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

Refer to NMFS No:
WCRO-2020-02758

June 14, 2022

Christopher Page
Chief, Environmental Resources Branch
United States Army Corps of Engineers
Portland District
333 SW 1st Ave.
Portland, Oregon 97204

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Management Act and Essential Fish Habitat Response for the Sand Island Pile Dike Repair Project, near Chinook, Washington. 6th field HUC 170800060501, Baker Bay-Columbia River.

Dear Mr. Page:

Thank you for your letter of June 20, 2020, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for Sand Island Pile Dike Repair Project.

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. Therefore, we have included the results of that review in Section 3 of this document.

In this biological opinion, we conclude that the proposed action is not likely to jeopardize the continued existence of Snake River (SR) fall Chinook salmon (*Oncorhynchus tshawytscha*), Lower Columbia River (LCR) Chinook salmon, Columbia River (CR) chum salmon (*O. keta*), Upper Willamette River (UWR) Chinook salmon, Upper Columbia River (UCR) spring Chinook salmon, SR spring/summer Chinook salmon, LCR coho salmon (*O. kisutch*), LCR steelhead (*O. mykiss*), SR Basin steelhead, UCR steelhead, Middle Columbia River (MCR) steelhead, UWR steelhead, SR sockeye salmon (*O. nerka*), green sturgeon (*Acipenser medirostris*), or their designated critical habitat or result in the destruction or adverse modification of their designated critical habitats.

Also in this document, NMFS's opinion concludes that the proposed action is not likely to adversely affect:

- Southern Resident killer whales or their designated critical habitat
- Humpback whales or their designated critical habitat
- Leatherback sea turtles or their designated critical habitat
- Green sturgeon designated critical habitat
- Eulachon or their designated critical habitat

- Blue whales, fin whales, sperm whales, or sei whales (no designated critical habitat for these species in the action area)

As required by section 7 of the ESA, we are providing an incidental take statement with the biological opinion. The incidental take statement describes reasonable and project measures we consider necessary or appropriate to minimize incidental take associated with this action. The take statement sets forth terms and conditions, including reporting requirements that the Corps and any person who performs the action must comply with to carry out the reasonable and prudent measures. Incidental take from actions that meet these terms and conditions will be exempt from the ESA take prohibition.

Please contact Scott Anderson (Scott.Anderson@noaa.gov) or Bonnie Shorin (Bonnie.Shorin@noaa.gov) if you have any questions concerning this section 7 consultation, or if you require additional information.

Sincerely,

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

cc: E. Santana, 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

Sand Island Pile Dike Repair Project

NMFS Consultation Number: WCRO-2020-02758

Action Agency: U.S. Army Corps of Engineers

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely to Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely to Destroy or Adversely Modify Critical Habitat?
Lower Columbia River Chinook salmon (*Oncorhynchus tshawytscha)*	Threatened	Yes	No	Yes	No
Upper Willamette River Chinook salmon	Threatened	Yes	No	Yes	No
Upper Columbia River spring Chinook salmon	Endangered	Yes	No	Yes	No
Snake River fall Chinook salmon	Threatened	Yes	No	Yes	No
Snake River spring/summer Chinook salmon	Threatened	Yes	No	Yes	No
Lower Columbia River Coho salmon (*O. kisutch*)	Threatened	Yes	No	Yes	No
Columbia River chum salmon (*O. keta*)	Threatened	Yes	No	Yes	No
Snake River sockeye salmon (*O. nerka*)	Endangered	Yes	No	Yes	No
Lower Columbia River steelhead (*O. mykiss*)	Threatened	Yes	No	Yes	No
Upper Willamette River steelhead	Threatened	Yes	No	Yes	No
Middle Columbia River steelhead	Threatened	Yes	No	Yes	No
Upper Columbia River steelhead	Threatened	Yes	No	Yes	No
Snake River steelhead	Threatened	Yes	No	Yes	No
Pacific eulachon (*Thaleichthys pacificus*)	Threatened	No	N/A	No	N/A
Green sturgeon (*Acipenser medirostris*)	Threatened	Yes	No	No	N/A
Southern Resident killer whales (*Orcinus orca*)	Endangered	No	N/A	No	N/A
Humpback whale	Endangered	No	N/A	No	N/A
Blue, Fin, Sperm, Sei whales	Endangered	No	N/A	N/A	N/A

Fishery Management Plan That Identifies EFH in the Project Area	Does Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific Coast Salmon	Yes	Yes
Pacific Coast Groundfish	Yes	Yes
Coastal Pelagic Species	Yes	Yes

Consultation Conducted By: National Marine Fisheries Service
West Coast Region

Issued By:

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

Date: June 14, 2022

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1. INTRODUCTION

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

1.1. Background

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

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

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

1.2. Consultation History

The proponent of the proposed work is the United States Army Corps of Engineers - Portland District (USACE). NMFS first received a consultation package from the USACE on June 30, 2020. NMFS provided a letter of insufficiency on July 24, 2020. The USACE provided an updated biological assessment (BA) on October 1, 2020. Given resource constraints at NMFS, the BA was not reviewed until May of 2021. At this point, further questions were identified and several more conversations occurred between NMFS and USACE. In July 2021, the NMFS and USACE began discussions regarding the USACE's request for a July 15 work window to minimize dangerous working conditions in the Columbia River Estuary. Several discussions followed over a period of 4 months. On December 1, 2021, NMFS and USACE agreed on an August 1 start to the proposed work window. Consultation was initiated on December 1, 2021. A revised biological assessment reflecting this and other agreed-to project revisions was provided on December 22, 2022.

The USACE determined that the proposed action was likely to adversely affect Lower Columbia River (LCR) Chinook salmon, Upper Columbia River (UCR) spring-run Chinook salmon, Snake River (SR) spring/summer-run Chinook salmon, Upper Willamette River (UWR) Chinook salmon, SR fall-run Chinook salmon, Columbia River (CR) chum salmon, LCR coho salmon, SR sockeye salmon, UCR steelhead, LCR steelhead, UWR steelhead, Middle Columbia River (MCR) steelhead, SR Basin steelhead, designated critical habitats for these species, and southern distinct population segment (DPS) of green sturgeon.

The USACE also determined the proposed action was not likely to adversely affect eulachon or their designated critical habitat, green sturgeon designated critical habitat, Southern Resident killer whale (SRKW), leatherback turtles, humpback whales or the designated critical habitats of these three species.

The USACE also determined the proposed action is not likely to adversely affect blue whales, fin whales, sperm whales, and sei whales. There is no proposed or designated critical habitat for these whales in the action area. NMFS concurred with the COE's not likely to adversely affect determinations.

NMFS determined that the construction of the proposed action was likely to adversely affect salmonids and green sturgeon that will be exposed to sound exposure levels greater than 183 decibel sound exposure levels (dB_{SEL}) from impact pile driving, effects from entrainment (salmonids only), and effects from elevated suspended sediment. Further, the USACE's design choices governing the repair and replacement of the pile dikes will have some adverse and some beneficial effects on salmonids and critical habitat.

NMFS used the following information sources and documents from the action agency and other sources to make its determination; the BA provided by USACE, status of species summaries prepared by NMFS from papers and reports listed in the References section of this opinion, the Washington Lower Columbia Salmon Recovery and Fish and Wildlife Subbasin Plan (NMFS, 2013) and other scientific books, papers and reports listed in the References section of this opinion or otherwise in the record for this consultation. An email from the USACE to the consultation biologist subsequent to the initiation of the consultation supplemented the list of Best Management Practices (BMPs), and these are included in the Proposed Action.

In March, 2022, NMFS and the USACE discussed the January 2022 memorandum between the Department of the Army (Civil Works) and NOAA to ensure consistency with this Opinion.

On May 26, 2022, the Corps provided the following statement on authorities for the Sand Island Pile Dikes:

> The Corps constructed Sand Island Pile Dikes between 1933 and 1935 and these structures are part of the "MCR Project," which includes the six miles between river mile 3 and river mile -3 of the Columbia River where it meets the Pacific Ocean. Congress first authorized the MCR Project under the River and Harbor Act of July 5, 1884. The authorized plan included construction of the south jetty to improve navigation for commercial shipping. As part of President Franklin D. Roosevelt's New Deal legislative program, he signed the National Industrial Recovery Act (NIRA) on June 16, 1933, Public Law 73-67. NIRA established a comprehensive public works program known as the Public Works Administration. Documentation of federal projects during this period is lacking but it appears that the Federal Emergency Administrator of Public Works would have authorized construction, and continued operation and maintenance, of Sand Island Pile Dikes under Section 202 of NIRA. The continued existence and operation of the Sand Island Pile Dikes is also established through later congressionally approved plans

of improvement which specifically identify these structures as a component of the MCR Project considering their role in maintaining the dimensions of the deep-water navigation channel. See, e.g., Section 101 of the Rivers and Harbors Act of September 3, 1954, which approved plans that identified the Sand Island Pile Dikes as protective works and the need to maintain Sand Island itself to control the inner reach of the entrance channel.

1.3. Proposed Federal Action

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

The USACE proposes to remove and replace, or repair, deteriorating pile dikes on East and West Sand Islands, Lower Columbia River (Figure 1). This Civil Works project will proceed under the USACE's mandate to maintain the Federal Navigation Channel (FNC) in the Columbia River. Additional authorization under Section 401 of the Clean Water Act is required from both the State of Oregon and the State of Washington.

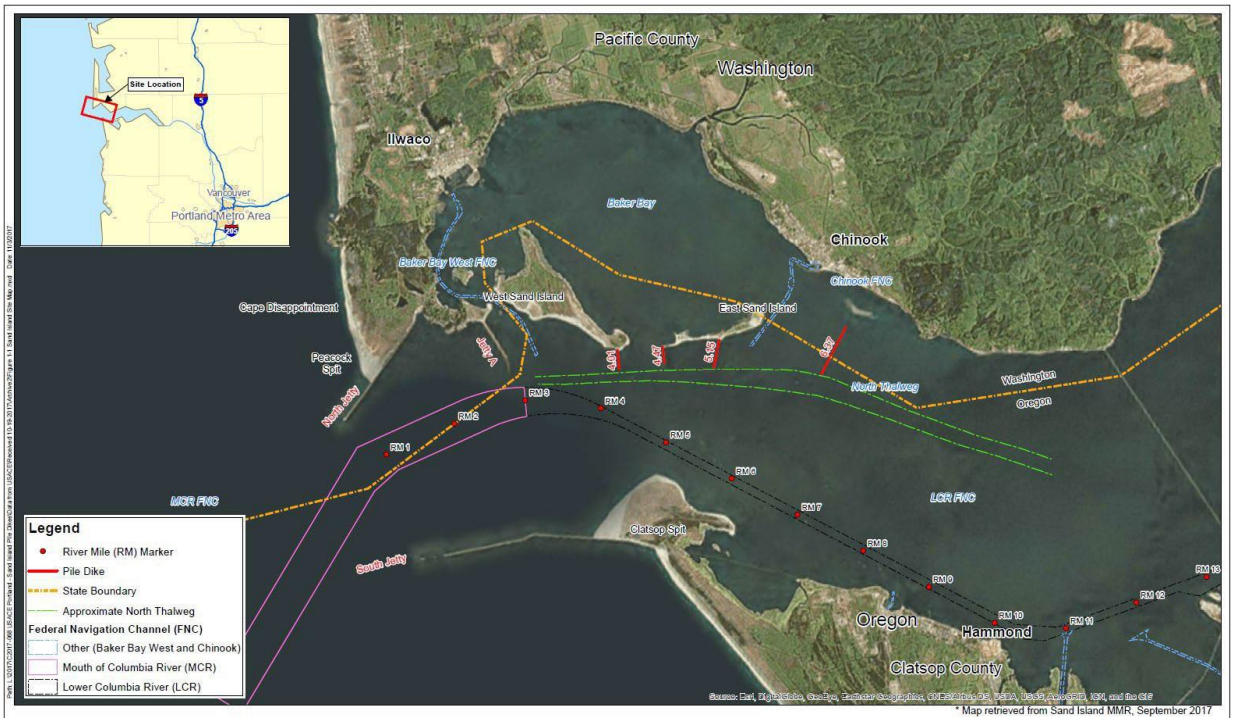

Figure 1. General vicinity and location of 4 Sand Island Pile Dikes (Red lines) (Sand Island Pile Dike Repair Biological Assessment, USACE, 2020).

The four existing timber pile dikes at and around Sand Island consist of three rows of vertical timber pilings between 12 and 20 inches in diameter with two rows of horizontal spreaders. The USACE evaluated the existing timber pile dike design using extensive hydrodynamic and

sediment transport modeling. The USACE determined that at the channel-ward ends of the pile dikes, replacement of the existing, deteriorated piles with new piles is necessary but that in shallower water depths, it is possible to remove timber piles completely and add rock for higher enrockment elevation to achieve equivalent hydraulic and sediment transport functions (Figure 2). The USACE also determined that steel piles would provide equivalent hydraulic function and do not require horizontal spreaders. In addition, it is feasible to cap steel piles with cones to discourage piscivorous bird perching. These design choices are within the Corp's discretion.

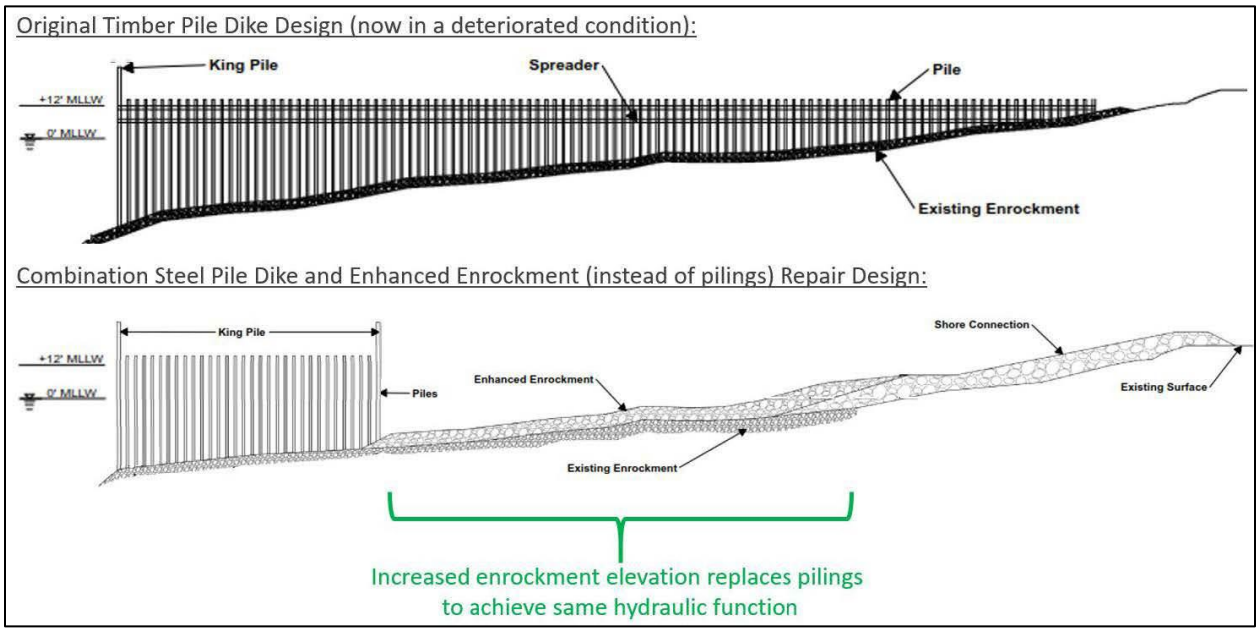

Figure 2. Original pile dike structure (top) and proposed steel pile dike (Sand Island Pile Dike Repair Biological Assessment, USACE, 2020).

The USACE proposes to remove all remaining timber piles (roughly 3,000) and install a total of 652, 24-inch steel pipe piles at the four pile dike locations (Figure 3). Removal will rely on pulling, cutting, or snapping at the level of the enrockment. Construction is proposed to occur over a minimum 3-year period, between 2023 and 2025-26. Each pile dike is 80 feet long; minimum embedment depths are between approximately 30 and 40 feet. In addition, 32 king pile markers will be installed along the enrockment to warn boat traffic of the navigational hazard (see Appendix A). The contractor may use barge-mounted cranes equipped with survey grade positioning software to ensure the piles are installed with precision. The rigs will use either impact hammers or vibratory hammers; the USACE anticipates that half of the piles will be driven using impact and half using vibratory. The project is expected to require 34 days of impact pile driving (12 days year one, 22 days in year two) and at least 37 days of vibratory driving. Driving shoes (ring tips) will be used to facilitate driving and reduce driving time. Pile cushions will be used to reduce noise impacts during impact pile driving and are estimated to reduce sound peak levels (SPLs) by 10 decibels (dB) (Laughlin 2006).

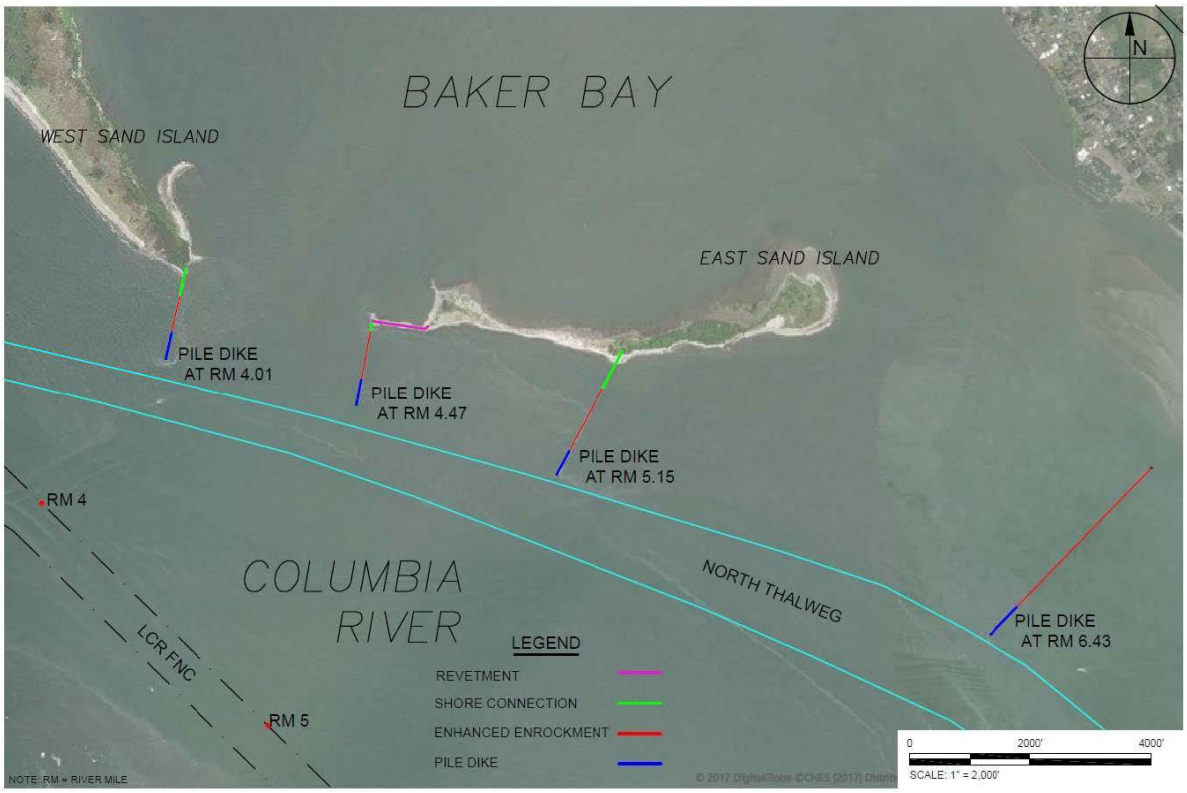

Figure 3. Four Pile Dike Locations near Baker Bay (Sand Island Pile Dike Repair Biological Assessment, USACE, 2020)

The contractor will excavate the minimum amount of existing scour protection rock needed in order to drive the new pile. The contractor will then reinstall the rock to provide scour protection for the new pile. The contractor may pre-drill by installing steel casing that the pile is driven down through and subsequently removed.

The proposed design is an offset of the existing pile dike alignment, with piles driven approximately 30 feet downstream of the existing centerline. The pile configuration needed to achieve hydraulic and sediment transport functions includes two rows of 24-inch steel pipe piles, staggered and spaced 6.2 feet on center.

Additional rock will be placed for scour protection at the base of the new piles, enhanced enrockment segments, shore connections, and for revetment at East Sand Island. Scour protection rock creates a rock apron to stabilize piles. Rock will replace some sections of piles (Figure 2). Shore connections currently consist of enrockment and would be reinforced where needed. Existing revetment on East Sand Island would be reinforced where needed on the western portion of the island, which involves re-grading some existing rock and augmenting with new rock. Rock placement will occur by means of land-based or barge-based excavators and cranes. A specialized dump barge may also be used.

The volume of enhanced enrockment and scour apron rock corresponds to the volume to be installed below the mean lower low water (MLLW). The volume of shore connection and

revetment rock (cubic yards) corresponds to the volume to be installed above MLLW. The rock quantities summarized in Figure 4 were calculated using an estimated 35% porosity. The final design includes new rock placement between -50 feet and +15 feet MLLW. Rock placement spans supratidal (i.e., above mean higher high water (MHHW)), intertidal (i.e., between MLLW and MHHW), and subtidal (i.e., below MLLW) zones. The approximate depth range of rock placement at each pile dike is noted below:

- At pile dike 4.01: -42 to +15 feet.
- At pile dike 4.47: -45 to +15 feet.
- At pile dike 5.15: -50 to +15 feet.
- At pile dike 6.37: -50 to -1 feet.

Pile Dike	Timber Piling Removal	Steel Piling Installation	Marker Pile Installation	Enhanced Enrockment & Scour Apron Installation	Shore Connection & Revetment Installation
4.01	all remaining	138 piles	2	35,555 CY	9,297 CY
4.47	all remaining	138 piles	4	13,053 CY	1,559 CY
5.15	all remaining	146 piles	4	7,742 CY	4,576 CY
6.37	all remaining	230 piles	14	6,819 CY	n/a
Total	(-3,000 piles)	652 piles	24	63,169 CY	15,432 CY

Figure 4. Sand Island Pile Dike Repair Biological Assessment, USACE, 2022

1.3.1. Anticipated Construction Schedule

Repair·Activity¤	Estimated·Start¤	Estimated·Duration¤
Season·One·~~2022~~2023¤	¤	¤
Mobilization¤	June·2023¤	2·weeks¤
New·pile·installation·at·PD·6.37¤	August·2023¤	2·months¤
Enrockment·at·PD·6.37¤	July·2023¤	2·months¤
Marine·based·construction·on·East·Sand·Island·(dredge·temp·channel,·construct·barge·landing,·delivery)·¶ ¤	October·2023·¤	1·month¤
Land·Based·Construction·on·East¶ Sand·Island·(haul·road,·staging)¤	October·2023¤	1·month¤
Season·Two·~~2023~~4¤	¤	¤
Mobilization¤	June·2024¤	1·weeks¤
Enrockment·at·5.15¤	July·2024¤	1·month¤
¤	¤	
New·pile¶ installation·at·PD·5.15¤	August·2024¤	5·weeks¤
¤	¤	¤
New·pile·installation·at·6.3¤	August·2024¤	1·month¤
Land·based·construction·on·East¶ Sand·Island·(5.15·shore·connection)¤	October·2024¤	¤
Season·Three·2025¤	¤	¤
Mobilization¤	June·2025¤	2·weeks¤
Enhanced·enrockment·at·PD·4.47¤	July·2025¤	2·weeks¤
Enhanced·enrockment·at·PD·4.01¤	July·2025¤	2·weeks¤
Land·based·construction·on·East¶ Sand·Island·(haul·roads,·staging,· shore·connection,·revetment)¤	October·2025¤	5·weeks¤
Land·based·construction·on·West· Sand·Island·(haul·roads,·staging,¶ shore·connection)¤	August·2025¤	5·weeks¤
New·pile·installation·at·PD·4.01¤	August·2025¤	5·weeks¤
New·pile·installation·at·4.47¤	September·2025¤	6·weeks¤

Figure 5. Estimated construction timing and duration of major repair activities

1.3.2. Site Access and Staging

Barges will transport all equipment and material to and from the site and serve as staging platforms for in-water construction. Barges may be spudded or anchored into position. Land-based work will be necessary at pile dikes 4.01, 4.47, and 5.15 to remove some existing timber piles and improve the existing pile dike shore connections and sections of enhanced enrockment

that are too shallow for barge-based equipment access. Construction of pile dike 6.37 will occur by over-water equipment only.

For land access to pile dike 4.01 on West Sand Island, the proposed barge landing area and associated material off-loading facility (MOF) is approximately 2,000 feet north on the southeast side of the island. Figure 4 is an example of a MOF. The MOF would require dredging and pile dolphins installed from a barge using vibratory pile driving methods. A clamshell dredge or excavator would excavate approximately 16,000 cubic yards (cy) of sand to allow for the barge docking area. Dredged material would be side-cast into shallow water alongside the MOF area. A temporary landing ramp may be constructed to facilitate off-loading equipment. A maximum of 24 steel pipe piles with a maximum diameter of 24 inches and up to 100 (24-inch) AZ steel sheet piles will be required. Upon completion of the work, any barge landing piles will be removed and the area of the MOF will be re-graded according to best management practices.

For access to work on land at pile dikes 4.47 and 5.15, the existing "primary barge landing" is anticipated to be used as the MOF and is approximately 2 acres. Alternatively, the landing may be constructed in the "auxiliary barge landing" area shown, depending upon site conditions. For the purpose of this opinion, we assumed the auxiliary barge landing would be required. Similar to the other MOF, this landing would require dredging of an estimated 16,000 cy and 24-inch piles for supporting dolphins, as well as up to 100 (24-inch) AZ steel sheet piles. All piles would be installed by barge using vibratory pile driving methods. Dredged material would be side-cast into open water alongside the MOF area. Following construction, all piles for the MOF would be removed and the MOF would be regraded to match the original contour as closely as possible. MOFs will be removed at the end of each work season and reinstalled for the next work season.

Construction of temporary haul roads, using a combination of material located onsite and imported to the site, may be necessary to provide access from the barge landing and staging areas to the pile dikes. Upon completion of work, any materials brought onto the islands to construct haul roads will be removed by the contractor.

Figure 6. Example photos of island access for materials and equipment (Sand Island Pile Dike Repair Biological Assessment, USACE, 2020)

1.3.3. Best Management Practices

The Corps eliminated all proposed in water work during the months of May and June to avoid impacts to fish as well as potential impacts to SRKWs. However, upland work (mobilization and rock placement) is scheduled to occur in July and mobilization will occur in June. Pile driving work, beginning in August, would start no sooner than 30 minutes after sunrise and would stop no later than 30 minutes before sunset, which equates to an average work day of 13 hours per day. The USACE will use, or require its contractor to use, the following BMPs during the repair and replacement work:

- Any construction contractors will be required to conduct construction activities using BMPs for in-water and land-based work. The Corps has received Nationwide 401 Water Quality Certification from Oregon Department of Environmental Quality and will follow all the required conditions. BMPs include but are not limited to:
    - Fueling and lubrication of equipment will be conducted in a manner that affords the maximum protection against spill and evaporation. Fuel, lubricants and oil will be managed and stored in accordance with all federal, state, regional, and local laws and regulations. BMPs will be employed in order to prevent petroleum products, chemicals, or other deleterious waste materials from entering waters. Fuel hoses, oil drums, oil or fuel transfer valves and fittings, etc., will undergo

frequent inspection for drips or leaks, and shall be maintained in order to prevent spills into waters.
    - To avoid the need for emergency response a USACE Government Quality Assurance Representative will be on-site or available by phone at all times throughout construction. Emergency erosion/pollution control equipment and best management practices will be on site at all times; USACE staff will conduct inspections and ensure that hazardous material containment booms and spill containment booms are available and accessible to facilitate the cleanup of hazardous material spills, if necessary.
    - Construction waste material used or stored will be confined, removed, and disposed of properly.
    - A description of spill containment and control procedures will be on-site.
    - Upon completion of the work, any barge landing pilings will be removed and the area will be re-graded according to best management practices to minimize the risk of wake stranding.
    - Erosion and sediment control measures will be implemented.
    - Minimization of materials by using the smallest rock sizes possible.
    - Wetland areas will be avoided.
    - Minimization of project footprint by limiting staging areas and haul roads to the minimum needed, and by replacing only a portion of the existing pile dike with new piles.
    - BMPs to minimize and monitor turbidity will be implemented, and bucket control will be carried out.
- Mitigation for noise impacts associated with pile driving activities in order to reduce injury include:
    - A soft-start procedure for pile installation will be used in order to provide a warning and/or give animals in close proximity to pile driving a chance to leave the area prior to a pile driver operating at full capacity thereby, exposing fewer animals to loud underwater and airborne sounds. A soft start procedure will be used at the beginning of each day when in-water pile driving or any time pile driving has ceased for more than 30 minutes. These or similar mitigation measures could be employed order to reduce the amount and severity of adverse impacts on pinnipeds, marine mammals, and fish.
    - Conditions of the Incidental Harassment Authorization including mitigation and monitoring for noise impacts associated with pile driving: soft-start procedures, pile driving during daylight hours only, shutdown zones during pile driving to avoid strikes enforced by marine mammal monitors.
    - Noise dampeners, also called pile cushions or caps, will be used during all pile installations with an impact hammer.
- All removed piles will be disposed of at an approved appropriate upland facility.
- Project construction will be completed in compliance with Washington State Water Quality Standards WAC 173-201A, including but not limited to prohibitions on discharge of oil, fuel, or chemicals into state waters, proper maintenance of equipment to prevent spills, and appropriate spill response including corrective actions and reporting as outlined in permits and authorizations (USACE permit, HPA, 401 water quality certifications from Oregon Department of Environmental Quality).

The state-recommended in-water work window (IWWW) for this area of the LCR is November 1 through February 28. Given the adverse weather and sea conditions in this portion of the LCR during this recommended IWWW, the USACE requested an earlier start date of August 1. In addition, the USACE stated that IWWW will be limited to August 1 through November 30, with few exceptions for low-impact (i.e., upland) work (Elizabeth Santana, January 21, 2022, personal communication). NMFS agreed to this start date and has assumed that all pile driving activities will occur only between August 1 and November 30.

2. ENDANGERED SPECIES ACT BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

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

The USACE determined the proposed action is not likely to adversely affect eulachon, leatherback turtles, humpback whales, SRKW, blue whales, fin whale, sperm whales, and sei whales. The USACE also determined the proposed action is not likely to adversely affect designated critical habitat for green sturgeon, eulachon, leatherback turtles, SRKW, and humpback whales. NMFS concurs with these determinations, and our concurrence is described in Section 2.12.

2.1. Analytical Approach

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

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

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

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

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

As described in the Consultation History, for this consultation, the USACE provided authorities for the presence of pile dikes such that their existence and continued maintenance in some form at these approximate locations is non-discretionary. However, NMFS assumes that the specific design, timing of repairs, and methods of construction are within the Corp's discretion and therefore we analyze the effects of these discretionary choices as effects of the proposed action.

2.2. Rangewide Status of the Species and Critical Habitat

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

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

During the last century, average regional air temperatures in the Pacific Northwest increased by 1-1.4°F as an annual average, and up to 2°F in some seasons (based on average linear increase per decade) (Abatzoglou et al., 2014; Kunkel et al., 2013). Recent temperatures in all but two years since 1998 ranked above the 20th century average (Mote et al., 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 (Abatzoglou 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 (Abatzoglou 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). 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). 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).

As more basins become rain-dominated and prone to more severe winter storms, higher winter stream flows may increase the risk that winter or spring floods in sensitive watersheds will damage spawning redds and wash away incubating eggs (Goode et al., 2013). Earlier peak stream flows will also alter migration timing for salmon smolts, and may flush some young

salmon and steelhead from rivers to estuaries before they are physically mature, increasing stress and reducing smolt survival (Lawson et al., 2004; McMahon and Hartman, 1989).

In addition to changes in freshwater conditions, predicted changes for coastal waters in the Pacific Northwest as a result of climate change include increasing surface water temperature, increasing but highly variable acidity, and increasing storm frequency and magnitude (Mote et al., 2014). Elevated ocean temperatures already documented for the Pacific Northwest are highly likely to continue during the next century, with sea surface temperature projected to increase by 1.0-3.7°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 (Reeder et al., 2013; Tillmann and Siemann, 2011).

Moreover, as atmospheric carbon emissions increase, increasing levels of carbon are absorbed by the oceans, changing the pH of the water. A 38 percent to 109 percent increase in acidity is projected by the end of this century in all but the most stringent carbon dioxide mitigation scenarios, and is essentially irreversible over a time scale of centuries (IPCC, 2014). Regional factors appear to be amplifying acidification in Northwest ocean waters, which is occurring earlier and more acutely than in other regions and is already impacting important local marine species (Barton et al., 2012; Feely et al., 2012). Acidification also affects sensitive estuary habitats, where organic matter and nutrient inputs further reduce pH and produce conditions more corrosive than those in offshore waters (Feely et al., 2012; Sunda and Cai, 2012).

Global sea levels are expected to continue rising throughout this century, likely reaching 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 (Reeder et al., 2013; Tillmann and Siemann, 2011). Estuarine-dependent salmonids such as chum and Chinook salmon are predicted to be impacted by significant reductions in rearing habitat in some Pacific Northwest coastal areas (Glick et al., 2007).

Historically, warm periods in the coastal Pacific Ocean have coincided with relatively low abundances of salmon and steelhead, while cooler ocean periods have coincided with relatively high abundances, and therefore these species are predicted to fare poorly in warming ocean conditions (Scheuerell and Williams, 2005; 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, 2015a). Changes to estuarine and coastal conditions, as well as the timing of seasonal shifts in these habitats, have the potential to impact a wide range of listed aquatic species (Reeder et al., 2013; Tillmann and Siemann, 2011).

The adaptive ability of these threatened and endangered species is depressed due to reductions in population size, habitat quantity and diversity, and loss of behavioral and genetic variation. Without these natural sources of resilience, systematic changes in local and regional climatic conditions due to anthropogenic global climate change will likely reduce long-term viability and sustainability of populations in many of these evolutionarily significant units (ESUs) (NWFSC, 2015a). New stressors generated by climate change, or existing stressors with effects that have

been amplified by climate change, may also have synergistic impacts on species and ecosystems (Doney et al., 2012). These conditions will possibly intensify the climate change stressors inhibiting recovery of ESA-listed species in the future.

2.2.1. Status of Critical Habitat

This section describes the status of designated critical habitat affected by the proposed action by examining the condition and trends of the essential PBFs of that habitat throughout the designated areas. These PBFs are essential to the conservation of the ESA-listed species because they support one or more of the species' life stages (e.g., sites with conditions that support spawning, rearing, migration and foraging). Table 1 summarizes the general status of critical habitat, range-wide, for each species considered in this analysis.

NMFS designated critical habitat for three different groups of salmonids that occupy the LCR on three different dates, as described below.

The NMFS designated critical habitat for several SR salmonids on October 25, 1999 (64 FR 57399): the SR sockeye and SR spring/summer and fall Chinook salmon ESUs. The PBFs of critical habitat for SR salmon are: (1) spawning and juvenile rearing areas; (2) juvenile migration corridors; (3) areas for growth and development to adulthood; and (4) adult migration corridors. The essential elements of the spawning and rearing PBFs are: (1) Spawning gravel; (2) water quality; (3) water quantity; (4) water temperature; (5) food; (6) riparian vegetation; and (7) access. The designation also breaks down the migration corridor for juvenile and adult salmonids as follows: essential features of the juvenile migration corridors include adequate: (1) Substrate (2) water quality; (3) water quantity; (4) water temperature; (5) water velocity; (6) cover/shelter; (7) food; (8) riparian vegetation; (9) space; and (10) safe passage conditions. The adult migration corridors are the same areas included in juvenile migration corridors. Essential features would include those in the juvenile migration corridors, excluding adequate food.

Subsequently, NMFS designated critical habitat for 10 more ESUs and DPSs of Columbia River basin salmon and steelhead, including SRB steelhead, on September 2, 2005 (70 FR 52630), and for lower Columbia River coho salmon on February 24, 2016 (81 FR 9252). Specific PBFs, and essential features for salmonids designated in 2005 and in 2016 include:

- Freshwater spawning sites with water quantity and quality conditions and substrate that support spawning, incubation, and larval development;
- Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility, water quality and forage that support juvenile development, and natural cover such as shade, submerged and overhanging large wood, logjams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks;
- Freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks that support juvenile and adult mobility and survival;

- Estuarine areas free of obstruction and excessive predation with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels; and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation;
- Nearshore marine areas[1] free of obstruction and excessive predation with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and
- Offshore marine areas[2] with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

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

[1] NMFS designated nearshore marine areas as critical habitat for Columbia basin salmon and steelhead only from the mouth of the river to an imaginary line connecting the outer extents of the north and south jetties.
[2] NMFS did not designate any offshore marine areas as critical habitat for Columbia basin salmon and steelhead.

Table 1. Critical habitat designation date, federal Register citation, and status summary for critical habitat considered in this opinion.

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Lower Columbia River Chinook salmon	9/02/05 70 FR 52630	Critical habitat encompasses 10 subbasins in Oregon and Washington containing 47 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most field-field hydrologic unit code (HUC5) watersheds with physical and biological features (PBFs) for salmon are in fair-to-poor or fair-to-good condition (NOAA Fisheries, 2005). However, most of these watersheds have some, or high potential for improvement. We rated conservation value of HUC5 watersheds as high for 30 watersheds, medium for 13 watersheds, and low for four watersheds.
Upper 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 PBFs for salmon are in fair-to-poor or fair-to-good condition. However, most of these watersheds have some, or high, potential for improvement. 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.
Upper Columbia River spring-run Chinook salmon	9/02/05 70 FR 52630	Critical habitat encompasses four subbasins in Washington containing 15 occupied watersheds, as well as the Columbia River rearing/migration corridor. Most HUC5 watersheds with PBFs for salmon are in fair-to-poor or fair-to-good condition. However, most of these watersheds have some, or high, potential for improvement. We rated conservation value of HUC5 watersheds as high for 10 watersheds, and medium for five watersheds. Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.
Snake River spring/summer-run Chinook salmon	10/25/99 64 FR 57399	Critical habitat consists of river reaches of the Columbia, Snake, and Salmon rivers, and all tributaries of the Snake and Salmon rivers (except the Clearwater River) presently or historically accessible to this ESU (except reaches above impassable natural falls and Hells Canyon Dam). Habitat quality in tributary streams varies from excellent in wilderness and roadless areas, to poor in areas subject to heavy agricultural and urban development (Wissmar et al. 1994). Reduced summer stream flows, impaired water quality, and reduced habitat complexity are common problems. Migratory habitat quality in the lower Snake River and Columbia River has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.
Snake River fall-run Chinook salmon	10/25/99 64 FR 57399	Critical habitat consists of river reaches of the Columbia, Snake, and Salmon rivers, and all tributaries of the Snake and Salmon rivers presently or historically accessible to this ESU (except reaches above impassable natural falls, and Dworshak and Hells Canyon dams). Habitat quality in tributary streams varies from excellent in wilderness and roadless areas, to poor in areas subject to heavy agricultural and urban development (Wissmar et al. 1994). Reduced summer stream flows, impaired water quality, and reduced habitat complexity are common problems. Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Columbia River chum salmon	9/02/05 70 FR 52630	Critical habitat encompasses six subbasins in Oregon and Washington containing 19 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PBFs for salmon are in fair-to-poor or fair-to-good condition (NOAA Fisheries, 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 16 watersheds, and medium for three watersheds.
Lower Columbia River coho salmon	2/24/16 81 FR 9252	Critical habitat encompasses 10 subbasins in Oregon and Washington containing 55 occupied watersheds, as well as the lower Columbia River and estuary rearing/migration corridor. Most HUC5 watersheds with PBFs for salmon are in fair-to-poor or fair-to-good condition (NOAA Fisheries, 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 34 watersheds, medium for 18 watersheds, and low for three watersheds.
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 2015a). 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.
Lower Columbia River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses nine subbasins in Oregon and Washington containing 41 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PBFs for salmon are in fair-to-poor or fair-to-good condition (NOAA Fisheries, 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 28 watersheds, medium for 11 watersheds, and low for two watersheds.
Upper 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 PBFs 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 PBFs for salmon are in fair-to-poor or fair-to-good condition (NOAA Fisheries, 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of occupied HUC5 watersheds as high for 80 watersheds, medium for 24 watersheds, and low for 9 watersheds.

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Upper Columbia River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses 10 subbasins in Washington containing 31 occupied watersheds, as well as the Columbia River rearing/migration corridor. Most HUC5 watersheds with PBFs for salmon are in fair-to-poor or fair-to-good condition (NOAA Fisheries, 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 20 watersheds, medium for eight watersheds, and low for three watersheds.
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.

2.2.2. Status of the Species

Table 2 provides a summary of the most recent listing and recovery plan information, status summaries and limiting factors for the species addressed in this opinion. More information can be found in available recovery plans and status reviews for these species. Additional information (e.g., abundance estimates) that has become available since the latest status reviews and technical support documents also comprises the best scientific and commercial data available and has also been summarized and included in the table. Acronyms appearing in the table include DPS (Distinct Population Segment), ESU (Evolutionarily Significant Unit), ICTRT (Interior Columbia Technical Recovery Team), MPG (Multiple Population Grouping), NWFSC (Northwest Fisheries Science Center), and VSP (Viable Salmonid Population).

Table 2. Listing classification and date, recovery plan reference, most recent status review, status summary, and limiting factors for each species considered in this opinion.

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review/Viability Assessment	Status Summary	Limiting Factors
Lower Columbia River Chinook salmon	Threatened 6/28/05	NMFS 2013a	NWFSC 2022	This ESU comprises 32 independent populations seven are at or near the recovery viability goals. Ten independent populations either had no abundance information (presumed near zero) or exist at very low abundances. 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. Many of the populations in this ESU remain at "high risk," with low natural-origin abundance levels. Hatchery contributions remain high for a number of populations, and it is likely that many returning unmarked adults are the progeny of hatchery-origin parents, especially where large hatchery programs operate. Increases in abundance were noted in about half of the fall-run populations, and in 75% of the spring-run populations for which data were available. Overall, the viability of the ESU has increased somewhat since the last status review, although the ESU remains at "moderate" risk of extinction (NWFSC 2022).	• 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 2022	This ESU comprises four independent populations. Three are at high risk and one is functionally extirpated. Abundance and productivity remained well below the viable thresholds called for in the Upper Columbia Recovery Plan for all three populations. Based on the information available for the most recent viability assessment review (NWFSC 2022), the Upper Columbia River spring-run Chinook salmon ESU remains at high risk, with viability largely unchanged from the 2015 status review (NWFSC 2022)	• 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/Viability Assessment	Status Summary	Limiting Factors
Snake River spring/summer-run Chinook salmon	Threatened 6/28/05	NMFS 2017a	NWFSC 2022	This ESU comprises 28 extant and four extirpated populations. All except three populations are at high risk. The most recent five-year geometric mean abundance estimates for 26 of the 27 populations are lower than the corresponding estimates for the previous five-year period by varying degrees. The most recent ESU abundance data show consistent and marked pattern of declining population size, with the recent five-year abundance levels for the 27 populations declining by an average of 55%. The consistent and sharp declines for all populations in the ESU are concerning, as the abundances for some populations are approaching similar levels to those of the early 1990s when the ESU was listed. The Snake River spring/summer-run Chinook salmon ESU continues to be at moderate-to-high risk (NWFSC 2022).	• Degraded freshwater habitat • Effects related to the hydropower system in the mainstem Columbia River, • Altered flows and degraded water quality • Harvest-related effects • Predation
Upper Willamette River Chinook salmon	Threatened 6/28/05	ODFW and NMFS 2011	NMFS 2016a/ NWFSC 2022	This ESU comprises seven populations. Abundance levels for all but one of the seven DIPs in this ESU remain well below their recovery goals. The Clackamas River DIP currently exceeds its abundance recovery goal, while the Calapooia River population may be functionally extinct, and the Molalla River population remains critically low (there is considerable uncertainty in the level of natural production in the Molalla River). Abundances in the North and South Santiam Rivers have declined since the last review, with natural-origin abundances in the low hundreds of fish. The Middle Fork Willamette River is at a very low abundance, even with the inclusion of natural-origin spring-run Chinook salmon spawning in Fall Creek. Overall, there has likely been a declining trend in the viability of the ESU since the last review (NWFSC 2015). The Upper Willamette River Chinook salmon ESU remains at “moderate” risk of extinction (NWFSC 2022).	• 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/Viability Assessment	Status Summary	Limiting Factors
Snake River fall-run Chinook salmon	Threatened 6/28/05	NMFS 2017b	NWFSC 2022	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. Overall, the status of Snake River fall-run Chinook salmon has improved compared to the time of listing. The single extant population in the ESU is currently meeting the criteria for a rating of "viable", but the ESU as a whole is not meeting the recovery goals described in the recovery plan for the species, which require the single population to be "highly viable with high certainty" and/or will require reintroduction of a viable population above the Hells Canyon Complex (NMFS 2017b). The Snake River fall-run Chinook salmon ESU therefore is considered to be at a moderate-to-low risk of extinction, with viability largely unchanged from the prior review (NWFSC 2022).	• 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 2013a	NWFSC 2022	Presently, detectable numbers of chum salmon persist in only four of the 17 populations, a fraction of their historical range. A total of three of 17 populations exceed the recovery goals established in the recovery plan (Dornbusch 2013). The remaining populations have unknown abundances, although it is reasonable to assume that the abundances are very low and unlikely to be more than 10% of the established recovery goals. With so many primary populations at near-zero abundance, none of the major population groups could be considered viable. It is notable that during this most recent review period, the three populations (Grays River, Washougal, and Lower Gorge) improved markedly in abundance. The ESU remains at "moderate" risk of extinction, and the viability is largely unchanged from the 2015 review (NWFSC 2022).	• 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/Viability Assessment	Status Summary	Limiting Factors
Lower Columbia River coho salmon	Threatened 6/28/05	NMFS 2013a	NWFSC 2022	In contrast to the previous status review update (NWFSC 2015), which occurred at a time of near-record returns for several populations, the ESU's abundance has declined during the last five years. Only six of the 23 populations for which we have data appear to be above their recovery goals. This includes the Youngs Bay and Big Creek DIPs, which have very low recovery goals, and the Tilton River and Salmon Creek DIPs, which were not assigned goals but have relatively high abundances. Of the remaining DIPs in the ESU, three are at 50–99% of their recovery goals, seven are at 10–50% of their recovery goals, and seven are at <10% of their recovery goals (this includes the Lower Gorge DIP, for which there are no data, but it is assumed that the abundance is low). Overall, abundance trends for the ESU are generally negative and the status remains at "moderate" risk (NWFSC 2022).	• 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/Viability Assessment	Status Summary	Limiting Factors
Snake River sockeye salmon	Endangered 6/28/05	NMFS 2015b	NWFSC 2015/ NWFSC 2022	This single population ESU is at extremely high risk although there has been substantial progress on the first phase of the proposed recovery approach—developing a hatchery-based program to amplify and conserve the stock to facilitate reintroductions. Current climate change modeling supports the "extremely high risk" rating with the potential for extirpation in the near future (Crozier et al. 2020). Adult returns to the Sawtooth Valley were significantly affected by earlier than average warm water temperatures in the mainstem in 2015. Additionally, hatchery operations faced significant water chemistry issues in 2015 to 2017, which resulted in very poor survival of outplanted juveniles as they made their way through the Columbia River hydrosystem. Those hatchery practices were modified significantly, and indications were positive that water chemistry is no longer a significant source of mortality during outmigration through the hydrosystem. The viability of the Snake River sockeye salmon ESU has likely declined since the time of the 2015 review, and the extinction risk category remains "high" (NEFSC 2022).	• Effects related to the hydropower system in the mainstem Columbia River • Reduced water quality and elevated temperatures in the Salmon River • Water quantity • Predation

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review/Viability Assessment	Status Summary	Limiting Factors
Upper Columbia River steelhead	Threatened 1/5/06	Upper Columbia Salmon Recovery Board 2007	NWFSC 2022	This DPS comprises four independent populations. All four populations are at high risk of extinction. The proportions of hatchery-origin returns in natural spawning areas remain high across the DPS, especially in the Methow and Okanogan River populations. Tributary habitat actions called for in the Upper Columbia Salmon Recovery Plan are anticipated to be implemented over the next 25 years, and the benefits of some of those actions will require some time to be realized. The most recent estimates (five-year geometric mean) of total and natural-origin spawner abundance have declined since the 2015 report, largely erasing gains observed over the past two decades for all four populations. Recent declines are persistent and large enough to result in small, but negative 15-year trends in abundance for all four populations. The overall DPS viability remains largely unchanged from the 2015 review, and the DPS is at high risk driven by low abundance and productivity relative to viability objectives and diversity concerns (NWFSC 2022).	• 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/Viability Assessment	Status Summary	Limiting Factors
Lower Columbia River steelhead	Threatened 1/5/06	NMFS 2013a	NWFSC 2022	This DPS comprises 23 historical populations, 17 winter-run populations and six summer-run populations. The majority of winter-run steelhead DIPs in this DPS continue to persist at low abundance levels (hundreds of fish), with the exception of the Clackamas and Sandy River DIPs, which have abundances in the low 1,000s. Although the five-year geometric abundance means are near recovery plan goals for many populations, the recent trends are negative. Summer-run steelhead DIPs were similarly stable, but also at low abundance levels. Summer-run DIPs in the Kalama, East Fork Lewis, and Washougal River DIPs are near their recovery plan goals; however, it is unclear how hatchery-origin fish contribute to this abundance. The decline in the Wind River summer-run DIP is a source of concern, given that this population has been considered one of the healthiest of the summer runs. The juvenile collection facilities at North Fork Dam in the Clackamas River appear to be successful enough to support increases in abundance. Hatchery interactions remain a concern in select basins, but the overall situation is somewhat improved compared to prior reviews. Although a number of DIPs exhibited increases in their five-year geometric means, others still remain depressed, and neither the winter- nor summer-run MPGs are near viability in the Gorge. Overall, the Lower Columbia River steelhead DPS is therefore considered to be at "moderate" risk, and the viability is largely unchanged from the prior review (NWFSC 2022).	• 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/Viability Assessment	Status Summary	Limiting Factors
Upper Willamette River steelhead	Threatened 1/5/06	NMFS 2011	NMFS 2016a/ NWFSC 2022	This DPS has four demographically independent populations. Populations in this DPS have experienced long-term declines in spawner abundance. The underlying cause(s) of these declines is not well understood. Returning adult winter steelhead do not experience the same deleterious water temperatures as the spring-run Chinook salmon, and prespawn mortalities are not likely to be significant. Although the recent magnitude of these declines is relatively moderate, continued declines would be a cause for concern. Improvements to Bennett Dam fish passage and operational temperature control at Detroit Dam may be providing some stability in abundance in the North Santiam River DIP. It is unclear if sufficient high-quality habitat is available below Detroit Dam to support the population reaching its VSP recovery goal, or if some form of access to the upper watershed is necessary to sustain a "recovered" population. Similarly, the South Santiam River basin may not be able to achieve its recovery goal status without access to historical spawning and rearing habitat above Green Peter Dam (Quartzville Creek and the Middle Santiam River) and/or improved juvenile downstream passage at Foster Dam. Overall, the Upper Willamette River steelhead DPS continued to decline in abundance, and introgression by non-native summer-run steelhead continues to be a concern. Although the most recent counts at Willamette Falls and the Bennett Dams in 2019 and 2020 suggest a rebound from the record 2017 lows, it should be noted that current "highs" are equivalent to past lows. In the absence of substantial changes in accessibility to high-quality habitat, the DPS will remain at "moderate-to-high" risk (NWFSC 2022).	• Degraded freshwater habitat • Degraded water quality • Increased disease incidence • Altered stream flows • Reduced access to spawning and rearing habitats due to impaired passage at dams • Altered food web due to changes in inputs of microdetritus • Predation by native and non-native species, including hatchery fish and pinnipeds • Competition related to introduced salmon and steelhead • Altered population traits due to interbreeding with hatchery origin fish

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review/Viability Assessment	Status Summary	Limiting Factors
Middle Columbia River steelhead	Threatened 1/5/06	NMFS 2009	NWFSC 2022	This DPS comprises 17 extant populations. The DPS does not currently meet the viability criteria described in the Middle Columbia River steelhead recovery plan. While recent (five-year) returns are declining across all populations, the declines are from relatively high returns in the previous five-to-ten-year interval, so the longer-term risk metrics that are meant to buffer against short-period changes in abundance and productivity remain unchanged. Overall, the Middle Columbia River steelhead DPS remains at "moderate" risk of extinction, with viability unchanged from the prior review.	• Degraded freshwater habitat • Mainstem Columbia River hydropower-related impacts • Degraded estuarine and nearshore marine habitat • Hatchery-related effects • Harvest-related effects • Effects of predation, competition, and disease
Snake River Basin steelhead	Threatened 1/5/06	NMFS 2017a	NWFSC 2022	This DPS comprises 24 populations. Snake River Basin steelhead are classified as summer-run based on their adult run timing patterns. Much of the freshwater habitat used by Snake River Basin steelhead for spawning and rearing is warmer and drier than that associated with other steelhead DPSs. Snake River Basin steelhead spawn and rear as juveniles across a wide range of freshwater temperature/precipitation regimes. Based on the updated viability information available for this review, all five MPGs are not meeting the specific objectives in the draft recovery plan, and the viability of many individual populations remains uncertain. Of particular note, the updated, population-level abundance estimates have made very clear the recent (last five years) sharp declines that are extremely worrisome, were they to continue. Overall, the Snake River Basin steelhead DPS remains at "moderate" risk of extinction, with viability largely unchanged from the 2015 review (NWFSC 2022).	• 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

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review/Viability Assessment	Status Summary	Limiting Factors
Southern DPS of green sturgeon	Threatened 4/7/06	NMFS 2018	NMFS 2021	The Sacramento River contains the only known green sturgeon spawning population in this DPS. The spawning population in the Sacramento River congregates in a limited area of the river compared to potentially available habitat. The reason for this is unknown. This is concerning given that a catastrophic or targeted poaching event impacting just a few holding areas could affect a significant portion of the adult population. Recent studies estimate the abundance of adults at 2,106 individuals. Future surveys and abundance estimates will provide a basis for understanding the population trajectory of the Southern DPS. Since there are no past survey data or abundance estimates that can be used as a reference point, these data do not provide a basis for changing the status of the Southern DPS. Consistent with the 2015 review, data suggest that the spawning population of the Southern DPS is smaller than the Northern DPS, which is consistent with the fact that Southern DPS is listed under the ESA, and the Northern DPS is not (NMFS 2021).	• Reduction of its spawning area to a single known population • Lack of water quantity • Poor water quality • Poaching

Summary – Status of the Listed Species. Each species of salmon and steelhead considered in this opinion is at risk of becoming endangered in the foreseeable future, with the exception of two species (UCR spring Chinook salmon and SR sockeye salmon), which are currently endangered. Each species is ESA-listed due to a combination of low abundance and productivity, reduced spatial structure, and decreased genetic (and life history) diversity. Many of the component populations of these ESUs and DPSs are also at low levels of abundance or productivity; in many cases, decreases in the last few years are associated with poor ocean conditions. Several species have lost some of their historical population structure due to human activities, and the populations that remain in the available habitat face multiple limiting factors. Individuals from all of the ESA-listed component populations must move through or use parts of the action area at some point during their life history. Being exposed to poor baseline conditions in the action area (see Section 2.4, below) may make individual fish more vulnerable to the effects of the action.

The abundance of the sDPS of green sturgeon is now estimated at 2,106 spawning adults, but no data are available to establish trends in population growth or decline. The greatest extinction risk for the DPS is that it consists of a single known population that spawns in a limited portion of the Sacramento River, which has been degraded by land use activities and water diversions.

2.3. Action Area

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

The action area for this proposed action is defined as the Columbia River between rivermile (RM) 0 and RM 8, including Baker Bay. This area lies mostly within Oregon; with a portion of Baker Bay North of East Sand Island in Washington.

At varying times throughout the year, the action area could be occupied by 13 species of anadromous salmonids, the southern green sturgeon, eulachon, seven marine mammals, and the leatherback sea turtle (*Dermochelys coriacea*) listed under the ESA. In addition, designated critical habitat for 12 species is found in the action area including: anadromous salmonids, southern green sturgeon, southern eulachon, and SRKW. There is designated critical habitat for humpback whales near the action area (86 FR 21082, 4/21/2021).

2.4. Environmental Baseline

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

As described in the Consultation History and Analytical Approach sections, we assume that the existence of the subject pile dikes is non-discretionary based on previous Congressional authorization and direction to construct and maintain a federal navigation. As such, the general effects of the existences of these structures are now a baseline condition. The function of the pile dikes is to direct water flow and sediment in a manner that maintains the navigation channel. We expect pile dikes to have some baseline effects that will, in some way, obstruct the migratory pathway of 13 salmonids and eulachon, and alter some of the hydrology that directs juveniles of these species away from preferred shallow areas into deeper water during their outmigration. All of these juveniles are exposed to greater predation risk by being directed to deeper water where larger piscivorous fish are present, as well increased risk from avian piscivores that perch on the piles themselves. Juvenile salmonid that must migrate around the pile dikes also experience increased energetic expenditure and less access to prey commonly available in the shallower habitat, both of which can reduce growth and fitness among individual fish. This effect does not occur among larval eulachon which have passive outmigration and rely primarily on absorbing their yolk sac until reaching the estuary. Green sturgeon and adult salmonids are less likely to have migration impairment from these structures as a baseline condition. The baseline also includes 3.35 of rock placed among the four existing pile dikes to ensure stability of the piles themselves against scour and river flow. This rock, particularly in shallower areas, inhibits production of benthic prey which is a food source for listed salmonids.

The action area lies within the Columbia River estuary between rivermile (RM) 0 and RM 8, including Baker Bay. The area provides important migratory and rearing habitat for salmon and steelhead populations, as well as two ESA-listed non-salmonids that are also anadromous (i.e., green sturgeon and Pacific eulachon). Since the late 1800s, 68 to 74 percent of the vegetated tidal wetlands of the estuary have been lost to diking, filling, and bank hardening, combined with hydrosystem flow regulation and other modifications (Kukulka and Jay 2003, Bottom et al. 2005, Marcoe and Pilson 2017, Brophy et al. 2019). Disconnection of tidal wetlands and floodplains has eliminated much of the historical rearing habitat for subyearling Chinook and chum salmon and reduced the production of wetland macrodetritus that supports salmonid food webs (Simenstad et al. 1990, Maier and Simenstad 2009), both in shallow water and the mainstem (PNNL and NMFS 2020).

Restoration actions in the estuary have improved access and connectivity to some floodplain habitat. From 2007 through 2019, restoration sponsors implemented 64 projects, including dike and levee breaching or lowering, tide-gate removal, and tide-gate upgrades that reconnected over 6,100 acres of historical tidal floodplain habitat to the mainstem and another 2,000 acres of floodplain lakes (Karnezis 2019, BPA et al. 2020). This represents a more than a 2.5 percent net increase in a connectivity index for habitats that are used extensively by subyearling salmon (Johnson et al. 2018, PNNL and NMFS 2020). Although yearling migrants are less likely to enter and rear in these areas compared to subyearlings, the large amounts of prey (particularly chironomid insects) exported from restored wetlands to the Columbia River are actively consumed by both yearling and subyearling smolts. The resulting growth by these fish likely contributes to survival at ocean entry (PNNL and NMFS 2020). In addition to these extensive reconnection efforts, about 2,500 acres of currently functioning floodplain habitat have been acquired for conservation. However, much of the historical floodplain remains sequestered

behind levees, and riparian conditions along the mainstem and in secondary and side channels are highly degraded by urban, industrial, and agricultural development.

Habitat quality and the food web in the estuary are also degraded because of past and continuing releases of toxic contaminants (Fresh et al. 2005, LCREP 2007) from both estuarine and upstream sources. Historically, levels of contaminants in the Columbia River were low, except for some metals and naturally occurring substances (Fresh et al. 2005). Today, the levels in the estuary are much higher, as it receives contaminants from more than 1,000 sources that discharge into a river and numerous sources of runoff (Fuhrer et al. 1996). With Portland and other cities on its banks, the Columbia River below Bonneville Dam is the most urbanized section of the river. Sediments in the river at Portland are contaminated with various toxic compounds, including metals, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), chlorinated pesticides, and dioxin (EPA 2020).

Contaminants have been detected in aquatic insects, resident fish species, salmonids, river mammals, and osprey, and they are widespread throughout the estuarine food web (Furher et al. 1996, Tetra Tech 1996, LCREP 2007). Additionally, many contaminants are specifically designed to kill insects and plants, reducing the availability of insect prey or modifying the surrounding vegetation and habitats. Changes in vegetative habitat can shift the composition of biological communities; create favorable conditions for invasive, pollution-tolerant plants and animals; and further shift the food web from macrodetrital to microdetrital sources.

In addition, the environmental baseline includes the impacts from operation and maintenance (e.g., dredging and presence of pile dikes) of the FNC for commercial vessel traffic and shallow water (shoreline, slough, side channel, and wetland) dredging to maintain marinas for government (e.g., Coast Guard), commercial, and recreational vessels. Modification of the Columbia River for commercial navigation began in 1878, when the USACE began deepening the river to 20 feet−within the range of depths preferred by juvenile rearing and migrating salmonids−then deepening it to 30 feet in 1912, and 35 feet in 1935. Since 1964, the FNC is maintained at 40+ feet in depth. The USACE is periodically dredging 13 secondary and side channels: West Channel in Baker Bay, Chinook Channel, Hammond Boat Basin, Skipanon Channel, Skamokawa Creek, Wahkiakum Ferry Channel, Westport Slough, Old Mouth of the Cowlitz River, Upstream Entrance to Oregon Slough, Tongue Point, Clatsop Elochoman Slough, Lake River, and Oregon Slough. All are degraded by periodic sediment removal, degraded water quality, and the construction, maintenance, and use of moorage facilities. The Sand Island pile dike system was originally constructed in the 1930s and was regularly inspected and maintained through the mid to late 1980s. Since then, maintenance has largely been curtailed, resulting in what the USACE categorizes as substantial pile dike structural and functional degradation. As a result of these and other human activities, the lower river does not provide many areas of rearing habitats in an undisturbed state.

The hydrology of the lower Columbia River also is significantly altered from historical conditions, shifting the natural cues that salmonids rely on for spawning and outmigration behavior. Water management in the Columbia River System and other water storage projects have reduced flows below Bonneville Dam during April through July; these reductions range from average of 7 kcfs (thousand cubic feet per second) in March to 171 kcfs in June. Flow

management for hydropower has increased flows during the winter months. The seasonal mainstem temperature regime also has been altered due to a variety of factors, including increased temperatures in tributaries throughout the basin due to flow management, water withdrawals, loss of riparian shading, point source discharges from cities and industry, and climate change. These combine with the thermal inertia of the mainstem reservoirs so that temperatures exceed 70°F during August and early September (Figure 7), affecting the later summer-run as well as early fall-run adults. Elevated temperatures have the potential to reduce the survival and productivity of adult salmon via direct lethality, migration delays, depletion of energy stores through heightened respiration, deformation of eggs and decreased viability of gametes, and increased incidence of disease (McCullough et al. 2001).

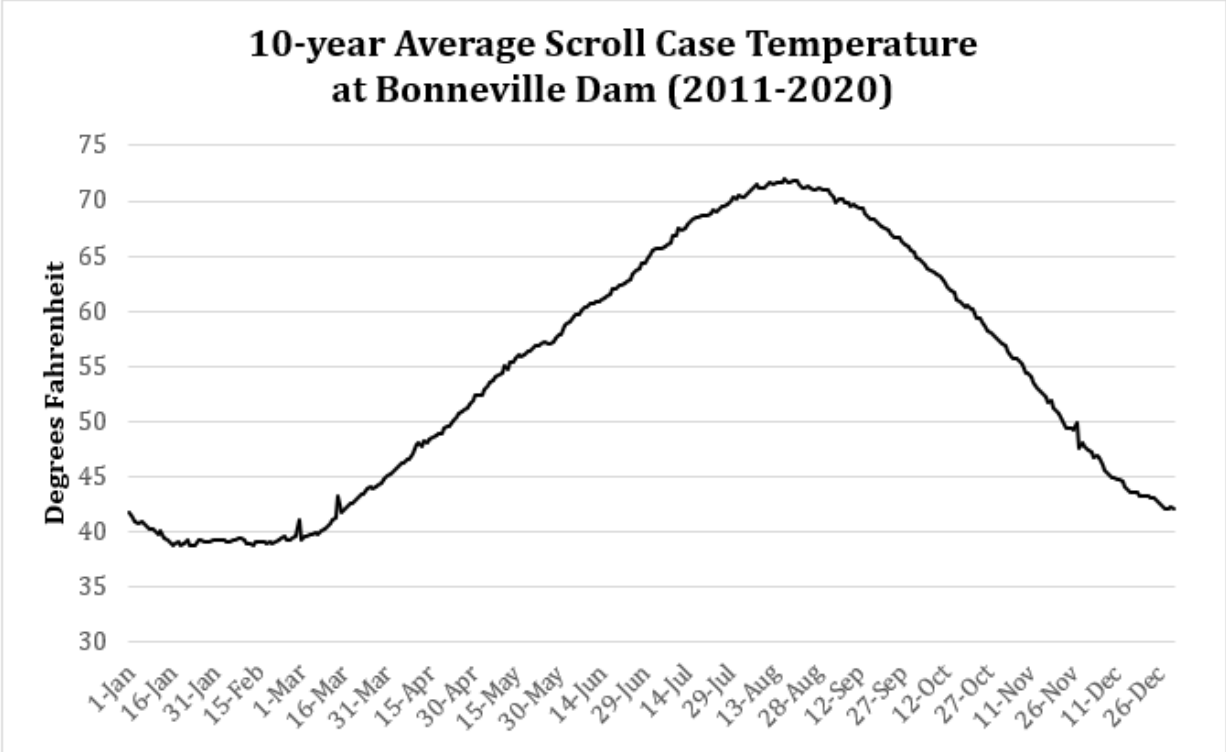

Figure 7. 10-year average temperatures in the scroll case at Bonneville Dam, 2011-2020. Source: Columbia River DART, Columbia Basin Research, University of Washington. River Environment Graphics & Text. Available from http://www.cbr.washington.edu/dart/query/ river_graph_text. Accessed April 1, 2021.

The river acquires sediment as it moves downstream. Total sediment load consists of the material that travels in suspension (suspended sediment) and that which rolls and bounces along the bottom (bedload) (Simenstad et al. 1992). Suspended sediment load is mostly silt and clay, particles that can be transported by all but the lowest flows. Major freshets also can transport fine sand, which is otherwise carried downstream as bedload. Because of the exponential relationship between sediment transport and river flow, even a small reduction in peak flow during the freshet can cause a large decrease in sediment transport. Sherwood et al. (1990) calculated an average annual total suspended load for the period 1868 to 1934 (before the construction of the federal

hydrosystem) of 14.9 metric tons (MT) per year. This decreased to an estimated 7.6 MT per year in 1958 to 1981. The percent fine sand decreased from more than 50 percent before 1900 to about 33 percent for 1958 to 1981. Thus, while the model used by Sherwood et al. (1990) reduced the total input of fine sediment to the lower river by about a third between the two time periods, it reduced the input of sand (the dominant size class retained in the estuary) by a factor of three. Most of the change was attributed to flow regulation, due to the reduced intensity of the spring freshet. Although the consequences of reduced sand transport to habitat in the action area are unknown, the magnitude of the decrease indicates that there may have been a substantial effect on habitat-forming processes including those in shoreline rearing areas used by juvenile salmonids, spawning and incubation areas used by eulachon, and foraging areas used by sub-adult and adult green sturgeon.

Juvenile salmonids are vulnerable to predation by birds, fish, and marine mammals, and sea lions also prey on returning adults. A Columbia basin-wide assessment (Roby et al. 2021) of avian predation indicates that the most significant impacts on smolt survival are on steelhead and occur in the Columbia River below Bonneville Dam. Actions to reduce avian predation rates are ongoing, but this factor continues to affect juvenile survival and safe passage and refuge in rearing areas and migration corridors for salmonid ESUs and DPSs. Predation by Caspian terns (*Hydropogne caspia*) on East Sand Island is especially high for juvenile steelhead (more than 10 percent of each cohort of PIT-tagged fish passing Bonneville Dam; Chapter 1 in Roby et al. 2021). Predation on LCR Chinook salmon by double-crested cormorants (*Phalacrocorax auritis*) is also very high—up to 7 percent for the small numbers of birds that now nest on East Sand Island and even higher numbers for the colony that has moved to the Astoria-Megler Bridge (Chapter 4 in Roby et al. 2021). Areas with diverse topography, including shoreline vegetation and overhanging banks, are therefore important for the function of rearing habitat within the action area.

The native northern pikeminnow (*Ptychocheilus oregonensis*) is a significant predator of juvenile salmonids in the Columbia and Snake Rivers followed by non-native smallmouth bass and walleye (reviewed in Friesen and Ward 1999; ISAB 2011, 2015). Before the start of the sport reward fishery in the Northern Pikeminnow Management Program in 1990, this species was estimated to eat about 8 percent of the 200 million juvenile salmonids that migrated downstream in the Columbia River each year. Williams et al. (2017) compared current estimates of northern pikeminnow predation rates on juvenile salmonids to before the start of the program and estimated a median annual reduction of 30 percent. The lower Columbia River has been the highest producing zone for the pikeminnow sport reward fishery for all but one season since system-wide implementation began in 1991 (Williams et al. 2018, Winther et al. 2019). The Oregon and Washington Departments of Fish and Wildlife, which manage the non-native fish predators smallmouth bass and walleye, have removed size and bag limits for these species in their sport fishing regulations in an effort to reduce predation pressure on juvenile salmonids. Removing more of these individuals, in addition to pikeminnow, reduces predation on juvenile salmonids and the functioning of rearing and migration areas within the action area.

Predation of adult salmonids by pinnipeds has been a concern due to the general increase in sea lion populations along the West Coast and the numbers observed in the tailrace of Bonneville Dam. The Endangered Salmon Predation Prevention Act, signed into law in December, 2018,

reduced restrictions on control efforts (by superseding the criteria that sea lions be individually identifiable and having a significant negative impact before lethal removal) and allowed the removal of Steller as well as California sea lions in the Columbia River and its tributaries. A permit issued by NMFS in 2020 allows three states and six tribes to kill as many as 540 California sea lions and 176 Steller sea lions between Portland and McNary Dam. According to the Oregon Department of Fish and Wildlife, the number of California sea lions feeding in the tailrace at Bonneville Dam declined from a high of 104 animals in 2003 to a low of 19 in 2019 (ODFW 2021). This indicates that control efforts are improving the survival of adult salmonids and sub-adult and adult green sturgeon and the functioning of the adult migration corridor in the action area.

The baseline also includes the future effects of federal actions that have proceeded subsequent to section 7 consultation. During the last five years, NMFS has engaged in several Section 7 consultations on federal projects adversely affecting ESA-listed fish and their habitats in and near the action area. These include vicinities (Multnomah County, Oregon; Clark County, Washington) adjacent to or within the action area (WCR-2019-11648, WCR-2018-10138, WCR-2017-7450, WCR-2017-6622, WCR-2016-5516), including the effects of actions addressed in programmatic consultations (the SLOPES IV programmatic consultation; NMFS number WCR-2011-05585). In general, those actions caused temporary, construction-related effects (increased noise and turbidity), and longer-term effects like increasing or prolonging the life of overwater coverage. Conditions of the baseline hinder the quality of downstream migration and reduce benthic production of forage items.

All of the actions processed under the SLOPES IV programmatic consultation also include minimization measures to reduce or avoid both short- and long-term effects in the environment. These include requiring grated and translucent materials to allow light penetration, pile caps to prevent piscivorous bird perching, and limits on square footage of new overwater coverage. Actions implemented under SLOPES IV continue to have some effects that can reduce fitness in a small number of individuals, and have contemporaneous minimization measures to reduce the level of habitat degradation at large. Overall effects of these SLOPES IV actions incrementally contribute to the condition of habitat in the action area under the environmental baseline and the effects of existing structures (e.g. increased shading, reduction in prey, increased predation, and possible minor migration delays).

2.5. Effects of the Action

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

Here, the action includes construction activity and design modifications that repair and replace the original pile dikes. The discretionary elements (design and construction technique) will be evaluated to consider the short-term impacts, and those longer term impacts relative to the

existing structure. The existence of the pile dikes however, and those unavoidable effects, however, are considered part of the baseline. The effects of the construction and design include the effects on habitat that fish will experience and respond to, and effects on the fish themselves Construction will cause (1) temporarily elevated underwater noise from pile driving and removal, (2) temporarily decreased water quality as sediments become suspended, (3) temporarily diminished forage when benthic conditions are disrupted. The design changes, relative to the baseline structures, include an improvement in passage with the new staggered placement of piles, and a diminishment in prey availability due to substitution of rock rather than piles in the shallower habitat areas.

2.5.1 Effects on Critical Habitat

As described in Section 2.3, the action area contains designated critical habitat for thirteen species of anadromous salmonids and the sDPS green sturgeon. The PBFs that could be impacted by the proposed action include: water quality, substrate, forage, areas free of obstruction, and areas free of excessive predation. The conservation role or value of these PBFs were described previously. The temporary and/or permanent effects to these PBFs are described further below, along with the consequence of the effect on their conservation value in the action area.

2.5.1.1. Construction Effects on Critical Habitat

Sound Pressure. Impact pile driving generates sound pressure waves that have the potential to temporarily diminish rearing and migration values for listed salmonids.

The 652 new 24-inch diameter piles installed by impact driving will require 200 strikes each to be proofed. In a 24-hour period, no more than 20 piles would be installed using either an impact or vibratory hammer and an average of 15 piles would be installed each work day. Up to 20 piles would be installed per day, resulting in up to 4,000 strikes per day. NMFS estimates that the maximum worst-case sound pressure levels resulting from impact driving 24-inch diameter steel pilings without attenuation would be 207 dB_{Peak} (re: 1µPa), 194 dB_{RMS} (re: 1µPa), and 178 dB_{SEL} (re: 1µPa2·sec) 9 meters from the source (Laughlin, 2004). However, test piles at two of the pile dikes resulted in an average of 203 dB and 190 dB_{RMS} (Miner Testing, 2020). When these parameters are used in NMFS pile driving model at 4,000 strikes per day, the radial distance from the pile to the point where sound exposure level (SEL) is below 187 dB_{SEL} is 136 meters. The radial distance to the point where SEL is below 183 dB_{SEL} is 252 meters and the radial distance to the point where sound pressure is below 150 dB_{RMS} is 4,642 meters. Elevated sound pressure during pile driving will create a temporary negative effect on the value of the action area to support rearing and migration for salmonids.

Construction of the pile dikes and two MOFs would also require vibratory pile driving. It is estimated that each MOF would require a maximum of 24 steel pipe piles with a maximum diameter of 24 inches and up to 100 (24-inch) AZ steel sheet piles. Noise generated during vibratory driving may alter fish behaviors in a way that indicates the habitat temporarily is less effective at supporting rearing and migrating juvenile salmonids. See more detail on this in Section 2.5.2, below.

Decreased Forage. Dredging for the two MOFs will temporarily remove up to 7 acres of benthic habitat and associated forage for salmonids. This temporary impact will occur for both of the construction seasons.

Invertebrate colonization in the substrates of the lower estuary is considered low. Most phytoplankton in the LCR are freshwater species that originate from upstream reservoirs behind mainstem dams (Sherwood et al 1990, Small et al 1990). Production by resident phytoplankton species in the LCR does not presently appear to make up a significant part of the total primary production. An existing theory to explain this is that the low level of phytoplankton production within the estuary is a result of the relatively quick flushing time associated with the lower river (CREDDP 1984). Because the freshwater phytoplankton are moving quickly through the lower river estuary, it is suggested that they cannot build up concentrated communities before being exposed to lethal salinity levels. The present-day flushing time is estimated to be between 1 to 5 days, depending on flow and tidal conditions (CREDDP 1984).

A species of particular importance in the estuary and the river is the amphipod, *Corophium* salmonids. It is a macroscopic organism (typically 4-6mm) and important as a prey item for juvenile and adult salmonids, as well as other fish species. It occurs in both freshwater and estuarine environments and burrows into the bottom in primarily silty sands during the day (Hiebert, 2015). It migrates up into the water column at night to feed. This amphipod is abundant in Youngs and Cathlamet Bays and Desdemona Sands in the estuary and throughout the upriver area in suitable habitat. Its distribution in the estuary is dependent primarily upon salinity. Holton and Higley (1984) found that it prefers a salinity range from 0 to 14 parts per thousand (ppt) and that its distribution in the estuary changes with seasonal changes in salinity patterns. Its abundance can range from zero to as high as 75,000 individuals per square meter. This species also is able to recolonize a disturbed area rapidly. McCabe and others (1996) determined that population levels recovered relatively rapidly after a ferry access channel was dredged in the upper river. Complete recovery of the disturbed population was evident in less than one year.

Based on the information above, we expect temporary removal of 7 acres of benthic habitat in the estuary to constitute a slight reduction in the conservation value of the forage PBF to support rearing and migrating juvenile salmonids, in each year that the work occurs

Degradation of Water Quality. Water quality will be temporarily degraded by increased suspended sediments and may be temporarily degraded by contaminants, both of which are described further below.

Increased Suspended Sediments. Water quality will be temporarily degraded by sediment associated with dredging, side-casting, re-grading, placement of enrockment, pile removal, and pile installation. The vibratory removal of approximately 3,000 existing timber piles and the installation of 652, 24-inch steel piles will create 3,652 small suspended sediment plumes. For land access to pile dike 4.01 on West Sand Island, the proposed barge landing area and associated MOF is approximately 2,000 feet north on the southeast side of the island. Another MOF would be constructed to provide access to pile dikes 4.47 and 5.15 (Figure 2). Dredging would be required to build each MOF. A clamshell dredge or backhoe would be used and approximately 16,000 cy of sand over a 3.5-acre area for each MOF to allow for the barge

docking area. Side-casting of dredged material and site regrading will also create temporary sediment plumes. Once in the water column, the Columbia River will transport and disperse suspended sediment downstream.

Water quality is a feature of critical habitat supporting migration values for all juvenile and adult fish considered in this opinion, also supporting rearing values for LCR, UWR, and SR fall Chinook salmon, and LCR steelhead. Water quality is likely to be moderately degraded during dredging and pile removal and installation activities, which will occur between August 1 and November 30. Degradation will take the form of temporary increases in suspended sediments measured as turbidity into the water column. The amount of sediment that will be suspended in the water column, as well as the duration and extent of a turbidity plume will depend on the composition of the sediments and the movement of the water (including tidal forces). The finer the sediment, the longer those particles will remain suspended. The faster the current, the greater distance the turbidity plume will extend from the activity, although at lower suspended sediment concentrations.

Clamshell buckets or excavators used during mechanical dredging for this project, as well as restoration of the dredged areas, will mobilize sediments across the full depth of the water column as the equipment is pulled through the water. The turbidity plumes from dredging of sands, such as those at the MOF sites, are expected to be intense in the immediate area, although both localized and short-lived (minutes to hours).

In an evaluation of turbidity generated by vibratory pile removal at Jimmycomelately Creek, suspended sediment concentrations from activation of the vibratory hammer to loosen the pile from the substrate ranged from 13 to 42 milligrams per liter (mg/L) and averaged 25 mg/L. A 10- to 16- foot diameter plume extended at least 15 to 20 feet from the actual pulling event (Weston Solutions, 2006). Because the substrate in the project area is predominantly sand, we expect areas of turbidity and suspended sediment concentrations associated with the proposed action will be similar (or less) in scale for each of the 3,652 plumes.

Based on their presence in the action area during the modified IWWW of August 1 through November 30, the influence of these reductions in water quality varies for the critical habitat of species in Table 1. Because the material to be dredged is primarily sand, there will be small, temporary reductions in the water quality PBF of the migration and rearing corridor near the MOFs and piles, for up to 100 feet downstream for brief periods each year over the 2-year duration of the proposed action. This is expected to impact the following species life stages and designated critical sites:

- LCR Chinook salmon—juvenile and adult migration corridors, juvenile rearing
- UCR spring-run Chinook salmon—juvenile migration
- UWR Chinook salmon—juvenile migration corridor, juvenile rearing
- SR spring/summer Chinook salmon—juvenile and adult migration corridors
- SR fall Chinook salmon—juvenile and adult migration corridors, juvenile rearing
- CR chum salmon—adult migration corridor
- LCR coho salmon—juvenile and adult migration corridors
- SR sockeye salmon—juvenile migration corridor

- LCR steelhead—juvenile migration corridor, juvenile rearing
- MCR steelhead—juvenile migration corridor
- UCR steelhead—juvenile migration corridor
- UWR steelhead—juvenile migration corridor
- SR steelhead—juvenile migration corridor

The small size of the dredge areas for the MOFs as well as the limited suspended sediment caused by pile activities, combined with the short-term nature of the exposure indicates that the functioning of the water quality component of rearing sites will not be substantially affected for more than a few hours at a time over the course of IWWW.

Increased Contaminants. Although the USACE believes none of the piles were treated with creosote based on their age and appearance, we can't discount to possibility that some of the existing wooden piles were treated with creosote. Creosote is a wood preservative that contains a mixture of hydrophobic organic compounds. Some of these compounds are toxic to fish but are not bioavailable when they are sequestered in the creosote in the pile (Stratus Consulting, 2006). Over time, these compounds will slowly partition from the wooden piles to the organic carbon in the sediment surrounding the piles until they reach an equilibrium determined by the fraction of organic carbon in the sediment. When this surrounding sediment becomes suspended by pile driving, a very small fraction of these chemicals may undergo phase transfer to suspended or dissolved organic matter in the water column. Once the compounds are in suspended or dissolved organic matter in the water column they are more bioavailable to fish than they are when sequestered in the piles or in the sediment around the piles (Johnson et al., 2007b). The action of cutting, snapping, or pulling for removing the piles may increase the bioavailability of toxic compounds for reasons described above, as the wood of the piles is quite decayed and will splinter, flake, and crumble when removal occurs. However, the actual mass of compounds transferred to the flowing water column is likely much too small to and to abbreviated for the degradation of the water quality to reduce the role of this habitat feature to support growth, maturation, and development of juvenile migrating or rearing salmonids, or to impair the migration value for returning adult fish.

Obstruction in Migratory Corridors. The placement of the barges in the shallow water habitat for construction will result in a temporary migration barrier for juvenile salmonids. Barges are intended to be left in intermittently as they move equipment and materials to and from the work sites. Placement of the barges in these shallow water habitats will create intermittent, temporary decreases in the conservation value of the migration and safe passage PBF of critical habitat for salmonids in Table 2.

2.5.1.2 Effects of Design Changes on Critical Habitat

Reduced Forage. Installment of the enhanced enrockment in the shallower area will substitute for replacement piles themselves in the main migration area of juvenile salmonids. Each pile dike and associated enrockment will have a larger enrocked footprint than the existing 3.35 acres of the baseline structures. In total, the proposed action will result in a 6.41-acre increase in acreage of enrockment (Figure 8). Production of invertebrates is a benthic-based process, invertebrates (Corophium, etc) are consumed as planktonic forage, moving downriver with the

current. As such new placement of rock over covering 6.41 acres benthic area will constitute a net loss of forage production. Over time, we expect shoaling of sediment to cover some of this rock and provide limited benthic production. The recruitment of planktonic forage from upstream into the action area will continue to provide forage opportunity for juvenile salmonids. Nevertheless, the loss of production of forage from the pile dikes will result in a measurable, but small, reduction in the substrate and forage PBF of critical habitat designated to support rearing and migration.

ESTIMATED EXISTING FOOTPRINT					
Pile Dike	**Existing Shore Connection (sf)**	**Existing Enrockment (sf)**	**Existing Offset Scour (sf)**	**Existing Total (sf)**	**Total (acres)**
4.01	27,509	11,833	11,002	50,343	1.16
4.47	1,424	3,313	9,616	14,353	0.33
5.15	22,095	20,897	9,905	52,897	1.21
6.37	0	15,767	12,693	28,460	0.65
Total Existing	51,028	51,810	43,216	146,054	3.35
ESTIMATED NEW AREA TO BE IMPACTED					
	Proposed Shore Connection (sf)	**Proposed Enrockment (sf)**	**Proposed Offset Scour (sf)**	**Proposed New Total (sf)**	**Proposed New Total (acres)**
4.01	11,789	7,888	7,335	27,013	0.62
4.47	2,137	29,816	9,616	41,568	0.95
5.15	14,730	31,346	9,905	55,981	1.29
6.37	0	141,905	12,693	154,598	3.55
Total New Proposed	28,656	210,955	39,548	279,159	6.41
ESTIMATED TOTAL FOOTPRINT AFTER REPAIRS					
4.01	39,298	19,721	18,337	77,356	1.78
4.47	3,561	33,129	19,231	55,921	1.28
5.15	36,825	52,243	19,810	108,878	2.50
6.37	0	157,672	25,386	183,058	4.20
Total Footprint After Repairs	79,684	262,765	82,764	425,213	9.76

Figure 8. Image of a table showing Existing and Proposed Footprint of Each Pile Dike and Associated Enrockment (Biological Assessment, USACE, September, 2020).

Obstruction in Migratory Corridors. The COE 1999 Supplemental BA for Columbia and Lower Willamette Rivers, Navigation Channel Maintenance Dredging Program (USACE 1999b), addressed concerns regarding the potential indirect impacts that pile dikes may have on juvenile and adult salmonid migration. It was thought that the presence of pile dikes in the LCR could cause adult salmonids to be delayed in their migration and could force the juveniles to move offshore and be subjected to increased predation in deeper water. A study was conducted over several consecutive 24-hour periods between July 26 and August 5, 1996 using hydroacoustics to determine the behavior of fish in the vicinity of a pile dike. Results of the study indicated that juvenile salmon readily moved past the pile dike during the day when they were migrating. Most moved around the end of the pile dike while only a few moved through it. Previous studies on the feeding behavior of pikeminnow and other larger fish in the vicinity of this pile dike have indicated that they were not eating juvenile salmonids to any extent (Dawley et al. 1986). The

behavior of juvenile salmonids around the pile dike changed at night. Most fish stopped moving at night and their number increased dramatically at the downstream side of the pile dikes where current velocities were much reduced and they appeared to using the areas as a nighttime holding area. Consequently, the results of the study indicated that juveniles are reacting to the pile dikes like any other structure in the river. This night time effect may in fact be beneficial since much of the natural shoreline structure that provided night time holding areas have been removed as a result of development or shoreline placement (USACE 1999b). Three of the four pile dikes include an enrockment connection to the shore.

The above-mentioned studies were conducted on the existing pile dikes. Because the new design decreases the number of piles in each pile dike, and spacing of piles will be increased, we expect fewer migration impediments for juvenile (and adult) salmonids than occurs with baseline condition. With this change in design, migration conditions are considered improved. Fewer piles reduces potential delay of migration and decreases predation risk among migrating juveniles, both by avoiding movement of juveniles to deeper water where piscivory by larger fish is more likely, and because less avian perching can occur. We note that the new piles will be installed with pile caps to reduce any chance of avian perching and this reduces the likelihood of subsequent avian predation on juvenile salmonids as they pass through the pile dikes, improving both rearing and migration values.

2.5.2 Effects on Listed Species

The effects of the proposed action on listed species (salmonids and green sturgeon) are from the exposure to: (1) sound pressure waves from pile driving (temporary); (2) decreased water quality (temporary); (3) decreased forage (temporary and permanent); (4) obstructions in migratory corridors (temporary and permanent; and (5) entrainment during work (temporary).

2.5.2.1. Construction Effects

The proposed work window is August 1 through February 28. The outmigration of most juvenile salmon occurs prior to the August 1 work window. At this time, emigrating juvenile salmonids from the upper, middle, and lower Columbia River, Snake River, and Willamette River will be nearing the end of their presence in the estuary, therefore it is likely that only a small number of these fish from each ESU will be in the action area during the work window and exposed to the effects related to construction of the proposed action. Of these ESUs, LCR Chinook, UWR Chinook, and SR fall Chinook would subyearlings and expected to occupy shallow water areas around the pile dikes. Other ESUs that would be exposed to construction effects include stream-type yearling and older salmonids. Also, green sturgeon may be exposed to construction effects, particularly elevated sound.

Outmigrating smolts may be present in the LCR in February with peak abundances occurring in April and June. The smolts tend to be found in the deeper channels such as the Federal Navigation Channel (FNC) and side channels. The migrating smolts can be found at depths over 30 feet but are generally higher in the water column. Outmigrating steelhead and yearling Chinook will migrate deeper in the water column, while subyearling LCR Chinook salmon smolts are usually found in the upper portions of the water column and in shallow water and off channel habitats (NMFS 2012a). NMFS (2005a and 2005b) determined the greatest potential

effects to the food web for salmonids would be "likely to occur in the more productive, shallow draft side channels where subyearling salmon are likely to occur." While these side channel habitats are not present in the project area, three of the pile dikes are within the shallow water habitats of East and West Sand islands.

McMichael and others (2011) found that the majority of juvenile Chinook salmon passed on the north side of the channel with steelhead being more uniformly distributed across the river. At the hydrophone array, located between East and West Sand Island, fish were detected more frequently on hydrophones just south of the pile dike king piles with relatively low detection rates closer to shore. Additionally, McMichael found that the fish passed from the Astoria Bridge to the mouth of the Columbia River relatively quickly with median travel times of 2.2, 2.4 and 2.1 hours for yearling Chinook, steelhead and subyearling Chinook respectively. Fish also exhibited tidal transport with most first being detected during ebb tides. The amount of time the smolts may be utilizing habitat within close proximity to the pile dikes and the intermittent and temporary nature of the pile dike construction activities are likely to result in reduced potential impacts to outmigrating smolts. However, a small number of subyearling Chinook salmon from the LCR, UWR, and SR will overwinter in the estuary, occupy shallow water habitat areas, and have a higher likelihood of incurring impacts from the proposed action.

Exposure and Response to Impact Driving Sound. The impact pile driving activities can be summarized as follows:

- The average number of hours in each work day is 13 hours per day.
- In a 24-hour period, no more than 20 piles would be installed using either an impact or vibratory hammer per day, with an average of 15 piles installed each day.
- The average number of strikes per pile with an impact hammer is 200.
- The average number of strikes per minute with an impact hammer is 43.
- The average duration to install a single 24-inch pile with an impact hammer is 5 minutes.
- The average duration to install a single 24-inch steel pipe pile with vibratory is 20 minutes.

Likelihood of Salmonid Exposure to Injurious Sound Levels. For impact pile driving in rearing and migration habitat, accumulated SEL is a measure of the risk of injury from exposure to multiple pile strikes over pile driving work periods separated by 12 hours (sufficient time for fish to recover from sub-injurious exposure to high noise levels). For an impact pile driving in migration habitat, fish are moving past the pile driver without stopping and are exposed to just a fraction of the total impacts for the day. Subyearling Chinook in the LCR between August and February are a mixture of smolts that are migrating to the ocean and juveniles that have paused downstream migration to overwinter in the estuary. Some fish will be exposed to a whole workday of pile driving impacts while other fish will only be briefly exposed to pile driving impacts as they travel past the pile driving. Based on information provided by the USACE, we anticipate that on average a fish would likely be exposed to approximately 200 strikes during a 5-minute window of time. Up to 20 piles would be installed in a single day. Proofing a single pile would require 200 strikes over an approximate 5-minute period. This period would be followed by a 45- to 100-minute pause in driving while the next pile is prepared for installation. Rearing subyearling Chinook in the action area would likely be exposed to up to 4,000 strikes. Other

salmonids and green sturgeon in the vicinity of construction area would be able to move far downstream (or upstream) during this 45- to 100-minute pause, thus limiting their likely exposure to a maximum of 200 strikes over 5 minutes. As previously described, the radial distance from the pile to the point where sound exposure level (SEL) is below 187 dB_{SEL} is 136 meters. The radial distance to the point where SEL is below 183 dB_{SEL} is 252 meters and the radial distance to the point where sound pressure is below 150 dB_{RMS} is 4,642 meters.

Proofing 20, 24-inch diameter piles with 200 strikes creates a 252-meter radius zone around the pile where fish less than 2 grams would accumulate sound pressure greater than 183 dB_{SEL} and become injured or killed. However, shielding of sound pressure waves by the East Sand Island will effectively cut this area in half for 2 of the 4 piles dikes. Fish larger than two grams would also incur effects from sound pressure greater than 183 dB_{SEL} within a 136-meter radius zone around the pile. However, most of these larger fish are expected to exhibit primarily sub-lethal behavioral effects such as avoidance, although a few could be killed if they are in the vicinity of sound pressure levels above 183 Db_{sel} for sufficient periods of time.

Magnitude of Response. An accumulated sound exposure level (SEL) of 183 dB (re: 1µPa2·sec) for fish with swim bladders weighing less than 2 grams will result in harm or injury. Similarly, accumulated SEL of 187 dB (re: 1µPa2·sec) for fish with swim bladders and being larger than 2 grams will result in harm or injury. Fish with swim bladders, such as salmonids and sturgeon, can be injured by sounds with the sharp pressure peak (Caltrans 2001) created during impact pile driving because the corresponding longitudinal, mechanical waves mechanically squeeze and then expand the fish swim bladder, causing it to rupture and damage other organs (Halvorsen et al., 2012). Fish exposed to these waveforms show blood in the abdominal cavity and maceration of their kidney tissues (Caltrans, 2001; Yelverton et al., 1975). Other injuries include hemorrhage and rupture of internal organs and damage to the auditory system. Death can be instantaneous, happen within minutes or happen several days after exposure. Fish without swim bladders, such as eulachon, have been shown to be much less affected by pile-driving noise.

Consequence of Salmonid Exposure and Response to Individual Fitness. It is reasonably certain that juvenile salmonids less than 2 grams will be exposed to impact pile driving sound pressure waves with sufficient amplitude and frequency to injure or kill individual fish. Fish larger than 2 grams, may also be injured or killed if they remain in the vicinity of pile driving activities for sufficient periods of time. Because larger fish are generally migrating through the area, we anticipate that few will be injured or killed. SR fall Chinook salmon are one exception and are at greater risk of injury or mortality because they remain in the area for longer periods of time as some life histories rear in the LCR estuary.

Fish behavior changes occur at lower noise levels than levels that injure. The root mean square (RMS) of sound pressure levels (SPLs) is commonly used in behavioral studies. The FHWG (2008) presumes that SPLs in excess of 150 dB_{RMS} (re: 1µPa) are likely to elicit temporary behavioral changes, such as a startle response, or other behaviors indicative of stress and recommends this value as a threshold for possible behavioral effects.

Likelihood of Salmonid Exposure to Non-injurious Sound Levels. Proofing each 24-inch diameter pile with 200 strikes creates a 1,848 meter long zone upstream and downstream of the

pile where fish will be exposed to sound greater than 150 dB_{RMS}. This effect is expected to reach land in nearly every direction before attenuating to below 150 dB_{RMS}. Because of the lack of shielding from 2 of the 4 pile dikes, we expect all salmonid and green sturgeon species to be exposed to sound pressure greater than 150 dB_{RMS}.

Magnitude of Response. While SPLs between 150 dB_{RMS} and 183 dB_{SEL} are unlikely to lead to permanent injury, they can still result in lethal effects by increasing the vulnerability of individual fish to predation. Feist et al. (1996) noted that juvenile pink and chum salmon exposed to pile driving noise were less likely to startle and flee when approached by an observer. Popper (2003) suggests that behavioral response of fishes to loud sounds may include swimming away from the sound source, thereby decreasing potential exposure to the sound, or "freezing" (staying in place), thereby becoming vulnerable to possible injury. Based on the above information, NMFS uses an SPL of 150 dB_{RMS} (re: 1µPa) as a guideline for when behavioral effects can be expected.

Consequence of Exposure and Response to Individual Fitness. It is reasonably certain that the exposure of fish to sound pressure greater than 150 dB_{RMS} will cause some fraction of these fish to alter their behavior in a way that they may be injured or killed by predators.

Exposure and Response to Vibratory Pile Driving Noise. Underwater noise from vibratory pile driving and extraction is not expected to have measurable effects on the species considered in this consultation. Vibratory pile driving produces a low-level continuous noise (Duncan et al., 2010) that has not been linked to injury to fish. While noise levels from vibratory pile driving have been shown, in some circumstances, to exceed the behavioral threshold of 150 dBRMS (re: 1µPa) they generally do not exceed the injury threshold of 206 dBpeak (re: 1µPa) (Caltrans, 2007; Rodkin and Reyff, 2007). Moreover, as reported by (Caltrans, 2007), the loudest SPLs produced by vibratory driving of 72-inch steel piles yielded underwater sound levels of 180 dBRMS (re: 1µPa) and 195 dBpeak (re: 1µPa). Here, the pile sizes are significantly less than 72 inches. Thus, considering these data (Caltrans, 2007), vibratory installation of up to 20 piles per day between sunrise and sunset are expected to produce SPLs below the NMFS agreed upon injury threshold and are not expected to exceed (or only marginally so) the 150 dBRMS (re: 1µPa) threshold for behavioral effects.

Green Sturgeon Exposure and Response to Pile Driving Sound. Green Sturgeon will be present as adults and subadults in the action area in August and are likely to be exposed to sound pressure levels described above, both from impact and vibratory pile driving. However green sturgeon, when present in the Columbia River, are large fish much less vulnerable to the types of body trauma from impact driving sound. Based on the behavior of other sturgeon, we think it likely green sturgeon will detect and try to avoid pile driving noise by moving from the area. If individual sturgeon can vacate the area influenced by sound, then with this behavioral response, they may avoid any deleterious physiological effects (Krebs et al. 2016).

Exposure and Response to Water Quality Reductions.

Suspended Sediment. We estimated above that the average suspended sediment concentration from pile installation and extraction will be about 25 mg/L and that there will be suspended

sediment plumes created and dispersed by river currents throughout the work day as piles are removed. We expect that suspended sediment plumes will exist as long as the vibratory pile driver is operating and that they will dissipate within a few minutes after the vibratory pile driver stops. Suspended sediment during clamshell dredging and side-casting, placement of enrockment, and regrading for the MOFs will likely be above 25 mg/L. The Section 401 water quality certification from the Oregon Department of Environmental Quality has identified a 100-foot upstream and downstream compliance point for the turbidity plume, which requires monitoring every two hours (Nationwide 401 Water Quality Certification Approval for 2019-USACE-3, Sand Island Pile Dike).

Likelihood of salmonid exposure. The above-mentioned water quality reductions will occur when summer- and fall-migrating adult salmon, migrating juveniles salmon and rearing subyearling salmon are present. Some individuals from each of the ESUs will be present during dredging and pile activities and thus exposed to altered water quality. Water temperatures during August and early September, the early part of the IWWW, are some of the warmest in the lower Columbia River, often exceeding 70°F in recent years. Thus, some individuals are likely to experience thermal stress contemporaneous with the effects of the proposed action.

Magnitude of response. Newcombe and Jensen (1996) show that the response of juvenile salmon to a suspended sediment concentration of 25 mg/L will be a decrease in foraging success while the plume exists. We expect concentrations of suspended sediment to be above 25 mg/L around the dredge and enrockment areas. Since the plumes are intermittent, juvenile salmon rearing around the work site will likely take up less food than salmon rearing farther away from the work site.

Consequence of exposure and response. Suspended sediment plumes during pile removal and installation are expected to be relatively minor and temporary. As a result, we expect that exposures to elevated sediment concentrations will be brief and will elicit only low-level responses such as avoidance of the turbidity plume, and temporary minor physiological responses such as gill flaring (coughing), temporarily reduced feeding rates and success, and moderate levels of stress. Therefore, we do not anticipate fitness consequences to adult summer and fall migrants.

Juvenile salmonids are more sensitive to suspended sediment than adults, and warm water increases their sensitivity. Their metabolic demand for oxygen increases with the need to perform repeated coughing, but warm water holds less dissolved oxygen (Muck 2010). Under these circumstances (e.g., during suspended sediment-producing activities in August and September), even small increases in oxygen demand (e.g., for stress responses and avoidance of the turbidity plume), can result in reduced foraging capability; reduced growth and resistance to disease; physical abrasion; clogging of gills; and interference with orientation in homing and migration (Kjelland et al. 2015).

Hostetter et al. (2012) found that the susceptibility of steelhead to Caspian tern predation increased significantly during periods of decreased water clarity (increased turbidity), along with other factors. Thus, small numbers of salmonids from species identified in Table 2 that are

rearing in the action area are likely to experience predation, reduced fitness, especially if the exposure is contemporaneous with elevated temperatures, due to degraded water quality.

Increased Contaminants. As described in the critical habitat section, we are not able to discount to possibility that some of the existing wooden piles were treated with creosote. The action of cutting, snapping, or pulling for removing the piles may increase the bioavailability of toxic compounds for reasons described above, as the wood of the piles is quite decayed and will splinter, flake, and crumble when removal occurs. However, the actual mass of compounds transferred to the flowing water column is likely much too small to and the duration of elevated concentrations of contaminants too abbreviated to elicit adverse effects in salmonids or green sturgeon.

Exposure and Response of Green Sturgeon to Degraded Water Quality.

Likelihood of exposure. Adult and subadult green sturgeon will be present in the LCR estuary during construction of the proposed action. Although green sturgeon typically occupy deeper areas than the shallow water habitats where pile dikes are, it is likely they would be exposed to some unknown level of suspended sediment from dredging, enrockment, and pile work. They may also have a brief exposure to elevated contaminants when the piles are removed.

Magnitude of response. Green sturgeon are relatively tolerant of elevated suspended sediment concentrations. They are typically found in turbid conditions, and forage by stirring up sediments to access benthic prey such as burrowing shrimp. We expect any green sturgeon exposed to elevated suspended sediment to move away from the area if the intensity of the exposure exceeds that to which this species is adapted. Green sturgeon are, however, susceptible to contaminants, particularly because their life history behaviors put them in prolonged contact with sediments and prey that may be contaminated, and the longevity of green sturgeon makes adults vulnerable to bioaccumulation and biomagnification of toxins (Rodgers et al. 2019). If water quality (or sediment quality) is reduced by suspension of detrital pile debris that contains residual creosote, this would add to body load of green sturgeon, though in amounts too small to measure.

Consequence of exposure and response. Wilkens et al. (2015) demonstrated that closely related Atlantic sturgeon experienced no significant effects from three days of continuous exposure to suspended sediment concentrations of up 500 mg/L. Their tolerance of relatively high levels of suspended sediment suggests that this exposure would not affect the fitness of sub-adult or adult green sturgeon during the proposed dredging and pile activities. If any of the piles were treated with creosote, the level of contaminants that might be released into the environment when the piles are removed is anticipated to be too small and the exposure too brief to exert biologically meaningful responses.

Exposure and Response to Construction related Migratory Obstruction. Obstructions to migration are most likely to affect juveniles in their outmigration, as these fish range in size from about 2 inches (subyearling chum and Chinook salmon) to several inches (yearling Chinook salmon, and age 1+ and 2 steelhead, coho) and these fish rely on shallow water habitat when migrating (to depths of about 20 feet). Barges stationed at the MOF will function as temporary obstructions to migration for juvenile fish. These fish will be required to navigate around the

barges, into deeper water, which adds energetic expenditure and risk of predation. Because barges are intended to be left in intermittently as they move equipment and materials to and from the work sites, and because the IWWW is timed such that in-water work does not overlap peak migration periods, we anticipate that only small numbers of juvenile fish will be forced to alter their migration course around the area.

Exposure and Response to Entrainment.

Likelihood of exposure. In order to be entrained, mobile organisms such as adult and juvenile salmonids must be directly in the path of a bucket or backhoe. This exposure will occur in a small area at any given time, compared with the distribution of fishes across the available habitat. Further, mechanical dredges move slowly during dredging operations, with the barge staying in one location for up to several hours, while the bucket or backhoe is repeatedly deployed within that area. Although there is evidence of fish surviving entrainment (Armstrong et al. 1981), entrainment is often fatal. Green sturgeon are seldom entrained (Stanford et al. 2009).

Magnitude of response. We expect that most of the fish that are in the vicinity of a dredge at the start of operations are likely to swim away to avoid the noise and activity. Therefore, we consider it highly unlikely that any of the adults and very few of the yearling or subyearling salmonids considered in this opinion would be entrained by the clamshell or backhoe dredge. The risk of entrainment, and injury or death, is higher for the small subyearlings because it is influenced by the swimming stamina and size of the individual fish (Boysen and Hoover 2009). Small, subyearling Chinook from lower river spawning areas (i.e., populations of LCR and UWR Chinook salmon) and SR fall Chinook salmon will be present during the IWWW, with some individuals rearing in or moving through the dredge areas during construction.

Consequence of exposure and response. We are unable to estimate the numbers of these fish that will be injured or killed through this pathway, but assume that the magnitude of exposure to and the likelihood of entrainment is a function of the expected days of operation and the frequency of dredging, combined with the volume of material to be dredged. Therefore, we anticipate that entrainment will reduce the fitness (likelihood of surviving to adulthood, mating, and producing offspring) of some individuals of each of the salmonid species over the 2-year period of dredging activities.

2.5.2.2. Exposure and Response to Design Changes in Pile Dikes

Exposure and Response to Migratory Obstruction. Obstructions to migration are most likely to affect juveniles in their outmigration, as these fish range in size from about 2 inches (chum) to several inches (yearling Chinook salmon, and age 1+ and 2 steelhead) and these fish rely on shallow water habitat when migrating (to depths of about 20 feet). When juveniles intercept the new piles, they will be able to swim over the enrocked area in shallow habitat at most water levels, and will be able to swim between the staggered piles. This avoids the need to navigate around, into deeper water, decreasing energetic expenditure and risk of predation among all individual juvenile salmonids that migrate through the area. Larval eulachon migration is also likely to be slightly improved as the larvae can float with less impediment through the new pile

structures. The consequence among individual fish is likely to include improved growth and fitness among juveniles as they reach the estuary and ocean.

Reduced Forage. As described in the Effects to Critical Habitat section, installment of the enhanced enrockment for each pile dike, as well as the piles themselves, will eliminate the production of forage (benthic invertebrates) in the footprint of the pile dike. The proposed action will result in a 6.41-acre increase in acreage of enrockment (Figure 8 of benthic estuarine habitat.

Production of invertebrates is a benthic-based process, and disturbance of the benthos will temporarily reduce invertebrate biomass and impact invertebrate diversity. *Corophium* species are benthic amphipods that undergo vertical migration and are consumed by juvenile salmonids as planktonic forage, moving downriver with the current. The placement of new rock covering an additional 6.41 acres of benthic estuarine habitat will constitute a net loss of forage production. Over time, we expect shoaling of sediment to cover some of this rock and provide limited benthic production. The recruitment of planktonic forage from upstream into the action area will continue to provide forage opportunity for juvenile salmonids. Most juvenile salmonids will encounter this reduction while they are migrating through the action area, and the loss of benthic condition, while in the shallower habitat area, is distributed across four sites, suggesting that fish will transit past these low productivity areas quickly, and resume feeding in less altered habitat. Some individual fish, particularly those from the Lower Columbia species with longer rearing behavior in the action area, may have slight reduction in growth or fitness from the reduction in available forage.

2.6. Cumulative Effects

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

Some continuing non-Federal activities are reasonably certain to contribute to climate effects within the action area. However, it is difficult if not impossible to distinguish between the action area's future environmental conditions caused by global climate change that are properly part of the environmental baseline *vs.* cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described earlier in the discussion of environmental baseline (Section 2.4). Many of the habitat changes described in the baseline will continue or exacerbate contemporaneously with climate change effects such as modified water temperatures, altered river hydrograph, and shifting salinity over the service life of the project. Taken together, these will exert more influence on the habitat quality and related carrying capacity.

The NMFS expects State and private activities near and upriver from the proposed action will contribute to cumulative effects in the action area. Therefore, our analysis considers: 1) effects caused by specific future non-federal activities in the action area. 2) effects in the action area caused by future non-federal activities in the Columbia basin.

Development trends indicate that upland private and public actions that affect the action area will continue. NMFS looked for but did not find any proposals for specific, local project proposals within or adjacent to the action area that would not require a Federal permit consultation. However, as the population in and around Longview grows, demand for residential development and infrastructure in the upland and riparian zones is also likely to grow. We believe the majority of environmental effects related to future growth will be linked to land-use changes and increased impervious surface that can affect shallow water habitat quality and deliver contaminants to substrates near the action area.

Similar activities outside of the action area will influence conditions in the action area. Approximately 1.13 million people live along the LCR, concentrated largely in urban parts of the LCR (U.S. Census Bureau 2017). The legacy of resource-based industries (e.g., agriculture, hydropower facilities, timber harvest, fishing, and metals and gravel mining) caused long-lasting environmental changes that harmed ESA-listed species and their critical habitats. Stream channel morphology, roughness and cover, estuarine rearing habitats, wetlands, floodplains, riparian areas, water quality, fish passage, and habitat refugia has been degraded throughout the Columbia River basin. Those changes reduce the ability of populations of ESA-listed species to sustain themselves in the natural environment by altering or interfering with their behavior in ways that reduce their survival throughout their life cycle.

While widespread degradation of aquatic habitat associated with intense natural resource extraction is no longer common, ongoing land management actions are likely to continue to adversely affect the estuary and retard natural recovery of aquatic habitat in the Columbia River basin including the action area. This trend is somewhat countered by non-federal aquatic habitat restoration occurring in the LCR. The Lower Columbia River Partnership has over 100 regional partners in the LCR and has completed 199 restoration and conservation projects encompassing a total of 22,685 acres. Projects include land acquisitions and conservation easements, adding large logs to streams to create fish habitat, planting trees to shade and cool streams, and removing barriers to fish passage (LCEP 2017). Still, when considered together, the net cumulative effects are likely to have an adverse effect on salmon and steelhead.

2.7. Integration and Synthesis

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

All of the species affected by the proposed action are threatened with extinction, and conditions throughout their designated critical habitat, including within the action area, are diminished quantitatively and qualitatively, in a manner that inhibits their recovery. The environmental baseline of the Columbia River estuary is degraded. Estuarine and nearshore habitat, floodplain connectivity and function, channel structure, riparian areas, stream substrates, streamflow, fish

passage, water quality are all degraded. Predation on salmon smolts, facilitated by overwater structures, is a limiting factor to the recovery of salmon and steelhead. The natural recovery of aquatic habitat PBFs important to the survival and recovery of listed species continues to be inhibited by the anthropogenic changes motivated by economic demands on the estuary.

Climate change affects the LCR. Direct effects of higher temperature include mortality from heat stress, changes in juvenile growth and development rates, decreased disease resistance and shifts in seasonal timing of important life history events (adult migration, spawning, fry emergence timing, and the juvenile migration). Indirect effects on salmon mortality, growth rates and movement behavior stem from changes in the estuarine habitat structure, the invertebrate and vertebrate food supply and abundance of predators. Both direct and indirect effects of climate change will vary among Pacific salmonid ESUs/DPSs and among populations in the same ESU/DPS. Adaptive change in any salmonid population will depend on the local consequences of climate change as well as ESU-specific characteristics and existing local habitat characteristics (NWFSC, 2015b). In this context we consider the added effects of the proposed action on habitat and on species to evaluate the aggregate effect on the conservation role of the critical habitat.

2.7.1 Critical Habitat

The critical habitat effects of the proposed action are both temporary and permanent. Temporary effects include: (1) generation of sound pressure waves by approximately 34 days of impact pile driving (12 days year one, 22 days in year; (2) generation of suspended sediment during all in-water activities; (3) increase in chemical contaminants during removal of piles treated with creosote; (4) creation of migration barriers during periods of MOF construction and use; and (5) loss of forage from MOF construction. Long-term effects include: (1) reduction in forage from placement of rock; and (2) long-term improvement to safe passage in migration compared with baseline conditions.

The pile dikes are man-made habitat that affects the migration of smolts which travel along the shoreline. The new pile dike design is expected to have fewer impacts on migration than the original pile dikes. This is because fewer piles will be used and they will be spaced farther apart. Once completed, we expect most smolts to pass over or through the structure, although a few may incur delayed migration. We also expect the reduction in forage from placement of enrockment to slightly decrease the conservation value of the rearing and forage PBF. The initial reduction in forage will somewhat ameliorate when sediment shoals against the rock allowing some colonization of prey species. These long-term effects will occur during the extended duration of the structure. While the conservation value of migration will be improved compared to the existing structures, the conservation value of the rearing and forage PBFs will be slightly degraded by the project's design.

2.7.2 ESA Listed Species

Green sturgeon and the majority of salmonids in Table 2 will be above 2 grams and are expected to move through the action area in minutes to hours. These fish will be exposed to temporary effects of suspended sediment, loss of forage, and elevated sound from pile driving. However, Chinook salmon from the LCR, UWR, and SR are known to overwinter in the LCR estuary. As

such, they will have longer exposure to the proposed action and are more likely to have adverse response, expressed as reduced growth and fitness, which could increase susceptibility to predation, and death.

Lower Columbia Chinook Salmon. Juvenile fall chinook salmon comprise 23 of the 32 populations of this ESU. Most of these populations are at very high risk of extinction and only a few populations are viable. LCR Chinook salmon are present in the action area during the IWWW, thus they will be exposed to the temporary effects of the proposed action.

Upper Willamette River Chinook salmon. This ESU is comprised of 7 populations, most at a very high risk of extinction. UWR Chinook are spring Chinook; however, some subyearlings from the populations migrate to the estuary in the fall and overwinter in the estuary before entering the ocean in the spring (NMFS 2011). Only these atypical fish are likely to experience the temporary effects of the proposed action, while all cohorts will experience effects of the proposed action until future repairs or redesign modify the structure.

Snake River fall Chinook salmon. This ESU is comprised of one extant population that is at moderate risk for extinction. This population will experience the temporary effects of the proposed action because some juveniles pause migration to overwinter in the LCR before resuming migration in the spring.

Impact pile driving will produce SELs above 183dB SEL around each pile. Any subyearling salmon in that area during the time is expected to be injured or killed. With the exception of CR chum salmon, impact pile driving is expected to affect all fish in Table 2. Fish less than 2 grams in size are expected to experience the greatest impacts. Only subyearling Chinook salmon from the LCR and UWR would be less than 2 grams, and expected to co-occur within the shallow water habitat where pile driving, suspended sediment, and entrainment will occur. Given the size of the SEL zone around impact driven piles where accumulated sound pressure is greater than 183 dB SEL and the number of piles proposed to be impact driven, it is likely that a small number of subyearling Chinook will be killed or injured. This episode of fish injured or killed is likely to be dispersed across multiple Chinook salmon populations for each impact. Even if all injured or killed fish were from the same population, the number is expected to be small enough that no discernible effect will result in the returning cohort of adult fish, so that productivity will not be impaired by this reduction in abundance. Fish larger than 2 grams are also expected to experience some injury or mortality, with SR fall Chinook salmon being at greatest risk since that species rears in the LCR estuary and has the potential to be in the area for greater periods of time relative to other species that are generally actively migrating through the area. All salmonids (except CR chum salmon) and green sturgeon, are expected to be exposed to pile driving and experience some behavioral effects as a result.

The effect of the design changes, while creating a small decrease in forage and benthic conditions in rearing and migration habitat, is not expected to appreciably impair exposed populations, and these same populations are likely to experience contemporaneous benefit from the reduction in passage obstruction.

The cumulative effects will include some restoration and recovery actions, so that we can reasonably anticipate that some beneficial effects will improve habitat and juvenile to adult survival over the life of the project while other negative cumulative effects will contemporaneously occur in the action area. However, we also reasonably expect contemporaneously negative habitat pressures from climate change and continued and intensifying upland development. Taken together, we expect the negative cumulative effects may outweigh the positive effects.

Considering the current status of all salmon and steelhead populations, the degraded environmental baseline within the action area, and cumulative effects, the proposed action itself is not expected to measurably affect the distribution, diversity, or productivity of any of the populations, and while prey availability will slightly decrease when compared to the baseline condition, migration value will improve. The detrimental effects of the action on individual fish, when factored with the beneficial effects on individual fish, will be too small in scale to have a measurable impact on the affected populations' overall general level of abundance, or productivity. Because the proposed action is not expected to reduce the productivity, spatial structure, or diversity of the affected populations, the action, even when combined with additional pressure from cumulative effects, will not appreciably affect the status of any of the listed species considered in this opinion. Similarly, because degradation of critical habitat PBFs will occur in small, localized areas of the LCR estuary, and negative effects are anticipated to be short-term in nature, the conservation value of designated critical habitat in the LCR estuary or at the designation scale is not expected to decline.

2.8. Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, the effects of other activities caused by the proposed action, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of salmon, steelhead, or green sturgeon in Table 2, or destroy or adversely modify designated critical habitat for the salmon and steelhead species listed in Table 2.

2.9. Incidental Take Statement

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

incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this ITS.

2.9.1 Amount or Extent of Take

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

1. Incidental take in the form of harm, injury, or death of juvenile salmonids present in the action area during pile driving.
2. Incidental take in the form of harm (reduced forage, increased predation risk) of juvenile salmonids present in the action area when water quality is degraded by sediment.
3. Incidental take in the form of harm (latent health effects) of juvenile salmonids and subadult and adult green sturgeon from exposure to contaminants in water or sediment from pile debris.
4. Incidental take in the form of harm (reduced growth and fitness) of juvenile salmonid from the loss of loss of forage.
5. Incidental take in the form of injury or death of juvenile salmonids from entrainment during dredging.

Quantifying the number of juvenile salmonids that will be harmed, injured, or killed is not practicable because the distribution and abundance of fish in the action area changes over time, and because not all fish respond to habitat impacts the same. In such a case we rely on an "extent of take" which is a surrogate measure that is causally linked to the take. The surrogate serves the same role as an estimate of the actual number of salmonids harmed or killed in that it is: (a) quantifiable; (b) can be monitored in real time so that it serves its role as a meaningful reinitiation trigger; and (c) is causally related to the harm/death.

In this case, the surrogate for harm, injury and death from pile driving noise is the total number of piles installed for the project. Because the number piles proofed is directly related to the size of the SEL zone where juvenile salmon will be injured or killed, and juvenile salmon are presumed to be migrating or rearing in the estuary at all times, the number of impact pile driving blows is directly related to the salmonids that are exposed to and harmed or killed by impact pile driving. If the number of piles proofed exceeds 652 the take limit is exceeded and the opinion must be reinitiated.

The extent take in the form of harm from water quality diminishment and reduced forage is the volume and size of dredge areas, and the total area of enrockment because these disturb the substrate (upon which the prey depend) either temporarily or long-term. Furthermore, the volume of material dredged is directly related to elevated suspended sediment. If the volume of dredged material exceeds 16,000 cy at either MOF or the area dredged of either MOF is greater than 3.5 acres, the take limit is exceeded, and if the area of new enrockment for the four pile dikes combined is greater than 6.41 acres, take will be exceeded.

The extent of take in the form of injury or death from entrainment is the volume to be dredged, because the amount of time dredging occurs to meet a particular volume is directly related to the risk of entrainment. If the volume of dredged material exceeds 16,000 cy at either MOF or the

area dredged of either MOF is greater than 3.5 acres due to reduced foraging opportunities is directly related to the dredging and enrockment areas.

Although these surrogates are somewhat coextensive with the proposed action, they nevertheless serve as an effective reinitiation trigger the number of individual piles, area of enrockment, and volume and area of dredged material are causal to the forms of take, and they can be tracked to confirm if exceedance occurs.

2.9.2 Effect of the Take

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

2.9.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" are measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02). NMFS believes the RPMs described below are necessary and appropriate to: (1) minimize the likelihood of incidental take of ESA-listed species due to implementation of the proposed action; and (2) monitor the impacts of incidental take.

1. Minimize incidental take from impact pile driving noise.
2. Minimize incidental take from suspended sediment and entrainment.
3. Minimize incidental take from forage reduction.
4. Ensure completion of a monitoring and reporting program to confirm that the take exemption for the proposed action is not exceeded, and that the terms and conditions in this incidental take statement are effective in minimizing incidental take.

2.9.4 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the federal action agency or its contractor must comply with the following terms and conditions. The USACE or any contractor working on its behalf 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: USACE shall include the following as required conditions of the contract:
    a. Pile driver operators may proof no more than 20 piles per day. Monitor the number of impact blows delivered to each pile each day.
    b. Pile driver operators must allow for a 12-hour period of no pile driving after each day of pile driving.

2. The following terms and conditions implement reasonable and prudent measure 2 and 3: The USACE shall:
    a. Require dredge operators to limit the dredge prism and volume of removed sediment to the minimum area necessary to achieve project goals.
    b. Require mechanical dredge operators to ensure the clamshell or backhoe bucket is be lowered to the bottom of the channel as slowly as feasible to allow ESA-listed fish to escape.
    c. Require dredge operators to dredge no more than 3.5 acres per MOF site each year of use.
    d. Ensure that enrockment is no more than 6.35 acres at completion of work
    e. Require dredge operators to comply with the current ODEQ water quality monitoring plan(s) issued for the site.
    f. Require dredge operators to monitor turbidity and comply with the following:
        i. A properly and regularly calibrated turbidimeter is recommended, but visual turbidity gauging is acceptable.
        ii. Locations of turbidity samples or observations must be identified and described in the USACE's water quality monitoring plans. At a minimum, monitoring must take place at the following distance, and within any visible plumes:
            1. Dredging and pile activities, 100 feet upstream and downstream of the activity.
            2. If a meter is used, the USACE must identify a depth between 10 and 20 feet, or at mid-depth in water less than 20 feet in depth, to collect all sample readings.
        iii. Monitoring must occur when dredging is being conducted and must meet the following requirements:
            1. Active dredging–once a day during a flood tide and once a day during an ebb tide.
            2. Background turbidity NTU or observation, location tidal stage, and time must be recorded before monitoring down-current.
        iv. The USACE and any dredging contractors, shall ensure turbidity remains at background levels beyond 100 feet downstream from the point of disturbance during dredging and pile operations by adhering to the measure to monitor turbidity and respond to exceedances as proposed in the project description. This shall include monitoring and compliance reporting of turbidity levels observed during dredging operations as required by the State of Oregon's CWA section 401 certifications.

3. The following terms and conditions implement reasonable and prudent measure 4:
    a. The USACE shall report all monitoring items, to include, at a minimum, the following:
        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 type and use of sound attenuation device, and type of hammer used. Report if pile driving occurs for more than a 13-hour consecutive period.

ii. Turbidity monitoring. Report the results from the turbidity monitoring, including location and time. Report any exceedance of the 100-foot turbidity plume.
iii. Dredge area. Report the final area dredged does not exceed 3.5 acres at each MOF.
iv. Enrockment. Report the final cumulative enrockment area does not exceed 6.35acres

b. The USACE shall submit each annual report, in electronic format, to NMFS at the following email address no later than January 31 of the year following in-water work:
projectreports.wcr@noaa.gov;
Attention: Scott Anderson.
Include the NMFS Tracking Number WCRO-2020-02758 on the report.

2.10. Conservation Recommendations

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

The USACE should continue to study and develop new methods to construct and design in-river structures to lessen impacts on ESA-listed species and designated critical habitats. The USACE should continue to identify in-river structures that need repair and remove derelict structures no longer in use.

2.11. Reinitiation of Consultation

This concludes formal consultation for the East Sand Island Pile Dike Repair Project.

Under 50 CFR 402.16(a): "Reinitiation of consultation is required and shall be requested by the Federal agency or by the Service where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and if: (1) the amount or extent of taking specified in the incidental take statement 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 previously considered; (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 written concurrence; or (4) a new species is listed or critical habitat designated that may be affected by the identified action."

2.12. "Not Likely to Adversely Affect" Determinations

Under the ESA, "effects of the action" means the direct and indirect effects of an action on the listed species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action (50 CFR 402.02). The applicable standard to find that a proposed

action is not likely to adversely affect listed species or critical habitat is that all of the effects of the action are expected to be discountable, insignificant, or completely beneficial. Beneficial effects are contemporaneous positive effects without any adverse effects to the species or critical habitat. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur.

The USACE determined the proposed project is not likely to adversely affect SRKW, humpback whales, sei whales, fin whales, sperm whales, blue whales, leatherback sea turtles, or eulachon. The USACE also determined the proposed project was not likely to adversely affect designated critical habitats for eulachon, green sturgeon, SRKW, humpback whale, and leatherback sea turtle. Our rationale for concurring with these determinations is described below.

2.12.1. Southern DPS Green Sturgeon Critical Habitat

Designated critical habitat for southern DPS green sturgeon includes the LCR estuary from the river mouth to RM 46 (October 9, 2009; 74 FR 52300), which supports aggregations of southern DPS green sturgeon during summer. Specific PBFs, and the essential features associated with the PBFs for green sturgeon designated in 2009 that are relevant to this consultation include:

- Freshwater riverine systems which provide food resources, and water quality including depth and flow for embryo, larval and juvenile growth and development. Adult spawning requires appropriate substrate and sediment quality, in addition to migratory corridors free of obstruction.
- Estuarine areas which provide food resources, migratory corridors, and appropriate water and sediment quality, flow and depth to support growth of juvenile, sub-adult, and sexually mature green sturgeon.

The proposed action will have minor, temporary effects on food resources, water quality, and migratory corridors during dredging and pile driving. However, once the project is complete, the pile dike structures are not expected to impede migration or negatively affect any other PBFs of critical habitat. As such, effects from the proposed action are not likely to adversely affect green sturgeon critical habitat

2.12.2. Eulachon and Their Critical Habitat

The Southern DPS includes those eulachon originating from the Skeena River in British Columbia south to and including the Mad River in northern California (NOAA 2014); eulachon originating from the Nass river and further north comprise at least one additional DPS (NOAA 2010). The Southern DPS was originally listed as threatened on March 18, 2010 (Gustafson et al, 2010). The action area is within designated critical habitat of eulachon.

Eulachon, also known as Pacific smelt, candlefish, or Columbia River smelt, are small ocean-going fish that occur in offshore marine waters and return to tidal portions of rivers to spawn. Adults do not feed while in freshwater (WDFW and ODFW 2001).

NMFS designated critical habitat for the southern DPS of eulachon on October 11, 2011 (76 FR 65324). Critical habitat includes portions of 16 rivers and streams in California, Oregon, and

Washington. We designated all of these areas as migration and spawning habitat for this species. Specific PBFs, and the essential features associated with the PBFs for eulachon designated in 2011 that are relevant to this consultation include:

- Freshwater spawning and incubation sites with water flow, quality and temperature conditions and substrate supporting spawning and incubation, and with migratory access for adults and juveniles. These features are essential to conservation because without them the species cannot successfully spawn and produce offspring.
- Freshwater and estuarine migration corridors associated with spawning and incubation sites that are free of obstruction and with water flow, quality and temperature conditions supporting larval and adult mobility, and with abundant prey items supporting larval feeding after the yolk sac is depleted. These features are essential to conservation because they allow adult fish to swim upstream to reach spawning areas and they allow larval fish to proceed downstream and reach the ocean.

Impact pile driving will occur in August-November, prior to eulachon migrating into the Columbia River (December-January). Further, because eulachon do not have swim bladders, elevated noise from pile driving is not known to cause harm to eulachon. Adult eulachon moving upriver can easily avoid turbid plumes from dredging and pile driving. Their response is insignificant.

The pile dike structures will not impede adult migration or impact eulachon eggs that could be drifting or settling in sediment around the structure. Exposure will not cause a significant response; the likelihood of construction and presence of the pile dikes causing a measurable impact to the eulachon southern DPS is insignificant.

The project is not likely to adversely affect eulachon or their critical habitat.

2.12.3. SRKW and Their Critical Habitat

The proposed action may directly affect SRKWs by increasing underwater sound, and it may indirectly affect SRKW by reducing availability of their primary prey, Chinook salmon. SRKWs that may be in the vicinity of the construction activity may alter their mating, foraging, and communication behavior as a result of the introduction of pile driving noise into the marine environment. There is a small chance SRKWs could be present near the mouth of the Columbia River during construction activities. If SRKW are present in the vicinity, the impact of noise generated by pile driving could temporarily alter their behavior. The project will employ "soft start" procedures during pile driving, which is intended to alert nearby marine mammals to the activity before the full intensity of impact pile driving occurs. Because of the temporary nature of the construction and the fact that it is unlikely this species will be in the action area during construction, we do not expect this altered behavior to have any meaningful effects on fitness and survival of SRKWs.

While some salmonids will likely be harmed or killed as a result of project implementation, the reductions are not expected to produce a measurable effect on the abundance, distribution, diversity, or productivity of Chinook salmon at either the population or species level. Given the

total quantity of prey available to SRKWs throughout their range, this reduction in prey is extremely small, and is not anticipated to be different from zero by multiple decimal places. Because the reduction is so small, there is also a low probability that any juvenile Chinook salmon killed by the proposed activities would have later (in 3-5 years' time) been intercepted by the killer whales across their vast range in the absence of the proposed activities. Therefore, the anticipated reduction of salmonids associated with the proposed action would result in an insignificant reduction in adult equivalent prey resources for SRKWs.

SRKW designated critical habitat was revised in 2021 (86 FR 41668, August 2, 2021) and includes: (1) the Summer Core Area in Haro Strait and waters around the San Juan Islands; (2) Puget Sound; (3) the Strait of Juan de Fuca, and (4) marine waters between the 6.1-meter and 200-meter depth contours off the coasts of Washington, Oregon, and California from the U.S. international border with Canada south to Point Sur, California. As described above, the proposed action will affect prey items of SRKW, and prey is a PBF of critical habitat for SRKW. While pile dike repair will result in the loss of some juvenile salmonids, the associated reduction in adult equivalent prey resources for SRKWs is expected to be insignificant as described above.

In summary, the effects on SRKW from elevated noise and the effect on SRKW and SRKW designated critical habitat from reduced prey are expected to be insignificant.

2.12.4. Humpback Whales and Their Critical Habitat

Similar to SRKW, there is a small chance humpback whales of the Mexico and Central America, or Western North Pacific DPSs could be present near the mouth of the Columbia River to feed during construction activities. The project will include marine mammal observers with authority to stop pile driving work if humpbacks (or other marine mammals) are sighted in the estuary. If humpbacks are present in the vicinity, the impact of noise generated by pile driving could temporarily alter their behavior. The project will employ "soft start" procedures during pile driving, which is intended to alert nearby marine mammals to the activity before the full intensity of impact pile driving occurs. Because of the temporary nature of the construction and the fact that it is unlikely this species will be in the action area during construction, we do not expect this altered behavior to have any meaningful effects on fitness and survival of humpback whales. Therefore, effects on humpback whales are insignificant.

Humpbacks forage near the mouth of the Columbia river on small schooling fish such as smelt or herring. Because we expect few effects of the project on eulachon (smelt), we do not expect there to be an adverse effect on prey, the one PBF of humpback whale critical habitat.

2.12.5. Leatherback Sea Turtles and Their Critical Habitat

While leatherback turtles will forage in the coastal and shelf waters adjacent to the Columbia River plume (Sato, 2017; Benson et al. 2011), their presence within the action area is unlikely. From 1975 to 2013, there were 78 documented occurrences from a variety of sources with records extending from the mouth of the Columbia River north to Cape Flattery. Although not expected, if any leatherback sea turtles enter the action area when pile driving noise occurs, effects of noise on leatherback prey species near the mouth of the river would depend on the dBs

produced by pile driving and may include changes in behavior including temporarily leaving the area.

Critical habitat for leatherback sea turtles is designated along the coast of Oregon, including the mouth of the Columbia River. Though no direct impacts on critical habitat are anticipated as a result of rehabilitating pile dikes within the Columbia River, some ancillary impacts may be associated with noise generated by pile driving activities. Sea turtle prey that occur in the designated critical habitat area (which is also a PBF of leatherback critical habitat) could encounter elevated noise levels when pile driving is occurring. Effects of noise on leatherback prey species is not well understood, but it is possible that elevated noise may cause changes in behavior of these prey items (Sole et al. 2016). Effects on leatherback sea turtle prey species or sea turtles themselves are expected to be temporary and insignificant. No permanent adverse impacts on leatherback sea turtle critical habitat are expected as a result of replacing pile dikes within the Columbia River estuary. As such, the proposed project is not likely to adversely affect leatherback sea turtles or their critical habitat.

2.12.6. Sei Whales, Blue Whales, Fin Whales, Sperm Whales

These ESA-listed whale species occur along the coast of Oregon and Washington during migration, and are more likely to be found several miles offshore and not near the mouth of the Columbia River. It is extremely unlikely that they would occur in the action area. While there is a small chance pile driving noise could emanate into the ocean where these whales may detect noise above background, it is highly unlikely to be of the magnitude to elicit any behavioral changes. Therefore, effects of the project are highly unlikely to reach habitat where these whales could occur. As such, these whales are not expected to be impacted by this project. Therefore, effects of the project on these whales is discountable, and the proposed action is not likely to adversely affect Sei whales, Blue whales, Fin whales, or Sperm whales.

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

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

measures to avoid, minimize, mitigate, or otherwise offset the adverse effects of the action on EFH [CFR 600.905(b)].

This analysis is based, in part, on the EFH assessment provided by the USACE and descriptions of EFH for Pacific Coast salmon (PFMC 2014), Pacific Coast groundfish (PFMC 2005), and coastal pelagic species (CPS) (PFMC 1998) contained in the fishery management plans developed by the Pacific Fishery Management Council and approved by the Secretary of Commerce.

3.1. Essential Fish Habitat Affected by the Project

The proposed action and action area for this consultation are described in the Introduction section to this document. The action area includes areas designated as EFH for various life history stages of Chinook and coho salmon. The action area also includes areas designated as EFH for various life history stages of groundfish and coastal pelagic species. The LCR near the river mouth is considered a habitat area of particular concern (HAPC) for Pacific Coast groundfish and the LCR estuary is a HAPC for Pacific salmon.

3.2. Adverse Effects on Essential Fish Habitat

We conclude that the proposed action will have the following adverse effects on designated EFH for Pacific salmon, groundfish, and coastal pelagic species:

- Water quality reductions suspended sediment during pile driving and dredging
- Physical changes to water from sound pressure waves during pile driving.
- Loss of forage and substrate from placement of rock and pile structures.

3.3. Essential Fish Habitat Conservation Recommendations

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

1. To reduce impairment of water quality, monitor turbidity levels and stop work if suspended sediment exceeds parameters of Washington or Oregon's 401 certification, and evaluate suitability of using barrier (curtain) to constrain sediment. This will also reduce impairments to forage.

2. To reduce modification of water from sound, apply all suitable and available sound reduction measures during impact driving.

3. To reduce impacts to forage and minimize generation of suspended sediment, dredge no more than 3.5 acres per MOF site each year of use.

4. To reduce impacts to forage, ensure that enrockment is no more than 6.35 acres at completion of work

Fully implementing these EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in section 3.2, above, approximately 6.85 acres (3.5/MOF areas + 6.35 acres enrockment) of designated EFH for Pacific Coast salmon, Pacific Coast groundfish, and coastal pelagic species.

3.4. Statutory Response Requirement

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

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

3.5. Supplemental Consultation

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

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

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

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are the USACE. Other interested users could include Columbia River ports. Individual copies of this opinion were provided to the [*name of action agency(ies)*]. The document will be available at the

NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adhere to conventional standards for style.

4.2 Integrity

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

4.3 Objectivity

Information Product Category: Natural Resource Plan

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

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

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

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

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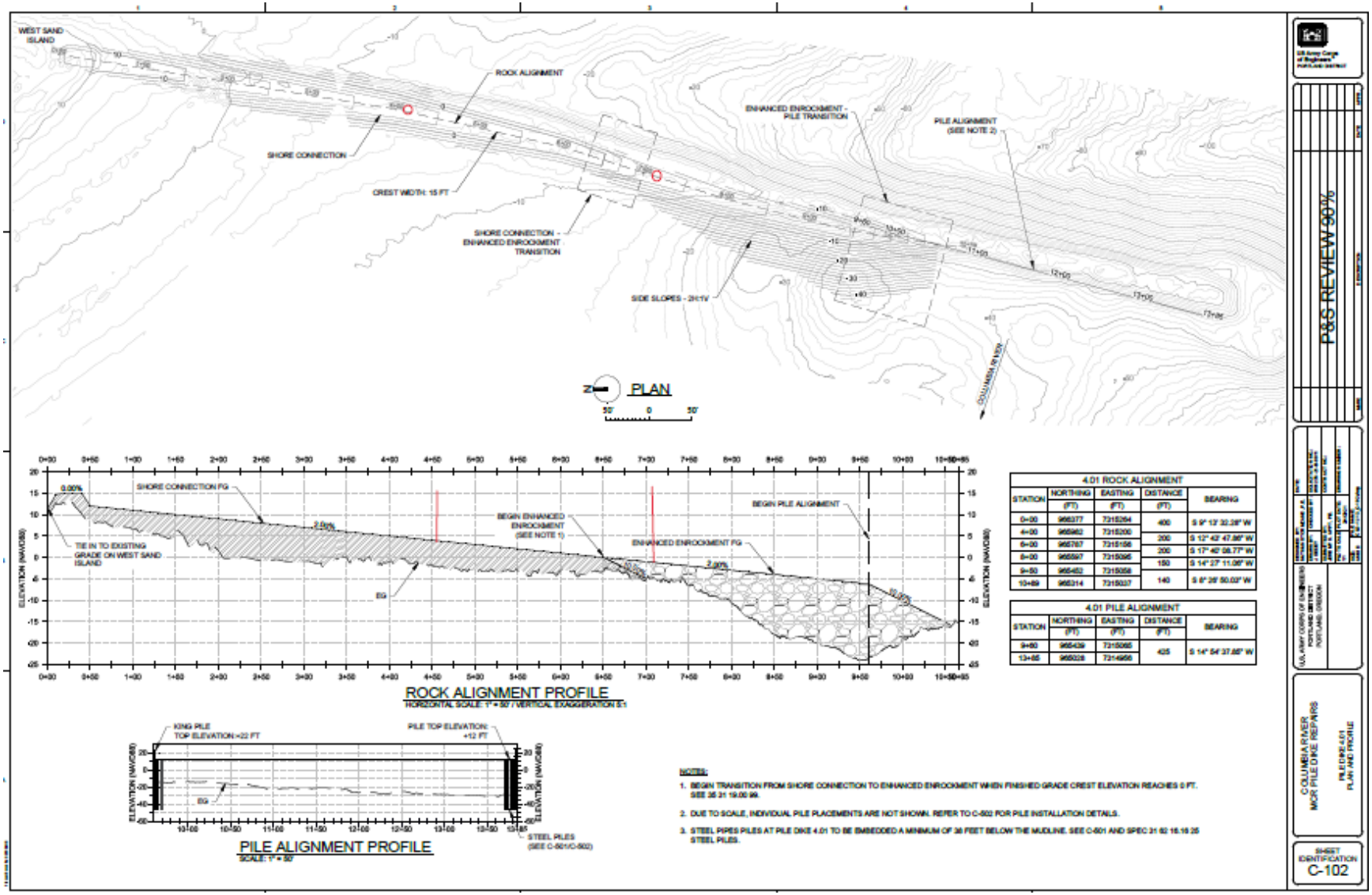
6. APPENDIX A: NAVIGATION HAZARD WARNING PILE PLACEMENT

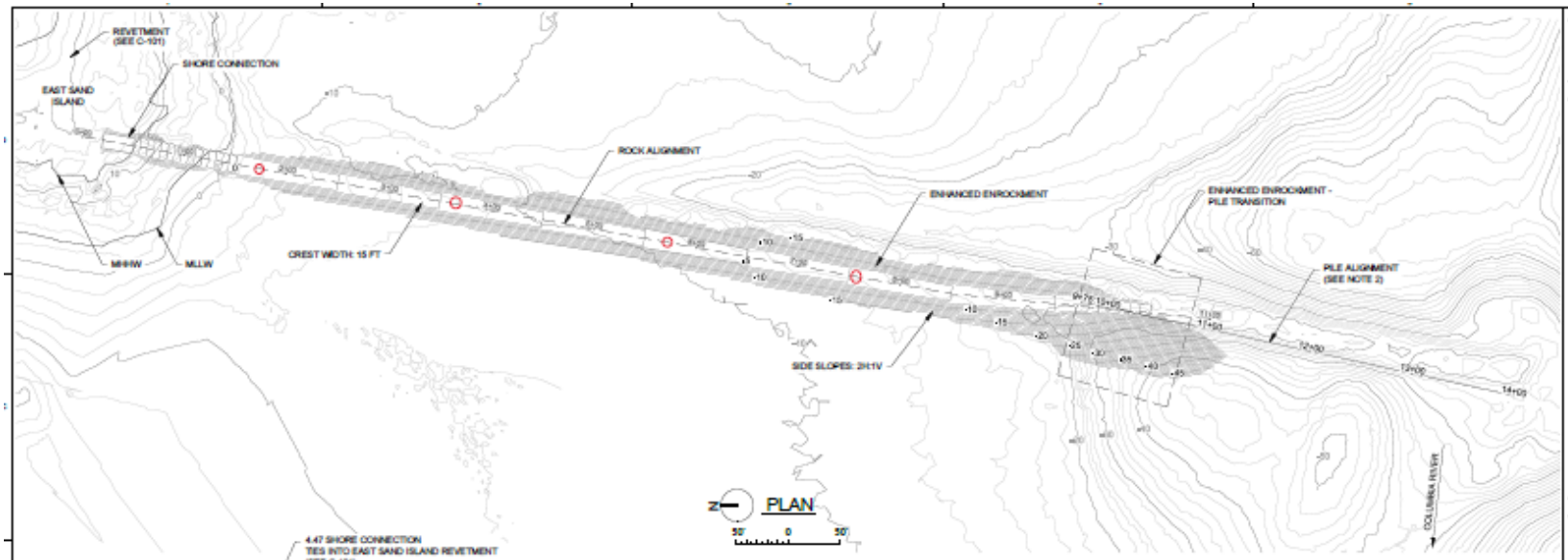


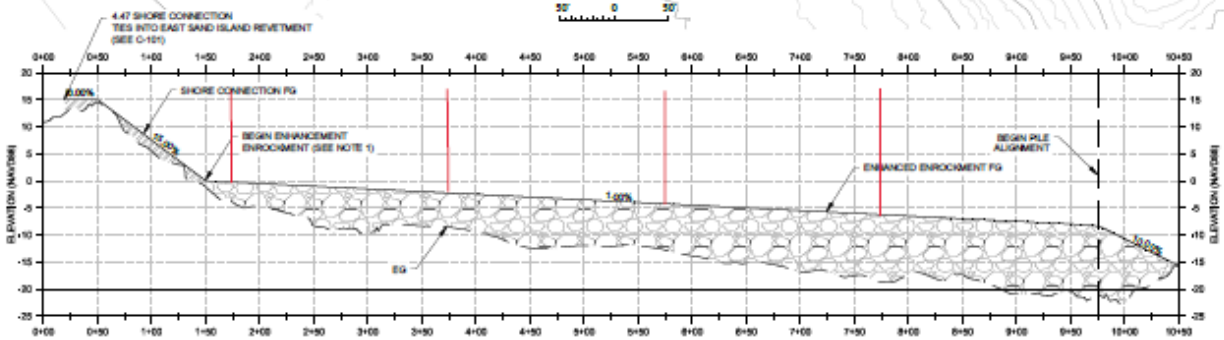
4.01 ROCK ALIGNMENT

STATION	NORTHING (FT)	EASTING (FT)	DISTANCE (FT)	BEARING
0+00	966377	7315264	400	S 9° 13' 32.28" W
4+00	965962	7315200	200	S 12° 42' 47.86" W
6+00	965767	7315156	200	S 17° 40' 08.77" W
8+00	965597	7315095	150	S 14° 27' 11.06" W
9+50	965452	7315058	140	S 8° 26' 50.03" W
10+89	965314	7315037		

4.01 PILE ALIGNMENT

STATION	NORTHING (FT)	EASTING (FT)	DISTANCE (FT)	BEARING
9+60	965439	7315065	425	S 14° 54' 37.68" W
13+85	965028	7314956		



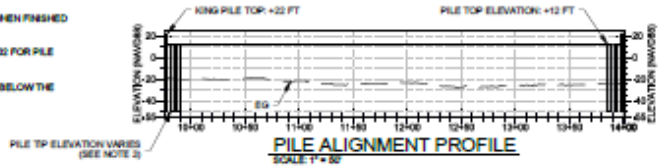


ROCK ALIGNMENT PROFILE

HORIZONTAL SCALE: 1" = 50' / VERTICAL EXAGGERATION 5:1

NOTES:

1. BEGIN TRANSITION FROM SHORE CONNECTION TO ENHANCED ENROCHMENT WHEN FINISHED GRADE CREST ELEVATION REACHES 0 FT. SEE 35 31 19.00 99.
2. DUE TO SCALE, INDIVIDUAL PILE PLACEMENTS ARE NOT SHOWN. REFER TO C-502 FOR PILE INSTALLATION DETAILS.
3. STEEL PIPES PILES AT PILE DIKE 4.47 TO BE EMBEDDED A MINIMUM OF 30 FEET BELOW THE MUDLINE. SEE C-501 AND SPEC 31 62 16.16 25 STEEL PILES.



PILE ALIGNMENT PROFILE

SCALE: 1" = 50'

4.47 ROCK ALIGNMENT				
STATION	NORTHING (FT)	EASTING (FT)	DISTANCE (FT)	BEARING
0+00	965813	7318359	850	S 10° 14' 52.04" W
8+50	964776	7318208	200.159	S 5° 32' 08.46" W
11+00	964627	7318184		

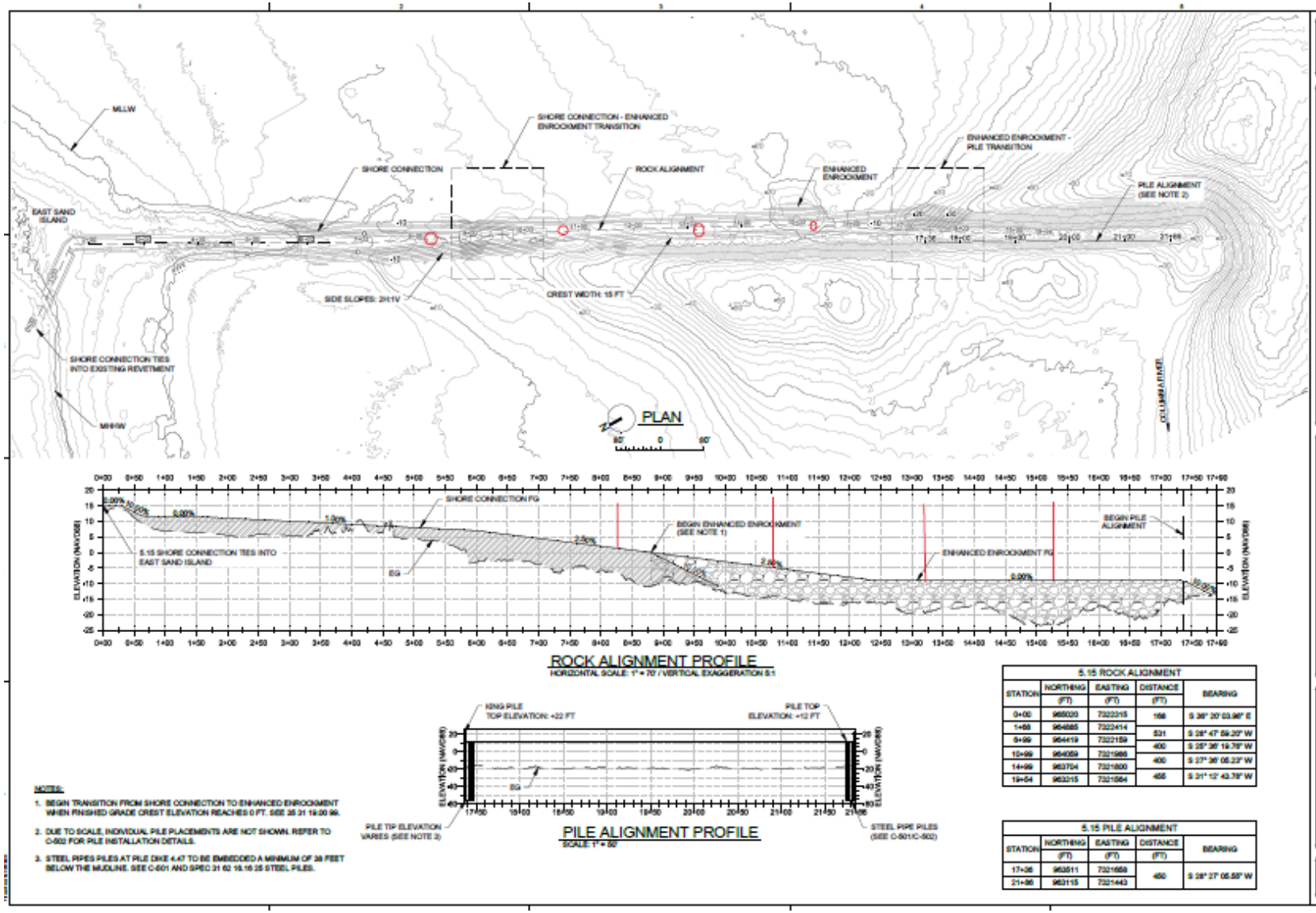
4.47 PILE ALIGNMENT				
STATION	NORTHING (FT)	EASTING (FT)	DISTANCE (FT)	BEARING
9+75	964860	7318200	425	S 12° 15' 08.36" W
14+00	964235	7318110		

P&S REVIEW 90%

COLUMBIA RIVER
MOA PILE DIKE REPAIRS

PILE DIKE 4.47
PLAN AND PROFILE

SHEET IDENTIFICATION
C-103



NOTES:

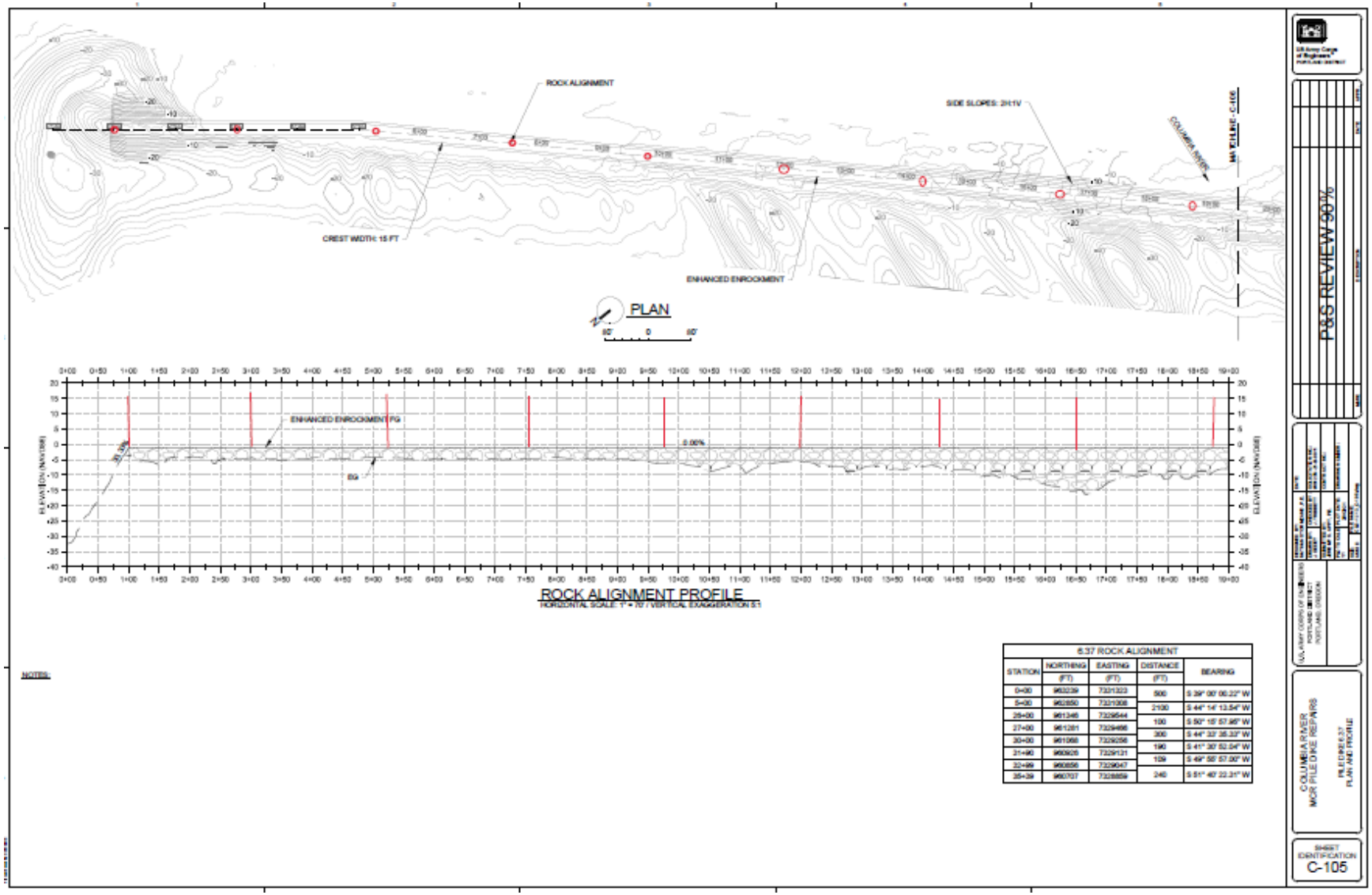
1. BEGIN TRANSITION FROM SHORE CONNECTION TO ENHANCED ENROCKMENT WHEN FINISHED GRADE CREST ELEVATION REACHES 0 FT. SEE 35 31 19.00 99.
2. DUE TO SCALE, INDIVIDUAL PILE PLACEMENTS ARE NOT SHOWN. REFER TO C-502 FOR PILE INSTALLATION DETAILS.
3. STEEL PIPES PILES AT PILE DIKE 4.47 TO BE EMBEDDED A MINIMUM OF 30 FEET BELOW THE MUDLINE. SEE C-501 AND SPEC 31 62 16.16 25 STEEL PILES.

5.15 ROCK ALIGNMENT

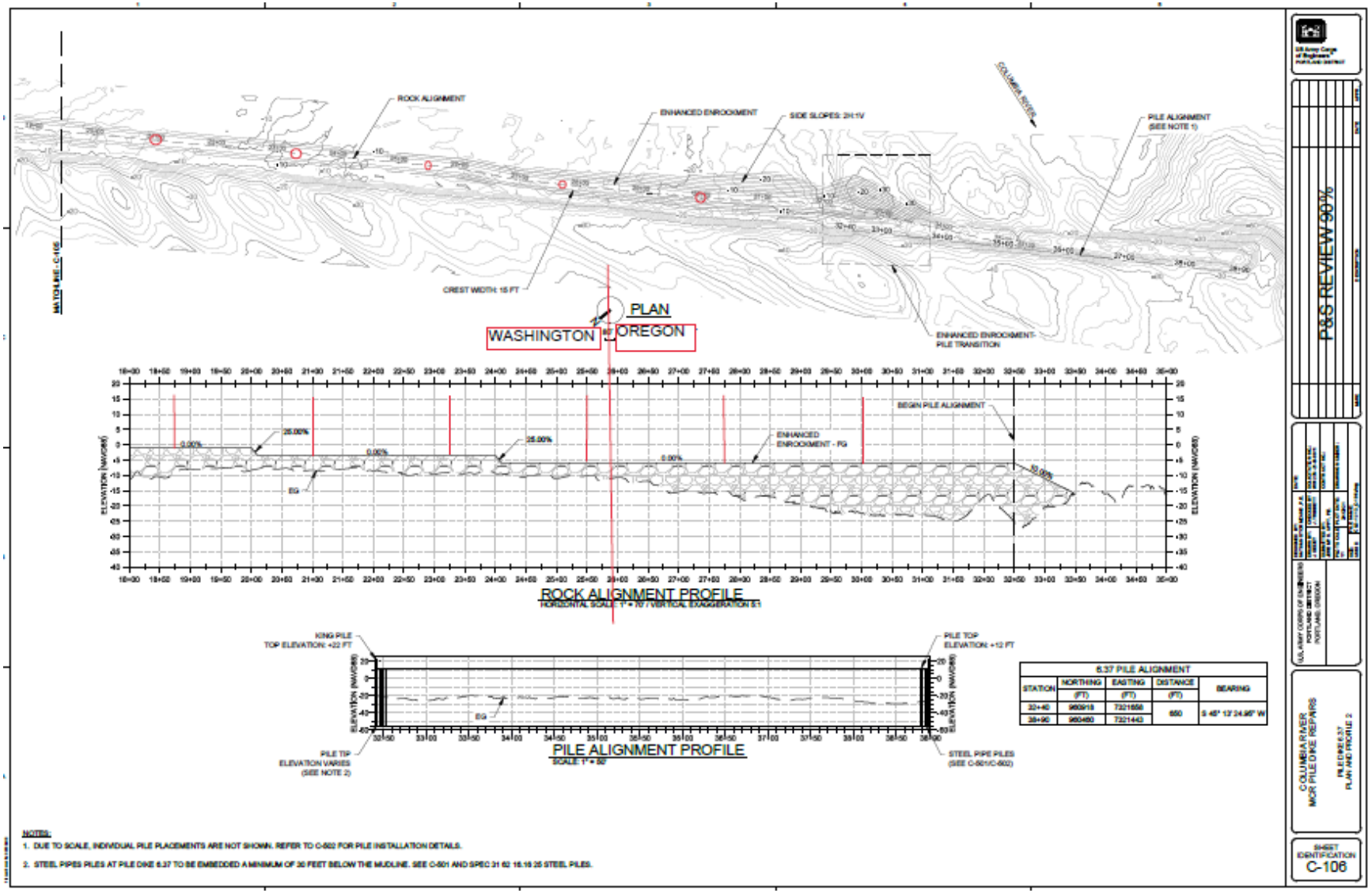
STATION	NORTHING (FT)	EASTING (FT)	DISTANCE (FT)	BEARING
0+00	965020	7322315	166	S 36° 20' 03.98" E
1+66	964865	7322414	531	S 28° 47' 59.20" W
6+99	964419	7322159	400	S 28° 36' 19.78" W
10+99	964059	7321986	400	S 27° 36' 06.23" W
14+99	963704	7321800	455	S 31° 12' 43.78" W
19+54	963315	7321564		

5.15 PILE ALIGNMENT

STATION	NORTHING (FT)	EASTING (FT)	DISTANCE (FT)	BEARING
17+36	963511	7321668	450	S 28° 27' 06.58" W
21+86	963115	7321443		



6.37 ROCK ALIGNMENT				
STATION	NORTHING (FT)	EASTING (FT)	DISTANCE (FT)	BEARING
0+00	962239	7331323	500	S 29° 00' 06.22" W
5+00	962850	7331306	2100	S 44° 14' 13.54" W
25+00	961346	7329544	100	S 50° 15' 57.95" W
27+00	961201	7329466	300	S 44° 33' 35.33" W
30+00	961066	7329256	190	S 41° 30' 52.04" W
31+90	960926	7329131	109	S 49° 58' 57.00" W
32+99	960856	7329047	240	S 51° 40' 22.31" W
35+39	960707	7328859		


ROCK ALIGNMENT
ENHANCED ENROCKMENT
SIDE SLOPES: 2H:1V
COLUMBIA RIVER
PILE ALIGNMENT (SEE NOTE 1)
CREST WIDTH: 15 FT
PLAN
WASHINGTON
OREGON
ENHANCED ENROCKMENT - PILE TRANSITION
BEGIN PILE ALIGNMENT
ENHANCED ENROCKMENT - FG
EG
ROCK ALIGNMENT PROFILE
HORIZONTAL SCALE: 1" = 70' / VERTICAL EXAGGERATION 5:1
KING PILE TOP ELEVATION: +22 FT
PILE TOP ELEVATION: +12 FT
PILE TIP ELEVATION VARIES (SEE NOTE 2)
STEEL PIPE PILES (SEE C-501/C-502)
PILE ALIGNMENT PROFILE
SCALE: 1" = 50'
6.37 PILE ALIGNMENT
STATION
NORTHING (FT)
EASTING (FT)
DISTANCE (FT)
BEARING
22+40
960918
7321856
650
S 45° 13' 24.98" W
28+90
960460
7321443
NOTES:
1. DUE TO SCALE, INDIVIDUAL PILE PLACEMENTS ARE NOT SHOWN. REFER TO C-502 FOR PILE INSTALLATION DETAILS.
2. STEEL PIPES PILES AT PILE DIKE 6.37 TO BE EMBEDDED A MINIMUM OF 30 FEET BELOW THE MUDLINE. SEE C-501 AND SPEC 31 62 16.16 25 STEEL PILES.
P&S REVIEW 90%
COLUMBIA RIVER
MCR PILE DIKE REPAIRS
PILE DIKE 6.37
PLAN AND PROFILE 2
SHEET IDENTIFICATION
C-106