, amount, and accessibility of habitat, resulting from diking, dredging, and filling for agricultural, urban, industrial, and hydroregulation for power generation and flood control activities. Regulation of river flow has reduced spring freshet flows to about 50% of the natural level, and has increased fall minimum flows by 10 to 50% (Simenstad et al. 1992). As a result of flow regulation, increased nutrients, increased water clarity and temperature. The current base-level food source in the LCR consists of microdetritus, such as phytoplankton and zooplankton transported from areas throughout the Columbia watershed (Sherwood et al 1990; Weitkamp 1994). Nearly all emergent aquatic vegetation in the LCR is located in tidal swamps near brackish water areas (Weitkamp 1994). The action area is located in a reach of the Columbia River with rapid flow and coarse sand and does not support the presence, nor establishment of submerged aquatic vegetation.

The combined effects of water withdrawals for irrigation, hydroregulation, diking and filling have reduced the surface area of the estuary by approximately 20 percent over the past 200 years, resulting in decreased access to up to 77 percent of historical tidal swamps and peripheral wetlands (Fresh et al. 2005). Currently a lack of habitat and reduced habitat quality are identified as factors limiting viability of salmonids in the mainstem LCR (NMFS 2011b). Overbank flooding that normally would aid juveniles in accessing off-channel refugia and food resources has been virtually eliminated, and sediment transport processes that build habitat and constitute refugia habitat have been impaired (NMFS 2011a). Bottom et al. (2005) noted the near complete elimination of overbank flood events in the LCR and the separation of the river from its floodplain, both conditions that have altered the food web by reducing macrodetrital inputs by approximately 84 percent. Currently, phytoplankton detrital sources from upstream reservoirs now dominate the base of the food chain. This change from a food web based on macrodetritus to one based on microdetritus has profound effects on the estuary ecosystem to support migration and rearing of juvenile salmonids.

Upstream dams have prevented sediments from entering the estuary, while dredging activities have increasingly deepened the channel and exported sand and gravel out of the estuary. Since the late nineteenth century, sediment transport from the interior basin to the Columbia River estuary has decreased about 60 percent and total sediment transport has decreased about 70 percent (Jay and Kukulka 2003). Currently, sand is exported from the estuary at a rate approximately three times higher than that at which it enters the estuary. The full impact of these changes is unknown; however, sediment transport is a primary habitat-shaping force that determines the type, location, and availability of habitats distributed in the estuary and plume. It is thought that reductions in the amount of fine sediment have increased water clarity, allowing avian and aquatic predators to more easily locate and consume salmonids during both adult and juvenile life stages.

Toxic contaminants are widespread in the estuary, both geographically and in the food chain, with the urban and industrial portions of the estuary contributing significantly to juvenile salmon's toxic load (LCREP 2007). Some of these contaminants are water-soluble agricultural pesticides and fertilizers, such as simazine, atrazine, and diazinon, and copper-based chemicals (Hecht et al. 2007). Industrial contaminants include polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs). Also present are pharmaceuticals, personal care products, brominated fire retardants, and other emerging contaminants. Concentrations of toxic contaminants in the bodies of juvenile salmonids in the estuary sometimes are above levels estimated to cause health effects. In a 2007 study, this was the case for PCBs, PAHs, and DDT, and juveniles showed evidence of exposure to hormone-disrupting compounds (LCREP 2007). Salmon and steelhead experience both short-term exposure to toxic substances and long-term exposure to contaminants that accumulate over time and magnify through the food chain. Even when exposures are sublethal, they can cause significant developmental, behavioral, health, and reproductive impairments. The SCTP currently discharges effluent that contributes to these baseline conditions.

The LCR is has become a central point of economic growth, particularly in areas between Longview, Washington and Portland, Oregon. Marine terminal facilities at the ports of Longview, Kalama, Portland, Vancouver, and Woodland dominate use of shorelines on the Columbia River. EPA identified 49 different chemicals of emerging concern in sediments in the lower Columbia River main stem and several tributaries. Endocrine-disrupting compounds (contaminants that block or mimic hormones in the body and cause harm to fish and wildlife) were detected at 22 of 23 sites sampled (EPA 2014).

2.4 Effects of the Action

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

Effects of the action will occur in three waterbodies: The Columbia River, Lake River, and Salmon Creek. Temporary effects include those related to construction such as elevated turbidity, temporary loss of forage, pile driving generated noise, dewatering, and fish handling/salvage. Permanent effects will occur from the continued use of the facility, which includes discharge of treated effluent into the main stem Columbia River which contain toxic chemicals. The new pipeline will also cross under BNSF Railway, undeveloped SR 501 right of way, former NW Lower River Road, floodplain and diked pasture, and open fields. Peripheral wetlands surrounding Curtis Lake, Round Lake, and Green Lake will be temporarily disturbed.

With exception of impaired water quality from the SCTP's effluent discharge (discussed below), all of the effects on habitat and species from this project are temporary. These temporary effects include: Elevated suspended sediment and turbidity above background levels (intermittent plumes anticipated for 5 weeks) elevated noise from pile driving (anticipated for about 30 days at each location), temporary loss of stream habitat and forage from placement of isolation structures required to build the pipeline (anticipated to be 5 months).

2.4.1 Effects on Critical Habitat

Critical habitat includes Physical and Biological Features (PBFs) necessary to support various life stages of listed fish (i.e, rearing, migration), including good water quality, appropriate substrate, good riparian conditions, and sufficient prey.

Summary of Temporary Effects
Substrate, forage and water quality will each be temporarily diminished during construction, at multiple locations. Substrate and forage in each cofferdam area will be disturbed and inaccessible for about 5 months. Water quality will be intermittently degraded during installation of piles (about 50 days), trench excavation (3-5 days) placement and burial of the new pipe (3-5 days) and disposal of excess material (3-5 days).

Pipeline Alignment Reach 1:

Salmon Creek
Temporary loss of substrate: Placement of stream isolation structures will prohibit fish use in each area (not simultaneously) for a period of 5 months. The first (left bank) cofferdam would preclude fish use in a 6,969 sf area. The second (right bank) cofferdam would preclude fish from a 23,522 sf area. Each 24-inch pile will temporarily impair 3.14 square feet of substrate, for a total of 191 square feet. Piles will remain in place for up to 17 months.

Forage: Because forage for salmonids is mainly derived from invertebrates that live and emerge from the substrate, temporary loss of substrate is commensurate with loss of forage. In total, approximately 32,015 square feet of the Salmon Creek main channel, although not all at once, will be isolated and excavated for the new pipeline (left cofferdam + right cofferdam). Cofferdam areas will be inaccessible to salmonids during the work, and the disturbance of materials within work area will affect substrate and benthic colonies that are forage base for juvenile salmonids. The period of time that fish will be excluded from either one isolation area or the other is a minimum of five months. The placement of piles for a temporary work trestle will remove about 191 sf of habitat for 17 months. Following construction, it is likely to take several weeks to a few months for the benthic prey to re-colonize the area. In the interim, both the abundance and diversity of prey will be diminished relative to the baseline condition of the habitat, described in more detail below.

Water Quality: Prior to excavation, turbidity curtains will be deployed around each each cofferdam area. Fish passage will not be impeded as about half the channel will remain open at any one time. Placement of the curtains around each cofferdam area will temporarily block access to the work area for 5 months, but the up- stream curtain will allow for fish to escape the work area. Each half cofferdam, excavation, and to a lesser extent, sheet and pipe pile removal will produce suspended sediment. Turbidity curtains will be deployed both up and downstream of the work area prior to excavation. The most significant increased turbidity within the aquatic portion of the action area is anticipated to be limited to the time during excavation of the pipe trench, placement of the pipe, and burial of the pipe. The zone of turbidity effects extends to a state water quality standard compliance point at 100 feet downstream, and a point where background concentrations are reached at 300 feet downstream of each source, creating temporary adverse effects on the water quality PBF.

Pipeline Alignment Reach 2:

Salmon Creek to Lake River.
Because all work for this reach is above ordinary high water, we do not expect effects on Critical Habitat from the construction of Pipeline Alignment 2.

Pipeline Alignment Reach 3:

Lake River Crossing:
The total width of Lake River is approximately 370 feet. The Lake River pipeline undercrossing construction will be similar to the Salmon Creek undercrossing. A temporary floating silt curtain will be installed around the in-water work area for a period of 5 months, blocking access to the work area. Because only half width of Lake River will be isolated at any one time, up and downstream fish passage is not expected to be blocked in Lake River. The work trestle will be constructed with clear spans between bents of at least 28 feet to allow fish, watercraft, and debris passage. A total of 78, 24-inch trestle support piles will be driven and proofed using an impact hammer with sound attenuation if the water depth is greater than 3.28 feet (Stadler 2017). The deck will be curbed and sealed to prevent unintentional discharges to the creek. Each cofferdam will be approximately 185 feet in length, by 75 feet wide, and each will be in place for up to 5 months, consecutively. Open trenching will occur within sheet pile cofferdam isolation areas to manage turbidity and minimize effects on fish and habitat. Work trestles will be in Lake River for a minimum of 5 months, and will be completely removed after pipeline construction is completed.

Temporary loss of substrate: Cofferdams and piles will remove access to substrate in Lake River for about 10 months (5 months for each cofferdam, consecutively). The half cofferdam at the left bank will be about 13,939 sf. The half cofferdam at the right bank will also be about 13,939 sf. Piles for temporary work trestles will temporarily remove 245 sf of substrate.

Forage: Temporary loss of forage will occur from placement of each cofferdam and pipe piles in Lake River. The period of time that fish will be excluded from either one isolation area or the other is 5 months. One cofferdam will be in place at a time, and each will preclude forage over about 13,939 sf for a period of 5 months. The placement of piles for a temporary work trestle will remove about 244 sf of habitat for 17 months. Following construction, it is likely to take several weeks to a few months for the benthic prey to re-colonize the area. In the interim, both the abundance and diversity of prey will be diminished relative to the baseline condition of the habitat.

Water Quality: The zone of turbidity effects extends to a state water quality standard compliance point at 100 feet downstream, and a point where background concentrations are reached at 300 feet downstream of each source. Each half cofferdam, excavation, and to a lesser extent, sheet and pipe pile removal will produce suspended sediment. Turbidity curtains will be deployed both up and downstream of the work area prior to excavation. The most significant increased turbidity within the aquatic portion of the action area is anticipated to be limited to the time during excavation of the pipe trench, placement of the pipe, and burial of the pipe. Elevated suspended sediment is expected to occur within 300 feet downstream of each excavation area in Lake River, creating temporary adverse effects the water quality PBF.

Columbia River Outfall

Temporary Loss of Substrate (5 months): The temporary work trestles will be constructed east to west by driving up to 142 temporary steel piles (24 inches diameter) to form pile bents (4 piles per bent) supporting 32-foot- wide timber decks. The total area of substrate temporarily covered by the 24 inch piles would be 445 sf. Each clear span between bents will be about 28 feet long to allow fish and debris passage. A total of 22 pipe piles will be vibrated about 55 feet into the riverbed for 11 pipe supports. The 22 piles will remove about 17 sf of benthic habitat in the Columbia River. Work platforms will be in place for up to 5 months. Excavation areas for the new pipe will cover an area of about 35,490 sf of substrate. Excavation for removal of the existing 30-inch pipe will temporarily disturb about 11,302 sf of substrate. Because excavated material will be sidecast next to the excavated trench and used for backfill, substrate will also be lost (buried) in approximately the same size area as the excavation. As such, the total substrate that will be temporarily lost from trench excavation and sidecasting is 93,384 sf. The project will also relocate a navigation marker and upsize the existing piles from 18-inch to 24-inch in diameter. This will temporarily remove substrate in the Columbia River riverbed in an approximately 4 sf area. In total, placement of piles for the project will temporarily remove 466 sf of substrate for a total of 5 months. Excavation for placement of the new pipe and excavation for removal of the old pipe will temporarily disturb 93,384 sf of substrate for approximately 5 months.

Forage: As discussed above, approximately 46,692 square feet of substrate material will be excavated in the Columbia River. Another 466 sf will be temporarily removed by piles. Because excavated material will be sidecast next to the excavation area and then used to backfill, benthic forage will be covered and temporarily lost by the same square footage (approximately) as the excavation, 46,692 sf. In total, excavation and sidecasting will temporarily remove about 93,384 square feet of substrate supporting benthic forage. Fill of the two scour holes with excavated material will also temporarily bury about 5,000 sf of benthic forage. Following disposal of material for backfill and filling of scour holes, and remaining material may be disposed of in open water using flow-lane disposal. Placement of material in the flow-lane will dissipate downstream and will have temporary effects on forage in an approximate 300 foot by 100 foot (30,000 sf) area. Following construction, it is likely to take several weeks to a few months for the benthic prey to re-colonize the area. In the interim, both the abundance and diversity of prey will be diminished relative to the baseline condition of the habitat.

Water Quality: The zone of turbidity effects extends to a state water quality standard compliance point at 100 feet downstream, and a point where background concentrations are reached at 300 feet downstream of each source. Turbidity curtains will be deployed both up and downstream of the work area prior to excavation. The most significant increased turbidity within the aquatic portion of the action area is anticipated to be limited to the time during excavation of the pipe trench, placement of the pipe, removal of the existing outfall diffuser and associated riprap and piles, burial of the pipe new pipe and other excavated areas, and placement of excavated materials in scour holes and flow-lane disposal. Elevated suspended sediment is expected to occur in intermittent plumes within 300 feet downstream of the excavation and disposal areas in the Columbia River, creating temporary adverse effects the water quality PBF.

In each waterbody crossing discussed above, there is a small chance of an accidental contaminant release from construction equipment or activities; however, BMPs to prevent such a release make a spill unlikely, any release likely would be small and quickly contained due to the implementation of a pollution control plan. We discount this potential effect from occurring and if it does occur consider it insignificant.

Site Restoration: Emergent floodplain wetlands will be restored at the pipeline-receiving pit and within half-cofferdams by returning pre-project grades and revegetating with native species by seeding and vegetative propagation. Outside the creek channel, the contractor will replace the salvaged topsoil over the trench. The wetland seed mixtures will consist of perennial native wetland grasses, sedges, and rushes such as spike bentgrass, slough grass, slender hairgrass, and tufted hairgrass; or similar locally endemic species; and shrubs if they existed prior to disturbance.

Riparian pasture outside wetland will be seeded for the first growing season after construction with perennial non-native pasture grasses, such as orchardgrass, perennial ryegrass, tall fescue, subclover, Dutch white clover, and New Zealand white clover; with at least one grass and one legume.

The streambank will be restored using bioengineering techniques for post-construction riverbank stabilization. Native restoration-sized plant materials will be planted in streambank restoration areas within the permanent and temporary construction easements. The soil reinforcement method will follow Washington Department of Fish and Wildlife *Integrated Streambank Protection Guidelines* (Cramer, et al. 2003). After trench backfilling, the riverbanks will be reconstructed using encapsulated soil wraps, which involve wrapping a slowly biodegradable erosion blanket around stacked layers (lifts) of native soil. The soil layers will be seeded with native plant species, and native trees and shrubs will be established, either as cuttings in hydric soil, rooted cuttings, or seedlings. We expect site conditions to return to baseline conditions in about 1 year following restoration actions.

Long-Term Effects on Water Quality

SCTP presently discharges treated effluent between River Miles 95 and 96 under National Pollutant Discharge Elimination System (NPDES) Waste Discharge Permit No. WA0023639, issued by Washington Department of Ecology. The permit verifies that discharges comply with the provisions of the State of Washington Water Pollution Control Law Chapter 90.48 Revised Code of Washington and the Federal Water Pollution Control Act (Clean Water Act) Title 33 United States Code, Section 1251 et seq. The permit's influent flow limit (treatment capacity) is 14.95 mgd monthly average flow (maximum month). The effluent limits of the permit address Biochemical Oxygen Demand (5 day), Total Suspended Solids, Fecal Coliform Bacteria, pH, Acute Whole Effluent Toxicity (WET), and Total Ammonia (as NH3-N). The NPDES Permit does not have limits for pharmaceuticals and personal care products (PPCPs) in the effluent.

The SCTP is characterized as a conventional secondary treatment plant with advanced treatment for biological nitrogen (ammonia) removal. The conventional secondary treatment system has physical phase separation to remove settleable solids and a biological process to remove dissolved and suspended organic compounds. The biological process is performed by indigenous, aquatic microorganisms in a managed aerobic habitat. Bacteria and protozoa consume biodegradable soluble organic contaminants (e.g., sugars, fats, and organic short-chain carbon molecules) while reproducing to form cells of biological solids. Disinfection is the final step in the treatment process, where treated effluent passes through chambers containing ultraviolet lamps that kill any remaining bacteria and pathogens.

Nevertheless, discharge of municipal wastewater effluent adversely affects water quality in a receiving water body. The extent of adverse effects is directly related to the level of treatment of the effluent, the types and concentrations of toxic chemicals and metals, and the baseline water quality, as poor water quality is likely to increase additive or synergistic effects with effluent. Effluent has been shown to contain trace amounts of many chemicals and metals found in a variety of products that are disposed of via municipal sewer systems and through industrial discharges. Municipal effluents have been identified as sources of endocrine disrupting chemicals (EDCs), PPCPs, persistent, bioaccumulative and toxic chemicals (PBTs), perfluoroalkyl substances (PFASs) and other compounds of anthropogenic origin in surface waters of the United States, and Europe (Valder et al. 2014; Gerbersdorf et al, 2015; Lazorchak 2004; Luo et al, 2014; EPA 2014).

Additionally, municipal effluents commonly contain fragrances or musks which are ubiquitous ingredients in perfumes, lotions and cosmetics. There are no current regulatory requirements for testing these emerging chemicals, nor are water quality standards or other recognized benchmarks available, although research has shown them to be frequently detected in rivers, lakes and streams, as discussed below. Further, while these emerging chemicals are not currently under the auspices of regulatory authority requirements, various effects concentrations have been identified in the scientific literature. A subset of these constituents and their associated effect concentrations can be found in Table 2.

While we do not have monitoring data on effluent contaminants from the SCTP, the review of similar treatment methods found in Lubliner et al (2010) for municipal waste water indicated the facility reduced levels of metals, PBTs, PPCPs, EDCs and other contaminants. We expect the proposed action's facility to also behave similarly. Data used for this characterization included NPDES effluent data from the Puyallup WWTP from April 2003 to October 2008, an unrelated study that evaluated efficacy of biological nutrient removal in reducing the loading and concentration of PPCPs conducted in 2010 that included the Puyallup WWTP (Lubliner et al. 2010), and surrogate data from similar size WWTPs in Puget Sound. The EPA used the latter information to predict PPCP concentrations discharged from the facility, as these chemicals are not monitored. These predicted concentrations along with predicted concentrations of other compounds expected to be found in effluent from the Puyallup WWTP can be found in Table 3. Lubliner et al., (2010) revealed that the hormones and phthalates were removed to nearly undetectable levels from the Puyallup WWTP effluent. Reproductive hormones including 17a-estradiol, ethinyl estradiol and estradiol were all removed at 85 to 95 percent of their influent concentrations, resulting in concentrations of less than 2 parts per trillion, which translates to less than 2ng/L. Lubliner et al, (2010**)** also noted that the Puyallup WWTP removed a significant amount of the total suspended solids and nutrients (99 percent each). Because treatment methods for the SCTP and the Puyallup WWTP are very similar, we expect similar solids and nutrient removal efficiencies to be present in the SCTP effluent.

Pharmaceuticals and Personal Care Products. Pharmaceuticals and personal care products are an emerging environmental and human health issue and have been identified as constituents discharged into receiving waterbodies in a recent survey of effluent from five municipal wastewater treatment plants (Lubliner et al. 2010). Any product used by people for personal, health or cosmetic reasons are considered PPCPs. They are present at low concentrations in surface water, groundwater, soils, sediments, marine waters, and drinking water. Researchers monitoring the environment find PPCPs virtually everywhere domestic wastewater is discharged. PPCPs enter the environment as they pass-through the human body or when unwanted PPCPs are disposed in the trash or down the drain. Other significant sources include livestock, aquaculture, pets, and agriculture. PPCPs have not been monitored in the SCTP effluent. A myriad of pharmaceuticals and personal care products have been detected in the effluent from wastewater treatment plants discharging to the Columbia River (see https://www.epa.gov/columbiariver/chemicals-emerging-concern-columbia-river#:~:text=Chemicals%20of%20emerging%20concern%20(also,human%20health%20and%20aquatic%20life accessed 11/2/2020). We anticipate PPCPs will be present in the effluent.

Washington State's *Water Quality Standards* (Washington Administrative Code [WAC] Chapter 173-201A) specifies regulatory mixing zone (RMZ) sizes for acute and chronic aquatic life-based criteria. The acute toxicity mixing zone is an area for rapidly mixing a discharge plume with the receiving water to prevent acute toxicity to fish and aquatic life (aquatic invertebrates). The existing acute mixing zone boundary under the NPDES permit is 22 feet downstream and upstream from the diffuser's discharge ports, with an acute mixing zone ratio (dilution factor) of 18:1 (river flow: effluent flow).

The chronic toxicity mixing zone is an area in the receiving water in which the discharge of an effluent is mixed with the receiving water to assure dilution of any toxicant in the effluent to concentrations such that no chronic impacts to fish and aquatic organisms will occur outside of the mixing zone. Discharges to flowing streams will have the mixing zone calculated as a dilution ratio based on the stream and effluent design flows. The chronic mixing zone boundary for the existing SCTP's effluent outfall in the Columbia River under NPDES permit #WA0023639 extends 217 feet downstream and upstream from the diffuser's discharge ports, with a chronic mixing zone ratio of 65:1.

Relevance of Effects on Primary Biological Features to Critical Habitat Conservation Value

As described above, the proposed action has permanent negative effect on water quality in the which is more intense in the mixing zone eliciting chronic toxicity at low levels in the entire action area. We interpret this to create slightly negative effects on safe passage, forage, along with temporary effects described above on water quality from elevated suspended sediment and sound. However, when these changes are added to the baseline condition, the function of PBFs are modified at a level that we do not anticipate to be appreciable within the watershed. Since these effects are difficult to distinguish beyond the site scale, we expect that they will not appreciably diminish the conservation role of the watershed in which the site is located.

2.4.2 Effects on Listed Species

Individuals of the listed species will have exposure to both long and short term effects in their habitat, described above, as well as experiencing "direct effects" – consequences of the proposed action that are focused on or can be immediately discerned among exposed individual fishes. Some direct effects occur concurrently with minimization measures that are standard best management practice.

Exposure and Response to Worksite Isolation and Fish Handling

As discussed above, to minimize the risk of harm or mortality, an attempt will first be made to capture fish within the isolation area with seines or dip nets. If fish are unable to be captured with a seine or net, electrofishing equipment will be used. While effective at capturing fish, electrofishing has a higher likelihood of causing harm to fish. Reported rates of injury to juvenile salmonids captured by electrofishing range from 5.1 percent to 15 percent (McMichael et al. 1998; Ainslie et al. 1998). Only a few studies have examined the long-term effects of electrofishing on salmonid survival and growth (Ainslie et al. 1998; Dalbey et al. 1996). Use of electrofishing for fish salvage will comply with NMFS' electrofishing guidelines (NMFS 2000), which are expected to adequately minimize the levels of stress, mortality, and behavioral effects related to electrofishing.

A qualified fishery biologist will conduct and supervise fish removal and handling activities to minimize effects to fish, in accordance with the 2012 *WSDOT Fish Exclusion Protocols and Standards* (WSDOT 2012), or its equivalent. Excluded fish will be moved to another part of the Cowlitz River outside of the work area and released. Although listed salmonids occur in the area, only juveniles are expected to be present in the isolated work areas when the work would occur. The work isolation area will be dewatered after initial fish removal efforts are completed. Pump intakes will be screened according to the guidance provided in *Anadromous Salmonid Passage*

Facility Design (NMFS 2011a) to prevent impacts to aquatic organisms that may have been missed during fish removal activities. A qualified fishery biologist will monitor the area being dewatered for any stranded fish. Any fish found during dewatering using dip nets or other similar means and released outside the work area.

Isolating the worksites is intended to reduce the number of individual fish exposed to the effects of in-water work including equipment operating in the channel. Installing cofferdams and removing fish from the isolated worksites are designed to reduce stranding, capture, and handling. While these activities minimize the number of fish exposed to in-water work, the activities themselves can adversely affect fish. All capture methods are stressful to some degree (Wydoski 1980 in Synder 2003). Therefore, the effects of capture and relocation are discussed below.

Typically fish recover fairly rapidly from the stress and fatigue of capture and relocation, unless injured. Stress and fatigue are physiological responses that disrupt physicochemical balance, osmoregulatory functions, and normal behavior, but usually require only a short time for recovery (Snyder 2003). To minimize stress, injury and death an experienced fishery biologist will directly supervise all fish capture and handling operations, and all staff working with the seining, netting, and trapping operations will have the necessary knowledge, skills, and abilities to ensure the safe capture and relocation of salmonids. Fish remaining within the isolated areas when construction commences will likely die or be injured as a result of direct contact from heavy equipment or from the extremely high turbidity expected within the isolated areas.

Even though the goal of the fish exclusion is to reduce overall stress and mortality, capturing and handling fish can cause short-term stress, disrupt normal behavior, and may result in injury or mortality (Frisch and Anderson 2000). Fish handling may also cause reduced predator avoidance (Olla et al. 1995). Injury and handling stress from nets and seines are expected to be lower than the stress from electroshocking but may still result in adverse effects. Worksite isolation, capture, handling, transport and release of at-risk fish species will strand some juvenile fish, disrupt normal behavior, and cause short-term stress, fatigue, and some injury and mortality. Capturing and handling fish causes them short-term stress, including increased plasma levels of cortisol and glucose (Frisch and Anderson 2000; Hemre and Krogdahl 1996). Even short-term, low intensity handling may cause reduced predatory avoidance for up to 24 hours (Olla et al. 1995).

Regardless of best practices used, salvage and relocation efforts could harm some listed juvenile salmonids that may be rearing in the vicinity of the project. In summary, the capture, transport, and release of ESA-listed fish, if needed, would cause short-term stress and possibly kill some juveniles from netting and electrofishing injury, as well as from an increased chance of predation. Effects of stocking captured fish into a new upstream habitat may lead to competitive interactions with fish residing at the site and in some cases can lead to predation on the disoriented fish being released.

Exposure and Response to long term water quality effects

Exposure of listed fishes to effluent is expected at any lifestage of listed fish that is present in the action area (e.g, larval eulachon and adult eulachon, juvenile salmonids and adult salmonids, sub-adult and adult green sturgeon), with varying intensity and duration of exposure based on species and lifehistory behaviors. Because the outfall diffuser will be moved to deep water (-40 CRD), we expect minimal co-occurrence of effluent mixing zone and juvenile salmonids and eulachon. Green sturgeon are not known to travel this far upriver in significant numbers. Those green sturgeon that do move into the mixing zone would be adult and sub-adult green sturgeon. Outside of the RMZ, released contaminants do not disappear, but their concentrations are much lower. We expect low-level contaminants from the mixing zone to continue downriver and contribute incrementally to the degraded baseline conditions as discussed in Section 2.4.

Greater exposure is likely among salmonids. An EPA nationwide effort at evaluating chemicals of emerging concern performed sampling of fish tissues from sites across the nation including Snake River and Willamette River, and samples collected from the 353 river sites yielded 353 fillet sample results for mercury, 349 fillet sample results for PFAS (four samples had insufficient fillet tissue for PFAS analysis), and 223 fillet sample results for PCBs (only fillet samples from river sites previously sampled for the 2008-09 NRSA Fish Tissue Study were analyzed for PCBs). All the fish fillet samples analyzed contained detectable levels of mercury and PCBs, and PFAS were detected in 99.7% of the fillet samples. And, there is considerable evidence that fishes inhabiting waters that receive effluent from municipal WWTPs are exposed to chemicals that affect reproductive endocrine function. Male fish downstream of some WWTP outfalls produce vitellogenin (an egg yolk precursor protein) mRNA (messenger ribonucleic acid, which carries information from DNA in the nucleus to the ribosome sites of protein synthesis in the cell), and protein associated with oocyte (an immature ovum or egg cell) maturation in females, and early-stage eggs in their testes (Jobling et al. 1998).

This feminization has been linked to the presence of estrogenic substances such as natural estrogen, 17 beta-estradiol (E2) and synthetic estrogen, 17 alpha-ethenylestradiol (EE2). These substances are usually found in the aquatic environment at low parts per trillion concentrations, typically less than 5 nanograms (ng)/L (Zhou et al. 2007). Synthetic estrogen is used in birth control pills (EE2) and is one of the more potent estrogens and has been linked to the feminization of male fishes in rivers receiving municipal wastewater (Thorpe et al. 2003). Laboratory studies have shown decreased reproductive success of fish exposed to less than 1-5 ng/L of EE2 for a period of 150 days (Parrott & Blunt 2005).

Kidd et al., (2007) showed that seven years of chronic exposure of fathead minnows to low concentrations (5-6 ng/L) of EE2 led to feminization of males through the production of vitellogenin mRNA and protein, impacts on gonadal development as evidenced by intersex in males and altered oogenesis (egg cell production) in females. This exposure ultimately caused a near extinction of this fish species from the lake where they were being studied. This outcome demonstrated that the concentrations of estrogens and their mimics observed in freshwaters can impact the sustainability of wild fish populations.

Review of the data collected by Lubliner et al., (2010) revealed that the hormones and phthalates were removed to nearly undetectable levels from the Puyallup WWTP effluent. Reproductive hormones including 17a-estradiol, ethinyl estradiol and estradiol were all removed at 85 to 95 percent of their influent concentrations, resulting in concentrations of less than 2 parts per trillion, which translates to less than 2ng/L. The removal efficiency of these hormones is significant as these compounds are highly biologically active at low concentrations, as discussed above, and often responsible for much of the endocrine activity in fish exposed to municipal effluents.

In studies conducted by Kidd et al., 2007 and Parrott and Blunt (2005) fish were exposed to either greater concentrations of EE2 or longer exposure periods than what NMFS would expect a juvenile salmonid residing in the action area to be exposed to. Parrot and Blunt (2005) observed an increase in the ovipositor index (a female secondary sex characteristic) as the most sensitive early response 60 dph (days post hatch) when fish were exposed to EE2 concentrations greater than or equal to 3.5 ng/L in a laboratory setting. However, no significant changes were seen in fish exposed for up to day 30. Kidd et al., 2007 observed elevated vitellogenin seven weeks after the first estrogen additions to the experimental lake began in 2001.

Although data indicate juvenile salmonids may reside in the lower Columbia River for extended periods, NMFS does not expect these juveniles to spend more than a few minutes to hours within the acute or chronic mixing zone, due to the depth, velocity, and lack of habitat suitable for juveniles in the area of the mixing zone. Based upon the brief exposure duration anticipated in the mixing zone, and the low levels of environmental estrogens, current data do not indicate that significant elevations in vitellogenin or other effects related to endocrine activity discussed above would occur in salmonids that enter the mixing zone from this facility. Exposure is most likely to occur at chronic sublethal levels in areas outside of the mixing zone, where contaminants are ubiquitous but diffuse and lower in concentrations compared to the mixing zones. Those species with longer freshwater rearing strategies are likely to have the greatest duration of exposure to these low levels.

Cleuvers (2004) demonstrated that some of these pharmaceuticals, including NSAIDs diclofenac, ibuprofen, naproxen and acetylsalicylic acid, follow the concept of “concentration addition”, meaning that these substances applied at less than their individual “no observable effect levels” (NOECs), can nevertheless contribute to a toxic mixture, as can be seen in Table 2 below. Of the NSAIDs investigated by Cleuvers (2004), naproxen and ibuprofen were detected in WWTP effluent, and their combined predicted surface water concentration was 9.2 ng/L. This concentration is well below levels shown to cause effects even when combined with other NSAIDs. A subset of compounds that are expected in the effluent discharge and their associated effects levels can be found in Table 3.

Table 3. Concentrations (mg/L^{-1}) of the tested drugs at their effective concentrations (EC) applied in the mixture in the acute Daphnia survival test in comparison to the individual NOECs of the single compounds*

Substance	$EC_5/4$ (mgL^{-1})	$EC_{10}/4$	$EC_{20}/4$	$EC_{50}/4$	$EC_{80}/4$	NOEC
Diclofenac	2.5	3.8	6.4	17.0	45.3	45
Ibuprofen	14.6	16.5	19.1	25.3	33.5	75
Naproxen	6.6	9.9	16.2	41.6	106.7	32
ASA	9.5	11.5	14.4	22.0	33.8	75

*For assessing mixture toxicity, a quarter of the calculated effect concentrations (EC5/4, EC10/4, EC20/4, EC50/4, and EC80/4) of each substance was used. (Source: Cleuvers 2004)

Exposure and Response to Elevated Suspended Sediments

Elevated suspended sediment and turbidity above background levels can cause stress by impairing the ability to locate predators, find prey, defend territories, or by interfering with gill functions (Newcombe and Jensen 1996). Increased stress can compromise the effectiveness of the immune system, thereby affecting mortality rates (USFWS, 1998). Increased stress can also affect blood physiology, thereby decreasing immunological competence, growth, and reproductive success.

A temporary increase in suspended sediments will occur during the placement cofferdams, piles, excavation, and removal of this infrastructure, and will result in short-term impacts to water quality within the aquatic portions of the action area. Significant increased turbidity within the aquatic portion of the action area is anticipated to be limited to the time during initial cofferdam set up, during excavation, during removal of infrastructure. Turbidity is expected to occur within 300 feet of each excavation area in the project site. To lessen the impacts of sediment from upland erosion, appropriate sediment and erosion control BMPs will be put into place before construction begins and will be maintained in working order throughout the construction period. Juvenile salmonids present in the action area are reasonably likely to display behavioral and sublethal effects from the suspended sediment and associated turbidity, such as reduced feeding activity, and avoidance; forcing them to forage in other areas. Increased stress can compromise the effectiveness of the immune system, thereby affecting mortality rates (USFWS, 1998). Laboratory studies have consistently found that the 96- hour median lethal concentration (LC50) for juvenile salmonids is above 1,097 mg/L for 1 to 3 hour exposure (Newcombe and Jensen 1996). However, effects of suspended sediment and turbidity on juvenile ESA-listed fish will be minimized by the limited, temporary and localized area of disturbance to aquatic substrates from the project; by the low probability of fish presence in the area from timing project activities during the in-water work window; and by the poor rearing habitat in the project area that is inherently less likely to support rearing juvenile salmonids irrespective of the work window timing to be employed. Columbia River chum salmon adults could also be migrating through the action area during project activities. Adult salmon can easily avoid disturbance including elevated turbidity by accessing nearby areas of the river that are not turbid. Effects on CR chum salmon from suspended sediment are not likely to rise to the level of harm for adult CR chum salmon.

There is a small chance of an accidental contaminant release from construction equipment or activities; however, any release likely would be small and quickly contained due to the implementation of a pollution prevention and control plan, and is therefore not likely to have an adverse effect on ESA-listed species.

Exposure and Response to Temporary Loss of Forage

Work area isolation activities for the project are expected to take place in phases totaling 5-14 months in Salmon Creek and about 5 months in Lake River, between July 1 and October 31. Cofferdam isolation structures will not be used in the Columbia River portion of the project area.

- Cofferdams at Lake River will not be present at the same time, as such, the impact on forage will be 13,939 feet for about 5 months. Piles for the work trestle at Lake River will impact 245 sf of substrate and forage.
- Cofferdams at Salmon Creek will not be present at the same time, as such, the temporary impact on forage will be about 6,969 sf area for the first cofferdam. The second cofferdam would impact a 23,522 sf area. These impact areas, which will not occur at the same time, are expected to impact forage for 5-14 months. Each 24-inch pile for the work trestle will temporarily remove 3.14 square feet of substrate, for a total of 191 square feet.
- Temporary work platform piles will preclude fish use of about 445 sf of substrate in the Columbia River. Excavation for removal of the existing 30-inch pipe would remove about 11,302 sf of substrate over a period of 5 months. Excavation for the new pipe will impact about 35,490 sf. Sidecasting of excavated material at each excavated area will double the area of impacted forage, for a total of 93,384 sf. Flow-lane disposal will displace about 30,000 sf of forage. Filling of scour holes will add another 5,000 sf of impacted forage area. The 22 piles for the pipe support structure will permanently remove about 17 sf of benthic habitat in the Columbia River.

Temporary loss of forage at all three water crossing locations is not expected to have lethal effects on listed fish. This is because while each in-water work location is relatively large, fish will be able to navigate through and around these work areas to access forage. This will create a small negative effect on an exposed individual's fitness, but should not result in long-term negative effects on individual fish.

Exposure and Response to Elevated Noise

We assume that some juvenile LCR coho salmon, LCR Chinook salmon, LCR steelhead and adult CR chum salmon could be present in the vicinity of the project when construction will occur. Elevated Sound Exposure Levels (SEL) will occur on all three waterbodies. Acoustic disturbances associated with pile driving are likely to disrupt the foraging behavior and reduce forage efficiency of juvenile salmonids. Biological effects to ESA-listed salmonids may also result from the high sound pressures produced when the piles are proofed with an impact hammer.

Due to prohibitively high temperatures in lower Salmon Creek during the summer pile driving window, we anticipate few fish will be present during impact pile driving, and any present should be actively migrating; minimizing their exposure to high noise levels. Also, low water surface elevations will result in many piles driven in-the-dry or in shallow water (<3.28 feet deep). All impact pile work will be conducted during the September 1 through December 31 pile driving work window. All piles will initially be installed via vibratory hammer, followed by proofing with an impact hammer with sound attenuation strategies including the use of bubble curtains where water depths are above 3.28 feet. At the Lake River crossing, up to 78, 24-inch-diameter piles will be driven to construct the platforms. Each pile will be driven initially with a vibratory hammer, then proofed with an impact hammer. Temporary round steel piles will be driven at least 100 feet below ground. Assuming each pile requires 200 proofing strikes to install, it will take 15,600 blows to install the temporary piles. At the Columbia River site, up to 142 24-inch-diameter piles will be driven into the Columbia River shoreline to construct the work trestles/platforms. Each pile will be driven initially with a vibratory hammer, then proofed with an impact hammer with sound attenuation. Temporary round steel piles will be driven at least 100 feet below ground. Assuming each pile requires 200 proofing strikes to install, it will take 28,400 blows to install the temporary piles. However, the applicant is expecting to install up to 6 pile per day regardless of the location. As such, the applicant estimates a total of 1,200 impacts within a 12 hour period, each day.

In Lake River, the zone of hydroacoustic effects is limited to the width of river (about 370 feet), and upstream about 3,000 feet, and downstream about 2,200 feet. The zone of hydroacoustic effects in Salmon Creek would be limited by both steam width (about 100 feet) and up and downstream (dependent on water depth and stream contours) approximately 200 feet. In the Columbia River, the zone of hydroacoustic effects of in-water work is from about 23,200 feet (4.4 miles) downstream to about 24,194 feet (4.6 miles) upstream of the outfall diffuser construction site.

Fishes with swimbladders (including salmonids) are sensitive to underwater impulsive sounds, i.e., sounds with a sharp sound pressure peak occurring in a short interval of time (Caltrans 2001). As the pressure wave passes through a fish, the swimbladder is rapidly squeezed due to the high pressure, and then rapidly expanded as the under pressure component of the wave passes through the fish. The pneumatic pounding may rupture capillaries in the internal organs as indicated by observed blood in the abdominal cavity, and maceration of the kidney tissues (Caltrans 2001). The injuries caused by such pressure waves are known as barotraumas, and include hemorrhage and rupture of internal organs, as described above, and damage to the auditory system. Death can be instantaneous, can occur within minutes after exposure, or can occur several days later. A multi-agency work group determined that to protect listed species, sound pressure waves should be within a single strike threshold of 206 decibels (dB), and for cumulative strikes either 187 dB sound exposure level (SEL) where fish are larger than 2 grams or 183 dB SEL where fish are smaller than 2 grams. The SEL measurement is a cumulative measurement, based on the number of consecutive strikes, where the SEL increases as pile strikes increase in number. Based on information provided in the Biological Assessment, we estimate a cumulative SEL at approximately 209 dB based on 1,200 strikes per day. This dB could increase if more than 1,200 strikes occur each day for about 23 days**.** We cannot meaningfully estimate the number of salmonids that would be exposed to elevated SELs. However, because of work windows and general disturbance that would preclude fish presence, we expect the number of fish to be exposed to be small. Nevertheless, death or injury of exposed individual fish is likely to occur.

Summary of Construction Effects on Listed Species.
Some fish will be present during project construction. Most of the fish present will incur short-term stress due to interaction with construction equipment, noise, increased energetic costs, and reduced water quality and foraging ability. This stress is likely to reduce long-term fitness for some of these fish, and a few fish are likely to be entrained or crushed by the excavation equipment. A few other fish may die due to the culmination of joint causes, such as the stresses cause by the proposed action combined with a previous stressor unrelated to the proposed action. Any fish in the vicinity of injuries noise levels as discussed above, may be injured or killed.

We evaluate project effects at the population scale by determining if effects to individual fish will negatively influence viability salmonid population (VSP) characteristics of exposed populations. Because listed fish are not likely to be present in large numbers do to timing, as well as the minimization measures described in the BA, the death or injury of juvenile LCR coho, LCR Chinook salmon and LCR steelhead juveniles from the effects of the action will be limited to the those areas described above for elevated noise, electroshocking and fish handling, and turbidity, be indiscernible against present abundance and therefore unlikely to influence the rate of juvenile to adult survival for returning adults. While adult CR chum salmon could be migrating during the work window, they would avoid any effects from turbidity or fish handling. As such, only impact pile driving is likely to adversely affect CR chum salmon. Because CR chum would be adult fish, they would likely move away from the area at the onset of pile driving. As such, we do not expect lethal effects on CR chum from pile driving. Adult salmon would likely experience delayed spawning migration, but would have unimpeded access past the construction areas during intermittent cessation of pile driving, which would occur for an hour or so several times a day, and during the night when all pile driving is stopped. As such, this effect is unlikely result in decreased spawning success, but is likely to result in sublethal effects on adult CR chum salmon through elevated stress.

2.5 Cumulative Effects

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

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

Other effects that are likely to occur in the action area that are outside of any federal nexus are related to recreational uses of the Columbia River, which are likely to intensify with increases in human population growth. Effluent discharges from other WWTP plants and industrial areas will also contribute to continued water quality diminishment associated with human population growth. Further water quality diminishment will occur as the landscape in uplands continues to be transformed by intensifying uses (commercial, industrial, and residential). These effects, while certain to occur, are difficult to quantify in any degree.

2.6 Integration and Synthesis

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

Species
All but two of the species affected by the proposed action are considered threatened by the risk of extinction, and the other two are considered endangered by the risk of extinction. All of the species have lower abundance, productivity, spatial structure and diversity than was common in recent history, and each of the species has both less habitat, and degraded quality of habitat available to them. These conditions contribute to their status, and also to the quality of their designated critical habitat. Even areas of critical habitat that have high conservation value are likely to be impaired in one or more of their PBFs, in particular, water quality. Impaired baseline conditions in the action area are representative of systemic habitat degradation, and are factors that inhibit the increases in productivity necessary for robust recovery of the species. We add the effects of the proposed action to this context.

The action will add both short term and long term, sublethal and lethal effects to listed species and their habitats. The most acute effects will occur primarily among salmonids that co-occur with pile driving, stream isolation (fish handling) and turbidity. Timing of the construction is intended to reduce exposure of vulnerable life stages, and we therefore conclude that fish injured or killed 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. The action's chronic low level (sublethal) effects are likely among all species in Table 2. When added to the contaminants and temperature effects from other sources, these effects will manifest with the co-occurrence of elevated temperatures and low levels of contaminants including dissolved copper, PPCPs, and ammonia. These effects will largely be sublethal to exposed individuals and are not expected to alter current abundances and productivities of the affected populations. The proposed action authorizes the current discharge to occur for another five years, thus contributing to baseline conditions. 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 populations 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 contaminants and temperature effects of the proposed action. Because the effects of the proposed action are not expected to measurably affect population trends among the salmonids, eulachon, and green sturgeon 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 the any species in Table 2, or appreciably reduce the likelihood of both the survival and recovery of ESUs or DPSs in the wild.

Critical Habitat

With the exception of CR chum salmon in Salmon Creek, the entire action area is located in critical habitat for the species found in Table 4. Construction effects on PBFs of critical habitat from the project 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 effluent discharged from the SCTP and other effluent and non-point sources considered in the cumulative effects analysis adversely affect long-term water quality PBF in the action area. This PBF is a necessary element of habitat for rearing and migrating fish. Rearing and migration features as a baseline matter have been impaired by degraded water quality, bank armoring, channelization, and loss of riparian cover. Under the proposed action, effects from the SCTP discharge will continue its contribution to degraded water quality in perpetuity. 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). 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. Notwithstanding, the chronic long term effects of the proposed action will not improve the conservation value of critical habitat in The Columbia River, Lake River, or Salmon Creek, but additional degradation is difficult to quantify and discern because the habitat in the action area will be minimally altered outside the acute and chronic mixing zones. Within the action area, we consider the overall conservation value of the critical habitat remains unchanged from its currently constrained condition when the consequences of the proposed action are added to the baseline condition. However, while conditions of critical habitat will remain constrained, chronic water quality conditions created by effluent discharge will be moved to deeper water where better dilution is expected with less direct contact with critical habitat needed for PBFs for juvenile and adult salmon, we do not expect this condition to diminish the conservation value of any PBFs of critical habitat.

2.7 Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, the effects of other activities caused by the proposed action, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence LCR Chinook salmon, UWR Chinook salmon, UCR spring-run Chinook salmon, SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, Columbia River chum salmon, LCR coho salmon, SR sockeye salmon, LCR steelhead, UWR steelhead, MCR steelhead, UCR steelhead, SRB steelhead, Southern green sturgeon, eulachon or destroy or adversely modify designated critical habitat for these species.

2.8 Incidental Take Statement

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

2.8.1 Amount or Extent of Take

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 associated with hydroacoustic impacts to salmon and steelhead from driving the pilings with an impact hammer: the number cumulative hours of pile driving each day: The extent of take for hydroacoustic effects is a maximum of 12 consecutive hours with a 12 hour delay before resuming each day's pile driving, for a total of 54 days of pile

driving. This surrogate is causally linked to incidental take by hydroacoustic impacts because the amount of take increases incrementally with each pile strike and hydroacoustic impacts go back to baseline SELs after a 12 hour delay.

2. Harm associated with temporary loss of forage, and fish isolation including fish handling and electroshocking: The extent of take for fish isolation effects is the size of each cofferdam, listed below in section 2.8.4. This surrogate is causally linked to incidental take because take from foreclosed habitat access increases as the size of the cofferdam increases.
3. Harm associated with effluent discharge: Harm (sublethal effects) resultant from contaminants present in effluent discharged in the Columbia River among 100 percent of fish rearing in and near the effluent mixing zone and in the downstream action area to the Pacific Ocean.
4. Harm to salmon and steelhead associated with suspended sediment related to excavation, discharge of excavated materials including flow-land disposal : a 300-foot downstream plume from the point of disturbance based on Washington State Department of Ecology water quality standards (WAC 173-201A-200 (1)(e)). Specifically, if turbidity occurs in any waterbody beyond that authorized mixing zone, the anticipated take would be exceeded. This surrogate is casually linked to incidental take by suspended sediment because injury and susceptibility to piscivorous increases as turbidity increases.

2.8.2 Effect of the Take

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

2.8.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" are nondiscretionary measures to minimize the amount or extent of incidental take (50 CFR 402.02). The Corps and applicant shall minimize incidental take by:

1. Applying NPDES, HPA, and county shoreline permit conditions to avoid or minimize harm to the ESA-listed species considered in this opinion.

2. 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.

Because non-regulated contaminants such as pharmaceuticals and personal care products are not regularly monitored and are currently outside the monitoring requirements for the NPDES permit, we use monitored contaminants (Dissolved Oxygen, BOD, temperature, turbidity, etc.) as a surrogate for measuring the effects within the chronic and acute mixing zones.

The reasonable and prudent measure for this action is to ensure by routine monitoring that conventional effluent constituents are within permit limits within the acute and chronic mixing zones.

2.8.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the COE or any applicant must comply with them in order to implement the RPMs (50 CFR 402.14). The COE 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 (COE protective permit conditions):

    a) Require Specific Maximum Dimensions of Temporary Fish Isolation Structures.
        i) Temporary fish isolation structures (i.e., cofferdams) in Salmon Creek shall not exceed 30,491-square feet in total.
        ii) Temporary fish isolation structures (i.e., cofferdams) in Lake River shall not exceed 26,786-square feet in total.
        iii) Confirm that as-built temporary cofferdams do not exceed these dimensions.
    b) Require Specific Timing of In-Water Work.
        i) All piles shall be installed with a vibratory pile driver, except while proofing with an impact hammer.
        ii) Pile driving and excavation shall be completed over two work years.
        iii) In-water work (pile driving and excavation) in Columbia River shall occur only during the period of October 1 to February 28 in each of the two work years, except that pile driving with an impact hammer shall not occur between January 15 and February 28.
        iv) In-water work (pile driving and excavation) in Lake River and Salmon Creek shall occur only during the period of June 1 – October 31 in each of the two work years.
        v) All work must be completed within these dates.
    c) Require Specific Conditions for Pile Driving.
        i) Steel piles shall not exceed 24-inches in diameter.
        ii) When possible, use a vibratory hammer for pile installation.
        iii) When water depth exceeds 3.28-feet, use a confined bubble curtain or similar sound attenuation system capable of achieving approximately 7 dB of sound attenuation during impact pile driving.
        iv) When impact pile driving, minimize simultaneous pile driving to the extent possible by alternating pile driving between each pile driver, any simultaneous pile driving shall only occur when pile drivers are within 150 feet of each other to minimize effects on listed species.

v) When pile driving, minimize cumulative SELs by delaying pile driving 12 hours after each day of pile driving. Pile driving shall be limited to 54 non-consecutive days.

d) Require Verification that the Effluent Outfall Diffuser Is Constructed and Functions as Designed.

i) Prepare as-built drawings of the constructed outfall diffuser demonstrating that the structure was constructed as permitted.

ii) Verify compliance with State water quality criteria, and verify that the outfall diffuser functions as designed, by performing a Field Tracer Performance Study during the first low flow season (September-October) following outfall construction. Use the field-measured dilutions to calibrate and validate the dilution modeling that serves as the basis for design. Use the calibrated model to predict dilutions under design river flows and effluent flows, as defined in the Washington State Department of Ecology's (Ecology) *Permit Writers Manual* and in the applicant's Phase 5A Project *Engineering Report*. Document the results of the Field Tracer Performance Study and dilution modeling in the Outfall Mixing Performance Study.

iii) Inform NMFS of NPDES permit limit exceedances, as the NPDES permit requires.

2) The following terms and conditions implement reasonable and prudent measure 2 (monitoring):

a) Effluent Discharge: During operation of the 48" SCTP outfall diffuser, provide NMFS with the Salmon Creek Wastewater Treatment Plant's (SCTP) Annual Summary of Discharge Monitoring Reports (DMR). The DMRs record effluent monitoring required by the NPDES permit. The DMR Annual Summaries will provide monitoring data for NPDES permit-identified, regularly-monitored effluent constituents.

b) Reporting: USACE and the applicant shall monitor and report on the following items, at a minimum:

i) Pile installation. Report the number of strikes per pile, the number of piles installed, the type of piles installed, the time between pile installation sessions, the total days of pile driving, the type and use of sound attenuation device, and type of driving hammer used.

ii) Turbidity monitoring. Report the results from the turbidity monitoring, including monitoring location and time. Report any exceedance of the 300-foot turbidity plume.

iii) Fish Isolation Structures. Report the as-built areas of temporary fish isolation structures (i.e., cofferdams), which shall not exceed 30,491-square feet in Salmon Creek and 26,786-square feet in Lake River.

iv) Effluent Discharge Concentrations. Monitor and report SCTP effluent discharge concentrations, as the NPDES permit requires for Ecology, in DMR Annual Summary Reports.

v) Submit reports to NMFS addressing pile installation, turbidity monitoring, and fish isolation structures annually, no later than January 31, until project construction is substantially completed.
vi) Submit to NMFS the Outfall Mixing Performance Study Report addressing the 48" outfall diffuser Field Tracer Performance Study and dilution modeling no later than March 31 in the year following the completion of the Field Tracer Performance Study.
vii) Submit DMR Annual Summary Reports to NMFS annually for up to three years, no later than 2 months after laboratory results are received by the applicant in the year following monitoring.
viii) Submit monitoring reports to NMFS through the following e-mail addresses: projectreports.wcr@noaa.gov with a cc to Scott.Anderson@noaa.gov.

2.9 Conservation Recommendations

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

> Support the investigation of the re-use of treated municipal wastewater for appropriate municipal and agricultural needs such as irrigation. Such actions would not only alleviate effects to listed fish within Columbia River by decreasing discharge volume, but would also decrease the demand for clean freshwater in the municipality.

2.10 Reinitiation of Consultation

This concludes formal consultation for Clean Water Alliance Phase 5, Columbia River Outfall and Effluent Pipeline.

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

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

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. The MSA (section 3) defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." 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) also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH.

This analysis is based, in part, on the EFH assessment provided by the COE 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. Stream isolation and 5 month temporary removal of benthic habitat (substrate) Lake River (13,939 square feet for each) and Salmon Creek (6,969 and 23,522 square feet) of channel substrate.
2. Suspended sediment plumes in Salmon Creek, Lake River, and Columbia River. During pile installation and removal, cofferdam installation and removal, and during excavation for the pipe.
3. Permanent effects on water quality in the Columbia River resultant from levels of contaminants in discharged effluent.

These effects are described more fully in Section 2 of this document.

3.3 Essential Fish Habitat Conservation Recommendations

Fully implementing the EFH conservation recommendations described in this section would protect, by avoiding or minimizing the adverse effects described in Section 3.2, above, approximately 4 acres of designated EFH for Pacific Coast salmon:

1. Take care when removing trestle piles and cofferdams to minimize bed disturbance and suspended sediments.

2. Return flow to the coffered area at a slow, measured pace to minimize bed disturbance and downstream release of suspended sediments.
3. Excavate the minimum trench necessary to bury the new pipe.
4. Revegetate disturbed areas with appropriate native riparian vegetation.
5. Initiate monitoring of the effluent plume in the Columbia River to ensure load and contaminants are consistent with the NPDES permit.
6. Use erosion minimization measures and BMPs

3.4 Statutory Response Requirement

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

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

3.5 Supplemental Consultation

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

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

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

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are the COE. Other interested users could include the Discovery Clean Water Alliance, and outdoor recreationalists from Clark or Wahkiakum Counties, or interest groups such as American Rivers or American Audubon. Individual copies of this opinion were provided to the COE. The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adheres to conventional standards for style.

4.2 Integrity

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

4.3 Objectivity

Information Product Category: Natural Resource Plan

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

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

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

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

5. REFERENCES

Abatzoglou, J.T. Rupp, D.E. and Mote, P.W. 2014. Seasonal climate variability and change in the pacific northwest of the United States. Journal of Climate 27(5): 2125-2142.

B.J. Ainslie, J.R. Post and J. Paul. 1998 effects of pulsed and continuous dc electrofishing on juvenile rainbow trout, North American Journal of Fisheries Management, 18, pages 905– 918.

Cleuvers, M.. 2004. Mixture toxicity of the anti-inflammatory drugs diclofenac, ibuprofen, naproxen, and acetylsalicylic acid. Ecotoxicology and Environmental Safety 59(3): 309-315.COE (United States Army Corps of Engineers) 2012. Mud Mountain Dam Fish Escapement Website: http://www.nws.usace.army.mil/Missions/CivilWorks/LocksandDams/MudMountainDam/FishCounts.aspx

Crozier, L.G., Hendry, A.P., Lawson, P.W., Quinn, T.P., Mantua, N.J., Battin, J., Shaw, R.G. and Huey, R.B., 2008. Potential responses to climate change in organisms with complex life histories: evolution and plasticity in Pacific salmon. Evolutionary Applications 1(2): 252- 270.

Crozier, L. G., M. D. Scheuerell, and E. W. Zabel. 2011. Using Time Series Analysis to Characterize Evolutionary and Plastic Responses to Environmental Change: A Case Study of a Shift Toward Earlier Migration Date in Sockeye Salmon. The American Naturalist 178 (6): 755-773.

EPA (U.S. Environmental Protection Agency). 2014. 2013-2014 National River and Streams Assessment Fish Tissue Study. HTTPS:// WWW.EPA.GOV/Fish-Tech/2013-2014 National Rivers and Streams Assessment Fish Tissue Study. Access 11/2/2020

Dalbey, S. R., T. E. McMahon, and W. Fredenberg. 1996. Effect of electrofishing pulse shape and electrofishing-induced spinal injury on long-term growth and survival of wild rainbow trout. North American Journal of Fisheries Management 16:560-569

Dominguez, F., E. Rivera, D. P. Lettenmaier, and C. L. Castro. 2012. Changes in Winter Precipitation Extremes for the Western United States under a Warmer Climate as Simulated by Regional Climate Models. Geophysical Research Letters 39(5).

Doney, S. C., M. Ruckelshaus, J. E. Duffy, J. P. Barry, F. Chan, C. A. English, H. M. Galindo, J. M. Grebmeier, A. B. Hollowed, N. Knowlton, J. Polovina, N. N. Rabalais, W. J. Sydeman, and L. D. Talley. 2012. Climate Change Impacts on Marine Ecosystems. Annual Review of Marine Science 4: 11-37.

Feely, R.A., T. Klinger, J.A. Newton, and M. Chadsey (editors). 2012. Scientific summary of ocean acidification in Washington state marine waters. NOAA Office of Oceanic and Atmospheric Research Special Report.

Frisch, A.J. and T.A. Anderson. 2000. The response of coral trout (*Plectropomus leopardus*) to capture, handling and transport and shallow water stress. Fish Physiology and Biochemistry 23(1): 23-24.

Gerbersdorf., Sabine U., Cimatoribus, Carla., ClassKarl-H., Holger, Steffen. Engesser,Henner Helbich, Claudia.,Hollert, Lange., Kranert, Martin., Metzger, Jörg., Nowak,Wolfgang., Benjamin, Thomas-Seiler Steger, Kristin., Steinmetz, Heidrun., Wieprecht,Silke. Anthropogenic Trace Compounds (ATCs) in aquatic habitats—Research needs on sources, fate, detection and toxicity to ensure timely elimination strategies and risk management.

Glick, P. Clough J., and B. Nunley. 2007. Sea-Level Rise and Coastal Habitats in the Pacific Northwest: An analysis for Puget Sound, southwestern Washington, and northwestern Oregon. National Wildlife Federation, Seattle, WA.

Goode, J.R., Buffington, J.M., Tonina, D., Isaak, D.J., Thurow, R.F., Wenger, S., Nagel, D., Luce, C., Tetzlaff, D. and Soulsby, C., 2013. Potential effects of climate change on streambed scour and risks to salmonid s rvival in snow-dominated mountain basins. Hydrological Processes 27(5): 750-765.

Hecht, S.A., D.H. Baldwin, C.A. Mebane, T. Hawkes, S.J. Gross, and N.L. Scholz. 2007. An overview of sensory effects on juvenile salmonids exposed to dissolved copper: Applying a benchmark concentration approach to evaluate sublethal neurobehavioral toxicity. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-83, 39 p

Hemre, G.I. and A. Krogdahl. 1996. Effect of handling and fish size on secondary changes in carbohydrate metabolism in Atlantic salmon, Salmo salar L. Aquaculture Nutrition 2(4): 249-252.

Isaak, D.J., Wollrab, S., Horan, D. and Chandler, G., 2012. Climate change effects on stream and river temperatures across the northwest US from 1980–2009 and implications for salmonid fishes. Climatic Change 113(2): 499-524.

IPCC 2014 Summary for policymakers In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change ed C B Field et al (Cambridge)(Cambridge University Press)(Cambridge, United Kingdom and New York, NY, USA) pp 1–32

ISAB (editor). 2007. Climate change impacts on Columbia River Basin fish and wildlife.In: Climate Change Report, ISAB 2007-2. Independent Scientific Advisory Board, Northwest Power and Conservation Council. Portland, Oregon.

Kidd, K.A., P.J. Blanchfield, K.H. Mills, V.P. Palace, R.E. Evans, J.M. Lazorchak and R.W. Flick. 2007. Collapse of a fish population after exposure to a synthetic estrogen. Proceedings of the National Academy of Sciences 104(21):8897-8901.

Kunkel, K. E., L. E. Stevens, S. E. Stevens, L. Sun, E. Janssen, D. Wuebbles, K. T. Redmond, and J. G. Dobson. 2013. Regional Climate Trends and Scenarios for the U.S. National Climate Assessment: Part 6. Climate of the Northwest U.S. NOAA Technical Report NESDIS 142-6. 83 pp. National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Service, Washington, D.C.

Lawson, P. W., Logerwell, E. A., Mantua, N. J., Francis, R. C., & Agostini, V. N. 2004. Environmental factors influencing freshwater survival and smolt production in Pacific Northwest coho salmon (Oncorhynchus kisutch). Canadian Journal of Fisheries and Aquatic Sciences 61(3): 360-373.

Lubliner, B., M. Redding, and D. Ragsdale. 2010. Pharmaceuticals and Personal Care Products in Municipal Wastewater and their Removal by Nutrient Treatment Technologies. Washington State Department of Ecology, Olympia, WA. Publication Number 10-03-004. http://www.ecy.wa.gov/biblio/1003004.html.

Luo, Y. Guo, W. H.H. Ngo, Long Duc, N. Hai, F.I. Zhang, J. Liang S. and Wang, X.C. Sci. Total Environ., 473 (2014), pp. 619-641

Mantua, N., I. Tohver, and A. Hamlet. 2009. Impacts of Climate Change on Key Aspects of Freshwater Salmon Habitat in Washington State. In The Washington Climate Change Impacts Assessment: Evaluating Washington's Future in a Changing Climate, edited by M. M. Elsner, J. Littell, L. Whitely Binder, 217-253. The Climate Impacts Group, University of Washington, Seattle, Washington.

Mantua, N., I. Tohver, and A. Hamlet. 2010. Climate change impacts on streamflow extremes and summertime stream temperature and their possible consequences for freshwater salmon habitat in Washington State. Climatic Change 102(1): 187-223.

McMahon, T.E., and G.F. Hartman. 1989. Influence of cover complexity and current velocity on winter habitat use by juvenile coho salmon (Oncorhynchus kisutch). Canadian Journal of Fisheries and Aquatic Sciences 46: 1551–1557.

McMichael, G. A. 1998. Examination of electrofishing injury and short-term mortality in hatchery rainbow trout. North American Journal of Fisheries Management 13:229–233.

Mote, P.W., Dalton, M., Snover, A.K. 2013. Climate Change in the Northwest: Implications for our Landscapes, Waters, and Communities. Washington, D.C.: Island Press. 271 pp.

Mote, P.W, A. K. Snover, S. Capalbo, S.D. Eigenbrode, P. Glick, J. Littell, R.R. Raymondi, and W.S. Reeder. 2014. Ch. 21: Northwest. In Climate Change Impacts in the United States: The Third National Climate Assessment, J. M. Melillo, T.C. Richmond, and G.W. Yohe, Eds., U.S. Global Change Research Program, 487-513.

Mote, P.W., D.E. Rupp, S. Li, D.J. Sharp, F. Otto, P.F. Uhe, M. Xiao, D.P. Lettenmaier, H. Cullen, and M. R. Allen. 2016. Perspectives on the cause of exceptionally low 2015 snowpack in the western United States, Geophysical Research Letters, 43, doi:10.1002/2016GLO69665

Northwest Fisheries Science Center. 2015. Status review update for Pacific salmon and steelhead listed under the Endangered Species Act: Pacific Northwest.

National Marine Fisheries Service. 2012. Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the City of Puyallup Municipal Wastewater Treatment Plant National Pollution Discharge and Elimination System (NPDES) Permit Reissua ce. National Marine Fisheries Service, Northwest Region, Seattle, WA. NMFS Tracking No. 2012/1103.

Newcombe C. P. and J. O. T. Jensen. 1996. Channel Suspended Sediment and Fisheries: A Synthesis for Quantitative Assessment of Risk and Impact. North American Journal of Fisheries Management. 16: 693-727.

Olla, B.L. Davis, M.W. Schreck, C.C. 1995. Stress-induced impairment of predator evasion and non-predator mortality in Pacific salmon. Journal of Aquatic Research, Volume 26 Issue 6. June 1995.

Parrott, J.L. and B.R. Blunt. 2005. Life-Cycle exposure of fathead minnows (*Pimephalepromelas*) to an ethinylestradiol concentration below 1 ng/L reduces fertilization success and demasculinizes males. Environmental Toxicology 20(2):119–218.

PFMC (Pacific Fishery Management Council). 1998. Description and identification of essential fish habitat for the Coastal Pelagic Species Fishery Management Plan. Appendix D to Amendment 8 to the Coastal Pelagic Species Fishery Management Plan. Pacific Fishery Management Council, Portland, Oregon. December.

PFMC. 2014. Appendix A to the Pacific Coast Salmon Fishery Management Plan, as modified by Amendment 18. Identification and description of essential fish habitat, adverse impacts, and recommended conservation measures for salmon.

PFMC. 2007. U.S. West Coast highly migratory species: Life history accounts and essential fish habitat descriptions. Appendix F to the Fishery Management Plan for the U.S. West Coast Fisheries for Highly Migratory Species. Pacific Fishery Management Council, Portland, Oregon. January.

PFMC. 2005. Amendment 18 (bycatch mitigation program), Amendment 19 (essential fish habitat) to the Pacific Coast Groundfish Fishery Management Plan for the California, Oregon, and Washington groundfish fishery. Pacific Fishery Management Council, Portland, Oregon. November.

PFMC. 2008. Management of krill as an essential component of the California Current ecosystem. Amendment 12 to the Coastal Pelagic Species Fishery Management Plan. Environmental assessment, regulatory impact review & regulatory flexibility analysis. Pacific Fishery Management Council, Portland, Oregon. February.]

Raymondi, R.R., J.E. Cuhaciyan, P. Glick, S.M. Capalbo, L.L. Houston, S.L. Shafer, and O. Grah. 2013. Water Resources: Implications of Changes in Temperature and Precipitation. In Climate Change in the Northwest: Implications for Our Landscapes, Waters, and Communities, edited by M.M. Dalton, P.W. Mote, and A.K. Snover, 41-58. Island Press, Washington, DC.

Reeder W.S., P.R. Ruggiero, S.L. Shafer, A.K. Snover, L.L Houston, P. Glick, J.A. Newton, and S.M Capalbo. 2013. Coasts: Complex Changes Affecting the Northwest's Diverse Shorelines. In Climate Change in the Northwest: Implications for Our Landscapes, Waters, and Communities, edi ed by M.M. Dalton, P.W. Mote, and A.K. Snover, 41-58. Island Press, Washington, DC

Scheuerell, M.D., and J.G. Williams. 2005. Forecasting climate-induced changes in the survival of Snake River spring/summer Chinook salmon (Oncorhynchus tshawytscha). Fisheries Oceanography 14:448-457.

Snyder, D.E. (2003) Electrofishing and its harmful effects on fish. Information and Technology Report USGS/BRD/ITR– 2003-0002, U.S. Geological Survey Biological Resources Division. U.S. Government Printing Office, Denver, CO, 149 pp

Stadler, John. 2019. National Marine Fisheries Service. Personal Communication. May 18, 2019.

Sunda, W. G., and W. J. Cai. 2012. Eutrophication induced CO2-acidification of subsurface coastal waters: interactive effects of temperature, salinity, and atmospheric p CO2. Environmental Science & Technology, 46(19): 10651-10659

Tague, C. L., Choate, J. S., & Grant, G. 2013. Parameterizing sub-surface drainage with geology to improve modeling streamflow responses to climate in data limited environments. Hydrology and Earth System Sciences 17(1): 341-354

Thatcher, Erin and Carrie Andrews. 2018. Columbia River Outfall and Effluent Pipeline Project Sediment Characterization: Tier 1 Evaluation and Site History. [Draft] CH2M, Portland,OR. June 15, 2018.

Tillmann, P., and D. Siemann. 2011. Climate Change Effects and Adaptation Approaches in Marine and Coastal Ecosystems of the North Pacific Landscape Conservation Cooperative Region. National Wildlife Federation.

Valder, J.F., Delzer, G.C., Kingsbury, J.A., Hopple, J.A., Price, C.V., and Bender, D.A., 2014, Anthropogenic organic compounds in source water of select community water systems in the United States, 2002–10: U.S. Geological Survey Scientific Investigations Report 2014–5139, 129 p., http://dx.doi.org/10.3133/sir20145139.

Wainwright, T. C., and L. A. Weitkamp. 2013. Effects of climate change on Oregon Coast coho salmon: habitat and life-cycle interactions. Northwest Science 87(3): 219-242.

Winder, M., and Schindler, D.E. (2004). Climate change uncouples trophic interactions in an aquatic ecosystem. Ecology *85*, 2100-2106.

Zabel, R.W., M.D. Scheuerell, M.M. McClure, and J.G. Williams. 2006. The interplay between climate variability and density dependence in the population viability of Chinook salmon. Conservation Biology 20(1):190-200